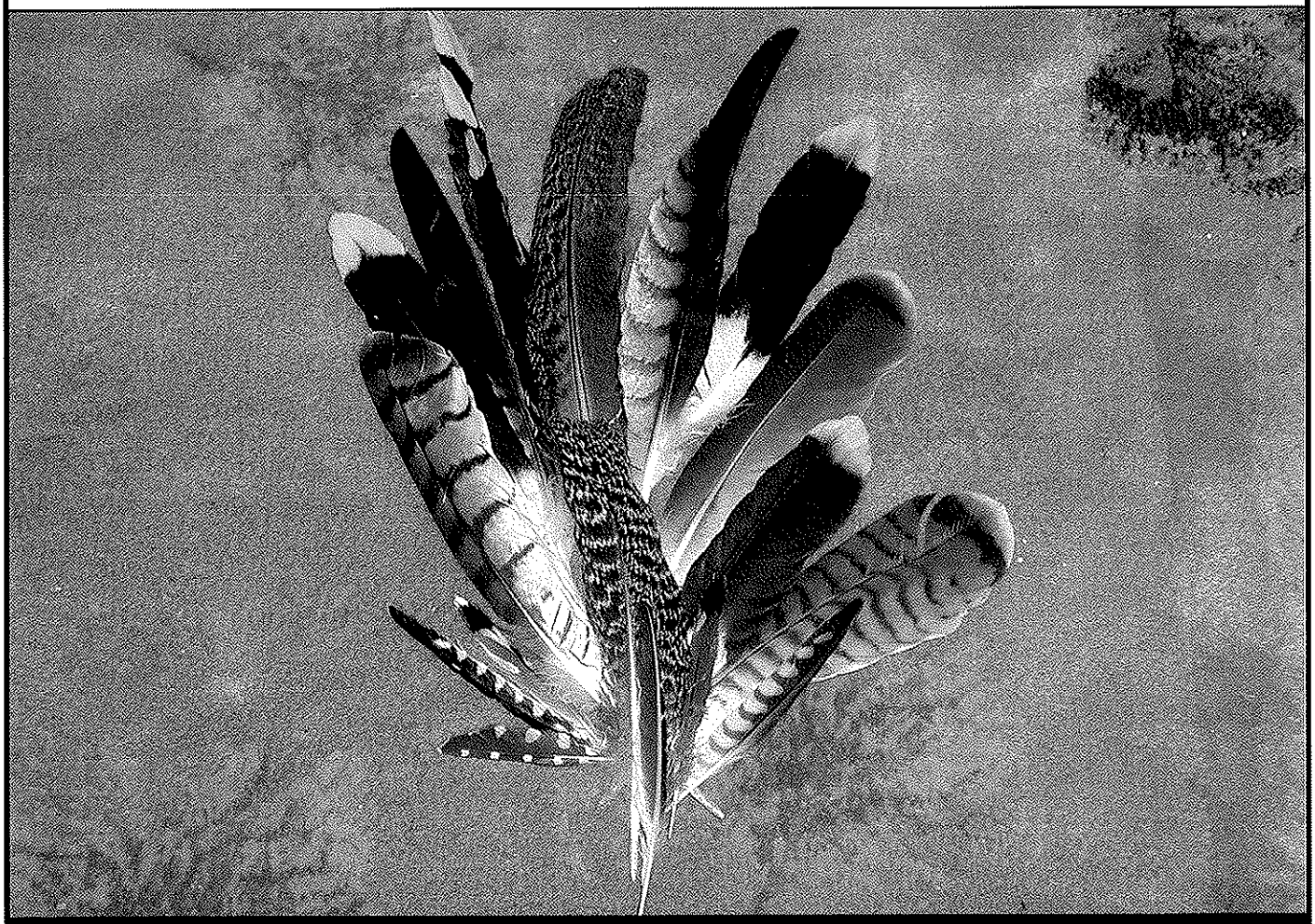
INTERNATIONAL WILDLIFE REHABILITATION COUNCIL

SUMMER 2003
VOLUME 26, NUMBER 2

# JOURNAL OF WILDLIFE REHABILITATION



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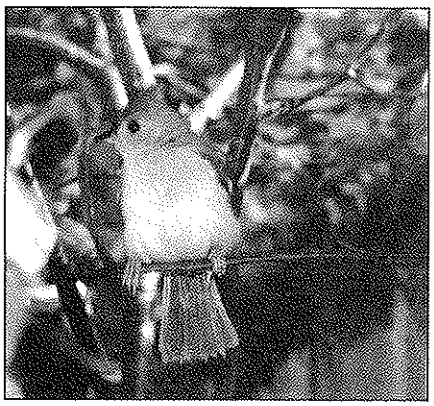
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## ABOUT THE JOURNAL . . .

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: Feathers from bird species that hold high cultural importance for Native Americans. [see page 15; photo: Elizabeth Penn Elliston]

BELOW: Banding helped ascertain the ability of a rehabilitated tufted titmouse (*Parus bicolor*) to survive, despite a droopy wing. [see page 25; photo: Jayne Amico]




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EDITORIAL

# A Program to Meet Your Needs

What does it mean to be a wildlife rehabilitator? There are as many answers to that question as there are wildlife rehabilitators. Many of us would list professionalism somewhere in our reply.

Most of us, myself included, have struggled to define what it means to be a professional wildlife rehabilitator. I've spoken with many of you, both prior to becoming executive director of IWRC and certainly since, about the challenges we face from the general public, other professionals, and those in our own field who challenge what we mean when we say we are a professional wildlife rehabilitator.

Earlier this year IWRC's staff and board of directors turned our energy toward the issue of qualifications, accreditation, and certification. For many years IWRC ran an accreditation program for wildlife rehabilitation centers. This program never accomplished what wildlife rehabilitators or IWRC wanted it to. The logistics of attempting to cover every possible situation for a wide variety of centers and to make accommodations for state and municipal regulations was simply too challenging. The program was too complex, too expensive for both IWRC and for the center seeking accreditation, and was not set up to accommodate individual rehabilitators or home-based centers—the majority of our members, and wildlife rehabilitators in general.

We needed to find a solution that addressed the problems with the accreditation program, while meeting the needs of wildlife rehabilitators looking for accreditation, certification, and a way to demonstrate their commitment to excellence in wildlife rehabilitation.

After much discussion we decided on an individual certification program.

Our goal for this program is to provide *all* wildlife rehabilitator access to a tiered certification program.

***We want the certification program to:***

- Offer wildlife rehabilitators access to an internationally recognized, voluntary, multilevel certification program for wildlife rehabilitation.
- Be accessible to all wildlife rehabilitators—whether they have been rehabilitating for several months or several years; whether they specialize in one or two species or are generalists; whether they work at large centers or are home based; and whether they want learn more specialized medical skills or want to become an expert in hand rearing.
- Acknowledge the hands-on work that is done so well by so many of us.
- Give wildlife rehabilitators the option to progress through the levels of certification and increase the scope of their knowledge—or to remain certified at a specific level through continuing education.
- Be portable. You may move across state lines, through USFWS regions, or to another country. IWRC certification will have the same recognition and meaning no matter where you go.

These are the ideas that build the framework for the program. ***But we need your input and your support to make the program truly effective.*** Our new Training Plan and Certification Survey, and Charter Level 1 Certification allow you to "try out" the program and give us your feedback. For more information visit www.iwrc-online.org and select Training & Certification, or call us at 707/864-1761.

Charter Level 1 Certification is available now. The application form is available on our website or through the office. To qualify for Charter Level 1 Certification you must have (1) successfully completed the IWRC Basic Wildlife Rehabilitation class and (2) attended at least two IWRC Annual Conferences or NWRA conferences within the last five years.

We will be accepting applications for Charter Level 1 Certification through 15 October 2004. During the next nine months we will be soliciting your ideas, thoughts, and input on the program as it begins to take shape. By this time next year we plan to have a full certification program in place.

Please let us know what you think about our new program. We are here to help you help wildlife.

**—Jennifer Bennett**
*IWRC Executive Director*

# Hedgehogs Threatened in the U.K.

The British hedgehog (*Erinaceus europaeus*) is understood to be on the decline in mainland Britain. The main causes are road kills and fragmentation of habitat. Reduction of suitable foraging and nesting areas is also contributing to their demise. The only natural predator of the hedgehog is the badger, but as both species have existed alongside each other since time immemorial, the badger is not responsible for the recent reduction in hedgehog numbers.

Many hundreds of rehabilitators throughout Britain play an important role in caring for, and restoring to normal health, sick and injured hedgehogs. The several thousand animals released back to the wild each year contribute significantly in helping to restore falling hedgehog numbers. The countless hours spent in administering care are justified, as research studies have shown that rehabilitated hedgehogs survive well following release back to the wild.

The hedgehog is now a protected species in Britain. Despite this, a cull of 5000 hedgehogs took place on the Isles of North Uist and Benbecula, Scotland, in April 2003. The hedgehog is not native to the Isles and has no natural predators. Following the introduction of a pair of animals to the Isles, in the 1970s, to act as slug control, the hedgehog population has reportedly escalated to 5000. This poses a serious threat to ground-nesting birds that apparently face imminent extinction if hedgehog numbers are not drastically reduced. Scottish Natural Heritage (SNH), despite countless objections from animal welfare groups, decided to cull the animals, intending to kill 200 in the seven week period beginning 7 April 2003.

A rescue operation was organized by animal welfare groups, which worked against the clock to try to locate and remove hedgehogs from the Isles before they were killed by SNH, a difficult process as the animals were only just beginning to emerge from hibernation. SNH killed the hedgehogs that they caught by first administering gas, and then a lethal injection. They reportedly refused to hand over any hedgehogs, that they found, to animal welfare volunteers who would ensure that they were safely taken off the island to mainland Britain and relocated.

SNH succeeded in killing 50 hedgehogs, while the animal welfare groups managed to catch and relocate 130 animals to carefully selected areas on mainland Britain.

SNH plans to resume the cull at a later date.

A feasibility study, to assess the issues surrounding relocation of all 5000 hedgehogs was carried out more than a year ago, and concluded that relocation to mainland Britain would not pose any problems to existing populations of hedgehogs, provided that certain precautionary measures were taken. Indeed, successful relocation of rehabilitated hedgehogs occurs all the time when animals are released back to the wild from animal sanctuaries and wildlife hospitals. No adverse effect on existing wild populations has ever been reported, as concluded by thorough follow-up studies monitoring the progress of released rehabilitated hedgehogs.

At a time when the hedgehog population on mainland Britain is in decline, it seems rather to defy reason to exterminate 5000 animals that could easily be relocated. Now is surely the time to attempt to redress the balance, and not to act in a cavalier manner by the needless slaughtering of so many members of this vulnerable species.

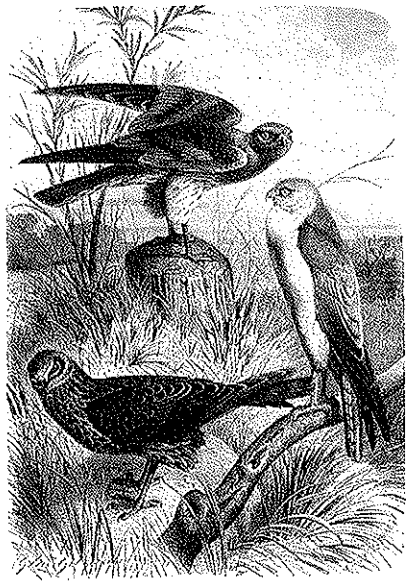
Anyone wishing to express an opinion regarding the cull of hedgehogs on the Isles North Uist and Benbecula, Scotland, can email George Anderson at Scottish Natural Heritage:

George.Anderson@snh.gov.uk

The animal welfare group attempting to save the hedgehogs can be contacted at:

Ross@advocatesforanimals.org

**—Toni Bunnell, PhD**
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*The Editors encourage readers to respond to the articles, columns, and other items featured in the* Journal of Wildlife Rehabilitation. *Please direct general questions and comments to the Editor at runmuki@earthlink.net (USPS address on the journal's inside back cover). To respond to a specific article or column, please contact the author directly. (NOTE: Letters may be edited for clarity and length.)*

# Acute Rumen Lactic Acidosis and Related Lesions in Wild Fallow Deer (*Dama dama*)

by Ozlem Ozmen

## Introduction

Six adult male wild fallow deer (*Dama dama*) died in the Duzler Cami Forest National Park, Antalya, Turkey between October and December 2001. Three animals were found in a state of putrefaction. Three moribund animals were observed; they were recovered before autolysis, and necropsy was performed. A seventh animal, also an adult male, was found alive but in very poor condition. Ruminal fluid pH of the deer was observed at 5.0 and no protozoa were seen. The animal was treated successfully for acute rumen lactic acidosis and subsequently released.

Ueckerman and Hansen (1994) report that rumen acidosis is one of the most common nutritional diseases seen in domestic fallow deer, effecting 21% of captive animals. Although the disease in wild fallow deer is sometimes reported, there exists no prior description of clinical symptoms and necropsy findings of acidosis in *Dama dama*.

The aim of this study is to describe the clinical and pathological findings seen in acute lactic ruminal acidosis in wild free-ranging fallow deer, and to alert those who are involved in the care or rehabilitation of wild ruminants to a disease that, while uncommon in wild free-ranging deer, should be taken into consideration.

## Materials and Methods

Upon necropsy, all organs were examined macroscopically for lesions. Complete sets of tissue specimens were collected. Tissue samples were fixed in 10% buffered formalin and embedded in paraffin sectioned at 5 micron. The sections were stained with hematoxylin-eosin (H&E) and examined microscopically. Ruminal fluid samples were taken for examination. All organs were examined for parasites.

## Results

Prior to admission, the three moribund animals exhibited lethargy and ataxia before becoming recumbent. All affected animals were adult males (5 to 8 years; Figure 1). Ages were determined by comparing antler development to published data (Chapman and Chapman 1997).

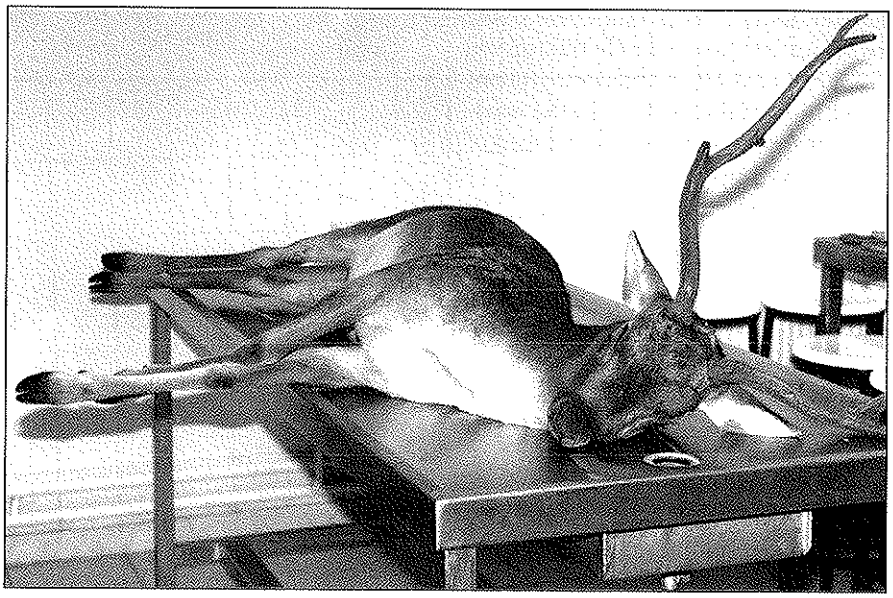


**Figure 1. This adult male fallow deer (*Dama dama*) died from acute ruminal lactic acidosis.**

**ABSTRACT:** Acute ruminal lactic acidosis was diagnosed in seven adult male wild fallow deer (*Dama dama*). Six animals died, and one was treated successfully. Decreased ruminal motility, decreased ruminal pH and dehydration were observed. Ruminal pH in three samples ranged from 4.5 to 5.0, and no protozoa were seen. Macroscopic examination revealed oedema pulmonum, abomasal and jejunal ulcers. Clinical and necropsy findings were very similar in fallow deer and afflicted cattle, but fallow deer were observed to be more susceptible to acute lactic ruminal acidosis. This condition is not common in wild free-ranging ruminants.

**KEY WORDS:** Rumen lactic acidosis, Fallow deer, *Dama dama*, pathology, histopathology.

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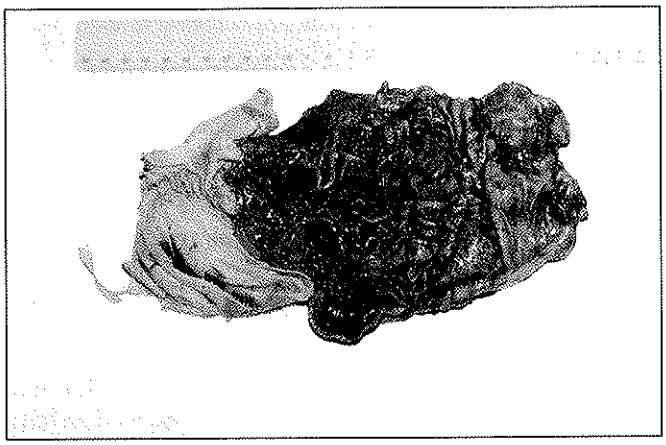


**Figure 2. Ulcers and bleeding in abomasum.**

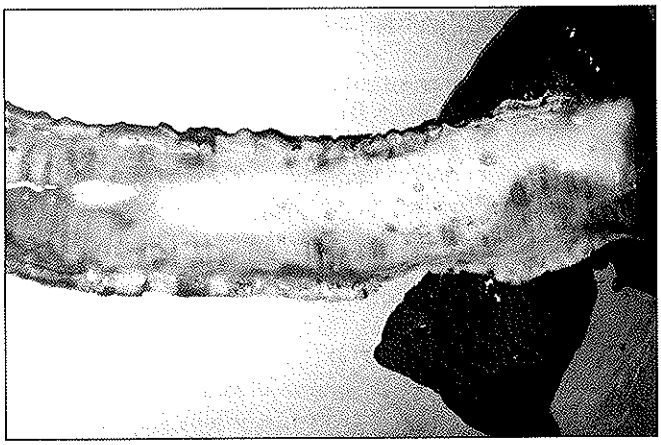


**Figure 3. Pulmonary congestion and foamy exudate in the trachea.**

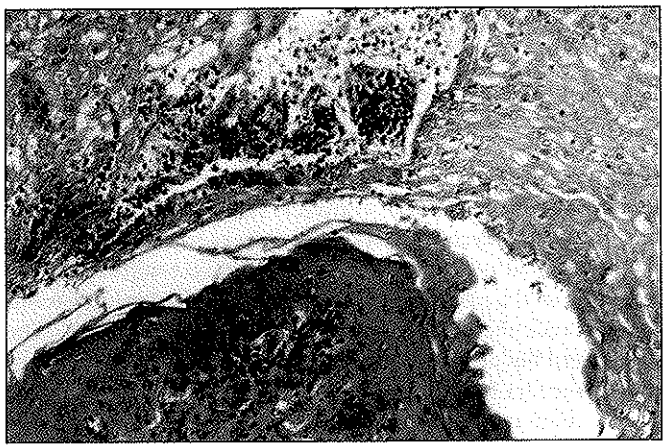


**Figure 4. Neutrophyl leukocyte infiltrations in the lamina epithelialis at the rumen, H&E, 400x.**

At necropsy, severe dehydration and abdominal distention were evident in all three animals. An estimated 3–4 kg of grain were found in the rumens. Ruminal fluid samples were sour, yellow, and contained partially digested pieces of grain. No protozoa were detected in the three fluid samples, and pH readings were 4.5, 4.6, and 5.0.

Multiple erosions and ulcers were found in the abomasums, and abomasal fluid of all three animals contained blood (Figure 2). Blood was dark and poorly coagulated. Haemorrhagic exudates were also seen in the jejunums. Pulmonary congestion and foamy exudate were observed in tracheas (Figure 3).

Microscopical examination of the rumen revealed cytoplasmic vacuoles at the ruminal papillae. Slight neutrophyl leukocyte infiltrations were observed in the lamina epithelialis and propria (Figure 4). Ulcers and haemorrhagia were seen at the abomasum and jejunum. Oedema pulmonum were seen in lungs. Multifocal necrotic areas were observed in liver in one animal. There was no gross or microscopic evidence of parasites in organs examined.

A seventh fallow deer was admitted with clinical signs of acidosis. The animal, a 5-year old male, was lethargic and ataxic, and became recumbent. The rumen lacked motility; no protozoa were detected upon examination of a rumen fluid sample, and pH was 5.0. Mean blood values were: pH, 7.29; p $CO_2$ 36.5 mmHg; and $HCO_3$ 22.3 mmol/lt. Isotonic and electrolyte fluids, $NaHCO_3$ (0.8 %), enroflaxacin, a nonsteroid anti-inflammatory drug, and B-complex vitamins were administered. The patient normalised within 8–24 hours and was subesquently released.

## Discussion

Acidosis is a condition that follows ingestion of excessive amounts of readily fermented carbohydrate. In acute acidosis, ruminal acidity and osmolality increase markedly as acids and glucose accumulate; these can decrease blood pH and cause fatal dehydration (Ovens at al. 1998). The accumulation of excess organic acids disrupts rumen function and causes malaise (Provenza et al. 1994; Cooper at al. 1995; Cooper et al. 1996).

The six deceased and one surviving animal were diagnosed with acute rumen lactic acidosis. The source of the problem was cattle feed.

## Natural History

Historically, Turkey was one of the world's most important areas for fallow deer. Since the Pleistocene age, the species is thought to have been restricted to the Mediterranean area, and possibly only to Asia. The Romans and Phoenicians introduced fallow deer into Europe, and the Normans may have introduced them to Britain. Herds have been established in more than 30 countries to which they are not native (Chapman and Chapman 1975, 1980; Grzimek 1975), for the purposes of hunting and game farming, but the wild species was extirpated from much of its original range (Meester and Setzer 1977; Chapman and Chapman 1975, 1980). The fallow deer population extant in Turkey is the only group in the world with historic morphology and behavior, and has retained the species' primitive characteristics. The animals are smaller, grow more slowly, and palmation of the antlers occurs at a later age than in other populations (Chapman and Chapman 1997).

*Dama dama* lived as very crowded herds in Anatolia until the 20th century (Chapman and Chapman 1997), when they began to decline due to agricultural practices and illegal hunting. This unique population has been under threat of extinction in recent years; thus the Turkish government implemented programs to protect them and prevent genetic alteration. The most important conservation area is the Duzler Cami Forest National Park in Antalya. Here, only a handful of fallow deer

existed until illegal hunting and grazing by domestic stock were eliminated. Today, 75 fallow deer are under protection in this area, where they are monitored by Ministry of Forestry staff.

Throughout their range, fallow deer are predominantly grazing animals, feeding in fields, pastures, and meadows, although trees and shrubs are commonly browsed. They feed sporadically throughout the day, and feeding periods are interspersed with periods of rest and rumination. Exact percentages of time spent feeding throughout a 24-hour period are unknown, but probably vary with time of year, age, and sex of the individual, and the degree of disturbance (Ueckermann and Hansen 1994; Chapman and Chapman 1997).

Food selection depends upon availability and varies both seasonally and annually, as well as with locality. Grasses, rushes, and sedges are among the principal foods of fallow deer throughout the year (Chapman and Chapman 1997). Gradual changes occur in the digestive system between the vegetation period and winter, as the animals move from green foods to dry grasses and browse (Kamler 1999).

### Ruminal Function

The functioning of a ruminant's specialized stomach depends upon the presence, principally in the rumen, of microscopic flora and fauna. Ruminal fermentation occurs as a function of symbiotic bacteria and ciliated protozoa that digest large quantities of plant material and convert it into absorbable nutrients (Jones et al. 1997). The vital role of these microorganisms lies in their ability to break down cellulose, the carbohydrate that forms the cell walls of plants, into glucose (Ueckermann and Hansen 1994; Chapman and Chapman 1997).

Ruminal fermentation initially results in the degradation of starch, fibre and protein to short-term intermediates, such as sugars and amino acids. These initial degradation steps are considered to be rate-limited processes, which are dependent on substrate level and enzyme-specific activity, and are in turn effected by the microbial population and ruminal environment. The products of this initial degradation are readily metabolized to microbial mass and carbon dioxide ($CO_2$), methane ($CH_4$), ammonia ($NH_3$), volatile fatty acids (VFA) and, to a lesser degree, branched-chain VFA and occasionally lactate (McNamara et al. 2000).

The relative proportions of these and other byproducts of ruminal fermentation vary considerably with the composition of the diet. Likewise, the composition of the ruminal flora and fauna is markedly influenced by diet and the type and amounts of fermentation byproducts produced. For example, in winter, protozoa concentration is significantly lower than it is during the vegetation period (Kamler 1999). The composition of ruminal flora and fermentation byproducts also effects pH. The normal pH of the rumen ranges from 5.5. to 7.5. Deviations from this range can drastically alter the composition of the ruminal flora, which in turn can adversely affect ruminal function and the health of the animal (Jones et al. 1997).

Acidosis syndrome is associated with large increases of lactic acid in the rumen. It results from diets that are high in ruminally available carbohydrates (e.g., grain, bread, brewery byproducts, apples, beets, turnips, etc.), forage that is low in effective fiber, or both. The syndrome involves the gastrointestinal tract and body fluids, and is related to the rate and extent of lactic acid production, utilization, and absorption. Acute acidosis results in very sick animals; physiological functions may be significantly impaired. Clinical manifestation can range from loss of appetite to death (Nocek et al. 1984; Cebra et al. 1996; Jones et al. 1997; Nocek 1997).

The pathogenesis involves the sudden availability of excessive quantities of a highly fermentable carbohydrate substrate for fermentation by the normal ruminal flora and fauna. It is sometimes described as carbohydrate or grain overload. Within hours of ingestion of such a diet, the pH of the rumen begins to decline due to increased production of volatile fatty acids (acetic, propionic, and butyric acids). As pH approaches approximately 5.0, the normal Gram-negative bacteria and protozoa of the rumen die, with a concomitant overgrowth of streptococci. These organisms, unlike the normal ruminal flora, produce large quantities of lactic acids from the carbohydrate substrate. This results in further decline in ruminal pH to a level less than 5.0, which in turn kills off the streptococci. At this point, the acid-loving *Lactobacillus acidophilus* rapidly proliferates within the ruminal contents (Nagel and Broderick 1992; Jubb et al. 1993; Jones et al. 1997). In cattle, the critical pH threshold of rumen is < 5.0 during acute acidosis (Jubb et al. 1993).

During the sequence of chemical events described above, musculature of the rumen and reticulum begins to progressively lose tone and the ability to contract. This phenomenon is mediated by the increasing concentrations of volatile fatty acids in the ruminal contents. These acids interact with epithelial receptors in the ruminal and reticular mucosa to inhibit ruminal and reticular contractions via the vagovagal reflex. The subsequent building-up of lactic acid resulting from overgrowth of streptococci is corrosive to the mucosa of these organs and causes chemical rumenitis and reticulitis, leading to damage and loss of epithelium in these organs. Concomitant with these events, there may be cessation of salivation, leading to loss of the buffering effect of salivary bicarbonate on ruminal pH (Jubb et al. 1993; Jones et al. 1997).

Ruminal changes initiate several systemic changes. Increased organic acid (particularly lactic acid) and reduced pH result in decreased ruminal motility, stasis, and ruminitis (Nocek et al. 1984). Furthermore, the increased lactic acid concentration in the ruminal and intestinal contents increases the osmotic pressure of the ingesta, which attracts water and electrolytes from the blood, leading to clinical dehydration, hemoconcentration, anuria, and eventually, shock. Animals also develop clinical acidosis due to absorption of lactic acid from the rumen.

### Field Observations

The animals in this study developed acute rumen lactic acidosis after staff at Duzler Cami Forest National Park supplemented them with cattle feed.

As a result of a severe drought and high temperatures in the summer of 2001, grasses and other vegetation dried, and it was feared that the herds' natural foods would not be enough to sustain them. They were supplemented with rations that had been prepared for dairy cattle; these rations have a high level of carbohydrate, for milk production (McNamara et al. 2000).

The effected animals in this study were adult males. For an appreciable part of the year, adult bucks form bachelor groups and live apart from the doe herds, which comprise adult females, yearlings, and fawns. The does often move to different fields, while the bucks, especially in winter, remain near the

feeding area (Chapman and Chapman 1997). Consequently, it was this group of adult males that consumed the bulk of the concentrated feed. Does and young animals were not effected because when they visited the feeding area, they found only the little food that the bucks had not eaten.

The energy requirement of a 45-kg deer is 1534 kcal/day; a balanced winter diet would include 1 kg dry hay and 100–200 g of protein. When natural foods are abundant, supplemental feeding is not necessary. However, when conditions require the animals be supplemented, vegetables or green grass must be included. The ratio of dry hay and green grass or vegetables must be 1:1 to 1:3 (Ueckermann and Hansen 1994).

The deer in this study developed acute ruminal lactic acidosis because in one meal they had eaten more than 3 kg of concentrated food meant for dairy cattle; it contained 2650 kcal. After the cause of death was determined, the ratio of concentrated feed was immediately reduced, and mortality stopped. Prior to these events, park staff had no understanding of the diets of wild fallow deer. This situation was remedied subsequent to investigation, and those responsible for feeding are now trained to understand dietary requirements and correct concentration of feed.

## Conclusion

Clinical signs, macroscopical and microscopical findings of ruminal acidosis in this study were similar to those seen in cattle (Blood and Radostits 1989; Jubb et al. 1993; Nocek et al. 1984; Smith 1990), but *Dama dama* were observed to be more susceptible than cattle to ruminal lactic acidosis. A decrease in ruminal pH below 5.5 proved very dangerous to fallow deer, while in cattle, the critical pH threshold of rumen is < 5.0 during acute acidosis (Jubb et al. 1993).

Acute rumen lactic acidosis is potentially lethal to all ruminants. This condition is well known in domestic species (especially in cows), but it is not common in wild, free-ranging animals. When it becomes necessary to provide extra food to wild ruminants in rural areas or parks or to formulate diets for animals in rehabilitation, rations must be evaluated and controlled carefully to prevent illness and possible deaths.

## Acknowledgement

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# Conversations with Stakeholders, Part II: Contentious Issues in Wildlife Rehabilitation

by Sara Dubois and David Fraser

**ABSTRACT:** Semistructured interviews were conducted with 27 wildlife rehabilitators, five veterinarians, and eight government officials involved in wildlife rehabilitation in British Columbia, Canada, in order to describe the range of views held by stakeholders on contentious rehabilitation issues. In general, stakeholders identified a need to promote awareness of existing care and euthanasia guidelines among rehabilitators and government agencies, and for assistance to access relevant resources. Rehabilitators and veterinarians believed there is a need for locally relevant and accessible training for all rehabilitators and felt that government agencies do not adequately monitor and inspect facilities. Many rehabilitators and veterinarians saw the system of government permits and related enforcement as a potential means to maintain consistent high care standards, but rehabilitators were dissatisfied with lax controls on permits. There was a consensus that any care assessments should be made by a team of diverse stakeholders. These findings can help rehabilitators assess their current practices and identify areas to focus rehabilitator education and training, as well as communication efforts with other stakeholders.

**KEY WORDS:** non-native species, nonreleasable wildlife, euthanasia, training, permits, enforcement

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## Introduction

Given that wildlife rehabilitation deals with many types of species and injuries, and involves choices among various methods of care and euthanasia, there is great scope for disagreement among rehabilitators on many issues. Standard protocols and care guidelines exist for some aspects, but some rehabilitators may not access these resources either by circumstance, by being isolated or financially unable to participate, or by choice. Additionally, there are aspects of rehabilitation where standard care protocols are more difficult to implement and as a result, practices are left up to the judgment of rehabilitators.

One contentious issue is the rehabilitation of non-native species, with many arguments for and against the practice (Heckly 1996, Sproat 1997, Tonner and Penn 1997). Non-native species are those that have been introduced into an ecosystem in which they did not evolve, generally as a result of direct, indirect, deliberate, or accidental actions by humans. Some facilities avoid the issue of non-native rehabilitation through specialization, and only accept and treat a narrow group of animals such as raptors or marine mammals. Proponents of specialization feel that it also contributes to quality care in rehabilitation because facilities are able to focus their knowledge, time, and energies, as well as caging and supplies, on specific types of animals. Many facilities must also decide whether to keep nonreleasable animals permanently in their programs, although some government agencies explicitly prohibit the use of nonreleasable animals in education programs.

In an interview study of people involved in wildlife rehabilitation in British Columbia BC), Canada, the authors identified the goals of, and impediments to, successful wildlife rehabilitation as perceived by rehabilitators, veterinarians, and government officials (Dubois and Fraser 2003). In so doing, several key points of disagreement or controversy over existing practices were identified. The present paper explores these issues in detail and assesses what scope there is to achieve consensus. Specifically, this paper addresses the handling of non-native species and nonreleasable animals, factors that impact care quality, methods of euthanasia, and the role of permits and related enforcement as a means of monitoring rehabilitation practices.

## Methods

Forty semistructured interviews were conducted between December 2001 and June 2002 with individuals involved in wildlife rehabilitation. These included five veterinarians, eight government wildlife officials, and 27 rehabilitation workers from 22 facilities. The purposive nature of the sampling and the small sample size of government officials and veterinarians meant that the study did not aim to be representative of these respective populations of stakeholders, and rather served to elicit a range of views from these two groups. Participants, recruitment, and interview methods are described by Dubois and Fraser (2003). In order to maintain confidentiality, participants will be referred to by group association: veterinarians, officials, and rehabilitators. Interview questions were developed based on data gathered from previous volunteer experience and questionnaires as described by Dubois and Fraser (2003). In brief, open-ended questions were used to explore participants' practices and views on rehabilitation issues; in a few cases, a yes/no question was asked to ascertain descriptive data about contentious practices before participants discussed why they opted for such practices. Interview analysis also followed Dubois and Fraser (2003).

## Results

### *Conservation Issues: Rehabilitation of Non-Native Species*

Participants disagreed sharply over the rehabilitation of non-native species. All rehabilitators, veterinarians, and government officials agreed that there is little data

to support any claims concerning postrelease impact on individuals or populations, and that there is generally no impact of releasing rehabilitated animals on species conservation, except in a few cases where released animals are endangered, or where large numbers are released into small local populations. Of the 22 rehabilitators who commented on the care of non-native species, 12 said they approved of their treatment and release, feeling that there is no population impact of the "relatively few" animals released and that there are ethical reasons to treat non-native and native species alike. One rehabilitator pointed out that domestic cats are a non-native species that also cause damage to native wildlife populations, yet they are not euthanized as a result. Another stated that since they are "not supposed to" rehabilitate non-natives in their region as per government recommendations, they will incorrectly record the species of the non-native animal upon intake (fox sparrow [*Passerella iliaca*] for house sparrow [*Passer domesticus*], for instance) and provide treatment. An additional three rehabilitators, who currently treat most non-natives, stated that they are considering future policy changes to reduce their treatment of non-natives significantly, based on their facility's capability and the abundance of these species in the wild.

Five rehabilitators opposed treating non-native species; they either euthanized all non-natives or used some as teaching animals for volunteers and/or to train predator species with live prey. Two of these rehabilitators also stated that they have caught healthy European starlings (*Sturnus vulgaris*) from the wild to train predator species. Two additional rehabilitators had looser policies, euthanizing most non-natives, but still treating a few in their "weak moments" or when there were no other animals in care for volunteers to learn from. Irrespective of whether they treated non-native species, a few rehabilitators showed favoritism toward predator species, since "they are longer living" and appear to "fight to survive." For example, one rehabilitator stated that they would make an effort to place a nonreleasable owl in permanent care but not a robin.

Three veterinarians expressed differing views on treating non-native species. One stated they would not euthanize non-natives as they believed releasing a few would make no difference to the population. Another felt that all non-natives should be humanely euthanized, as precious money is wasted rehabilitating these animals, which damage ecosystems. A third stated they did not differentiate between "bad and good species" but rather on the basis of rarity, noting that "robins are a dime a dozen."

Five of seven provincial officials stated that they leave euthanasia decisions regarding non-natives to the rehabilitators in their regions. These officials agreed that releasing a few non-natives does not generally have an impact on the population. One official believed that a "starling is no less valid than a robin for many," and others agreed that it is not ethical to kill these species merely because they are disliked. In one region, government wildlife personnel receive all animals before rehabilitators, and euthanize all non-natives. The final provincial official would "encourage" their rehabilitators to euthanize all non-natives.

### *Quality Care: Decisions, Specialization, and Staffing*

Generally, rehabilitators stated that they decide whether to rehabilitate individual animals based on a combination of factors including injury severity, species, and potential for rehabilitation and release (Table 1). To a lesser degree, facility capabilities and age of animals were cited as main decision factors. Final care decisions in nine facilties were made by senior rehabilitators only. In another eight facilties, senior rehabilitators made many decisions but sought veterinary advice for "grey areas"; in the final five facilities, veterinarians and rehabilitators made all decisions together.

Decisions relating to injury severity varied among rehabilitators. For example, one rehabilitator stated they will spend more than an hour gluing together the skin of a mauled cottontail rabbit, whereas another suggested that some repairs should not be done even if they are medically possible. Two rehabilitators reported using some animals, which are to be euthanized, as "guinea pigs" to attempt new procedures, believing that rehabilitators have an opportunity to learn from the experience. In contrast, a few others strongly believed that testing procedures on animals is inappropriate as most practices have already been proven. To address these differences, many rehabilitators indicated a need for standard facility and care guidelines that recognize that facilities vary in means and methods; this was particularly stressed for new rehabilitators.

Rehabilitators indicated that the type of facility can also affect the intensity of treatment; for example, a few participants noted that homecare facilities generally have people con-

**TABLE 1. NUMBER OF FACILITIES REPORTING DIFFERENT FACTORS AS THE MAIN BASIS FOR DECIDING WHETHER TO REHABILITATE ANIMALS**

| Main basis for decisions | No. of facilities |
|---|---|
| Injury severity, overall condition | 21 |
| Species (fit to facility specialization, fit to non-native species policy) | 13 |
| Potential for rehabilitation and good quality of life | 10 |
| Potential for release in the wild | 8 |
| Facility capabilities (available resources, existing caseload) | 6 |
| Age | 2 |

stantly present and may have more time to monitor or keep animals longer. However, several rehabilitators stressed that generally homecare facilities need additional support, as many are not as connected to the rehabilitation community as larger facilities.

Veterinarians indicated that guidelines exist for assessing releasability and most were aware of rehabilitation triage manuals, but they were unsure of their use by rehabilitators. Veterinarians indicated that when they assess an animal before sending it to a rehabilitation facility, they may use stricter release criteria and might euthanize more cases than a rehabilitator would. Overall, veterinarians believed care decisions in a rehabilitation facility should be made by well-trained people or an authority figure, and when a medical decision is required, rehabilitators should consult a veterinarian. Several officials were unsure if government-approved care standards exist. Others suggested that no such guidelines for care exist and some thought that the Wildlife Rehabilitators Network of British Columbia (the "Network") had standards available. Most officials indicated that the only government guidelines were for caging, and, as one official stated, these minimum requirements were outdated and had been developed for healthy zoo animals. In most regions, officials believed decisions should be made by rehabilitators based on their experience, but that veterinary advice should be sought in medical situations. However, in two regions where all animals must first be seen by government officials or veterinarians before being transferred to a rehabilitator, initial care decisions are made by these individuals.

Of the 22 facilities, six strictly specialized in one animal type such as mammals or birds, or in one animal group, such as raptors. Another five facilities accepted and treated most species, but focused largely on one group such as large mammals, raptors, or waterfowl. All of these facilities believed that specializing allows rehabilitators to target resources effectively and to avoid excessive caseloads. However, several of these rehabilitators also pointed out that it is important that individuals working in these facilities be well-rounded and have a broad knowledge of wildlife care since they may encounter other species in practice. One participant felt that some rehabilitators may think that those who specialize are discriminating against other species. Although specialized rehabilitators indicated a fondness for the species they treated, many chose to limit their intake for other reasons: to improve care; because they began with one species or group and did not want to expand; because permits did not allow additional species; or, in two cases, because rehabilitators had allergies to certain species.

All of the rehabilitators in the more generalized facilities had positive comments about specialization and recognized it is a natural progression in rehabilitation. Two of these rehabilitators stated they would like to specialize more if there were other rehabilitators in their region to take other species. An additional rehabilitator pointed out that in rural areas, where there is generally only one facility for thousands of square kilometers, specialization could actually impede rehabilitation. Three veterinarians suggested that they would like to see more specialization. However, one veterinarian added that although some species do better in small specialized facilities, many species do very well in general facilities. All officials were positive about specialization, and felt that it contributes to streamlining the rehabilitation process.

The presence of paid staff was mentioned by some participants as affecting quality of care. Ten of the 22 facilities had one or more regular, paid staff, either part- or full-time. Rehabilitators from these facilities commented that paid staff are highly trained, offer consistency and stability, and are accountable for their work. They also suggested that the ability to pay staff means that facilities can attract people with experience, and that experience can increase and remain within a facility. Several veterinarians and rehabilitators pointed out that although paid staff may be better than volunteers for consistency, paid staff in a larger facility are generally less consistent than a primary caregiver in a homecare facility; however, they felt burnout is higher in homecare situations. Facilities with paid staff recognized that they rely on volunteers, but stated that it is often difficult to find and keep good volunteers.

### *Public Education and Nonreleasable Wildlife*

All facilities were involved in public education in some way, including telephone advice, direct contact through incoming animals, off-site presentations, displays, on-site tours, and open houses, and through websites, advertisements, and pamphlets. A major difference between facilities was the use of nonreleasable wildlife as an educational tool. Eleven of the 22 facilities used nonreleasable animals for educational purposes in presentations. Of the 24 rehabilitators who discussed the topic, 12 believed in the use of nonreleasable animals in education and breeding programs, five strongly opposed keeping any wildlife in permanent captivity, and another seven, although keeping no permanent animals at their facility, occasionally transferred animals elsewhere for permanent care and felt that limited numbers were valuable for education and breeding programs.

One veterinarian was positive and another was very negative towards the use of nonreleasable animals for education, while the three remaining vets did not encourage it and emphasized that limits should exist. One of these three felt that without limits and monitoring, facilities with permanent animals can become "zoos acting under guise of public education." A second emphasized that "simply warehousing [permanent animals] so that the volunteers can go around and feel good about themselves is a mistake." Provincial officials overall discouraged keeping permanent wildlife except for rare or endangered species, which could be used either in breeding or fostering programs, and stated that few permits for nonreleasables are given out. Provincial officials stated that they did not want a gradual build-up of nonreleasables and felt it was important to limit the numbers of animals kept for education to those that are used often enough to justify a life in captivity. No federally regulated migratory species are allowed to be kept permanently for education purposes.

### *Rehabilitator Education and Training*

All 27 rehabilitators stated they gained some or all of their training "on the job." Six initially volunteered or trained at facilities, and others had a variety of backgrounds prior to their rehabilitation experience: four rehabilitators had university degrees in animal science or biology; three were trained at zoos; four gained experience from raising domestic animals; two had animal health technician training; and another two were trained as nurses. More than half of the rehabilitators had taken the International Wildlife Rehabilitation Council basic skills train-

**TABLE 2. NUMBER OF FACILITIES REPORTING DIFFERENT TYPES OF EUTHANASIA PROVIDER**

| Provider of euthanasia | No. of facilities |
|---|---|
| Rehabilitators only | 8 |
| Rehabilitators and consulting vet | 6 |
| Rehabilitators and on-staff vet | 3 |
| Consulting vet only | 3 |
| Rehabilitators and on-staff animal health technician | 2 |

ing. Many rehabilitators indicated that training opportunities for new rehabilitators were limited, and that more formal local training and upgrading programs are needed.

Most veterinarians were unsure of the training requirements for rehabilitators and believed that most started as volunteers in other facilities or learned on their own through trial and error. One veterinarian claimed that this latter situation can create a "lot of needless suffering in the learning process." This veterinarian also suggested that rehabilitators improve with experience, but it is important that they recognize the limits of their abilities. Several veterinarians indicated that more rehabilitator education and training are needed, as learning and experience are key to making sound care decisions. Officials were aware that there is no formal rehabilitation training required or provided by the government agencies. Generally, officials viewed the level of rehabilitation experience and/or training as appropriate for the service provided, and believed that rehabilitators should consult a veterinarian if they are not confident making a decision or performing a procedure.

### *Euthanasia*

All rehabilitators saw euthanasia as a form of release from suffering, and many considered that they must be able to euthanize because injured wildlife have a right to a humane death. Veterinarians stressed that rehabilitators are not failing by euthanizing and, in fact, rehabilitation should include a significant amount of euthanasia. Two veterinarians believed that rehabilitators are currently not euthanizing enough. Officials stated there are no requirements as to who should perform euthanasia. Although one official felt a veterinarian should perform all euthanasia, the majority of officials stated that it does not matter who it is, as long as the methods are humane and the individual is properly trained. Most officials were not aware of specific rehabilitation euthanasia guidelines and stated that the government agencies do not provide such information. One official cited humane euthanasia guidelines of defined by the Canadian Council on Animal Care (a national body that oversees the use of laboratory animals, including wildlife, in Canada), but felt that these guidelines are probably not familiar to most rehabilitators.

Euthanasia was performed by varying combinations of rehabilitators, veterinarians, and animal health technicians in the 22 facilities (Table 2). Rehabilitators had a variety of euthanasia training. The majority of facilities had in-house training, conducted by either senior staff or their consulting veterinarian. Two rehabilitators had also taken euthanasia courses given by animal shelters and three stated that they learned how to perform euthanasia from books or on the Internet. Seventeen rehabilitators commented on the methods of euthanasia their facility employed (Table 3). Of the 16 facilities that used injections, nine also used other methods to euthanize certain species. For example, injections were often used for mammals and large birds and either gas or physical methods for smaller birds. Seven facilities reported using injections to euthanize all animals, and one facility stated they used only chloroform. Methods for euthanizing prey animals (generally mice) raised for feeding wildlife in care were discussed by several rehabilitators, with the majority performing physical euthanasia.

### *Permits, Inspections, and Enforcement*

Generally, rehabilitators looked to the government process of permits, inspections, and enforcement to maintain consistent high care standards, although many were unsatisfied with the current system. One representative called for some form of centralized control:

> There should be a strong central organization that all wildlife shelters would be mandated to join. This central "head" should have experts to inspect and advise shelters (preferably a wildlife veterinarian) and the "head" should have the "teeth" to advise federal and provincial license providers to either grant or revoke any license. And the "head" should have the power to bring unlicensed premises under their control. If we don't soon get rehabbers into a strong unit, we may find ourselves redundant—taken over possibly by [organizations] such as the SPCA—who here at least know next to nothing about wildlife.

Rehabilitators had varying experiences in obtaining permits. Although many stated that they had no difficulty obtaining provincial permits, most were aware of others who had some difficulties. Six rehabilitators stated they had encountered administrative problems in obtaining provincial permits, and, in fact, four of these did not have permits to rehabilitate for several years. Additionally, a few rehabilitators admitted that they accept and treat animals that they are not permitted for. A few provincial officials stated they did not bother writing permits for some rehabilitation activities, particularly for temporary rehabilitators, who treat only a few animals and subsequently transfer them. Most rehabilitators with migratory species permits from the federal government stated that they did not have a problem obtaining a permit initially or in renewing their permits. They stated that the Canadian Wildlife Service was quick to send the permits without any inspection or communication. A quarter of these rehabilitators suggested that the agency is not stringent enough in their requirements and should regularly inspect facilities.

Although some rehabilitators had difficulty obtaining permits due to a lack of administrative support, more than a third of rehabilitators still complained that the quality control of provincial permitting is not strict enough; as one rehabilitator

**TABLE 3. NUMBER OF FACILITIES REPORTING DIFFERENT EUTHANASIA METHODS**

| Euthanasia Method | No. of facilities |
|---|---|
| **Injections** | |
| T61 | 3 |
| Euthanol | 3 |
| Agent not specified | 10 |
| TOTAL | 16* |
| **Physical** | |
| Cervical dislocation | 3 |
| Blunt trauma to head | 1 |
| Gun shot | 2 |
| TOTAL | 6* |
| **Gas** | |
| Carbon Dioxide | 3 |
| Chloroform | 1 |
| TOTAL | 4* |

***Some facilities use more than one method of euthanasia.**

stated, permits are "given to everyone and their uncle." A few rehabilitators also felt that permits should regulate the allowable number of nonreleasable animals and how they are obtained. However, the biggest criticism by most rehabilitators was that permits are rolled over without inspection; they felt that in order for the permits to be valuable, facilities need to be inspected and permits must be enforced to ensure that legitimate species and numbers are in care. Twenty rehabilitators suggested the need for more permit inspections to assess species types, numbers, and caging, and spot checks for quality of care. A few rehabilitators also suggested that they are aware of situations where individuals are still taking in animals after their permits had been revoked, and that permits have been renewed to individuals who have had many complaints made about their care. Four veterinarians also perceived minimal monitoring and enforcement of rehabilitation, and felt that this creates a "free-for-all" where a rehabilitator can do whatever they want, a situation that may not always be beneficial for the animals.

Although provincial rehabilitation permits require that facilities be prepared for initial and annual inspections, officials stated that initial inspections are not done in some cases, and facility inspections are not conducted annually in all regions. Only two provincial officials reported a minimum of one annual visit in their regions and stated that permits were renewed partially based on this visit. Other provincial officials were uncertain about the frequency of inspections in their regions, and most were generally unaware of Canadian Wildlife Service inspection frequency. The federal official stated that the Canadian Wildlife Service aims to enforce rehabilitation permits once every four years, or more often for active centers, and felt that there is currently adequate enforcement by both government agencies. Four of the seven provincial officials believed that there is enough enforcement at present, and no increase is needed in their respective regions. Provincial officials stated there is no inspection for temporary rehabilitation permit holders, and that these individuals' applications can be approved over the telephone. One official suggested a need for additional enforcement for these rehabilitators but indicated there are no resources for this. A few officials recognized that government personnel are not necessarily qualified to make care assessments, as this is not their background.

All rehabilitators felt that, ideally, provincial and federal agencies should enforce regulations and monitor facilities to ensure that they abide by permit conditions; however, only three believed that the current level of provincial enforcement was sufficient at their facilities. Overall, rehabilitators believed that Canadian Wildlife Service enforcement was insufficient, as many facilities have never been federally inspected. Indeed, of the six facilities reporting on the frequency of migratory bird permit inspections, only two had had one inspection since their facilities opened. Several rehabilitators attributed the low frequency of inspection to government understaffing and lack of time. They recognized that officials who drop animals at facilities can gain some awareness of a facility's practices from this contact, but they do not see these visits as official inspections. Overall, rehabilitators and officials had different views on the purpose of enforcement; rehabilitators see enforcement as a quality control, whereas officials stated enforcement assesses whether a facility is operating according to permits and wildlife regulations, and does not address care standards, although they indicated that they are able to act on cruelty or neglect cases that are covered by the Prevention of Cruelty to Animals Act (Province of British Columbia 1996).

In light of government's little interest or ability to increase their involvement in permit enforcement and care inspections, several rehabilitators suggested that the Network become involved in enforcement or certification of facilities; however, just as many rehabilitators disagreed, stating that the Network's internal politics might influence its judgment and obscure its objectivity; also, it was pointed out that the Network has no legal authority to enforce standards. There was agreement, however, among many rehabilitators and several veterinarians and officials, all of whom called for standards in animal care, release criteria, record keeping, training and policing, as well as specific government regulations for facilities, euthanasia, and nonreleasable animals. Additionally, some members of all groups agreed that any care enforcement should be conducted by a team of individuals representing different wildlife stakeholder groups.

## Discussion

The results identified several key areas of disagreement among wildlife rehabilitators: the treatment of non-native species, the use of nonreleasable animals, methods of euthanasia, and the purpose of permitting and enforcement.

The treatment and release of non-native species was a major point of contention, with just over half of the study's rehabilitators approving such treatment, and most officials stating they do not require their local rehabilitators to euthanize non-

native species. Arguments for the rehabilitation of non-native species, both in this study and in previous literature, include suggestions that rehabilitators often learn from working on high numbers of non-natives, that these species have the same right to live as natives, and, finally, that there is a negligible effect of released non-natives on the overall population (Sproat 1997, Tonner and Penn 1997). In contrast, those opposed to non-native rehabilitation argue that non-native species are taking up precious resources that could be better used for the treatment of native species, that non-natives are a hazard to native wildlife and the environment, and that there are limits to the carrying capacity of the environment that may be exceeded by releasing non-natives (Heckly 1996, Sproat 1997, Tonner and Penn 1997). The split in opinions of BC rehabilitators, based on many such arguments, is compounded by a lack of regulatory guidance, and presumably leads to mixed messages being sent to the public about these species.

Moreover, some facilities used non-natives, particularly pigeons and starlings, to train volunteers and to train predator species with live prey. Although live prey training is important for the rehabilitation of many predatory species, as Orendorff (2002) suggests, prey animals need to be treated with the same care as those animals to which they will be fed.

The second key area of disagreement was the use of nonreleasable animals in educational programs. Several rehabilitators opposed any permanent captivity; many others used nonreleasable animals for public education, although most felt that the number of nonreleasables per facility should be limited.

For both of these issues—non-native species and nonreleasable animals—most participants perceived a need for defined regulations and enforcement in order to provide consistent quality care to these species, consistent messages to the public, and to relieve tensions among rehabilitators.

Euthanasia was a third area where practices differed, raising some controversial issues. Some rehabilitators were not aware of the most current acceptable euthanasia practices and what other rehabilitators used. For example, chloroform is no longer recommended as a euthanasia agent due to its toxicity and carcinogenicity to humans (Canadian Council on Animal Care 1993), but it was used by one facility. Ether, although not used by any survey participants, has had recent use in other areas (Wolff 1992), but is not recommended because of danger to handlers (Canadian Council on Animal Care 1993, Richards 1993). The nonregistered injectable T-61, although taken off the market in the U.S. against the wishes of some rehabilitators and veterinarians (Richards 1993), is an acceptable euthanasia agent according to the Canadian Council on Animal Care (1993) and is used by some BC rehabilitators despite being described as an inhumane method in the Network protocols of care (WRNBC 1991). Research may be needed to determine the humaneness of this product.

Overall, there is a need to inform rehabilitators and officials about the most current standards for euthanasia and to provide a forum for stakeholders to communicate about issues surrounding euthanasia training and methods. Although some rehabilitators have veterinary input on most of their euthanasia cases, many do not have frequent contact with veterinarians and need to be qualified to handle a variety of species. Therefore, it may be of benefit to offer rehabilitators euthanasia training programs similar to those offered by humane societies.

Members of all participant groups identified a need for standards for facilities and care practices. Both the International Wildlife Rehabilitation Council and the National Wildlife Rehabilitators Association provide ethical and care guidelines for rehabilitation and establish criteria and standards to promote professionalism in the practice. Together, they jointly produced Minimum Standards for Wildlife Rehabilitation (Miller 2000), including standards for cleaning, disease control, caging, euthanasia, release criteria, and record keeping. The organizations also produce publications addressing ethics, handling, diets, and postrelease studies, in addition to offering basic and advanced rehabilitation skills seminars and workshops. In Canada, care guidelines for wildlife, including euthanasia methods, are also available through the Canadian Council on Animal Care (1984, 1993, 2002).

Although the above standards are freely available, their use does not appear to be widespread and may be confined to those rehabilitators who access them through professional associations. A lack of consistency in the use of standard care protocols appears to create uncertainty among rehabilitators; for example, one rehabilitator suggested that it is difficult to make decisions to transfer animals to other facilities, since they are not certain of the receiving facility's care standards. Improved communication and support of existing care protocols among rehabilitators, and between other stakeholders is required in order to achieve a high level of animal care in rehabilitation. Specialization was also suggested by many participants as effectively contributing to quality care, although it was recognized that there is a valid role for both general and specialized facilities.

Although most officials felt that current rehabilitation training levels were sufficient, rehabilitators and veterinarians disagreed, and indicated a need for locally relevant and accessible training, not only for Network members but for all rehabilitators. There is a need to inform rehabilitators of the resources available and perhaps direct them to more sources with content relevant to their particular jurisdictions, particularly on legislation and permitting. Government agencies, which are also not fully aware of the information available from these organizations, could also become more informed in order to direct new and current rehabilitators to the most recent practices and research. In particular, temporary rehabilitators should be informed and trained, since these individuals often are isolated, have less experience, are not monitored, and yet deal with a large variety of animals and injuries.

Rehabilitators suggested that effective enforcement would also contribute to professionalism in rehabilitation. Most rehabilitators and veterinarians felt there was a lack of monitoring and inspection, which allowed some rehabilitators to continue their activities without permits or with unauthorized animals. Both an increase in inspection frequency and intensity were called for by these groups to improve quality control. Government wildlife personnel are not necessarily trained in wildlife identification or species care, nor are all rehabilitators aware of proper care practices for all species. This situation might be addressed by following the model of the Alberta provincial rehabilitation association, whereby inspection panels

are composed of government wildlife officers, a veterinarian, a member of a humane society, and executives of the provincial rehabilitation organization (Wittner 2002). Overall, there appeared to be consensus that any care assessments should be undertaken by a team of stakeholders, although most officials felt that such assessments would not be a priority for government resources. However, in order to assess rehabilitation efforts over the long term, there is a need to consistently monitor rehabilitation care practices.

For some of the contentious issues raised, it may be possible to achieve a degree of consensus. By promoting standardized care and euthanasia policies and establishing limits to the use of nonreleasable animals, stakeholders might achieve greater consistency. Some issues, such as rehabilitation of non-native species may never reach consensus, but by clearly outlining their rationale, disagreeing facilities can at least consistently inform the public about both sides of the issue. Finally, there is call by many rehabilitators and veterinarians for more inspection to maintain quality of care and facilities. While additional inspections are unlikely to come from government, there was consensus that a team of rehabilitation stakeholders should serve in this capacity.


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# Native American Use of Bird Species for Ceremonial Purposes: Can Wildlife Rehabilitators Address the Need?

by Janelle Harden
*with responses from Zuni Pueblo, the Region 2 U.S. Fish and Wildlife Service, and the New Mexico Department of Game and Fish*

**ABSTRACT:** Various federal laws make it illegal for anyone to possess migratory birds, or their body parts, nests, or eggs unless specifically permitted. Although a variety of bird species have for centuries held high cultural importance with Native Americans, no current mechanism allows Native Americans to "take" or receive wild bird species for ceremonial use.

This paper details the research process to determine whether wildlife rehabilitators might be an appropriate source of bird species for Native American ceremonies; applicable regulations; and a historical overview of the effects of said regulations on Native Americans. A Native American response is provided by a member of the Zuni Tribe in New Mexico, as well as a "current status of the situation" report from the Region 2 USFWS and the New Mexico Department of Game and Fish.

**KEY WORDS:** avian carcasses, ceremonial use, feathers, Migratory Bird Treaty Act (MBTA), Native Americans, rehabilitators, U.S. Fish and Wildlife Service, 50 CFR

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## Introduction

Various federal laws, overseen by the U.S. Fish and Wildlife Service (USFWS), make it illegal for anyone to have migratory birds, or their body parts, nests, or eggs in their possession unless specifically permitted. For centuries, a variety of bird species have held high cultural importance with Native Americans; however, no current mechanism allows Native Americans to "take" or receive wild bird species for ceremonial use. This paper explores whether wildlife rehabilitators might be an appropriate source.

The 2001 annual reports for all New Mexico rehabilitators yielded a list of avian species that were DOA, died during rehabilitation, or were euthanized due to the seriousness of injuries. To compare potentially available rehabilitation carcasses with those species important to Native American groups in New Mexico, a questionnaire was sent to each pueblo and tribe in the state.

## Study Area

The author resides in Albuquerque, New Mexico, which is regulated by the Region 2 Migratory Bird Permits Office of the U.S. Fish and Wildlife Service (USFWS). Region 2 (Southwest) covers Arizona, New Mexico, Oklahoma, and Texas. It was determined that the research should focus on the single state of New Mexico. Rehabilitation acquisition data submitted to the USFWS in the form of annual reports is protected under the Privacy Act; it is not available to the public. However, the New Mexico Department of Game and Fish (NMDGF) allows rehabilitators to submit duplicates of their USFWS records as their state-level (avian) annual reports. These state reports are in the public record, and thus were available for use. This allowed the author to determine an exact accounting of both quantity and species of avian carcasses resulting from 2001 rehabilitation activities. In addition, this availability of state-level data dictated that only New Mexico tribes be contacted because the research project attempted to match available bird carcasses with those desired by "local" Native Americans.

## Methods

The 2001 annual reports, submitted to NMDGF by all rehabilitators in New Mexico, were acquired. Within these reports, a final disposition must be reported for all animals acquired under rehabilitation permits. These data were extracted and categorized by species. A questionnaire was then developed to compare available species with those desired by the 21 recognized Native American tribes in New Mexico, to whom the questionnaire was sent.

In addition, a literature search was conducted to review historical hunting and collecting activities that affected avian populations. Negative impacts led to a series of regulations, most established in the first half of the 20th century. Current statutes were examined to determine pertinent state and federal regulations that could affect a tribal organization's ability to obtain these carcasses.

## Historical Status of Birds and Federal Regulations

During the end of the 1800s and through the first decades of the last century, birds were killed in vast numbers by an unregulated public. Their feathers were used to adorn hats, and bird eggs and nests were taken for display in private collections. In concert with other activities, such as unregulated hunting, this brought about the decline or outright extinction of species (USFWS 2002). The USFWS website states:

> By the late 1800s, the hunting and shipment of birds for the commercial market (to embellish the platters of elegant restaurants) and the plume trade (to provide

feathers to adorn lady's fancy hats) had taken their toll on many bird species. Passenger pigeons, whose immense flocks had once darkened the skies, were nearing extinction. Populations of the Eskimo curlew and other shorebirds had been decimated. The snowy egret and other colonial-nesting wading birds had been reduced to mere remnants of their historical populations.

Though it took several decades to respond to these and other concerns, several regulatory acts were eventually passed. These began with the Lacey Act, passed by Congress on 25 May 1900; it prohibited game illegally taken in one state to be shipped across state boundaries. The 1913 Weeks-McLean Law was designed to stop commercial market hunting and the illegal shipment of migratory birds from one state to another. In 1918, the Migratory Bird Treaty Act (MBTA) was passed specifically to end all commercial trade in birds—and their feathers—which, by the early years of the 20th century, had wreaked such havoc on many native bird populations. It placed every indigenous migratory bird species and their body parts (including eggs, nests, and feathers) under fully protected status. This covered not only birds thought of as rare or unusual, but also robins, crows, finches, and other birds the general public considers common and abundant. Only the European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and rock dove (*Columba livia*) were exempt; as "exotic" imports from Europe, they do not qualify for protection under the MBTA.

The USFWS was given the legislative authority to administer regulations under the MBTA. A permit process was created to allow hunting, scientific collection, and other activities deemed necessary (and biologically supportable), without further devastating the remaining bird populations. Specific provisions in the statute include:

> Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." (MBTA; 16 U.S.C. 703)

In layperson's terms, this simply says, "Don't kill... don't even touch!" One must have a proven, acceptable reason, "permitted by regulations," to be in possession of birds or their parts. Note that this might be construed to address only individual birds, as distinct from the habitat destruction that affects entire populations. Over the years, better data became available about the population health of various bird species. Stricter regulations were required to ensure the protection of all native avian species. The more recent Endangered Species Act of 1973 (ESA) provided for the conservation of ecosystems upon which threatened and endangered species depend. It also authorizes the determination and listing of species as endangered and threatened (ESA; 87 sata 884, 16 USC 1361–1407).

## Current Status of the Human-Avian Interface

It would be pleasant (and naive) to believe these regulations have solved the issues that once endangered bird populations. Just as protective laws are relative newcomers to the cultural scene, so are the human constructs our avifauna must deal with. Through millennia of evolution, birds have adapted to natural dangers. However, they have not yet been able to fully adapt to every danger created by human technology, especially those created in just the last few decades. Wildlife rehabilitators, by the very nature of their activities, are in an excellent position to clarify the daily anthropomorphic risks to birds. One of the requirements of a rehabilitation permit is the filing of annual reports with both state and federal authorities. These reports must detail the number of each species brought for care, the cause of their illness or injury (if known), and the final disposition (i.e., died or released back to the wild). In a recent study (Harden 2002), five years of annual reports from Wildlife Rescue, Inc. of New Mexico (WRI) were examined. Only 22 percent of the known causes could be classified as "natural" for the years 1994 through 1998. Natural causes include disease, attack by predators, and displacement by serious weather or other natural occurrence. The remaining problems create an extensive list of human-caused injury and destruction. These anthropogenic causes of avian mortality include collisions with windows, buildings, towers, power lines, and vehicles; getting chewed up by domestic cats and dogs; entrapment in buildings, swimming pools, oil pits, and chimneys; poisoning—both intentional and "nontarget" (via ingestion of insects or animals intentionally poisoned); ingestion of plastic and other trash; and damage or death by well-meaning members of the public who "rescue" (kidnap) youngsters because they mistakenly believe the parents are gone. The five years of WRI data examined involved almost 4,000 birds from the Albuquerque, New Mexico area alone—and these data cover only those that people actually found—and were willing to bring to the organization.

The "urbanization of America" not only creates a maze of buildings and other constructs that can kill wildlife, it also usurps the native habitat required for wildlife population health. Loss of habitat is the number one cause of species' extinction around the globe. Our ever-increasing presence is enough to devastate bird populations, even if we have foregone those damaging activities of the early 20th century. Wildlife rehabilitators, as well as state and federal wildlife officers, encounter daily situations that indicate the problems are not solved. Examples abound, such as people who shoot down hawks, cut off their legs (talons) and tail-feathers, and hang the bundle from their rearview mirrors after tossing the bird into a field to die of starvation or predation (WRI 1998). Other people trap and sell wildlife to the exotic pet trade or to foreign countries as medicines, gourmet food items, or aphrodisiacs. Harden's (2002) paper discusses global problems such as commercial fishing methods, mining sludge or other chemical destruction of habitat, and other disasters that decimate bird populations.

It could be argued that the damage "controlled" by state and federal regulations is miniscule in comparison to such global devastation. The point is that those damages can be controlled. In light of the ongoing endangerment and extinctions of so many avian species, these controls are vital, however cumbersome. The current regulations ***do*** include a permit procedure to allow possession of birds or their parts for certain purposes. However, the regulations do ***not*** address ceremonial feather use by Native Americans.

### Federal and State Permit Procedures

As of the 2003 writing of this paper, there are 32 different permit types that allow some form of bird possession (Kamile McKeever, USFWS; pers. comm. 2003). The Title 50 CFR (Code of Federal Regulations) from the USFWS covers all permit forms. General Provisions are in 50 CFR 10, General Permit Procedures appear in 50 CFR 13, and specific Migratory Bird Permits are detailed in 50 CFR 21 and 22. Additionally, most activities involving migratory birds have matching regulations and permits through the state agency responsible for wildlife—the New Mexico Department of Game and Fish in this instance. This may double the potential for infractions involving migratory birds because state controls and concerns may be different than those at the federal level. As might be expected with government documents, the regulatory verbiage is lengthy and often difficult to understand. It should not be a surprise to learn that many illegal activities occur due to ignorance or misunderstanding of the various regulations. Finally, the last issue concerning permits is the fact that Native Americans' needs are not adequately covered under current permit types This has disenfranchised the tribes who wish to obtain bird feathers for religious and cultural needs.

### Native Americans and Current Regulations for Possession of Birds or Their Parts

This paper has explained the illegality of any member of the public having a bird or its parts in their possession without the appropriate permits. Even wildlife rehabilitators—who clearly intend being a force for bird conservation—must have special permits to conduct their activities. Even though a rehabilitation permit indicates that they can be trusted with live birds, rehabilitators are not allowed to pick up road-kill without a special "Salvage" permit. It should therefore, be no surprise that tribes can't obtain the birds they need, since it is understood (for the most part) that the birds must die to be utilized for ceremonial purposes. They cannot legally even pick up the dead ones found within their tribal boundaries, much less purposely trap or kill bird species. The only mention of Native Americans in Regulations falls under Section 22, which is dedicated to eagle permits. After successful application for an "Indian Religious Purposes" permit, tribal authorities are sent to the National Eagle Repository in Denver, Color-ado, which, as the name implies, deals only in eagle remains. The repository is administrated by the USFWS. The website (http://www.r6.fws.gov/law/le27.html) basically reiterates the language found in Title 50 CFR:

> *Division of Law Enforcement*
> *National Eagle Repository*
>
> The National Eagle Repository (Repository) is located at Rocky Mountain Arsenal northeast of Denver, Colorado. Its mission is to provide a central location for the receipt, storage, and distribution of bald and golden eagles that are found dead, and their parts. The eagles, and their parts, are shipped to Native Americans who are enrolled in federally recognized tribes, for use in religious and cultural ceremonies.

It is illegal for any individual to possess a bald or golden eagle, including its parts (feathers, feet, etc.) without a permit. The distribution of bald and golden eagles, and their parts, to Native Americans is authorized by the Bald and Golden Eagle Protection Act and Regulations found in 50 CFR 22. Native Americans wishing to obtain bald or golden eagles or their parts, must submit an application to the U.S. Fish and Wildlife Service, Migratory Bird Permit Office, which services the state where the applicant resides. The completed request form is sent to the National Eagle Repository and the order is filled on a first come, first served basis. Currently there are over 5000 people on the waiting list for approximately 1000 eagles the Repository receives each year.

At this point it is important to note that the most recent checklist of New Mexico Birds (NMOS 2000) lists more than 495 birds species confirmed to reside in, or migrate through, New Mexico each year. While the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) appear to be the most important species to Native Americans across the United States (John Antonio, USFWS; pers. comm. 2002), they still represent only two of the hundreds of known species. No additional permits exist to allow possession of any other specie's feathers. Additional regulation will be required to allow tribes to legally obtain feathers that became deeply embedded in their religious ceremonies centuries before "white laws" came into existence.

### "Don't Kill... Don't Even Touch!"

Debates abound as to whether or not birds are the property of the reservation or tribal lands on which they appear. "Appear" is the operative word here. There are a large number of neotropical migrants who do not reside in the United States on a year-round basis. Even resident species may migrate from state to state. The bottom line is that the Migratory Bird Treaty Act considers all native birds the property of the people of the United State. The USFWS, as a government agency, is the steward of this public resource. The public must adhere to all regulations, regardless of whether they are members of any tribe or merely part of the general populace. Just because something flies over—or builds a nest upon—a given plot of land does not mean it can be considered the property of the landowner. However, it could be construed that this is how birds were viewed by Native Americans over centuries of religious tradition. Tyler (1979) states in his *Pueblo Birds & Myths* preface: "The Pueblos have been watching their birds for centuries and during that time they have incorporated these creatures into every aspect of community life." Does this mean birds should be "fair game" if (even momentarily) found on tribal lands? Some might argue that Native American tribes, as sovereign nations, should be exempt from the federal MBTA permit requirements that apply to the general U.S. citizenry. And lastly, is there any evidence to indicate this desire for feathers is not a recent, post-regulation development?

### A Historical Perspective

In the late 1870s Congress appropriated funds for continuing research among North American Indians (National Anthropological Archives 2001). Early settlement and military surveys were geographic in nature, with no interest per se in the peoples already occupying the territory (J. P. Hubbard, pers. comm. 2002). An act of Congress led to the founding of the Bureau of Ethnology under the directorship of John Wesley Powell. The Bureau undertook both broad and basic anthropological research projects and sponsored extensive, intensive field

research. A library and specimen collection were created in the United States National Museum. By the time the name changed to the Bureau of American Ethnology in 1897, a growing body of work appeared that focused on native peoples and their culture. Rather than just categorizing the geographic features, researchers began living with indigenous people to better understand the diversity of the original residents of the "Territories."

Matilde Coxe Stevenson is perhaps one of the better-known ethnographers of this period. Her work with the Zuni (Stevenson 1904) and Sia (Stevenson 1894) were seminal in gendering respect for a people and their beliefs, completely outside mere academic interest. A review of the literature from those early days until the present verifies the importance of birds to Native Americans. Details of "how many feathers are used for which sacred items" could indicate that thousands of birds may be required by each Tribe (Stevenson 1904). It was understood that, whether these birds were trapped or possibly raised in captivity, they were eventually killed. During these early surveys of the Territories, there was no real reason to even address the issue because regulations had not yet been established. Nonetheless, we cannot make the mistake of thinking that all studies cover activities prior to the regulations detailed earlier. Much of the pertinent research was conducted and published after the establishment of these laws.

The writings of ornithologist and ethnobiologist Amadeo M. Rea are just one example. His five years as a teacher on the Gila River Reservation in Arizona were only a portion of greater than 30 years of research there. He is acknowledged as an authority on Pima and Uto-Aztecan peoples. In *Once a River* (1983), Rea traces the decline of bird life on the Middle Gila; the declines were verifiable by comparing present populations to the historical knowledge of the Gila River Tribe. Over a decade later, Rea's long-awaited *At the Desert's Green Edge: An Ethnobotany of the Gila River Pima* was published in 1997. It is the first complete ethnobotany of the Gila River Akimel O'odham, or Pima Indians. Even though it deals with the plant lore, at least 58 birds species are mentioned; it is not possible to detail any aspect of tribal culture without including the birds that are so integral.

Ornithologist John Gripper Tyler (1883–1969) shared his fascination with Native American bird use in *Pueblo Birds and Myths*, published posthumously in 1979. Tyler reports that much of his knowledge is credited to information gained from Edmund J. Ladd. *Zuni Ethno-Ornithology* (1963) was Ladd's master's thesis for the University of New Mexico. As a member of the Zuni Tribe, he provided amazing detail of the ceremonial usage of feathers. This also provides an idea of the volume of feathers required for the making of various ceremonial objects. In his discussion of prayer-sticks, Tyler referenced Ladd's work:

> "Ladd, a Zuni Indian and serious student of birds, estimates that each member of his tribe offers at present between sixteen and eighty prayer sticks a year.... To make these Zuni offerings, feathers from seventy-two species of birds are needed. Most of the feathers used for this and other purposes are specified, not only the kind of bird but also the type of feather—whether primary wing, tail, downy, breast, or whatever." (Tyler 1979, p. 3).

In 1887 Stevenson described that not just adults, but Zuni children as well, were involved in religious life. By June 1962 the Zuni population was reported as 4380 (Smith 1969). Should this number be used as the multiplier for Ladd's statement that "each member... (offers) between sixteen and eighty prayer-sticks a year"? If indeed, every man, woman, and child did this—times the 72 different bird species used—the number of feathers required would be vast. It should be pointed out that the Zuni Tribe is the largest in New Mexico; the number of birds or individual feathers they require cannot fairly be assigned to all tribes in the state. In addition, the Zuni have also been the most forthcoming with information: Stevenson's final report on the Zuni (1904) filled the entire 608 pages of the Bureau of Ethnology's *Twenty-Third Annual Report*. Most tribes have never shared such quantity-detailed information. Nonetheless, two important points become clear: (1) Bird use by Native Americans has been documented since the earliest days of information-gathering by ethnographers, and (2) the most recent literature—including that by tribal members—indicate the quantity of birds and feathers used has not decreased just because an "outside government" decreed it illegal to have such items in one's possession. This knowledge brings us full circle to an earlier question. How can tribes legally obtain feathers that became deeply embedded in their religious ceremonies centuries before "white laws" came into existence?

Though strict law enforcement definitions might vary, for the purposes of this paper, "take" is a euphemism for "kill." In many discussions with state and federal wildlife employees, it was acknowledged that tribes probably continue to take whatever species they need, when and if the birds can be found (no one agreed to be cited for this belief). None of the more recent ethno-ornithology writings overtly admit to this, however. Chapter Two in Ladd (1963) describes "Hunting Methods" by which birds are obtained. Various guns, slingshots, traps, and snares are mentioned. Legal issues are not even broached, other than to say there are no *Zuni* taboos about using feathers, based on the method by which it was killed. A recent issue of *Conservation Biology* carried what has become a somewhat controversial article—again involving the Zuni Tribe. Taylor and Albert (1999) interviewed various male hunters on the Zuni Reservation. They basically then multiplied the "take" of each hunter by the total number of hunters. Note that the population had grown to about 8800 by the time of their research. They estimated that in one year (1994–95) the 1199 Zuni hunters took approximately 55,000 nongame birds. Additionally, they estimated the total take of each of the two most heavily hunted species, bluebirds (*Sialia spp.*) and northern flicker (*Colaptes auratus*) to be >11,000 individuals per year. In my discussions with several New Mexico ornithologists (John P. Hubbard, J. David Ligon; pers. comm. 2002), it was felt that these numbers were unlikely to be accurate. Without data such as that derived from breeding bird surveys, it is difficult to believe either bluebirds or northern flickers exist on the Zuni Reservation in enough numbers to withstand an 11,000 annual kill.

The author's academic experience has shown that, in many research projects, there are difficulties in finding the proper method by which to apply small data sets to a larger picture. One of the authors of the 1999 Zuni paper, Steve Albert, was contacted. He graciously shared some ideas about their data (pers. comm. 2002). He acknowledged that he also questioned the large numbers of estimated bird kills. He felt it possible

that some hunters exaggerated the number of birds taken—and the total number of hunters could have been wrong as well. Mr. Albert also made another important point. The Zuni Reservation is just under one million square acres, only one percent of which is developed. The remainder is a natural landscape that supports native animal species. This must be compared to the urbanization discussed earlier. Acre for acre, species on Zuni land will fare better than those trying to deal with human constructs (Author's note: this may depend on the species). Albert pointed out that while it is illegal to kill wildlife, it is not considered illegal when, for example, commercial enterprises pave over wildlife habitat in urban areas. It should be reiterated that killing of most wildlife is definitely against the law. Habitat destruction, though "covered" by acts such as the ESA, does not fall under any simple, distinct law—a significant point. These, and other anthropogenic causes of bird mortality already discussed, must be considered in any comparison with bird loss through Native American take.

Whatever the actual numbers may be, when added to the take from the rest of the state's tribes, it is certainly possible such activities have an impact on bird populations. Before pursuing the issue any further, we also need to look at one other group responsible for the taking of both game and nongame species. Museums are allowed to collect birds under a Scientific Collecting permit, detailed in 50 CFR 21.23 or Special Purpose—Salvage permit, 50 CFR 21.27. Educational institutions require a certain number of each bird species in order to have a large enough sampling to obtain "robust" population data. Even though allowed take is determined by the numbers a given species can theoretically support and museums have long depended on carcasses found by park rangers, wildlife employees, and the public, live birds are nonetheless removed from the population. This is where wildlife rehabilitators enter the picture.

Wildlife rehabilitators receive injured and orphaned wildlife from people who find these creatures under a variety of circumstances. Some animals are already dead when they arrive, some die in care due to the severity of injuries, and some must be euthanized because their injuries would not allow successful survival if released back to the wild. Most injured adult wildlife brought to rehabilitators has already been "down" for some period of time (E. P. Elliston, pers. comm. 2002). The pathology may be too far progressed for adequate recovery. The average for successful release of injured adults hovers around 35%; this means two-thirds of adult birds acquired end up as carcasses (Wildlife Rescue, Inc. of New Mexico 1994–98). These carcasses are an important resource to museums and educational institutions (R. W. Dickerman, pers. comm. 2002). The Standard Conditions for wildlife rehabilitation dictates what rehabilitators can legally do with these dead birds. Item 13 of those conditions states that:

> Dead birds, or any parts thereof (except bald and golden eagles, endangered and/or threatened species) shall be *promptly destroyed by burial or incineration, or donated to public institutions*, as specified in 50 CFR 10.12, or transferred, with permission from the issuing office, to individuals authorized to possess migratory bird specimens for educational purposes. [author's emphasis]

For years, most rehabilitators were not associated with a museum and were unaware that such an option existed (R. W. Dickerman, pers. comm. 2002). Dickerman, Museum of Southwestern Biology, University of New Mexico, has worked locally to enlighten rehabilitators about the value to museums of rehabilitation carcasses. In the early 1990s he formed a relationship with Wildlife Rescue, Inc. of New Mexico (WRI) and other New Mexico rehabilitators, accepting every bird carcass—regardless of species. He reports that approximately 1500 rehabilitation specimens have been accessioned into the museum's collection during the last decade (R. W. Dickerman, pers. comm. 2002). In 1999 he surveyed many avian curators across the nation to find out which ones wanted to receive birds from rehabilitators. He then reported his findings at the International Wildlife Rehabilitation Council's 1999 annual conference in Tucson, Arizona, requesting greater participation from their membership (Dickerman 1999). The important point is that every bird provided by rehabilitators is one more live bird that will not have to be killed to enlarge a museum collection. It should also be noted that this "benefit" depends on how the curator or researcher views rehab birds as a representative and random sampling of the larger population. In any case, birds not needed by museum collections have an application to the issue of tribal usage.

The 1500 rehabilitation birds kept by the Museum of Southwestern Biology represent only 15–20% of the total number received by the museum, leaving a balance of 5000–7500 that were not needed by the museum. The permit procedure already discussed dictates disposal of remaining carcasses via burning or burial, with no provision for use by Native Americans. Beyond application to the Eagle Repository in Colorado, tribal "institutions" are not covered by educational—or any—section of the regulations. Yet, if museums (and initially, wildlife rehabilitators) end up with any quantity of bird carcasses, could they not be made available for ceremonial use?

## Results of the Questionnaire Sent to New Mexico Tribes

The questionnaire concerning desirable bird species yielded a response from nine of the 21 New Mexico tribes to which it was sent. The cover letter accompanying the questionnaire stated that all responses would be confidential, so individual tribes and their specific comments are not included herein. However, an overview of their responses is appropriate. The survey showed photos of 45 avian species that most commonly appeared as carcasses on the 2001 annual reports of all New Mexico rehabilitators. The nine respondents collectively chose 35 species as desirable for ceremonial usage, although only 12 species were chosen in common by all nine tribes. In another section of the survey, respondents were given the opportunity to record desirable species that did not appear within the 45 species commonly available. An additional dozen species were named in that section of the responses. Lastly, it should be noted that in some cases it is the size, shape, and color of the feather that is of greatest import—not the distinct bird species.

## Conclusions

Many local wildlife law enforcement officials (both federal and state agencies) contacted during this project were supportive of providing carcasses to tribal authorities. However, they are cautious about implementing carcass-distribution systems without clear guidance that provides both authority and legal

protection for all parties involved (Chuck Hayes, NMDGF, pers. comm. 2002). The regulations established over the past century were not initially formulated for later disciplines such as wildlife rehabilitation, nor with concern for the religious practices of Native Americans. They also did not address a conservation-oriented disposition of rehabilitation bird carcasses. There has been some progress in revision of laws and regulations. Special permits do allow the possession of protected wildlife for legitimate conservation, rehabilitation, or educational purposes. A final point concerns the difficulties of determining which religious groups might be "appropriate" for ceremonial activities involving bird species. There are a variety of non-natives who may claim religious needs, and thus expect legal take of migratory birds. Establishing a legal method for Native Americans to have bird feathers—beyond the eagle program already in existence—could open a huge can of worms that may be difficult or impossible to address. Note that the eagle program applies only to "all federally recognized tribal governments" as stated in a Presidential Document Memorandum dated 29 April 1994. *The Policy Concerning Distribution of Eagle Feathers for Native American Religious Purposes* states that "...this administration has undertaken policy and procedural changes to facilitate the collection and distribution of scarce eagle bodies and parts for this purpose" (Federal Register 1994). This memorandum deals only with Native Americans—and there are tribes within the United States that are not federally recognized, and therefore do not have access to the eagle repository.

The Native American issue is at the heart of many decisions that must be made. The Region 2 FWS office is currently working with the New Mexico Department of Game and Fish on this issue. Various options are being explored to perhaps establish a local distribution process through the New Mexico Department of Game and Fish. New Mexico is an ideal state to act as a "test case" to demonstrate how this resource from rehabilitators could be effectively utilized by museums and tribes alike. It is important to note that officials at both state and federal offices were aware—and supportive—of the research material reported in this paper. Kamile McKeever of FWS Region 2 Migratory Bird Permits Office sent the initial report to the appropriate personnel at the FWS's Washington, D.C. office. The New Mexico Department of Game and Fish stated that the results may be used as a potential reference resource for future planning (Chuck Hayes, NMDGF, pers. comm. 2002).

In the meantime, the legal restrictions have placed Native Americans in a difficult situation. Decisions are required to address the heated debates over what "tribal sovereignty" actually means as regards the wildlife found on tribal lands. Some form of legal take may need to be formulated. In the interim, creating a legal procedure by which rehabilitation carcasses may be distributed to the tribes would be only a first step. It would then be necessary to find the appropriate agency—and the financing and personnel—to both collect and fairly distribute these feathers. It is the author's firm opinion, however, that such efforts are well worth the resulting conservation of our avian species.


## Acknowledgments

The author is grateful to Dr. Les Field (University of New Mexico Anthropology Department). The research would not have been possible without the assistance of both federal and state wildlife agency personnel: Kamile McKeever, B. J. Golec, and John Antonio at the U.S. Fish and Wildlife Service; and Tod Stevenson, Chuck Hayes, Brian Gleadle, and Greg Schmitt (Rtd.) of the New Mexico Department of Game and Fish. The author is indebted to several others who offered major advice and information: John P. Hubbard and Robert W. Dickerman, ornithologists; Kieran Lindsey, urban biologist; and Barton Martza, Lt. Governor of Zuni Pueblo.


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## To Contact the Author


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## APPENDIX A: A NATIVE AMERICAN PERSPECTIVE

**Barton Martza was the Lieutenant Governor of Zuni Pueblo, New Mexico, at the time this research paper was originally produced. Below, he offers a response to the paper.**

Ms. Harden:

Thank you for asking me to review your article on Native American use of birds.

**Concerning birds killed in vast numbers:** Through what knowledge I have, dating back to late 1940s: The Federal government (BIA) was using a poison which I believe was M-44. Zunis called it "white powder"—this was used reservation-wide for coyote control purposes. It destroyed all or a majority of Bird of Prey and other meat-eating songbirds.

**...people no longer collect** [nests, eggs, and other paraphernalia]. The only Indian Tribe I know are the Hopis who still collect eaglets from the nest for religious purposes. But they have to have a Federal Permit and it has a lot of problems for them among the Navajo Indians and the Navajo Tribe, where some are collected on their reservation [by the Hopi]. And on the list of **human-caused destruction**, I refer back to the use of poison by BIA. On same page, "people who shoot hawks"—Zuni People now use more hawk feathers for religious purposes, due to very limited availability of eagle feathers. And **people selling wildlife**: it is a problem among our Native Americans because feathers are in such demand and people are willing to pay for them. In the late 70s I arrested a Native American for selling eagle feathers and handed the case over to U.S. Fish and Wildlife (USF&W) and I was never informed of what happened to the case.

**Permit System**: I'm proud to tell you that my tribe has a permit system and we also regulate and enforce the Migratory Bird Act. Water fowl/ducks are hunted less [due] to USF&W providing duck wings to the tribe by the thousands, which are distributed to the Zuni People. Another bird under protection is the dove, which is hunted for sport under Tribal and Federal regulations.

**National Eagle Repository**: In the late 70s thru the early 80s Albuquerque had its own Repository, operated by the USF&W, where Zunis as individuals or as a tribe could make their request for eagles—which were made available. The same day requested, [they] were delivered. During this period [at present], very few eagles—both Golden and Bald—pass through the Reservation. They were on the increase but with this last seven- to eight-year drought, migration is again on the decrease.

**Migratory Bird Act**: Presently, all our [Zuni] Game & Fish officers are deputized with the USF&W Service and they enforce all Federal F&W laws and other applicable Natural Resource Laws.

**Concerning the late E. Ladd's article:** [Ladd basically said] "Eighty-six prayer sticks offered per year is about average but with the increase in [Zuni] population, it has now been on the increase and over seventy-two species of birds are needed..." I don't know if he meant for prayer sticks, because after checking with various individuals from religious societies and Kiva leaders, the most they will put on a prayer stick is approximately 10 to 12 feathers, but I'll leave it at that since I cannot go into details. But if it's for dance costumes, any feathers [mentioned by quantity] are including exotic birds.

**Steve Albert**: Steve pointed out commercial development is not considered illegal [although it occurs] over wildlife habitat. This is no longer true since Zuni now has their own EPA department. Any commercial project that comes up has to have an Environmental Impact study since several species of endangered birds are on the Reservation for nesting, etc. It's now Steve's job to complete these studies. (Mr. Albert is now with Zuni's Game and Fish department.)

**Roadkills**: The State of New Mexico Game and Fish does provide any and all birds (both song and prey) to the Zuni Tribe going back to the 1970s—which are collected by the public or [NM Game and Fish] enforcement people.

**Issues on Tribal Sovereignty**: In the past of our administration (1999–2002) USF&W enforcement found out that several Zuni individuals had eagles in captivity under the previous Region 2 director [USF&W]; there was indication that enforcement agents were going to come to Zuni and confiscate these eagles. After calls to several attorneys specializing in Indian Law, both Head Councilman Eldred Bowekaty and I agreed to be arrested to protect our Zuni individual. The full government and Council were in agreement for the actions that took place about a month later. Nothing happened, but dialog was started between the Tribe and USF&W. After so many face-to-face meetings, issues were worked out—not only for the individuals with eagles but also for the eagles presently located in the Eagle Aviary [at Zuni Pueblo]. Along with that came the cross-deputization of the Tribe's Game and Fish offices. From that time, our government-to-government meetings continued and out of those meetings another prayer milestone was accomplished where several religious groups requested if they could take some of the [aviary] eagles. This was approved both by the Tribe and USF&W, providing pens were built to specifications that met the needs of both government agencies. I believe three pens have now been completed and are awaiting transfer of the eagles to these groups. These groups will be fully responsible for the care of these birds, but the Zuni Fish and Wildlife department will continue the medical care and check-ups on an annual basis.

Presently, the Aviary has approximately 21 birds, both bald and golden. The majority of the feathers are distributed to our local High Religious leaders, but the Tribe is assisting other pueblos—and on occasion the Jicarilla [Apache] Tribe—with some eagle feathers that were requested. All of this depends on the availability of feathers. On one occasion, Mr. J. Antonio [USF&W Region 2 Native American Liaison] requested feathers for purification purposes which were conducted by another tribe at the World Trade Center after the 9-11 incident. Overall, this is a good project, and expansion of aviaries are in the planning stage, as well as the possibilities of captive breeding, which would be a long-term project. Various tribes are also taking interest in starting their own aviaries and have visited Zuni to see the project.

I hope this helps you, and if there are any other issues, concerns, or questions, feel free to contact me.

**—B. Martza**

*Zuni Pueblo, Zuni, New Mexico*

*[Written April 2003]*

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**
Migratory Bird/Permits Division
P.O. Box 709
Albuquerque, New Mexico 87103-0709

IN REPLY REFER TO:

R2/MB/SP-MB

AUG 07 2003

Janelle Harden
2710 San Rafael SE
Albuquerque, New Mexico 87106

Dear Ms. Harden:

We have reviewed your article relating to "Native American Use of Bird Species for Ceremonial Purposes: Can Rehabilitators Legally Meet the Need?" We find it to be well-written and very thoughtful.

The Region 2 Migratory Bird Permits Office recognizes the need to develop a system that would allow rehabilitators and other sources to legally provide non-eagle feathers for Native American religious use. However, the Regional Migratory Bird Office does not have sufficient resources to develop a suitable program at this time. Furthermore, there is currently no direct provision in the Migratory Bird Treaty Act and its implementing regulations which would allow such an activity.

Thank you for sending us a review copy of your article. We appreciate your willingness to contribute to the development of alternatives to address the feather distribution problem. If you have questions or comments, please call me at (505) 248-7882 or e-mail me at kamile_mckeever@fws.gov.

Sincerely,

Kat McKeever

Kamile McKeever
Migratory Bird Permits Administrator

GOVERNOR
Bill Richardson

DIRECTOR AND SECRETARY
TO THE COMMISSION
Larry G. Bell

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Peter Pino
Zia Pueblo, NM

Guy Riordan
Albuquerque, NM

Leo Sims
Hobbs, NM

April 25, 2003

Janelle Harden
Via E-mail

Dear Ms. Harden,

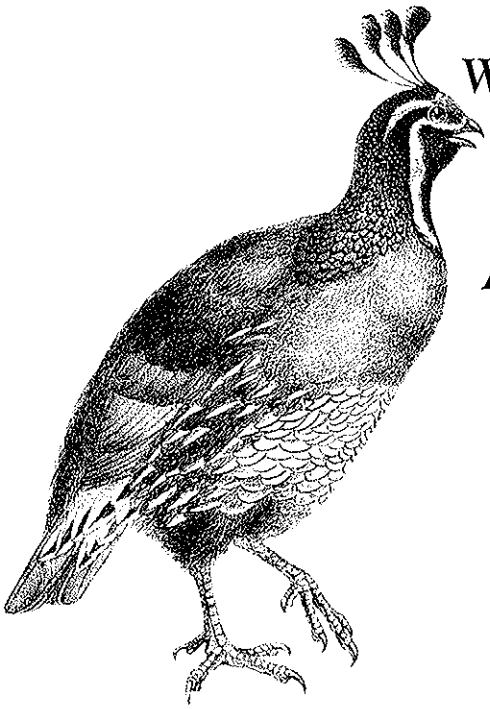
Thank you for the opportunity to review and comment on your article "Native American Use of Bird Species for Ceremonial Purposes: Can Wildlife Rehabilitators Legally Meet the Need?"

In his response to your article, Mr. Barton Martza of Zuni Pueblo, New Mexico states, "**Roadkills**: The State of New Mexico Game and Fish does provide any and all birds (both song and prey) to the Zuni Tribe going back to the 1970s—which are collected by the public or [NM Game and Fish] enforcement people."

While Mr. Martza's assessment has been true in the past, the New Mexico Department of Game and Fish (Department) currently has no mechanism for the distribution of remains of avian species to Native Americans. In the recent past, an employee of the Department had worked with the U. S. Fish and Wildlife Service to obtain permission to participate in this activity. This activity was of special interest to the employee and when he retired, the practice halted.

At this time, the Department is working with the U. S. Fish and Wildlife Service to re-initiate the service of providing avian species remains to Native American tribes or individuals. Details regarding any special permitting, as well as the logistics of how the program would operate are currently being discussed. We look forward to working with you and other interested individuals as we strive to revive this practice.

Lisa Kirkpatrick
Chief, Conservation Services Division
New Mexico Department of Game and Fish



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# The Importance of Banding

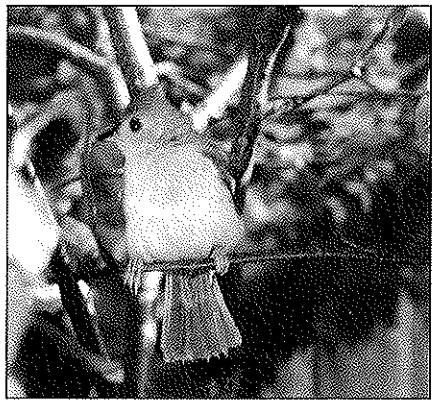
by Jayne Amico

On 4 July 2001 I received an injured tufted titmouse (*Parus bicolor*) from residents of my town, whose cat had brought it home. Upon examination, I found that the bird had a radius/ulna fracture of the right wing, very near the wrist. The wing was wrapped and the bird was given Baytril (enrofloxacin), as the fracture site was open (punctured by the cat's teeth). One drop, or approximately 67 mg/kg, was given every 12 hours for 7 days.

Because the bird was a fledgling and not yet self-feeding, it was raised on live mealworms, waxworms, and crickets pinched and killed immediately before feeding and dipped into MacDiet (MacLeod and Perlman 2000).

On 18 July the wing wrap was removed. The bird had soft flight, but after a few days of exercise, it was flying well despite an apparent wing droop. In order to further assess the bird's abilities and to encourage independence, it was moved to an outside aviary to provide a large flying space with natural elements and foraging options. By August the bird was independent and flying strongly, although the wing droop was still present.

I have had other birds in rehabilitation that, upon recovering from a wing injury, continue to have a substantial droop yet have apparently unimpaired flight. Since the titmouse's flight appeared completely normal, I chose to release it. Master bander Mark Szantyr supplied the USFWS band 1441 77127, and the bird was released from the flight cage on 16 August 2001. The tray that had provided supplemental foods inside the aviary was placed on top of the flight cage. A tube feeder filled with hulled sunflower and a suet basket that had also been in the aviary were hung on the outside, in case the bird chose to return. This titmouse was not observed to return to the tray or feeders.



In winter during bad weather, I routinely open one of my empty flight cages so that the birds may have shelter from the elements and find food and water. On the snowy morning of 6 March 2003, I went to the cage to refill the feeders. There, taking shelter with a mixed group of birds was a banded tufted titmouse with a drooping wing.

I caught the bird and took it into the clinic for a quick examination. It was in excellent condition and well fleshed. I recorded the band number and returned the bird to the flight cage. Then, I checked my records and contacted Mark Szantyr. Sure enough, our records confirmed that this was the injured fledgling admitted in July 2001 released with band number 1441 77127.

I have often wondered if a drooping wing would improve with flight and time. For this bird it did not prove to be the case, but clearly a droopy wing did not affect its ability to fly well, avoid predators, find food and shelter, and go on to survive for the next 1-1/2 years. Had the bird not been banded, a valuable opportunity to confirm the survival of a rehabilitated fledgling would have been lost. Many thanks to Mark Szantyr for assisting with the banding. JWR

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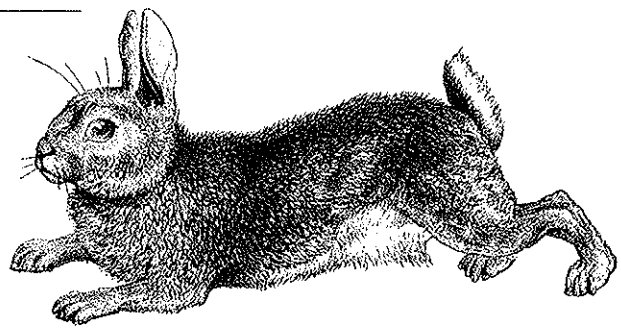
*Jayne Amico is director of the Recovery Wing in Southington, Connecticut.*

please read:

**The final rule on Migratory Bird Permits—Regulations Governing Rehabilitation Activities and Permit Exceptions from the U.S. Fish and Wildlife Service were published in the *Federal Register* Monday, 27 October 2003, 68(207): 61123–40, "Rules and Regulations." (50 CFR Parts 17, 21, and 22)**

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INSIGHT

# Bugs & Drugs

## WEST NILE VIRUS TESTING METHODS

by Kathy Dolan and Emi Saito

By now almost everyone is aware of West Nile virus (WNV) and its rapid spread throughout the North American continent. By the winter of 2003, WNV had been reported in 44 (continental) U.S. states, five Canadian provinces, and northeastern Mexico, as well as El Salvador. In addition, researchers have detected antibodies against WNV in nonmigratory birds in Jamaica and the Dominican Republic, suggesting the virus is being transmitted in local populations on these Caribbean islands. It is undoubtedly only a matter of time before the virus is disseminated throughout both North and South American continents. WNV was first detected in New York City during the summer of 1999, when it caused massive crow die-offs and resulted in 62 known human cases, including seven deaths. WNV had previously been reported only in the Eastern Hemisphere, specifically Africa, the Middle East, Australia, and parts of Europe and Asia. How WNV crossed the Atlantic Ocean and entered the U.S. remains unknown. Although crows and other corvids appear to be the most susceptible to fatal infection, the list of species (birds, mammals, and reptiles) in which WNV has been detected continues to increase with each passing WNV season.

WNV is a mosquito-borne virus belonging to the Flavivirus family; it is a close relative to Saint Louis Encephalitis virus (SLE), which has been in the Americas for decades. WNV has a single strand of RNA, a nucleic acid, surrounded by a coat or capsid composed of viral protein C (see Figure 1). The nucleic acid and the capsid are enclosed by a lipid envelope derived from the host cell from which the virus was produced. The envelope is studded with viral proteins called E (envelope) and M (membrane) proteins. It is believed that viral protein E is responsible for viral binding to receptors on animal cells, which results in the uptake of the virus into the animal cell, and has been implicated as the key cause of inflammation and cell death leading to disease and death in the host animal. The overall shape of the virus as determined by the capsid and envelope is spherical or icosahederal.

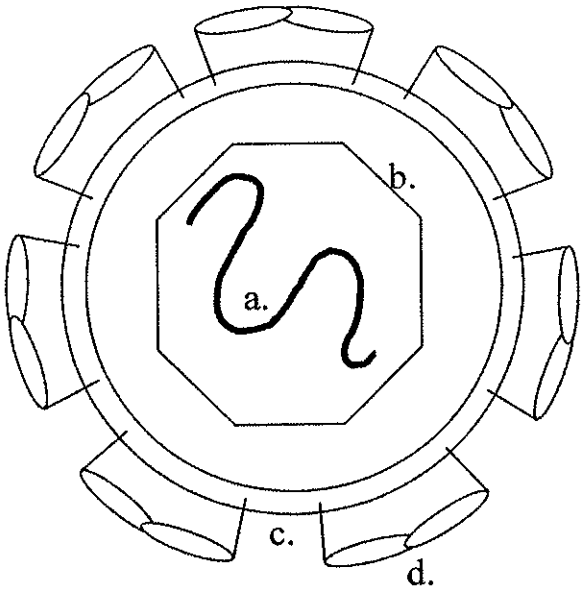



**Figure 1. Flavivirus structure. The basic features of WNV: (a) the viral RNA molecule, (b) the viral capsid, (c) the viral lipid envelope, and (d) the envelope proteins.**

In order to produce disease, pathogens must be introduced in adequate numbers via the proper route(s) of infection. They also must be able to avoid the host defenses once they enter the body. To date, one indisputable route of entry for WNV is deposition of the virus into the bloodstream during feeding by an infected female mosquito. Mosquitoes of the genus Culex have been implicated as the important vector in the endemic (bird-bird transmission) cycle. Other routes of transmission (i.e., ingestion of infected prey or direct contact with other infected birds) have been demonstrated in controlled laboratory studies, but the significance of these routes of transmission in nature has yet to be determined. Further, additional arthropod vectors have been found positive (e.g., hippo-boscid flies) in North America, but it remains unknown whether they are capable of transmitting infection after feeding on an infected bird. The number of infectious virus particles needed to establish an infection and the amount of disease caused by the infection can vary by both species and individual host immunity, among other things.

Immunity in animals is generally similar across species. Upon infection by WNV, white blood cells and other immune factors recognize foreign material has entered the body and cause a complex chain of events that act to terminate, or at least limit, the infection process. The main immune response for WNV (that will be discussed in this brief summary) is development of antibodies, proteins produced by a subset of white blood cells. There are several classes of antibodies, termed immunoglobulins (Ig). Only two will be discussed here. First, IgM develops approximately 3–4 days after infection with

serum concentrations peaking at approximately 7–8 days after infection. This primes the immune system for development of a second class of antibody, IgG, which develops approximately 7–10 days after infection. IgG serum concentrations peak at approximately 10–14 days after infection and become the more abundant circulating antibody at this point. Actions of the antibodies and other immune factors in some hosts leads to the virus being killed and cleared from the body without the host aware that infection has even occurred. This is the case for most human WNV infections. In other hosts, however, host defenses will be less effective, allowing the virus to multiply. This will lead to development of disease symptoms and sometimes death.

In both scenarios, evidence of WNV exposure may be present in the host and can be demonstrated by various laboratory tests. Several WNV tests are available, with new ones added to the market with each season. Four of these tests are the most commonly used in diagnostic laboratories and will be elaborated in this article: (1) ELISA, (2) Virus Isolation, (3) PRNT, and (4) RT-PCR.

### ELISA (Enzyme-Linked ImmunoSorbent Assay)

To detect WNV antibodies in animal/patient blood, laboratory-purified virus proteins are allowed to adsorb, interact and bind to a solid plastic surfaces, such as the walls of a test tray. These trays are developed at laboratories manufacturing these tests. Serum from the animal/patient is diluted, applied to the tray, and allowed to react or incubate with the adsorbed viral proteins. After incubation, the serum is washed away, leaving only those antibodies that have bound to adsorbed proteins. This binding can be detected with the application of a second antibody that binds only to the antibodies of the animal/patient. Linked to this second antibody is an enzyme or chemical that generates a colored-product when the two antibodies bind in the tray. The production of color is a positive reaction for the presence of circulating host antibodies against WNV. No color production either indicates that antibodies are not present or not yet at detectable levels. Some diagnostic laboratories will determine antibody titers, or the amount of antibody circulating in the blood. This is done by performing the ELISA on serum samples at various dilutions until no reactivity is detected. A higher titer is indicative of a higher antibody level (e.g., a titer of 1:64 is better than 1:20).

To determine whether an active infection is occurring at the time of testing, two serum samples are needed. The first is collected shortly after suspected exposure or onset of symptoms—this is the "acute" or "pre-immune" sample. The second sample, taken 2–3 weeks later, is termed the "convalescent" or "post-immune" sample. The two samples are tested simultaneously as described above. The resulting titers of the two samples are compared—a four-fold rise in titer (e.g., from 1:20 in the acute sample to 1:160 in the convalescent) is generally accepted as an indication of active infection.

For WNV, two ELISA tests are generally used by diagnostic laboratories. One tests for IgG. A positive result on this indicates previous exposure to WNV, but not necessarily a recent infection. The IgG test commonly available in labs is generally not recommended, as it is not specific for WNV and requires further confirmatory testing. Currently, confirmation by PRNT (see below) is recommended. The second ELISA commonly used tests for IgM. Unlike the IgG ELISA, the IgM test is specific for WNV. A strong positive reaction (i.e., high titer) suggests a recent infection, but a convalescent sample is recommended to confirm it as a recent infection. It is known that human IgM against WNV may persist in some people for more than a year after exposure, and it is unknown how long IgM in birds and other animals may persist.

### Virus Isolation

WNV itself can be retrieved from blood or tissue samples by the use of tissue culture. Susceptible animal cells, such Vero cells derived from green monkey kidneys, are grown in a single cell layer (a monolayer) in a flask. The specimen is diluted and applied to the monolayer. Virus, if present in the specimen, will bind to and infect the cell layer. As the virus reproduces and matures in the cells, the new infectious virus will exit the cells and infect adjacent cells to repeat the reproduction cycle. Ultimately, enough cells die from this process to produce a clear area devoid of cells in the monolayer known as a plaque (or CPE, Cytopathic Effect). The identity of the virus can be confirmed by application of a WNV-specific antibody linked to a fluorescent dye. If the virus infecting the monolayer is WNV, the fluorescent antibody will bind to the virus in the plaque, which will fluoresce when viewed under a fluorescent microscope. Other methods to identify the virus are by electron microscopy, which requires specialized equipment and a well-trained microbiologist, or by molecular methods, such as RT-PCR (see below). Tissue culture methods are useful in detecting active infection and determining actual virus load in the blood/tissue, but may not detect viruses present in low levels and can take up to 5 days to get results. Also, not all laboratories are able to perform virus isolation. It is recommended that tissue culture (or any procedure dealing with live WNV virus) be performed in BioSafety Level 3 (BSL-3) facilities, which is not available in all diagnostic laboratories.

### PRNT (Plaque Reduction Neutralization Test)

Similar to the ELISA, this test determines antibody levels in serum samples. Laboratory-prepared WNV is incubated with the animal/patient serum prior to application of the virus to the tissue culture. During this incubation period, antibody to WNV in the serum will bind to the virus and will neutralize the infectious capability of the virus, preventing viral uptake and reproduction and thus resulting in a reduction in the number of plaques formed in tissue culture. The presence of neutralizing antibody demonstrated by this method may serve as an indication of host response to previous exposure, but is not indicative of protective immunity to subsequent exposure. When utilizing PRNT to determine the effectiveness of vaccination, protective immunity needs to be demonstrated in live animals purposely challenged with the virus in a controlled environment. This has not yet been done in birds vaccinated with the recently approved Fort Dodge equine WNV vaccine (Innovator). Because live virus is used for this test, PRNT for WNV also requires BSL-3 laboratory conditions.

### RT-PCR (Reverse Transcriptase-Polymerase Chain Reaction)

Better understanding of genetics and advances in technology have led to the

development of very sensitive molecular methods that can be used in diagnostic laboratories. The most recent and popular advancement is PCR, which takes small amounts of DNA and makes millions of copies to allow for detection and analysis of material that may be undetectable by other methods. Because WNV is an RNA virus, a method called RT-PCR is used: the RNA is converted into DNA and copies of the DNA are made. DNA generated by this method can be detected by numerous methods that vary from laboratory to laboratory or from test kit to test kit. A positive test result is highly suggestive of the presence of active WNV infection, but requires further confirmation for definitive diagnosis (electron microscopy or other molecular methods, such as immunoh istochemistry or immunofluorescent antibody test). When viruses are killed, fragments of RNA may remain for a time after the infection is cleared, and these fragments could be picked up by RT-PCR. In addition to detecting virus in minute amounts, PCR has the advantage of being a very rapid test compared to tissue culture assays and is a direct test. But, because PCR is specifically testing for WNV, it will not detect other possible viruses that could be causing similar symptoms and that would be detected by either virus isolation in tissue culture or by running multiple panels of tests to test for each possible virus. In addition, cost of equipment and materials can limit some diagnostic laboratories from establishing this testing capacity.

There are numerous testing methods available to demonstrate, either directly or indirectly, WNV infection in an animal. The methods used by each laboratory is primarily dependent on laboratory capability. In deciding which test is appropriate, one needs to consider what the goal of testing their animal/patient is: virus detection, active infection, or exposure. Consultation with a veterinarian and diagnostic laboratories may be necessary to determine which test is appropriate or available in your area. JWR

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*Emi Sato received her undergraduate training in zoology at the University of Wisconsin–Madison and went on to graduate from the University of Pennsylvania School of Veterinary Medicine in 1997. After a few years in small animal practice, she obtained a MSPH in epidemiology from Emory University. In addition to other interesting investigations, she worked for the WNV surveillance program in Atlanta, Georgia, during the 2001 season.*

## SELECTED ABSTRACTS

### AVIAN

#### Occurrence and Evolution of Cooperative Breeding among the Diurnal Raptors (Accipitridae and Falconidae)

**by R. T. Kimball, P. G. Parker, and J. C. Bednarzd**

The Auk 120(3): 717–29

Cooperative breeding, in which more than two individuals live in a group and raise offspring, usually in a single nest, is found in only 3% of avian species. On the basis of a review of the literature, the authors found reports of groups (usually trios) at nest sites in 42 species of diurnal raptors. At least one example of cooperative breeding was found in 29% of genera and 14% of species, distributed in both Accipitridae and Falconidae. Given incomplete available information, cooperative breeding in diurnal raptors may be more common than the data indicate. When data on the sex of the extra bird(s) or relationships among group members were available, patterns were quite varied. For seven of 13 species, groups primarily contained multiple adult males, though three of those species also had groups formed from offspring that had delayed dispersal; three species had a low, but regular, occurrence of multiple females; the remaining three species had extra birds that were yearlings or subadults. In over half of species, groups did not appear to be composed of related individuals, contrary to many cooperatively breeding passerine species. This review suggests that the evolution of group living in many raptors may be independent of delayed dispersal, and that the factors important in explaining the evolution of that behavior depend upon the benefits of group living.

#### *Plasmodium juxtanucleare* Associated with Mortality in Black-Footed Penguins (*Spheniscus demersus*) Admitted to a Rehabilitation Center

**by K. C. Grim et al.**

*J. Zoo and Wildlife Med.* 34(3): 250–55

Five black-footed penguins (*Spheniscus demersus*) admitted to the Southern African Foundation for the Conservation of Coastal Birds in Cape Town, South Africa, died from malaria infection. Evidence for malaria as the cause of death included antemortem clinical signs, parasitemia, splenomegaly, pulmonary edema, and the presence of histologically visible schizonts in the reticuloendothelial system. A portion of the malarial small subunit ribosomal ribonucleic acid gene was detected by polymerase chain reaction from postmortem blood samples from all the birds. A species-specific variable region of this gene was compared with the same region on genes from other known avian malarial organisms to establish that *Plasmodium juxtanucleare* was involved.

#### Long-Term Declines and Decadal Patterns in Population Trends of Songbirds in Western North America, 1979–1999

**by G. Ballard et al.**

*The Condor* 105(4): 737–55

The authors analyzed population trends from a constant-effort mist-netting study conducted in central coastal California during the falls of 1979–1999. Of 31 taxa captured in sufficient numbers, 16 underwent statistically significant declines and none increased. Twice as many species declined from 1989–1999 as com-

pared to 1979–1989. Overall, the results were similar to those of regional Breeding Bird Surveys determined for the same species during the same period. In an attempt to identify possible causes for trends, the authors grouped species by various life-history categories, including nest height, nest type, likelihood of cowbird parasitism, wintering location, winter food preference, and tolerance for human presence on the breeding grounds. All groups underwent significant declines, although high nesters, common cowbird hosts, and neotropical migrants declined faster than their respective counterparts. While life-history attributes explained differences in trends between groups, there was significant heterogeneity of trends within groups. Capture rates of certain species and groups appeared to be affected by various climate variables, and accelerating declines since 1990 may reflect effects of large-scale climate cycles, particularly on long-distance migrants. The authors suggest that long-term population trajectories of songbird populations across North America may be better understood in the context of the Pacific Decadal Oscillation. Interpretation of the results is, in some cases, problematic due to the complex interaction of methodological limitations and environmental variables, especially habitat change on the study site. Use of multiple methods and multiple sites for monitoring trends in songbird population abundance during fall migration is recommended.

### The Use of Skin Flaps and Grafts for Wound Management in Raptors

**By P. K. Stroud, T. Amalsadvala, and S. F. Swaim**

*J. Avian Med. and Surg.* 17(2): 78–85

Managing large open wounds in birds is challenging because of the limited amount of skin and the difficulties associated with bandaging. New techniques involving the use of skin flaps, autografts, and extracellular matrix grafts are emerging to the forefront of wound management as viable options in avian patients. Understanding the anatomy of the avian integument is important when considering the use of one of these forms of reconstruction as a wound management technique in birds. Here we review the use of skin grafts and flaps in avian patients in relation to the anatomy of the avian integumentary.

## MAMMALS

### Parasitic Helminths and Arthropods of Coyotes (*Canis latrans*) from Florida, U.S.A

**by G. W. Foster et al.**

*Comp. Parasitology* 70(2): 162–66

Twenty-six coyotes (Canis latrans) collected in Florida, U.S.A., were examined for parasites. Nine species of helminths (1 trematode, 1 cestode, 6 nematodes, and 1 acanthocephalan), 1 species of biting louse, and 2 species of ticks were identified. Dirofilaria immitis (43%), Ancylostoma caninum (33%), Physaloptera rara (29%), and Taenia pisiformis (24%) were the most prevalent helminths. Macracanthorhynchus ingens is reported from coyotes for the first time, and Spirocerca lupi is reported in coyotes from Florida for the first time. Ectoparasites collected included the biting louse Trichodectes canis and the ticks Amblyomma maculatum and Dermacentor variabilis. A coyote infected with 66 Di. immitis had evidence of chronic pulmonary arteritis and medial hypertrophy of pulmonary aterioles.

## CONSERVATION

### Teetering on the Edge or Too Late? Conservation and Research Issues for Avifauna or Sagebrush Habitats

**by S. T. Knick et al.**

*The Condor* 105(4): 611–34

Degradation, fragmentation, and loss of native sagebrush (Artemisia spp.) landscapes have imperiled these habitats and their associated avifauna. Historically, this vast piece of the Western landscape has been undervalued: although more than 70% of all remaining sagebrush habitat in the U.S. is publicly owned, <3% of it is protected as federal reserves or national parks. The authors review the threats facing birds in sagebrush habitats to emphasize the urgency for conservation and research actions, and synthesize existing information that forms the foundation for recommended research directions. Management and conservation of birds in sagebrush habitats will require more research into four major topics: identification of primary land-use practices and their influence on sagebrush habitats and birds; better understanding of bird responses to habitat components and disturbance processes of sagebrush ecosystems; improved hierarchical designs for surveying and monitoring programs; and linking bird movements and population changes during migration and wintering periods to dynamics on the sagebrush breeding grounds. This research is essential: it is already known that sagebrush habitats can be altered by land use, spread of invasive plants, and disrupted disturbance regimes beyond a threshold at which natural recovery is unlikely. Research should be instituted on lands managed by state or federal agencies. In addition to the challenge of understanding shrubsteppe bird-habitat dynamics, conservation of sagebrush landscapes depends on our ability to recognize and communicate their intrinsic value and on our resolve to conserve them.

### Habitat Use, Home Ranges, and Survival of Swift Foxes in a Fragmented Landscape: Conservation Implications

**by J. F. Kamler et al.**

*J. Mammalogy* 84(3): 989–95

Habitat loss might be one of the primary reasons for the decline of the swift fox (*Vulpes velox*) in the western Great Plains of North America. From 1998–2001the authors monitored 42 swift foxes in a landscape interspersed with native short-grass prairies, nonnative grasslands enrolled in the Conservation Reserve Program, irrigated agricultural fields, and dry-land agricultural fields. Survival estimates ranged from 0.52–0.66 for both adults and juveniles; the primary causes of death were vehicle collisions (42% deaths) and coyote (*Canis latrans*) predation (33%). Annual home-range size was similar for males and females. Within the study area, swift foxes selected only short-grass prairies and had lower-than-expected use or complete avoidance of all other habitat types. The study's results indicate swift foxes are more specialized in habitat selection than other North American canids; thus, protection of native short-grass prairies might be necessary for their long-term existence. AWR

**Please Note:** *Beth Dillingham's column, Open Minds, will return in the fall 2003 issue of the* Journal of Wildlife Rehabilitation.

# Forester's Log

## THE "PERFECT FIRE" ON POWELL PLATEAU

**by Mary Stuever**

When fire researcher Stephen Pyne dubbed last year's Rodeo-Chediski Fire in west-central Arizona as "The Perfect Fire," I was a bit unsettled. I understood that he was referencing Sebastian Junger's book, *The Perfect Storm* (which inspired a movie by the same name). "The Perfect Storm" referred to the meteorological phenomenon of uncommon weather conditions that combine to produce the most violent storm. Still, Rodeo-Chediski was anything but perfect if one applies the common meaning of the word. It was human-caused. It burned more acres than any fire ever recorded in the American West. It destroyed more than 400 homes. It required the evacuation of over 10 communities along the Mogollon Rim. It is awfully hard for me to employ the word "perfect" in describing this disaster.

Rather, this summer I worked on a fire I think is much closer to "perfect." The Powell Fire was in a remote region on the North Rim of the Grand Canyon. On 15 June lightning struck on the far northeast corner of the Powell Plateau. "It could not have started at a more convenient location," explained Jim Kitchen, the park's assistant fire management officer. With prevailing southwest winds, and a change in vegetation that prevented fire spread to the northeast, the Powell Fire spent most of its life as a "backing fire" burning into the wind. This kept the flame lengths low, and allowed for light intensity burning that slowly spread across the plateau over the next few weeks. The fire was declared out on 20 August and had burned approximately 3800 acres.

One of the perfect conditions for this fire can be attributed to the geography of Powell Plateau itself. The plateau is separated from the main North Rim by Muav Saddle. There is no road access, although there is a trail that crosses the plateau. Due to this remoteness, the plateau has missed most of the human influences experienced by other southwestern forests. There is no history of grazing, or logging, and very little fire suppression. As a result, the Powell Plateau supports what forest ecologists claim is more akin to the "natural" forest that evolved under a "natural" fire regime. There are many large trees towering over a grassy understory. Due to regular burning—the last time the Powell Plateau burned was in three separate fires in the mid-1980s—there is little build-up of branches, logs, and other "debris" that firefighters see as "excessive fuel."

Another vote for "perfect" status was the lack of threat to lives and property. The past few years have had a deep impact on the psyche of wildland firefighters as we have watched more homes burn than we ever imagined possible. There is a historic cabin in the vicinity of this burn, allegedly built for Teddy Roosevelt's lion hunting trips. However, there was plenty of time to cover this structure in protective wrap, although the fire never did reach its Muav Saddle location. With closures to the area and no need for immediate access to the flames, no lives were threatened, no accidents occurred.

I spent the majority of my assignment during the fire, 20 miles away, a thousand feet lower, and with a gaping chasm between my location and the smoke columns. It was that chasm that drew my audience from around the world, and each day I would engage them in storytelling about this perfect fire. One piece of the perfect story is the commitment to fire management practiced by the Grand Canyon park staff. All the i's are dotted, all the t's are crossed, and the plans are in place that identify the conditions when fires are allowed to burn their natural courses. Called a "wildland fire use strategy," park firefighters dispatched to wildfires now ask the critical question "Should we even try to put this fire out?"

I like redefining our concept of the perfect fire. I hope we can steward forests across the Southwest that will burn more like the Powell Fire and less like the Rodeo-Chediski Fire. From the comments I heard while conversing with hundreds of park visitors, I don't think I am alone in this dream. JWR

*Mary Stuever is a consulting forester specializing in forest ecosystems of the American Southwest. She can be reached via e-mail at sse@nmia.com.*



**Monitoring the fire at Point Swamp.**



**Short head fire run.**



**A post-burn open stand.**

FACT SHEET

# Rehabilitation Notebook: ASPERGILLOSIS

**(also known as Brooder pneumonia, pseudotuberculosis, or mycotic pneumonia)**

### Causative agent

This respiratory tract infection occurs as a result of inhalation of *Aspergillus fumigatus* and related fungal organisms. Aspergillus is a saprophytic mold; it is typically found on damp soils, decaying vegetation, organic debris, and moldy feeds.

### Clinical Signs

A bird with aspergillosis may have no clinical signs or may present with severe respiratory distress. Birds may present with weakness, emaciation, unthriftiness, failure to attempt to escape, and/or severe and progressive difficulty in breathing or pronounced tail bob. Difficulty in breathing may be displayed as gaping or rapid opening and closing of the bill or beak. Aside from respiratory distress, a bird's clinical signs may resemble those of lead poisoning. A bird may present with either the acute or chronic form of the disease. In the acute form, one may see acute respiratory distress and failure or sudden death. With the chronic form, there will be eventual dissemination of the fungus to the liver, gut wall, and viscera.

### Hosts

Aspergillus is present throughout the world and is most commonly associated with wild aquatic avian species. The most common species of birds that are affected are waterfowl, gulls, crows, ravens, and captive raptors, with the young being most susceptible. Although it is less likely, this fungus can infect humans and other mammals.

### Transmission

This disease is not contagious from one bird to another. The host must inhale the fungal spores (conidia). These spores then travel through the upper respiratory tract to the lungs, where they colonize. From the lungs and air sacs, the fungi may disseminate to other body parts.

### Seasonality

Outbreaks of this disease in waterfowl are typically seen in the fall and early winter. Individual cases can happen at any time in stressed or immunocompromised birds. "Brooder pneumonia" is a limited springtime form that infects chicks and ducklings in contaminated brooders.

### Diagnosis

A definitive diagnosis can be made by finding a typical lesion on postmortem examination. These lesions are usually variable in size, flattened yellow or white plaques with a fluffy, cheesy appearance. Typically they can be found in the lungs, air sacs, and/or oral cavity. Thickened air sacs or fungal growth on tissues may also be seen. If a plaque is found, a sample should be sent to a diagnostic laboratory either in formalin for histopathology or as a fresh tissue for culture. To find a plaque in a live animal one may do a deep tracheal culture, radiographs, or look for them using an endoscope or laparoscope. Typically you will see a leukocytosis with a heterophilia and monocytosis on a CBC. Serological evaluation may also lead to a diagnosis of aspergillosis. Blood may be analyzed for Aspergillus antibodies and antigen. These results can be difficult to interpret, and familiarity with the laboratory is recommended. Paired titers may be more helpful in making a diagnosis.

### Treatment

If prevention of the condition has failed, various antifungal agents can be used to treat this disease. One of the more popular protocols is Itraconazole at 5–10mg/kg orally once a day for 45 days with Amphotericin B and clotrimazole nebulazation. In severe cases Amphotericin B may be given intravenously. It is important to recognize that this requires a long-term (i.e., 6-month) treatment. A thorough cleaning of the bird's environment is also critical to eliminate the fungus. This may include avoiding the use of moldy straw, silage, or feeding/dumping waste in waterfowl areas. Feeding stations should be cleaned periodically. Even with aggressive treatment of this disease, the prognosis is guarded. Prevention is the primary method of control.

### Public Health Considerations

Since the fungus is ubiquitous in the environment and only immunocompromised humans are typically at risk for this disease, infected birds are not an important source of infections for humans. An acute infection, if not properly treated, however, could be life threatening. It has also been reported that people may develop an allergic response to aspergillus, and this also could result in a life-threatening reaction. As there is increased risk of inhaling spores during necropsy, a mask/respirator should be worn. Eating infected carcasses is unlikely to cause disease.

*This Fact Sheet is based on one prepared by the Wildlife Center of Virginia and is published with the center's approval.*

INSIGHT

# Food for Thought

## THERE "IS" A CURE FOR THE SUMMERTIME BLUES...

by Astrid MacLeod and Janine Perlman

There *is* a cure for the summertime blues...or at least for some of them. Many rehabbers contacted us this past summer to share their experiences, and a few themes emerged. One oft-repeated lament was that when we're overwhelmed with young birds and mammals, it's easy to give short shrift to one of the most basic aspects of care: hydration.

Water comprises 99% of all the molecules in an animal's body. Every rehabilitator knows that after making sure that the animal is warm and isn't in a life-threatening crisis, hydration is the first concern. Water is also, however, the most invisible nutrient. We don't know of any rehabber, beginner or experienced (including ourselves), who hasn't at some times failed to give animals the water they need.

It's easy to remember to hydrate an animal when it's presented parched and semiconscious from lack of water in the summer heat. It's harder to remember when the animal has been in care for a few days and we're "sure" that the milk, or the tube-feeding formula, or the insects or mice contain "plenty of water."

What are the insidious ways in which animals can become dehydrated while in care?

Animals lose water in several ways. Some of these losses are normal and inevitable; they necessitate the animal's receiving a minimum amount of daily maintenance fluids. Others arise from illness or injury, and require fluid replacement in addition to maintenance amounts.

Obvious routes of loss include urination, defecation (especially diarrhea), vomiting, bleeding, fluid losses (oozing and evaporation) from wounds or burns, and salivation. Less obvious ways include panting, breathing, and evaporation from the skin.

* * *

**Hand-fed animals**—those that are too young or too sick to eat and drink on their own—are, of course, most subject to dehydration. Hand-fed animals may be receiving formulas (milk or tubing mixes), insects, or whatever they're fed, that are marginally deficient in water (i.e., slightly too concentrated). Young kidneys cannot concentrate urine (retain water for the body) as well as mature ones, so over time on a not-quite-dilute-enough diet, there is more loss (through normal routes) than gain (through the food) of water.

THE LESSON: **When handfeeding formulas or mixes, always err on the side of more water rather than less.**

* * *

Sometimes, when we're treating dehydrated animals, we can actually worsen their condition, either by using the wrong fluid, or by combining rehydration solutions with food. With the wrong fluids, or the wrong combination of fluids and food, attempts to rehydrate animals may dehydrate them further.

EXAMPLE: Animals may be rehydrated or re-fed with solutions that contain sugars, either glucose (dextrose) or sucrose (table sugar). Although rehydration is sometimes aided by the presence of sugars, in other cases animals are intolerant of them, and they can cause osmotic diarrhea and further dehydration. Some animals are specifically sucrose-intolerant.

THE LESSON: **If you are going to give any fluid or food containing sugar, be sure you know that the animal will benefit from it.**

EXAMPLE: Animals are often rehydrated with salt-containing solutions such as Lactated Ringer's, physiological saline, or Pedialyte®. We've heard numerous times from rehabbers who, after thus rehydrating an animal, have then soaked or diluted food in those same solutions, with the result that the animal's condition deteriorates. *This is a serious mistake*. Food contains a great deal of electrolytes (salts), and plain water is required to dilute it sufficiently. The use of rehydrating solutions with food results in the animal consuming too much salt, and not enough water.

THE LESSON: **As soon as any food is given to the animal, plain water should be the only oral fluid the animal receives. This is extremely important for tubing mixes, since the animal is generally not drinking water on its own.**

* * *

In some cases of handfed animals becoming dehydrated, there may simply have been too few feedings over some period, resulting in a water deficit.

EXAMPLE: A nestling blue jay had been in care for several days, transferred twice between finder and two rehabbers. Over that time, it had missed a number of meals. By the time it reached its final caretaker, the bird gaped fairly well and had apparently normal droppings, but it was 'sleepy', with eyelids at half-mast. It turned out to be badly dehydrated; none of the caregivers had paid sufficient attention to giving it the water it needed. Extra water in the food, and frequent offerings of water by dropper, soon allowed the bird to regain normal activity (and wide-open eyes).

*Depression is the hallmark of dehydration.* We may interpret depression as sleepiness, tameness, or docility. It often manifests as 'lack of energy', and reluctance to gape or suckle. Other symptoms include dry mouth and eyes, and inelastic skin that tents when pinched.

THE LESSON: **Offer water by dropper to all hand-fed birds at least once per hour, or with every feeding, whichever is more frequent. Give them all they want; don't ever withhold water because droppings "look" wet, or because the bird seemingly "shouldn't need it." *If a bird wants water, it needs it.***

* * *

While making the **transition to self-feeding,** animals may not receive enough water.

EXAMPLE: As it matured, a young cottontail rabbit was taking less milk and increasingly eating more solid food. It was given dry alfalfa and little fresh greens, and was offered no water. One morning, it was found staggering (ataxic). With a diagnosis of dehydration, large quantities of subcutaneous fluids were administered, and water was given by mouth every 45 minutes for a

day. Rehydration was continued for the subsequent two days and, of course, a dish of water was made available at all times. The rabbit made a full recovery.

THE LESSON: **As soon as the animal begins to self-feed, even if it only tentatively nibbles the food or picks it up and drops it, it must have water available at all times.**

* * *

There are many possible unusual causes of fluid loss.

EXAMPLE: An older, rapidly growing nestling songbird was splinted for a fractured tibiotarsus. The bird outgrew the splint nearly overnight, and the splint constricted the leg above the hock. This caused severe swelling of the entire leg distally. Serum chronically oozed from between the scales, and contributed to the bird's subsequent dehydration.

THE LESSON: **In a compromised animal, think hard about every possible route of fluid loss, and be sure to compensate for all losses.**

* * *

The appearance of diarrhea, a more usual problem, may give us the (very mistaken) urge to restrict oral fluids. Indeed, newer rehabbers may mistake avian diarrhea for polyuria (greater than normal urine excretion).

[Avian droppings consist of three parts: (1) feces, which are colored green to brown and are, in a healthy bird, discrete, well-formed tubular coils; (2) a white paste of urates (the main nitrogenous waste product); and (3) urine, which is clear and usually colorless fluid, though it may be tinted by the feces.

If there are discrete feces and clear fluid in addition, the bird is producing urine. All birds in rehabilitation should produce a significant amount of urine with each dropping. If there is little urine, increase the water given to the bird. If the feces are not well defined and are mixed with the other constituents, the bird has diarrhea.

During the rehydration process, there should be copious urine for the duration of the three-day process.]

THE LESSON: **Regardless of the route of fluid loss, all lost fluids must be replaced, along with supplying the animal's daily maintenance fluid needs. Restricting fluids will only reduce the symptoms of diarrhea or polyuria by dehydrating the animal so much that it has nothing left to excrete. Remember that diarrhea is often actually useful in helping the animal to rid itself of pathogens.**

* * *

Medications can cause dehydration. Sulfa-type antibiotics, including Albon® (sulfadimethoxine), Corid® (amprolium), or medications containing sulfas and trimethoprim (Bactrim®, Sulfatrim®, Tribrissen®, etc.) must be given only to animals that are well hydrated, because sulfas can precipitate in the kidney. We have noticed that whether or not the animal is dehydrated, such medications appear to cause dehydration and unusual thirst. As is the case for all patients (unless you are otherwise advised by a veterinarian), animals on these and other medications must be given all the water they want, either free-choice, or offered by dropper hourly.

* * *

Unnatural foods can cause hydration-related problems.

EXAMPLE: One rehabber gave some young pigeons hand-feeding pellets, rather than seed, to peck as they were beginning to self-feed. One of the birds' feces were diarrheal and full of undigested food; another's crop impacted, as the pellets turned into cement. For mammals and birds, dry pelleted food (kibble) draws water out of the body and into the gut, thus dehydrating the animal. This is a result of factors including the chemistry of the pellets, their particle size, and the presence of salts. Inexperienced or hyperphagic animals may not voluntarily drink sufficient water when given kibbled food.

Columbids have evolved to eat whole seed, which, in contrast to pellets, is gradually softened in the crop, and then gradually macerated in the gizzard. Seed also contains very little salt.

**The lesson, as always, is that animals must be given the kinds and forms of foods that they eat in the wild. We cannot improve on nature.**

* * *

These are just some of a large number of ways that animals in care may become dehydrated. Remember that a dehydrated animal must receive lots of extra fluids for three full days to assure recovery, and plenty of fluids thereafter, as well. Among other things, this permits the kidneys to be reperfused for sufficient time to regain normal function and health.

Always give handfed animals, whether bird or mammal, sufficient water that they produce plenty of dilute urine. Always, of course, provide self-feeding animals continuous access to clean, fresh water.

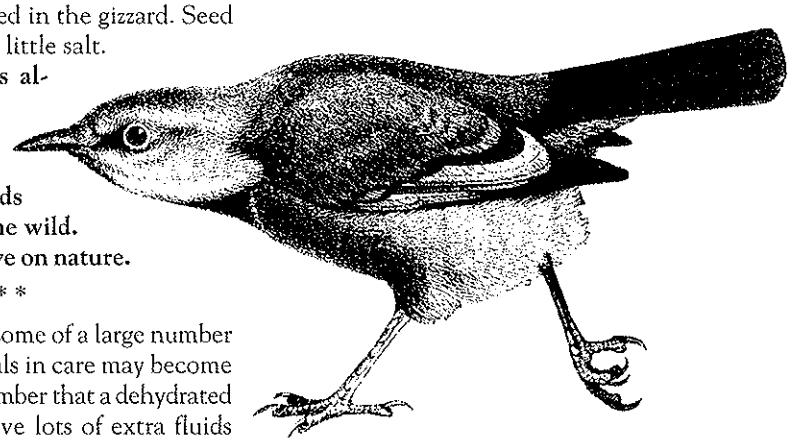
When it comes to dehydration, an ounce of prevention is worth a liter of cure. JWR

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*The authors welcome feedback and suggestions for future columns. Please feel free to write to them.*

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***Janine Perlman, Ph.D.,** conducted laboratory research in biochemistry and molecular genetics for 20 years. She is now a comparative nutritionist and wildlife nutrition consultant. She serves on the nutrition advisory group of the American Zoo and Aquarium Association, and on the board of directors of Advanced Primate Ethical Studies. She rehabilitates birds and small mammals. She can be contacted at jpandjf@swbell.net.*



### Alaska Approves Aerial Wolf Kills

The Alaska Board of Game has approved permits to allow the shooting of large numbers of wolves either directly from airplanes or after chasing the animals to the point of exhaustion and then landing the aircraft to kill the them on foot. Alaskans voted in 1996 and 2000 to ban aerial wolf kills.

The areas approved for aerial wolf control include almost 2000 square miles in interior Alaska. Land-and-shoot killings will also occur in an enormous area east of Anchorage, where 80% of the resident wolves could die as a result. Other areas throughout Alaska are being considered for similar permits.

Alaska is home to the largest remaining grey wolf population in the U.S., with some 7000–9000 wolves. Unlike wolves in the lower 48 states, their Alaskan counterparts are not protected under the U.S. Endangered Species Act, and wolf hunting is allowed in 95% of the state. In the past five years more than 7500 wolves have been killed through hunting and trapping. JWR

### Invasive Marine Animals Larger

Animals and plants that are innocuous in their home environment can become serious pests when they invade a new area. A recent study in the journal *Ecology Letters* shows that for a wide group of marine pests, invasion is coupled with a marked increase in body size. The findings have implications for understanding both how modern-day nuisance species become successful, and for interpreting fossil evidence of changes in populations of marine animals over millions of years.

Researchers Edwin Grosholz and Gregory M. Ruiz compared body sizes of 19 species of marine and estuarine invaders including crabs, shellfish, and starfish in their native habitat and in other parts of the world where they have become invasive pests.

Twelve of the 19 showed increases in maximum size of up to 40%. European green crabs and Chinese mitten crabs, both prominent nuisance species in U.S. waters, were about 20% bigger than in their native habitat. Only one, the gem clam, showed any sign of a decrease.

Increases in body size were not clearly linked to differences in latitude between the native range and invaded areas or to the length of time since invasion. The changes could be because the animals are no longer held back by predators or parasites, Grosholz said. JWR

### Iceland Resumes Whaling

On 18 August 2003 Iceland killed its first whale in 14 years, a young 17-foot minke. Earlier that month, Iceland had announced its plan to kill 500 minke whales for "scientific study" over the next two years, exploiting a loophole in the International Whaling Commission (IWC) convention, which placed a moratorium on commercial whaling in 1982. The IWC has found the plan's scienticific premise shaky, and has condemmed it. (Iceland, like Japan, believes that studying what whales eat will help prove the unsubstantiated theory that whales are consuming their way through the world's fish stocks. The U.S. and other countries say this study can be accomplished with nonlethal means.)

According to animal protection organizations, no method of killing whales can be considered "humane." Whether whales are killed with explosive harpoons or bullets, death is rarely instantaneous; a "struck and landed" whale may suffer anywhere from a few minutes to several hours. Contrary to general humane slaughter laws in effect throughout the world, there is no method of killing whales that renders them instantaneously insensible to the pain of their deaths. JWR

### Coral Reefs Face Further Stress

Coral reefs, once the prolific producers of seafood stocks, are reeling from the effects of overfishing and pollution—and global climate change. In the 15 August 2003 issue of the journal *Science*, marine experts gave a grim prognosis for coral reef survival and prescribed a rigorous course of therapy. Research for the study was conducted on Australia's Great Barrier Reef.

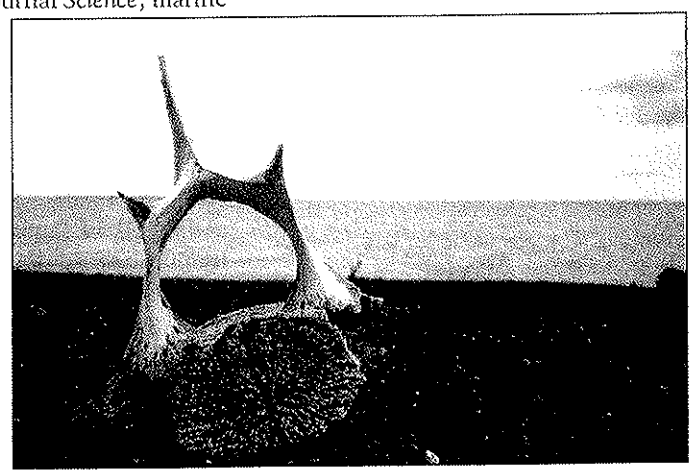
"In the next 50 years, coral reef ecosystems will experience environmental changes greater than any they have faced in the past half-million years," said evolutionary ecologist Rick Grosberg. "Complicating their existing health problems will be the impacts of climate change, such as warmer water, more frequent and more intense hurricanes, and changes in seawater chemistry."

Last October the forum "Managing Coral Reefs in the Face of Global Change" produced the Townsville Declaration, a road map for reef rescue. The report concludes that:

- 30–50% of all coral reefs should be designated as no-fishing zones to preserve the long-term variety and abundance of reef plants and animals.
- Greenhouse gas emissions must be reduced. Warmer conditions are already causing widespread coral bleaching. The increase of carbon dioxide in the air is changing ocean chemistry, which may cause reefs' limestone skeleton to fracture or dissolve.
- Coral reef management must be coordinated across local and international agencies.

Coral reefs are undersea communities of thousands of species of plants and animals, all interdependent. Reef-building coral is a delicate and dynamic partnership between a polyp and a plant that lives inside its cells. The reef is a colony of thousands of these polyps and their limestone walls and skeletons. JWR

**Whale vertebra.**



USFWS

# *The Forgotten Pollinators*

**by Stephen L. Buchman and Gary Paul Nabhan**
**Illustrations by Paul Mirocha; Foreword by Edward O. Wilson**

Washington, D.C.: Island Press, 1996 (First paperback edition, 1997); 292 pp. U.S. $18 (paperback); ISBN: 1-55963-353-0

**Reviewed by Elsa C. Bumstead**

Pollination ecology. A new term describing the interrelationships among plants and their pollinators. Why "forgotten" pollinators? Humankind, in its zealous pursuit of developing native landscapes into residential and industrial communities, has forgotten about connections to the land, forgotten about the forces and the creatures, great and small, that provide vital pollination services to crops as well as to native plants.

Why is this service so important? Dear readers, your survival depends on it. Your very food supply depends on it. One survey has shown that there are seven crops currently worth $1.25 billion annually in the U.S. pollinated by wild insects: cashews, squash, mangos, cardamon, cacao (chocolate), cranberries, and highland blueberries. Wild pollinators also are critical in seed production for such crops as onions, carrots, kapok, sunflowers, strawberries, cinnamon, clovers, figs and coconuts. Do I have your attention now?

There are lessons in floral morphology, nectar chemistry, pollinator designs and strategies. There are lessons in pollinator syndromes—the identification of plant/pollinator landscapes. There are insights into the little-known world of insects. Consider this: the male orchid bee uses orchid scents as an aphrodisiac to lure females, something akin to a female choosing her mate based on who is wearing the best aftershave.

There are travels that take you from the deserts of the Southwest to Australia, Greece, Central America, New Guinea, and from the Napa Valley to eastern Massachusetts in search of plants, pollinators and pollination processes. There even is a look at the "castaways of the botanical world" on the Galapagos and on Sea Horse Key off the coast of Florida.

Nectar corridors have served generations of such migratory pollinators as hummingbirds, bats, and butterflies. Those corridors and their codependent migrants now are threatened by disruptions in the wild landscape and by the use of toxic chemicals along the way, threatening cascading extinctions.

The latter part of *The Forgotten Pollinators* focuses on the economics of pollination services once taken for granted. It takes a look at crop production, the rise and fall of the use of European honeybees, the loss of wild pollinators, and beekeeping liability issues associated with the expansion of the Africanized honeybee. It ends with a look at stewardship: how to cultivate lasting relationships through ecological restoration and the establishment of pollinator gardens.

This book is filled with a wealth of information on the interconnectiveness of life, the food chains and food webs, and events that are happening to unravel the tapestry of life as we know it. There is an extensive bibliography, a glossary of terms, an index, and a number of appendices. The first appendix calls for a national policy on pollination. The second is a list of pollinators of the major crop plants; the third, a list of conservation and research organizations; and the fourth, a list of useful sources about pollinators and associated information. The fifth is a table of the pollinator classes for the world's wild flowering plants (~240,000 worldwide). Last of all, there is a list of common agricultural pesticides with their toxicity levels.

The winner of the 1997 PMA/Benjamin Franklin Award for Science and the Environment, *The Forgotten Pollinators* is an eminently readable book about the growing field of pollination ecology. Edmund O. Wilson provides a most persuasive introduction that entices you to go deeper. The black and white images



of artist Paul Mirocha have been described as "visually arresting," and they are. Authors economic entomologist Stephen Buchman and economic botanist Gary Nabhan have pooled their knowledge and their resources to provide valuable information about the diversity and complexity of plant and pollinator interactions and how they are related to the healthy functioning of the world's economy.

After reading *The Forgotten Pollinators* may you be inspired to become a steward and plant gardens filled with native flowering plants. And the wild pollinators, such as moths, ants, flies, beetles, bees, bats, and hummingbirds, will thank you. IWR

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*Reviewer Elsa C. Bumstead is an interpretive naturalist, writer, environmental scientist, and sometime wildlife rehabilitator who is based in Albuquerque, New Mexico.*

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

## Veterinary Anesthesia

**10th edition**

**by L. W. Hall, K. W. Clarke and C. M. Trim (eds.).**

Philadelphia: W. B. Saunders, 2001; 561 pp; U.S.$94 (hard cover)
ISBN: 0-70201-421-4

This book was first published in 1941 and has been extensively revised multiple times to keep pace with the new advances in veterinary anesthesiology. In fact, it was with some intrigue that I agreed to review it, as it was the textbook I used as a veterinary student, and one of the editors was my anesthesiology professor!

The book is hardbound and is divided into three sections, plus appendices. The first section consists of 10 chapters on the general principles and procedures of veterinary anesthesia and includes topics such as patient monitoring and clinical measurement, pharmacology of injectable and inhalation anesthetics, and apparatus for administration of anesthetics. The second section consists of seven chapters on the anesthesia of different species, including a separate chapter on the anesthesia of birds, laboratory animals, and wild animals. The third section contains three chapters on special anesthetic circumstances such as anesthesia for obstetrics, intrathoracic surgery, and anesthetic emergencies.

Of most relevance to the readers of this journal is the chapter on anesthesia of wild animals. Unfortunately, I found the chapter to be an inadequate overview of the topic. The material was mostly cursory and lacked detail. For example, when discussing inhalation anesthesia in birds, no mention was made of the types of endotracheal tubes that should be used or the need for intermittent positive pressure ventilation. In addition, some information was anecdotal, and possibly incorrect and inhumane. Few would regard the lowering of the environmental temperature of a snake as an appropriate restraint method. Also of some frustration for the U.S. reader was the mention of products only available in the U.K. One aspect of the chapter that did impress me was the mention of doses of analgesics for each taxonomic group discussed, something that is often neglected. Finally, the chapter was poorly referenced, making it difficult to check the sources of information, or pursue further reading.

In summary, this would be a useful general textbook on veterinary anesthesia; however, it lacks enough depth to be of use to the wildlife veterinarian who performs anesthesia on wild animals on a daily basis. JWR

*Reviewer Jonathan M. Sleeman, VetMB, MRCVS, Dipl. ACZM, is director of veterinary services at the Wildlife Center of Virginia in Waynesboro, Virginia.*

## Conversations with an Eagle

**by Brenda Cox**

Vancouver, B.C.: GreyStone Books, 2002; 262 pp.; U.S.$14.95
ISBN: 1-55054-811-5

Dedicated to the volunteers who work with wild birds and animals, Brenda Cox's book is a remarkable and well written true story that goes beyond rehabilitation to the core of why we do this work. *Conversations with an Eagle* details an eight-year relationship between the author and Ichabod, a human imprint bald eagle at O.W.L., Orphaned Wild Life, a raptor rehabilitation facility just outside Vancouver, British Columbia. Woven throughout the story are autobiographical notes and observations in what seems to this reader to be an interesting and appropriate balance. I never felt that there was too much about the author and not enough about the eagle or other birds. Cox's natural history observations of wildlife, both within and outside the center, are detailed and interesting.

Cox has a descriptive prose that occasionally borders the overblown, but that brings the reader a clear visual, and sometimes visceral, image. She personalizes the animals with her narrative, depicting moods and actions with great insight, without being overtly anthropomorphic. The book contains nice details on the stress of handling and making eye contact, as well as the impact of stress on healing. I particularly appreciated one of her insights in regard to wildlife rehabilitation: "Being constantly feared was mentally tiring. I understood why some volunteers wished the birds would get accustomed to them; it was the human social need to comfort."

Ichabod, the eagle in question, was one of those imprints that become dangerous, and the author became the only person willing to clean her cage or interact with her. Almost accidentally, she starts a training regimen that is fascinating. Ultimately, to save the bird from euthanasia, she undertakes glove training her for education, using falconry techniques to train her to fly to the glove. The insights and experiences she shares during this process are priceless. She puts into words experiences that are probably universal but that I have rarely seen so well described.

> In Ichabod's company, my mind was wiped clear of troubles, and I felt refreshed, my whole body relaxed. Whenever I approached the young bird, the weight of her attention felt almost physical. She'd focus her rapier eyes on me, seeming to catalogue the details of my clothes and my face. The location of my hands was of special interest to her. If I was rooting in a pocket absentmindedly, her sharp gaze at the wiggling pocket would draw my attention and still my hand.

Although the author's relationship with O.W.L. must have been strained by their shunting aside of the bird's training needs and their ultimate decision that the bird had to go, Cox makes it clear through her writing that this facility takes excellent care of their birds. I always find myself somewhat tense in reading a "rehab" book, afraid I'll find some practice described with which I wildly disagree and that will affect my enjoyment of the core of the book, the wildlife. However, I came away very impressed with O.W.L. and with the author's ability to set what must have been a high level of personal frustration aside to write dispassionately about her experiences there. The decisions that the directors took in regard to this bird are sad but understandable.

As to why we do this dirty, exhausting, emotionally draining, and spiritually rewarding work for hours at a time, and then can still get excited about a sighting of a wild one:

> ...we reflected on how privileged we were, through our work at O.W.L., to know eagles as few people did. We'd heard the rattle in their lungs made when pneumonia took hold, the rasping sounds their wings made against wood and cloth. Their blood had splashed on our hands, and during surgeries we'd seen their bones exposed. But nothing compared to seeing them whole and soaring, to hearing their shrieks and warbles in the wild.

I found this book an engaging, thought-provoking, yet quick and easy read. I highly recommend it, not just for fellow rehabilitators but for anyone with a fascination with wild creatures.

> At first there was no movement inside, only a kind of shocked stillness. Then the crate rocked back against my legs, and the owl catapulted from confinement. Huge heather wings folded and rose before my face, but no more than a faint hush, hush reached my ears. Light gilded the bird's wings, warming them almost to cinnamon. The owl's hanging legs lifted up and tucked straight back, dispelling any notion that he was of this earthbound world where I stood. He turned his head once in that eerie, seamless way owls have, and I caught a glimpse of his huge sulphur-coloured eyes before he swung around and flew straight towards the sun and the forest, his shadow tagging black over the grass. JWR

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

## Hand-Rearing Wild and Domestic Mammals

**by Laurie J. Gage, DVM (ed.)**

Ames, Iowa: Iowa State Press, A Blackwell Publishing Company, 2002; 304 pp.; U.S.$59.99 (hardcover, illustrations)
ISBN 0-8138-2683-7

The editor's goal in compiling this book was to assemble a practical guide for hand-rearing mammals that would bring together some of the vast quantity of material published on the subject of hand-rearing into a useful reference for those presented with an infant mammal.

The book's chapters were written by 34 authors, consisting of an international group of veterinary technicians, wildlife rehabilitators, and veterinarians. Various staff members and volunteers of wildlife centers, zoos, marine mammal centers, and wild animal parks made contributions as well.

The book is divided into two parts. Part I: Domestic Mammals and Part II: Wildlife, Zoo, and Marine Mammals. The two parts total 32 chapters, covering more than 50 mammal species. The species presented, for the most part, are commonly encountered species presented for hand-rearing at wildlife centers, zoo hospitals, and veterinary practices, and include raccoons and opossums, monkeys and lemurs, seals and sea lions, dogs, cats, and farm animals such as horses and goats.

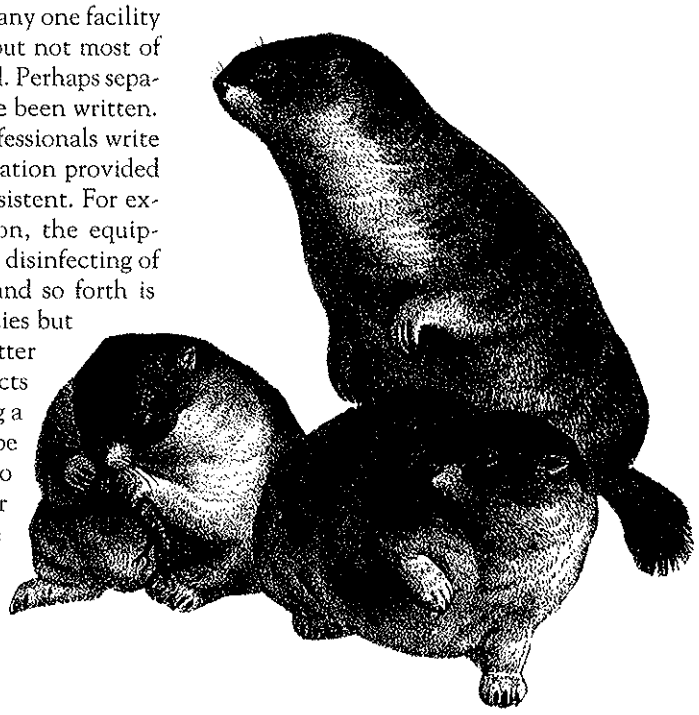
The information is good and useful regarding infant formulas and general neonatal care for the species covered. This book can be a useful reference tool in hand-rearing orphan mammals. However, I am not sure for whom this book would be entirely useful. The scope of species is too large for it to be entirely beneficial in any one profession. If it is in a veterinary practice, the part on domestic mammals and some exotic species may be helpful. Part II covers only pieces of information regarding raising wild animals for release, and raising an animal to be kept in a captive setting such as a zoo. Therefore, any one facility may have use for some but not most of the information provided. Perhaps separate volumes should have been written.

Because different professionals write each section, the information provided for each species is inconsistent. For example, age determination, the equipment needed, and proper disinfecting of bedding, cages, dishes, and so forth is mentioned for some species but not others. In order to better understand all the aspects provided for hand rearing a particular animal, it may be necessary for the reader to explore sections of other chapters as well as the chapter for the specific species that they are seeking information for.

A couple of chapters providing general information regarding infant mammal care—for example, hygiene for both the caregiver and the animal and basic supplies and equipment needed—may have been helpful. Some chapters, particularly those written by veterinarians, contain information and medical treatments beyond the scope and abilities of most non-veterinarians.

Although this book should not be viewed as a complete source, the information provided makes it a good quick reference tool. It would be especially helpful when one is presented with an animal not previously encountered. However, it would be necessary to do further extensive research to have a more complete understanding of how to raise a particular orphan mammal species successfully. A good start would be the reputable listing of references and the helpful appendix of product resources included at the end of the book. JWR

*Reviewer Sharon T. Kzinowek, is a licensed wildlife rehabilitator with the Wildlife Center of Virginia in Waynesboro, Virginia.*






The Wildlife Land Trust, an affiliate of the Humane Society of the United States, is seeking volunteer sanctuary monitors for wildlife sanctuaries in 21 states. The Wildlife Land Trust exists in order to protect wild animals by preserving their habitats and by providing them true sanctuary within those habitats. We work with private land owners who wish to protect their land and the wildlife living there from hunting, trapping, development and logging. Sanctuary monitors are needed to ensure that our mission is carried out.

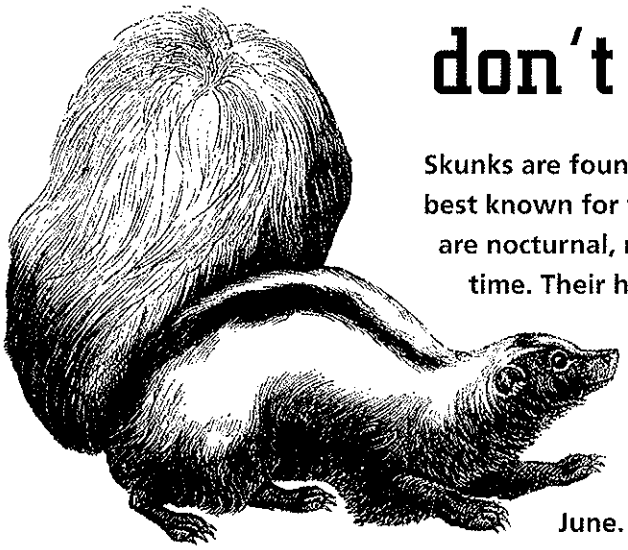
Volunteer sanctuary monitors are trained by the Wildlife Land Trust, oriented to the sanctuary and reimbursed for approved out-of-pocket expenses such as mileage, film and meals. Some of their duties include inspecting the assigned sanctuary for violations, maintaining posting signs, and reporting any problems to us. Sanctuary monitors are actively engaged in protecting wild animals on Wildlife Land Trust property.

Currently, sanctuary monitors are needed in the areas listed below. If you live near any of these areas, we hope you will contact us for a position description and an application.

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Fox, Arkansas
Fayetteville, Arkansas
Pocahontas, Arkansas
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Sebastapol, California
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Peyton, Colorado
Cripple Creek, Colorado
Hawkinsville, Georgia
Newtown, Connecticut
Haddam, Connecticut
Hendrix County, Indiana
Scottburg, Indiana
Feirson, Louisiana
Sherman Station, Maine
Palmyra, Maine
Sedgwick, Maine
Calais, Maine
Bar Harbor, Maine
Mount Chase, Maine
Skowhegan, Maine
Back River Neck, Maryland
Crystal Falls, Michigan
Holly, Michigan
Askov, Minnesota
Marlow, New Hampshire
Swanzey, New Hampshire
Nelson, New Hampshire
Weare, New Hampshire
Steins, New Mexico
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Poulsbo, Washington
Springdale, Wisconsin
Ashland County, Wisconsin
Trempealeau Couny, Wisc.
River Falls, Wisconsin

Please contact Sue Farinato, Public Outreach Coordinator, at 1-800-729-SAVE, or write:

Sue Farinato
Public Outreach Coordinator
The Wildlife Land Trust/HSUS
2100 L Street, NW



# don't get skunked!

**Skunks are found throughout most of North America and are best known for their strong, "don't-mess-with-me" spray. Skunks are nocturnal, needing a quiet and dark place during the day time. Their homes are usually in burrows but they will also nest under houses, decks, woodpiles, etc. Skunks are attracted by pet food, ripe fruit, water, snails and insects. They can uproot gardens and lawns when searching for food. Their nesting season is usually April through June. Skunks do have an important role and place in the ecosystem. Learn how you can coexist peacefully with them.**

### TO AVOID BEING SPRAYED

- Keep pets indoors at night when skunks are more likely to be out.
- Keep dogs on leash when walking, especially in wild areas.

### IF YOU OR YOUR PET IS SPRAYED

- Wash with Simple Green, rinsing well. Follow with vinegar rinse.
- You can also try washing with a mixture of: 1 qt. 3% hydrogen peroxide (from the drugstore), 1/4 cup baking soda, 1 tsp. liquid soap. Keep mixture out of eyes, nose, and mouth. Follow with a tap water rinse. Do not store mixture in closed bottle—it could explode. Quantity is suitable for cat or small dog.
- Wash clothes with Simple Green and use a dilute bleach solution to rinse if the item is safe to bleach.
- Use a commercial skunk deodorizer, available from veterinarians or feed stores.

### IF YOUR HOUSE HAS BEEN SPRAYED

- Wash sprayed surfaces with a bleach solution or a commercial skunk deodorizer.
- Boil water and rosemary on your stove to eliminate the odor from inside the house.

### TO KEEP SKUNKS FROM ENTERING YOUR YARD...

- A 3-foot-high wire mesh fence extended 6 inches beneath the ground surface will keep most striped skunks out.
- Commercial repellents may work on a temporary basis. Use around the perimeter of the yard.
- Try this homemade repellent: One cup castor oil plus one cup liquid dish detergent, mixed with a gallon of water in a spray can. Spray well around the area.
- Most repellents work to varying degrees based on how enticing the attractant is.

### SKUNK UNDER THE HOUSE?

- Find the entrance, usually a loose vent cover, but sometimes a hole dug under the foundation. Wait until the skunk comes out, then securely close the hole. Make sure there are no babies still under the house.
- If there are babies present, leave the hole open and make the area unpleasant by lights and noise. Skunks are very sensitive to light. The mother will move her babies to another nest site, and you can then safely close the hole.
- Sprinkle flour or corn starch on the ground around the opening so you can more easily check for footprints to see if the skunk has come out.

*(This space for your organization's name, address, website, and phone number.)*

Ditto content provided by the Lindsay Wildlife Museum, Walnut Creek, California (www.wildlife-museum.org)

# TAIL END

by Astrid MacLeod



STRIPED SKUNK (*MEPHITIS MEPHITIS*) PHOTO: PAT ISAACS

"Go ahead, punk. Make my day."

## INSTRUCTIONS FOR AUTHORS

POLICY Original manuscripts concerning any aspect of wildlife rehabilitation are welcome. Articles on topics including administration, law, education, veterinary medicine, animal husbandry, and public relations as they relate to wildlife rehabilitation are all invited. Book reviews are also welcome. Submissions are not confined to the North American continent.

Associate editors and anonymous reviewers judge each submitted manuscript on appropriate subject matter, originality, accuracy, conciseness, clarity, and contribution to existing literature. Concurrent submission to other peer-reviewed journals may preclude publication in the *Journal of Wildlife Rehabilitation* (JWR). IWRC retains copyright on all original articles published in JWR, but will grant permission to reprint articles upon request, with credit given to IWRC.

MANUSCRIPT Copy should be typewritten and double-spaced. Include the name of each author, addresses, phone numbers, e-mail addresses, a one-paragraph biography for each author, an abstract, and several keywords. Templates have been developed for the following categories of submissions: Species paper (i.e., rehabilitation notes), case study, technique, research paper, and review; authors may request a copy of one or all of these templates from the Editor or the IWRC office before developing work for submission in JWR.

SUBMISSIONS All submissions should be accompanied by a cover letter stating the intent of the author(s) to submit the manuscript exclusively for publication in JWR. Double space throughout, with 1 inch margins. The author(s) should keep at least one copy of the manuscript.

ELECTRONIC SUBMISSIONS Electronic submissions (PC or Macintosh platforms) are preferred but not required. The manuscript should be attached to the submission letter and sent to ALL of the following:

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runmuki@earthlink.net

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STYLE Citations should be noted within the body of the manuscript with the last name of the author and the year published (with one space between—no comma) using the following format: single author (Smith 1959); two authors (Smith and Jones 1979); more than two authors (Smith et al. 1989). A complete list of literature cited should be included at the end of the manuscript in alphabetical order, beginning with the last name of the first author. (Citations with more than two authors may list all authors names in the References section.) Please use sentence-style capitalization throughout the citation (mixed case). Provide complete citation information, including date; title; issue, volume, and page numbers of journal articles; and place of publication and publisher of books. Tables and illustrations must be self-explanatory and reference to them included in the text. The first use of a common species name should be followed by scientific names in parentheses (i.e., The appearance of the American robin (*Turdus migratorius)* does not always coincide with the beginning of spring.). Use metric units of measure followed by English/U.S. units in parentheses. If trade names are used, indicate if the product is trademarked or registered and list any products cited along with generic equivalents, when available, at the end of the article. Please provide full address (including zip code) of the product manufacturers.

ABSTRACT, KEYWORDS Manuscripts require an abstract of about 1 typed line per typed page of text. Place keywords below the abstract.

TABLES Start each table on a separate page and continue long tables onto 2 or more pages. Double-space throughout and leave margins of at least 1 inch. Annotate abbreviations.

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