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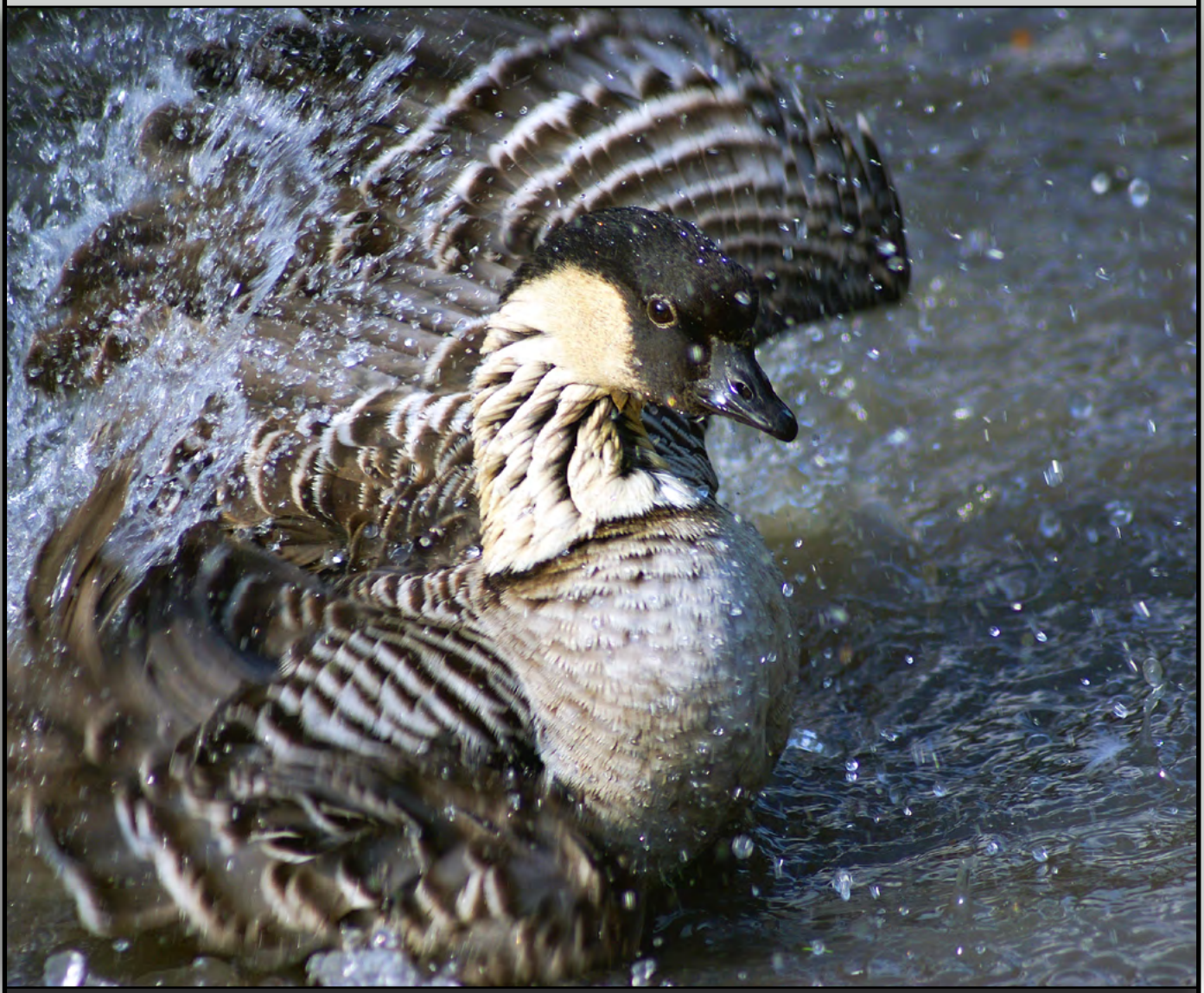

IN THIS ISSUE: FRACTURE REPAIR FOR A HAWAIIAN NENE GOOSE...TRACKING NUTRITION AND GROWTH OF TWO COOPER'S HAWKS FROM EGG TO RELEASE...A LOOK INTO THE GENOTYPE OF THE WHITE NOSE SYNDROME VIRUS...MANAGING DEMANDS UPON A WILDLIFE HOTLINE...THE ROLE OF WILDLIFE REHABILITATION IN KOALA CONSERVATION.

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 publication, rehabilitation courses offered online and on-site in numerous locations, and an annual symposium, IWRC works to disseminate information and improve the quality of the care provided to wildlife.

On the cover:
Hawaiian nene goose *(Branta sandvicensis).*
PHOTO © ANNETTE RUMBELOW. USED WITH PERMISSION.

Left:
Brown Hyena (Hyaena brunnea).
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JOURNAL OF WILDLIFE REHABILITATION

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Courtesy Calls

by Harry Kelton

Good relationships between nearby rehabilitators are consciously formed, maintained, discussed, nurtured, and negotiated as between neighbors. If they are left undiscussed, relationships can develop that tend to fester, with little positive communication. Some of the factors involved between rehabber neighbors are as follows:

The referral of telephone calls that will require animal pickup needs coordination because rehabbers tend to specialize—most referrals will be made based on species specialization. Mammal people deal better with mammal calls and bird people deal better with bird calls. If both rehabilitators work with the species involved, then the proximity of the animal in distress may indicate whether the case will be handled by the rehab center receiving the call or whether the caller should be directed to the center closer to the caller. The possibility of a donation at pickup time, based on relative affluence, poverty, or downright social danger posed by the neighborhood of the distressed animal, should not be a factor in determining whether to make a pickup directly or to refer the call to another rehabilitator. That having been said, no rehabilitator should endanger themselves by going into the wrong place at the wrong time.

If the caller is planning to deliver the animal in distress to the rehab center that they have reached by phone, and another rehabilitation center is much closer to them, then the question arises of, "Should the caller be told about the closer center?" The wrong answer could pose an ethical question.

With the pickup and transfer of an animal, rescuers should be especially considerate of their neighboring rehabbers when performing this type of service. In most cases, there is more to be picked up than just the animal in distress. There is a possibility of a donation made by the grateful citizen at the time of the pickup of a distressed animal, and there is also the name and mailing address of the concerned citizen that may be (and rightfully so) added to the mailing list of either the rescuer or the rehabber, and maybe even to both. Some questions are, "Which center should keep the donation, and which center should add the name of the grateful citizen to its mailing list?"

I believe there are so many combinations of species specialization, proximity, and other factors involved that a proper protocol for all situations cannot be worked out in advance. I also believe that small gatherings of neighboring rehabilitators need to get together and discuss the factors involved in their interactions, all based on what is best for the wildlife involved and what seems fair in certain combinations of circumstances that occur frequently.

Harry Kelton
IWRC Board Member
Founder, Pelican Harbor Seabird Station
Miami, Florida, USA

Alberta Wildlife Institute Soaring with Help from Nexen

MADDEN, Alberta, Canada (December 1, 2011)—Injured wildlife in Rocky View County will benefit from a recent donation from Nexen Inc. The company, which operates the Balzac sour gas plant, has agreed to donate CA$70,000 over two years to the Alberta Institute for Wildlife Conservation (AIWC) to support the rehabilitation of injured wildlife. The donation is part of Nexen's Balzac Heritage Project, a community investment initiative seeking meaningful ways to give back to the community. Nexen will invest $35,000 in 2011 and $35,000 in 2012 in the facility.

"The operation was shutting down and we felt there was something that we needed to give back to the community," said Bob Simpson, general manager of operations at the Balzac complex. "We pride ourselves on being responsible as a company in terms of safety and environment and public safety. And this (investment), we thought, was very fundamental to some of our core values."

AIWC provides medical care and rehabilitation for 230 species of wildlife, including hawks, bald eagles, great horned owls, red fox, and beavers. AIWC sees about 2,000 patients a year. The non-profit organization relies on government grants, donations, and fundraisers to keep up its operations.

Diana Segboer, executive director of AIWC, said Nexen's donation would go a long way towards helping wildlife in the region. Some of the money has been earmarked to pay for an upgraded x-ray machine, upgraded raptor enclosures, and to purchase some intensive care equipment. "It is an incredible gift," she said. "It helps us to continue with the projects that we've already started on and be able to improve the care facilities that we have for animals."

Bald Eagle Recovering at Downeast Wildlife Rehabilitation Center

AYDEN, North Carolina, USA (November 29, 2011)—U.S. Fish and Wildlife Service (USFWS) agents are supervising the Downeast Wildlife Rehabilitation Center (DWRC) on the care of a bald eagle rescued in Pitt County. The federally protected bird was brought to the center by sheriff's deputies on Thanksgiving. A passing motorist spotted the eagle and noticed it was unable to fly.

The bird's right wing appeared to be weakened by infection, either from an animal bite or in a tussle with another eagle, according to Marti Brinson, DWRC president and licensed wildlife rehabilitator. She suspects the bird is a female of advanced age, but it can be hard to tell. The eagle—nicknamed "Catfish" for her preferred diet—could go to another facility in Pitt County or to one in Jacksonville with more pen space for rehabilitative flight exercises. Wildlife agents with the USFWS specializing in birds of prey are being kept in the loop, Brinson said. "You have to let them (federal officials) know what's going on. They try to keep [eagles] in the same area where they came from, so there's less [feeding] competition." If the bird cannot regain her ability to fly, she will remain in captivity [at the Center] until a permanent home is found.

Though removed from the endangered species list in 2007, eagles and other birds of prey are protected under federal legislation like the Bald and Golden Eagle Protection Act of 1940 and the Migratory Bird Treaty Act of 1918, according to John Stanton with the USFWS. "They're doing very well; eastern North Carolina seems to be very conducive to them, with large forests and wetlands. The habitat down here is very suitable." Stanton estimates there are more than 50 nesting pairs in the state, up from fewer than five in the mid-1990s.

The DWRC does not receive any federal funding for her efforts with the eagle. [Brinson's] non-profit rehabilitation center in Ayden serves a variety of animals through donations.

Wildlife Groups Split on Ideas for Virginia Beach Facility

VIRGINIA BEACH, Virginia, USA (November 25, 2011)—Virginia Beach city officials have given up hope that competing groups will flock together and build a new wildlife rehabilitation center in southern Virginia Beach. Instead, planners will begin reviewing separate proposals—one from Wildlife Response Inc. and another from the local Society for the Prevention of Cruelty to Animals and from Evelyn's Wildlife Refuge—according to Jack Whitney, the city's planning director. "Both sides have a lot to bring to the table and they have common interests," Whitney said. "It would have been really, really nice if they could have come together."

The city had postponed its review process in late summer and asked the two sides to come up with one proposal to lease 50 city-owned acres near Indian River and North Landing roads. But the relationship between the wildlife rehabbers has been plagued with distrust and concerns that each side was trying to undermine the other's work. At one point, the possibility of bringing in a mediator was discussed. Then, in late October, Wildlife Response representatives asked the city to review their proposal independently. "The other two groups didn't share the same vision," said Cindy Lakin, a spokeswoman for Wildlife Response, a volunteer network of home-based animal rehabbers.

Sharon Adams, the SPCA's executive director, said her organization tried to work with Wildlife Response but agreed that they have different perspectives on the rehab center. "This isn't about two groups fighting over who gets to wear the crown," Adams said.

City officials, the SPCA's coalition, and Wildlife Response all agree they want to create a facility similar to the Wildlife Center of Virginia in Waynesboro. The SPCA said that its fundraising prowess and volunteer support would ensure the center gets built. Wildlife Response said its expertise, specifically in wildlife treatment, would help create a refuge for injured wild animals. Both groups said they plan to include home rehabbers in their plan. City officials hope the center will help address the rehabilitation needs of larger

wildlife in the area. Currently, the city allows residents to care for injured wild animals in their homes with a permit. Those home rehabbers could still serve as clinics for rescued wildlife, but the center would become more of a hospital-type facility where complex needs of wildlife can be met, Whitney said.

Wildlife Raffle Raises Questions

WINDHOEK, Namibia (November 24, 2011)—A Namibian wildlife rehabilitation trust was fined N$900 for harboring wildlife without a valid permit. The rehabilitation center, registered at the Master of the High Court as the Namibian Wildlife Conservation Trust (NWCT), lacked valid permits to house one brown hyena, a leopard, and a crocodile.

NWCT has for the past six years raffled two new Landcruisers to members of the public annually, at N$100 for a ticket. The trust was recently reported to the Anti-Corruption Commission (ACC) concerning the authenticity of the organization and whether the funds collected are used to support a genuine wildlife rehabilitation program. Gert Petrus (Poenie) Weakley, one of the trustees and the owner of farm, denied any wrongdoing.

Weakly said the trust works "with a lot of wildlife orphans that we raise and rehabilitate [back] to the wild. We just received a baby porcupine that we are raising, and two months ago we rehabilitated a bunch of baboons."

Weakley did admit that the trust is not registered as a rehabilitation center with the Ministry of Environment (MET). Weakley said the leopard and crocodile have been with the program for more than three years and claimed the hyena and a porcupine are recent additions. The MET officials found everything in order with the animals' enclosure, care, and condition. "The problem was, I didn't know I had to apply for a permit every year," Weakly claimed.

Weakley was unable to provide financial figures as to how much money has been pumped into the rehabilitation project to date. He said the raffle provides an income for around six months of the year, while [in] the other months the rehabilitation program is sustained by his farming activities.

But conservation community sources cite the absence of any public record or documentation of any wildlife rehabilitation as "disturbing." In addition, an Internet search reveals a second trust with the same name is registered in the United Kingdom. Enquiries have revealed that the UK-registered Namibian Wildlife Conservation Trust, while sporting an identical name, has no relation to Weakley's trust. Concerns have been raised over the number of Namibians who have found the UK organization website and believed it was Weakley's trust.

Wildlife Hotline Now Open for Business

CAPE GIRARDEAU, Missouri, USA (November 20, 2011)—A group of wildlife rehabilitators in southeast Missouri and southwest Illinois have organized a Wildlife Hotline to help area residents manage wildlife conflicts. Wildlife specialists are available to answer questions about native wild animals, help determine if an animal is in need of rescue, and refer callers to a nearby rehab center.

The specialists are current or past wildlife rehabilitation volunteers who have been educated by the International Wildlife Rehabilitation Council (IWRC) or the National Wildlife Rehabilitators Association (NWRA). The hotline (636–492-1610) is manned 24 hours a day, 7 days per week. In the event that a call is forwarded to voice mail, the message is sent to all of the organization's volunteers so callers will receive a response as quickly as possible, usually within an hour. The service is available free of charge to the public, and the organization encourages police, animal control, conservation centers, nature centers, etc. to refer citizen's wildlife calls to the Hotline.

Wildlife Hotline volunteers cannot always send someone "on-site" to assist; in many cases, a telephone consultation is all that's need to help homeowners handle these conflicts on their own. It is a win–win situation. The caller gets the information they need to resolve their conflict, saving hundreds of dollar that they may have spent with a pest control or "nuisance" wildlife control company, plus the animal conflict is settled safely, efficiently, and humanely.

Neighborhood Files Suit Against Wildlife Rescue

LOUISVILLE, Kentucky, USA (November 17, 2011)—The Buckeye Trace Homeowners Association has filed a lawsuit against a couple running a wildlife rehab center in their back yard. Bruce and Brigette Williams operate Second Chances Wildlife Rehabilitation and Education Center. Brigette Williams is also a full-time schoolteacher and longtime Louisville Zoo volunteer.

For the past year and a half, the couple has run the non-profit center right outside their Goshen home. "We have lots of little squirrels coming in—possums, skunks, little ground hogs," Williams said. "We have the goal to release them, fully vaccinated, back out into the wild that is not very populated by people." But the center hasn't been well received among neighbors on the street. In fact, they've filed a lawsuit to shut it down. "We have not been treated very kindly," Williams said.

The suit lists 27 plaintiffs—neighbors and members of the Buckeye Trace Homeowners Association—and accuses the couple of violating the neighborhood's declaration of restrictions. It alleges they run a business on residential property, built structures without approval, and that the business is, or may become, a nuisance to the neighborhood. The couple has 20 days from the date the lawsuit was filed to respond. "It's frustrating to go through this process," association president Andrew Baird said. "What she does is a wonderful thing. This is just not the proper venue to run this type of operation. We have to protect people's property values."

But Williams said Second Chance isn't a nuisance to anyone, and she's concerned about protecting the animals, especially since, she says, she's the only person in the county who does so.

"All these orphaned animals, where will they go?" she asked. Williams is currently unable to accept any animals due to the pending lawsuit. ■

A Novel Approach to Tibiotarsal Fracture Management in the Hawaiian Nene

Ann Goody, Jacob Head, Athena Gianopoulos, Sharon Liu, and Brianna McCoy

PHOTO © ANN GOODY

Figure 1. Nene upon intake with a traumatic, compound, transverse fracture of the left tibiotarsus.

ABSTRACT: An endangered Hawaiian nene *(Branta sandvicensis)* with a traumatic, compound, transverse fracture of the left tibiotarsus was admitted for treatment to the Three Ring Ranch, Kailua-Kona Hawai'i, United States. An intramedullary pin was surgically inserted longitudinally through the tibiotarsal bone from hock to knee. External support was provided by a modified Schroeder–Thomas splint (hereafter Schroeder–Thomas–Goody); this allowed wildlife rehabilitators to immediately access the foot for physical therapy and the patient to assume a natural recumbent position. In the past, rehabilitation of birds with similar injuries has been arduous due to the prolonged and intensive physical therapy required to correct contractures that develop from immobilization of the hock and foot. The modifications of the splint enabled physical therapy to begin 72 hr post-operation. Full recovery and release of the nene followed 5 wk later, as opposed to the standard rehabilitative period of 4 to 10 mo for this type of injury.

KEY WORDS: Contractures, fracture repair, Hawaiian goose, intramedullary pin, nene, physical therapy, Schroeder–Thomas splint, tibiotarsal fracture.

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Introduction

Management of fractures in birds has traditionally been challenging due to the high calcium content of bird bones and the resulting brittleness (Bennett *et al.* 1992). Surgical repairs of fractured pelvic limbs commonly involve internal fixation with pins in combination with external support with splints (Harrison and Harrison 1986; Rebecca Duerr, International Bird Rescue, Fairfield, California USA, pers. comm.). External fixation devices used for psittacines and raptors have not been well tolerated by waterfowl and seabirds, who frequently remove the devices themselves, causing extensive damage. Effective as external support during fracture repair, the traditional Schroeder–Thomas (ST) splint immobilizes digits of the bird in a contracted state. In captive psittacines and raptors that typically perch at rest, the degree of restoration of digit function after splint removal, while less than optimal, has been adequate. While the complete restoration of function in the digits is not essential for companion birds, such a recovery is necessary if wild birds are to thrive after release. Achieving this using a traditional ST splint requires a period of immobilization and intensive physical therapy for the digits. As a result, this form of fracture management is not optimal for birds intended to be returned to the wild, especially in birds that depend on a flat-footed gait, such as waterfowl. Traditional ST

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splints are meant to keep an animal upright and enable weight bearing on the lower edge of the splint, which works well for canine, feline, raptors, and psittacines. Furthermore, traditional ST splints limit the ability of waterfowl to rest sternally recumbent and they create pressure on the femoral nerve, damaging nerve function and rendering the affected foot unable to naturally flex or to function normally.

The endangered Hawaiian nene (*Branta sandvicensis*) goose is an example of such a weight-bearing bird. Due to human impact, this species has been pushed to occupy hazardous landscapes such as golf courses, where they are occasionally struck by golf balls. This can result in fractures and, in the past, has required lengthy wildlife rehabilitation times. At Three Ring Ranch (TRR), an exotic animal sanctuary and native wildlife rehabilitation center based in Kona, Hawai'i, the average admission period for this injury was 4–6 mo but has taken as long as 10 mo. With the utilization of the Schroeder–Thomas–Goody (STG) modified splint, rehabilitation time was dramatically reduced due to the lightweight structure and the resulting accessibility of the foot for physical therapy within just days of surgery. The nene, band number 446 by the Hawai'i Department of Land and Natural Resources (HDLNR), was the first case using the modified splint. This nene was released after only 5 wk.

Natural history of the Hawaiian nene goose *(Branta sandvicensis)*

Believed to be a descendant of both the lesser Canada goose (*Branta canadensis parvipes*) and the lesser snow goose (*Chen caerulescens caerulescens*), the nene, state bird of Hawai'i, is an endangered species endemic to the state. Unlike its migratory cousins, nenes never leave the islands and have the smallest range of any goose. With terrestrial habits, the nene possess stouter legs, shorter wings, and partial loss of webbing. These geese are grazers that spend most of their time browsing in grasses, feeding predominantly on plant material, and do not actively seek insects or other invertebrates. The birds undergo a complete molt of their feathers over a period of 6–8 wk which coincide with the rearing of their young. Like many island species, the nene evolved in an environment absent of predators and became the only surviving goose in Hawai'i. Arrival of the first humans pushed the birds to the rockiest, harshest environments in which they were forced to travel great distances to forage and maintain their metabolic intake. This resulted in the sturdy and comparatively robust goose we know today. Dramatic decline in their numbers is attributed to their lack of fear response toward humans and to introduced mammalian predators. Adult nene fell easy prey to humans, while their egg and young populations were decimated by predation. Habitat destruction limited the nene's ability to feed and breed, subsequently limiting their population's ability to recover. Between the 1890s and 1940s, the nene population plunged from 25,000 to 30 individuals. Breeding programs began in the mid-1950s, and the goose was listed as endangered under the Endangered Species Act on 28 December 1973 (16 U.S.C. §1531 et. seq.). Repopulation programs are in place and have had the most success on the mongoose-free islands. Approximately 1,950 nene exist in the wild today with 416 on Maui, 165 on Molokai, 850–900 on Kauai, and 457 on the island of Hawai'i (U.S. Fish and Wildlife Service 2010).

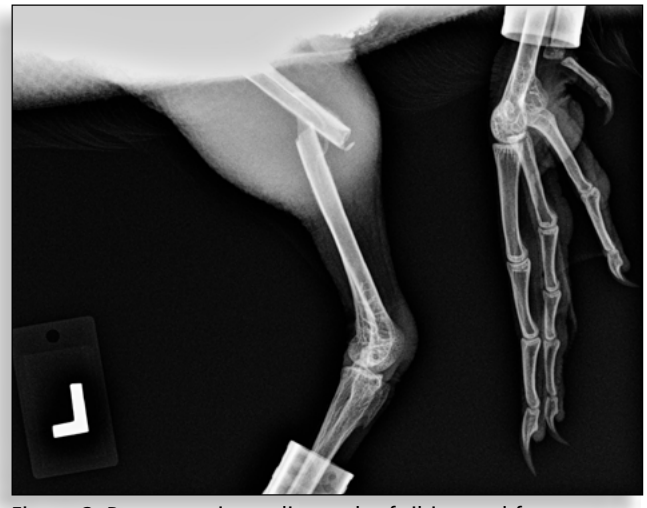

Figure 2. Pre-operative radiograph of tibiotarsal fracture.

Clinical Notes

Intake

The trauma to nene 446 occurred on 27 January 2011 as a result of a golf ball strike. The bird was delivered by the HDLNR for treatment 5 days later. A left leg fracture was suspected due to significant displacement and consequential shortening of the limb. Initial physical exam and radiographs revealed a transverse tibiotarsal fracture of the left leg. The foot had good circulation but was folded, rotated, and developing contractures. The bird was thin but not emaciated. All other findings were normal. When the bird was prepped for surgery and anesthetized, a healing skin break was noted, changing the diagnosis to an open comminuted fracture.

Upon intake (Fig. 1), nene 446's initial radiograph (Fig. 2) showed a significant transverse midshaft tibiotarsal fracture. The bird was kept still in a small ICU crate until surgery. Swelling immobilized the injured limb sufficiently until surgery the next morning. The bird was medicated for pain with an intramuscular (i.m.) injection of buprenorphine 0.006 mg. The patient was a 3-yr-old, otherwise healthy ambulatory bird and was, therefore, a good anesthetic candidate for internal fixation. (Hawaiian nene are all banded by the HDLNR prior to first flight, so we knew not only the hatch year but the geographical location at which the bird was hatched.) We had the availability of an exceptionally trained orthopedic surgeon, Jacob Head, D.V.M., who donated his time and services to operate on nene 446 on 3 February 2011.

Surgery and splinting

The midshaft tibiotarsal fracture was reduced with an open approach to the lateral surface of the fracture site. Closed reduction alone was not enough to adequately reduce the fracture ends due to a large soft-tissue callus already present at the time of surgery. Once

the fracture was reduced, an intramedullary pin was introduced from the distal lateral condyle of the tibiotarsal bone and pushed proximally through the fracture site and ending in the proximal segment. The intramedullary pin was 3/32 in (0.24 cm) in diameter and was placed 4.33 in (11 cm) into the tibiotarsus, continuing 3.92 in (9.90 cm) proximal to the fracture. The distal end of the pin was bent to prevent displacement. The patient was induced using isoflurane (isofluorane USP; Baxter, Deerfield, Illinois, USA) delivered through a mask at a rate of 2–3 L/min at an initial 3.5 percent and a maintenance rate of 2.5–3.0 percent. A brief increase to 3.5 was required during alignment of the fracture ends.

Figure 3. The ST-modified (Schroeder–Thomas–Goody; STG) splint frame.

We determined that the intramedullary pin would allow adequate bending of distal joints and provide for stability of the fracture ends. The incision was closed with monofilament absorbable suture. The bird was medicated for pain with an injection of buprenorphine 0.006 mg i.m. at the time of surgery and again 12 hr postoperatively. Additional pain medication was provided once daily for 3 days.

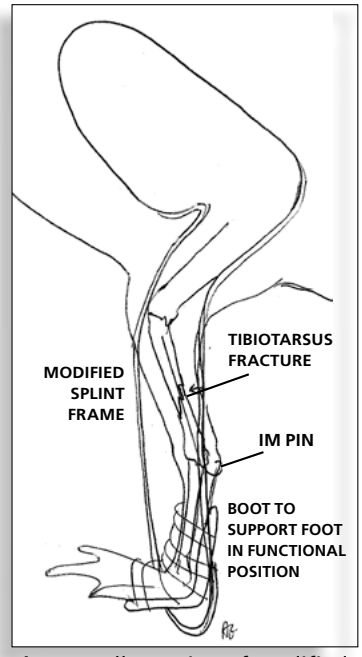

ILLUSTRATION: ANN GOODY

Figure 5. Illustration of modified splint with relationship to leg and body of nene.

The STG modified splint was applied while the patient was under anesthesia to provide external support to the leg and foot. Surgery lasted for 2 hr, significantly longer than the anticipated time of half an hour for similar procedures. The extended surgery time was due to severe edema, fracture displacement, and contracture complications exacerbated by the prolonged period between the time of injury and the time of admittance for treatment (verified to be 5 days based on eyewitness report of initial injury).

The STG splint provided two novel features that played a crucial role in accelerating the rehabilitation of the patient. First, the traditional ST splint was modified from having a fully enclosed ring at the pelvic end to having a semicircle that supported the lateral lower abdomen (Figs. 3, 4). This modification allowed for full pivoting of the hip while providing rotational stability of the fracture, and it also permitted immediate weight-bearing by the bird. With the reduction of splint material at the pelvic end, the STG splint also accommodated the nene's natural tendency to rest sternally recumbent; a traditional ST splint would have interfered with a nene's ability to rest naturally and the injured limb would be forced into a tripod angle when resting in a recumbent position. The splint was well tolerated and the patient was, overall, more comfortable during recovery when compared to prior similar cases.

Second, although the base of the bird's foot was enclosed by the splint frame and the hock of the bird secured to the splint by bandage tape, the foot itself remained exposed (see illustration in Fig. 5). This modification enabled access to the foot, allowing physical therapy to begin at 72 hr without removal of the splint. After application of the modified splint, a supportive boot was secured to the foot for 10 days to limit contractures and maintain position of function. The sole and heel of the boot was constructed from a tongue depressor padded with bandage tape. Half of the tongue depressor was pressed flat against the plantar surface of the foot so that the foot was in the full position of function; the second half created the heel of the boot. The L-shaped boot was secured to the foot with bandage tape, leaving access to the distal half of the foot. This boot prevented contractures by flexing the hock and extending the digits, thereby minimizing the duration of physical therapy required.

Figure 4. Post-operative radiograph of STG modified splint and intramedullary pin

Post-operative care

Nene 446 was housed in a 3 × 6 × 6 ft (0.9 × 1.8 × 1.8 m) indoor cage that limited excessive mobility. To further minimize stress and activity, a screen provided a visual barrier. Physical therapy began 72 hr after surgery and consisted of passive range-of-motion of the toes, including flexion and extension. The boot provided pressure to the sole of the foot, which prevented hyperextension of the hock and balling of the foot. Physical therapy occurred initially as sets of five repetitions, five times daily and gradually increased to 20 repetitions, five times daily for the first 10 days. Physical therapy after the boot was removed continued similarly, with the hock being included in the passive range-of-motion and flexion and extension exercises.

The intramedullary pin and the STG modified splint were removed under anesthesia on 1 March 2011. A radiograph taken to assess the fracture site showed a well-formed callus (Fig. 6). Physical assessment of the surrounding soft tissue showed no edema.

To decrease the likelihood of re-injury, housing the patient

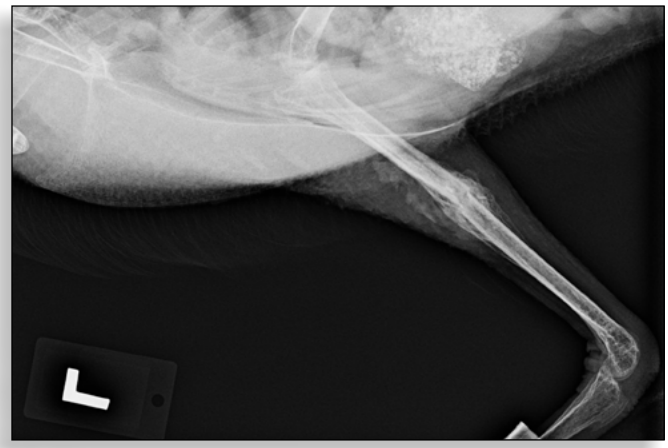

Figure 6. Post-operative radiograph after removal of STG modified splint and intramedullary pin.

in a controlled environment during rehabilitation was necessary. Once awake post-pin removal, the nene was placed in a 35 × 8 × 12 ft (10.6 × 2.4 × 3.6 m) outdoor aviary on grass. At this point, no physical therapy was required as the bird was ambulating gradually back and forth through the entire length of the enclosure to graze. Functionality of the foot increased from 60 to 90 percent in 9 days and was determined by the bird's ability to move back and forth across the pen without subsequent limp. Nene 446 was released on 12 March 2011, only 12 days after the pin was removed, with 100% function of the foot; standard release criteria at TRR is that a bird exceeds 85% restoration of foot function.

Summary

Traditional ST splints have been useful in captive raptors and psittacines. Previous attempts to redesign them for weight-bearing birds such as the wild nene resulted in heavy, cumbersome splints that soiled easily and created panic in the patient. At TRR, we have found through trial and error that, by providing access to the foot for immediate physical therapy post-operatively, we can assure mobility for the foot while keeping the hock immobile. In addition to minimizing foot contractures and the duration of rehabilitation, the modified splint also enabled the bird to rest in its natural, sternally recumbent position which further reduced stress. Because the STG modified splint worked well for nene 446, its application would likely be an ideal alternative to the use of traditional ST splints for wildlife rehabilitators across the board in not only geese but in raptors and psittacines.

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About the Authors

PHOTO © NORM GOODY.

Ann Goody

Ann Goody, RN, Ph.D., is curator of the ASA- and GFAS-Accredited Three Ring Ranch Exotic Animal Sanctuary (www.threeringranch.org) in Kailua Kona, Hawai'i. She cares for the 150 or so residents of the Sanctuary along with her husband, Norm Goody, M.D. Prior to her curator position she was an emergency room nurse and the administrator of a home health care agency.

Dr. Jacob Head

Dr. Jacob Head was born and raised in Hawaii. At an early age he was instilled with a sense of stewardship for the land and the animals on it. Raised on a farm in South Kona, he was an active participant in 4H. His family still owns and operates an organic coffee farm that they tend with the help of a flock of white Chinese Geese. Dr. Head spent 18 years of his adult life in Colorado. After he obtained his DVM in 1998, he completed an internship in small animal medicine and surgery in New Mexico. Dr. Head works at the Keauhou Veterinary Hospital, the only AAHA-accredited practice on the Big Island, and is a member of the AVMA, CVMA, HVMA, and the Veterinary Orthopedic Society. Dr. Head, his wife, and three children work and reside with him in Kailua-Kona, Hawaii.

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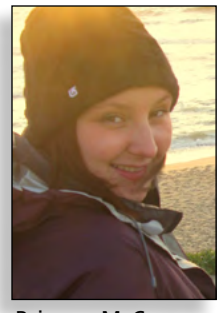

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Growth and Nutrition of Two Hand-Reared Cooper's Hawks (*Accipiteri cooperii)* from Egg to Release

by Kerrin Grant

ABSTRACT: In 2010, The Wildlife Center in New Mexico incubated four Cooper's hawk eggs. Two chicks survived and were hand-reared until release at 13 wk of age. Information is provided on incubation, diet, and growth rate of the birds as hatchlings, nestlings, and fledglings. Chicks were fed quail throughout the hand-rearing process, but were supplemented with nutritional products to assist in optimal health and development. Taurine, an amino acid important for normal brain, eye, and spatial skill development in some animals was incorporated into the hatchling diet. Thiamine and vitamin E were also provided in the diet from hatchling stage to release. Differential growth of two birds while consuming the same diet suggested one was male and the other female.

KEY WORDS: Cooper's hawk, diet, incubation, growth and development rates, housing.

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Introduction

On May 4, 2010 The Wildlife Center (TWC) received four viable and one non-viable Cooper's hawk (*Accipiter cooperii*) eggs from Hawks Aloft, an organization in Albuquerque, New Mexico, United States. The nest was located on a homeowner's porch and the female had been incubating the eggs for an indeterminate amount of time. The homeowner removed the nest because the female hawk was dive-bombing people in an attempt to protect her nest. Once the nest was removed, the eggs were transported to TWC in Espanola, New Mexico for continued incubation. If possible, once the eggs hatched, it was hoped that the surviving chicks would be placed in an active Cooper's hawk nest with chicks of similar size to receive foster care.

Methods

Incubation of eggs

The incubation period for Cooper's hawk eggs is typically 34–36 days in length, with a range of 30–36 days (Meng and Rosenfiel, 1988). Cooper's hawks typically lay three to five eggs; active incubation begins after the third egg is laid (Meng 1951). All eggs typically

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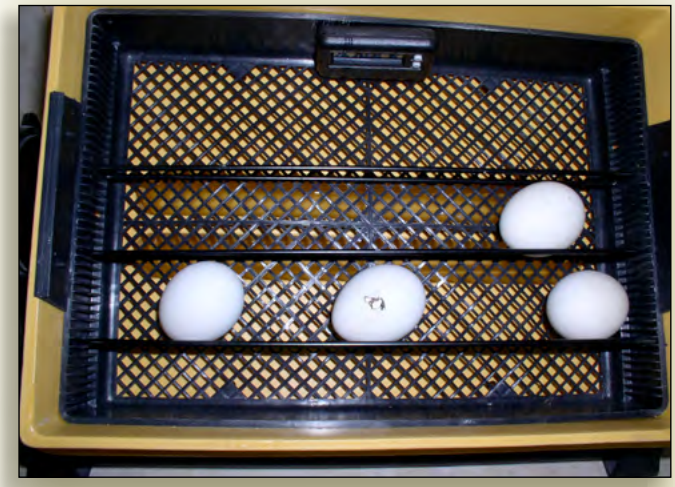

Figure 1. Brinsea Octagon 20 Ox™ incubator tray with eggs; middle egg has pipping hole.

hatch within a 2 to 3-day period between the first- and last-laid egg. The chicks are brooded for 2 wk and then fledge between 25 and 34 days of age (Rosenfield and Bielefeld 1993). Parents continue care-giving for an additional 5–6 wk, with total parenting time being 7–8 wk from hatch to independence (Meng 1959; Kelly and Kennedy 1993).

The rehabilitation staff at TWC incubated the eggs in a Brinsea Octagon 20 Ox™ incubator (Brinsea Products, Inc., Titusville, Florida USA). This model has a water trough for humidity, a temperature control gauge, and an automatic rocker. Eggs were incubated at ambient temperatures of 36.1–38.2°C (97–101°F) and a humidity range of 37–40%. The rocker maintained constant, gentle movement and staff turned the eggs 180° once per day. The eggs were tilted slightly so that the large end of the egg was slightly higher than the pointed end.

A daily log was kept to record temperature and humidity values within the incubator until chicks hatched, and data were collected on daily weight changes of eggs. Based on hatch date, it was estimated the eggs were received approximately 14 days post-laying. During the 19-day period of artificial incubation, total weight loss for each of three eggs was 10–11% and 19% for the fourth egg (the fifth egg was non-viable). It has been determined eggs will lose approximately 15% total weight between day laid to day hatched (Kasielke 2007).

Pipping (process of chick using an egg tooth to break open the shell) and cracking of the first egg began on 23 May 2010, with the chick hatching during the night on 25 May 2010 (21 days after intake), as shown in Figure 1. Two other eggs showed cracks on 23 May and both chicks hatched the morning of 26 May. The fourth egg showed cracks on 23 May but had not hatched by 27 May, so staff assisted the chick with hatching.

Hatching of eggs

Hatch weight ranged between 25.1–28.5 g for the first three chicks and 21.6 g for the fourth. Three days post-hatch the fourth chick, which was always very weak and lethargic compared to the others, died. The remaining three chicks were identified by color markings. "Blue" was the first chick hatched followed by "Pink" and "Red." Weight change of the three chicks was consistent during incubation, as were hatch weight and growth during the first 2 days post-hatch. At day 3 post-hatch, Blue and Pink were consistent in growth, with Red starting to lag behind; weight increase of Blue and Pink was 50.4–53.8%, whereas Red had only gained 17.5%. By day 7, Blue and Pink had gained 186–201% in weight followed by Red at 108%. Red continued to lag behind in growth and started showing irreparable developmental abnormalities and, thus, was euthanized.

It is interesting to note that Blue was the first chick to hatch, but Pink was consistently the largest and heaviest, from hatchling stage to release, suggesting size is not a reflection of hatching order but may be associated with gender dimorphism.

Diet

The diet for the two remaining hatchlings (Blue and Pink) was comprised of domestically raised quail supplemented with products to provide a nutritionally balanced captive diet (see Table 1). Initially, plucked–skinned quail were pulverized in a blender so that the whole bird (meat, bones, organs, and connective tissue) could be fed. The consistency of the diet was of meatloaf. During the first few days post-hatch, chicks lacked motor-function control, so feeding became a messy process. Chicks had dirty beaks and soiled feathers from the food because they bobbed their heads trying to grab the loose meat product; therefore, the pulverizing process was discontinued. Instead, quail meat was cut into small pieces and pulverized bone and connective tissue were added in. The chicks readily grabbed food from forceps and no clean-up was required after feeding.

Supplementation

Several nutritional supplements were added to the diet to ensure chicks received a nutritionally balanced diet, including the proper calcium to phosphorus ratio. Taurine, calcium, magnesium, zinc, thiamin-E paste, and pancreatic enzymes were added to the diet on a daily basis. The following supplements were added per 90 g chopped quail meat: (1) Taurine: 1/8 tab (31.25 mg by dose, 0.2 g by weight); (2) CaMgZn: 0.2mL (provides 334 mg Ca, 134 mg Mg, and 5 mg Zn); (3) thiamin-E paste: 0.5 mL; and (4) pancreatic enzyme: 1/8 tsp (or 0.35 g by wt).

Thiamin-E™ paste is a commercial product (Stuart Products; available through Mazuri) used for captive fish-eating birds that provides

TABLE 1. NUTRITIONAL COMPOSITION OF DIET WITH SUPPLEMENTS.[1]

DRY MATTER = 34.79%	CRUDE PROTEIN = 66.98%	CRUDE FAT = 29.43%
CALCIUM = 3.79%	PHOSPHORUS = 2.73%	CA:P RATIO = 1.4:1
IRON = 97.79 MG/KG	COPPER = 2.77 MG/KG	TAURINE = 0.1%
VITAMIN A = 49.26 IU/G	VITAMIN E = 218.3 MG/KG	VITAMIN D = 0.03 IU/G

[1]Analysis done with Zootrition® software.

100 IU/g vitamin E and 50 mg/g thiamin (vitamin B1). Vitamin E is essential for proper cellular and organ development; it is an antioxidant and helps reduce stress in animals during captivity (Liu *et al.* 1985). Additionally, the vitamin is commonly deficient in domestically raised quail. It is common to add Thiamin-E paste to the diets of animals at TWC that consume fish, quail, or day-old-chicks on a regular basis.

A commercially available product containing calcium, magnesium, vitamin D_3, and zinc, CaMgZn,™ (Vitamin Cottage, Lakewood, Colorado USA) was added to increase the Ca:P ratio to ensure proper bone growth. Pancreatic enzyme powder (Pancrezyme,™ Virbac; Viokase-V,™ Fort Dodge Animal Health, Overland Park, Kansas USA) was added to assist with proper digestion. Pancreatic enzymes listed may be purchased from 1800PetMed.com.

Taurine (PetAg, Hampshire, Illinois USA) was added because reports indicate it is required for normal brain function, eye development, and spatial learning in growing animals (Arnold *et al.* 2007). Taurine is an amino acid derivative important for proper development of retinal tissue and has also been associated with post-fledgling risk-taking skills in insectivorous passerines (Arnold *et al.* 2007). Passerine parents reportedly provide a greater volume of spiders to hatchlings because they contain proportionally higher amounts of taurine than do other insects fed later in the growth phase. However, in captivity, the closest comparable food to the Cooper's hawk wild diet is quail. Taurine values are typically low or not present in domestically raised quail (USDA 2011), and variability in nutritional composition may occur among distributors, so the supplement was added.

Feeding

From day 1–7, chicks were fed five times a day in an amount equal to 5–10% body weight (BW) per chick per feeding. Figure 2 shows chicks at 2 days of age. The recommendation for feeding hatchling birds is every 2 hr during daylight (Shimmel 2007). However, these chicks did not empty their crops during that time frame and so were fed every 3 hr.

From 8–14 days of age, chicks were fed four times per day and consumed 45–50% BW per chick per day (avg. of 12% BW/feeding). At 2 wk of age, feedings were decreased to three per day and the chicks' average consumption was 28% BW per day (9–10% BW/feeding).

At 3 wk of age, the carcass of a quail was offered in the cage to encourage food exploration and self-feeding, but chicks were still hand-fed three times per day. Initially, the carcass meat was not calculated into the daily food allotment. Pink was the first chick to demonstrate "mantling" behavior associated with the prey (a falconry term; birds spread out the wings and feathers to hide food). Complete self-feeding occurred by 4 wk of age at which time whole, split quail was offered to the pair so each chick had access to half a quail (60–80 g) per day. The prey was split into two pieces to prevent food aggression; Pink was the more aggressive of the two. When the birds became self-feeding and ate whole prey, supplements were discontinued except for the Thiamin-E paste, which was added to quail three times per week (0.05 mL/bird) until release.

Figure 2. Two Cooper's hawk hatchlings at two days of age.

Figure 3. Cooper's hawk nestlings at 6 days of age.

Results and Discussion

Growth and Development

The Cooper's hawk is an altricial (lack hair or down and must be cared for by adults) species that is dependent on the parents for feeding, protection, and learning of survival skills (Rosenfield and Bielefeldt 1993). At hatching, chicks had blue eyes, were covered with white natal down, and had dark-colored beaks. They could not thermoregulate and required an external heat source 24 hr/day. Weight range was 21.6–28.5 g (avg. = 25.45 g).

When chicks were 24–48 hr old, they were already trying to grab pieces of meat from siblings during feeding. By 4 days of age, weight gain exceeded 50% in the two birds that ultimately survived and were released. The third chick, which exhibited developmental issues, displayed a slower rate of weight gain (17.5% increase from hatch). Figure 3 shows chicks at 6 days of age.

At 14 days of age, weight of chicks was five times (160–181 g) that of hatching weight. Pin feathers on wings and tail started to emerge. Figure 4 shows a nestling at 2 wk of age. Pink was gaining

Figure 4. Cooper's hawk nestling at 2 wk of age.

Figure 6. Cooper's hawk nestling at 23 days of age.

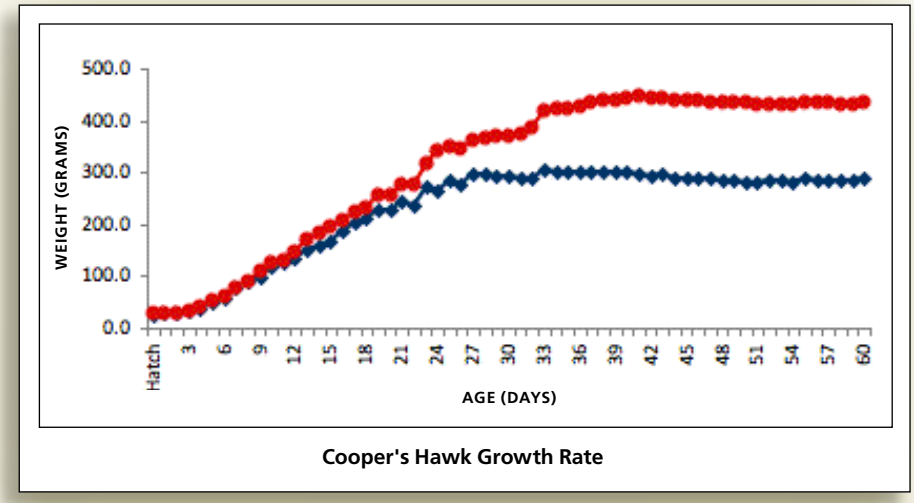

Figure 5. Graph of Cooper's hawk growth rate from hatch until 2 mo of age; the data demonstrate weight difference between two birds over time, which may be a reflection of gender differences.

Figure 7. Cooper's hawk fledglings at 39 days of age. Pink is on the left.

weight at a faster rate than Blue, as shown in Figure 5. This may have been an early reflection of gender dimorphism, as adult female Cooper's hawks are typically much larger and heavier than males (Sibley 2000). By 19 days, chicks began grabbing pieces of food from the ground and started to stand upright.

By 21 days of age, chicks were able to stand on their feet rather than sitting back on their hocks. By 23 days, feathers were unfurling and chicks were becoming food aggressive, as shown in Figure 6. At this age, they were also able to focus on food and pick up pieces of meat from the ground and were partially self-feeding. Weight for both birds was over 200 g.

Weights stabilized at 5 wk of age until release (13 wk), with Blue weighing approximately 300 g and Pink between 425–445 g. Figure 7 shows the two COHA fledglings perching at 5 wk. By 7 wk, juvenile plumage was nearly complete with minimal natal down present. Eye color was still blue, although vision was clear. Birds were perching and starting to fly in the mews. Between 7–8 wk of age, fledglings had full juvenile plumage and were permanently housed in the flight mews, where they were fed whole quail (1/2 quail/bird) daily. Figure 8 shows the fledglings perching together at 8 wk. Birds were released at 13 wk of age; eye color was still light blue rather than yellow, as shown in Figure 9.

Growth was charted from age 0 days (hatch) to 60 days, as shown in Figure 5. By 12 days of age, there was a consistent difference in weight of ≥10% between Blue (possibly male) and Pink (possibly female), with Pink being the larger. By 1 mo of age, the difference was 25% and, after 6 wk of age, the (apparent) female was consistently 33–35% heavier by weight than the assumed male.

Housing

Week One—Chicks were housed in an incubator with the rocker attachment removed during the hatchling stage. A shallow nest was provided using a round, plastic dish, approximately 5 in diameter and 1.5 in deep, and lined with a terry cloth towel (face cloth or blue surgical towel works well). This setup comfortably housed three chicks. The ambient temperature inside the incubator was initially kept at 32°C (90°F). Chicks became overheated and hung their heads and necks over the side of the incubator when the temperature exceeded 37°C (99°F). When comfortable, chicks kept heads tucked under them and faced toward the center of the nest. Ideally, hatchlings should be housed at temperatures between 29–33°C (84–91°F) with a humidity of 40% (Shimmel 2007).

Week Two—Nestlings doubled their hatching weight in 5 days

and tripled their weight in seven. They became mobile, so they were moved to a cardboard apple produce box that had a "donut" nest made out of rolled-up towels. Chicks no longer required an external heat source to regulate their body temperature, although at night a heating pad was placed under half of the cardboard box and turned to the "low" setting in case they became cold as the ambient temperature decreased.

Week Three—Nestlings were moved to a bank cage (30" w × 30" d × 30" h; similar to stacked aluminum, solid-walled cages found in veterinary hospitals) during the day to allow for movement and leg muscle development. Chicks had increased their body weight 8-fold since hatching. At night, they were housed in a mesh cage approximately the same dimensions as the cardboard apple box but were completely enclosed to prevent escape.

Week Four until Release—Chicks were moving toward the fledgling stage and were housed in the bank cage day and night by 4 wk of age. At 5 wk, they were moved into a small outdoor mews to start flight training. By 7 wk, they were housed in a mews 25 ft long, at 8 wk 50 ft long, and in a 100-ft long mews by 10 wk, where they remained until release.

Release

When this project was started, it was hoped the nestlings could eventually be placed into an active Cooper's hawk nest and receive foster care until they fledged, thereby 'self-releasing' at the appropriate age. Unfortunately, an appropriate situation was not available until the birds were approximately 4 wk of age. At that point, there was concern they would not be accepted and might be pushed out of a nest, so the birds were kept at TWC and hand-reared until release.

The natural habitat of the Cooper's hawk is forested (deciduous, evergreen, or mixed) and has riparian areas for nesting and forest edge for hunting (Kennedy 1988; Fischer 1986). Cooper's hawks are also tolerant of human encroachment and are regular visitors to bird feeders in residential areas. They primarily hunt mid-sized birds (e.g., robins and jays) as well as some small mammals, reptiles, amphibians, insects, and fish (Rosenfield 1988).

At 13 wk of age, the fledglings demonstrated the strong flight, stamina, and maneuverability needed to capture prey in flight. They were self-feeding and, for several weeks, had maintained body weights that were within the normal adult range. They avoided all contact with the staff whenever we were present in the mews, and they were as difficult to capture for health and weight checks as any prior adult Cooper's hawk the staff has cared for.

Because the two fledglings had been housed together since hatching, they recognized each other as their own species and developed an early bond, which was evident until the time of release. In addition, these birds passed all of TWC's requirements to demonstrate that they were prepared to care for themselves in the wild; these include ability to catch live prey, good 'lift' in their flight skills, and a demonstrated lack of human habituation. Additional information regarding preparation for release of raptors may be found in Shimmel (2007). They were released at the Randall

Figure 8. Cooper's hawk fledglings at 8 wk. Blue is in the foreground.

Figure 9. Female Cooper's hawk at 13 wk of age, just prior to release.

Davey Audubon Center and Sanctuary in Santa Fe, New Mexico, an area that met all of the habitat requirements for this species.

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Zootrition® V2.6 dietary management software. 1998.
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Kerrin Grant has worked in the animal care field since 1983, including wildlife rehabilitation, zoos, veterinary medicine, and research. She has B.S. degrees in Wildlife Science and Zoology from Oregon State University and an M.S. degree in wildlife nutrition from Utah State University. Her specialty areas are hand-rearing and nutrition. She is currently employed at The Wildlife Center in Espanola, New Mexico, United States as the Wildlife Care Director and Nutritionist.

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Clonal Genotype of *Geomyces destructans* among Bats with White Nose Syndrome, New York, USA

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Little brown bat *(Myotis lucifugus).*

ABSTRACT: The dispersal mechanism of *Geomyces destructans*, which causes geomycosis (white nose syndrome) in hibernating bats, remains unknown. Multiple gene genealogic analyses were conducted on 16 fungal isolates from diverse sites in New York State during 2008–2010. The results are consistent with the clonal dispersal of a single *G. destructans* genotype.

KEY WORDS: Bats, *Geomyces destructans, Geomyces pannorum*, geomycosis, white nose syndrome.

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Introduction

Geomycosis, or white nose syndrome, is a newly recognized fungal infection of hibernating bats. The etiologic agent, the psychrophilic fungus *Geomyces destructans*, was first recognized in caves and mines around Albany, New York, United States (Blehert *et al*. 2009; Chaturvedi *et al*. 2010). The disease has spread rapidly in New York and other states in the northeastern United States. At least one affected bat species is predicted to face regional extinction in the near future (Frick *et al*. 2010). Much remains unknown about this fungus, including its ecol-

TABLE 1. *GEOMYCES DESTRUCTANS* ISOLATES STUDIED, NEW YORK, USA.

ISOLATE	DATE OBTAINED	SITE	COUNTY[1]
M1379[2]	2008 Mar 28	Williams Hotel Mine	Ulster
M1380[2]	2008 Mar 28	Williams Hotel Mine	Ulster
M1381[2]	2008 Mar 28	Williams Hotel Mine	Ulster
M1383[2]	2008 Apr 11	Graphite Mine	Warren
M2325	2010 Jan 25	Westchester	
M2327	2010 Feb 2	Dewitt	Onondaga
M2330	2009 Mar 5	Lancaster	Erie
M2331	2009 Mar 9	White Plains	Westchester
M2332	2009 Mar 11	Dannemora	Clinton
M2333	2009 Mar 11	Dannemora	Clinton
M2334	2009 Mar 12	Newstead	Erie
M2335	2009 Mar 16	Ithaca	Tompkins
M2336	2009 Oct 6	Bridgewater Mine	Windsor, VT
M2337	2010 Feb 9	Akron Mine	Erie
M2338	2010 Mar 4	Hailes Cave	Albany
M2339	2010 Mar 11	Letchworth Tunnel	Livingston

[1]All locations in New York state except Bridgewater Mine, Windsor, Vermont. [2]Previously analyzed by randomly amplified polymorphic DNA typing.

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ogy and geographic distribution. For example, although hibernacula are high on the list of suspected sites,where the bats acquire this infection is not known. Similarly, although strongly suspected, the role of humans and other animals in the dispersal of *G. destructans* and the effect of such dispersals in bat infections have not been confirmed. We recently showed that six *G. destructans* strains from sites near Albany were genetically similar (Chaturvedi *et al*. 2010), raising the possibility of a common source for the spread of this infection. Corollary to this observation and other opinions (Frick *et al*. 2010; Hallam and McCracken 2011), the U.S. Fish and Wildlife Service has made an administrative decision to bar human access to caves as a precautionary measure. Thus, an understanding of the dispersal mechanism of *G. destructans* is urgently needed to formulate effective strategies to control bat geomycosis.

The study

We applied multiple gene genealogic analyses in studying *G. destructans* isolates; this approach yields robust results that are easily reproduced by other laboratories (Xu 2006). Sixteen *G. destructans* isolates recovered from infected bats during 2008–2010 were analyzed. These isolates originated from seven counties in New York and an adjoining county in Vermont, all within a 500-mi radius (Table 1). The details of isolation and identification of *G. destructans* from bat samples have been described (Chaturvedi *et al*. 2010). One isolate of a closely related fungus, *Geomyces pannorum* M1372 (University of Alberta Mold Herbarium, Edmonton, Alberta, Canada), was included as a reference control. To generate molecular markers, one isolate, *G. destructans* (M1379), was grown in yeast extract peptone dextrose broth at 15°C, and high molecular weight genomic DNA was prepared according to Moller *et al*. (1992). A cosmid DNA library was constructed by using pWEB kit (Epicenter Biotechnologies, Madison, Wisconsin, USA) by following protocols described elsewhere (Ren *et al*. 2005). One-hundred cosmid clones, each with an approximate 40-kb DNA insert, were partially sequenced in both directions by using primers M13 and T7. The nucleotide sequences were assembled

TABLE 2. *GEOMYCES DESTRUCTANS* AND *G. PANNORUM* TARGET GENE FRAGMENTS USED FOR MULTIPLE GENE GENEALOGIC ANALYSES, NEW YORK, USA.

GENE[1]	HOMOLOGY (GENBANK ACCESSION NO.)	AMPLICON SIZE; SEQUENCE USED FOR COMPARISON, BP	PRIMER SEQUENCE, 5′3′2	*G. DESTRUCTANS*/ *G. PANNORUM* (GENBANK ACCESSION NOS.)
ALR	Penicillium marneffe (XP_002152078.1)	654/534	V1905 (f): CGGAGTGAGATTTATGACGGC V1904 (r): CGTCCATCCCAGACGTTCATC	HQ834314– HQ834329/HQ834330
Bpntase	Glomerella graminicola (EFQ33509.1)	921/745	V1869 (f): TCAGACGGACTCGGAGGGCAAG V1926 (r): TCGGTTACAGAGCCTCAGTCG	HQ834331– HQ834346/HQ834347
DHC1	Sordaria macrospore (CBI53717.1)	597/418	V1906 (f): GGATGATTCGGTCACCAAACAG V1907 (r): ACAGCAAACACAGCGCTGCAAG	HQ834348– HQ834363/HQ834364
GPHN	Ajellomyces capsulatus (EEH06836.1)	659/525	V1918 (f): CACTATTACATCGCCAGGCTC V1919 (r): CTAAACGCAGGCACTGCCTC	HQ834365– HQ834380/HQ834381
PCS	A. capsulatus (EEH08767.1)	920/749	V1929 (f): AGGCTGCGATTGCTGAGTGC V1873 (r): CCTTATCCAGCTTTCCTTGGTC	HQ834382– HQ834397/HQ834398
POB3	Pyrenophora tritici-repentis (XP_001937502.1)	653/417	V1908 (f): CACAGTGGAGCAAGGCATCC V1909 (r): ACATACCTAGGCGTCAAGTGC	HQ834399– HQ834414/HQ834415
SRP72	Ajellomyces dermatitidis (EEQ90678.1)	941/640	V1927 (f): AAGGGAAGGTTGGAGAGACTC V1895 (r): CAAGCAGCATTGTACGCCGTC	HQ834416– HQ834431/HQ834432
VPS13	Verticillium albo-atrum (XP_003001174.1)	665/545	V1922 (f): GAGACAACGCTTGTTTGCAAGG V1923 (r): ACATGCGTCGTTCCAAGATCTG	HQ834433– HQ834448/HQ834449

[1]Genes: ALR = α-L-rhamnosidase; Bpntase = 3′ (2′), 5′-bisphosphate nucleotidase; DHC1 = dynein heavy chain; GPHN = gephyrin, molybdenum cofactor biosynthesis protein; PCS = peroxisomal-coenzyme A synthetase; POB3 = FACT complex subunit; SRP72 = signal recognition particle protein 72; VPS13 = vacuolar protein sorting-associated protein

with Sequencher 4.6 (Gene Codes Corp., Ann Arbor, Michigan, USA) and BLAST (www.ncbi.nlm.nih.gov/BLAST) homology searches identified 37 putative genes. Sequences of 10 genes including open reading frames, 3′ or 5′ (or both) untranslated regions, and introns were evaluated as potential markers for analyzing *G. pannorum* and *G. destructans*. Our screening approach indicated that eight gene targets could be amplified from both *G. destructans* and *G. pannorum* by polymerase chain reaction (PCR; Table 2).

To obtain DNA sequences from one *G. pannorum* and 16 *G. destructans* isolates, we prepared genomic DNA from mycelia grown in yeast extract peptone dextrose broth through conventional glass bead treatment and phenol-chloroform extraction followed by ethanol precipitation (Ren *et al*. 2005). AccuTaq LA DNA Polymerase (Sigma-Aldrich, St. Louis, Missouri, USA) was used for PCR: 3 min initial denaturation at 94°C, 35 amplification cycles with a 15-sec denaturation at 94°C, a 30-sec annealing at 55°C, a 1-min extension at 68°C, and a 5-min final extension at 68°C. The PCR products were treated with ExoSAP-IT (USB Corp., Cleveland, Ohio, USA) before sequencing. Both strands of amplicons were sequenced by the same primers used for PCR amplification (Table 2). A database was created by using Microsoft Access (Microsoft, Redmond, Washington, USA) to deposit and analyze the sequences. Nucleotide sequences were aligned with ClustalW version 1.4 (www.clustal.org) and edited with MacVector 7.1.1 software (Accelrys, San Diego, California, USA). Phylogenetic analyses were done by using PAUP 4.0 (Swofford 2000) and MEGA 4 (Tamura *et al*. 2007).

We cloned and sequenced approximately 200 kb of the *G. destructans* genome and identified genes involved in a variety of cellular processes and metabolic pathways (Table 2). DNA sequence typing by using eight gene fragments showed that all 16 *G. destructans* isolates had identical nucleotide sequences at all eight sequenced gene fragments but were distinct from *G. pannorum* sequences. A maximum parsimony tree generated from the eight concatenated gene fragments indicated a single clonal genotype for the 16 *G. destructans* strains (Fig. 1). This consensus tree included 4,470 aligned nucleotides from all targeted gene sequences with 545 variable sites that separate the *G. destructans* clonal genotype from *G. pannorum*. Further analyses of the same concatenated gene fragments, with exclusion of 50 insertions and deletions between *G. destructans* and *G. pannorum*, yielded a tree with a shorter length (495 steps instead of 545 steps) but an identical topology. This pattern remained unchanged when different phylogenetic models were used for analysis. The lack of polymorphism among the 16 *G. destructans* isolates was unlikely because of evolutionary constraint at the sequenced gene fragments. We found many synonymous and nonsynonymous substitutions in target genes among a diversity of fungal species, including between *G. destructans* and *G. pannorum* (Kasuga *et al*. 2002).

Figure 1. Consensus maximum parsimony tree derived from analyzing eight concatenated gene fragments including a total of 4,470 aligned nucleotides by using PAUP* 4.0 (Swofford 2000). The number 545 on the branch indicates the total number of variable nucleotide positions (out of the 4,470 nucleotides) separating *Geomyces pannorum* M1372 from the clonal genotype of *Geomyces destructans* identified here. Fifty of the 545 variable sites correspond to insertions and deletions. Scale bar indicates number of nucleotide substitutions per site.

Conclusions

Our finding of a single clonal genotype in the *G. destructans* population fits well with the rapid spread of geomycosis in New York (Fig. 2). Our sampling population covered both spatial and temporal dimensions, and the numbers of isolates analyzed were adequate in view of difficulties encountered in obtaining pure isolations of *G. destructans* (Wibbelt *et al*. 2010). Although the affected New York sites are separated by sizable distances and include geographic barriers, a role for the natural dissemination of the fungus through air, soil, and water cannot be ruled out. Indeed, several fungi with geographic distributions similar to that in our study have shown major genetic variation among strains (Morgan *et al*. 2007; Hovmøller *et al*. 2008). It is also possible that humans or animals (or both) contributed to the rapid clonal dispersal. In such a scenario, the diseased—or asymptomatic bats—might act as carriers of the fungus by their migration into new hibernation sites where new animals get infected and the dissemination cycle continues (Hallam and McCracken 2011). Similarly, the likely roles played by humans or other animals in

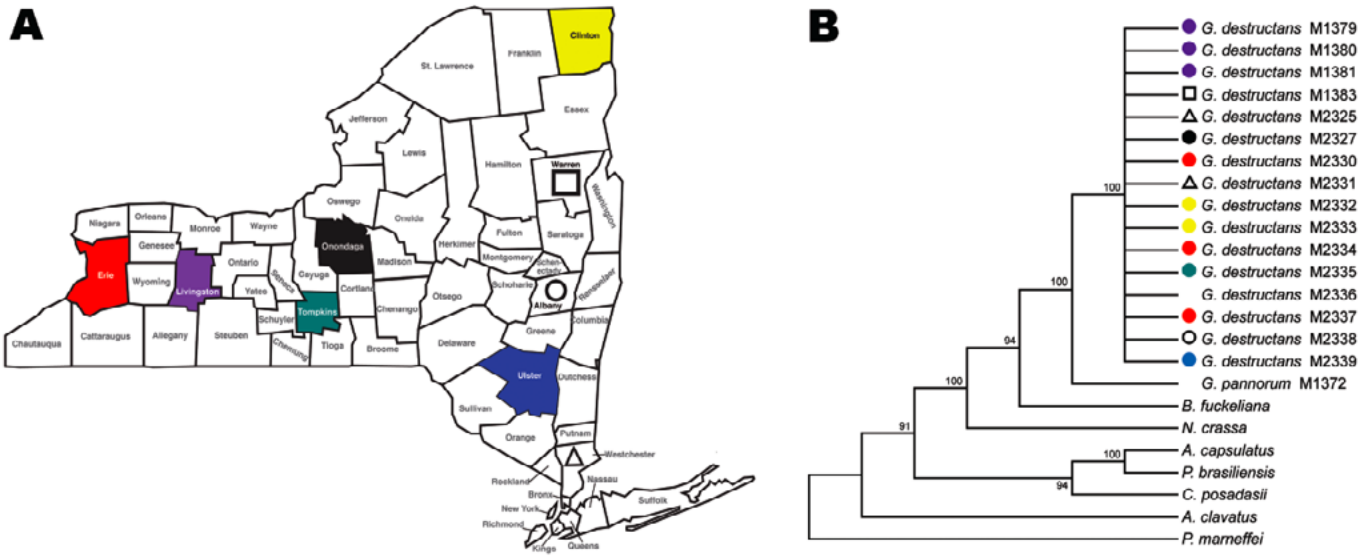

Figure 2. Collection sites in New York counties (A) are color-matched with respective *Geomyces destructans* isolates in a maximum parsimony tree based on nucleotide sequence of the VPS13 gene (B). The tree was constructed with MEGA4 (Tamura *et al*. 2007) by using 450 nucleotides and a bootstrap test with 500 replicates. In addition to *G. destructans* and *Geomyces pannorum*, fungi analyzed were *Ajellomyces capsulatus, Aspergillus clavatus* NRRL 1, *Botryotinia fuckeliana* B05.10, *Coccidioides posadasii* C735 delta SOWgp, *Neurospora crassa* OR74A, *Paracoccidioides brasiliensis* Pb01, and *Penicillium marneffei* ATCC 18224.

the transfer of the fungal propagules from an affected site to a clean one cannot be ruled out from our data. Virulent clones of human and plant pathogenic fungi that spread rapidly among affected populations have been recognized with increasing frequency in recent years (Kidd *et al*. 2004; Hovmøller *et al*. 2008). However, other pathogens, such as the frog-killing fungus *Batrachochytrium dendrobatidis*, have emerged with both clonal and recombining populations (Morgan *et al*. 2007). Our data do not eliminate the possibility that the *G. destructans* population undergoes recombination in nature. This process to generate genetic variability would require some form of sexual reproduction, which remains unknown in *G. destructans*. In addition, the fungus might have both asexual and sexual modes in its saprobic life elsewhere in nature, but it exists only in asexual mode on bats (Halkett *et al*. 2005).

In conclusion, our data suggest that a single clonal genotype of *G. destructans* has spread among affected bats in New York. This finding might be helpful for the professionals involved in devising control measures. Many outstanding questions remain about the origin of *G. destructans*, its migration, and its reproduction, all of which will require concerted efforts if we are to save bats from predicted extinction (Frick *et al*. 2010).

Acknowledgments

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Biologist examines little brown bat *(Myotis lucifugus)* in the field for signs of white-nose syndrome.

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One Koala at a Time

By Deb Teachout, DVM

I hope all wildlife rehabilitators make it a point to see the extremely well-done wildlife documentary *Koala Hospital* created by Australian filmmaker Susan Kelly. This poignant film was showcased at the recent IWRC Symposium in Ft. Lauderdale, Florida USA as part of our annual film festival. The Koala Hospital has been rehabilitating koalas in Port Macquarie, New South Wales, Australia for almost 40 years. On-call 24 hours a day, staff and volunteers rescue koalas from forest fires, development, and human encroachment and treat koalas suffering from disease, car accidents, or pet dog attacks. The film chronicles the story of Jimmy. As a tiny joey, he is knocked unconscious by a car in an accident that kills his mother. Through the story of Jimmy's long and often uncertain rehabilitation, the many perils faced by Australia's koalas are revealed. As Jimmy is released into a gum tree at the film's conclusion, the narrator captures the essence of the film when she says, "He's just one small koala in a very big world, with many challenges ahead of him, but his success story is a victory for a little hospital making a difference—one koala at a time." This compelling documentary has underscored my long-held belief that wildlife rehabilitation must be considered an integral component to the future of wildlife conservation worldwide, precisely because wildlife rehabilitators care about the welfare of the individual animal.

Conservationists and wildlife biologists have long maintained that the welfare of the individual animal does not matter: Populations matter. Historically, there has been contention between wildlife biologists and wildlife rehabilitators because these two groups often do not agree about rehabilitation of the singular animal. Wildlife biologists have maintained that decisions which may be good for an individual animal may not be good for the population or species in the long run, as perhaps the individual being rehabilitated is genetically unfit and will give life to more of the genetically unfit, thus weakening the health of the population as a whole. They maintain that, due to their infirmities, these individuals find themselves in situations that solicit assistance from compassionate humans. For example, in a recent Wildlife Society Blog entitled *Pelican Rescue: Act of Kindness or Misplaced Compassion* (Hutchins 2010), the writer explores from a natural selection perspective the possible harmful genetic repercussions of rescuing several freezing brown pelicans that failed to migrate south for the winter. Interestingly enough, he goes on to state that if these brown pelicans were endangered, he might actually argue *for* intervention. In a recent paper from *Conservation Biology*, 99.5% of 583 conservationists agreed that a serious loss of biological diversity is likely, very likely, or virtually certain (Rudd 2011). I believe conservation attitudes will change as species go into this inevitable, rapid decline. Scientifically and morally, it will matter to help every sick, orphaned, or injured individual animal.

The *Koala Hospital* film mirrors the future of wildlife rehabilitation worldwide. Australia's iconic animal, the koala, is in trouble. Recent estimates from the Australian Koala Foundation place the number of koalas in Australia at 43,000. More than 80% of their original habitat has been destroyed and they are becoming urban refugees. Millions roamed the continent at the time of the European settlement in the late 1700s. This scenario is a common one. Numbers of indigenous wildlife species everywhere are dropping to dangerously low numbers. It is imperative to tend to these individuals as they likely represent the last of their kind. Because rehabilitators have worked diligently all along, even when conservationists and wildlife biologists have been dubious about our efforts, we emerge with years and years of experience and useful data. The Koala Hospital is a stellar example. Because of their efforts of over 40 years of caring for sick and injured koalas, the Port Macquarie Koala Hospital has been able to publish the detailed and thorough *Koala Rehabilitation Manual.* This invaluable resource and guide for the future did not come from wildlife biologists, zoos, or conservation authorities. It came from wildlife rehabilitators because they have always cared about the welfare of the individual.

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Deb Teachout is a veterinarian in Illinois, United States, whose practice serves both domestic and wildlife patients. She is a past member of the IWRC Board of Directors, an associate editor for JWR, and a long-time animal advocate.

Spread the News… and Hang On

by Prudi Koeninger and Kathy Milacek

In the last issue (Vol. 31, No. 3), we discussed what you'll need to start a virtual wildlife conflict resolution hotline. Let's review our checklist: a hosted PBX phone system vendor, training materials, a record-keeping system, a website, and at least two or three committed volunteers to direct activities and a good volunteer base. You've incorporated your organization in your state, and secured commitments for your first year funding. You're ready for the phone to ring!

But how will people know to call? First, you need the support of local rehabilitators. We asked those in the Dallas–Fort Worth area to add our hotline information to their own voicemail messages, and they quickly recognized the benefits to all parties. The hotline provides the public assistance when the rehabilitator cannot get to the phone—or would rather not spend valuable time between feedings educating the public on standard protocols such as re-nesting, eviction–exclusion, and other general concerns. Also, rehabilitators can contact us when they are at capacity for a break from referrals until they can accept more animals.

"...the phone is ringing off the wall! Your organization is experiencing growing pains—do you manage the situation or let it control you? Tough decisions may be required."

The next step is to contact local veterinarians, nature centers, pet supply stores, and municipal animal services to explain how your services can help them.

You'll also want to contact the media—television, radio, and newspapers—and watch for community events that provide outreach and education opportunities. An education animal "ambassador" can help draw the public to your booth. Have a clipboard handy to get contact information from anyone interested in volunteering!

Find volunteers who like to talk to the public and create a Speakers Bureau to give talks on urban wildlife for neighborhood associations, garden clubs, places of worship, civic organizations, and the like. Set a suggested donation amount, keeping in mind that you may want to establish different amounts for different kinds of groups. Half of our fee goes to the organization, the other half to the speaker to cover expenses (though most volunteers donate their portion back to the organization).

If you have volunteers who enjoy writing, consider an electronic newsletter. People want to hear success stories, wildlife tips, etc., and an e-newsletter can be a great opportunity to ask for a donation. Keep in mind, though, that an e-newsletter can be a time-intensive endeavor. You'll need to manage a database of information harvested from the hotline calls you receive as well as from other sources. Online e-mail marketing, such as Constant Contact or Vertical Response, can help, and consider using Facebook and Twitter to make your organization visible.

Printed materials like a simple tri-fold brochure or flyer can be distributed through the community and posted on public bulletin boards. Refrigerator magnets with contact information were a big hit for us.

Advise your volunteers to expect a spike in calls as awareness grows. Once the public knows a wildlife hotline exists, you'll no longer need to do much marketing. The phones will ring, and ring, and ring. Our calls increased from 300 the first year to 3,000 calls the second, and now equal about 15,000 calls annually—sometimes more than 20 calls per 2-hour shift. A typical call lasts 15–20 minutes; we listen to the caller's story, assess the situation, ask questions, educate, and make a referral.

Okay, so now the phone is ringing off the wall! Your organization is experiencing growing pains—do you manage the situation or let it control you? Tough decisions may be required.

We reworked our website to be interactive with the public and we continue to improve it. A flow chart requires a "yes/no" click to get the right rehabilitator contact information (http://www.dfwwildlife.org/Foundbird.html), empowering them to make an informed decision rather than just grabbing the phone number of an overwhelmed rehabilitator. Our "orphan/baby?" option with photos helps them identify what they've found and choose the right rehabilitator (http://www.dfwwildlife.org/MammalFlow.html), rather than delay the animal getting the care required. The photos also assist our volunteers in identifying what the caller has found.

A well-designed website can reduce call volume. When callers can't reach a live response, our voicemail directs them to our website. There they find answers to most questions, in sections based on most frequent calls (helping ducklings in a swimming pool, reuniting a baby squirrel and mother, re-nesting cottontails, etc.). Video clips add interactivity and information and give volunteers a visual tool to guide the caller.

In the next installment of this column, we'll discuss how to address a variety of hotline volunteer frustrations. ■

Prudence "Prudi" Martin-Koeninger and Kathy Milacek are founders (2003) and directors of the Dallas-Fort Worth, Texas (USA) Wildlife Coalition, which operates a community-supported urban wildlife conflict solution hotline that has logged 55,000 residential calls to date. Kathy is a Texas Master Naturalist. Prudi operates Rascal's Retreat, a home-based wildlife rehabilitation center.

Plan to attend Spring On-Site IWRC Classes

February 2012		
Wildlife Feeding and Nutrition	Eureka, MO USA	*February 25*
March 2012		
Basic Wildlife Rehabilitation	Murray, KY USA	*March 3-4*
Basic Wildlife Rehabilitation	Green Bay, WI USA	*March 3-4*
Wildlife Feeding and Nutrition	Green Bay, WI USA	*March 5*
Basic Wildlife Rehabilitation	Anderson, CA USA	*March 10-11*
Basic Wildlife Rehabilitation	Portland, OR USA	*March 10-11*
Basic Wildlife Rehabilitation	Huntington Beach, CA USA	*March 10-11*
Basic Wildlife Rehabilitation	Regina, SK CA	*March 24-25*
Wildlife Feeding and Nutrition	Regina, SK CA	*March 24*
Parasitology	Regina, SK CA	*March 25*
Basic Wildlife Rehabilitation	Ann Arbor, MI USA	*March 31-April 1*
April 2012		
Parasitology	Victoria, BC CA	*April 7*
Wildlife Feeding and Nutrition	Victoria, BC CA	*April 8*
Basic Wildlife Rehabilitation	Louisville, KY	*April 14 -15*
Basic Wildlife Rehabilitation	Brewster, MA	*April 28-29*

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West Nile Virus Activity in Central Iowa Bird Populations and the Utility of Wildlife Rehabilitation Centers in Monitoring Wildlife Disease

N. J. Randall. Ph.D. *Dissertation*, Iowa State University, December 2011. 81 pp.

Little is known about the frequency or occurrence of West Nile Virus (WNV) in many Iowa wildlife species, including birds. The lack of knowledge about WNV in Iowa birds is partially due to difficulties associated with monitoring wildlife health. We evaluated the utility of wildlife rehabilitation centers for providing information about wildlife health and disease monitoring and assessed where on the central Iowa landscape birds have the highest risk of exposure to WNV. Our results indicated that wildlife rehabilitation facilities have the potential to provide useful information about wildlife disease presence and prevalence. Additionally, we found that a bird's risk of WNV exposure increased in urban areas and that risk of exposure was different between years (potentially due to weather) and among taxa, where the Cardinalidae had the highest WNV seroprevalence. Overall, our findings provide insights regarding WNV activity in central Iowa bird populations.

PCR Prevalence of Ranavirus in Free-ranging Eastern Box Turtles *(Terrapene carolina carolina)* at Rehabilitation Centers in Three Southeastern U.S. States

M. C. Allender, M. Abd-Eldaim, J. Schumacher, D. McRuer, L. S. Christian, and M. Kennedy. *Journal of Wildlife Diseases* 47(3): 759–764. 2011.

Ranaviruses have been observed in disease epidemics and mass mortality events in free-ranging amphibian, turtle, and tortoise populations worldwide. Infection is highly fatal in turtles, and the potential impact on endangered populations could be devastating. The authors' objectives were to: (1) determine the prevalence of ranavirus DNA in blood and oral swabs; (2) report associated clinical signs of infection; and 3) determine spatial distribution of infected turtles. Blood and oral swabs were taken from 140 eastern box turtles (*Terrapene carolina carolina*) that were presented to the wildlife rehabilitation centers at the University of Tennessee (UT; $n = 39$), the Wildlife Center of Virginia (WCV; $n = 34$), and North Carolina State University (NCSU; $n = 36$) as well as from a free-ranging non-rehabilitation population near Oak Ridge, Tennessee (OR; $n = 39$) from March–November 2007. Samples were evaluated for ranavirus infection using polymerase chain reaction targeting a conserved portion of the major capsid protein. Two turtles, one from UT and one from NCSU, had evidence of ranavirus infection. Prevalence of ranavirus DNA in blood was 3, 0, 3, and 0% for UT, WCV, NCSU, and OR, respectively. Prevalence in oral swab samples was 3, 0, and 0% for UT, WCV, and NCSU, respectively. Wildlife rehabilitation centers may be useful in detection of *Ranavirus* infection and may serve as a useful early monitoring point for regional disease outbreaks.

Successful Management of Simple Fractures of the Femoral Neck with Femoral Head and Neck Excision Arthroplasty in Two Free-living Avian Species

A. Burgdorf-Moisuk, J. K. Whittington, R. A. Bennett, M. McFadden, M. Mitchell, and R. O'Brien. *Journal of Avian Medicine and Surgery* 25(3): 210–215. 2011.

A red-tailed hawk (*Buteo jamaicensis*) and a Canada goose (*Branta canadensis*) were evaluated for unilateral pelvic limb lameness. Physical examination findings and results of diagnostic imaging revealed femoral neck fractures in both birds. Both birds were treated with a femoral head and neck excision arthroplasty (surgical intervention to relieve pain and restore range of motion by realigning or reconstructing a joint). The affected legs were not immobilized, and the birds were encouraged to use the legs immediately after surgery to encourage formation of a pseudoarthrosis (a false joint associated with abnormal movement at the site). Within 2 wk, both birds were using the affected limb well enough to be either successfully released or transferred to a wildlife rehabilitation facility. Femoral head and neck excision arthroplasty without immobilization of the limb is recommended for managing avian femoral neck fractures, especially in free-ranging species in which a rapid and complete or near-complete return to function is vital for survival in the wild.

Managing Public Demand for Badger Rehabilitation in an Area of England with Endemic Tuberculosis

E. Mullineaux and P. Kidner. *Veterinary Microbiology* 151(1–2): 205–208. 2011.

Badgers are a popular and protected species in England, despite their association with tuberculosis (*Mycobacterium bovis* infection) in cattle. Badgers are commonly presented to veterinarians and wildlife rescue centers as a result of injury, disease, or as orphans. While strict policies are adopted for their rehabilitation and release, with respect to the prevention of spread of tuberculosis these policies differ between adult badgers and badger cubs. Adult badgers are not normally tested for *M. bovis* infection prior to release but are instead kept in isolation and released back where found. A study of adult badgers in rehabilitation found 10% to be positive on a single serological test. These animals had a variety of clinical signs that had resulted in none of them being released back to the wild. Badger cubs are serologically tested for evidence of *M. bovis* infection on three occasions during rearing, and 13% were found to test positive. Positive animals were examined at post-mortem and cultures were made for *M. bovis*; 12.5% of serologically positive animals were

found to be culture positive. Alternative test methods and zoonotic risks are considered.

Factors Affecting the Likelihood of Release of Injured and Orphaned Woodpigeons *(Columba palumbus)*

A. Kelly, C. Halstead, D. Hunter, K. Leighton, A. Grogan, and M. Harris. *Animal Welfare* 20(4): 523–534. 2011.

Very little is known about the fate of the large numbers of injured and orphaned wild animals taken to wildlife rehabilitation centers in the United Kingdom each year. We reviewed the reasons for admission and outcomes for 2,653 woodpigeons (*Columba palumbus*), 68% of which were juveniles, brought to a Royal Society for the Prevention of Cruelty to Animals (RSPCA) wildlife rehabilitation center in Cheshire, UK over a 5-yr period (2005–2009). Reasons for admission varied, with the most common reason for adults and juveniles being "injury (cause uncertain)" and "orphan," respectively. Twenty-one percent of adults and 16% of juveniles had been attacked by cats. Sixty-five percent of adults and 37% of juveniles were euthanized on admission or within the first 48 hr to prevent further suffering. Only 14% of adults and 31% of juveniles were released back into the wild. The remainder were either euthanized or died, despite treatment, more than 48 hr after admission. Body condition on admission was not a good predictor of the likelihood of release but age, weight on admission, and severity of symptoms were significant factors. A reduction in the median number of days in care for those birds euthanized more than 48 hr after being admitted was recorded for 2007 to 2009, possibly due to the introduction of radiography for all birds on admission. Leg-band recovery data for 15 birds revealed post-release survival ranging from 21–2,545 days (median = 231 days) compared to 1–2,898 days (median = 295) for non-rehabilitated birds.

Causes of Morbidity in Wild Raptor Populations Admitted at a Wildlife Rehabilitation Center in Spain from 1995–2007: A Long-term Retrospective Study

R. A. Molina-López, J. Casal, and L. Darwich. *PLoS One* 6(9): 1–10. 2011.

Morbidity studies complement the understanding of hazards to raptors by identifying natural or anthropogenic factors. This study describes the morbidity causes of hospitalized wild raptors, and their incidence in the wild populations, through a long-term retrospective study conducted at a wildlife rehabilitation center of Catalonia, Spain (1995–2007). Seasonal cumulative incidences (SCI) were calculated, considering estimations of the wild population in the region, and trend analyses were applied among the different years. A total of 7,021 birds were analyzed; seven species of Strigiformes (n = 3,521) and 23 of Falconiformes (n = 3,500). The main causes of morbidity were trauma (49.5%) for Falconiformes and orphaned–young birds (32.2%) for Strigiformes. During wintering periods, the largest morbidity incidence was observed in *Accipiter gentilis* [northern goshawk] due to gunshot wounds and in *Tyto alba* [barn owl] due to vehicle trauma. Within the breeding season, *Falco tinnunculus* [common kestrel] (orphaned–young category) and *Bubo bubo* [Eurasian eagle-owl] (electrocution and metabolic disorders) represented the most-affected species. Cases due to orphaned–young, infectious–parasitic diseases, electrocution, and unknown trauma tended to increase over the course of the study. By contrast, cases by undetermined cause, vehicle trauma, and captivity decreased throughout the study period. Interestingly, gunshot injuries remained constant during the study period.

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Young European badger *(Meles meles)*.

Pre-release Hunting Training and Post-release Monitoring are Key Components in the Rehabilitation of Orphaned Large Felids

A. Houser, M. Gusset, C. J. Bragg, L. K. Boast, and M. J. Somers. *South African Journal of Wildlife Research* 41(1): 11–20. 2011.

The rehabilitation of orphaned animals is commonly practiced but rarely scientifi-

cally documented. The behavioral development before release (e.g., hunting skills) is particularly important for ensuring animals are self-sustaining after release. We document the rehabilitation and release of three confiscated cheetah (*Acinonyx jubatus*) cubs and one leopard (*Panthera pardus*) cub that were taken from the wild in Botswana. The animals were raised with minimal human contact and the development of their hunting skills was observed and assisted by limited pre-release training. After release, all animals were monitored and data showed they successfully hunted, with behavioral patterns similar to wild conspecifics. All established stable home ranges at the release site. Home ranges of the cheetahs ranged from 44 to 121 km^2, travelling primarily during the early morning and evening, and ranging from 4.5 to 9.4 km/day. While the leopard survived and probably reproduced within a stable home range (449 km^2), all three cheetahs were shot within 7 mo of release. Therefore, although orphaned large felids can successfully hunt after release using appropriate rehabilitation techniques, they face the same human–carnivore conflicts of their wild counterparts. Our study demonstrates the indispensable but commonly neglected need for post-release monitoring in wildlife rehabilitation.

Salt Gland Adenitis as only Cause of Stranding of Loggerhead Sea Turtles (*Caretta caretta)*

J. Orós, M. Camacho, P. Calabuig, and A. Arencibia. *Diseases of Aquatic Organisms* 95(2): 163–166. 2011.

The present study describes pathological and microbiological findings in nine stranded loggerhead sea turtles, *Caretta caretta*, whose only observed lesion was bilateral purulent salt gland adenitis. Histological lesions ranged from the presence of abundant eosinophilic material associated with bacterial colonies in the lumen of the central ducts of the glandular lobules to the destruction of the glandular tissue and presence of abundant eosinophilic material composed of heterophils and cell debris, lined by multinucleated giant cells. *Aeromonas hydrophila, Staphylococcus* spp., and *Vibrio alginolyticus* were the bacteria most frequently isolated. Plasma concentrations of sodium and chloride and plasma osmolality from two turtles suffering from salt gland adenitis were, respectively, 45.7, 69.2, and 45.7% higher than the mean value for healthy turtles. These cases suggest that failure to maintain homeostasis due to severe lesions in the salt glands can cause stranding and death of loggerhead sea turtles.

First Reports of Ectoparasites Collected from Wild-Caught Exotic Reptiles in Florida

J. L. Corn, J. W. Mertins, B. Hanson, and S. Snow. *Journal of Medical Entomology* 48(1): 94–100. 2011.

We collected ectoparasites from 27 of 51 wild-caught, free-ranging exotic reptiles examined in Florida from 2003 to 2008. Sampled animals represented eight species, five of which yielded ectoparasites. Reported new parasite distribution records for the United States include the following: the first collection of the African tick *Amblyomma latum* (Koch) from a wild-caught animal [ball python, *Python regius* (Shaw)] in the United States; the first collection of the lizard scale mite *Hirstiella stamii* (Jack) from any wild-caught animal [green iguana, *Iguana iguana* (L.)]; and the first collection of the lizard scale mite *Geckobia hemidactyli* (Lawrence) in the continental United States from a wild-caught tropical house gecko, *Hemidactylus mabouia* (Moreau de Jonnès). We also report the first collections of the Neotropical ticks *Amblyomma rotundatum* (Koch) and *Amblyomma dissimile* (Koch) from wild-caught Burmese pythons, *Python molurus bivittatus* (Kuhl); the first collections of *A. dissimile* from a wild-caught African savannah monitor, *Varanus exanthematicus* (Bosc) and from wild-caught green iguanas in the United States; and the first collections of the native chiggers *Eutrombicula splendens* (Ewing) and *Eutrombicula cinnabaris* (Ewing) from wild-caught Burmese pythons. These reports may only suggest the diversity of reptile ectoparasites introduced and established in Florida and the new host–parasite relationships that have developed among exotic and native ectoparasites and established exotic reptiles.

Surveillance for West Nile Virus and Vaccination of Free-ranging Island Scrub-jays *(Aphelocoma insularis)* on Santa Cruz Island, California

W. M. Boyce, W. Vickers, S. A. Morrison, T. S. Sillett, L. Caldwell, S. S. Wheeler, C. M. Barker, R. Cummings, and W. K. Reisen. *Vector-Borne and Zoonotic Diseases* 11(8): 1063–1068. 2011.

Transmission of West Nile virus (WNV) on mainland California poses an ongoing threat to the island scrub-jay (*Aphelocoma insularis*), a species that occurs only on Santa Cruz Island, California and whose total population numbers are <5,000. Our report describes the surveillance and management efforts conducted since 2006 that are designed to understand, and mitigate for, the consequences of WNV introduction into the scrub-jay (ISSJ) population. We suspect that WNV would most likely be introduced to the island via the movement of infected birds from the mainland. However, antibody testing of >750 migrating and resident birds on the island from 2006 to 2009 indicated that WNV had not become established by the end of 2009. Several species of competent mosquito vectors were collected at very low abundance on the island including the important mainland vectors *Culex tarsalis* and *Culex quinquefasciatus*. However, the island was generally cooler than areas of mainland California that experienced intense WNV transmission, and these lower temperatures may have reduced the likelihood of WNV becoming established because they do not support efficient virus replication in mosquitoes. A vaccination program was initiated in 2008 to create a rescue population of ISSJ that would be more likely to survive a catastrophic outbreak. To further that goal, we recommend managers vaccinate >100 ISSJ each year as part of ongoing research and monitoring efforts. ■

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Cooper's hawk female with juveniles *(Accipiteri cooperii).*
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