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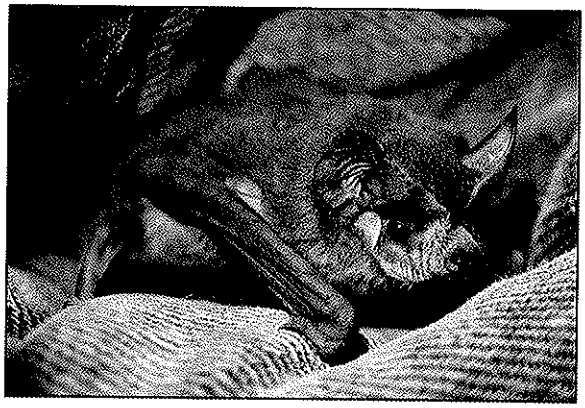
Rehabilitation and release of orangutans in northern Borneo... Frequency and clinical signs of rabies infections in bats ... Sporotrichosis in a broad-footed mole ... Delisting: Is the threat gone? ... Hummer diet update ... Truth about SmartWater® ... Forest fires: Legal and ethical considerations ... abstracts, news, book reviews, and more

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

ON THE COVER:
A young orangutan (*Pongo pygmaeus pygmaeus*) in a socialization cage at the Sepilok Orangutan Rehabilitation Center in Borneo. [Photo: Govindasamy Agoramoorthy]

BELOW:
A free-tail bat (*nyctinomops macrotus*) at a Texas rehabilitation facility. Bat rehabilitators should be familiar with the clinical signs of rabies. See page 6.
[Photo ©Bat World Sanctuary/www.batworld.org]



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EDITORIAL

Snatched from the Brink: Does Delisting Mean the Threat Is Gone?

On 28 June 2007, the Bush Administration announced that the bald eagle is being removed from the list of Threatened and Endangered Species and losing the special protections of the Endangered Species Act. Has the bald eagle truly been saved from extinction, or has its removal from "the list" set it on a course for another decline—one from which it may not be able to recover? The jury is out on that question.

The resurgence of the bald eagle population in the lower 48 states, and especially in the Mid-Atlantic region, has been dramatic. In 25 years, my own state of Virginia has seen its bald eagle population rise from just 50 nesting pairs to well over 550 pairs—an eleven-fold increase.

That's good news, but it's not the whole story. Population recovery is only one of the *two* main criteria established in the Endangered Species Act for determining when a species is no longer threatened or endangered.

The other critical factor in recovery is habitat, a place for the rebounding population to live and reproduce. There, the news is not so good. The law states that for a species to be removed from the list, the population must reach a sustainable level, *and* an adequate amount of critical habitat must be protected. The Bush Administration largely ignored the second part of that equation when declaring mission accomplished, and announcing that the bald eagle population is no longer in danger.

In most states, bald eagle populations depend upon a very limited amount of suitable habitat, found mainly along our major rivers and lakes. In most areas, this habitat is under tremendous development pressure and has been shrinking for decades. There were very few or no bald eagles in many regions for most of the 20th century, so even with unrestrained development, there was still more habitat than birds to fill it. That situation is changing.

There is strong evidence that in some places the available bald eagle habitat is approaching carrying capacity—that is, it's filling up. At some point, the eagle population and the available habitat will reach equilibrium. When the capacity of the habitat to support bald eagles is used up, there will simply be no room for more eagles to nest. From that point forward, if the habitat shrinks, the bald eagle population will decline as well.

Fortunately, it's not too late. In most critical areas, we can still protect habitat on both public and private land by changing development patterns that fragment and degrade habitat for all wildlife. It just takes the public will to make it so. Comprehensive land use planning with an eye to the environment, conservation easements on private land to protect open space, and public acquisition of special acreage are among the tools already available. If we want this happen, we must send a strong message to all of our public officials at the local, state, and national levels. We need to let them know we want conservation and environmental protection to be a *priority*. True conservation is not an event, it's a value system. But if those who hold these values keep silent, nothing will change.

It is not a matter of liberal or conservative, Republican or Democrat, rich or poor, haves or have-nots. *All* of us, humans and animals alike, depend

on clean water, pure air, and the integrity or our ecosystems. Protecting our environment isn't just about bald eagles and other flashy, charismatic species—it's what we need to do if we don't want humans to become the next endangered species.

The current Administration proclaims success with the bald eagle one day, then slashes funding for conservation and environmental programs the next. Partisan politics plays too great a role in discussions of environmental protection in our state capitals and in Washington. Bald eagles and other wildlife don't vote, so it's up to those of us who do to insist that all of our representatives get the message—the environment matters to all of us. You don't have to be a "tree-hugger" to care about conservation. If you breathe or drink water, you have a stake in the issue.

The removal of the bald eagle from the list of Threatened and Endangered Species is an important milestone, but it is just one encouraging step along the way. It shows us what *can* happen when public support and adequate resources are applied in a meaningful way. There is a lot more to do before we can declare victory over environmental degradation and other threats to wildlife. Let's celebrate the success of the bald eagle by strengthening and renewing our commitment to the natural world—*all* of it—and let our success with bald eagles inspire us to work even harder to build the kind of future in which there will be no need for a list of threatened or endangered species.

—Edward E. Clark Jr., President
Wildlife Center of Virginia
Waynesboro, Virginia

Ed Clark is president and co-founder of the Wildlife Center of Virginia, the nation's leading teaching and research hospital for wildlife medicine. He has been a national leader in conservation for more than 30 years.

U.S. Threatened or Endangered Avian Species

Akiapola`au (honeycreeper)
Attwater's greater prairie-chicken
Bachman's warbler (=wood)
Black-capped vireo
Bridled white-eye
Brown pelican
California clapper rail
California condor
California least tern
Cape Sable seaside sparrow
Crested honeycreeper
Dusky seaside sparrow
Eskimo curlew
Everglade snail kite
Florida grasshopper sparrow
Golden-cheeked warbler (=wood)
Guam Micronesian kingfisher
Guam rail
Hawaii akepa (honeycreeper)
Hawaii creeper
Hawaiian (='alala) crow
Hawaiian ('Io) hawk
Hawaiian (=koloa) duck
Hawaiian common moorhen
Hawaiian coot
Hawaiian dark-rumped petrel
Hawaiian goose
Hawaiian stilt
Ivory-billed woodpecker
Kauai akialoa (honeycreeper)
Kauai `o`o (honeyeater)
Kirtland's warbler (=wood)
Large Kauai (=kamao) thrush
Laysan duck
Laysan finch (honeycreeper)
Least Bell's vireo
Least tern
Light-footed clapper rail
Mariana (=aga) crow
Mariana common moorhen
Mariana gray swiftlet
Masked bobwhite (quail)
Maui akepa (honeycreeper)
Maui parrotbill (honeycreeper)
Micronesian megapode
Mississippi sandhill crane
Molokai creeper
Molokai thrush
Nightingale reed warbler
(Old World warbler)
Nihoa finch (honeycreeper)
Nihoa millerbird (Old World warbler)
Northern Aplomado falcon
Nukupu`u (honeycreeper)
`O`u (honeycreeper)
Oahu creeper
Oahu Elepaio
Palila (honeycreeper)
Piping plover
Po`ouli (honeycreeper)
Puerto Rican broad-winged hawk
Puerto Rican nightjar
Puerto Rican parrot
Puerto Rican plain pigeon
Puerto Rican sharp-shinned hawk
Red-cockaded woodpecker
Roseate tern
Rota bridled white-eye
San Clemente loggerhead shrike
Short-tailed albatross
Small Kauai (=puaiohi) thrush
Southwestern willow flycatcher
White-necked crow
Whooping crane
Wood stork
Yellow-shouldered blackbird
Yuma clapper rail

NOTE: ***Some species on this list, such as the Eskimo curlew, are considered extinct.***

Source: TESS (Threatened and Endangered Species System, U.S. Fish and Wildlife Service) http://ecos.fws.gov/tess_public/StartTESS.do Accessed 22 July 2007



BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*) PHOTO: DAVE MENKE/USFWS

Clarifying the Certified Wildlife Rehabilitator™ Program

Ms. Jennifer Gursu and the IWRC,

We received your e-mail with regards to becoming a "certified" wildlife rehabilitator. We are sorry to see that the IWRC has lost sight of the goal. We care for injured and orphaned wild animals. We feed baby squirrels, opossums, and raccoons around the clock. Baby birds are fed every hour on the hour. We spend 18–20 hours a day caring for our little lost ones to the exclusion of everything else. We are the dedicated few.

This certification is a mutual admiration society. It means nothing. To quote you: "Wildlife rehabilitator certification is exam based. The only requirement to become a certified wildlife rehabilitator (CWR) is to take and pass the CWR exam." One may never have cared for or handled a wild animal. Get 38 out of 50 questions correct and "poof" you're a certified wildlife rehabilitator. Are you kidding? We are scraping by to cover expenses for food, formula, medications, and veterinary care. Yet you charge $85 to take a test. Why not put your efforts towards something really helpful, such as approaching manufacturers to get lower costs for formulas and medications?

Those of us who care for wildlife 24/7, 365 days a year proudly announce that just by the virtues of our hands-on, day-to-day experience with wildlife we have decided that we have earned the title of "Expert Wildlife Rehabilitators" (EWR). Therefore, we have no need for your course or exam.

Please reconsider your priorities. "The Wild Animals Are the Goal."

—Hope Kosch-Davison, RN, EWR
Linda Mihatov, EWR
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RACCOON (*PROCYON LOTOR*) PHOTO: DAVE MENKE/USFWS

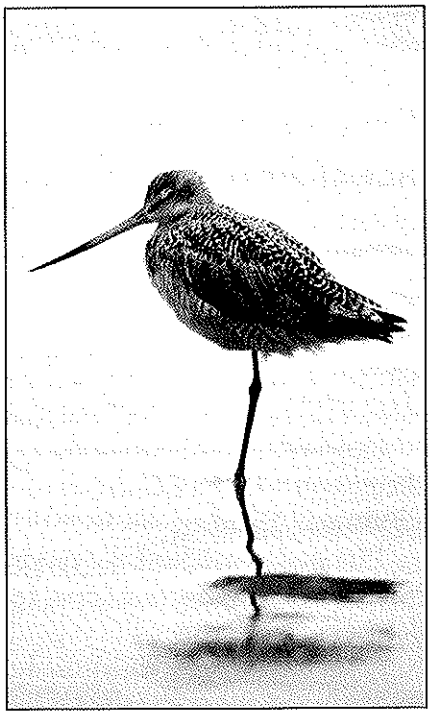
Dear Colleagues,

Thank you for your letter. There is certainly no denying that your feelings about the Certified Wildlife Rehabilitator™ (CWR) program are passionate; however, I believe that you have misunderstood our intention, and that of certification. I appreciate the opportunity you have given us to clarify the goals of this fledgling program.

It is important to acknowledge that IWRC believes the goal of wildlife rehabilitation to be far more than just taking care of wildlife "24/7, 365 days a year." To simply provide a quantity of care, even when the alternative is no care, should not be our only goal. The goals of this field are many, including providing high-quality, humane animal care, giving each animal the best chance at postrelease survival, incorporating sound ecological principles, adhering to the wildlife rehabilitator code of ethics—all while abiding within the limits of applicable laws.

Rehabilitators have long struggled with how best to achieve these goals. In the early days, most of our attempts were admittedly of the trial-and-error variety. But we've come a long way since those days of "turkey-mash diets" and dosing everything with antibiotics and dexamethasone. With that expansion of knowledge and passage of time, we have also learned that what we do as wildlife rehabilitators holds a significant place in the larger pictures of both conservation and public service. Like it or not, our activities have become more visible, and now intersect with other disciplines.

Through expansion of knowledge and passage of time, we have also learned that what we do as wildlife rehabilitators holds a significant place in the larger pictures of both conservation and public service.



MARBLED GODWIT (*LIMOSA FEDOA*) PHOTO: LEE KARNEY/USFWS

Most other wildlife and medical care professionals can (and often must) receive a certificate or degree from an accredited program or university. In some cases, they must also be certified by a professional organization in order to practice. One does not, for example, become a Registered Nurse (RN), simply by declaring oneself to be competent; rather, each individual must undergo an external review, either in the form of coursework graded by a qualified instructor, by comprehensive examination, or both. And rightly so! How many of us would be willing to submit to the care of a self-appointed RN... or MD... or DDS?

Until recently, wildlife rehabilitators haven't had the choice of undergoing an external review, or had any way to prove to themselves and others that they have met minimum knowledge standards. The CWR program is an attempt to address this problem. *It is not, nor does it claim to be, a perfect solution.* In this, we are no different than other certification programs. Just because veterinarians have passed state licensing board exams, there is no guarantee that they are exemplary practitioners, or highly skilled in every medical or surgical technique. It simply means they have met the minimum knowledge standards set by peers in the field. By the same token, *becoming a CWR does not guarantee that you are an expert rehabilitator, any more than not being a CWR means you are incompetent.* It does not prove that you are skilled at gavage, giving IM injections, or debriding wounds. It does, however, tell others that you can meet certain uniform and objective standards. You know when it is appropriate to perform these procedures. And, with the continuing education requirement in order to renew, it also tells others that you are committed to continually improving your knowledge and skills.

Still, changing the way things have always been done is never an easy path. IWRC recognizes that some individuals will not see value in certification, or may even feel threatened by it. That is their choice. Others will welcome the challenge, as is their choice. After all, certification is voluntary. It is an objective affirmation that you can carry from one location to another that will be understood as the uniform measure that it is. Keeping it current is a means of demonstrating to the world that you have made a commitment to continually improve your rehabilitation practice, to stay on top of new developments in rehabilitation, and to provide the best possible care 24/7, 365 days a year.

One other point to clarify any misconception there may be about certification as it relates to legal permits. *Becoming a Certified Wildlife Rehabilitator is not a substitute for state, provincial or federal permits.* It is a voluntary certification; the next step within the wildlife rehabilitation community toward becoming a recognized profession with professional standards.

Sincerely,

Jennifer Gursu, Executive Director
International Wildlife
Rehabilitation Council

For more information about the Certified Wildlife Rehabilitator™ program, go to www.iwrc-online.org/certification.

The Editors encourage readers to respond to the articles, columns, and other items featured in the *Journal of Wildlife Rehabilitation*. Please direct general questions and comments to journal@iwrc-online.org. To respond to a specific article or column, please contact the author directly. Letters may be edited for clarity and length.

Frequency of Rabies Infections and Clinical Signs in a Wildlife Rehabilitation Sample of Bats in Central Texas, 1997–2001

by Barbara Schmidt-French, Robert J. Rudd, and Charles V. Trimarchi

ABSTRACT: Two hundred and eighty-four (284) bats received by a wildlife rehabilitator in central Texas 1 January 1997–31 December 2001 either died or were euthanized due to severe injury or illness. All were examined for evidence of rabies infection by the direct fluorescent antibody procedure. Clinical signs of disease were documented and used to identify potentially rabid bats prior to laboratory testing. Rabies-infected bats were identified in two of the 10 species tested, specifically one red bat (*Lasiurus borealis*) and 18 Mexican free-tailed bats (*Tadarida brasiliensis*). Testing bats that are killed, or that die with clinical signs indicative of rabies, to confirm infection status can generate information that may aid recognition of genuine signs of infection during future bat rehabilitation efforts. This, in turn, may help reduce the risk of exposure to rabies virus by rehabilitators.

KEY WORDS: bats, rabies, clinical signs, wildlife rehabilitation, zoonosis

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Introduction

Wildlife rehabilitators care for sick, injured, or orphaned wildlife. Such wildlife populations may be expected to include a higher proportion of rabies-infected animals than is characteristic of asymptomatic populations. There is considerable debate about the captive care of rabies vector species due to the potential for human exposure to the virus from infected animals. The regulations regarding this issue vary significantly from state to state.

This study examined the incidence of rabies infection in bats received by a bat rehabilitator in central Texas over a period of 5 years, in order to determine the likelihood of exposure to rabies by wildlife caretakers. Only bats that died or were euthanized due to illness or injury were included in the study and tested for rabies. Clinical signs exhibited by animals in which rabies infection was suspected were recorded by the rehabilitator. This allowed an assessment of whether clinical signs could be used to identify infected insectivorous bats and consequently reduce the risk of accidental exposure in humans.

Materials and Methods

Two hundred and eighty-four (284) bats received by a wildlife rehabilitator in central Texas between 1 January 1997 and 31 December 2001 either died or were euthanized due to severe illness or injury. All 284 bats were submitted for rabies testing to the New York State Department of Health Rabies Laboratory in Albany, N.Y. Brain tissue from each bat was tested for evidence of rabies infection, using the direct fluorescent antibody procedure (DFA) (Trimarchi and Smith 2002). The tested population comprised 10 species: 116 Mexican free-tailed bats (*Tadarida brasiliensis*), one big free-tailed bat (*Nyctinomops macrotus*), 141 red bats (*Lasiurus borealis*), one hoary bat (*Lasiurus cinereus*), four northern yellow bats (*Lasiurus intermedius*), nine cave bats (*Myotis velifer*), one northern long-eared bat (*Myotis septentrionalis*), six eastern pipistrelles (*Pipistrellus subflavus*), two silver-haired bats (*Lasionycteris noctivagans*), and one evening bat (*Nycticeius humeralis*), as well as two bats unidentified by species. Clinical signs of disease were documented for all bats prior to laboratory testing.

Results

Results of rabies testing are given in Table 1. Eight specimens were not deemed in satisfactory condition for reliable testing due to tissue deterioration. Rabies infection was found in two of the 10 species, specifically one red bat and 18 Mexican free-tailed bats. The red bat was a male pup. Of the infected Mexican free-tailed bats, eight were females (six adults, two juveniles) and 10 were males (four adults, five juveniles, one unknown). Clinical signs of illness in all rabid bats included weakness, dehydration, and emaciation. Seven Mexican free-tailed bats had cloudy or persistently closed

TABLE 1: RABIES STATUS OF 284 BATS RECEIVED BY A TEXAS WILDLIFE REHABILITATOR, 1 JANUARY 1997–31 DECEMBER 2001

Species	Total	(-)	(+)	Not testable*
Molossidae				
Mexican free-tailed bat (*Tadarida brasiliensis*)	116	94	18	4
Free-tailed bat (*Nyctinomops macrotus*)	1	1		
Vespertilionidae				
Red bat (*Lasiurus borealis*)	141	136	1	4
Hoary bat (*Lasiurus cinereus*)	1	1		
Northern yellow bat (*Lasiurus intermedius*)	4	4		
Silver-haired bat (*Lasionycteris noctivagans*)	2	2		
Northern long-eared bat (*Myotis septentrionalis*)	1	1		
Cave bat (*Myotis velifer*)	9	9		
Evening bat (*Nycticeius humeralis*)	1	1		
Eastern pipistrelle (*Pipistrellus subflavus*)	6	6		
Unknown	2	2		
Total	**284**	**257(-)**	**19(+)**	**8**

*Not testable due to decomposition or other damage

eyes; four had spastic paralysis of the hind quarters; four had seizures; three exhibited signs of respiratory distress; five exhibited atypical biting or chewing behavior; two had dirt in the mouth and/or nose; and one repeatedly emitted alarm calls.

In comparison, bats that tested negative for rabies exhibited a variety of signs of illness or injury, including dehydration, emaciation, skeletal fractures, puncture wounds, broken teeth, significant wing membrane tears, infections at injury sites, eye infections, and bloating. Although bats that tested negative sometimes also bit, they did not chew incessantly on caging materials.

Discussion

Nineteen (7%) of the 284 bats in this study tested positive for rabies: one red bat and 18 Mexican free-tailed bats. These numbers correspond to < 1% of the red bats and ~15% of the Mexican free-tailed bats tested. These two species comprised 90% of all bats included in the study.

Because only those bats received by the wildlife rehabilitator that died or were euthanized due to serious illness or injury were included in this study, there was a high suspicion of rabies infection in the sample of bats. The frequency of rabies infection in the symptomatic bats was similar to what is seen in bats submitted to rabies diagnostic laboratories of state health departments (Constantine 1988, Childs 1994, Krebs 1999, Pape 1999, Rohde 2004).

Most of the bats submitted to rabies diagnostic laboratories have had contact with a person, either directly or mediated by the person's pet. Since such encounters are much more likely to occur with grounded bats, or bats that are acting abnormally, the sample of bats submitted to public health laboratories may be similar to that received by a wildlife rehabilitator.

None of the rabid bats in this study was retained by the rehabilitator for treatment. One died on the day it was received; the remaining 18 were euthanized because signs



FREE-TAILED BAT (*NYCTINOMOPS MACROTUS*) PHOTO ©BAT WORLD SANCTUARY/WWW.BATWORLD.ORG

Bat rehabilitators should be familiar with the clinical signs of rabies in bats.

indicative of rabies were observed. It is worth noting that the rehabilitator's experience and familiarity with signs of rabies enabled accurate recognition of rabies signs in each of the Mexican free-tailed bats that subsequently tested positive.

Clinical signs of rabies infection in insectivorous bats can include irritability or depression, weakness, anorexia, hypothermia, paralysis, abnormal vocalization, and daytime flight[1] (Centers for Disease Control and Prevention 1954, Bell et al. 1955, Bell et al. 1957, Constantine 1967, Moore and Raymond 1970, Price and Evard 1977, Schowalter 1980, Haagsma 1989 [cited by Brass 1994]).

In the study population, clinical signs of disease in all rabid bats included weakness, dehydration, and emaciation—signs also observed in bats that tested negative. Further signs of illness exhibited by the infected Mexican free-tailed bats included cloudy eyes or eyes that remained closed at all times, respiratory distress, spastic paralysis of the hind quarters, seizures, dirt in the mouth and/or nose, and vocalizations such as repeated alarm calls. Although none of the bats that tested negative exhibited any of these signs, there are causes other than rabies that can result in respiratory distress, and stressed but otherwise healthy bats sometimes emit alarm calls. Five of the rabid bats exhibited incessant biting and chewing behavior not seen in the bats that tested negative.[2]

The bats that exhibited biting and chewing behavior did not attack or respond to the presence of the observer in any manner until handled. However, they chewed incessantly on a glove when handled or on caging materials. This behavior is consistent with that observed by others for rabid free-tailed bats (Constantine 1967, Lollar and Schmidt-French 2002). This chewing behavior on any material that came into direct contact with them was not observed in bats that tested negative and could account for bites associated with some rabid bats (Frantz and Trimarchi 1999, Pape 1999).

The incessant chewing behavior by infected bats in the wild could eventually give rise to the dirt in the mouth, throat, or nose that was observed in this study, as the bat bites at the ground around it. This behavior has also been observed in rabid bats by others (Lollar and Schmidt-French 2002). None of the bats that tested negative had dirt in the mouth.

Conclusion

Some of the signs observed in rabid bats can also be exhibited by bats that are not rabid. The incidence of rabies infection in this study's sample was similar to that observed during the passive surveillance performed by public health programs. Nonetheless, the 7% incidence of rabies infection in this population emphasizes the importance of pre-exposure rabies vaccinations and other rabies-control practices for bat rehabilitators (Trimarchi 1997). Wildlife caretakers should always be aware that even clinically normal bats are of unknown infection status, and that juveniles are susceptible to infection (Childs 1994). Consequently, there is a risk of infection from both adult and young animals that may appear healthy. However, familiarity with a combination of the clinical signs the authors observed in rabid bats can reduce the likelihood of exposure and increase the possibility that postexposure treatment will be sought when necessary. An understanding of infection risks combined with knowledge of clinical signs will enable bat rehabilitators to make informed choices about when to euthanize and test for rabies, rather than treating, individual bats.

End Notes

[1] It should be noted that some species of bats normally fly in the late afternoon; healthy bats will fly out of roosts during daylight if sufficiently disturbed.

[2] Mating males in captive colonies sometimes chew on roosting materials at territorial boundaries (Lollar and French 2002).

Literature Cited

Bell, J. F., W. J. Hadlow, and W. L. Jellison. 1955. Chiropteran rabies in Montana. *Pub. Health Reports* 70: 991–94.

———. 1957. A survey of chiropteran rabies in western Montana. *Public Health Reports* 72: 16–18.

Brass, D. A. 1994. *Rabies in bats: Natural history and public health implications.* Ridgefield, Conn.: Livia Press.

Centers for Disease Control. 1954. Midwestern CDC Services. Report from the Rocky Mountain Laboratory. Hamilton, Mont.

Childs, J. E., C. V. Trimarchi, and J. W. Krebs. 1994. The epidemiology of bat rabies in New York State, 1988–1992. *Epidem. and Infection* 113: 501–11.

Constantine, D. G. 1967. Bat rabies in the southwestern United States. *Public Health Reports* 82: 867–88.

———. 1988. Health precautions for bat researchers. In *Ecological and behavioral methods for the study of bats,* edited by T. H. Kunz. Washington, D.C.: Smithsonian Institution Press.

Frantz, S. C., and C.V. Trimarchi. 1999. Bat rabies management update. In *Proceedings of the 4th International Symposium Urban Wildlife Conservation.* Tucson, Ariz.

Haagsma, J. 1989. Rabies en vleermuizen: hoe te handelen? (Rabies and bats: How should it be managed?) *Ned Tijdschr Geneesk* 133: 550–51.

Krebs, J. W., J. S. Smith, C. E. Rupprecht, and J. E. Childs. 1999. Rabies surveillance in the United States during 1998. *J. Am. Vet. Assn.* 215: 1786–98.

Lollar A., B. Schmidt-French. 2002. *Captive care and medical reference for the rehabilitation of insectivorous bats.* Mineral Wells, Tex.: Bat World.

Moore, G. J., and G. H. Raymond. 1970. Prolonged incubation period of rabies in a naturally infected insectivorous bat, *Eptesicus fuscus (Beavois). J. Wildlife Dis.* 6: 167–68.

Pape, W. J. 1999. Risk of rabies transmission from encounters with bats, Colorado, from 1977–1996. *Emerg. Infect. Dis.* 5: 433–37.

Price, J. L., and C. O. R. Everard. 1997. Rabies virus and antibody in bats in Grenada and Trinidad. *J. Wildlife Dis.* 13: 131–34.

Rohde, R. E., B. C. Mayes, J. S. Smith, and S. U. Neil. 2004. Bat Rabies, Texas, 1996–2000. *Emerg. Infect. Dis.* 10: 948–52.

Schowalter, D. B. 1980. Characteristics of bat rabies in Alberta. *Can. J. Comp. Med.* 44: 70–76.

Sullivan, T. D., J. E. Grimes, R. B. Eads, G. C. Menzies, and J. V. Irons. 1954. Recovery of rabies virus from colonial bats in Texas. *Pub. Health Reports* 69: 766–768.

Trimarchi, C. V. 1997. Wildlife rehabilitation and rabies. In *Wild today, wild tomorrow,* edited by M. D. Reynolds. Proceedings of the 1996 International Wildlife Rehabilitation Council. Suisun City, Calif.

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Rehabilitation and Release of Orangutans in Northern Borneo

by Govindasamy Agoramoorthy and Minna J. Hsu

Tropical forests are being destroyed at a rate of 17 million ha per year. If the current rate of habitat loss continues, half of the primate species will face extinction in the near future (Conservation International 2000). The survival of our closest relatives, the great apes—such as chimpanzees, gorillas, and orangutans—is at risk due to ongoing destruction of rainforests for timber, expansion of shifting cultivation, illegal hunting for bush-meat, and the pet trade.

Orangutans are large, sexually dimorphic apes, the only Asian representative of *Pongidae* and truly arboreal member of this family. Orangutans once ranged through much of Southeast Asia, but they are now restricted to the islands of Borneo and Sumatra (Kaplan and Rogers 1994). They have been listed as endangered in the IUCN (2000) Red List of Threatened Species and included in the Appendix I of CITES to restrict even the legal transfer from one country to another. They exist in two forms, the Bornean orangutan (*Pongo pygmaeus pygmaeus)* and the Sumatran orangutan (*P. p. abelii)* (Rowe 1996). Genetic studies have concluded that the Bornean and Sumatran orangutans are distinct species; therefore all regional and global captive-management programs have adopted a moratorium on the production of hybrids (Perking 1995).

It has been estimated that suitable orangutan habitat in Indonesia and Malaysia has declined by more than 80% in the last 20 years, and that

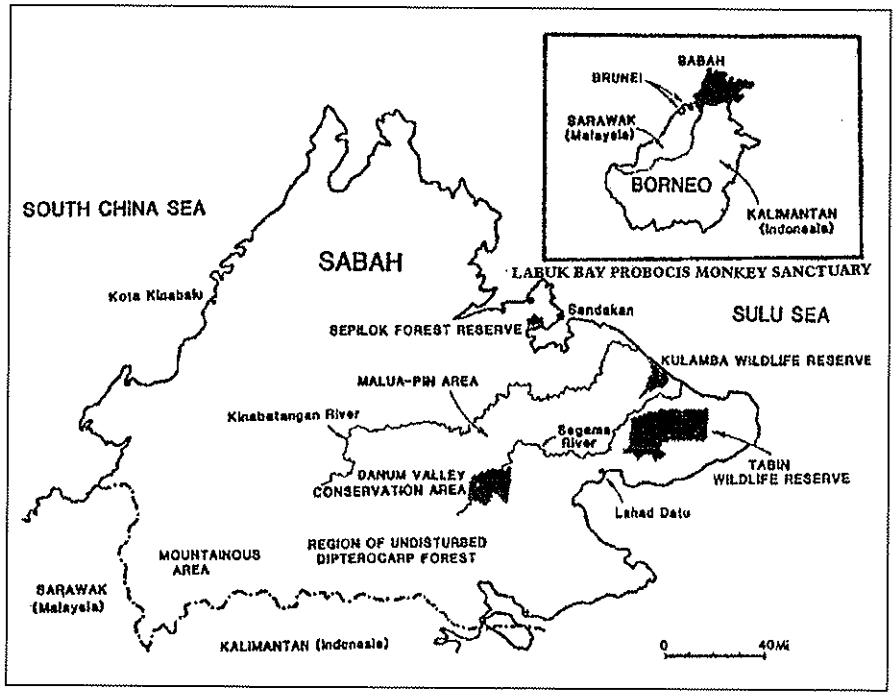


FIGURE 1. The Malaysian province of Sabah and its location in Borneo. Wildlife preserves are marked. The Sepilok Orangutan Rehabilitation Center is on the edge of the Sepilok Forest Reserve.

ABSTRACT: This paper presents data on the rehabilitation of orangutans and eventual release into the wild in Sepilok forest reserve in Sabah, northern Borneo. The authors share details involved in the rehabilitation of orangutans, including an analysis of success and failure involved in carrying out the rehabilitation work in the forest of Borneo.

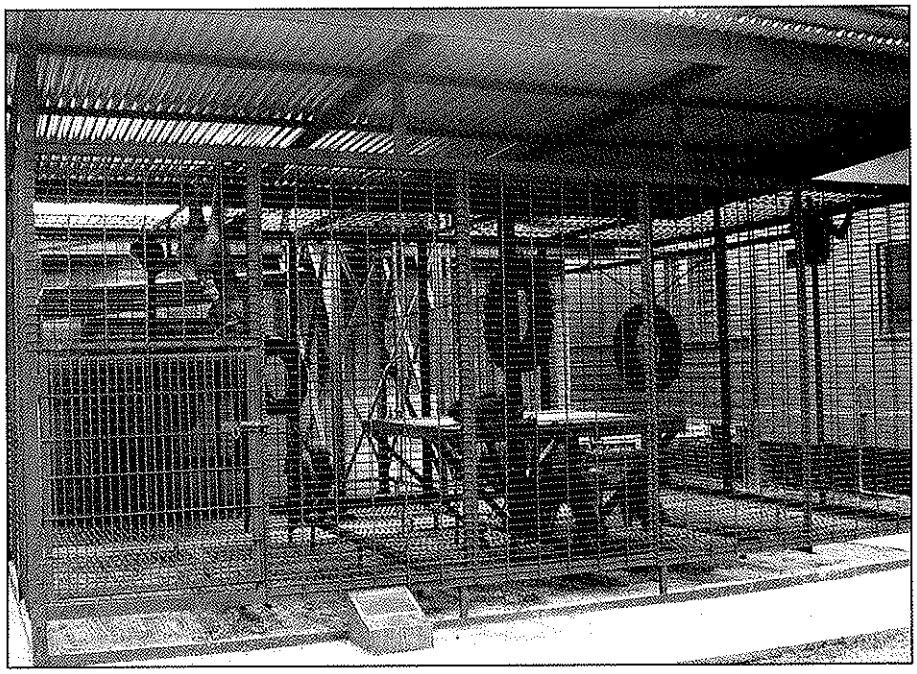
KEY WORDS: orangutan, *Pongo pygmaeus,* socialization, rehabilitation, release, Borneo

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wild populations have suffered a corresponding decline of 50% over the last 10 years (Brown 1997). Orangutan populations are threatened directly by habitat loss, expansion of oil palm plantations, and agricultural activities, and indirectly by habitat fragmentation. An additional threat is the capture of wild orangutans for the pet/entertainment trade that continues to flourish in Southeast Asia (Agoramoorthy 1997, 2002a, 2003, 2004; Agoramoorthy and Hsu 2005a).


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Orangutan socialization cage at Sepilok Orangutan Rehabilitation Center.

Most conservationists agree on the necessity of establishing projects to rehabilitate wild-caught great apes for eventual release into the wild. The rehabilitation usually involves training behaviorally inadequate individuals in skills that would enable them to survive independently. By socializing the great apes in naturalistic enclosures and natural forest areas, rehabilitators have worked to teach them to find and process food and water, find and avoid predators and other dangers, seek or make shelters, mate, and rear offspring (Agoramoorthy and Hsu 1999).

The Sepilok Orangutan Rehabilitation Center, located on the edge of the Sepilok forest reserve in northern Borneo (Sabah, Malaysia), has been involved in the rescue, rehabilitation, and release of orangutans into the wild since 1964 (Agoramoorthy and Hsu 2001a). We visited the center five times between January 2002 and December 2003 (each visit lasting from 3 to 14 days) to gather data on the center's orangutan rescue, rehabilitation, and release activities, and to conduct a survey of the forest to estimate the population density of orangutans. Details of this research are presented in this paper.

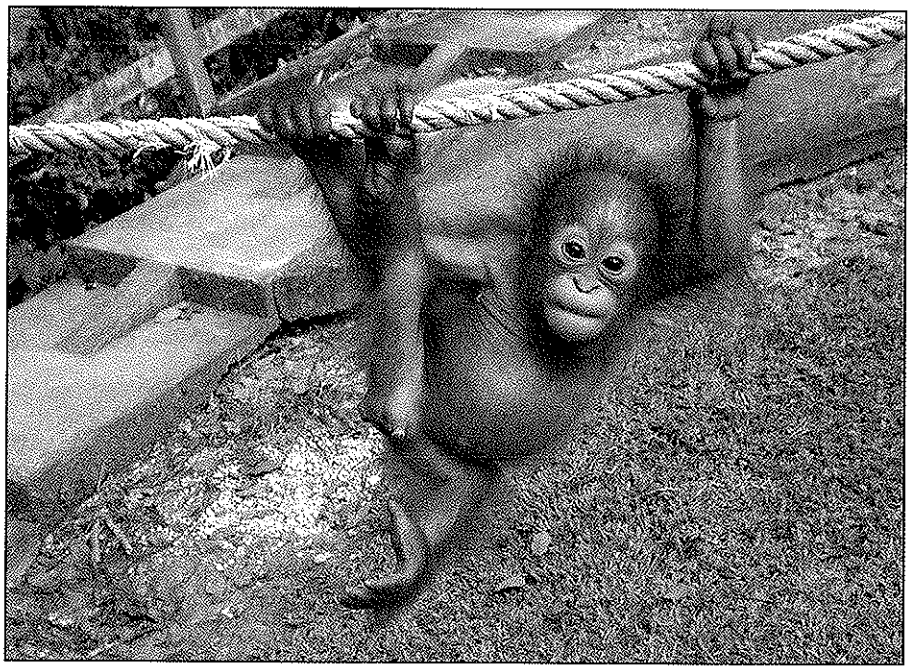
Orangutan Rehabilitation in Northern Borneo

Orangutans were first rehabilitated in Sarawak (Malaysia) in 1962. Two years later, the Sepilok Orangutan Rehabilitation Center was established as a consequence of the Fauna Conservation Ordinance (1963) of the government of Sabah (Malaysia). The center is located in the Kabil-Sepilok forest known as Sepilok, which was named after two rivers draining the area and flowing into the Sandakan Bay (Fox 1973). The Kabil-Sepilok forest reserve is located on the east coast of Sabah, 24 km from Sandakan (5° 52′ 0 N, 117° 58′ 0 E; Fig. 1) in an area of 42 km^2. The primary forest (4294 ha) is composed of three distinct terrains, namely lowland *dipterocarp* forest (58%), sandstone hill *dipterocarp* forest or sandstone forest (19%), and heath forest (23%). Mangrove swamps dominate the eastern and southern parts of the forest with sparsely occupied village communities that rely on fishing for their livelihood. The western and northwestern parts are composed of oil palm plantations, while the northeastern part comprises primarily private lands—some of which are orchards owned by palm plantations—and moderately inhabited by people.

The orangutan rehabilitation center consists of a tourist division and a rehabilitation division. The tourist division provides economic support for the center and includes a main office with a souvenir shop, a room where educational films are shown, and an information center. Educating local people about the importance of rainforest and orangutan conservation is a priority, and local visitors pay only 10% of the entrance fee charged to foreign tourists. From the information office, visitors can reach the feeding platform using an elevated wooden walk-way (250 m long) to view the orangutans' feeding. The center receives an average of 60,000 visitors annually.

Quarantine and Socialization of Orangutans

All orangutans that reached the center initially spent 90 days in quarantine; during this period the center's single veterinarian performed health tests that included blood hematology, clinical biochemistry, viral hepatitis screening, and tuberculosis tests. In the quarantine area, each



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Young orangutan outside the socialization cage.

orangutan was kept in a separate cage (1.5 x 1.5 x 1.5 m) and observed throughout the day. Four to six orangutan handlers usually met at 8 a.m. The infants were fed first with a locally available human-grade powdered milk. Adults were fed fruits, vegetables, and natural browse collected from the forest. The handlers ensured that all orangutans consumed sufficient food; daily records of body weight, quantity of food items given/consumed, and medications provided documented the health progress of each ape. Infant orangutans are sensitive to weight loss, and it is therefore crucial to monitor their development to avoid diseases such as diarrhea and pneumonia. These diseases have affected some orangutans in the past, but were not common during the study period.

All quarantine cages and socialization enclosures were cleaned and disinfected (using disinfectants such as Dettol®) daily to prevent the spread of infectious diseases. Orangutans who were deemed disease free were later moved from the quarantine building to a socialization cage (5 x 3 x 3 m), where they spent most of the day time interacting with other orangutans. They also spent a few hours each day outside the socialization cage.

Release of Orangutans into the Forest: Problems and Prospects

Orangutans were gradually moved from the socialization cage into the forest, where three feeding platforms are located progressively deeper into the forest. At 10 a.m. staff members fed the orangutans on these platforms and monitored their activities to check their health condition daily. Smaller orangutans were sometimes seen huddling together and refusing to move from the feeding platform; this behavior was interpreted as an indication of fear and stress in the absence of their mothers. Infants born in the wild usually spend the first few years in the company of their mothers. Between two and four rangers spent a total of 8–10 hours daily with young orangutans in the forest to make sure they moved and climbed trees independently. Those unable to do so were brought back to the socialization cage. This process was repeated until the orangutans moved freely on their own in forest trees near the first feeding platform.

Once the orangutans were acclimated to the first feeding platform, they were fed daily either at platform two or three, located approximately 200 m and 300 m, respectively, from the first platform. On these platforms, the orangutans were initially fed bananas and milk made from ordinary powdered milk with added protein and vitamins based on calculated need. In the past, no specific attention was given to individual orangutan welfare due to lack of staff, funds, and expertise. After feeding, the orangutans usually left the platforms and ventured into the forest in search of natural food items. Subsequently, the orangutans were presented with other fruits that occur naturally the forest such as durian, mango, jack fruit, rambutan, and figs. This eventually encouraged them to search the forest for similar or new varieties of foods such as fruits, bark, and insects. Young orangutans learned to choose new food items from experienced, older orangutans that occasionally visited the feeding platforms in search of supplement food. The young orangutans also had opportunities to observe nest-building behavior from older orangutans (both wild and rehabilitated) that made sleeping nests at the release site. After their final release, most young orangutans managed to make their own sleeping nests each evening. Thus, learning skills from adults played a major role in the successful rehabilitation of young individuals; this is similar to our prior observation of rehabilitated chimpanzees (*Pan troglodytes)* in Liberia, West Africa (Agoramoorthy and Hsu 1999).

Between 1965 and 2002, a total of 660 orangutans (365 males and 295 females) were received by the reha-

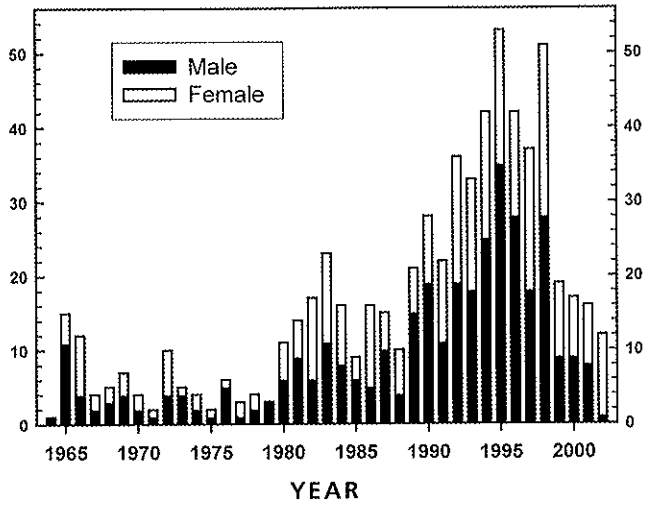


FIGURE 2: Number of orangutans that arrived annually at the Sepilok Orangutan Rehabilitation Center, 1965–2002.

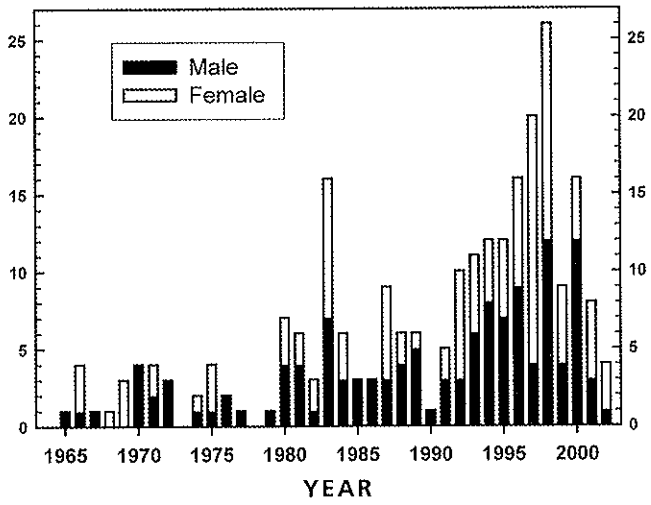


FIGURE 3: Number of orangutans that died annually at the Sepilok Orangutan Rehabilitation Center, 1965–2002.

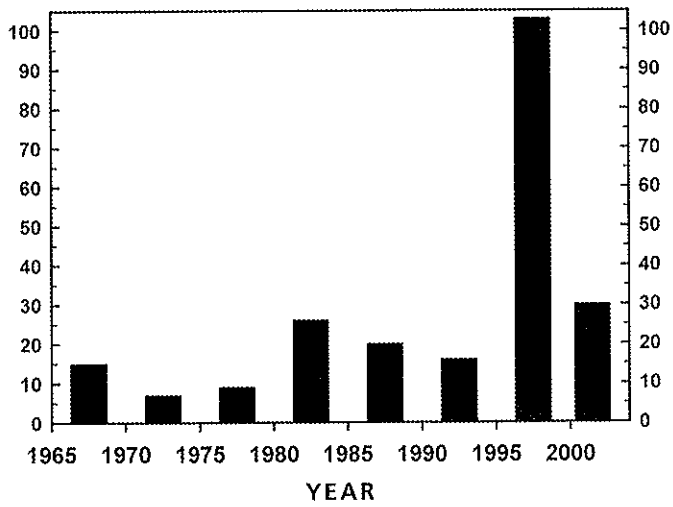


FIGURE 4: Number of rehabilitated orangutans released into the Sepilok forest reserve, 1965–2002.

bilitation center (Figure 2). The number of orangutans that reached the center ranged annually from one to 51. The greatest number of orangutans received at the center was 352 individuals between 1991 and 2000 (Figure 2), triggered by the expansion of agricultural activities, an increase in oil palm plantations, and uncontrolled forest fires.

Orangutan mortality was high, and a total of 246 individuals died after reaching the center between 1965 and 2002 (Figure 3). There was no statistical difference in the mortality of males (35.1%) and females (40.0%, $p > 0.05$). The causes for mortality included dehydration, transport stress, diseases, and injury. Some orangutans arrived with wounds and severe dehydration and eventually died at the rehabilitation center. The annual mortality ranged from one to 26 individuals, and mortality was usually high among orangutans younger than 3 years. Lack of a professional nutritionist to monitor the dietary needs of young orangutans under stress may have played a role in the increased mortality of young animals.

Because of the presence of parasites such as *Balantidium coli*, rehabilitated orangutans were periodically de-wormed prior to final release, which significantly reduced mortality due to parasitic infections and associated hygiene problems. During the study, four orangutans aged 3 to 4 years who were housed at the center were infected with malarial parasite (*Plasmodium pitheci*). They were treated with a dose of 10 mg/kg Artenam (Beta-Artemether, Dragon Pharmaceuticals, U.K.) given as a loading dose of 3.2 mg/kg on day 1 and a 1.6 mg/kg dose once a day for the subsequent 4 days. The treatment rapidly eliminated circulating parasites in the four individuals (Wolfe et al. 2001, 2002).

Although the initial mortality among orangutans younger than 3 years was high due to stress, diseases, starvation, and dehydration, many survived and were eventually released back into the forest. On the other hand, when orangutans were older than 3 years at the time of rescue, the mortality was low, but many were imprinted on people and therefore harder to rehabilitate and release. They spent the initial years of rehabilitation with human companions and relied more on them for care and attention. Some persistently raided garbage dumps and stole food from the center's kitchen and food storage area; some routinely roamed the visitor center in search of human food rather than venturing into the forest in search of natural food. These orangutans were caught by the staff and sent to zoos and recreational parks in Malaysia and China. Between 2000 and 2002 six such orangutans (two males and four females) that failed to return to the forest were sent to zoos and recreational

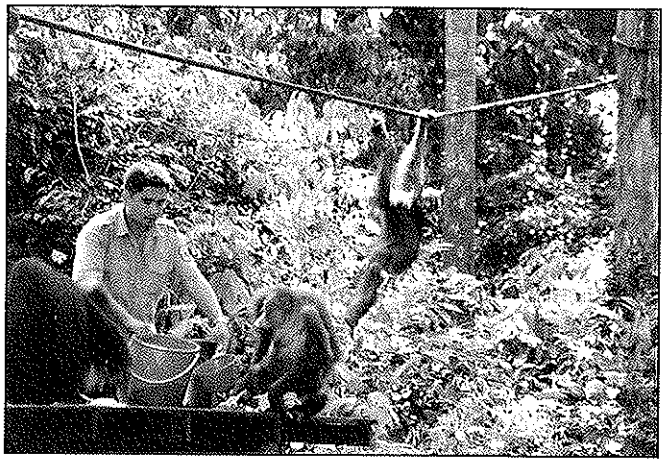
parks. In general, older apes that have had constant contact with people are difficult to rehabilitate; we have observed similar cases among rehabilitated chimpanzees in Africa (Agoramoorthy and Hsu 1999).

A total of 226 orangutans were released back into the Sepilok forest reserve between 1965 and 2002, with a success rate in rehabilitation of 35.2% (Figure 4). There were no systematic scientific observations of postrelease monitoring to assess the fate of released orangutans. Therefore, no data are available on how many orangutans survived after release and what complications they have encountered in the forest. This apparent weakness is a major concern in orangutan rehabilitation work. Lack of apparent funds and personnel might have prevented the staff from doing intensive monitoring work in the past. We therefore suggest that future rehabilitation and release efforts incorporate scientific and monitoring components to systematically document the long-term fate of each rehabilitated orangutan using GPS collars. We believe this would improve the success of future orangutan rehabilitation and release.

Rehabilitation and release of orangutans back into the wild is not new: the first rehabilitation work on orangutans was developed by Barbara Harrisson in 1962 in Bako National Park in Sarawak. In 1971 the Indonesian Nature Conservation Service established a rehabilitation center at Ketambe in Northern Sumatra. Subsequently, another rehabilitation center was established at Tanjung Putin National Park by Galdikas (Galdikas 1995) in Kalimantan. The Wanariset Orangutan Reintroduction Project was established in October 1991 in Kalimantan to reintroduce rehabilitated animals in natural habitat (Agoramoorthy 1997). This project has returned more than 300 orangutans in two protected forest reserves, namely Sungai Wain and Meratus (Siregar 1998). Some animals can still be seen in both areas. However, details on the fate of all reintroduced orangutans are not known.

Rehabilitation of endangered species is one of the central problems in conservation biology, and programs involving nonhuman primates have met with mixed success (Yeager 1997). Golden-lion tamarins (*Leontopithecus rosalia*) in Brazil are the best case of moderate success. Yet the project documented 50% mortality with a cost of thousands of U.S. dollars for rehabilitation (Kleiman et al. 1986).

Despite the advantages of rehabilitation in improving demographic and genetic diversity and reducing the threat of extinction in the wild, concerns about the problems and failures related to nonhuman primate rehabilitation projects have been debated since the 1980s (Aveling and Mitchell 1982; Yeger 1997).



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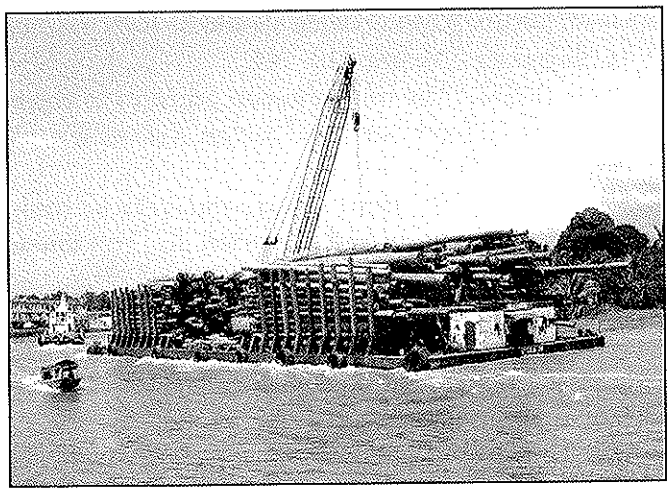
The first feeding platform, where visitors may view the orangutans.

Why is rehabilitation apparently less successful among nonhuman primates? In general, primates have extensive parental care and prolonged infancy and juvenile periods, which result in dependency. The greatest success in nonhuman primate rehabilitation appears to be with individuals with significant experience in the wild prior to capture and those whose time in captivity is short (Agoramoorthy and Hsu 1999). Unfortunately, many rehabilitated orangutans are young, lack significant prior exposure to their native habitats, and often spend long periods in unsuitable captive condition or in isolation from conspecifics.

Orangutan Survey in Sepilok Forest Reserve

A field study using systematic transect survey of Sepilok forest reserve was conducted to determine the population of orangutans (Agoramoorthy 1989). Earlier rehabilitation work did not involve population surveys in the forest due to lack of staffing, scientific support, and funds. As part of this study, we carried out surveys along 22 straight-line transects (2–4 km in length) that were laid randomly covering all major habitats (i.e., lowland forest, sandstone hill forest, and heath forest (National Research Council 1981). Survey work was conducted from 6:30–11:30 a.m., and from 2–6:30 p.m. As soon as an orangutan was sighted, details on the sex, age-class, height of tree in which the sighting occurred, habitat type, and perpendicular distance from the transect line to the orangutan were recorded. The perpendicular distances were used to calculate population estimates using Distance 4.0 (Buckland et al. 1993) at 95% confidence level.

We covered a total distance of 71.5 km and a corresponding area of 3.57 km^2 of forest over a 2-week period, and recorded seven orangutan sightings. It was not certain whether they were wild or rehabilitated individuals



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A boat transporting freshly cut rainforest logs in Borneo.

due to lack of visual identification marks. However, most of them were shy and avoided us by moving away, indicating a wild nature.

The density of orangutans was 2.52 individuals/km^2 with 77.7% coefficient of variance. One adult female was seen with a young, and an adult male and a female were seen together. In addition, three solitary adult males were seen, of which two showed aggressive behavior toward the authors (e.g., breaking and throwing branches). No orangutans were observed in small groups or in social settings in the forest. Some were seen in small groups near feeding platforms during the initial years of rehabilitation, but later their behavior became more solitary; social behavior is not normal for older orangutans. However, given the high density in a small forest area, these solitary great apes will be forced to become social in future if alternate sites with large forest area are not provided. Moreover, the increased population pressure may create additional stress on the orangutan population.

Orangutans' Influence on Forest Vegetation

We did not observe extensive damage to the forest vegetation by the orangutans in the core area of the Sepilok forest reserve. However, visible signs of forest destruction, including extensive loss of branches and leaves in trees, were seen within a 1 km radius of the first feeding platform. Near the feeding platforms, several nest-building activities were observed, and the orangutans were seen foraging on new shoots of trees. Such extensive feeding on new shoots and nest-building activities may have caused the trees to die near the first feeding platform. The small forest reserve is already facing an increased population pressure from the rehabilitated orangutans. This will be detrimental to the natural habitat in the near future if appropriate management strategies are not taken swiftly to decelerate the destruction.

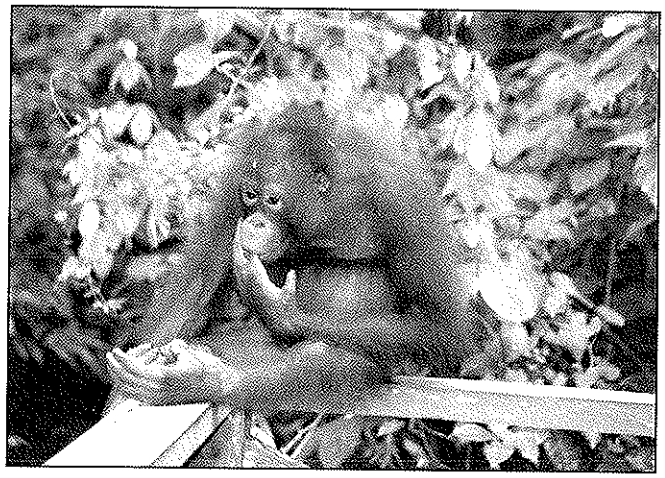
Conclusions

At present, humans use about 70% of the world's temperate and tropical ecosystems to produce 98% of their food and all of their wood products. Only 5% of the temperate and tropical land area is uninhabited. Asia and the Pacific region have 23% of the world's land area but 58% of its people (Agoramoorthy and Hsu 2005b). According to a recent report published by the World Wide Fund (2006), the tropical forests of Southeast Asia, which harbor major biodiversity hotspots (Agoramoorthy 2002b), have seen the fastest conversion in the last two decades. If the current rate of forest destruction continues, several endangered fauna and flora may be extinct within the next few decades (Agoramoorthy and Hsu 2001b; Sodhi and Brook 2005).

The wild populations of orangutans in Borneo are distributed in at least eight major isolated areas in the Kalimantan territory in Indonesia and the states of Sabah and Sarawak in Malaysia. The principal threats to the Bornean orangutan population are lack of law enforcement, unscrupulous logging, habitat degradation in parks and protected reserves, forest fires, expansion of agricultural activities, increasing oil palm plantations, and intensive poaching. Illegal logging is a chronic problem throughout the ranges of wild orangutans (Fox 2000, Jepson et al. 2001, McCarthy 2002). In addition, forest fires kill an unknown number of wild orangutans and destroy thousands of acres of rainforest habitats each year. The slash-and-burn technique—which involves first cutting vegetation and then setting it afire—has been used for decades in many Southeast Asian islands, including Borneo and Sumatra, as a cheap way to clear rainforest land for agriculture (Fox 2000).

Our review of habitat use and orangutan density revealed that Sepilok forest reserve has only 42 km^2, which limits the number of orangutans that can be released back into the wild. Since orphaned orangutans continue to be rescued and rehabilitated at the center, it is essential that a larger forest release site be selected as soon as possible. The forest area near Tabin Wildlife Reserve has been identified by the local government as a potential rehabilitation site where release of orangutans can be carried out in future.

Rehabilitation programs involving lesser and great apes have come under criticism due to their lack of scientific documentation, high costs involved, and the low probability of success (Aveling and Mitchell 1980, Bennett 1992, Yeager 1997). Very few programs include the use of radio-tracking and GPS monitoring systems to gather information on postrelease feeding range, health



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A rehabilitated orangutan resting near the feeding platform.

condition, survival, mortality, and habitat. Such studies are recommended for Sepilok.

Perhaps the greatest threat to wild orangutans in the region visited is interaction with people. Because orangutans can be easily imprinted on humans, it is vital to minimize the presence of visitors and local people in the forest where they are rehabilitated. Any type of visual contact or interaction with humans may prolong the rehabilitation process. Education programs for the local people—especially the owners of agricultural lands, oil palm plantations, and orchards—need to be expanded in this region urgently to safeguard wild populations of orangutans and their forest habitats.

Literature Cited

Agoramoorthy, G. 1989. Survey of rainforest primates in Sapo national park, Liberia, West Africa. *Primate Cons.* 10: 71–73.

———. 1997. Wildlife rescue and rehabilitation centers in South-East Asia. *Internat'l. Zoo News* 7: 397–400.

———. 2002a. Exhibiting orangutans on a natural island in Malaysia. *Internat'l. Zoo News* 49: 3–9.

———. 2002b. *Hotspots: Earth's biologically richest and most endangered terrestrial eco-regions.* Book review. *J. Mammalogy* 83: 630–633.

———. 2003. Illegal trade of exotic pets. *Hemispheres* 3: 36–39.

———. 2004. Ethics and welfare in Southeast Asian zoos. *J. Applied Animal Welfare Science* 7: 189–95.

Agoramoorthy, G., and M. J. Hsu. 1999. Rehabilitation and release of chimpanzees on a natural island. *J. Wildlife Rehab.* 22: 3–7.

———. 2001a. Rehabilitation and Rescue Center. In *Encyclopedia of the world's zoos,* edited by C. E. Bell. London: Fitzroy Dearborn.

———. 2001b. "Conservation should be high priority in Singapore." *Nature,* 410: 144.

———. 2005a. "Use of nonhuman primates in entertainment in Southeast Asia." *J. App. Animal Welfare Sci.* 8: 141–49.

———. 2005b. "Borneo's proboscis monkeys—a study of its diet of mineral and phytochemical concentrations." *Current Sci.* 89: 454–57.

Aveling, R., and A. Mitchell. 1980. Is rehabilitating orangutans worthwhile? *Oryx* 16: 263–71.

Bennet, J. 1992. A glut of gibbons in Sarawak- is rehabilitation the answer? *Oryx* 26: 175–64.

Brown, L. S. 1997. *Vital signs: The environmental trends that are shaping our future.* New York: Norton.

Buckland, S. T., D. R. Anderson, P. P. Burnham, and J. L. Lake. 1993. *Distance sampling: Estimating abundance of biological populations.* London: Chapman and Hall.

Conservation International. 2000. *Primates in peril: The world's top 25 most endangered primates.* Washington, D.C.: Conservation International.

Fauna Conservation Ordinance. 1963. *State of Sabah, Fauna Conservation Ordinance 1963, Sabah No. 11 of 1963.* Sabah: Government Printer.

Fox, J. E. D. 1973. *A handbook to Kabili-Sepilok forest reserve.* Sabah Forest record no. 9. Kuching, Sarawak: Borneo Literature Bureau.

Fox, J. M. 2000. *How blaming slash and burn farmers is deforesting mainland Southeast Asia.* Asia Pacific Issues, Analysis from the East-West Center, Publication No. 47.

Galdikas, B. 1995. *Reflection of Eden: My years with the orangutans of Borneo.* New York: Little, Brown.

Harrission, B. 1962. The immediate problem of orangutans. *Malayan Nature J.* 16: 4–5.

IUCN. 2000. *IUCN Red List of Threatened Species.* IUCN Publication, Gland.

Jepson, P., J. K. Jarvie, K. MacKinnon, K. A. Monk. 2001. The end for Indonesia's lowland forests? *Science* 292: 859–61.

Kaplan, G., and L. Rogers. 1994. *Orang-utans in Borneo.* Armidale, New South Wales, Australia: University of New England Press.

Kleiman, D. G., B. B. Beck, J. M. Dietz, L. A. Dietz, J. D. Balou, A. Coimbra-Filho. 1986. Conservation program for the golden lion tamarin: Captive research and management, ecological studies, educational strategies, and reintroduction. In *Primates: The road to self-sustaining populations,* edited by K. Benirschke. New York: Springer-Verlag.

McCarthy, J. F. 2002. Turning in circles: District governance, illegal logging, and environmental decline

in Sumatra, Indonesia. *Soc. and Nat'l. Resources* 15: 867–86.

National Research Council. 1981. *Techniques for the study of primate population ecology.* Washington, D.C.: National Academy Press,

Perkins, L. 1995. *International studbook of the orangutan (Pongo pygmaeus ssp.).* Atlanta: Fulton County Zoo.

Rowe, N. 1996. *The pictorial guide to the living primates.* Charlestown, R. I.: Pogonias Press.

Siregar, R. S. E. 1999. The Wanariset orangutan reintroduction project: Evaluation of problems and future solution. Unpublished Master's thesis, University of Cambridge, U.K.

Sodhi, N. S., and B. W. Brook. 2005. *Southeast Asian biodiversity in crisis.* Cambridge: Cambridge University Press.

Wolfe, N. D., A. M. Kilbourn, W. B. Karesh, H. A. Rahman, E. J. Bosi, B. C. Cropp, M. Andau, A. Spielman, and D. J. Gubler. 2001. Sylvatic transmission of arboviruses among Bornean orangutans. *Am. J. Tropical Med. and Hygiene* 64: 310–16.

Wolfe, N. D., W. B. Karesh, A. M. Kilbourn, J. Cox-Singh, E. J. Bos, H. A. Rhaman, A. T. Prosser, B. Singh, M. Andau, A. Spielman. 2002. The impact of ecological conditions on the prevalence of malaria among orangutans. *Vector Borne Zoo. Dis.* 2: 97–103.

World Wide Fund, 2006. *Living planet report.* Gland, Switzerland: WWF-International.

Yeager, C. P. 1997. Orangutan rehabilitation at Tanjung Putting national park, Kalimantan Tengah, Indonesia. *Cons. Bio.* 11: 802–05.

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Sporotrichosis in a Broad-Footed Mole (*Scapanus latimanus*), a Zoonotic Disease

by Nancy L. Anderson

ABSTRACT: This report describes the diagnosis and zoonotic implications of a case of *Sporothrix schenkii* in a broad-footed mole (*Scapanus latimanus*).

KEY WORDS: *Sporothrix schenkii*, sporotrichosis, broad-footed mole, *Scapanus latimanus*, zoonoses

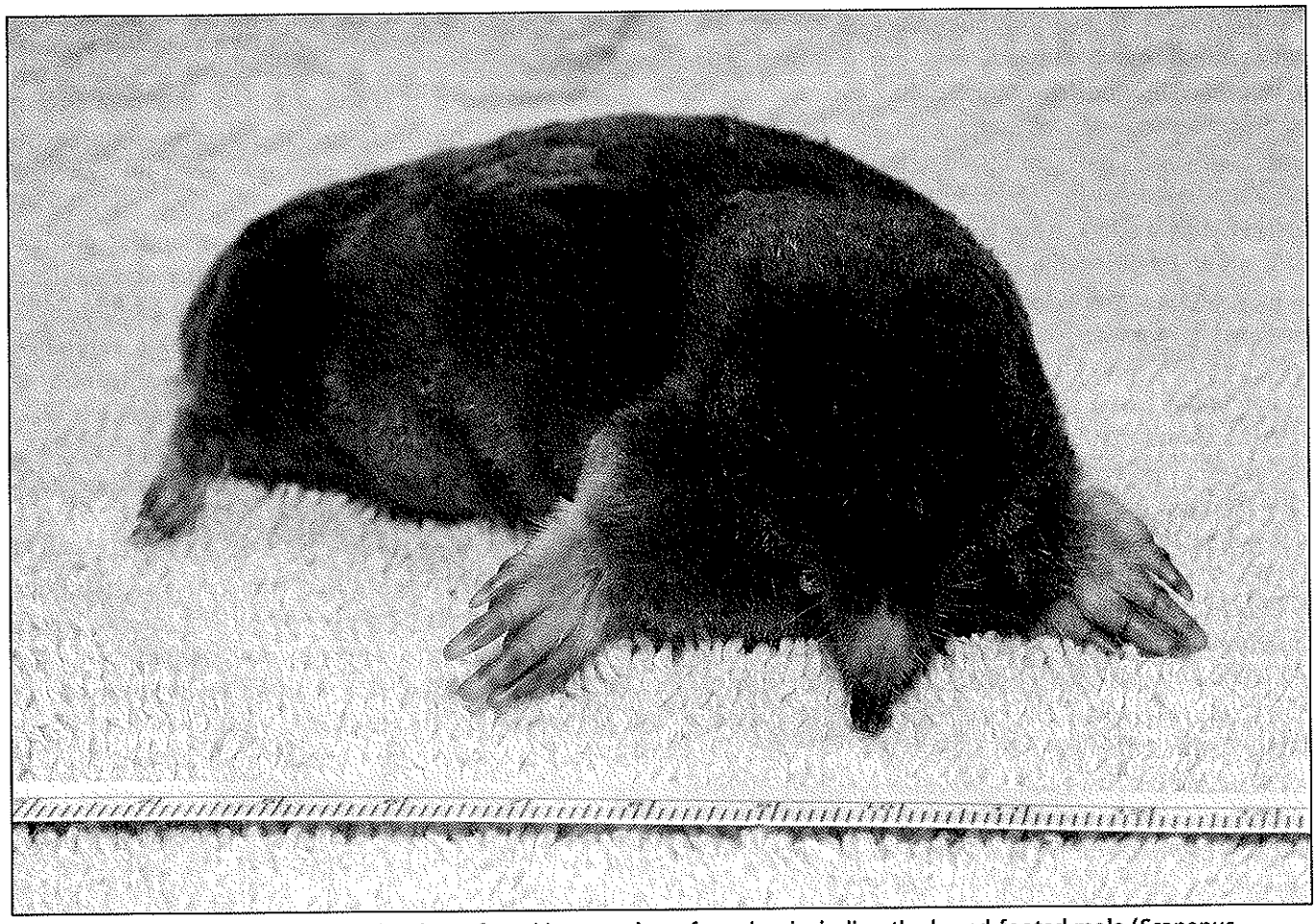
NANCY ANDERSON, DVM, ABVP (AVIAN), PH.D., graduated from the Ohio State University College of Veterinary Medicine in 1988. She worked as a private practitioner (small animals, horses, food animals, exotics) and provided services for local wildlife rehabilitators until 1991, when she joined the faculty at OSU. There she taught general practice, exotic animal medicine and surgery, and was the faculty advisor for the Raptor Rehabilitation Program. In 1997 she started a Ph.D. in ecophysiology; during this time she radiotracked brown tree snakes through the rain forest on Guam. While finishing her Ph.D. dissertation, Anderson joined the staff at Lindsay Wildlife Museum (Walnut Creek, Calif.) in 2000, where she is the staff veterinarian for approximately 6000 wildlife patients per year and a collection of 130 educational animal ambassadors. In her spare time (what's that?), she enjoys outdoor activities such as hiking, bird watching, SCUBA, and canoeing.

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Introduction

Sporothrix schenkii is a dimorphic fungus that is commonly found in soil around the world, with the highest incidence in North and Latin Americas, Japan, and Africa (Schubach et al. 2004). When temperatures are < 30° C, it grows as a mold. At body temperatures of homeotherms (~ 37° C), it grows as a yeast (Schubach et al. 2004). The organisms can cause infections in humans and animals when they gain entrance via wounds and, rarely, when inhaled (Schubach et al. 2003). Common routes of entry are punctures by wood splinters or thorns, scratches, and bite wounds (Scott et al. 2001). The disease is rare to uncommon in people and most animals, but has been identified in many species: cat, dog, fox, ferret, horse, mule, camel, cow, pig, dolphin, rodents, armadillo, chimpanzee, human, and fowl (Frean et al. 1991). The cutaneous form is most common in domestic animals and is associated with multiple firm skin nodules. Nodules may ulcerate and drain or present as ulcerated placques with red, raised borders. Nodules are most commonly located on the head, ears, nasal mucosa, neck, trunk, and distal limbs. Infection may be spread to other areas by grooming (Schubach et al. 2004, Scott et al. 2001, Sykes et al. 2001). In cats, concurrent sneezing or dyspnea occurred 41.8% of the time and were associated with lesions affecting the nasal area (Schubach et al. 2004). Sneezing sometimes preceded visible nodules. Humans usually present with the more serious cutaneolymphatic form in which infection spreads from a cutaneous nodule through lymphatic vessels to local lymph nodes that subsequently enlarge. Secondary nodules often appear near the affected lymph nodes. These nodules can rupture and release brownish red exudate. Resistance to sporotrichosis seems to be somewhat species dependent as dogs are much more resistant to systemic sporotrichosis than cats or humans (Barros et al. 2003, Sykes et al. 2001).

Initial diagnosis is based on finding pyogranulomatous to granulomatous inflammation with pleomorphic (round to cigar shaped) yeast 2–10 µm diameter on cytology. However, abundance of organisms in lesions varies with species. Organisms were rare in lesions in dogs and were visible on cytology in only 62.2% of culture positive cats (Schubach et al. 2004). Abundance of organisms on histopathology varies with presence of granulomatous inflammation. In cats, fungal structures were found in 57.8% of samples when no inflammation was present, but only 4.4% when inflammation was present. (Schubach et al. 2004). Fungal cultures are required for a definitive diagnosis. For best results, cultures should include both a piece of affected tissue and drainage from deep tracts. Though not widely available, a fluorescent antibody test is helpful to diagnose infections when organisms are scarce. Differential diagnoses for sporotrichosis include other causes for ulcerated masses: granuloma (bacteria [*Mycobacterium spp., Yersinia pestis, Francisella tularensis, Nocardia spp., Actinomyces spp.*]), fungus (Histoplasma, Blasto-



JEAN YIM

Sporotrichosis, while not common, has been found in a number of species, including the broad-footed mole (*Scapanus latimanus*). The disease can be spread from animals to humans.

myces, Cryptococcus), virus (pox, herpes), foreign body reaction, and neoplasia (Sykes et al. 2001). Several of the infectious causes of granulomatous cutaneous ulcerated nodules listed above are life-threatening zoonotic diseases that are endemic in wildlife in North America.

The treatment of choice for sporotrichosis in cats and dogs is itraconazole 5–10 mg/kg PO q 24 h at least 30 days past clinical cure (Schubach et al. 2004, Sykes et al. 2001). Nearly 80% of cats in one clinical trial required > 1 year of treatment to provide a cure (Schubach et al. 2004). Treatment with corticosteroids increases the likelihood of developing sporotrichosis in a wound and decreases chances for recovery. Prior to the availability of imidazole drugs, treatment of dogs and cats usually required 20–40 mg/kg potassium iodide mixed with food fed 2–3 times per day (lower dose for cats) or 10 mg/kg sodium iodide PO q 12 h. While as effective as itraconazole (38% cure rate, Schubach et al. 2004), many animals receiving iodine therapy (40.5% of cats, Schubach et al. 2004) show signs of toxicity (e.g., vomiting, anorexia, depression, twitching, low body temperature, heart failure) that require cessation or change in therapy. Treatments with ketaconazole, terbinafine, and diflucan have also been used with varying success.

Clinical Report

An adult broad-footed mole (*Scapanus latimanus*) was presented to the wildlife hospital for being out during the day and having debris on its head. The staff member who performed the intake examination did not follow hospital policy to wear gloves while handling mammals until zoonotic disease risks are minimized (endo- and ectoparasite control, inspection for abscesses/ other discharge). On physical examination, the mole was thin and weighed 54 g. It had crusty matter mixed with dirt on top of its head and crusts on the tip of its prepuce. The staff member used chlorhexidine solution to soften the crust on the head. She then used her fingers to remove the scab to reveal a 1.7 cm raised, ulcerated plaque. The surface of the placque was yellow and friable. The edges of the mass were slightly raised and erythematous. At this point in the examination, the staff veterinarian was asked to examine the wound. Cytology obtained from the mass revealed pyogranulomatous inflammation

(many macrophages, lymphocytes, and neutrophils) with a mixed bacterial infection and budding yeast (3 µm diameter). All handlers washed their hands thoroughly with povidone-iodine. "Wear latex gloves," "Quarantine," and "Staff only" signs were affixed to the mole's enclosure.

Due to concerns for the health of the initial handlers, further diagnostic testing was performed. One-tenth (0.1) ml of 2% lidocaine was instilled under the caudal margin of the mass on the head and a #15 surgical blade was used to remove a wedge for histopathology, bacterial and fungal cultures. The surface of the head wound and the preputial crusts were treated with topical 1% silver sulfadiazine ointment for its antibacterial and antifungal effects. The mole was also treated with 6 ml warmed LRS SQ for dehydration, 30 mg/kg sulfamethoxazole/trimethoprim PO q 12 h for bacterial dermatitis and 10 mg/kg itraconazole PO q 24 h for fungal granuloma. The mole died overnight. Aside from the head mass and crusting on the prepuce there were no obvious lesions observed on gross necropsy. The mass, prepuce, heart, lungs, liver, esophagus, stomach, intestine, and kidneys were submitted for histopathology.

Histopathology of the head mass revealed marked pleocelular inflammation that extended into the underlying musculature. There were 5 µm oval organisms surrounded by a clear halo within the macrophages. The preputial mass had multifocal to coalescing ulcerative and pyogranulomatous dermatitis with intralesional fungi. Gomori methenamine silver stain revealed cigar-shaped organisms with narrow-based budding. This morphology was most consistent with *Sporothrix schenkii*. Aside from mild acute interstitial pneumonia and mild hepatic lipidosis there were no significant lesions observed. The bacterial culture grew a nonhemolytic *Staphylococcus* species and a few *Morganella morganii* that were sensitive to sulfamethoxazole/trimethoprim. Both organisms were considered to be incidental. The fungal culture grew one colony of a *Penicillium* species that was considered to be incidental and many *Sporothrix schenkii*, a well-recognized zoonotic fungi. Handlers were instructed to watch for skin lesions, swollen lymph nodes, fever, joint pain, anorexia, headaches, cough, or other general signs of illness for the next month. If these were observed, they were asked to contact their physician and to inform their supervisors at the wildlife center. Because sporotrichosis is an uncommon disease and requires prolonged, unconventional therapy (8–20 weeks of itraconazole), handlers were asked to specifically report that they had been exposed to *Sporothrix schenkii* (Barros et al. 2003).

Discussion

The presentation of sporotricosis in this mole was most similar to that reported for the cutaneous form in cats (lesion on head, raised, ulcerated lesion with erythematous border, abundance of yeast on cytology, probable spread to prepuce by grooming, no internal organ abnormalities). Because of the similar clinical presentation to cats and the high number of organisms found in the lesion, we suggest that the likelihood of this mole infecting humans would be high, similar to risk associated with direct skin contact with a draining wound in a cat. We speculate that the two handlers involved in this exposure did not contract sportrichosis due to their innate immunity and the immediate post-contact povidine-iodine scrub.

While this mole presented with classical signs of sporotricosis that alerted the staff veterinarian to initiate measures to protect hospital staff and volunteers, not all animals will present with classical signs and most rehabilitation centers do not have a staff veterinarian on site to help make the diagnosis in a timely fashion. Therefore it is imperative that rehabilitation centers develop appropriate protocols for preventing spread of zoonotic diseases. As illustrated in this case, it is also important to ensure that rehabilitation staff and volunteers routinely follow these policies.

When handling any animal with an ulcerated mass with or without obvious exudate it is highly recommended that handlers wear gloves. When finished, the gloves should be inverted when removed and carefully disposed of to prevent infection of other people that may handle the trash. All exposed skin should be washed with chlorhexidine or povidine-iodine (Sykes et al. 2001). Long sleeves are recommended and clothing should be changed and washed after handling an affected animal. Use of a long-sleeved smock that is dedicated to use with the affected animal can work well to minimize laundry.

Precautions are warranted because zoonotic transmission of *Sporothrix schenkii* can occur via casual contact. Only about half of cat owners who contracted sporotrichosis from handling their cats reported a scratch or bite wound (Schubach et al. 2004). In addition to transmission from draining wounds, sporotrichosis has been documented to occur after bites from a wide variety of animals (cats, dogs, rats, other rodents, horses, cows, parrots, chickens, other birds, boa constrictors), after being stung by an insect, and after handling fish, so it is likely that direct contact, scratches, or bites from most wildlife species would constitute a risk for infection. Any rehabilitator who experiences skin nodules or ulcers,

enlarged lymph nodes, unexplained joint pain, or prolonged fever, anorexia, headache, and cough (Schubach et al. 2003) is encouraged to consult with their physician and advise them of their close contact with wildlife. Since these signs are compatible with many common human conditions and many physicians are not familiar with zoonotic diseases endemic in the wildlife in their region, it is often necessary for the rehabilitator to have a list to present to their physician. Rehabilitation centers are urged to work with their consulting veterinarian, local health department, and local physicians to develop a list appropriate for their region and the species treated.

Products Cited

Topical 1% Silver Sulfadiazine Ointment
Hoechst Marion Roussel, Inc.
Kansas City, MO 64137

Sulfamethoxazole/Trimethoprim
Hi-Tech Pharmaceutical Co., Inc.
Amityville, NY 11701
http://www.hitechpharm.com

Itraconazole
Ortho Biotech, Inc.
Bridgewater, NJ 08854

Literature Cited

Barros, M. B., A. O. Schubach, M.C.Gutierrez Galhardo, T. M. P. Schubach, R. S. Reis, and M. J. Conceicao, A.C.F. Valle. 2003. Sporotrichosis with widespread cutaenous lesions: Report of 24 cases related to transmission by domestic cats in Rio de Janeiro, Brazil. *Internat. J. Derm.* 42: 677–81.

Freab, J. A., M. Isaacson, G. B. Miller, B. D. Mistry, and C. Heney. 1991. Sporotrichosis following a rodent bite. *Mycopathologia* 116: 5–8.

Schubach, T. M., A. Schubach, T. Okamoto, M. B. L. Barros, F. B. Figueiredo, T. Cuzzi, P. C. Fialho-Monteiro, R. S. Reis, M.A. Perez, and B. Wanke. 2004. Evaluation of an epidemic of sporotrichosis in cats: 347 cases (1998–2001). *J. Amer. Vet. Assoc.* 224(10): 1623–29.

Schubach, T. M. P., A. Schubach, T. Okamoto, I. V. Pellon, P. C. Fialho-Monteiro, R. S. Reis, M. B. L. Barros, M. Andrade-Perez, and B. Wanke. 2003. Haematogenous spread of *Sporothrix schenkii* in cats with naturally acquired sporotrichosis. *J. Small. Anim. Pract.* 44: 395–98.

Scott, D. W., W. H. Miller, and C. E. Griffin. 2001. *Small animal dermatology,* 6th ed. Philadelphia: W. B. Saunders Co.

Sykes, J. E., S. M. Torres, P. J. Armstrong, and C. J. Lindeman. 2001. Itraconazole for treatment of sporotrichosis in a dog residing on a Christmas tree farm. *J. Amer. Vet. Assoc.* 218(9): 1440–43.

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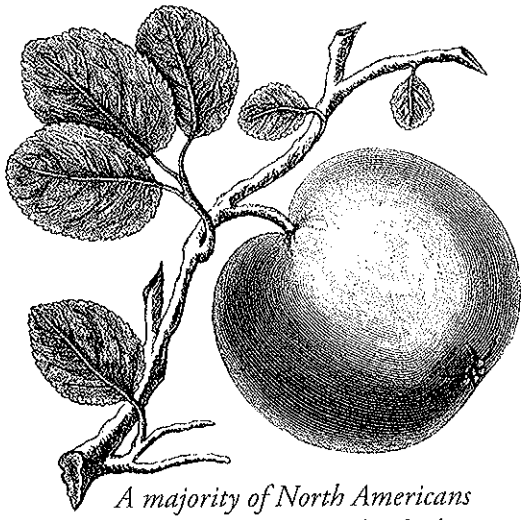
PHOTO: MIKE QUINN/TEXAS PARKS & WILDLIFE DEPARTMENT

Animal, Vegetable, Miracle: A Year of Food Life

by Barbara Kingsolver, with Steven L. Hopp and Camille Kingsolver

New York: Harper Collins, 2007; 384 pages; U.S. $26.95

Reviewed by Elsa Bumstead



A majority of North Americans do understand, at some level, that our food choices are politically charged, affecting arenas from rural culture to international oil cartels and global climate change.

—Barbara Kingsolver

In this day and age of questions about our food and its safety, the Kingsolver/Hopp family book arrives at a propitious time. It chronicles the family's journey from Arizona to Virginia and its deliberate move away from grocery store dependence to family farm independence.

Agribusiness has taken over the production of food in a very big way since WWII. The intent of application of pesticides to the land has been to reduce weeds and raise more crops. The development of concentrated animal feeding operations has allowed more poultry and livestock to be raised in less and less space and in more crowded and horrid conditions. All in the name of food production, "...but not to feed the poor. Most of it becomes animal feed for meat production, or the ingredients of processed foods for wealthier consumers who are already getting plenty of calories."

As the Kingsolver/Hopp family's year of food life unfolds, there is plenty to think about. I was reminded of my childhood memories at my grandparents' house—the chicken coop, the large garden, the apple, cherry, and pear trees, the raspberry and blueberry bushes. I loved putting my hand under each hen to gather eggs. I watched the chickens slaughtered for the freezer. I helped put food by in boxes for the freezer, root vegetables in the root cellar, and in glass canning jars for the pantry in the cellar, and store root vegetables in bins in the root cellar. Underlying this local family farm was an appreciation of the land, and of the wildlife that lived nearby. It was an organic operation, pesticide and chemical free. The micro-organisms and soil-building critters in the compost were valued. My grandfather married the harvest of game meat with wild berries and cultivated crops.

Animal, Vegetable, Miracle will take you on a similar journey through the first year of food production on the Kingsolver/Hopp family farm. You'll learn that the concept of community extends not only to village and town, but to wildlife, living in harmony with the land, rhythms of give and take, withdrawal and deposit, compost vs. harvest. Protection of predators? What a concept! They do provide valuable, free services in the garden.

You'll learn about slow food, as opposed to fast food ("drive-through dining"). Not only is slow food more nutritious, it allows one to savor all the ingredients and flavors. There are wonderful recipes gleaned from cookbooks and family sources that are shared with friends.

You'll learn about "local" food, that which is produced within a certain defined radius, and which doesn't cost much to get to farmer's markets and local grocery stores.

You'll learn about agritourism—the development of "U-pick operations, subscription farming, and farm-based restaurants or bed-and-breakfasts." It's an expanding economic base with far-reaching implications.

"Many of us who aren't farmers or gardeners still have some element of farm nostalgia in our family past, real or imagined: a secret longing for some connection to a life where a rooster crows in the yard," Kingsolver writes. Why not join her family today? "In a nation pouring its resources into commodity agriculture—corn and soybeans everywhere and not a speck fit to eat—*back to the land* is an option with a permanent, quiet appeal." Her book is an engaging look at the food chain, the web of life, the circle coming 'round. Just might start you thinking about how you could detach from the global petroleum-based economy. Just might do that. Victory gardens, here we come! JWR

Elsa Bumstead is a field biologist and writer who lives in Albuquerque, New Mexico.

Bugs & Drugs

WATER, WATER EVERYWHERE!

by Kathy Dolan

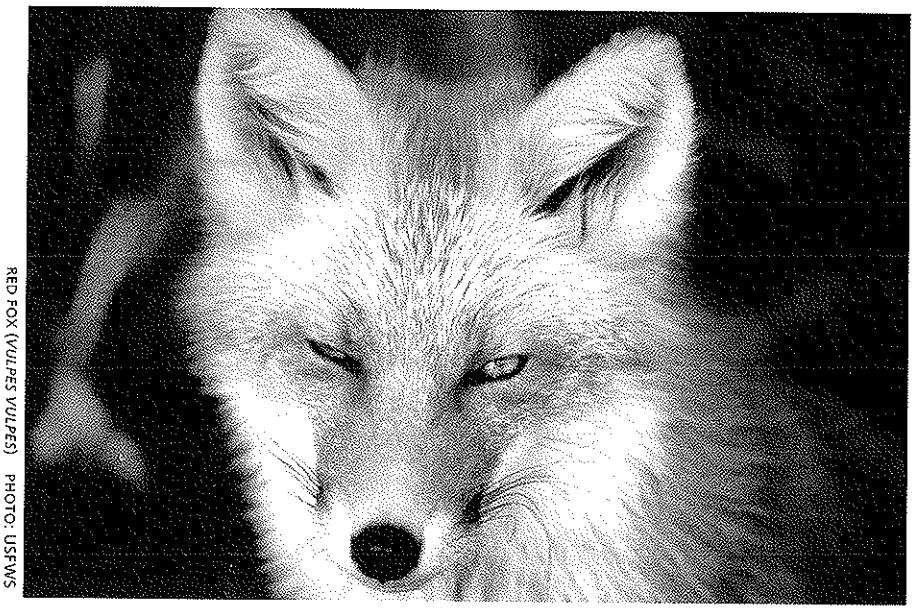
Joining the spate of bottled water products is a new product called SmartWater® by Glaceau. Rehabilitators have questioned the use of SmartWater® as an oral rehydration product. The following letter I recently received summarizes these questions.

> **SmartWater® is sold as an electrolyte-enhanced water. Is it suitable to orally hydrate wildlife in the way Pedialyte® is used by many rehabilitators today? Can a bottle of SmartWater® be used safely over a period of weeks after it has been opened?**

Before these questions can be addressed, a brief look at dehydration and the solutions commonly used for oral rehydration is necessary.

Wildlife brought to a rehabilitator is usually suffering from some degree of dehydration—the loss of body fluids, namely water. Dehydration can result from physical injuries (acute blood loss), disease processes (fever, chronic blood loss, diarrhea, vomiting), or even emaciation. An animal that is not getting food is most likely not getting sufficient fluids either. And of course, there is normal fluid loss through normal respiration.

Another aspect that goes along with fluid loss is the loss of essential electrolytes: sodium, potassium, chloride, as well as calcium and magnesium. These charged ions regulate vital functions of the body. Sodium, potassium, and chloride work together to maintain proper fluid balance in and between tissues. In addition to its much-touted roles in bone development, calcium is also needed for transmission of nerve impulses and muscle contraction. And finally, loss of fluid compromises the blood's ability to carry vital nutrients to tissues and organs, as well as to remove waste material from the tissues.



RED FOX (*VULPES VULPES*) PHOTO: USFWS

Rehydration, or replacement of lost fluids and electrolytes, early in the care of a dehydrated animal can mean the difference between life and death for that animal. Rehabilitators should be aware of the variety of replacement solutions and techniques that are available to deliver the replacement solutions to a dehydrated animal depending on the degree of dehydration.

Because of its ease of mastery and noninvasiveness, oral hydration will be the method of choice for the rest of this column. Note of caution: if an animal is unconscious, or unable to hold its head up, gavage is *not* the method of choice for rehydration. Animals in these conditions need more invasive fluid-replacement methods. (The author recommends training with a veterinarian or taking a fluid therapy class.)

Water is cheap and plentiful, and is recommended for slight or very mild dehydration. If the animal is able to stand and drink on its own, it will take care of its own hydration needs. Water can also be delivered to the animal by gavage. However, water alone neither replaces lost electrolytes nor restores their balance.

Better replacement solutions are those that contain concentrations of sodium, calcium, or other electrolytes that are approximately equal to the body's concentrations of electrolytes—in other words, isotonic solutions. Rehydration solutions that match the solute (salt) concentration of normal body fluids are referred to as *isotonic*. Solutions that have higher solute concentrations are *hypertonic*; those solutions that have lower solute concentrations are *hypotonic*.

TABLE 1. COMPARISON OF ELECTROLYTES IN REHYDRATION PRODUCTS MILLIGRAM (MG) ELECTROLYTE /100 ML SOLUTION

Product / Dissolved Electrolyte	Water	Physiological Saline	Lactated Ringer's Solution (LRS)	Lactated Ringer's with 5% Dextrose (LRD5)	Normosol-R	Pedialyte® (unflavored)	SmartWater®
Na^{+1} sodium	0	354.04 mg	299.62 mg	299.62 mg	321.86 mg	103.45 mg	0
Cl^{-1} Chloride	0	545.98 mg	387.91 mg	387.91 mg	347.44 mg	117.60 mg	3.96 mg*
K^{+1} Potassium	0	0	15.73 mg	15.73 mg	19.55 mg	74.00 mg	1.00 mg
Ca^{+2} Calcium	0	0	5.45 mg	5.45 mg	0	0	1.00 mg
Mg^{+2} Magnesium	0	0	0	0	3.65 mg	0	1.50 mg
Lactate	0	0	246.40 mg	246.40 mg	0	0	0
Dextrose, (glucose)	0	0	0	5.00 g	0	2.50 g	0

Milligrams calculated from Equ and mole fractions for direct comparisons of individual electrolytes.
* derived from calculations

Commonly used isotonic solutions used to reverse dehydration are physiological saline, Lactated Ringer's solution (LRS), and Normosol-R. The solutions are not identical; each has a slightly different electrolyte composition and concentration. Physiological saline contains only sodium chloride (table salt) at physiological concentrations 0.9%. Lactated Ringer's solution (LRS) contains sodium, potassium, chloride, calcium, and sodium lactate, while Normosol-R lacks chloride but contains acetate and gluconate. Lactate, acetate, and gluconate act as buffers to help re-establish proper fluid pH, which can go awry during illness, shock, or emaciation. The concentrations of various salts of each replacement fluid are readily available from published sources, the manufacturer, or the Internet.

While the above solutions correct fluid deficits and also electrolyte imbalance, they contain very few calories. Sometimes fluids containing a small amount of carbohydrate, namely dextrose (glucose), which is readily absorbed by the gastrointestinal system are chosen for use. Solutions such as unflavored Pedialyte® (full strength or half strength) or half-strength Lactated Ringer's with 5% dextrose (LRD5) not only hydrate and address electrolyte deficiencies, but also provide a few calories in the form of dextrose. (For a complete discussion on the use of glucose in replacement fluids, please see Perlman and MacLeod 2003.)

How does SmartWater® fit into this situation? It is advertised as an "electrolyte-enhanced water," not an electrolyte-replacement fluid. According the ingredient list on the bottle, SmartWater® contains "vapor distilled water+electrolytes," calcium

chloride, magnesium chloride, and calcium carbonate. However, the concentrations of the electrolytes are neither provided in the ingredient list nor on the manufacturer's website (www.glaceau.com). Distilling water removes metal-based impurities, such sodium, chloride, and calcium. A phone call to the company was necessary to obtain the concentrations of electrolytes added to the distilled water. When comparing the concentrations of electrolytes in SmartWater® to electrolytes in other fluids (Table 1), two things are obvious immediately. First, there is no sodium in SmartWater®. Sodium, along with potassium and chloride, is needed to re-establish and maintain proper tissue fluid balance. While humans consume too much sodium in their normal diets, wild animals rarely ingest unhealthy amounts of sodium. For many wild animals sodium (salt lick) is an essential and sought-after nutrient. Secondly, the concentrations of potassium, chloride, and magnesium in SmartWater® are significantly lower than in other replacement fluids. Also there is no carbohydrate contained in this product, and so it provides no energy for an animal (human or otherwise), that receives it. While this product could be used as a rehydration fluid, like water, it cannot be used as an electrolyte-replacement fluid. If used as water for simple rehydration, why not just use water? It's cheaper.

How long can a solution like SmartWater® can be stored after opening? There is no definite answer. In a perfect world, the unused portion should be discarded. The concern is with bacterial contamination and growth in the product. Bacteria and other microbes are all around us, floating in the air, settling out onto surfaces, growing in and on us. When a bottle is opened, or an aliquot is removed from a bag of fluids, there is a risk that bacteria in the air, on the port surface or on our hands will enter the container and contaminate the material. Multiple punctures to withdraw fluids from a bag physiological saline or LR5D increase the risks of bacterial contamination of the contents. Bacteria are not a desired component in *any* fluid used to rehydrate an animal by *any* method!

Dextrose is an important energy nutrient for many bacteria, and its presence will enhance bacterial growth many fold. Fluids that contain dextrose will readily support the growth of contaminating bacteria. Even solutions that contain only electrolytes can support the growth of some potentially opportunistic pathogenic bacteria, such as *Pseudomonas aeruginosa.* Bacteria, like *P. aeruginosa,* are oliogotrophic. They do not need sugars to grow, only very minute quantities of organic material. These bacteria will grow very nicely in LRS or in SmartWater®.

What to do with the rest of the bottle or bag? Date and refrigerate the unused portion immediately! But remember, refrigeration does not kill bacteria, it merely slows down bacterial growth. The bacteria are still in there, just growing very slowly. (Imagine Tim Conway doing the old man routine: that is how the bacteria are growing.) The unused portion should only be stored for a few days before discarding. Before removing another aliquot from the bottle or bag after refrigeration, visually check the fluids for suspended particles. If white particles are seen floating in the fluid, do not use it. Throw it away. If nothing is seen floating, watch the bottom of the bottle/bag while gently shaking the contents. If white wispy material or white clumpy material rises from the bottom of the bottle or bag, do not use it. Throw it away.

As a final note, good practices on the part of the rehabilitator can reduce the risk of bacterial contamination of rehydration fluids. Care should be taken whenever fluids are removed from a bottle: pour out the approximate amount needed, never stick syringes or feeding tubes directly into the container, do not pour unused fluids back into the container, replace caps, and refrigerate unused portions promptly. Contamination of bags of fluids can be reduced by wiping the port with alcohol and allowing it to dry before inserting a *sterile* needle attached to a *sterile* syringe. Reducing the number of times a bag is punctured also reduces the risk of bacterial contamination. The number of needle sticks can be reduced by attaching an IV set and allowing fluids to flow directly into tubes. JWR

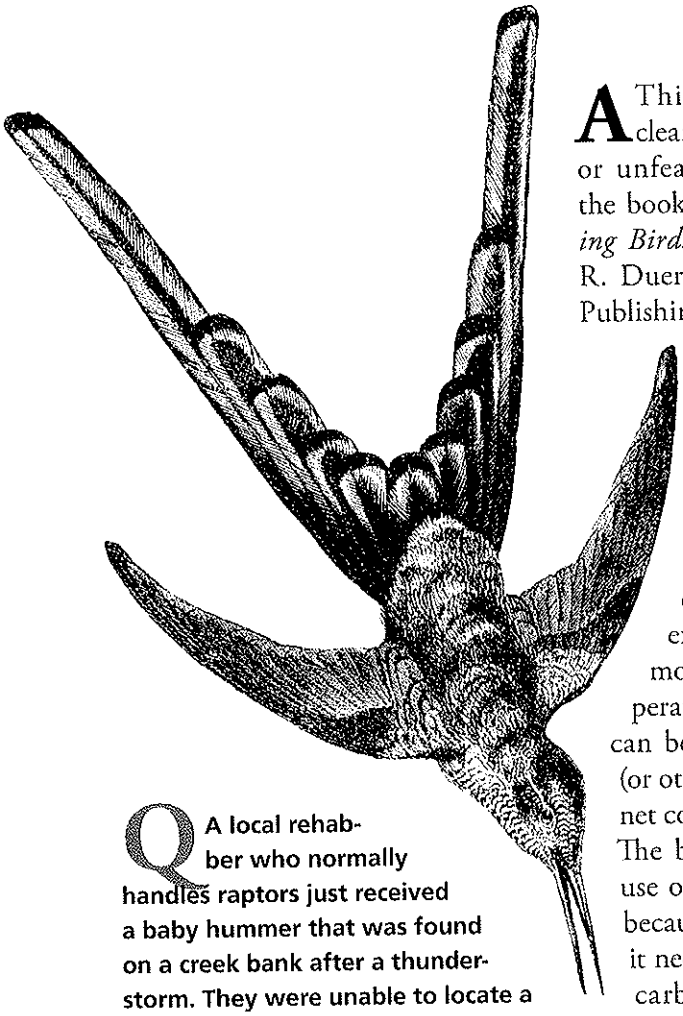
Literature Cited

Perlman, J., and A. MacLeod. 2003. Stayin' alive, stayin' alive: Feeding ill and emaciated birds. *J. Wildlife Rehab.* 26(4): 8–20.

Kathy Dolan, MS, is an instructor of microbiology at Nashville State Community College in Nashville, Tennessee. She can be reached at k2dolan2001@yahoo.com.

Hummer Diet Update

by Penny Elliston



Q A local rehabber who normally handles raptors just received a baby hummer that was found on a creek bank after a thunderstorm. They were unable to locate a nest. The baby squeaks, eats (every 15 minutes), and is covered with pinfeathers. A friend at the zoo has supplied a protein/sugar mix that is made for young hummers. The bird gapes and eats readily at first, but doesn't seem to really like this mix.

I found a sugar water and fruit fly diet on a hummer rehab website but I substituted mealworm guts because fruit flies are ridiculously expensive here. Is there a specific mealworm guts to sugar water ratio I should use? I'm worried about giving him too much of one and not enough of the other.

—Nancy A., Arizona

A This bird is a nestling and clearly needs the diet for naked or unfeathered birds provided in the book excerpt from *Hand-Rearing Birds,* edited by L. Gage and R. Duerr (Ames, Iowa: Blackwell Publishing) that begins on page 26.

The fact that the bird is squeaking (calling its parent) suggests that it was orphaned and has overridden its security strategy of silence while unflighted.

I have to smile at your complaint that fruit flies are expensive. During summer months most people are desperate to get rid of them. They can be cultivated with a banana (or other fruit) in a jar with a fine net cover and frozen for use later. The book excerpt discusses the use of meal worms. In addition, because the bird is not yet flying, it needs no more sugar than the carbohydrate in VitalHN® to meet its present needs.

Q Yesterday afternoon I received a "fledgling" ruby-throated hummer. Rather, I *believe* it is a fledgling, rather than an adult, due to the presence of some very fine downy feathers sticking out from its back and some heavier ones near its legs. It is also a little smaller than the mature ones I have received in the past.

Overnight, I gave it a sugar/H_2O mix. This morning I brought it a garden that is visited by *a lot* of hummers, set it on the feeder, and watched all day. The hummer was very alert, especially when the adults came looking around. By the end of the day, it seemed to be worn out and began falling off the feeder—maybe too exhausted to hang on anymore.

Is it possible this little one should still be *in* the nest? It made no attempt to fly, yet flapped its wings several times as if warming up. Is it possible the local adults will care for it? Or will they ignore it—or injure/kill it?

—Gail C., North Carolina

A It certainly sounds as though this is a fledgling. This can be ascertained by observing the length of the bill and whether the bill is shiny, as in the polished bill of an adult, or has fine corrugations down its length.

The bird may have been kidnapped after its first flight, or it may have been orphaned. In any case, it will need you as a surrogate parent for at least the next 2 weeks. It is apparently not yet skilled in flight. If that is the case, it has not yet even begun to learn to forage. The local birds, not being Mother, are unlikely to feed it and may harass it in typical hummingbird territorial fashion. I would confine the bird in a relatively small cage until it can fly well and find its food. Then I would introduce a culture of fruit flies into the flight so that it can learn to hunt. Until the hummer can catch flies and is no longer calling, I would feed it the fledgling/adult diet bird recipe in the following excerpt from *Hand-Rearing Birds.*

The recipes and figure below are excerpted from the hummingbird chapter of the forthcoming book *Hand-Rearing Birds*, edited by L. Gage and R. Duerr (Ames, Iowa: Blackwell Publishing)

FLEDGLING AND ADULT HUMMINGBIRD DIET

(Based on Elliston and Perlman 2002)

Fledglings that are developing independence can be fed this recipe, as can adult birds in care.

Mix the following ingredients; freeze the resulting solution as ice cubes.

25 g granulated table sugar

75 ml water

4 g VitalHN®

1.8 g powdered whey concentrate (Note: Whey is available in several consistencies and individual measuring spoons may vary considerably. It is important to weigh the powders until the relationship of volume to weight has been established for your equipment.)

To each day's thawed food (10 ml), add:

0.5 cc (~10 drops) of plain live-culture yogurt

1 drop of (5:1) cod liver oil:vitamin E

Small pinch of B-complex-plus-C vitamins (until the solution is a light lemon-yellow color)

- If the bird is a juvenile or has a possibly fractured bone, add 0.25 cc of NeoCalGlucon® to 10 ml food.
- This food contains 20 mg/ml of protein. Eating 5 ml/day will provide the approximate amount needed to sustain an adult's protein requirements. If a bird is given this mix, nectar (1 part sugar: 4 parts water), and plain water, it will choose the proportions of each that it needs. It has been observed that the older the bird is, the more personal the preference may be for sweetness. Adjustments for taste may be needed with small additions of sugar to coax the bird into readily drinking this mixture.
- Liquid food can be offered in 3 ml syringes. The nutrient mix is more susceptible to bacterial and fungal growth than water or sugar alone, and should be monitored carefully for signs of spoilage. **Dripping is a sign of fermentation and gas formation.** Hummingbirds will not eat something that tastes at all sour. They will starve first.
- A culture of flying fruit flies should be made available to flighted birds so that they will learn through practice how to catch small insects. As they become proficient at foraging and consume more flies, intake of the protein-rich liquid food will diminish, and plain nectar and/or water consumption may rise. When they are about 2 weeks after fledging in age, the birds are ready to be assessed for release. Black-chinned hummingbirds have a bill length of 13 mm when they fledge at 21 days. Their bills reach adult length 2 weeks later (Elliston and Baltosser 1995).
- VitalHN® (Ross Pharmaceuticals) is available in single packages from The Squirrel Store.
  Tel: 1/866/907-7757 (toll-free)
  Fax: 205/664-1386
  Website: www.thesquirrelstore.com/category.cfm?Category=29

NAKED NESTLING DIET FOR HUMMINGBIRDS

(Elliston 2007)

Development of an optimal naked nestling diet for hummingbirds is an ongoing effort. While a number of details regarding the components of suggested diets are clear, there have always been problems collecting adequate growth data to discriminate between recipes. Either people who keep meticulous data get too few birds to compare results; people who get numerous appropriate birds are too busy raising them to collect the necessary data; or others who have data for use, for various reasons, don't make them available for public examination. In any case, the work goes on, and those raising baby hummingbirds should make every effort to communicate with others regarding new findings.

The following protocol is recommended for *very* tiny, naked nestlings.

Mix 1:

To 8 g VitalHN® in 33 ml water (no extra sugar!) add 1/20 of a B-complex-plus-C vitamins tablet (produced for humans). Result should be light lemon yellow color.

In a separate dish, thoroughly mix 7 drops fish body (omega-3) oil, 2 drops of cod liver oil, and 1 drop of vitamin E.

Add 0.025 ml of the second mixture to the 33 ml of liquid food; mix well. 4. For each day's food, add one drop (0.05 cc) of live-culture yogurt per cc of food.

Refrigerate between feedings.

Mix 2:

To 10 cc of calcium glubionate (23 mg/ml Ca), add a sand-grain-sized bit of a B-complex-plus-C tablet and crush/dissolve/mix, so that the resultant solution is light-lemon-colored. (Any form of calcium can be used that results in the same concentration of elemental calcium; calcium glubionate is available as pediatric drops.)

Thoroughly mix 7 drops fish body (omega-3) oil, 2 drops of cod liver oil, and 1 drop of vitamin E. *Add the smallest drop possible of this to the above mixture.*

This is "supplemented calcium glubionate."

Insect Component:

Drain on paper towel, and weigh 2 g live or frozen tubifex (blood, red, or black) worms. Grind thoroughly with a mortar and pestle.

Add 0.60 ml of supplemented calcium glubionate (above), which equals 0.03 ml for every 100 mg (0.1g) of insect by weight. Grind to mix.

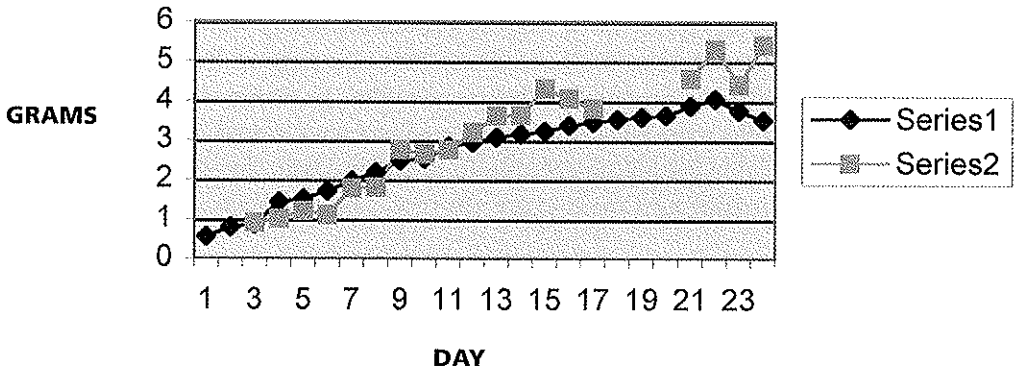
Add a toothpick tip amount of live culture yogurt for each 1 ml of food and mix.

Draw into a 1 ml syringe and deliver through a catheter.

Refrigerate between feedings.

Both Mix 1 and Mix 2 will pass through the very tiniest of catheters. As the bird grows and larger catheters can be used, other tiny insects that may have a greater particulate component than ground tubifex can be added to the insect slurry or to the fluid mix. As with all baby birds, diverse foods are always beneficial. "White" mosquito larvae and fruit flies—including dried versions of these—are

TABLE 1: AVERAGE GROWTH OF HUMMINGBIRDS IN WHICH INSECTS WERE ADDED TO THE STANDARD STRENGTH VITALHN®



Average growth of seven black-chinned (Series 1; N = 7) and four Anna's (Series 2; N = 4) hummingbirds

good foods. Frozen tropical fish dealers have a variety of such foods to choose from. The innards of meal worms are not recommended, as they seem to make the birds logy and unresponsive. All the "worms" mentioned above are one stage of flying insects, the bird's natural foods. It is beneficial to add some recently live insects to the mixture to provide certain enzymes and microbes that may not be present in the dried or preserved foods.

Insects such as fruit flies, midges, leaf hoppers, brine shrimp can be fed whole with forceps to gaping birds. The chitinous coverings of any of these little animals all break down into tiny plates that can be digested and/or excreted by baby hummingbirds.

Figure 1 shows the average growth of seven black-chinned hummingbirds (Series 1) and four Anna's hummingbirds (Series 2) in which insects were added to the standard strength VitalHN®(Van Epps 1999). Although the data are not as robust for the larger Anna's, comparison of the two curves indicates that good growth results can be obtained by feeding VitalHN® and insects separately or adding insects to the liquid mix. The only limiting factor is the size of the feeding implement, which can be mitigated by grinding the insects prior to adding them to the mix, as recommended above, or by blending in the liquid diet. (Note: The growth curves in Figure 1 were gathered using a diet composed of standard strength VitalHN® and insects that was developed in the 1990s. However, this diet has been subsequently been re-evaluated. The author's currently recommended diets are above.)

References

Elliston, E. P. 1999. Raising black-chinned hummingbirds. *International Wildlife Rehabilitation Council 22nd Annual Conference Proceedings.* Tucson, Ariz.

——— In press (2007). Hummingbirds. In *Hand-Rearing Birds* edited by L. Gage and R. Duerr. Ames, Iowa: Blackwell Publishing.

Elliston, E. P., and Perlman, J. 2002. Meeting the protein requirements of adult hummingbirds in captivity. *J. Wildlife Rehab.* 25(2): 14–19.

Van Epps, L. 1999. Care and feeding of the hummingbird. *International Wildlife Rehabilitation Council 22nd Annual Conference Proceedings.* Tucson, Ariz.

Voice from Abroad

THE BOWERBIRD AND THE SANDPIT

by Eric Terzaghi

The Atherton Tableland rises abruptly to about 3000 feet from the central Queensland (Australia) coast and overlooks the Coral Sea and the Great Barrier Reef. In times past, this ancient volcanic plateau was covered in subtropical rainforest, and now is gently rolling countryside given over largely to farming with scattered forest remnants. The strangler fig is one of the more spectacular features of these remnants. Here and there is found evidence of the volcanic past in the form of vent lakes and waterfalls plunging over basaltic ledges.

Our quarry was the fabled bowerbird, one of the 18 species that are limited to Australia and Papua, New Guinea. We were armed only with the briefest sort of sketch map, which bore a striking resemblance to a scrap of paper issued to the participants in a child's birthday party treasure hunt, on which "X" marked the prize. We had imagined that a creature as exotic as a bowerbird would be highly secretive and carry out his peculiar rituals hidden away in dense bush. Accordingly, we assumed that the "X" marking the spot was merely indicative, as it was shown between the jungle gym and the sandpit (sandbox, for North American readers) in the yard of Mt. Molloy Primary School. A thorough search of the surrounding bush yielded nothing even vaguely resembling a bowerbird retreat.

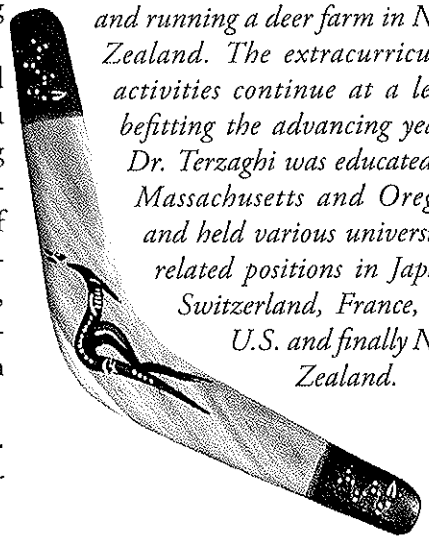
We gave up and sought assistance at the school. Finding the administration office occupied only by the school principal, we sheepishly asked if he happened to know anything of a bowerbird "nest" in the neighborhood. "Oh, yes, please come with me and I'll show you." As it turned out, the school has an active environmental-awareness program that entails, among other things, the maintenance of a natural bush habitat in a substantial corner of the schoolyard—bounded by the jungle gym and the sandpit! Their crowning achievement, in which the kids took especial pride, was seducing, so to speak, a male bowerbird into setting up shop in their environment corner. Indeed, they were fiercely protective of "their" bowerbird. We were told to just sit quietly for a little while at a discreet distance.

In due course, a splendid male satin bowerbird (*Ptilonorynchus violaceus*) appeared, bearing a brightly colored bit of plastic. This was added to his pile of bottle caps, bits of candy wrappers, marbles, and other odds and ends one might expect to find in a primary school playyard that he had gathered to decorate the doorstep of his bower. The latter was less a real cave, as is constructed by some species, but a more simple clearing between two clumps of grass that have been pressed over the clearing to form, well, a bower.

We next noticed another bird quietly appear, but no, it was not a female, but another male, a young one, we realized, who kept a respectful distance. Hmm, is this to be a turf confrontation rather than a courtship? No, it is an "apprentice" male, as, we later read, the protracted routine is apparently learned rather than "hard-wired" instinctive behavior.

Finally, there came the female. The first male, assured of his audience, embarked on his floor show in front of his bower. To our untrained eyes and ears it was clearly a song and dance routine but of no particular form or progression. Eventually, the participants vanished back into the bush from whence they had come, with nothing, to our knowledge, having been consummated.

To our astonishment, we later learned that the bower is merely the collection point for the colored bits and the stage upon which the male performs. They are, in a sense, an extension of his plumage, which in this case was not particularly eye-catching or spectacular. After mating, the female then goes off to build a nest and raise a family, with no apparent assistance from the male. He is too busy with image creation and serial polygamy. And it turns out that a primary school playground provides a perfect location for this activity, being supplied with plentiful raw material. JWR



Eric Terzaghi is a molecular geneticist with a long-standing love of the outdoors and travel. He is now "retired" and running a deer farm in New Zealand. The extracurricular activities continue at a level befitting the advancing years. Dr. Terzaghi was educated in Massachusetts and Oregon and held various university-related positions in Japan, Switzerland, France, the U.S. and finally New Zealand.

Bug Napper

by Denise Coil and Penny Elliston

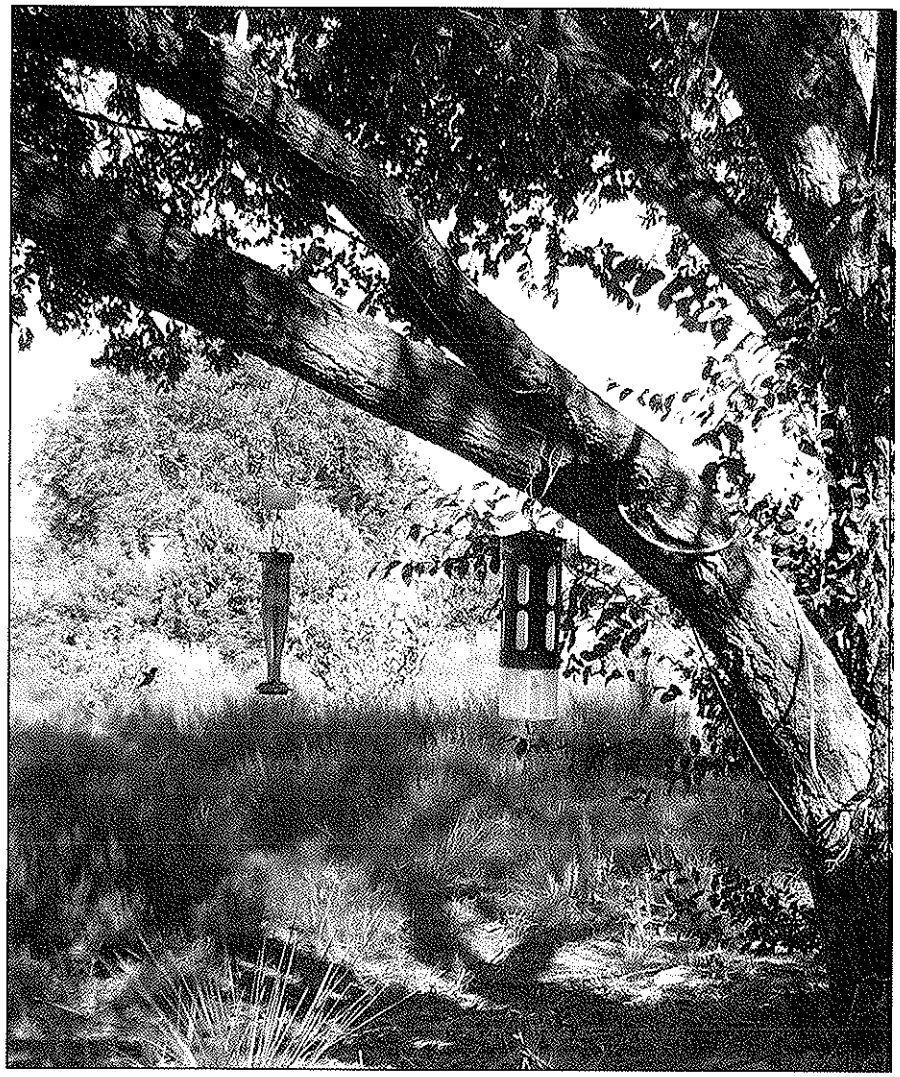
Finding a broad selection of insects to feed to growing captive wildlife is always a problem. Different kinds of bugs and beetles may be plentiful for short periods during the year, but catching them in numbers and preserving them for the future is an ongoing concern.

A certain number of moths, June bugs and other seasonal delicacies can be captured off one's screen door, or attracted into an outdoor flight with a black light. But these techniques have a variety of limitations and drawbacks, not the least of which are the hours available to the rehabilitator to harvest insects.

From Zoo Med Labs, specialists in support items for herpetiles, comes the Bug Napper live insect catcher. The attractant in this trap is a fluorescent bulb under which lies a funnel to direct insects into the jar at the bottom. There is a selection of funnels for limiting the size of the insects trapped, and the bugs don't escape from the collection jar even when it is being removed from the light. The plastic jar screws off the light and has a screw-on lid. The jar full of bugs can be placed in the fridge to slow the insects down before they are given as live food, or they can be packed in a Ziplock bag and frozen.

Swallows will eat cold or frozen insects readily from tweezers. Refrigerated moths can be offered in the flight cage to fledgling phoebes as part of their "kill training." The first day of hunting these bugs bring very poor results. However, in our experience, after 3 days of hawking moths, the phoebes are extremely proficient in catching their prey.

In addition, the light can be hung inside a flight cage for nocturnal birds, such as little owls. The attracted bugs can be picked off by the owls on their way to the light, or accumulated inside the flight for other more diurnal insect-eating species, like kestrels, to work on during the next day.



Denise Coil manages the Wildlife Rescue of New Mexico rehabilitation clinic and specializes in insectivorous birds.

Penny Elliston is a Certified Wildlife Rehabilitator specializing in birds and has worked in conjunction with Wildlife Rescue of New Mexico for more than 25 years.

The Bug Napper is available from pet supply companies or online at:

www.zoomed.com
www.petguys.com
www.amazon.com

(search sites for "Bug Napper")

AVIAN

Cache Protection Strategies by Western Scrub-Jays (*Aphelocoma californica*): Hiding Food in the Shade

by J. M. Dally, N. J. Emery, and N. S. Clayton
Proc. Royal Sci. 271(Biology Letters Supplement): S387–90

In the presence of conspecifics, food-caching western scrub-jays (*Aphelocoma californica*) implement a variety of strategies to reduce the chances of cache theft. This experiment aimed to determine whether the jays could exploit an environmental variable, the level of ambient light, to reduce the transfer of visual information to potential pilferers. Each jay was allowed to cache non-degradable food in two trays, one of which was well lit, whereas the other was in shadow. In some trials the birds cached in private and in others they were observed; however, they always recovered their caches in private. When observed the jays preferentially cached in the shaded tray, whereas both trays were used equally when caching in private. By caching in shaded sites, the quality and transfer of visual information available to the observer may be reduced, thereby making the location of cache sites less certain. These results suggest that western scrub-jays may selectively cache in the shade as a strategy to reduce the chance of cache theft by observing conspecifics.

Food-caching Western Scrub-Jays Keep Track of Who was Watching When

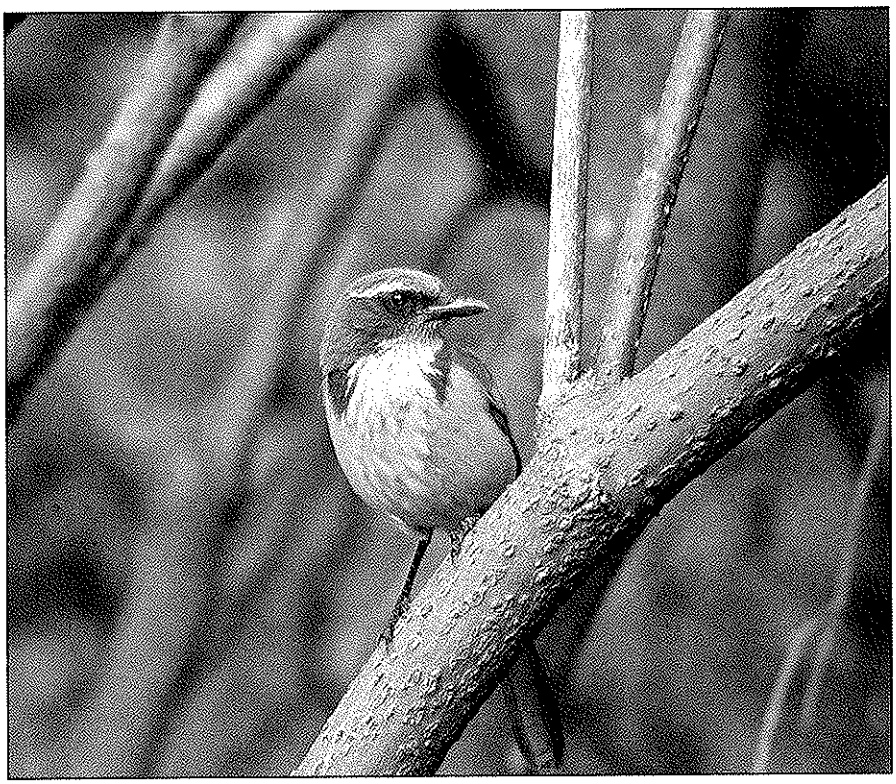
by J. M. Dally, N. J. Emery, and N. S. Clayton
Science 312(5780): 1162–65

Western scrub-jays (*Aphelocoma californica*) hide food caches for future consumption, steal others' caches, and engage in tactics to minimize the chance that their own caches will be stolen. The authors show that scrub-jays remember which individual watched them during particular caching events and alter their recaching behavior accordingly. They found no evidence to suggest that a storer's use of cache protection tactics is cued by the observer's behavior.

Planning for the Future by Western Scrub-Jays

by C. R. Raby, D. M. Alexis, A. Dickinson, and N. S. Clayton
Nature 445(22 February 2007): 919–21

Knowledge of and planning for the future is a complex skill that is considered by many to be uniquely human. We are not born with it; children develop a sense of the future at around the age of two and some planning ability by only the age of four to five. According to the Bischof-Köhler hypothesis, only humans can dissociate themselves from their current motivation and take action for future needs: other animals are incapable of anticipating future needs, and any future-oriented behaviors they exhibit are either fixed action patterns or cued by their current motivational state. The experiments described in this article test whether a member of the corvid family, the western scrub-jay (*Aphelocoma californica*), plans for the future. The authors show that the jays make provision for a future need, both by preferentially caching food in a place in which they have learned that they will be hungry the following morning, and by differentially storing a particular food in a place in which that type of food will not be available the next morning. Previous studies have shown that, in accord with the Bischof-Köhler hypothesis, rats and pigeons may solve tasks by encoding



WESTERN SCRUB JAY (*APHELOCOMA CALIFORNIA*) ON NEST PHOTO: LEE PERRY/USFWS

the future but only over very short time scales. Although some primates and corvids take actions now that are based on their future consequences, these have not been shown to be selected with reference to future motivational states, or without extensive reinforcement of the anticipatory act. The results described here suggest that the jays can spontaneously plan for tomorrow without reference to their current motivational state, thereby challenging the idea that this is a uniquely human ability.

Influence of Natal Experience on Nest-Site Selection by Urban-Nesting Cooper's Hawks

by R. W. Mannan, R. N. Mannan, C. A. Schmidt, W. A. Estes-Zumpf, and C. W. Boal
J. Wildlife Mgmt. 71(1): 64–68

Exposure to environmental features early in life potentially can influence the kinds of places animals select to live later in life. The authors examined whether there is evidence that Cooper's hawks (*Accipiter cooperii*) hatched in an urban environment choose sites with features similar to their natal areas when they nest for the first time. The features examined were the nest tree species and the level of development surrounding the nest tree. The authors banded nestling and fledgling Cooper's hawks in Tucson, Ariz., from 1994 to 2004. They then monitored nests in Tucson to identify hawks that had been hatched in the city and eventually secured a breeding site. Percent cover of buildings around first breeding nests was not related to percent cover of buildings around natal nests for either sex. There was some evidence that being hatched in a particular tree species influenced choice of tree species at first breeding sites for males, but the influence was weak. In contrast, tree species in which first-time breeders built their nests, and the sites where the trees were located relative to development, were proportional to what was available in the Tucson metropolitan area. The data suggest that natal experience played a limited role in nest-site selection by Cooper's hawks in Tucson for the features we examined. If learning occurred, it could have been for the general structure of natal sites. Thus, any small grove of large trees planted in Tucson could be used as a nest site by Cooper's hawks regardless of the level of development surrounding the nest.



COOPERS HAWK (*ACCIPITER COOPERII*) PHOTO: LEE KARNEY/USFWS

Avian Mortality Surveillance for West Nile Virus in Colorado

by N. M. Nemeth, S. Beckett, E. Edwards, K. Klenk, and N. Komar
Am. J. Tropical Med. and Hygiene 76(3): 431–37

The authors tested 1549 avian carcasses of 104 species to identify targets for West Nile virus (WNV) surveillance in Colorado, determine species affected by WNV, compare virus isolation versus RNA detection applied to hearts and oral swabs from carcasses, and compare the VecTest WNV Antigen Assay (VecTest) to standard assays. Forty-two (42) species tested positive. From June to September 2003, 86% of corvids, 34% of noncorvid passerines, and 37% of raptors tested positive. The authors developed the Target Species Index, which identified American crows as the most important avian indicator species. However, testing multiple species maximizes detection, which may be important early and late in the transmission season. This index may benefit surveillance for other zoonotic pathogens, such as highly pathogenic avian influenza H5N1 virus. VecTest using oral swabs was most sensitive for American crow, black-billed magpie, house finch, house sparrow, and American kestrel. Wildlife rehabilitation centers should be recruited to enhance WNV surveillance.

MAMMALS

Habitat Characteristics of Raccoon Daytime Resting Sites in Southern Illinois

by S. E. Wilson and C. K. Nielsen
Am. Midland Nat. 157(1): 175–86

Although much is known about raccoon (*Procyon lotor*) denning ecology, little information is avail-



DELMARVA FOX SQUIRREL (SCIURUS NIGER) PHOTO: W.H. JULIAN/USFWS

able regarding habitat correlates to raccoon daytime resting site (DRS) selection at multiple spatial scales. The authors studied the influence of habitat factors on DRS selection of raccoons in the Mississippi River bottomlands of southern Illinois. During 2003–2005, 54 adult females were equipped with radiocollars and were tracked to 313 DRS. Using field measurements and remotely sensed data, 156 microhabitat (e.g., den height) and macrohabitat (e.g., forest patch size) variables were measured at: (1) breeding season DRS (1 Dec.–1 Mar.), (2) cub-rearing season DRS (15 Mar.–30 Jun.), and (3) control locations. Tree cavities represented 73% of DRS; the remaining 27% were more exposed DRS. A 5-variable multinomial logistic regression model incorporating tree circumference at breast height, den height, distance to nearest road, distance to nearest water and number of nearby dens was significant ($P < 0.001$) and correctly classified 71% of DRS and control locations. Thus, microhabitat variables, but not macrohabitat variables, were influential in the selection of DRS for raccoons on the study area.

Habitat Use of Fox Squirrels in an Urban Environment

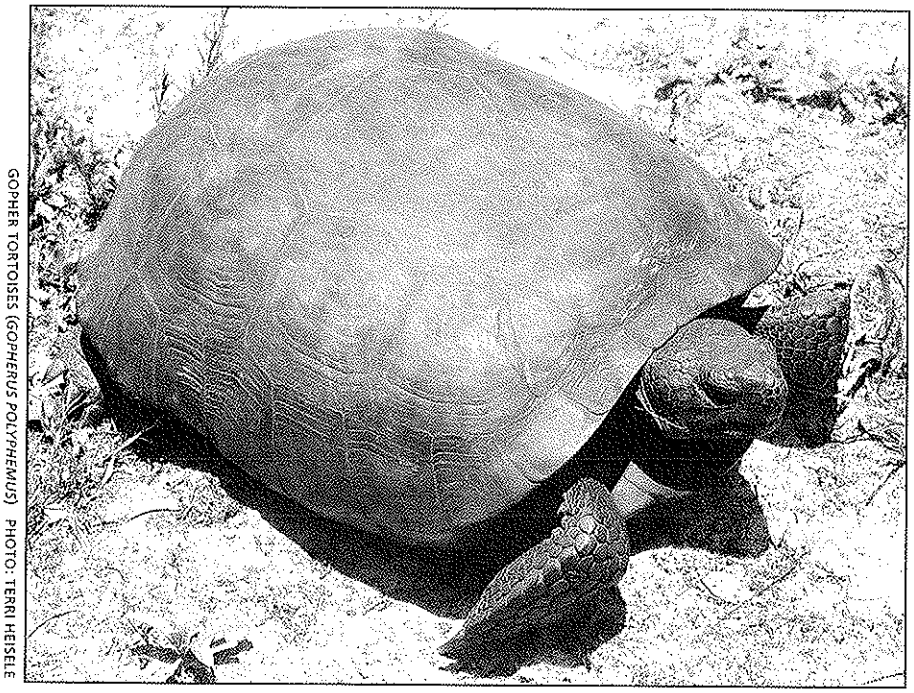
by R. A. McCleery, R. R. Lopez, N. J. Silvy, and S. N. Kahlick
J. Wildlife Mgmt. 71(4): 1149–57

Tree squirrels are common in urban areas, considered desirable by some and by others, a pest. The authors examined fox squirrel (*Sciurus niger*) habitat use in inner-city and suburban areas using radiotelemetry. They estimated habitat selection ratios at differing scales by season and fox squirrel activity. Telemetry data suggest that during periods of inactivity radiocollared fox squirrels (n = 82) selected areas with greater tree canopy; live oaks (*Quercus fusiromis* and *Q. virginiana*); and trees with larger diameters and canopies. When inactive during the winter and spring, fox squirrels preferred, within their core areas, to use the inside of buildings, and during periods of activity in the fall and spring, fox squirrels preferred grassy areas. They avoided using pavement but did not exclude it from their core-area movements. Fox squirrels' ability to use buildings and to tolerate pavement make vast areas of the urban environment available to them. The authors found the number of large and medium trees, amount of pavement and grassy areas, canopy cover, number of oaks, and the area covered by buildings were all important factors in predicting fox squirrel activity in an urban environment. The data suggest urban planners, animal damage control officials, wildlife managers, and landscapers who want to control urban fox squirrel populations through habitat manipulation should consider the reduction of oaks trees and of the canopy cover, and restricting fox squirrels' access to buildings. Alternatively, home owners and squirrel enthusiasts should consider increasing the number of large mast–bearing trees and canopy cover and providing nest boxes.

Roost Characteristics of Hoary Bats in Arkansas

by R. W. Perry and R. E. Thill
Am. Midland Naturalist 158(1): 132-28

The authors radiotracked nine hoary bats (*Lasiurus cinereus*) and characterized 12 roosts during late spring and early summer in the Ouachita Mountains of central Arkansas. Hoary bats generally roosted on the easterly sides of tree canopies in the foliage of white oaks (*Quercus alba*), post oaks (*Q. stellata*), and shortleaf pines (*Pinus echinata*). Roost heights averaged 16.5 ± 2.2 m and all roost trees were > 21 cm dbh and were taller and greater in diameter than random trees. Roost sites averaged 7.7 m^2/ha basal area (BA) of overstory pines, 4.4 m^2/ha BA of overstory hardwoods and 80% canopy cover. Roost sites had a greater number of understory stems than random sites. All roosts were located in stands dominated by mature overstory trees. Seven roosts were in relatively unmanaged mixed pine-hardwood and hardwood stands > 50 years old and four roosts



GOPHER TORTOISES (*GOPHERUS POLYPHEMUS*) PHOTO: TERRI HEISELE

were in mature mixed pine-hardwoods stands that recently had been thinned and subjected to prescribed burning; one additional roost was located outside the study area in a mature shortleaf pine stand that was thinned approximately 10 years previously. Although not abundant during early summer in Arkansas (only 3% of captures), hoary bats were confirmed to reproduce in the region.

CONSERVATION

Long-Term Retention of a Relocated Population of Gopher Tortoises

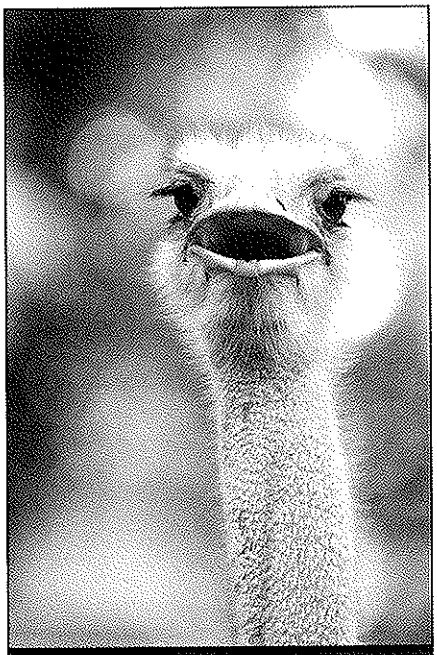
by K. G. Ashton and R. L. Burke
J. Wildlife Mgmt. 71(3): 783–87

Relocation of gopher tortoises (*Gopherus polyphemus*) in Florida is frequently employed as a mitigation tool when tortoises occupy land desired for development. The authors present information about retention and health of a relocated population of gopher tortoises 17 years after relocation, and combine this data with earlier surveys 1 year and 2 years postrelocation to examine whether retention rates change over time. They also evaluate whether retention rates vary by age and gender. Of 74 gopher tortoises relocated in 1985, 31 were present in 2002. There was a 1-year retention rate of 42%, with retention rates of 100% each year thereafter, when the percentage of relocated individuals captured at each survey was used. The authors found a 1-year retention rate of 73%, a retention rate of 92% from year 1 to year 2, and an overall retention rate of 98.5% from year 2 through year 17, based on the assumption that all individuals present in later surveys were present in earlier surveys. No significant difference in retention rate for adults and juveniles and for adult males and females was found. Relocated gopher tortoises showed natural growth patterns, indicating good health, but 35% of them had ≥ one symptom of upper-respiratory tract disease, a disease associated elsewhere with population declines of tortoises. Relocations can successfully lead to long-term retention of gopher tortoises, but without management (e.g., fire management and predator control) this relocated population is not viable.

Are External Mine Entrance Characteristics Related to Bat Use?

by J. B. Johnson, P. Bohall Wood, and J. W. Edwards
Wildlife Soc. Bull. 34(5): 1368–75

Abandoned mines provide summer roosts, fall swarming sites, and winter hibernacula for bats (Chiroptera). Abandoned mines are hazardous and often sealed to prevent human access, or may be gated to protect mine-roosting bats by deterring human entrance. The authors examined gates and other external mine entrance characteristics to determine if they influenced bat species presence and relative frequency. Bats were surveyed at 36 abandoned coal mine entrances during summer 2002 and 47 mine entrances (the same 36 as during summer and 11 additional mines) during fall 2002 at New River Gorge National River and Gauley River National Recreation Area, West Virginia. The authors captured 139 bats during summer and 1733 bats during fall of nine different species. During the fall, more bat species used mines with isolated entrances than those with multiple entrances. Results indicate that gates do not affect bats in terms of presence or frequency of use as much as mine entrance shape and proximity to other portals. Mine entrance size and shape positively influenced bat activity, particularly that of little brown myotis (*Myotis lucifugus*) and eastern pipistrelle (*Pipistrellus subflavus*), which were among the most commonly captured species. Spatial proximity of entrances should be considered in bat management decisions concerning abandoned mines. JWR

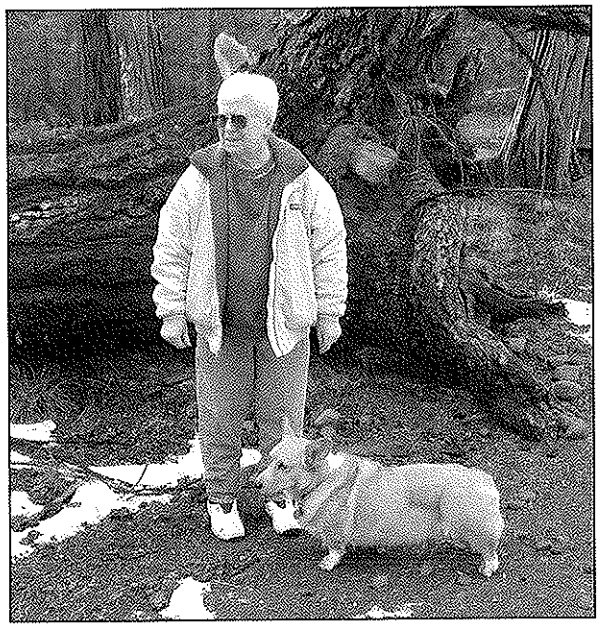


Do you have an easy answer to a frustrating rehab issue?

A new way to solve a common problem?

Share it!

Please send your "Simple Solution" to journal@iwrc-online.org. If possible, include high-resolution digital images, as well as a brief note about yourself.



Carol Ottomeier Remembered

by Connie Stevens, Lake Almanor, Calif.

For many people, 21 March 2007 was a day like most others. But local wildlife caregivers and a special family in Lake Almanor, Calif., will remember it as the day Carol Ann Ottomeier departed suddenly from this life while at work as a relief postmaster at the Canyon Dam post office.

Carol was born Christmas Eve 1936 in London, England, to Fredereck and Anna (Donovan) Easter. Raised and educated in England, she emigrated to the United States in 1962.

While attending a college roommate's wedding, Carol met a handsome young gentleman named Dale "Mo" Ottomeier. Their love quickly blossomed, and they solidified their commitment to one another in matrimony in August 1965 in Hollywood, Calif. Carol especially enjoyed spending time outdoors and found pleasure in target shooting with her husband.

Carol had a career as a librarian with the Loyola Law School (Los Angeles). Following her retirement, she and Mo relocated to Albany, Ore., for two years before his employment brought them to the Chester/Lake Almanor region in California, where she resided for the past 20 years.

Licensed at both the federal and state levels as a wildlife rehabilitation specialist, Carol quickly became known in the area as "the bird lady" for her affectionate care of wounded feathered friends. Her involvement in ensuring that Wildones Rehabilitation program succeeded was deeply appreciated by all who worked long days and short nights giving her patients the care they so badly needed to survive their second chance in a small world with humanity.

Carol is survived by Mo, her devoted husband and best friend for 41 years; son Kurt Ottomeier of Albany, Ore.; and daughter Alyssa Ottomeier of Corvallis, Ore. At her request, no services followed cremation; her cremains were scattered privately at sea. Friends and colleagues may express condolences to the family and sign a memorial guest register at www.fehrmanmortuary.com. The family suggests any remembrances in Carol's name be made to Wildones Rehabilitation, c/o Fehrman Mortuary and Crematory, P. O. Box 803, Greenville, CA 95947. JWR

Editor's Note: *Carol Ottomeier was a valued member of the IWRC for more than 20 years.*

IWRC/NWRA Code of Ethics

Although wildlife rehabilitation is not a profession "bound" by a code of ethics, a code was developed jointly by the International Wildlife Rehabilitation Council (IWRC) and the National Wildlife Rehabilitation Association (NWRA) some years back as part of their national standards program. The original is in the Standards Booklet, and is available from either IWRC or NWRA.

1. A wildlife rehabilitator should strive to achieve high standards of animal care through knowledge and an understanding of the field. Continuing efforts must be made to keep informed of current rehabilitation information, methods, and regulations.

2. A wildlife rehabilitator should be responsible, conscientious, and dedicated, and should continuously work toward improving the quality of care given to wild animals undergoing rehabilitation.

3. A wildlife rehabilitator must abide by local, state, provincial and federal laws concerning wildlife, wildlife rehabilitation, and associated activities.

4. A wildlife rehabilitator should establish safe work habits and conditions, abiding by current health and safety practices at all times.

5. A wildlife rehabilitator should acknowledge limitations and enlist the assistance of a veterinarian or other trained professional when appropriate.

6. A wildlife rehabilitator should respect other rehabilitators and persons in related fields, sharing skills and knowledge in the spirit of cooperation for the welfare of the animals.

7. A wildlife rehabilitator should place optimum animal care above personal gain.

8. A wildlife rehabilitator should strive to provide professional and humane care in all phases of wildlife rehabilitation, respecting the wildness and maintaining the dignity of each animal in life and in death. Releasable animals should be maintained in a wild condition and released as soon as appropriate. Nonreleasable animals which are inappropriate for education, foster-parenting, or captive breeding have a right to euthanasia.

9. A wildlife rehabilitator should encourage community support and involvement through volunteer training and public education. The common goal should be to promote a responsible concern for living beings and the welfare of the environment.

10. A wildlife rehabilitator should work on the basis of sound ecological principles, incorporating appropriate conservation ethics and an attitude of stewardship.

11. A wildlife rehabilitator should conduct all business and activities in a professional manner, with honesty, integrity, compassion, and commitment, realizing that an individual's conduct reflects on the entire field of wildlife rehabilitation.

Infectious Diseases of Wild Birds

edited by Nancy J. Thomas, D. Bruce Hunter, and Carter T. Atkinson
Ames, Iowa: Blackwell Publishing, 2007; 484 pages; U.S.$89.99

This book started out as a long-overdue second edition of the classic 1971 text, *Infectious and Parasitic Diseases of Wild Birds,* but it grew so large that the parasitic diseases portion was dropped, hopefully to be picked up at a later date in a separate volume. This new book serves as an able companion to the updated editions of *Infectious Diseases of Wild Mammals* (3rd edition) and *Parasitic Diseases of Wild Mammals* (2nd edition), both published in 2001.

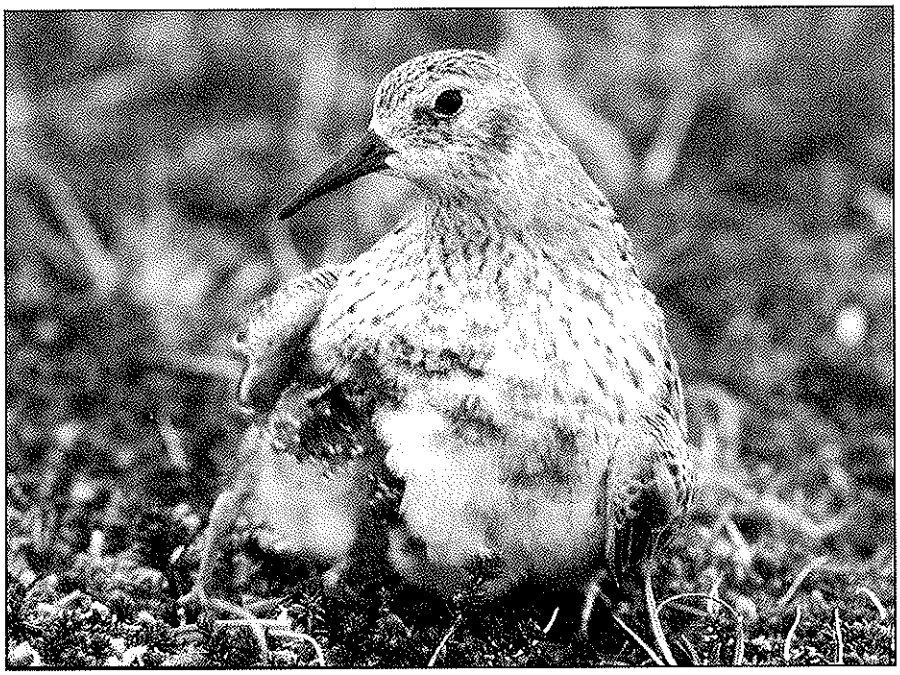
The book is divided into three sections: viral diseases (including Newcastle disease, duck plague, avian influenza, and pox), bacterial and fungal diseases (including avian cholera, salmonellosis, avian tuberculosis, chlamydiosis, and aspergillosis), and biotoxins (including botulism, mycotoxins, and algal toxicosis). Many chapters are updates from the original book, but several new diseases (e.g., circovirus, papilloma virus, and polyoma virus) are included here.

The book benefits greatly from its consistency. Every chapter follows the same general outline: disease history, distribution, host range, etiology, epizootiology, clinical signs, pathogenesis, pathology, diagnosis, public health concerns, domestic animal health concerns, management implications, control and treatment. Treatment is not emphasized.

The book is sparsely illustrated; however, most chapters make good use of tables, especially of lists of species most commonly affected by that particular disease.

Although this book would be extremely useful for veterinarians who work with wild bird species, it would be considerably less useful to the average wildlife rehabilitator. It is, however, an appropriate addition to the library of any nature or wildlife center. JWR

Reviewed by Ned Gentz, DVM.



LEAST SANDPIPER (*CALIDRIS MINUTILLA*) AND CHICK PHOTO: USFWS

First Flight: A Mother Hummingbird's Story

by Noriko and Don Caroll
Kansas City, Mo.: Andrews McMeel Publishing, 2006; 97 pages; U.S. $14.95

One of those wonderful photographic records that documents the subject from A to Z, this little book shows the reader an entire reproductive year of a black-chinned hummingbird (*Archilochus alexandri*). The authors have clearly researched their subject carefully, and include many little-known details about the bird's private life. They acknowledge the hummingbird specialists they consulted prior to the main text.

This is an excellent resource for anyone raising orphaned hummers. There are pictures of the birds as tiny naked, black, yellow-billed, hatchlings, and of them at approximately 10 days old, the porcupine stage when mother stops sitting on them at night. One wonderful picture shows Honey, the book's protagonist, with the maternal bill coated with pollen plunging down an infant's throat. The authors document the growth of the youngsters and the meticulous self-grooming behavior of the parent. A particularly entertaining series of Honey preening after a rain shows the importance of paying attention to every feather. The photographer must have missed my favorite position in which the bird lifts a leg over the humerus from behind, contorting to get a good scratch in on the back of the head and bill. Still, it's amazing the positions the photographer catches with such clarity.

Documenting the potential tribulations of the siblings' first flight was wonderful. One bird takes off with little problem and

lands in an appropriate tree, where he can spend the next few days. The second bird, however, lands on a perpendicular strand of fiber and has some difficulty getting to a sturdy horizontal perch. The authors are admirably restrained, never seduced into intervening and helping the little one. One can easily see how these inept explorers can end up on the windshield wiper of a car, a fence railing, or some other inappropriate and dangerous spot. The authors note that it is when the birds leave the nest that they make the peep characteristic of a hungry baby hummer, and that they never made that particular peep prior to fledging. The peep, is, of course, to tell Honey where they are when they need her. That high-frequency, single-note call is designed, however, to be difficult to locate. In desert Las Vegas there are roadrunners, jays, and many other avian predators that would delight in such a snack, small though it might be.

While struggling to define Honey to species, the Carolls had the opportunity to see her attending the mating dances of at least one potential suitor. Photographing his black chin and purple gorget, they describe the extravagant courtship flights of this species and identify Honey.

A last revelation made after the first pair of nestlings fledged was the discovery of another nest Honey was incubating while supporting her first brood as they learned to forage. The authors comment that this is the ultimate in multitasking.

This informative and pleasing book, warm and personal but devoid of sentimentality, is a great reference for rehabilitators or a gift for a friend. JWR

Reviewer Penny Elliston is a wildlife rehabilitator specializing in hummingbirds in Alburquerque, New Mexico.

Prodigal Summer

By Barbara Kingsolver

Perennial, an Imprint of HarperCollins Publishers, 2001; 444 pages; U.S.$14 (paperback)

In *Prodigal Summer,* Barbara Kingsolver weaves a tale that connects five main characters with magical narrative. The book is "sensuous and compelling" (*Newsday*). It is a novel of social conscience that is written with lush descriptions of nature and individuals. Kingsolver has a graduate degree in biology, and her writing reveals an astute knowledge of botany and animals. Her love and understanding of birds and the descriptions of them and their habits and songs will delight rehabilitators and bird watchers.

> "She sat cross-legged on the floor of the porch, brushing out her hair and listening to the opening chorus of this day. A black-and-white warbler had started it long before dawn, breaking into her sleep with his high pitched "Sweet sweet!" Deanna could picture him out there, circling the trunk of a poplar, tilting his tiny zebra-striped head towards the first hints of light, tearing yesterday off the calendar and opening the summer of love with his oversized voice.
>
> "The other warblers woke up soon after the black-and-white: first she heard the syncopated phrase of the hooded warbler with its upbeat ending like a good joke, the Kentucky with his more solemn, rolling trill. By now a faint gray light was seeping up the edge of the sky, or what she could see of the sky through the black-armed trees.... The cabin was no place to be if you craved long days and sunlight, but there was no better dawn chorus anywhere on earth. In the high season of courtship and mating, this music was like the earth itself opening its mouth to sing.... Deanna smiled to hear the first veery, whose song sounded like a thumb run down the tines of a comb. It had been the first bird-



SANTIAGO CORNEJO

call to capture her fascination in childhood, not the calls of the meadowlarks and sparrows that sang outside her window on the farm every morning, but the song of the veery, a high-elevation migrant that she encountered only up here, on fishing expeditions with her dad."

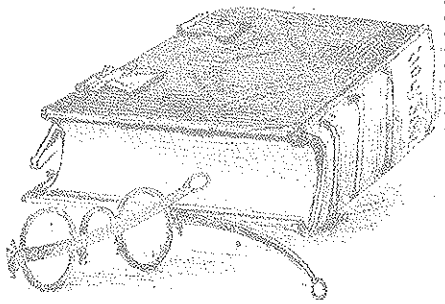
Deanna is a Forest Service ranger working in the Zebulon National Forest, North Carolina. She has spent two years on Zebulon Mountain by herself when a younger man, Eddie Bondo, appears and an intense romance commences. As Eddie moves in and out of her life, Deanna is torn by her passion for her solitary life with nature and the desire to be with this Wyoming cowboy hunter who lives a life that is diametrically opposed to hers.

Next we meet Lusa, a former National Science Foundation scholar whose research on moths is her passion. During her research she meets a fellow student and they fall in love and marry. Lusa gives up her work in Richmond and moves to North Carolina to take on the role of wife to a farmer, Cole Widener.

Garnett Walker and his neighbor, Nannie Land Rawley, are the fourth and fifth prominent figures. Garnett is 80 years old, a widower and former teacher. He comes from a line of farmers and his passion is to reintroduce the chestnut tree to the Zebulon Valley. Nannie is a naturalist whose apple orchard sits adjacent to Garnett's property. They have an ongoing battle over the use of pesticides.

With these seemingly unconnected strands Kingsolver weaves the fabric of family history and a story that evolves and connects them all in a journey that will mesmerize and delight you. *Prodigal Summer* is a must-read for anyone who loves a story that keeps you guessing and is filled with passion and love of those things human and in the natural world. JWR

Reviewer Ginnie Silva has been connected with the natural world since early childhood. She has worked in a variety of animal care and rehabilitation settings and has traveled widely, seeing wildlife on a close and personal level.



Editor's Note: *The* Journal of Wildlife Rehabilitation *welcomes reviews of relevant books, including veterinary reference books, memoirs, natural history, and novels. 600–700 word reviews should be e-mailed to journal@iwrc-online.org.*

NEWS BRIEFS

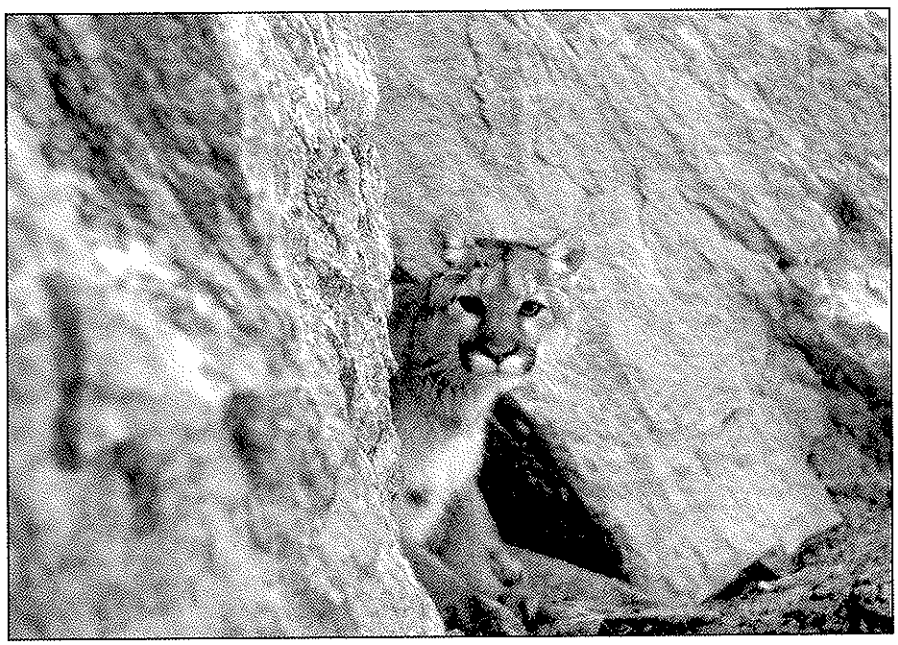
State-of-the-Art Wildlife Corridor Opens in New Mexico

The long-awaited highway mitigation wildlife passage under Interstate 40 going through Tijeras Canyon, New Mexico, opened in July 2007. This tunnel connects the Sandia mountain range to the north with the Manzanos to the south, enabling populations to continue to travel north and south in their ranges.

A 2000–2003 study measuring wildlife/traffic interface in New Mexico found 11 bears and diverse mule deer, cougars, bobcats, coyotes, raccoons, and numerous carnivorous birds (attracted by road kill) died after being hit by high-speed vehicles.

Electric fencing along the highway and electric matting underfoot funnel wildlife to a box culvert under the road. Motion cameras at the culvert's entrances trigger flashing lights to warn people on local roads of wildlife exiting the passage.

Both culvert use and the incidence of animal-caused vehicular accidents are being monitored to determine whether use of the culvert reduces



COUGAR (*PUMA CONCOLOR*) PHOTO: LARRY MOATS/USFWS

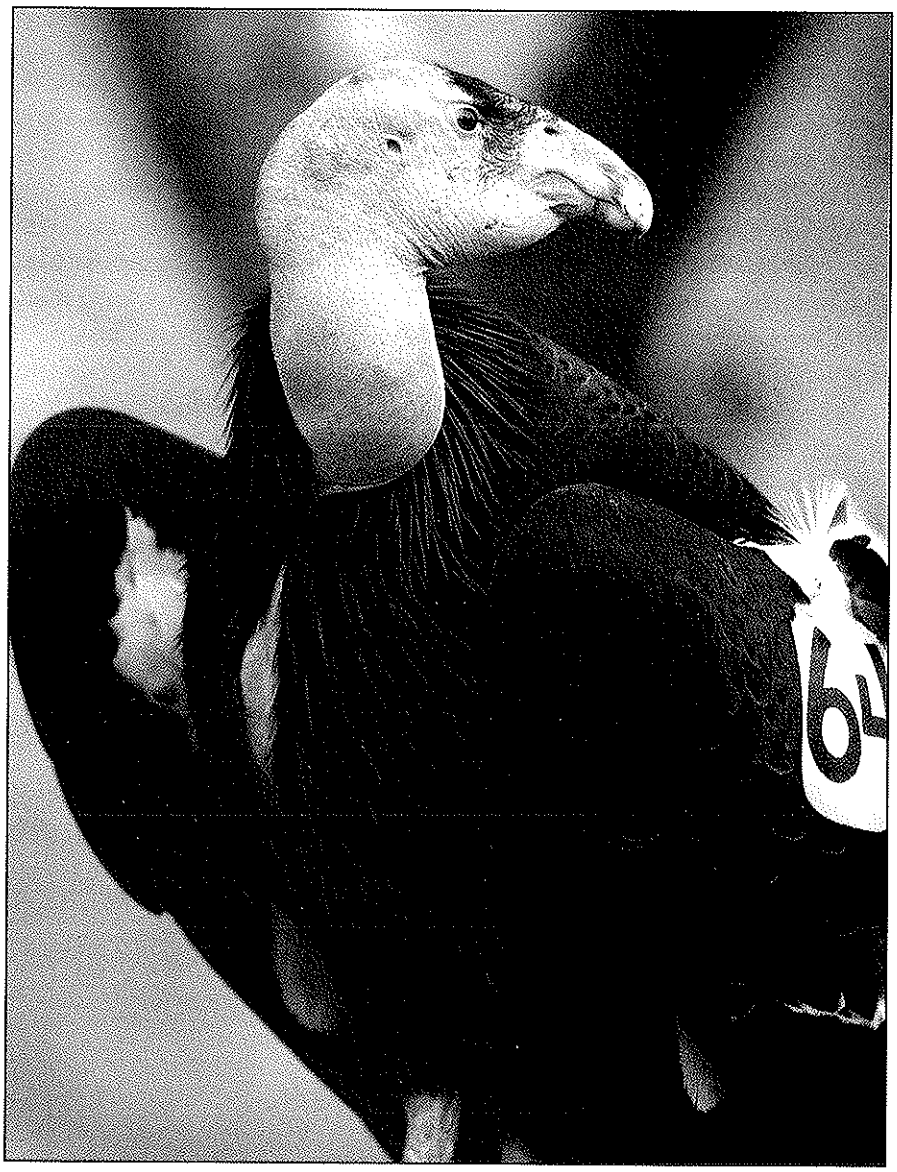
human and wildlife injury along this dangerous stretch of roadway. No doubt raptors that use the thermals in the Sandias and Manzanos to travel east and west during migration will still be monitoring road kill.

Junk Food Threatens Re-introduced Condors

Although many birds eat junk and it has been documented as a problem in Old World vultures in the last 30 years, consuming junk—defined as various kinds of human-generated trash—has been the primary cause of nest failure in Southern California reintroduction programs of California condors (*Gymnogyps californianus*). Of 13 breeding attempts, 2001–2005, only one young was raised to fledging. Four dead nestlings and two others removed from the wild had ingested substantial amounts of junk. In two cases the consumption of junk was determined to be the cause of death. Five of six dead nestlings had elevated levels of copper.

Now researcher Michael P. Wallace proposes recapturing the junk food junkies and subjecting them to operant conditioning to attempt to correct their bad habits. In a pilot study a pair of birds were given a choice of human-generated trash and good healthy carrion to eat. The trash was wired to produce an unpleasant shock when touched, in the expectation that the birds would associate that unpleasant experience with junk and devote their foraging time to focusing on more acceptable and nutritious edibles. The pair, after release, has raised one chick successfully in the wild. This parental training is designed to address the problem of chick starvation in the wild, one of the most serious problems of reintroduction of these huge and endangered vultures in Southern California.

See: A. Mee et al. 2007. Junk ingestion and nestling mortality in a reintroduced population of California condors *Gymnogyps californianus*. *Bird Conservation International* 17: 119–30.



CALIFORNIA CONDOR (*GYMNOGYPS CALIFORNIANUS*) PHOTO: SCOTT FRIER/ USFWS

WNV Risk to Virginia Bird Handlers

In 2004 the Virginia Department of Health, Division of Zoonotic and Environmental Epidemiology looked at evidence of West Nile virus (WNV) transmission to "Bird handlers" (wildlife rehabilitators, veterinarians, and environmental health department field personnel) to determine if there was a greater incidence of the virus among them than in the general public. The control group comprised friends and neighbors of these people and non-bird handler personnel. Blood was taken from the participants before and after the 2004 WNV/mosquito season. At the preseason testing two bird handlers were identified as having relatively recent exposure to the virus.

No new WNV conversions were identified in the postseason blood of either cohort. The study concluded there were no significant differences in seroprevalence rates between bird handlers and non-bird handlers, and serologic evidence of previous exposure was not statistically associated with being a bird handler.

Protective gear used by bird handlers varied widely; the three most reported practices were washing hands, covering wounds, and wearing gloves. There was no marked difference in use of these practices before and after the season.

The researchers noted the relatively small numbers of study participants (N= > 50, < 100) and environmental factors in Virginia that may have skewed results. They expressed interest in a larger study—and stressed the importance of preventive measures.

See: Bobo, T. et al. 2005. West Nile virus seroprevalence study of bird handlers in Virginia, 2004. *Epidemiology Bulletin* 105(9). Virginia Department of Health.

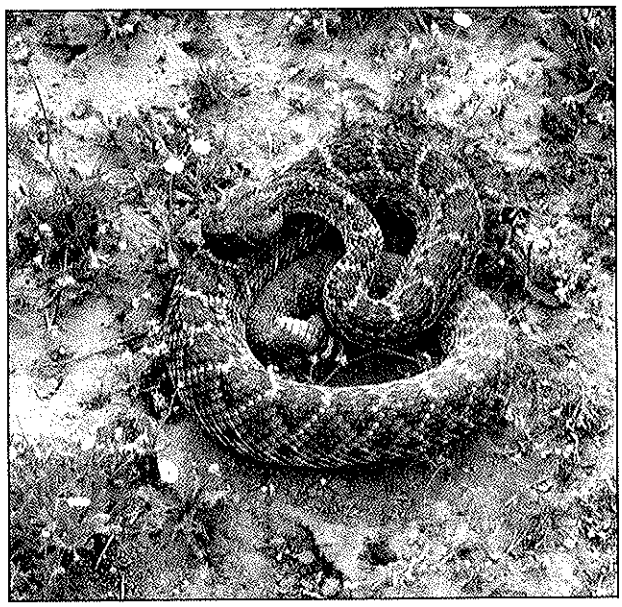
Aplomado Falcon Reintroduction in New Mexico

In July 2007, representatives of the Peregrine Fund World Center for Birds of Prey, Ted Turner's Armendaris Ranch, several state and federal agencies, and the interested public gathered at the Rio Grande Nature Center State Park to herald the release of 11 endangered juvenile Aplomado falcons.

The caravan proceeded from the Nature Center to the release site, lands managed by the Bureau of Land Management, the New Mexico State Land Office, and White Sands Missile range.

But during recent heavy rains on White Sands, carpenter ants, flooded out of their tunnels, had climbed the very handy hacking tower to escape the water. When the release party arrived they were reluctant to place the birds on the tower until the ants had returned to their homes in the ground. After another few days in captivity a new crop of young Aplomado falcons were introduced to the grasslands of the southwest. More will be released later in the summer, bring the total to an expected 40 in 2007.

This repopulation effort was first implemented in 1977 in Texas, where it accelerated the return of the endangered falcon to three national wildlife refuges. Under "safe harbor agreements" private landowners are encouraged to be stewards to natural resources and have helped to return the falcons to 1.5 million acres of private grasslands. With the 2006 release of 11 birds on the Armendaris ranch in New Mexico, the program expanded out of Texas. Two of these juveniles paired up and successfully fledged two young the following summer.



WESTERN DIAMONDBACK RATTLESNAKE (*CROTALUS ATROX*)
PHOTO: LUTHER C. GOLDMAN/USFWS

Lizards "Shout" to Rivals to Get Their Point Across

Male anole lizards signal ownership of their territory by sitting up on a tree trunk, bobbing their heads up and down and extending a colorful throat pouch. They can spot a rival lizard up to 25 m away.

The lizards' signals need to be strong enough for a rival to see, but not vivid enough to say "eat me" to a passing predator. But their forest home can be a visually noisy environment, with branches and leaves waving in the breeze and casting patterns of light and shade.

Researchers from the University of California, Davis videotaped two species of anole lizards, *Anolis cristatellus* and *Anolis gundlachi,* in the Caribbean National Forest in Puerto Rico. They found that the more "visual noise" in the background, the faster and more exaggerated the movements of the lizards.

Different species of anole lizards are found on different islands throughout the Caribbean. The lizards are separated by 30 million years of evolution, but they live in similar environments with the same obstacles to communication.

California Squirrels Heat Tails for Defense

California ground squirrels (*Spermophilus beecheyi*) intimidate rattlesnakes by heating their tails and shaking them aggressively to warn them away from their young.

Adult squirrels' blood contains a protein that enables them to survive snake venom. Squirrel pups have not yet developed this immunity— and can make a tasty meal for the rattlesnakes.

Because the snakes can sense infrared radiation, the warming makes the tails more conspicuous —and tells them they have been discovered.

Researchers believe the squirrels shunt warm blood from the body core into the tail, causing it to heat up. Because they do not heat their tails when confronted with other snakes, this does not appear to be simply a reflex. JWR

Forester's Log

NOTHING GREY ABOUT STARTING FIRE

by Mary Stuever

I re-read the last sentence of the guide book section on "What to do if lost or injured" again. I cannot believe the statement is there in print. It reads, *"**A note of warning:** in case of extreme fire conditions in the forest making any kind of a fire could be considered illegal."*

Excuse me. I think that needs to be re-written. The more accurate warning should read: *in the case of extreme fire conditions in the forest, making any kind of fire could kill people, destroy property, and devastate the forest!*

I live in the White Mountains of Arizona. I am relatively new to this area, thus my interest in a guide book to the hiking trails of the region. I came here to work as a Burn Area Emergency Coordinator, because five years ago, two people who felt they were in desperate situations started some fires. It is an action both individuals regret doing.

The Rodeo Fire, started by Leonard Gregg, and the Chediski Fire, started by Valinda Jo Elliott, burned together to scorch nearly a half-million acres of forests and woodlands, destroy almost 500 buildings, and cost almost $200 million for suppression, rehabilitation and property loss costs.

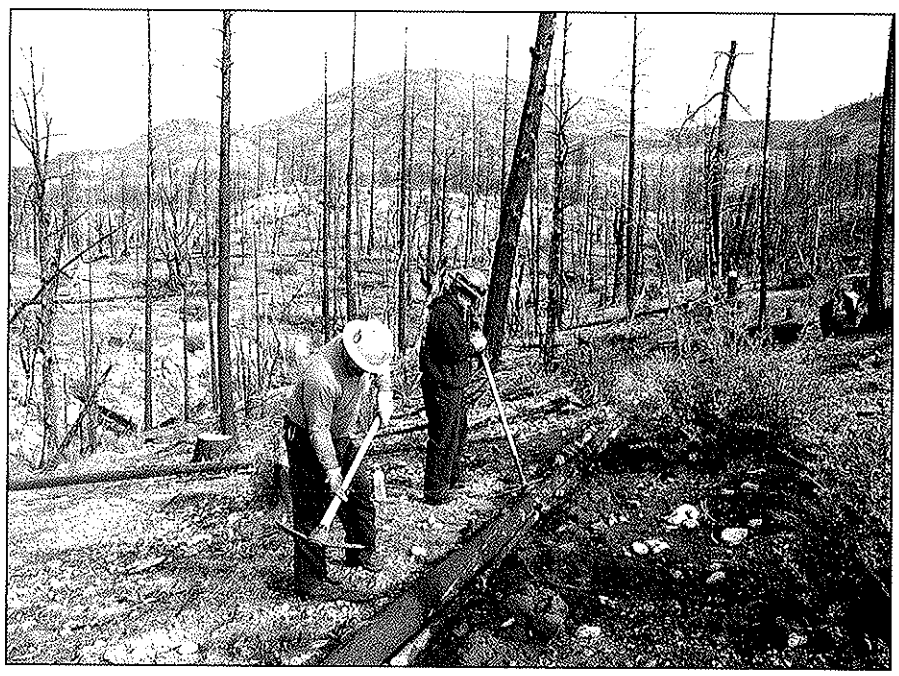
Elliott trespassed in a closed section of tribal lands without a permit. She got lost and started a signal fire on a steep hillside, only a ten-minute scramble from flat clearings and roads that would have provided safer locations for her fire. While the White Mountain Apache Tribe took her to court, she has yet to pay a fine or serve a day of community service.

I check the trail guide, *Walking the Edge* by Laurie Dee Acree, for a publishing date: 2004, two years after the Chediski Fire wreaked havoc in Heber and Overgaard. Since Elliott was "rescued" and continues to contest her fines, perhaps Acree, a White Mountain resident before, during, and after the Rodeo-Chediski fire, believes fire starting while lost should merely "be considered illegal."

Gregg, a White Mountain Apache Tribal member, was a part-time wildland firefighter with limited fire experience. Unemployed in a community that had a 60% unemployment rate, Gregg had limited opportunities to make money. He did not feel he had any other options but to get a part time job fighting fire. He wanted a day or two of work, and lit a fire that he hoped might provide that. Gregg is serving a 10-year jail sentence and owes $28 million in restitution.

Earlier this month, another firefighter was sentenced for the similar crime of starting a fire. Van Bateman was not only a full-time wildland firefighter with extensive experience, he had been one of the key incident commanders during the Rodeo-Chediski fire. The fires he started did not destroy homes or devastate vast expanses of forest. In fact, Bateman recently tried to explain to the public that he felt his intentions in starting the fires were good. In a story in the Arizona Republic, Bateman was quoted as saying "I wasn't trying to start an arson fire. I was just trying to clean this piece of country up. . ."

Still, as U. S. Forest Service Southwest Regional Forester Harv Forsgren wrote in a letter to the Arizona *Republic* editor, "(Bateman)



MARY STEUVER

Rehabilitation begins after an accidental burn.

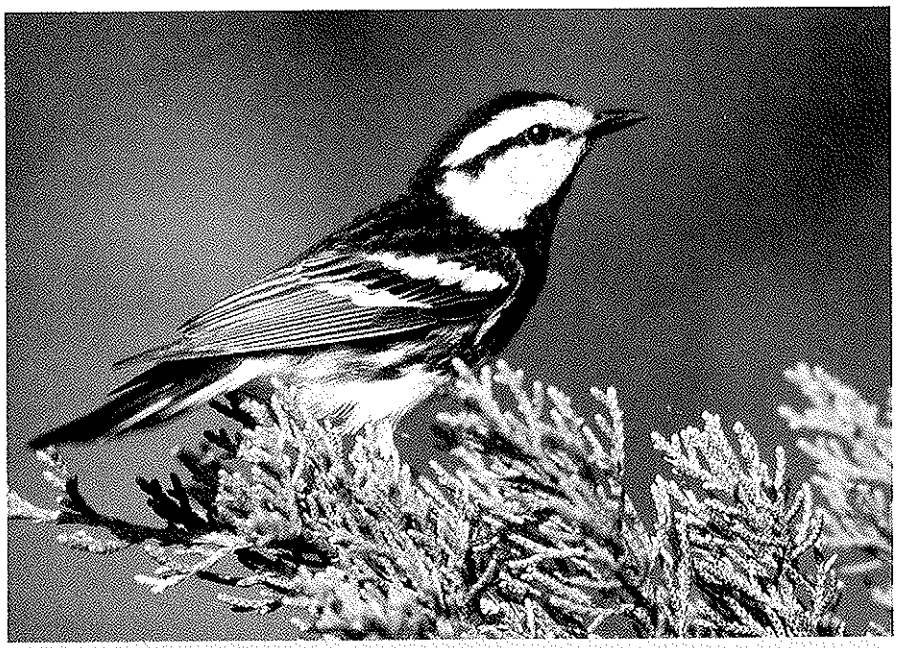
set the fires during a time when prescribed burning was not done because forest conditions were too dangerous. He did not arrange for other firefighters to manage the fires. He did not report the fires. He did not stay at the fires to make certain they were under control." Bateman was sentenced to two years in jail.

Society defines our relationship with fire. As with any other aspect of society, that role is often shifting. Forty years ago, any fire in the forest was generally thought to be a bad thing. Today, fire is recognized as being a natural process on the landscape.

Starting fires, especially during extreme conditions such as dry weather and high winds, is not acceptable. The act of starting a fire evokes the responsibility for that fire, to insure that it does no harm and to be responsible for any harm that it may cause. Like any other citizen, firefighters, who often double as fire starters for prescribed burning activities, need to cherish this societal value that we do not start fires during extreme conditions. That should go for people who are lost or injured as well.

Relying on our legal system to allow a lost individual the right to endanger others by starting a wildfire seems ludicrous. A better solution would be to encourage anyone going into the woods to carry a signal mirror. At least, the authors of trail guides should be promoting this strategy, rather than suggesting actions that risk lives and millions of dollars of damage. JWR

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



GOLDEN-CHEEKED WARBLER (DENDROICA CHRYSOPARIA)
PHOTO: STEVE MASLOWSKI/USFWS

Association of Avian Veterinarians Seeks Notes from the Field Manuscript Submissions

The Association of Avian Veterinarians is welcoming submissions for Notes from the Field. Notes from the Field is a subsection of the *Journal of Avian Medicine and Surgery* (*JAMS*) dedicated to stories from veterinarians, researchers, and support staff who are engaged in avian conservation, field research, or other field activities. *JAMS* is published on a quarterly basis. The goal of this section is to inspire others to get involved with avian conservation efforts. We are offering an honorarium of $250 for each accepted manuscript (one per issue) for publishing in the journal. Please make submissions to Scott Ford, DVM, ABVP-Avian by e-mail at akeaglevet@yahoo.com.

SELECTION CRITERIA:

Submissions should be made by individuals of any education level who are directly involved in avian conservation or field research efforts. Those that highlight the use or advancement of medical sciences will be preferred.

Submissions must not condone activities that violate the policies (e.g., AAV or AVMA statements) or laws (national or international) that pertain to the ethical treatment and international movement of animals.

Submissions should conform to the "Instructions to Authors" guidelines that appear in each issue of the *Journal of Avian Medicine and Surgery.*

Preference will be given to submissions that encourage participation or illustrate methods by which the "average person" can get involved in conservation efforts.



RENGA 1

a chipmunk rehearses
the catechism in French
pour le bon dieu

on bare winter limbs
a dozen crows squabble
serious skeptics

in the frozen field
a gray horse tosses its head,
clouds of hoary breath

fir limbs undulate
sprinkling needles everywhere—
holy trees bless all

alert on a branch
a guardian squirrel
claims the bird box

Note: Each verse of this renga (linked haiku) alternates authorship, the enchange passing slowly back and forth through the mails. The authors are Marion Davidson and David Laing.

WINTER LIGHT

Rigid in the season's grip,
upright as song, a sheaf
of frosted grass stands bright

and brighter—its light
sanctifying the moment.
It's so cold

even thought is frozen.
In the ditch, a sparrow
springs for grain, again

and again (ice had sentenced
the creek to silence). Our fingers
stiffen beside the bird's exertion.

Shadows of picnic tables
erect as startled geese
archive other times, and graffiti

trumpets minor victories
in some inscrutable language
on the icy limbs of the bridge

we cross on our way
back to the silent cars,
our breath preceding us.

POET'S CORNER

by Marion Davidson

A SUMMER LAKE

Dawn
a lone fisherman
passes by carrying two poles

A swallow soars in the chorus
of wind

The lake is old
dying to marsh

A settling of day
tucks in the west
behind a stand of pines

The slash of a nighthawk
reminds us

It was good to swim today.

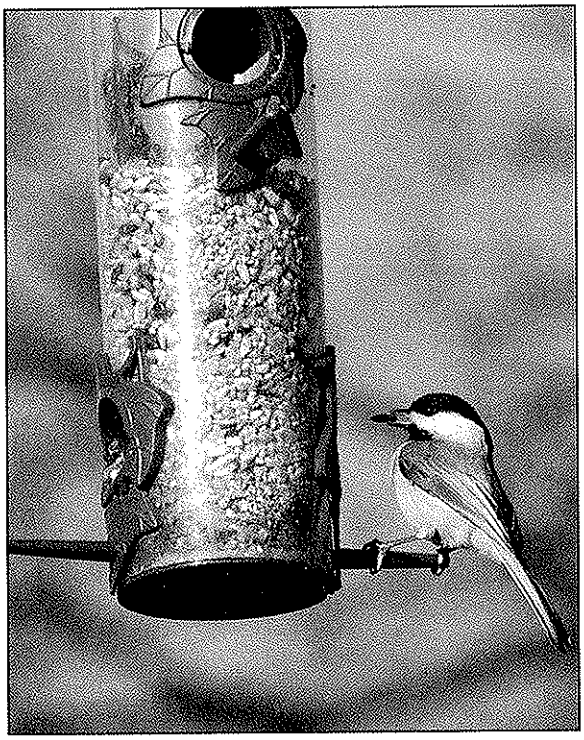
RESERVOIR IN WINTER

A monochrome sky presses
hard on gray water. Gurgling,
a raven rises above the hilltop—
her sharp beak loosening
days past. On the opposite bank
ponderosa pine march
with a demure linearity.
The skin of summer fish
wrap willow branches
in the freezing sand.

Still climbing,
the bird lifts to light
the faint evening star.

Marion Davidson is the author of Closeness of Ice, *a chapbook of poems (Finishing Line Press, 2004). Her poems have appeared in the* Sunday Oregonian *newspaper, numerous literary journals, and several anthologies. A retired attorney and avid birder, she lives on the Deschutes River in Bend, Oregon.*

FEED THE BIRDS BUT...



JONATHAN MCCALL

Bird feeders are a wonderful way to observe the variety of birds in your area. But if they're not kept clean, feeders can help spread salmonellosis, trichomoniasis, avian, pox, aspergillosis, and conjunctivitis—diseases that are fatal to birds.

So keep your bird feeders safe. **Clean the area around your feeders of waste food and droppings.** (A broom and shovel are good, but a heavy-duty vacuum cleaner is even better.)

Buy feeders that can be easily sterilized. **Clean and disinfect your feeders** by fully immersing them in a 10% bleach solution (1 part household bleach to 9 parts water) for 2–3 minutes. Allow them to air dry. Once or twice a month is generally often enough, but clean weekly if you notice sick birds at your feeders.

Finally, **spread the word!** Encourage neighbors who also feed birds to "keep it clean." Birds normally visit several feeders and can spread diseases as they go.

Keep it clean!

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

The International Wildlife Rehabilitation Council brings you this information from the National Wildlife Health Center * http://www.nwhc.usgs.gov

TAIL END

by Astrid MacLeod



"I'm telling you—stripes are in!"

INSTRUCTIONS FOR AUTHORS

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

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

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

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

ELECTRONIC SUBMISSIONS Electronic submissions are preferred but not required. The manuscript should be attached to the submission letter and sent to both:

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