INTERNATIONAL WILDLIFE REHABILITATION COUNCIL

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JOURNAL OF WILDLIFE REHABILITATION



IN THIS ISSUE

A new method for assessing health and viability of British hedgehogs ... Post-release study of western screech owls ... Writing your first annual report ... Emerging diseases, biosecurity, terrorism—and wildlife rehabilitators ... Coping with burn out ... Talking about rabies ... 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 quarterly publication, rehabilitation courses offered in numerous locations, and an annual conference, IWRC works to disseminate information and improve the quality of care provided to wildlife.

ON THE COVER: A malnourished, underweight British hedgehog (*Erinaceus europaeus*) with tapering rear end, signifying insufficient mass.
[see page 10; photo: Toni Bunnell]

BELOW: Attaching a tracking transmitter to the tail of a western screech owl (*Otus kennecotti*) with carpet thread and a commercial quick dry epoxy bond.
[see page 13; photo: Joanne Richards]



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EDITORIAL

What A Difference A Year Makes!

In 2002 the International Wildlife Rehabilitation Council underwent some dramatic changes, both internally and externally. While to the casual observer, things may seem much the same, the IWRC of today is stronger and more efficient than it was just a year ago.

At the beginning of 2002, IWRC was reeling from the downturn in the nation's economy. Like many nonprofits, IWRC was facing budget deficits and an uncertain future. In January 2002 the Board of Directors met to discuss the viability of the organization. The board, as a whole, reaffirmed their commitment to IWRC and the services it provides. We believe that the organization plays a vital role in the field and is a valuable resource for wildlife rehabilitators.

Reenergized, the board set out to renovate IWRC. Like many organizations with decades of history, there were business practices and ways of doing things that were simply out of date. It was clear that the way things had always been done for the previous 30 years was no longer appropriate.

A necessary first step in planning appropriate change and growth is to evaluate where you are. In looking at IWRC's strengths and weaknesses, the Board of Directors identified a number of priorities for attention.

Included on the list of *internal* priorities were:

- Strategic and operational planning
- Financial management, budgeting, and accounting practices
- Office automation and information management
- Membership services
- Board/staff relationships and communication
- Office location and operations

External program priorities included renovation of:

- Skills training and rehabilitation classes (content and format)
- IWRC publications and literature
- Online services and website
- Annual conference (content and format)
- Relationships with other professional groups

Any time an organization undertakes deliberate revision, unanticipated change often takes place as well. It was no different with IWRC. In June of 2002, shortly after the organizational transformation began in earnest, IWRC found itself in search of a new executive director and office staff. Several members of the board stepped in as volunteers and kept things running smoothly until Jennifer Bennett was hired as our interim executive director. She has a great deal of experience both in wildlife rehabilitation and in organization management. Her former colleague, Jennifer Haole (yes, two Jennifers!), came along at the same time. Already used to working as an effective team, they began implementing new ideas and long-awaited changes. Their first order of business was to modernize and improve IWRC's office operations.

Changes in the internal operation of IWRC are certainly the most difficult to recognize from the outside. Nevertheless, the organization has undergone a radical change in the way it manages its staff, information, and financial resources. Most of these changes can be categorized as improvements to efficiency—the ability of IWRC to use its resources as effectively as possible, minimizing wasted time and money.

IWRC's office has relocated to a new professional space in Berkeley. Ancient computers were finally replaced by a modern, high-speed computer network. Information has been consolidated into a single, integrated system. The entire network is now connected to a high-speed Internet connection. What this will mean for IWRC's members is a faster and more accurate processing of membership information and member communication, as well as a far more efficient use of staff time. That translates quickly into financial savings! IWRC is now able to do more for less.

The changes to IWRCs external programs are the most visible and can be seen in the organization's communication with its members, skills training

classes, and Internet presence. Here, almost immediately, new technologies and new approaches to the delivery of member services were instituted. In each case, we strived to expand the actual delivery of information and services while reducing the costs of providing them.

Better Communication, Training Programs, and Internet Presence

One obvious change was the elimination of IWRC's quarterly newsletter. This publication was extremely expensive to produce and distribute, yet was of very limited value as a means through which to communicate with our membership. The time delay between the writing and the arrival of the newsletter in members' mailboxes meant that the newsletter was usually out of date before it was received.

In place of the newsletter, IWRC now produces *IWRC Magazine*, an "e-zine," which can be found on the IWRC website. Members who wish to be notified when a new issue has been posted can visit the website and sign up for e-mail notification. The new electronic publication includes far more information than its paper predecessor, and does so at a saving of literally thousands of dollars. More importantly, the information contained in the online publication is timely and up-to-the-minute.

Anyone who has taken an IWRC skills class in the last six months will have noticed a change in both the format of class presentation and course content. Basic skills classes (1AB) are now presented using Power Point, instead of traditional slides. Course content has been updated in some areas. And, as all training programs are eventually converted to computer presentation format, updates, revisions, and modifications will be easily and quickly implemented as new information and techniques become available. Preparations are also underway so that those who wish to participate in classes can register and submit payment online. This will reduce the likelihood of delayed registrations, save time for registrants and the office, and will streamline the entire process. In addition, those who have previously taken a class can now refresh their skills by auditing a class at a reduced price.

The board has placed a very high priority on the development of new training programs. In coming years, the board is committed to offering a wider array of courses and subjects, and to providing even more tools for the improvement of the skills of the wildlife rehabilitation community.

Another area in which IWRC's renovation is obvious is the organization's websites. *IWRC Online*, the main website (http://www.iwrc-online.org), will undergo a complete redesign. Members are presently able to find current information about IWRC's programs and activities, read news from the wildlife rehabilitation community around the world, and enjoy many entertaining and educational features. The new design will enhance these already effective offerings, and add many more features.

Today the International Wildlife Rehabilitation Council is a more finely tuned, efficient organization. We are able to do more for you—our members—with fewer staff and financial resources.

Perhaps the most significant external program offered by IWRC during the last 12 months is the new internationally focused website *Wildlife International* (http://www.wildlife-international.org). Funded with a grant from the Humane Society of the United States, *Wildlife International* is a resource for the wildlife rehabilitation community worldwide. It contains valuable information on animal care, facility operation, public education, and the conservation of wildlife. It also provides an extensive network of contacts to assist wildlife rehabilitators in any country around the globe. The website is an unprecedented service to those involved in the care of injured and orphaned wildlife, public education, and protection of wildlife habitat. With this new web site, the "I" in IWRC now truly means *international.*

In the midst of all this change, some traditional publications, programs, and services will remain basically the same, or receive more subtle improvements. The *Journal of Wildlife Rehabilitation* will continue to be published in its traditional format. This professional resource will continue to provide peer-reviewed current information on wildlife care and other relevant conservation topics.

Likewise, IWRC's annual conference will continue to be a cornerstone of the organization's service to its members. While there have been some improvements and changes to the conference the basic format will remain unchanged. The board is committed to providing educational and networking opportunities to its members through this important annual event.

The cumulative result of these and other changes is an organization with renewed strength and renewed vision. The IWRC Board of Directors is committed to increasing the two-way communication with the membership, and to improving both the quality and quantity of membership services. The goal is to strengthen the ability of the wildlife rehabilitation community around the world to care for wildlife and preserve the planet on which we live. The board actively solicits feedback on the changes that have been implemented, and on the changes which lie ahead. If you have comments or questions about any of these changes please feel free to contact us at office@iwrc-online.org.

On behalf of our members, both board and staff are fully committed to pursue IWRC's mission of conserving and protecting wildlife and habitat through wildlife rehabilitation.

—Edward E. Clark Jr.
2002 President
IWRC Board of Directors

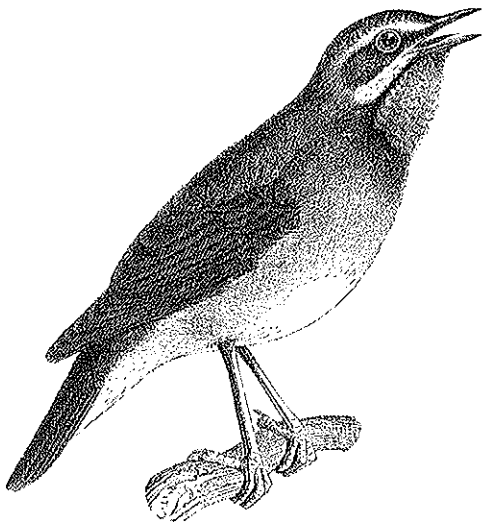
Diets for Songbirds

I've heard that dog food is better than cat food for raising nestling songbirds. I was told that dog food doesn't contain added taurine and cat food does, and that birds don't need it and it might even be toxic to them. Is that true? What is taurine, anyway?

Thank you for your query. Taurine is simply an amino acid. While amino acids are best known as the building blocks of proteins, taurine is not incorporated into proteins. It is not found in plants, but is one of the most abundant free amino acids in animal tissues, including skeletal and cardiac muscle and the brain. Taurine is also found in high concentrations in the eye, and is the most abundant amino acid in the retina of all species studied. It is necessary for a large number of vital processes in the body, including nerve, cardiac, and digestive functioning.

It is common knowledge that domestic cats (carnivores) require dietary taurine because they cannot synthesize it; it is an essential amino acid that must come from the diet. It had been thought that this is not true for adults of many 'omnivorous' species such as dogs and humans, but there is emerging evidence that this may not be the case even for those species.

As healthy adults, some species do synthesize enough taurine to meet their requirements. Others, such as true carnivores and skunks, do not. However, both very young and very old animals of many species require dietary taurine because their needs surpass their ability to synthesize the chemical.



Since nestling songbirds are obligate faunivores, it is safe to assume that they require taurine. They certainly receive it in significant amounts in the insects that they are fed by their parents. There is no reason to believe that taurine fed in levels that allow a cat to survive could possibly be harmful to these birds—on the contrary, it's likely to be essential for them.

In addition, dog food is never a good base for feeding nestling songbirds. It is composed mostly of grains, which are indigestible to young birds. Even if they were digestible, they do not provide the protein that is crucial for bodies growing at a faster rate than any other animal. Nestling songbirds require at least 50% high quality animal protein in their food; dog food often provides no more than 20% protein, and much of that comes from grains and is of poor quality.

This question presents an opportunity to note that it is never wise to "guess" what animals "may" need. Young animals in particular have very stringent dietary requirements. There is a growing body of scientific literature that provides information allowing rational diet formulations. When deciding what to feed, we must put that information to use. Our charges deserve nothing less than having their needs met in full.

—Astrid MacLeod and Janine Perlman
Authors, "Food for Thought"

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

In the recipe for FoNS (Formula for nestling songbirds: Down payment on fitness and survival, *J. Wildlife Rehab.* 25[3]: 16), author Diane Winns suggests that 2000–2500 IU of vitamin A can be obtained from 5 drops of cod liver oil. But when I look at the label of the cod-liver-oil product I take, it doesn't seem that there would be that much vitamin A in 5 drops. Can you clarify this?

The amount of vitamin A in cod liver oils varies; furthermore, some products are emulsified or contain added vegetable oil, either of which could reduce the concentration of vitamin A. You should go by the information on the label of whatever brand you use; I apologize for not giving a more precise recommendation.

An easy way to get the amount suggested for the FoNS recipe is to purchase cod-liver-oil softgels labeled "concentrated" or "high-potency." One softgel should contain about 2500 IU of vitamin A (check the label), so instead of counting drops, you can just use the contents of one softgel.

—Diane Winn



TO OUR READERS

Please join us at the IWRC's 26th annual conference in Illinois this fall. (See announcement on page 23.)

In honor of Susan Meredith Fosco, the IWRC is offering a conference scholarship that provides monetary support toward the cost of attending the conference. For more information and an application, please contact the IWRC at 707/846-1761 or director@iwrc-online.org.

A Postrelease Study of Rehabilitated Western Screech Owls (*Otus kennecotti*) in Douglas County, Oregon

by Marnie Allbritten and DeWaine Jackson

ABSTRACT: The authors examined the survival of 16 western screech owls (*Otus kennecotti*) released after rehabilitation. Initial injuries to nine of the owls included damage to one eye.

All owls were tracked until they either shed their transmitters and the transmitters were recovered, or until the transmitters failed. Average tracking period for the 16 owls was 115 days. Two confirmed mortalities, two probable mortalities, and one possible mortality occurred during the course of the study. Three of five radios recovered were from vision-impaired owls. Seven normal-vision owls had a 0.625 overall survival rate (+ 0.38) and nine vision-impaired owls had a 0.50 overall survival rate (+ .35).

KEY WORDS: western screech owls, *Otus kennecotti*, rehabilitation, eye injuries, survival

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Introduction

Postrelease survival studies of rehabilitated birds are critical to determine whether rehabilitation and prerelease training methods are adequate to assure survival of rehabilitated individuals. Little research has been done concerning survival of rehabilitated birds. With the exception of a few limited banding studies, few long-term studies have taken place (Sweeney et al. 1996, Goggin et al. 1999). In addition, because of the need for raptors to be in as perfect physical condition as possible, it is often stated that no raptor should be released in anything other than perfect physical condition (Redig 1993, 157; Martell and Redig 1985).

Umpqua Wildlife Rescue (UWR) has been releasing vision-impaired screech owls (*Otus kennecotti*) since it began rehabilitation activities in Douglas County, Oregon, in 1988. The decision to release these birds was based on three considerations. First, screech owls are "perch and pounce" predators; in most cases, their style of hunting does not require high-speed chases through dense forests, nor does it require a great deal of aerial maneuvering as in the case of pursuit hunters such as Cooper's hawks (*Accipiter cooperii*) or peregrine falcons (*Falco peregrinus*) (Woodbridge 1991). Second, Douglas County has very mild winters with rare snowfall. Thus, invertebrate prey, such as beetles and moths, may be available through the winter months, and screech owls could locate prey more easily without snow over it. Since 1970 the highest amount of snow received was 17.27 cm (6.8 in) in February 1989. Most years, no snowfall occurred in the Roseburg area (Western Regional Climate Center, Reno, Nevada). Third, western screech owls are not a migratory species and thus are not subject to additional predation during migration (although predation on screech owls by great horned owls has been documented [Craighead and Craighead 1956]). Because of these factors, the rehabilitators at UWR expected that if owls were prerelease trained on live prey and released back to their home territories, their survival would be good, even though they had impaired vision. (The term "impaired vision" as used in this paper encompasses a number of injuries, including retinal tears and scarring, cataracts, clouded lenses, lens detachment, and the total loss of an eye.)

The study sought to determine survival of rehabilitated western screech owls. This paper compares survival of rehabilitated owls with full vision to those with impaired vision. There was concern by state wildlife biologists (pers. comm., Denney 1995) that rehabilitated owls would not survive long enough to establish or re-establish home ranges, and that owls would not follow normal behavior patterns if they did survive. Accordingly, the first 18 months of the study were devoted to determining whether rehabilitated screech owls were able to survive. This phase examined the fate of the first six adult screech owls to come in for rehabilitation to UWR during April 1995–March 1996. Three of these owls had eye injuries.

Study Area

All data were collected in Douglas County, Oregon, from April 1995–June 1999. Douglas County lies at the conjunction of three ecosystem regions: the Coast Range, the Klamath Province, and the West Cascades. Topography varies widely and is usually characterized by steep hills surrounding relatively flat or gently rolling valley floors. Vegetation is either mixed Douglas fir (*Pseudotsuga menziesii*)/alder (*Alnus rubra*) or Douglas fir alternating with Oregon white oak (*Quercus garryana*) and California black oak (*Quercus kellogii*) pastures and open meadows. Fifteen owls came from rural residential areas with land use characterized by small residential acreages interspersed with large tracts of public or private timberland. One owl came from within the city limits of Roseburg, Oregon.

Methods

Only adult owls were included in the study. Owl age was determined by plumage characteristics as described in *The North American Bird Banding Manual* (1991). Any birds that had down on the tips of the head or neck feathers or lacked fault bars across all primaries were eliminated from the study group as possibly young of the year. The 16 adult western screech owls radio-marked in this study had recovered from injuries sustained in collisions with motor vehicles prior to release. Nine owls had minor to severe impairment of vision in one eye; seven had full binocular vision, as was confirmed by a veterinarian's examination prior to release. In most cases, the owls' injuries were readily apparent under examination by an ophthalmoscope and consisted of deformation of the pupil, scarring or misplacement of the lens, or visible damage to the pectin or retina. A method for reliably testing hearing was unavailable and thus hearing was not tested. All owls were trained in 3.64 m x 4.8 m (12 ft x 16 ft) flight cages on live prey (domestic mice) and were capturing one to two mice per day for > 7 days prior to release. Fourteen owls were released at the locations where they were found. Two owls had unknown original locations and were released into areas known to be frequented by screech owls.

Prior to release, a Holohil tail-mount transmitter weighing approximately 3 g was secured to the two center rectrices of each owl's tail using a commercial quick dry epoxy bond and carpet thread. Transmitter battery life was estimated at approximately 180 days by the manufacturer. Birds were monitored using telemetry triangulation methods daily for the first week after release, and were monitored 1x/week thereafter for the duration of the study (Fuller 1987, White and Garrott 1990, 35–40; Bookhout 1994.)

If an owl continued to change location coordinates between observation periods, it was recorded as alive on the date of the previous observation. (This was assumed because, in



PHOTOS: JOANNE RICHARDS



Two western screech owls involved in the study. The bird immediately above has only one functional eye.

FIGURE 1. SURVIVAL CURVES FOR IMPAIRED-VISION AND NORMAL-VISION WESTERN SCREECH OWLS, RADIO-MARKED AND RELEASED IN DOUGLAS COUNTY, OREGON, 1995–2000

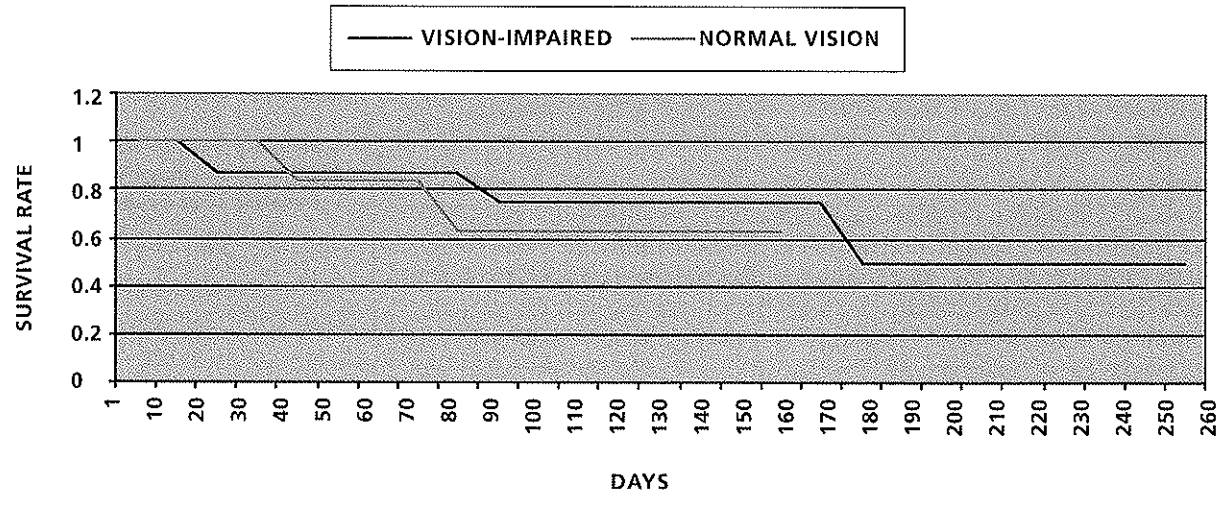


FIGURE 2. DAYS OF SURVIVAL FOR VISION-IMPAIRED AND NORMAL-VISION WESTERN SCREECH OWLS, RADIO-MARKED AND RELEASED IN DOUGLAS COUNTY, OREGON, 1995–2000

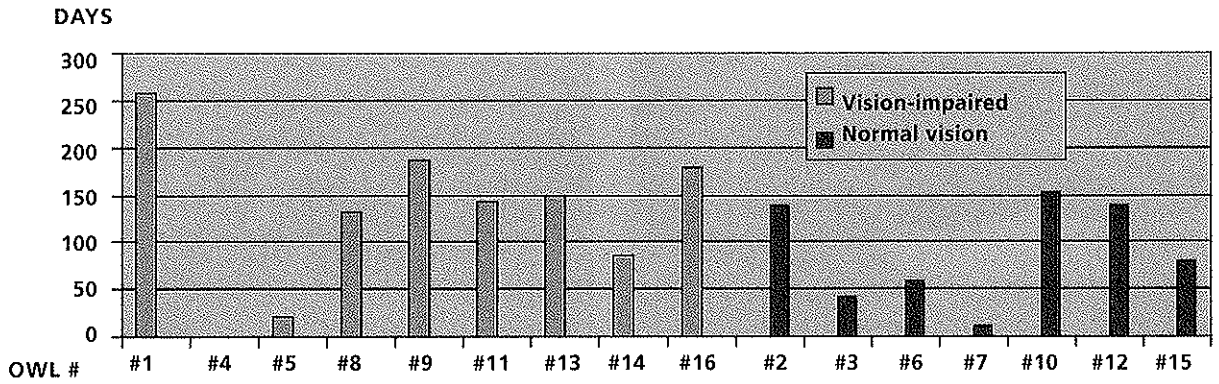
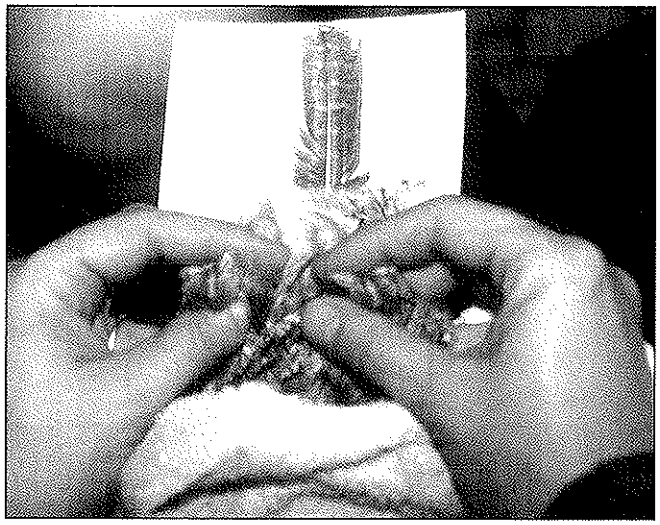


TABLE 1. DATA FOR 16 REHABILITATED ADULT WESTERN SCREECH OWLS, RADIO-MARKED AND RELEASED IN DOUGLAS COUNTY, OREGON, 1995-2000

OWL #	DATE RELEASED	END DATE[1]	# DAYS MONITORED	INJURY or INJURY SITE	TRANSMITTER RECOVERED	FATE
1	23 APR 95	05 JAN 96	257	Right eye	No	Still active
2	23 APR 95	08 SEPT 95	138	Concussion	No	Still active
3	29 JUL 95	08 SEPT 95	41	Concussion	Yes	Unknown[2]
4	20 SEPT 95	21 SEPT 95	1	Left eye	No	Unknown
5	19 DEC 95	10 JAN 96	22	Right eye	Yes	Unknown
6	13 MAR 96	11 MAY 96	59	Concussion	No	Still active
7	01 JUL 96	12 JUL 96	11	Concussion	Yes	Unknown.
8	04 AUG 96	15 DEC 96	133	Left eye blind	No	Still active[2]
9	10 NOV 96	15 MAY 97	186	Right eye blind	No	Still active
10	06 SEPT 97	06 FEB 98	153	Concussion	No	Still active
11	02 DEC 97	23 APR 98	142	Left eye	No	Still active
12	08 JAN 98	27 MAY 98	139	Concussion	No	Still active
13	09 MAR 98	05 AUG 98	149	Left eye	No	Still active
14	15 SEPT 98	10 DEC 98	86	Right eye blind	Yes	Dead
15	24 MAR 99	12 JUN 99	80	Concussion	No	Still active
16	09 AUG 99	03 FEB 00	178	Left eye	Yes	Still active

[1]This date defines the end of telemetry tracking either because a transmitter was recovered or stopped functioning.

[2] Owl released in new territory; original territory unknown



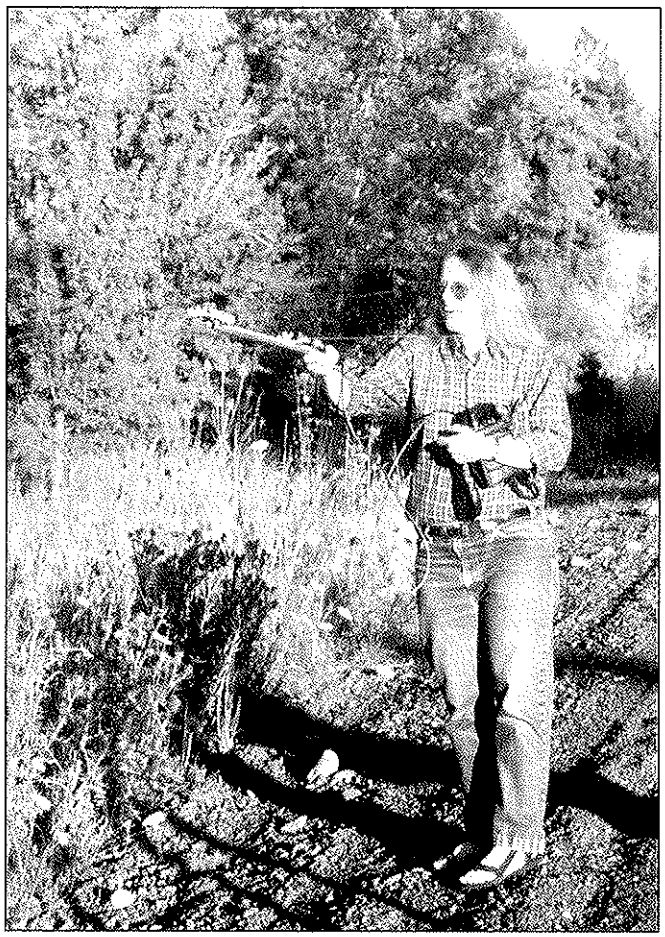
Attaching the transmitter to the tail with carpet thread and a commercial quick dry epoxy bond.

the event that a predator killed an owl, the predator would likely only move the transmitter once in order to carry the owl to its den or perch for consumption.) If an owl was at the same location coordinates during two consecutive observations, the observer obtained landowner permission and obtained a visual sighting of the owl, or recovered the transmitter and/or carcass. In some cases, a visual sighting was not obtained; in these instances, it was ascertained that the owl was alive through transmitter movement.

Mortality rate was calculated using a staggered entry Kaplan-Meier estimator (Pollock et al. 1989). The sporadic nature of owl injuries and the short life span of the transmitters made it impossible to have all owls entered into a single analysis using the actual dates of release. Instead, a common date of entry into the analysis was chosen (Owl No. 1 release date), and the date of each owl's fate (mortality or censoring) was determined based on the actual number of days it survived in the field. This analysis makes the assumption that all mortality factors were consistent during the monitoring periods even though the periods varied temporally.

Results

On completion of the study in January 2000, the following results were noted. Nine vision-impaired owls had an overall survival rate of 0.50 (+0.35), with one owl surviving 257 days. Seven normal-vision owls had a 0.625 (+0.38) overall survival rate, with one owl providing data for 153 days. The overall survival rate estimates were not different between vision-impaired owls and owls with normal vision (X^2=0.196, p=0.658). Postrelease survival was nearly identical between vision-impaired and normal vision owls through the first 80 days (Figure 1). Additionally, mean (± SD) survival time (in days) was not different, 128.2 ± 80.9 and 88.7 ± 55.3 between vision-impaired and normal-vision owls, respectively (t = 1.103, 14 df, p = 0.288) (Figure 2). Although the survival rate was lower for vision-impaired owls, their average survival time appears to be greater than normal-vision owls. This is primarily due to a single vision-impaired owl with 257 days of data (Table1).



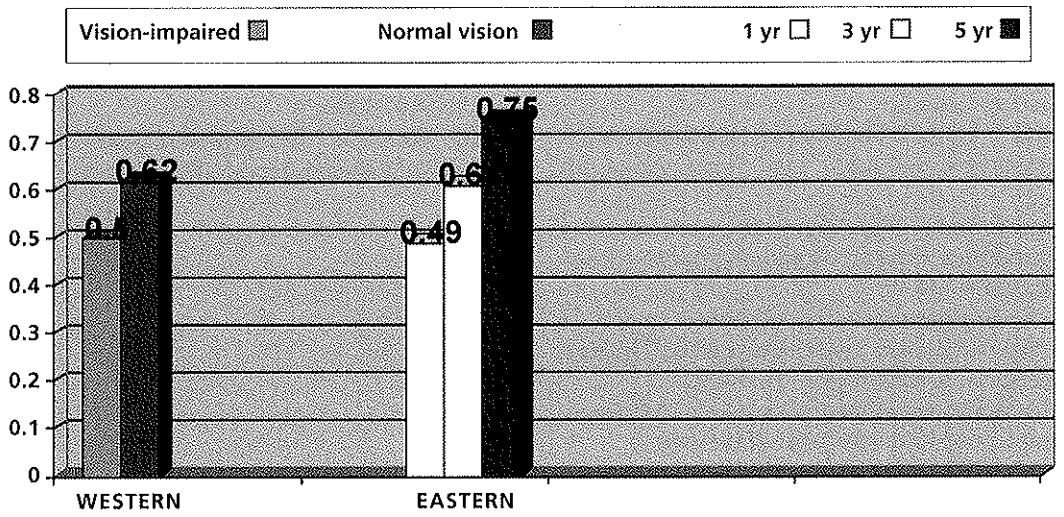
Author Marnie Allbritten radio-tracks an owl in the study.

The total number of radio-locations obtained per owl varied from one to 41. The average monitoring period was 111 days and ranged from 1 day (probable transmitter failure) to 257 days (Table 1). Five transmitters were found still functioning but no longer attached to owls. Of these, one was found attached to the two attachment rectrices during the normal molting period for screech owls in Douglas County (June–August) (J. Richards, pers. comm., F. Gehlbach 1994.); two were found still attached to the two attachment rectrices outside of the normal molting period; one was found absent of feathers with frayed strings still attached and small scratch marks on the transmitter casing; and one was found under a stump, in a small mammal burrow. (Three recovered transmitters were from vision-impaired owls, but only one transmitter was from an owl that was blind in one eye. The other two transmitters came from birds with central nervous system signs consistent with concussion.)

Discussion

Causes of mortality in screech owls normally include predation, starvation, adverse weather (i.e., exposure), disease, and vehicular collision. For eastern screech owls, (*Otus asio*), Van Camp and Henny (1975) suggested that the overwhelming cause of death is vehicular collision. Gehlbach (1994) found that vehicles killed more than 55% of the eastern screech owls he observed during a 25-year study. Although no carcasses

FIGURE 3. A COMPARISON OF WESTERN SCREECH OWL SURVIVAL RATES TO AN AGE CLASS SURVIVAL RATE FOR EASTERN SCREECH OWLS



Note: This study's survival rates are most similar to the rates for 3-year-old owls in Gehlbach's study.

were recovered during this study, one transmitter was recovered within 9.1 m (10 yd) of a road. This transmitter was also found during what would be an abnormal molting period for screech owls. All others were found between 45–450 m (50–500 yd) from a road in circumstances that could be consistent with predation. Regardless of mortality causes, survival rates for rehabilitated western screech owls in this study are nearly identical to the survival rate for wild, 3-year-old eastern screech owls documented by Gehlbach (1994; Figure 3). (Note: It is unlikely that the transmitters affected the sight-impaired birds more than the unimpaired birds since their survival rates were very close to equal.)

It appears from this study that impaired vision had no significant effect on survivability of rehabilitated screech owls. All owls survived a minimum of 22 days (with the exception of one whose transmitter likely failed). Therefore, starvation was not a likely mortality factor. In most cases, rehabilitated owls established new home ranges or re-established residence in their presumed previous home range (within approximately 1.6 km^2 of their original recovery site.)

The study's results suggest that rehabilitated adult western screech owls, trained for live prey capture, even with impaired vision, survive as well as normal-vision rehabilitated screech owls. The season of release did not seem to affect survivability. Birds were released during all times of the year and included subjects who survived short periods of time and those who survived long periods of time in all seasons. All the birds released during winter months were sight-impaired, but these three birds survived for 159, 22, and 186 days, respectively.

Acknowledgements

We would like to thank Umpqua Wildlife Rescue, Inc., the International Wildlife Rehabilitation Council, and the Oregon Department of Fish and Wildlife without whose funding and cooperation this work would not have been possible. We would also like to thank Joanne Richards, DVM, for her dedicated work as an owl tracker par excellence and Peg Boulay for her suggestions concerning the statistical analysis. Finally we would like to thank Janice Reid, long-time USDA Forest Service biologist and northern spotted owl researcher for all her suggestions and information on telemetry and radio-tracking.

Products Cited

Radio transmitters

Holohil, Inc.
112 John Cavanaugh Road
Carp, Ontario
Canada K0A1L0

Commercial epoxy bond

5 Minute Epoxy Devcon™
ITW Performance Polymers Consumer Division
2107 West Blue Heron Boulevard
Riviera Beach, Florida 33404
USA

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NEO-REHABILISMS...

hemostab
alternative instrument when you don't have a scapel

remages
wise men who can foresee date of fledging based on flight feathers

starveling
that featherless Sturnus vulgaricus *that arrives emaciated and dehydrated each spring*

The Assessment of British Hedgehog (*Erinaceus europaeus*) Casualties on Arrival and Determination of Optimum Release Weights Using a New Index

by Toni Bunnell

ABSTRACT: The data suggest that it is the relationship between the weight and size of a British hedgehog (*Erinaceus europaeus*) rather than the weight per se, that is important for assessing the animal's nutritional status and chances of postrelease survival. The relationship between two girth measurements, made at right angles to each other on a tightly curled hedgehog, provides an effective new index (Bunnell Index, BI). A minimum value of 0.80 for the BI should be obtained in a healthy animal. By reference to charts depicting values for weight and BI values recorded for 57 hedgehogs, a comparison can be made with BI values measured in sick animals presenting for treatment. This can suggest the level of treatment required to successfully rehabilitate an animal.

KEYWORDS: hedgehog, *Erinaceus europaeus*, wildlife rehabilitation, mammal conservation, animal welfare, wildlife sanctuaries.

TONI BUNNELL, PH.D., began rehabilitating hedgehogs in 1990. Since then she has treated and cared for an increasing number of sick or injured animals. She takes 90% of the hedgehogs received by York (England) RSPCA Animal Home, releasing survivors back to the wild with an 80% success rate. Bunnell earned a Ph.D. from the Open University (Milton Keynes, England) on playful behavior in the polecat (*Mustela putorius*) in relation to family group activity. She lectures full-time in biological sciences at the University of Hull, England. Her current research activities involve identifying the environmental factors that influence immune status resulting in pathological symptoms and subsequent incapacitation of hedgehogs.

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Introduction

British hedgehogs (*Erinaceus europaeus*) are reported to be declining in numbers (The Mammal Society 1999). This is partly due to road traffic kills (Stocker 1987, Kristiansson 1990, Morris et al.1993, Morris and Warwick 1994, Reeve 1998, Reeve and Huijser 1999, Huijser 1999). However, Morris (1997) conducted one study where 13 rehabilitated juvenile hedgehogs were released back to the wild and found that none were killed by road traffic. This finding could be explained if the release area was situated away from busy roads. Additional factors that could be contributing to the decline include increased fragmentation of habitat, resulting in animals tending to be more exposed to road traffic, and reduced areas for suitable nest building.

Many wildlife sanctuaries exist throughout Britain, and thousands of hedgehog casualties are rehabilitated and returned to the wild. Studies carried out by Morris et al. (1993) and Morris and Warwick (1994), monitoring the progress of released rehabilitated adult hedgehogs, concluded that they probably cope well with release.

One aspect of hedgehog physiology that has come under scrutiny (Morris 1984) is the minimum weight necessary for a hedgehog to survive the winter in Britain. The figure estimated as the threshold body size for winter survival is 450 g (Morris 1984). This figure was arrived at by informed guesswork, whereby the weights of hedgehogs surviving hibernation were used to calculate the probable weight necessary to survive the winter, assuming that only 25% weight loss occurs (Morris 1984). Morris determined that any hedgehog weighing less than 400 g before commencing hibernation would not be expected to survive until March–April the following year. He comments that this figure is a minimal estimate and should perhaps be raised to 450 g to allow for particularly adverse conditions.

Based on previous work, the main consideration for deciding when to release a healthy, rehabilitated hedgehog back to the wild appears to be the weight of the animal in question. "Healthy" in this instance means that the hedgehog has no open wounds, no pathological symptoms attributable to gastrointestinal parasites, bacterial or protozoan infection, no skin infestations, and no ectoparasites. Fecal analysis should reveal a parasite burden within normal, nonpathological, levels and a balanced gut flora should be evident. Blood analysis would provide a more detailed picture of the health status of an animal and possibly reveal underlying subclinical disease. However, apart from the cost, this would cause unnecessary suffering to the majority of animals where such a procedure is not necessary, and would therefore not justify the application of the procedure. However, although weight per se is obviously an important criterion, other considerations may be even more critical. This article describes a simple index of condition that should also be taken into account.

Material and Methods

The hedgehog generally presents for clinical examination as a tightly curled ball covered in sharp, impenetrable spines. This does not lend itself to easy examination. When the animal produces some droppings these can be examined either microscopically or by overt appearance (Bunnell 2001b).

Data for this study were collected from all hedgehogs (n = 57) arriving at the author's sanctuary in York, England, between June 2000 and December 2000. (A total of 77 animals arrived throughout the year 2000.) The sanctuary is run under the supervision of the Royal Society for the Prevention of Cruelty to Animals (RSPCA).

The arrival at the sanctuary of many hedgehogs weighing 700 g or more, but extremely thin with protruding ribs, suggested that the proposed minimum winter survival weight of 450 g (Morris 1984) was inaccurate. It seemed that weight per se

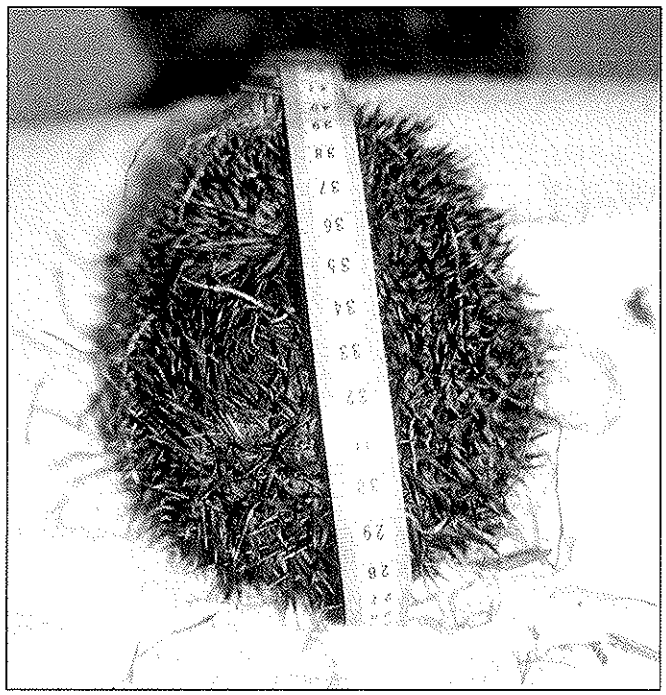
was an inadequate method for assessing hedgehog health and, therefore, suitability for release. The author decided to develop a procedure that would produce objective data, which would reliably indicate the condition of an animal with regard to nutritional status. This method involves taking measurements of a hedgehog when tightly curled up, determining an index (Bunnell Index, BI) from the data, and comparing this with data that indicate whether the index falls within a satisfactory range.

The procedure can be conducted immediately on arrival of any hedgehog casualty, and can be used to assess the state of malnutrition, if it exists, by determining the BI. The technique is simple and quick. Two measurements are taken using a standard nonstretchable tape measure, with the animal on a nonslip surface. One measurement is taken round the middle of the animal to cross at the point where the nose ends ("A," latitudinal circumference). The other measurement, using a second tape measure already secured underneath the animal, is taken round the hedgehog from head to tail ("B," longitudinal circumference). Care must be taken with both measurements to ensure that the ends of the tape measure meet easily without altering the shape/positioning of the hedgehog. When obtaining measurement A, the positioning of the tape measure is crucial; a measurement taken lower down toward the tail can result in a lower (inaccurate) reading. Repeatedly measuring many hedgehogs over several consecutive days demonstrated consistent BI values and hence the reliability of the method. A is divided by B to give a value for the BI. It is important to determine the BI value to two decimal places (i.e., a value of 0.794, becomes 0.79, while a value of 0.805 becomes 0.81).

It is also important that the animal is tightly curled; an animal that is relaxing out of this state will lead to inaccurate measurements being taken. Measurement B will be greater and measurement A smaller when a hedgehog is relaxed compared with when it is tightly curled, thus giving rise to a lower BI than is actually the case. With the exception of very sick or injured hedgehogs, all hedgehogs tend to curl tightly, so this does not present a problem. Variation in spine length between hedgehogs will not affect the BI value for individual animals. A hedgehog with relatively long spines, compared with another, will be uniformly covered with these spines and thus the BI value should still accurately portray the nutritional state of the animal.

Between June and December 2000, all hedgehogs (n = 57) brought to the sanctuary in need of care were assessed on arrival and monitored closely during their stay, this including daily examination and weight measurements. They were also measured to provide a BI value. Only when an animal was too poorly to be subjected to being measured, or too small to provide an accurate measurement due to an inability to curl up tightly (as with some nestlings), was the procedure for obtaining the BI omitted. ("Nestlings," in this instance, includes all animals with a weight less than 250 g.)

In order to obtain values for the BI for healthy animals during development, all animals in a litter of eight were weighed on a daily basis from 26–54 days old and the BI recorded at regular intervals. It has always been the practice at the sanctuary to weigh all animals daily to monitor their progress. The additional BI measurements helped to give a fuller picture of the state of health for each animal. By recording the weight and BI of this litter, it was possible to produce a chart depicting the normal weights and BI measurements of a hedgehog between 26 and 54 days old.



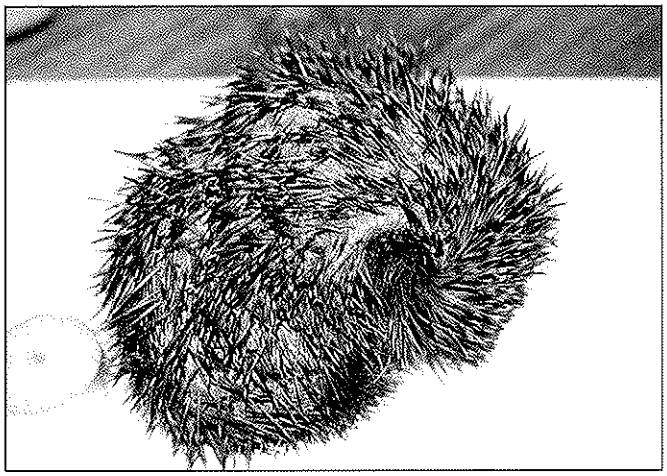
PHOTOS: TONI BUNNELL

Hedgehog being measured, head to tail (longitudinal circumference, measurement B), in order to determine the Bunnell Index and assess condition.

The ability of a number of hedgehogs (n = 25) to survive cold weather was recorded in those rehabilitated hedgehogs deemed unsuitable for return to the wild prior to or during the winter months. These animals were kept in conditions most suited to their state of health and weight. Some were released into an enclosed private garden, some kept in a heated unit, and some kept indoors. All animals received unlimited food and water and were weighed at regular intervals to ensure that they were making good progress. In addition, their BI was determined at regular intervals. If, at any time, those animals living in the garden were found to be losing weight, they were transferred to the heated unit, and given medication (wormer/antibiotics) where necessary (Bunnell 2001b). The minimum overnight temperatures for outdoors and the heated unit were monitored daily, bearing in mind that in the UK external air temperature can vary greatly over a day or night.

The data collected provided much information regarding the ability of hedgehogs to survive low temperatures when food was freely available and housing and nest materials were optimal.

When considering the release of an animal, having determined the BI, other factors were then taken into account, including recent rate of weight gain, age of the animal, the time of year, external temperature, and current weather conditions at the time of the proposed release. For example, if an animal had been exposed to external temperatures for at least a week; had continued to gain weight during this time; had reached a weight of 650 g or more prior to the onset of winter; and achieved a minimum BI value of 0.80, it was considered to be a suitable candidate for release.



Emaciated, skeletal adult male hedgehog, weighing 495 g.



Malnourished, underweight hedgehog with tapering rear end, signifying insufficient body mass.

Results

Table 1 shows a range of weights and BI readings in eight healthy hedgehog siblings, ranging from 26–54 days old. The BI values for individual animals range from 0.78–0.88, while the values averaged for all eight animals, on the eight occasions they were measured, range from 0.80–0.83. These values can be taken as being within a range compatible with that seen in normal wild British hedgehogs, as the animals that provided these data were not ailing in any way, merely orphaned prior to weaning. As a result they did not need any medication, merely warmth and food.

The data shown in Table 1 could be used to help assess all nestlings on arrival and determine their age and nutritional status for any particular weight. It can be seen that the minimum BI was 0.80. The BI of an underweight animal will be lower than 0.80, and thus it will be assessed as malnourished and of indeterminate age. The assessment of an animal as being underweight is made on the basis of the presence of protruding ribs and a pointed rear end (Stocker 1987, Sykes and Durrant 1995). The tendency of the average BI values to remain almost constant as the average weight for all eight siblings increases is seen in Figure 1.

The monitoring of hedgehogs in this study took place in an enclosed private garden with supplementary food made available, in addition to the "wild diet" of natural food existing in the garden. It is speculated that those animals that continued to gain weight over a period of a week or more, and achieved a BI of at least 0.80, were good candidates for release.

In order to test the idea that a minimum BI is necessary for a hedgehog to survive external temperatures while demonstrating a continuous weight gain, the BI data for survivors and nonsurvivors were examined in 28 animals arriving for treatment between June–October 2000. The BI values were determined on arrival and the eventual outcome of all individuals recorded. Of 16 hedgehogs with a BI less than 0.80, only five survived to release status (31%) (Figure 2). However, of 12 animals whose BI measured 0.80 or above on arrival, 10 survived to release status (83%).

These findings, accompanied by direct observation that animals with a lower than 0.80 BI value were thin in appearance with protruding ribs, suggest that a BI of 0.80 is a threshold point above which animals have an increased chance of survival compared with animals displaying a BI less than 0.80 (Figure 2). Testing the null hypothesis that the median indices for live (0.81) versus dead (0.76) animals are the same, using the nonparametric Mann-Whitney test, gives a P-value of 0.011. This shows that there is a statistically significant difference in survival rates between animals with a BI of 0.81 and those with a BI of 0.76, those with the higher BI on arrival for treatment being more likely to survive to release status. The survivors had, on average, a significantly higher BI than those animals that died.

As all hedgehogs were monitored on a regular basis, it was possible to determine the weights, BI, and minimum outdoor temperatures at which hedgehogs of different ages failed to sustain or increase their weight. Table 2 illustrates the external temperature and weight for a number of animals that were seen to lose weight during the following 24 hours and had to be moved to a warmer environment. For instance, Animal C weighing 455 g, with a BI of 0.82, was unable to maintain its weight at 9°C. Animal A weighing 425 g with a BI of 0.87 at 7°C, Animal O weighing 450 g with a BI of 0.80 at 10.5°C, and Animal P weighing 430 g with a BI of 0.80 at 10.5°C, failed to sustain their weight. All these hedgehogs showed further weight gain in a warmer environment and were subsequently released following further monitoring outdoors.

These data illustrate that, despite a BI of 0.80 or more, hedgehogs still needed to reach a certain weight to enable them to maintain their weight at specific external temperatures. The daily

TABLE 1. AGE, WEIGHT, AND HEDGEHOG INDEX (BI) IN A LITTER OF EIGHT SIBLINGS

[values for weight (g) are shown in normal type, BI in bold]

Age	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Animal A	131	138	137	140	149	171	185	195	210	200	220 **0.81**	230	235	235	245	275 **0.81**	287	310	320 **0.83**	325	345	335 **0.84**	340 **0.84**	355	355 **0.81**	365 **0.84**	355	380	410 **0.80**
Animal B	126	132	129	135	142	161	162	163	181	181	196 **0.81**	205	215	205	225	260 **0.80**	275	293	315 **0.82**	325	340	377 **0.83**	370 **0.82**	385	410 **0.82**	430 **0.82**	420	460	465 **0.81**
Animal C	118	120	125	142	157	175	193	205	220	235	260 **0.82**	270	260	245	270	290 **0.81**	320	310	325 **0.81**	360	340	375 **0.80**	370 **0.80**	380	400 **0.81**	415 **0.83**	385	425	420 **0.80**
Animal D	155	164	163	170	191	200	200	215	220	238	250 **0.83**	265	260	275	295	305 **0.79**	340	348	345 **0.80**	360	390	385 **0.79**	425 **0.81**	430	450 **0.80**	465 **0.79**	475	490	535 **0.84**
Animal E	129	136	132	125	131	145	150	148	162	169	178 **0.83**	190	190	184	200	230 **0.78**	232	250	270 **0.76**	290	300	315 **0.80**	325 **0.80**	340	325 **0.80**	358 **0.79**	355	370	380 **0.82**
Animal F	149	161	159	161	180	205	199	210	210	235	240 **0.83**	240	240	255	270	298 **0.84**	305	310	335 **0.83**	330	365	390 **0.88**	405 **0.84**	420	435 **0.83**	455 **0.78**	465	485	508 **0.85**
Animal G	128	140	132	142	144	167	175	169	184	190	205 **0.80**	215	220	210	232	270 **0.79**	275	300	305 **0.78**	328	350	365 **0.83**	355 **0.83**	375	400 **0.76**	415 **0.77**	420	425	445 **0.83**
Animal H	143	151	152	157	170	189	184	195	198	225	220 **0.83**	230	230	240	260	275 **0.79**	310	300	320 **0.78**	340	335	360 **0.84**	375 **0.82**	380	402 **0.80**	410 **0.79**	—	445	460 **0.81**
AVG.	135	143	141	147	158	177	181	188	198	209	221 **0.82**	231	231	231	250	275 **0.80**	293	303	317 **0.80**	332	346	363 **0.83**	371 **0.82**	383	397 **0.80**	414 **0.80**	—	435	453 **0.82**

Note: Age is given in days old

FIGURE 1. AVERAGE WEIGHT AND AVERAGE BUNNELL INDEX FOR EIGHT SIBLINGS

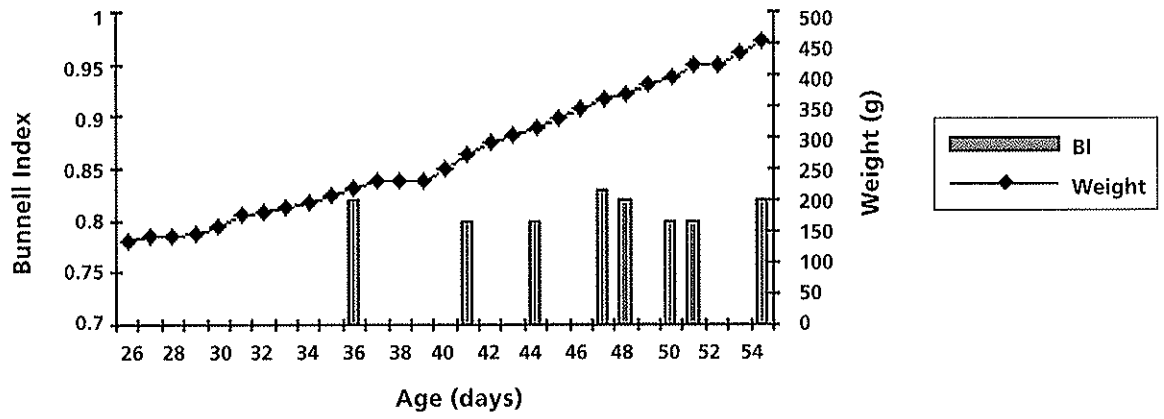
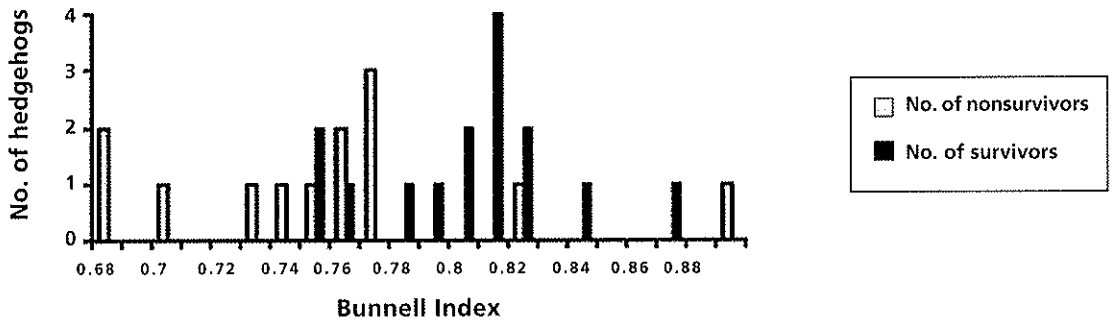


FIGURE 2. BUNNELL INDEX FOR SURVIVORS AND NONSURVIVORS ON ARRIVAL



provision of food was not enough to offset the demands made on underweight animals to maintain their core temperature.

Table 3 gives examples of hedgehogs that continued to gain weight in the days following the recording of these data. That is, for the given values of minimum ambient temperature, body weight, and BI value, all these animals continued to thrive and were subsequently released. For instance, on 1 August 2000, a hedgehog weighing 345 g with a BI of 0.84 at 15°C, gained weight continuously and was released at a weight of 445 g, a BI of 0.85, and a temperature of 17°C. At a temperature of 6°C, an animal needed to weigh 420 g or more, with a BI of at least 0.83, in order to continue to gain weight. As the minimum external temperature decreased, the weight and BI of an animal necessary for them to sustain their weight increased. It should be mentioned again that housing and food provision was optimal, and in a private enclosed garden. Also, these animals were not hibernating and were released back to the wild when the minimum overnight temperature was several degrees above zero (6.5–17°C), the ground was not frozen, and food was still available.

Table 3 also provides some examples of weights, with associated BI values, of several animals when released at the given minimum external temperatures. It can be seen that, at a temperature of 17°C, a satisfactory BI would be 0.81 for an animal weighing 495 g, while at a temperature of 4°C, a satisfactory BI would be 0.88 for an animal weighing 650 g.

Table 4 shows the numbers of animals that gained or lost weight when exposed to certain external temperatures. Between temperatures of -1°C and 3°C, nine out of 10 animals weighing less than 500 g failed to thrive (90%), while of those weighing more than 500 g, only eight out of 71 failed to thrive (11%), the remaining 63 (89%) continuing to gain weight. Some animals may have been included in this assessment more than once during the period of monitoring.

It can be seen that the ability of an animal to continue to gain weight depends, amongst other things, on its weight, BI value, and the ambient temperature. Other factors that may affect weight gain include burdening by gastrointestinal parasites and pathogens (Bunnell 2001b, Bunnell 2001c), and infestation with ringworm or sarcoptic mange (Bunnell 2000) or ticks (Bunnell 2001a). The data shown in Tables 2, 3, 4, and 5 are intended as a guide to indicating suitability for release to the wild of rehabilitated hedgehogs.

A threshold BI for all ages was determined to be 0.80 and applies to healthy hedgehogs during the warmer months of the year. This figure was arrived at based on data collected for 57

TABLE 2. WEIGHT AND BI VALUES FOR HEDGEHOGS THAT LOST WEIGHT AT THE GIVEN EXTERNAL TEMPERATURES

ANIMAL	DATE	TEMP °C	WEIGHT (g)	BI
I	23 OCT 00	9	345	> 0.84
I	27 OCT 00	10	365	0.86
A	23 OCT 00	19	345	
A	12 NOV 00	7	425	0.87
B	24 OCT 00	10.5	377	0.83
C	22 OCT 00	7	360	> 0.81
C	30 OCT 00	7	425	0.81
C	23 NOV 00	9	455	> 0.82
E	26 OCT 00	11	340	> 0.80
G	24 OCT 00	10.5	365	0.83
H	25 OCT 00	10	375	0.82
H	14 NOV 00	5	415	
J	03 NOV 00	6	330	0.86
J	06 NOV 00	7	373	0.86
J	14 NOV 00	5	355	
J	16 NOV 00	5	420	
J	12 DEC 00	10	553	
K	03 NOV 00	6	365	0.82
K	06 NOV 00	7	393	> 0.82
L	07 NOV 00	9	415	
L	14 NOV 00	5	425	
M	05 NOV 00	4.5	863	0.87
N	14 NOV 00	5	415	> 0.81
O	05 DEC 00	10.5	450	0.80
O	11 DEC 00	8	475	
O	20 DEC 00	7	525	
P	05 DEC 00	10.5	430	0.80
P	08 DEC 00	8.5	465	
Q	11 DEC 00	8	450	
R	11 DEC 00	8	450	

animals in 2000. The BI was determined for each animal and subsequent progress recorded as usual. The BI can often be higher than 0.80 in nestlings (Table 1), where the ability to maintain core temperature is partly dependent on the presence of siblings.

The BI is also seen to be higher in animals building up fat reserves in readiness for hibernation. BI values in the latter tend to exceed 0.90 in the hibernating state. Table 5 shows that although the weight of an animal remains the same on the onset of hibernation, compared with immediately before hibernation, the BI increases considerably. This increase is due to even tighter curling of the hedgehog, which in turn reduces the surface area to volume ratio, reducing the surface area exposed to the elements and hence minimizing heat loss. As the BI increases to the point where it approaches 1.0, the animal becomes almost spherical in shape, thus optimizing its ability to conserve heat and therefore maintain its core temperature during adverse conditions.

Figure 3, the Bunnell Index Chart, provides a method of assessing a hedgehog to determine if it has an adequate weight/size relationship. Table 6 is intended as a guideline for establishing what a satisfactory weight would be for an animal with a particular set of A and B BI measurements.

Discussion

It is commonly known that a malnourished hedgehog will present a more pointed rear end, while those that are better nourished will appear more rounded (Stocker 1987, Sykes and Durrant 1995). However, merely observing a hedgehog for signs of malnutrition is too subjective and can lead to hedgehogs being returned to the wild with insufficient body weight to sustain them through hibernation, or to ensure survival prior to hibernation. Insufficient body weight tends to lead to, or be accompanied by, subsequent overburdening with parasites, bacteria, ticks, etc. (Bunnell 2001c), which in turn can lead to collapse and eventually death.

Data collected from 168 hedgehogs between April 1998 and December 2000 demonstrated that a minimum weight of 450–500 g was not an acceptable criterion on which to base the release of rehabilitated wild hedgehogs when the onset of cold weather is imminent. Casualties kept arriving at the sanctuary with weights around 700 g, displaying typical signs of serious malnutrition (i.e., tapered rear end, concave stomach, and prominent ribs easily felt when the animal was picked up with bare hands). These animals, having come straight from the wild, had not been subject to captive conditions, including unlimited access to food, and therefore the weights observed could be considered to be true values, uninfluenced by a captive feeding regime.

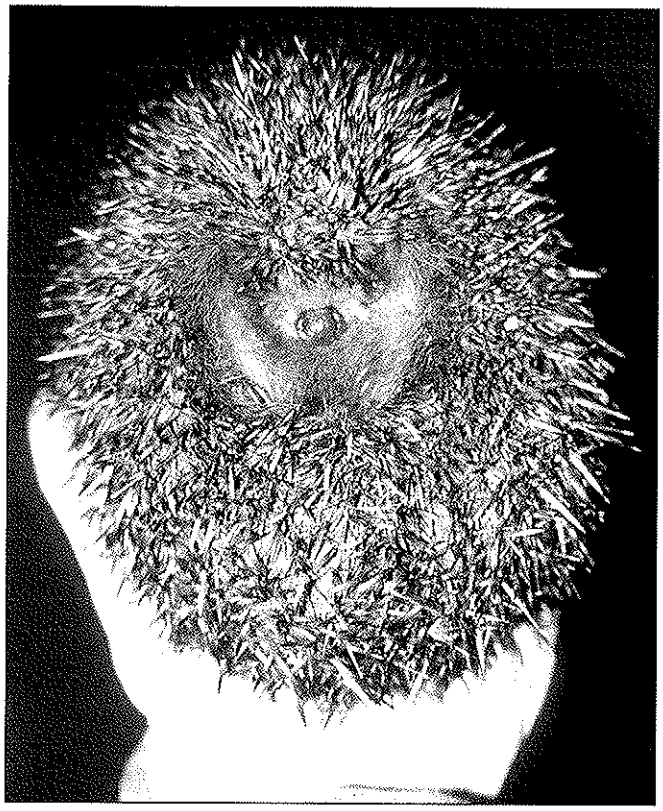
Where BI values are seen to change over a period of time, for any particular animal, it is interesting to note the reasons why. Animal C at one point weighed 400 g with a BI of 0.81, and a week later weighed 438 g with a BI of 0.77. Examination of the BI data showed that the fall in BI was due to the animal increasing in longitudinal circumference (B), proportionately more than the latitudinal circumference (A). Based on the data shown in Figure 2 and the associated statistical findings, this animal would have a poorer chance of survival at this point, with a BI of only 0.77. Animal C subsequently continued to gain weight (585 g on release), leading to a greater value of A compared with B, and a BI value of 0.88 on release.

An increase in weight tends to lead to an increase in the BI reading of an animal that is initially malnourished. However, this depends on the rate of weight gain. If the rate of weight gain is slow compared with that normally observed in hedgehogs of that size and/or age, then the BI value may fall. As the animal increases in length, with an increase in longitudinal circumference, this causes an increase in the B measurement and, at the same time, a decrease in the A measurement.

TABLE 3. WEIGHT AND BI VALUES FOR HEDGEHOGS THAT GAINED WEIGHT CONTINUOUSLY FOR THE WEEK PRIOR TO, AND FOLLOWING, DATE WHEN DATA WERE COLLECTED. VALUES ON RELEASE ARE ALSO SHOWN.

[Each line portrays a different animal.]

DATE	TEMP °C	WEIGHT (g)	BI	RELEASE DATE	TEMP °C	WEIGHT (g)	BI
12 MAY 00	10	850		26 MAY 00	7	1135	
12 MAY 00	10	610		26 MAY 00	7	805	
12 MAY 00	10	955		21 MAY 00	10	1080	
21 MAY 00	10	515		26 MAY 00	7	790	
11 JUN 00	14	900		15 JUN 00	11	940	
27 JUN 00	14	820		30 JUN 00	11	985	
11 JUL 00	10	400		28 JUL 00	15	525	0.83
25 JUL 00	14	400		09 AUG 00	17	495	0.81
01 AUG 00	15	345	0.84	09 AUG 00	17	445	0.85
02 AUG 00	14	365		15 AUG 00	14	490	0.83
06 AUG 00	15	365	0.86	25 AUG 00		490	
08 AUG 00	17	350	0.84	15 AUG 00	14	420	0.83
09 AUG 00	17	365	0.85	15 AUG 00	14	465	0.84
14 AUG 00	15	345		25 AUG 00		425	
02 SEP 00	12	420	0.82	05 SEP 00	14	480	0.82
09 SEP 00	14	365	0.80	17 SEP 00	13.5	460	0.81
12 OCT 00	7	645	0.78	15 DEC 00	12	700	0.79
20 OCT 00	9	348	0.80	03 NOV 00	6	555	0.84
21 OCT 00	7	335	0.83	03 NOV 00	6	565	0.84
03 NOV 00	6	425	0.85	12 NOV 00	7	580	0.83
06 NOV 00	7	450	0.89	22 NOV 00	6.5	600	0.84
08 NOV 00	7.5	520	0.83	18 NOV 00	6	615	0.84
14 NOV 00	5	425	>0.82	05 SEPT 00	14	480	0.82
16 NOV 00	5	420					
12 NOV 00	7	425	0.87	07 DEC 00	7.5	575	0.83
17 NOV 00	5	380	>0.80	07 DEC 00	7.5	550	0.83
17 NOV 00	5	440	>0.84	07 DEC 00	7.5	670	0.83
22 NOV 00	6.5	500	0.83	07 DEC 00	7.5	610	0.83
23 NOV 00	5	430	0.85				
23 NOV 00	5	455	>0.82	07 DEC 00	7.5	585	0.88
27 NOV 00	5	475	>0.84	08 DEC 00	8.5	630	0.81
28 NOV 00	6	435	>0.82				
02 DEC 00	9	745		07 DEC 00	7.5	743	0.81
17 DEC 00	2.5	535		03 JAN 01	4	650	0.88
20 DEC 00	7	525		03 JAN 01	4	660	0.86
20 DEC 00	7	533		03 JAN 01	4	660	0.85
26 DEC 00	2.5	560		03 JAN 01	4	640	0.87



Healthy adult male hedgehog showing typical, almost spherical shape when curled up.

As the BI is determined by dividing the A by the B measurement, this will cause a reduction in the BI.

Using the criterion of weight alone a British hedgehog weighing around 450 g would, according to the literature (Morris 1984), be deemed suitable for release. It could be argued that a severely malnourished hedgehog, whatever its weight, will be easily diagnosed as such by the experienced hedgehog caregiver. However, some animals with borderline malnutrition are not easy to identify. These animals might appear to be suitable candidates for release, all other criteria having been satisfied, but in fact would have a very poor chance of survival were they to be released with a BI lower than 0.80 during mild weather. This conclusion is based on the data shown in Figure 2 and also in Tables 2 and 3, where progress of animals under external temperatures was monitored. The only difference between survival in the wild and in a private garden is the availability of food and possibly decreased exposure to the elements. As mentioned earlier, studies following the release of rehabilitated hedgehogs concluded that rehabilitated adult hedgehogs probably cope well with release (Morris et al. 1993, Morris and Warwick 1994) and, therefore, the monitoring of animals in a garden would seem to provide a reasonable indication of their survival capability in the wild. This assumption is supported by the appearance of many (marked) rehabilitated animals, close to their original release site, several months after their release (Bunnell, unpubl.).

Considering the percentage of nonsurvivors and survivors (Figure 2), it would appear that there is a required minimum BI (in the warmer months) of 0.80. Those nonsurvivors with a BI less than 0.80 could not necessarily be said to have died from malnutrition. The lower BI has most probably predisposed them to an increased intestinal worm/pathogen burden. Alternatively, an increased susceptibility to increased infestation by worms and/or pathogens may have resulted in loss of appetite and/or reduced absorption and/or assimilation of food products, which in turn has resulted in weight loss and hence a lower BI. In either case the cause of a reduced BI can only be speculated upon.

However, a BI less than 0.80 would certainly seem to be strongly associated with a poor prognosis and slimmer chances of survival to release status. It should be mentioned that survival rates of hedgehogs, at the sanctuary run by the author, are very high (nestlings 74%, juveniles 55%, adults 58%) (Bunnell 2001c).

A recommended minimum release weight for subadult (juvenile) hedgehogs prior to the onset of winter (mid September) is 650 g (with an associated BI of 0.80 or more). This figure is based on the premise that any healthy, rehabilitated animal that has not yet reached its adult weight should, following release, continue to gain weight and reach a satisfactory hibernation weight prior to the onset of winter. Table 5 provides the BI measurements and weights observed in adult hedgehogs immediately prior to, and following the onset of, hibernation. These animals were exposed to external temperatures and only hibernated at the given weights and BI values. As the average weight of a hibernating animal, at the onset of hibernation, was 730 g (n = 15) (ranging from 635 g to 1005 g), it follows that any hedgehog released before winter needs to be a minimum weight of 650 g with associated satisfactory BI value.

It is actually preferable to release animals with a minimum weight of 650 g and a BI of 0.83 or more as this will give them a better chance of surviving during temporary unavailability of food. In addition, it has been observed (Bunnell, unpubl.) that rehabilitated animals, following introduction into a new environment, in this case an enclosed private garden, initially lost weight, despite unlimited access to supplementary feeding. This behavior was only temporary, and the animals, without exception, began to forage in the garden and consume the supplementary food within a couple of days. This quickly resulted in restoration of their initial weight and subsequent further increase to their expected adult weight.

Conclusion

This study has demonstrated an improved method to correctly assess whether a rehabilitated hedgehog is ready for release, or to assess its nutritional status, namely the determination of the Bunnell Index. The BI has been shown to be reliable across a range of size and weights as shown in Table 1 for hedgehogs aged 26–54 days. Table 6 also demonstrates consistency of the BI obtained for 26 animals ranging from 238–1000 g, all of these animals displaying optimum health and nutritional status.

Any animal displaying a BI of 0.80 or above is suitable for release back to the wild, all other factors being considered satisfactory. For instance, a sudden fall in temperature, inclement weather conditions such as snow or heavy winds, or predicted poor weather, are reasons to delay release until the situation improves. Also, all wounds must be healed, no ticks, ringworm or mange present, droppings normal, weight gain continuing, and body

TABLE 4. NUMBERS OF ANIMALS OVERWINTERED IN A PRIVATE GARDEN SHOWING THEIR ABILITY TO GAIN WEIGHT AT CERTAIN TEMPERATURES

MINIMUM TEMP °C	350–399 g	400–449 g	450–499 g	500–549 g	550–599 g	> 600g
-1			1-	3+	3+	2+
0				1-	1+	2+
1			1-	1+	3+	6+
2						3+
3			1+ 7-	14+ 4-	5+ 2-	20+ 1-
4					1-	6+
5	1+ 3-	16+ 1-	21+	14+	2+	2+

+ indicates that an animal is gaining weight continuously at the given temperature for that particular night.
- indicates that an animal is losing weight at the given temperature for that particular night.

Notes: An animal may appear one or more times in different weight categories. All animals had a BI value of 0.80 or greater. The minimum temperatures depicted may have existed on one or more nights during the winter months. None of these animals were hibernating.

TABLE 5. WEIGHTS AND BI MEASUREMENTS ON ONSET OF AND (WHERE AVAILABLE) IMMEDIATELY PRIOR TO, HIBERNATION

IMMEDIATELY PRIOR TO HIBERNATION				ON ONSET OF HIBERNATION			
Weight (g)	BI	A	B	Weight (g)	BI	A	B
770	0.87	40.5	46.5	775	0.90	42.0	46.5
770	0.87	39.5	45.5	770	0.92	42.0	46.5
850	0.89	42.5	48.0	825	0.94	44.0	47.0
805	0.89	41.0	46.0	780	0.90	41.5	46.0
635	0.82	36.0	44.0	635	0.90	39.0	43.5
735	0.84	37.0	44.0	740	0.92	41.0	44.5
695	0.80	36.0	45.0	680	0.91	40.0	44.0
				675	0.90	39.5	44.0
				830	0.89	42.5	48.0
				810	0.92	43.0	47.0
				740	0.92	41.0	44.5
				690	0.87	39.5	45.5

weight and BI acceptable for the time of year and minimum ambient temperature. The weight is important, particularly with juveniles, as a six-week-old animal can have a BI of 0.85 but be unable to survive one cold night out in January.

A minimum body weight of 650 g (with an associated BI of 0.83 or greater) is suggested for rehabilitated hedgehogs released in the autumn. Release of animals during the winter months, in temperatures lower than 5°C, is not recommended and is in contravention of the United Kingdom's Abandonment of Animals Act (1960), as directed by the Wildlife Department of the RSPCA.

Animal Welfare Implications

The development of the Bunnell Index for assessing the nutritional status of rehabilitated hedgehogs on arrival and prior to release is a step forward in the treatment of a species on the decline in Britain. It will have far-reaching effects by increasing the survival chances of hedgehogs released back to the wild by ensuring that each animal is released at its optimum weight and nutritional status. This information needs to be incorporated into all teaching and practices currently in use at veterinary schools and wildlife sanctuaries with regard to care of the hedgehog.

TABLE 6. BUNNELL INDEX
REFERENCE TABLE FOR ASSESSING HEDGEHOG WEIGHT/SIZE RELATIONSHIP

Weight (g)	Latitudinal circumference (cm) measurement A	Longitudinal circumference (cm) measurement B	Bunnell Index A/B
238	27.5	34.5	0.80
250	27.5	34.5	0.80
275	28	35	0.80
290	28	35	0.80
330	29	36.5	0.80
335	29	36.5	0.80
350	29	36	0.81
370	29.5	36.5	0.80
375	30	37.5	0.80
405	31	38.5	0.81
410	30.5	38	0.81
420	32	40	0.80
460	33	41	0.81
465	33.5	41.5	0.81
475	32.5	40.5	0.80
500	32	40	0.80
535	33	41	0.81
553	33	42	0.80
570	34	42	0.81
575	34	42	0.81
603	35	44	0.80
610	35	43	0.81
620	33	41	0.81
695	36	45	0.80
945	37	46	0.80
1000	38	47	0.81

Note: There will be individual differences regarding spine length which will affect the measurements A and B, but not the final Bunnell Index.

Acknowledgements

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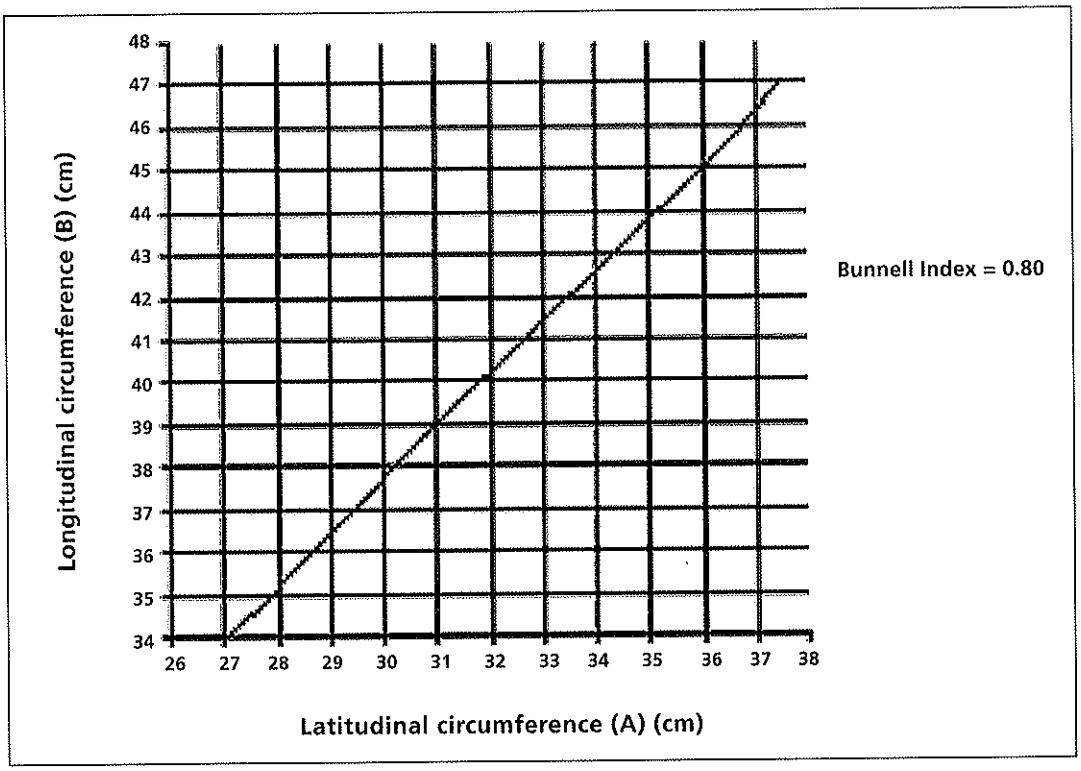
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FIGURE 3. BUNNELL INDEX CHART



The Bunnell Index Chart may only be used when assessing the British hedgehog. The graph represents the minimum Bunnell Index (BI) of 0.80, associated with a healthy animal displaying a satisfactory weight/size relationship.

To determine whether or not a hedgehog has a satisfactory weight/size relationship, observe where the longitudinal circumference measurement (B) meets the straight line graph and determine the required latitudinal circumference (A) by reading vertically down from this point. If the measurement A taken from the hedgehog, is less than the reading obtained from the chart (i.e., to the left of the vertical line projected down from the graph, from where the B measurement is registered), the animal has a BI less than 0.80. This means that it has a low weight for size relationship, is malnourished, and needs to gain weight before it can be considered for release.

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The Annual Report: Communicating with Funders and Friends

by Vicky Carder

In our ongoing efforts to present wildlife rehabilitation as a reputable profession, we need to make sure that our "public face" looks as good as our animal care actually is. Sometimes you may be judged first or even only by how your publications and other paperwork look, for instance, when you are trying to fundraise.

An annual report is a comprehensive summary of a 12-month period in the life of a business. Annual reports are used to fundraise, to impress clients or potential donors, to show where you have been and where you are going. Some foundations will not even consider a grant proposal without an annual report attached.

Annual reports have long been used by corporations and other businesses as an effective tool to let their clients, funders, stockholders, and others know how well they are doing. While it is rare for a wildlife rehabilitation center to publish one, in these times of scarce funding and growing need, it is critical that we, too, begin to publish these important records.

Walden's Puddle Wildlife Care Center (Nashville, Tennessee) published its first ever annual report in March 2002. It has been very well received by our board, volunteers, and major donors. (Our definition of a major donor is someone who gives gifts of money with commas in them.)

We started our project by looking through several types of annual reports from different companies, paying attention to what worked and what didn't. We threw out anything that was boring or didn't communicate well, and came up with a basic format. The outline of that follows. In our report, the sections are concise, often only one page long. The pages have plenty of "white space"; when a picture communicates better than words, we use graphs, charts, and other visual elements. The cover page is attractive and inviting.

The cost of producing the annual report was kept low. We typed and formatted the report in-house, using WordPerfect 8; it is printed in-house as well. We used a good quality cream-colored paper and purchased binders at a local office supply store.

Here are the basic elements of an annual report:

1. *Introduction Letter*

Our introduction letter includes a definition of wildlife rehabilitation, briefly describes two types of rehabilitators (facilities-based and home-based), and includes our mission statement. The introduction letter should be written and signed by the chief person in charge of the organization, usually the executive director or president of the board.

2. *List of Board of Directors*

3. *"Meet the Staff" and "Meet the Board"*

This section features a short paragraph about each of these people, including how they came to be involved in the organization and their role in the organization.

4. *Historic Highlights for the Organization*

For us, this included an outline of events such as our incorporation date, when we first hired full-time staff members, the purchase of our building, and so forth.

5. *The Wildlife Program*

This section included information on how rehabilitation is permitted in our state, which kinds of animals we are allowed to care for, our annual admissions, how many people call for help, and some of our basic philosophies on caring for wild animals.

We also included a page on how we determined our rate of release, plus our release rates. (We only included actual percentages on types of animals where we admitted more than 10 of each type, plus our overall release rate.)

ABSTRACT: An annual report serves multiple purposes, including marketing, public relations, fund raising, goal setting, and—most importantly—enhancing the credibility of an organization. It is a necessary tool for all wildlife caregivers, from home-based rehabilitators to the largest centers. This article discusses how a wildlife center can create a successful annual report.

KEY WORDS: annual report, marketing, fund raising, donor relations

VICKY CARDER is the founder and former executive director of Walden's Puddle Wildlife Rehabilitation Center, the largest wildlife rehabilitation facility in Tennessee. She started as an at-home rehabilitator in the late 1980s and incorporated the center as a nonprofit in 1991. The annual budget that year was $4,000. In 2002, more than $150,000 was raised. Walden's Puddle now owns its property/facility, and employs three full-time and two part-time staff members, and is assisted by more than 20 committed volunteers.

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The Wildlife Program also included a list of the different kinds of animals we admitted over the year, and a list of permanently disabled animals that were placed in education programs, along with where they went.

6. The Volunteer Program

This page highlighted the many contributions of the center's volunteers, and included how many hours volunteers donated, and the financial value of those hours.

7. What Else Did We do?

This was a list of accomplishments for the year. For instance, in 2001 (the year of the first annual report) we developed and started an internship program.

8. Financial Information

This is the section where most people tend to get bored; however, it is also the first area that major donors will look for and read in-depth. Take care to ensure that your information and its presentation *engage* the reader.

In this section we featured a graph showing the amount of income raised over the past years vis-à-vis income raised during the report year. A pie chart was then added, which showed where the different amounts of money came from. (For example, grant proposals raised 3.55 percent of income, direct mail raised 47.7 percent. Almost 18 percent was given to us, unsolicited.) We also included an explanation of how the money was spent, which included the salaries broken down, contrasting money spent on animal and money spent in administration. This was followed by an expense statement in which the numbers were split into easy categories such as utilities, animal care, salaries, and so forth.

9. Goals for the Present Year

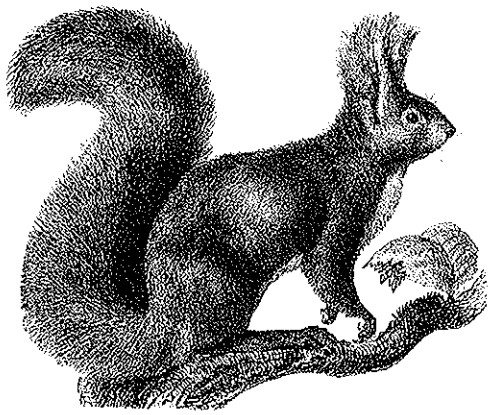
This was done in a simple line-by-line format, listing the accomplishments we hoped to achieve. This included increasing the number of volunteer hours, purchasing new computers, and other organizational priorities.

10. Goals for the Future

We used this page to share our dreams with everyone who reads the report. It represented a road-map for the future of the organization.

6. Conclusion

In this very short section, we thanked everyone for reading the report and for their care and concern for the wildlife and for our organization.



Using the Annual Report

We let our donors know in an appeal letter that the report was available, and that they could call and request a copy of it. We automatically sent it to our major donors, and use it when we are prospecting for new donors. It is given to anyone from the media as a general tool to provide them with more accurate information.

One of the results of making yourself sit down and write the report is that it gives you a unique perspective of what you have accomplished, where you were deficient, and where you want to go in the future.

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NEO-REHABILISM...
nopossum
what happens when you leave the door ajar

COLUMN

Operating Instructions

HELPING THE PUBLIC TO UNDERSTAND RABIES

by Nathalie Karvonen

Rabies is an issue that puts fear into the hearts of the public. Many myths and misconceptions surround this disease, making it a frequent topic of our discussions with the public. Hotline calls related to rabies generally fall into two categories:

1) Concerns about animals that the caller thinks may be rabid. These animals are almost never a genuine cause for concern, but the callers are genuinely worried.
2) An unconcerned caller who has unknowingly put themselves or someone else at risk from rabies.

General Concerns of the Public

Across North America, the particular species that are considered significant rabies vectors vary greatly by geographic area. For example, coyotes are considered a rabies vector species in Texas but here in Ontario they are not; rabies is virtually unheard of in coyotes in our area.

Much of the public is unaware which species in their area are considered rabies vector species; they are still more ignorant of the warning signs an individual may display if afflicted with the disease.

The public often assumes that all mammals are equally likely to be carrying rabies, and can even be concerned about birds. Behaviors that are normal for the animal, but unfamiliar to the caller, may give them cause for concern about themselves, their children, or their pets.

Your staff and/or volunteers must walk a fine balance between reassuring the caller that the animal in question likely does not have rabies, while providing them with the information they need to protect themselves should they actually encounter a sick animal.

When talking to a caller about a potentially "rabid" animal, one should:

1) ***Identify the species of concern and whether there is any basis for the concern*** (e.g., does the animal sound like it is sick, injured, or acting strangely for some other reason?). Take notes about everything they say so that you can respond to it all later.
2) ***Give the caller accurate information about that species.*** For example: "While there is a slim possibility that a Virginia opossum could contract rabies, there has only been one documented case of rabies in an opossum in this state/province in the last ten years. It is not considered a primary rabies vector species in our area."
3) ***Talk about rabies in general.*** Explain how animals get rabies and what happens once an animal comes into contact with another animal that has the disease. Explain how rabies progresses, especially when and for how long the animal is infectious. In our area, many red foxes have sarcoptic mange and, as a result, look sickly. Red foxes are considered a rabies vector species, although the disease has almost been eliminated in Ontario's red fox population. We explain that if the fox actually had rabies, he would likely die in three to five days. Foxes that look sickly for weeks or months are probably ill with something else.
4) ***If the animal is exhibiting normal behavior and sounds healthy, tell them so*** and explain further what to expect from the critter (e.g., it is normal for baby raccoons to be out playing during the day). Tell them also what may not be normal and invite them to call back if the animal does something new that concerns them.
5) ***If the animal sounds unusual,*** deal with the situation as you would any call about potentially sick, injured, or orphaned wildlife.

When the Public Is at Risk

As wildlife professionals, it is our responsibility to be on the alert for situations in which the public may be at risk from rabies. The health and safety of people must always come first.

When discussing mammals, and especially rabies vector species, be sure to ask a lot of questions about their contact with people and other animals. Here are some starter questions; each new situation will no doubt lead you to others as well.

1) Do you know if anyone has been bitten or scratched by this animal?
2) Could someone have been bitten or scratched and you (the caller) not know about it? Did unknown neighborhood kids handle the animal before it came into your possession? Is there a way to find out exactly who has had contact with the animal?
3) Was the animal handled a lot, even if it did not bite or scratch someone?
4) Was the animal in contact with pets? Could the animal have been bitten or scratched the pet? Could the pet have bitten this wild animal? Are your pet's vaccines current?

If there is reason to be concerned, admit the animal as you would normally, and tell the caller to contact their family doctor and/or the health department for further advice. (Health department regulations vary greatly by municipality. Discuss your protocol with your local health department to ensure it conforms with their policies.)

Take appropriate care of the animal, but do not house it with other animals until you know if it will need to be tested for rabies. If the species is not considered a rabies vector in your area, your health department may ask you to quarantine the animal for a period of time. If it is a rabies vector species, they will likely want to take the animal, euthanize it, and test it for rabies. Although this is always upsetting, especially if the animal appears to be a healthy baby, you must cooperate with the health department. Occasionally animals are positive in these situations; our center had two positive cases of rabies in patients we admitted last year.

By educating yourself (and everyone else who answers your phone) thoroughly about rabies, we can all help keep wildlife and people safe. JWR

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

The Role of Wildlife Rehabilitators in Emerging Disease Surveillance, Biosecurity, and Bioterrorism

by Edward Clark

Over the last year, two new words have eerily crept into our daily conversations: *biosecurity* and *bioterrorism*. While these words certainly existed in the English language prior to 11 September 2001, the frequency with which they are now used, and the sense of urgency attached to their use, is very unsettling.

What exactly is *biosecurity*? By general definition, the word refers to the security of living things and living systems. Some of the issues under the *biosecurity* umbrella include human health and safety, wildlife and environmental health, ecosystem health, ecosystem services such as the supply of food/water, the introduction of invasive species, the emergence of new diseases, and the impacts such issues have on our economy and quality of life. In short, it could include almost anything that affects life on the planet.

Perhaps the most frightening biosecurity issues emanate from the potential for deliberate attacks by an individual or an adversarial force. When these deliberate attacks are carried out using biological weapons, they are characterized as *bioterrorism*. Not all of these attacks are direct attacks on humans or human health. Bioterrorism attacks may be directed at our food supply, our water supply, or the environment. The attacks may be intended to disrupt our economy, international trade, or simply the feeling of security we enjoy in our daily lives. Often bioterrorism is a tool in psychological warfare, when the main goal is to instill fear and uncertainty into the human population.

Unfortunately, wildlife and wildlife health are significant issues in biosecurity considerations, and especially in bioterrorism. Wildlife diseases such as bubonic plague, anthrax, and tularemia, or parasites such as *Baylisascaris*, may well be the weapons of choice in a bioterrorism attack. Wildlife may also be used as dispersal vehicles for pathogens. We have already seen that diseases such as West Nile virus can be spread across North America in a matter of months, as a result of the normal migration of birds. We have no reason to believe that other, far more deadly diseases, cannot be similarly spread, potentially affecting entire ecosystems, our food supply, or the health of our human population.

As in the case of West Nile virus, wildlife may be the first indicators of the presence of emerging diseases. Scientists now believe that by monitoring wildlife health we may be able to detect certain threats to biosecurity, including deliberate bioterrorist attacks. The challenge will be to create a surveillance system that can detect and identify disease in the early stages, before it spreads and can no longer be controlled.

Across North America, there are already examples of new wildlife diseases that have implications for environmental health and safety, human health, and the integrity of our food supplies. Chronic wasting disease (CWD), rabies, Lyme disease, foot and mouth disease, bubonic plague, anthrax, epizootic hemorrhagic fever, and avian influenza are but a few such diseases presently on the public policy agenda. In too many cases, by the time these diseases are detected, they are far advanced, and control is extremely difficult.

Many factors are contributing to the increased risk of emerging diseases. Global environmental change, habitat alteration and destruction, loss of biodiversity, globalization of trade and travel, and the introduction of invasive species and pathogens are but a few of the challenges facing those whose job it is to protect the biosecurity of our nation and our planet. Organisms and diseases can now travel around the globe in a matter of hours. Surveillance methodologies of the past are no longer adequate to deal with the threats of the future.

Current wildlife health assessments seem to look primarily for population impacts and gross indicators of environmental change. Typically, by the time a disease has an impact on a population or species, it has spread to the point that mitigation or control is extremely difficult, if not impossible. In the United States, there is no centralized system that identifies priority biological threats or compiles information on them. A wide array of agencies and institutions may well detect an environmental problem, or the occurrence of a particular disease. However, there are no effective systems in place through which that information can be widely disseminated to all who may need it.

Responding to the Threat

While it may seem a simple issue to share information or establish coordinated surveillance networks, the political and economic realities of life make it an extremely challenging undertaking. In the United States, state and federal wildlife agencies are typically responsible for managing the wild birds, mammals, reptiles, and amphibians. However, the Bush Administration has named the United States Department of Agriculture (USDA) as the lead agency in the management of *all* animal diseases. This situation creates a dynamic in which conflict is inevitable.

To date, there is no universally accepted set of priorities or protocols with which to respond to a wildlife disease event or biosecurity threat. Wildlife agencies have the mandate and expertise to manage species and populations of wildlife for public and environmental benefit. For the USDA, the conservation of wildlife is not its top priority or mandate; its job is to promote American agriculture and protect our food supply. It is not hard to imagine what could happen to a wildlife species or population that was seen as a threat to the poultry industry, for example. Wildlife doesn't vote, but farmers do!

The scientific community agrees that more *targeted surveillance* is necessary. This involves the intensive monitoring of individual animal health in geographic areas where disease outbreaks are anticipated, or among populations vulnerable

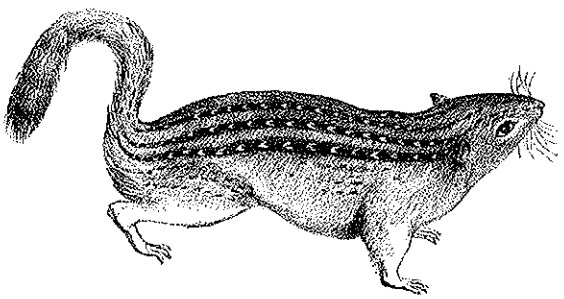
to specific priority diseases. Unfortunately, neither wildlife nor agriculture agencies have the capacity or resources with which to effectively monitor individual animal health on broad scale.

Our Challenge

Wildlife rehabilitators and the wildlife rehabilitation community could play a critical role in filling this gap in disease surveillance and biosecurity monitoring. The loose network of thousands of individuals and hundreds of organizations that form this community already focus on the health of individual animals, and see hundreds of thousands of patients annually. Wildlife rehabilitators are uniquely positioned to detect the occurrence of certain diseases, and do so at the early stages in the spread of the disease, when an effective control response may still be possible. Monitoring the emergence of wildlife disease could be the most important contribution to society that the wildlife rehabilitation community has ever made.

Unfortunately, the wildlife rehabilitation community is not presently ready to take on such an important responsibility. Before the data collected by wildlife rehabilitators can be useful on broad scale, it must be collected in a uniform and scientifically valid way. Better diagnostic testing, environmental and geographic information, and timely reporting will be required before the wildlife management community will accept information from wildlife rehabilitators. Those collecting the information will have to establish that they are qualified to do so.

Wildlife rehabilitators are all too familiar with the relationship problems that can exist between wildlife agencies and wildlife caregivers. Agency personnel are often traditionally trained biologists who have learned that individual animals are not significant in the dynamics of populations and species. Therefore, they often dismiss the perspective and expertise of those who focus on individual animals. Conversely, wildlife rehabilitators often do not appreciate the mandate and responsibility of agencies to care for the entire population of wildlife, rather than to focus on the welfare of the individual creatures within their jurisdictions.



Overcoming these challenges and building new relationships will not be an easy job, but it is possible. Many individuals and organizations within the wildlife rehabilitation and conservation medicine community have forged very productive relationships with wildlife management agencies and professionals. The time has come to build upon these exemplary relationships and broaden the cooperation and collaboration between wildlife rehabilitators and wildlife management agencies across the board. The common threats posed by biosecurity risks, bioterrorism, the emergence of new wildlife diseases, and the loss of control of wildlife management to agriculture agencies confronts wildlife agencies and wildlife rehabilitators alike. We must recognize our shared interests and begin to work together as never before.

For this to happen, wildlife rehabilitators across North America must engage in scientific and public policy discussions, both within their own community and in broader scientific venues All wildlife rehabilitation organizations, whether large or small, professional or volunteer, must learn to work as a team and vigorously promote professional standards and the pursuit of excellence if they are to ever realize their full potential to benefit wildlife. The fierce individualism and turf battles that too often characterize the wildlife rehabilitation community can no longer be tolerated. Those who refuse to standardize their practices, improve their record-keeping, and participate in collective efforts will be marginalized and may eventually lose the privilege of rehabilitating wildlife altogether.

Those organizations with the current expertise and resources to participate in professional and public policy initiatives must share their knowledge and experience with others. We must work together to strengthen the capacity of all members of our community. The improvement of our skills, and the advancement of our knowledge, is no longer a discretionary matter. The world has changed around us, and we must change with it.

In the months ahead, new programs and initiatives will be established and made public, through which all wildlife rehabilitators can contribute information and observations in the battle to confront emerging wildlife disease and bioterrorism threats. We must change some of the ways in which we have done business in the past and this applies equally to individual wildlife rehabilitators and the major centers and organizations.

Simply by better documenting the case histories of the hundreds of thousands of animals seen by wildlife rehabilitators each year, we could dramatically expand the information base upon which wildlife disease management policy can be predicated. By learning about and participating in ongoing programs, conferences, and public policy discussions on wildlife diseases and biosecurity, we could play an important role in shaping the future for wildlife conservation in North America and around the globe.

The wildlife rehabilitation community has long claimed that the care of individual animals is significant and important. It is now time to prove it! JWR

Edward Clark *is the cofounder and president of the Wildlife Center of Virginia. Each year, the center cares for an average of 3,000 wildlife animals and presents environmental education programs to tens of thousands of people, mostly children. The center also trains veterinary and wildlife management professionals from around the world. It is a leader in wildlife disease surveillance and research, and is actively involved in the effort to monitor for threats to biosecurity from the emergence of wildlife diseases and bioterrorism.*

Clark has been a national leader in the field of conservation for nearly twenty-five years. His successful efforts have ranged from wilderness designation and public land management to pesticide regulation and endangered species protection.

The Journal of Wildlife Rehabilitation *invites your comments on this important issue. Please send your responses to the Editor at runmuki@earthlink.net or mail them to Editor,* Journal of Wildlife Rehabilitation, *address. We'll run a selection in the Letters section of a future issue.*

COLUMN

Food for Thought

NUTRITION NEWS

by Janine Perlman and Astrid MacLeod

In this issue's "Food for Thought" column, we examine some new and interesting findings in nutrition that have broad applicability to animals—nonhuman and human alike.

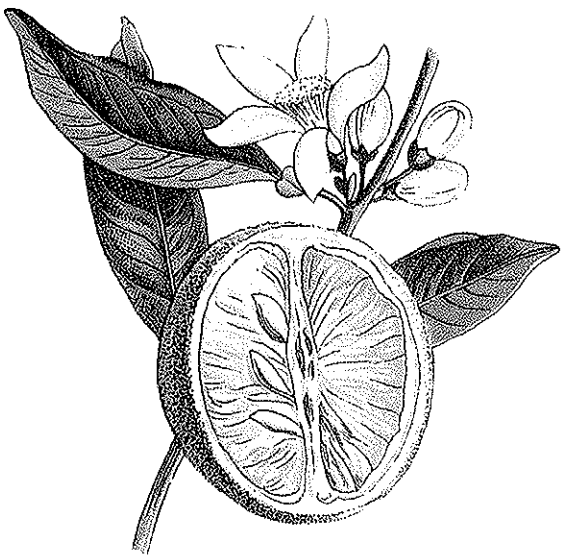
Live longer.....

Antioxidants

Older dogs often suffer age-related cognitive deterioration, a condition in which they may not remember to relieve themselves outdoors or experience their former joy when their humans return home. Elderly dogs with cognitive dysfunction syndrome are being used as a model to study human senile dementia. Their troubling canine symptoms were significantly reduced, and even reversed, when the dogs were fed a diet containing modest amounts of carrots, citrus, tomato, grape, L-carnitine (needed for mitochondrial function), and the antioxidants vitamins C and E and alpha-lipoic acid.

The plant ingredients in the diet contain hundreds of phytochemicals, many with antioxidant properties.

The lesson would seem to be that all animals need an array of phytochemicals that comes from eating a variety of colorful vegetables and fruits. If animals are strict faunivores, they should be at the top of a broad and diverse food chain, meaning that their prey should have eaten a wide array of their own natural nutrients. It is increasingly clear that diets consisting only of formulated foods do not contain even a small fraction of the thousands of bioactive chemicals needed for optimal health in every species. The implications for feeding our wild patients are obvious: offer the widest possible variety of whole, natural foods.



Calorie restriction

Animals, including laboratory rodents, monkeys, and, now, dogs, live significantly longer and healthier lives when they consume about one-third fewer calories than their normal or ad libitum diet. Calorie restriction is the only proven way to extend life span, and it appears that this will apply across the animal kingdom. Diseases of aging such as arthritis, cancer, diabetes, and heart disease, as well as endometriosis, are much reduced in animals that eat less.

The lesson is NOT to feed wild animals less than their normal or ad libitum diet, unless they are permanently captive *and* show signs of overweight. Animals destined for release should *never* be food-restricted without cause. However, these studies do demonstrate the importance of maintaining a natural state of leanness in animals in long-term or permanent captivity.

.....and live better!

Eat dirt!

The early ingestion of environmental 'dirt'—which carries bacteria (both 'good' and pathogenic), viruses, fungi, parasites, and allergens—appears to be important in both generating a vigorous immune system and in preventing allergies. All animals evolved to live in an environment devoid of Clorox and mops. Neonate gastro-intestinal tracts require inoculation with beneficial flora, and immune systems need to know what are "normal" constituents of the environment, so that allergies and asthma don't arise later. Early exposure to pathogens often also confers some degree of immunity later in life.

The lesson is that animals in rehabilitation, particularly youngsters, need exposure to dirt, both directly from the ground and from general sources of "contamination" such as feces of older healthy conspecifics. Don't worry—a little bit of feces goes a long way; just don't keep animal quarters excessively hygienic.

Food intolerance

Allergies and other negative reactions to foods appear to be on the rise in humans. It seems that people develop intolerance to foods that are eaten very often—especially daily or multiple times daily. In Asia, intolerance to rice and soy occurs. In England and North America, wheat, milk (both separate from and including lactose intolerance), and eggs are some common culprits. Although the mechanism(s) of intolerance are not fully understood, it is plausible that immune system reactivity is involved in at least some cases. Unsurprisingly, genetics plays a large role.

Food intolerance/allergies are very common in dogs, too. Again, reactions arise to foods eaten day in and day out.

A variable that is difficult to separate from high-frequency consumption is the fact that many of the culprit foods are ones that humans or dogs, respectively, did not evolve to eat. The use of grains as a staple only arose with agriculture 10,000 years ago; and there is obviously little in dog kibble that wolves evolved eating.

The lesson: Feeding animals in rehabilitation foods, in large amounts or frequently, not natural to them, may cause health problems. This notably applies to formulated diets, but also to any food that would not be a significant part of their natural diet.

For example, squirrels are unlikely develop an intolerance to acorns, no matter how many they eat, since genes

that might contribute to such intolerance would be under great negative selective pressure. However, squirrels could become intolerant of rodent blocks or peanuts.

Although information on the nutritional needs of wildlife is scanty compared to that for domestic animals and humans, some knowledge can be generalized and applied. And, in a happily circular way, we are now in a position to learn from our animal relatives. Arguably the most interesting and important theme emerging in human nutrition is that we need to go back to our evolutionary roots. If we are to reverse the negative health consequences of overeating and undernourishment, we need to eat a variety of whole, natural foods, in caloric balance with our energetic demands. The animals in our care deserve no less. JWR

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

Janine Perlman, Ph.D., *is an avian rehabilitator and has conducted laboratory research in biochemistry and molecular genetics for twenty years. She can be contacted at jpandjf@swbell.net.*

Astrid MacLeod *is a writer and experienced avian rehabilitator who works for Manitoba Conservation (formerly the Manitoba Department of Natural Resources). She has researched avian nutrition for much of the past decade. She may be reached via e-mail at sparrow1@mb.sympatico.ca.*

NEO-REHABILISM...

kilosalorie
what it will cost you to feed a polar bear

SELECTED ABSTRACTS

MAMMALS

Characteristics of Fringed Myotis Day Roosts in Northern California

Theodore J. Weller and Cynthia J. Zabel

J. Wildlife Mgmt. 65(3): 489–97

The authors found that fringed myotis bats use roost sites that are relatively open areas near streams. They tend to use snags for roosting during the day and in Northern California and are more likely to use Douglas fir snags that are 40 to 45 inches in diameter at breast height and taller than 9 feet. They are found in the tallest available snags. This may be due to the fact that taller snags receive greater solar radiation. They tend to roost under loose bark and are found in snags that are in Decay Class 2 or 3. (In Decay Class 2, there are few limbs and no fine branches and the wood is fibrous though still firm. In Decay Class 3, there are limb stubs only and the wood is fibrous and soft.) They are usually no more than 140 m from water. These factors may all be important when researching release sites for fringed myotis in your area.

Nutritional Condition and Survival of Red Foxes with Sarcoptic Mange

T. J. Newman, P. J. Baker, and S. Harris

Can. J. Zool./Rev. Can. Zool. 80(1): 154–61

The authors aimed to compare body condition, urine profiles, and survival times between red foxes (*Vulpes vulpes*) that were infected with sarcoptic mange and others that were uninfected.

First the authors compared the relative body mass, chest girth, fat reserves, and urinary urea nitrogen:creatinine (UN:C) ratios of red foxes in three infection classes: uninfected, Class I (no hyperkeratotic mange), and Class II (hyperkeratotic mange present). Infected foxes had lower relative body mass and lower fat reserves than uninfected foxes. Both fat reserves and urinary UN:C data suggested that Class II infection was more severe than class I infection. Urinary UN:C in Class II foxes was significantly higher than in uninfected and Class I foxes, indicating accelerated muscle catabolism in Class II foxes. Elevated urinary UN:C has never been recorded in wild canids, indicating that these animals had been subjected to a period of prolonged starvation or chronic undernourishment.

The survival time of foxes once infected with mange was estimated from capture–mark–recapture data. Twenty-five foxes were caught at an early stage of infection and had a known date of death. Although some were treated once with ivermectin, they did not recover, and their survival time was no longer than that of untreated infected foxes.

Untreated infected adults survived for up to 271 days after capture, which is longer than previously suggested. Overall, the survival time of infected foxes was roughly one-fifth of that of uninfected foxes (matched by age and sex).

AVIAN

A Habitat Island Approach To Conserving Birds in Urban Landscapes: Case Studies from Southern and Northern Europe

E. Fernández-Juricic and J. Jokimäki

Biodiversity and Conservation 10(12): 2023–43

Wildlife conservation in urban habitats is increasingly important due to current urbanization trends. This article reviews the different approaches to studying birds in urban landscapes, and points out the importance of the habitat island ecological theory as a research framework for the management and conservation of urban birds. Based on two comprehensive research projects conducted at urban parks in Spain (Madrid) and Finland (Oulu and Rovaniemi), several different issues related to bird conservation in cities are discussed, main findings of these projects are presented, and future research needs are suggested. Urban parks are important biodiversity hotspots in cities. Fragmentation conditions have the same deleterious effects to urban birds as in other fragmented landscapes. Park size accounts for species accumulation in urban parks; this pat-

tern being highly nested. Urban parks of 10–35 ha would contain most of the species recorded in cities, but other indicators related to the probabilities of persistence of the target species should be obtained. Wooded streets can increase urban landscape connectivity by providing alternative habitat for feeding and nesting during the breeding season. Because increasing the size of parks is difficult in cities, enhancement of habitat diversity and resource availability for birds within parks (e.g., nest boxes, winter feeding tables, etc.) appears to be a straightforward way of increasing urban bird diversity. However, human disturbance (pedestrians) should be controlled since it can negatively influence many urban birds. The authors present a conceptual model for urban bird conservation, which includes three aspects (management, environmental education and research) and new alternatives to promote the involvement of different sectors of society. *(Abstract © 2001 Kluwer Academic Publishers)*

Disappearance of Insectivorous Birds from Tropical Forest Fragments

P. R. Ehrlich, G. C. Daily, D. Aygen, D. Goehring, and R. F. Sand
Proc. Natl. Acad. Sci. 99(1): 263–67

Determining the impact of forest disturbance and fragmentation on tropical biotas is a central goal of conservation biology. Among tropical forest birds, understory insectivores are particularly sensitive to habitat disturbance and fragmentation, despite their relatively small sizes and freedom from hunting pressure. Why these birds are especially vulnerable to fragmentation is not known. Our data indicate that the best determinant of the persistence of understory insectivorous birds in small fragments is the ability to disperse through deforested countryside habitats. This finding contradicts our initial hypothesis that the decline of insectivorous birds in forest fragments is caused by impoverished invertebrate prey base in fragments. Although the authors observed significantly fewer insectivorous birds in smaller fragments, extensive sampling of invertebrate communities (106,082 individuals) and avian diets (of 735 birds) revealed no important differences between large and small fragments. Neither habitat specificity nor drier fragment microclimates seemed critical. Bird species that were less affected by forest fragmentation were, in general, those that used the deforested countryside more, and we suggest that the key to their conservation will be found there.



ANTHROPOGENIC

Golden Eagles, Feral Pigs, and Insular Carnivores: How Exotic Species Turn Native Predators into Prey

G. W. Roemer, C. J. Donlan, and F. Courchamp
Proc. Natl. Acad. Sci. 99(2): 971–96

Island ecosystems are particularly vulnerable to exotic species. This article describes how an introduced prey has led to the wholesale restructuring of an island food web, including the near extinction of an endemic carnivore. Introduced pigs, by providing abundant food, enabled golden eagles to colonize the California Channel Islands. Eagles preyed heavily on the island fox, whose resulting decline toward extinction released populations of the competitively inferior island skunk. The presence of exotic pigs led to major ecosystem shifts by indirectly causing predation to replace competition as the dominant force shaping these island communities.

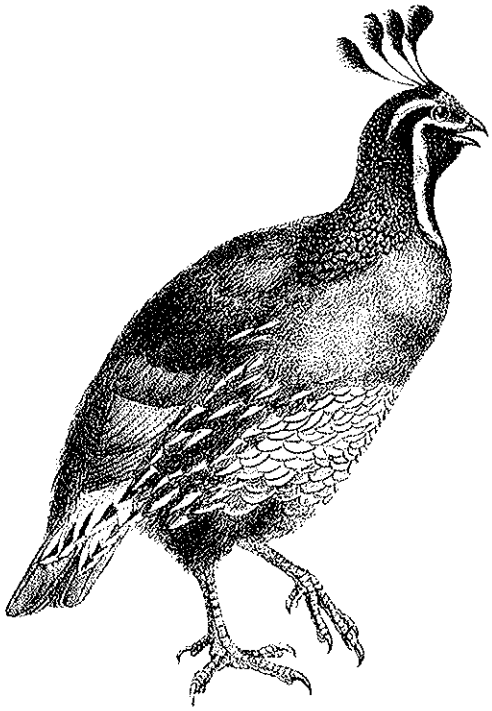
ADMINISTRATIVE

Communicating Ecological Indicators to Decision Makers And the Public

A. Schiller, C. T. Hunsaker, M. A. Kane, A. K. Wolfe, V. H. Dale, G. W. Suter, C. S. Russell, G. Pion, M. H. Jensen, and V. C. Konar
Conservation Ecology 5(1): 19
[Available online: http://www.consecol.org/vol5/iss1/art19]

Ecological assessments and monitoring programs often rely on indicators to evaluate environmental conditions. Such indicators are frequently developed by scientists, expressed in technical language, and target aspects of the environment that scientists consider useful. Yet setting environmental policy priorities and making environmental decisions requires both effective communication of environmental information to decision makers and consideration of what members of the public value about ecosystems. However, the complexity of ecological issues, and the ways in which they are often communicated, make it difficult for these parties to fully engage such a dialogue. This paper describes the authors' efforts to develop a process for translating the indicators of regional ecological condition used by the U.S. Environmental Protection Agency into common language for communication with public and decision-making audiences. A series of small-group sessions revealed that people did not want to know what these indicators measured, or how measurements were performed. Rather, respondents wanted to know what such measurements can tell them about environmental conditions. Most positively received were descriptions of the kinds of information that various combinations of indicators provide about broad ecological conditions. Descriptions that respondents found most appealing contained general reference to both the set of indicators from which the information was drawn and aspects of the environment valued by society to which the information could be applied.

IWR



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Conservation Classics: *The Moon by Whale Light and Other Adventures Among Bats, Penguins, Crocodilians, and Whales*

by Diane Ackerman

Reviewed by Elsa C. Bumstead

New York: Random House, 1991
(First Vintage Books edition: October 1992)
249 pp.; U.S. $12 (paperback)
ISBN: 0-679-74226-3

"One of the things I like best about animals in the wild is that they're always off on some errand. They have appointments to keep. It's only we humans who wonder what we're here for."
—Diane Ackerman

"Heartfelt thanks...for sending me out on such nourishing journeys." Diane Ackerman begins by acknowledging gratitude to Robert Gottlieb, editor-in-chief of the *New Yorker*. It is the *New Yorker* that has sent her on the travels that resulted in four essays for the magazine, later to be expanded and compiled into this remarkable book.

What nourishing journeys they are! Four distinctive adventures—one into the world of bats, one into the world of crocodilians, another into the world of whales, and the last into the world of penguins.

She begins with bats. A wealth of information unfolds as the reader is led into Bracken Cave, into the world of 20 million Mexican free-tailed bats hanging by their toes. Merlin Tuttle is introduced as "the world's authority on bats, founder and science director of Bat Conservation International, and an explorer whose cliff-hanging exploits put Indiana Jones to shame." And life in a bat colony unfolds. Here you learn about *Chiroptera* (the scientific term for "hand-wing"), about bat parenting skills, how tidy and well-groomed bats are, the dangers that await inside the cave as well as out, their echolocation abilities, that bats are "the longest-lived mammal on earth" yet the "slowest reproducing mammal for their size." You learn about bat physiology and anatomy, their economic importance, their evolutionary history, and their place in film, literature, and mythology around the world. And about conservation efforts on behalf of "one of the least popular groups of animals on earth." As Tuttle explains to Ackerman, "We don't know enough to permit us to play God and decide that some animals are good and some are bad.... Cute and cuddly has nothing to do with intrinsic value. Some of the ugliest animals on earth are the most valuable either ecologically or economically."

Next stop: the St. Augustine Alligator Farm with zoologist Kent Vlient and other researchers studying the effects of captivity on crocodilian hormone cycles. The evolutionary history of dinosaurs, birds, and crocodilians from early reptiles called *thecodonts* is revealed. Described as "Mesozoic leftovers," the crocodilians are very much adapted to their aquatic lifestyle, from courtship and mating to feeding habits. Their "gator hole" ponds—wet places that tend to stay wet during the winter—support whole communities of animals. Threatened by commercial hunting and mutilation in developing countries, crocodilians are valued for their skins and as sources of food, and lose their habitats to industry and power plants. Yet alligators are valued medicinally for their blood, in the treatment of arthritis, and in the development of fetal surgery techniques. As for attractiveness, the author asks, "Why are children charmed, obsessed even, by such violent predators as crocodilians and sharks, which aren't at all cute and cuddly?"

Roger Payne, renowned for his work with whales, is the next to be visited, first in Hawaii, then in his lab in Boston, and later in Patagonia. It is from him that we learn that "Whales have the largest brains on earth, brains every bit as complex as our own. They have culture and they have language. They sing songs that obey the kinds of rules one finds in classical music. What does a creature with the largest brain on earth use it for? Why does it sing?" With Ackerman, Payne discusses just how self-conscious whales might be. What might the lesson of whales be? He says it "is that you can have a brain of great complexity that doesn't result in the death of the planet." In this day and age, think about it.

In the "White Lanterns" chapter, you find yourself in the deep freeze of the Penguin Quarantine at Sea World in San Diego. Ackerman has come to visit Frank Todd and his king penguin brood, hatched from the collection of doomed eggs on South Georgia. You see firsthand just how curious and alert penguins are, how snugly the babies are, and how they need to be handled. "Fallen into life from an unmappable world, they are the ultimate immigrants, full of wonder and confusion," Ackerman says as she gathers a chick into her arms. Later she discourses on penguin anatomy, physiology, evolution, the sea skills they need, and how the penguin got its name. Then there are the sea-going trips to Antarctica and around Cape Horn islands to see penguin colonies in the wild. Penguins have been valued as a food source, to make oil, and for their guano as fertilizer. In light of the threats to their existence, are they a litmus of the health of our planet, as Roger Tory Peterson suggests here?

Conscious-raising. In a word, that's how I would describe this book. There is so much about the importance of diversity and uniqueness of each species on this planet. Diane Ackerman is a master of the English language. Her vibrant descriptions rise from her poet's soul. Want to know more? Get this book, read it, and let it work its magic. JWR

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

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

My Colors: Mis Colores My Opposites: Mis Opuestos

Rebecca Emberley

Suitable for baby through preschool
Boston: Little Brown, 2000
10 pp each: U.S. $5.95 (hardcover)
ISBN 0-316-23347-1
ISBN 0-316-23345-5

To a person who learned all the Hindi she took with her to India from Rudyard Kipling, these little books look like a great introduction to Spanish—or English. If you aren't fortunate enough to hear two languages at your mother's knee, at least you can have them read to you and begin to understand the concept. The pages are strong paper-board that stands up well to loving fingers; the colors and pictures encourage page turning.

Mis colores is really elemental. Apples and the usual simple shapes illustrate typical object:color relationships. Words like *amarillo* and *anaranjado* are challenging to the English speakers palate. *Yellow* and *violet* may feel strange on the Spanish tongue. But this young age would be the time to start learning how to hear the complex sounds and perhaps even wrap one's tongue around the sounds of other languages.

Mis opuestos is a lot more sophisticated. The brightly colored pictures portrayed are not identified by name, but by some associated characteristic. The snake is long and the worm short; the hippo *grande* and the mouse *pequeno*. I like the use of the tiger's head to discriminate front from back, and the moose and antelope horns to demonstrate *ancho* and *estrecho*. The two birds, one *sencillo* and the other *ornamentado*, could well be demonstrating female and male differences as well as plain and fancy.

Though I had no idea I was hearing Hindi at the time, years later Rudyard Kipling served me well. Asking questions of villagers about rodent biology is not easy without a common language. However, Chua, Nag/Nagena, Chuchundar, and their associates were already familiar to me from childhood. These useful little Spanish/English books are also fun. Fun for very little people and their friends. JWR

Neptune's Nursery

A companion book to the award-winning *one less fish*

by Kim Michelle Toft and Allan Sheather

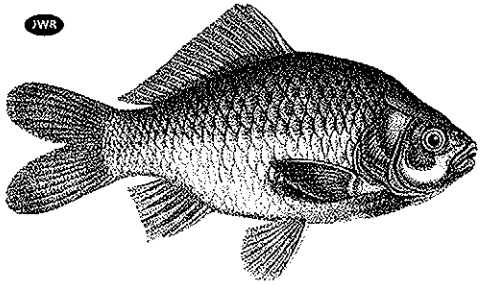
Suitable for baby through preschool
Watertown, Mass.: Charlesbridge, 2000
18 pp; U.S. $6.95 (paperback)
ISBN1-57091-392-7

Eighteen pages with covers included make this book one of the best buys for the money I've seen in a long time. Hand drawn and painted on silk with inks and dyes blended like watercolor these colors are, to land lubbers, like stained glass or enamel. Shapes, both simple and complex, are cloisonné on a page.

The tale is an aquatic mystery story or game of hide and seek through the animals of Australian coastal waters. Rhyming text flowing throughout describes, as the name implies, the reproductive habits of ten of the animals surrounding the protagonist as he sometimes hides nearby. Two pages at the end are devoted to fuller descriptions of each of the ten, common name, class, and reproductive behavior. A glossary of terms—including *pelagic* and *tentacles*—helps define some of these words more commonly used in connection with oceanic than land experiences. Seven pages, six of pictures and one of text, are devoted to our hero and his family. They describe the size and diversity of his type, the unique reproductive behavior of this animal, its diet, the threats to its existence, and one way people are attempting to mitigate a threat imposed by humans.

I'd love to see an exhibit of the silk version of these pictures in which a walk through the hanging panels would be as close to a diving experience as might be possible on land. But I'd probably have to go to Australia to do it, and maybe even shrink like Alice of Wonderland.

JWR



Ten Little Ladybugs

by Melanie Gerth
illustrated by Laura Huliska-Beith

Suitable for baby through preschool
Santa Monica, Calif.: Piggy Toes Press, 2000
22 pp; U.S. $10.95 (hardcover)

This book looks tactile and delicious. Delicious in the sense that the ten little ladybugs look to me, a chocoholic, like big wonderful M&Ms. Though they look as though one could pick them right off the page, they are, in fact, very firmly attached. I doubt they could be removed by little fingers, or even mine, without the aid of some strong implement of destruction. Each of the insects lies in a little well of its own, so, as the thick cardboard pages turn, the wells that don't hold bugs are windows to peek through and places to poke the fingers.

The first page has ten spotted bugs being admired by a butterfly; the second, nine, observed by a caterpillar, and so on. Though a butterfly and bee don't seem to pose any threat to the bugs, one can't help but wonder if the missing ones, after meeting a bird, a turtle, or a frog, haven't become dinner. Maybe that would be OK from the viewpoint of a gardener, however, since some of these insects look a little more like bean or tortoise beetles than our very beneficial friend the ladybug, a voracious enough predator in her own right. On the last page a child attentive to anatomy and how things work may be curiously interested in the flying bug. But all the ladybugs and their buddies are cheerfully hanging out together, and this time the familiar bugs are all quite red, so I guess the story ends happily for everyone.

JWR

Reviewer Penny Elliston is a traveler, nature lover, rehabilitator, and grandmother of two, one thirteen and one two-and-a-half years old.

Wild Health:
How Animals Keep Themselves Well and What We Can Learn From Them
by Cindy Engel

New York: Houghton Mifflin Co.
288 pp; U.S. $24 (hardcover)
ISBN: 0-618-07178-4

As a rehabilitator, do you ever wonder how the animals who don't come into your care survive without you in the wild?

Humor aside, there is something to ponder in that question. We're all aware that, in most species, the majority of animals who are born or hatched don't live to reproduce. But what about the ones who do live long? Do they live well? If so, how?

This issue isn't merely of academic interest. Many species actually rely on family/social structures that transmit cultural knowledge of, for example, foraging locations and methods; the success and survival of younger generations depend on the long life of older relatives.

Cindy Engel begins her fascinating book with her conclusion that, yes, animals who are "making it" in the wild are, for the most part, in robust health. She describes the dynamic and never-ending struggle by animal hosts to stay ahead of myriad assaultive forces, mainly endo- and ectoparasites, but also other infections, toxins in foods, injuries, and even psychological stress. She correctly asserts that depending solely and passively on the immune system would not allow the animal to prevail over these inimical forces. She proceeds to explore how animals *behave*—the active steps they take—in order to maintain and improve their health in the wild.

Engel first provides needed background information on "nature's pharmacy." This is the vast array of secondary compounds in plants that protect them from animals (prominently including insects) that would eat them. Those compounds can also have salutary effects for animals that do consume them. The author makes the wonderful point that, in nature, food and medicine lie on a continuum. At one end of that continuum, food may be eaten strictly for the energy (calories) it provides—to keep an animal alive for a limited time. At the other end of the spectrum may lie a plant that is bitter, has a high percentage of toxins, and which is eaten in small amounts and only for its medicinal qualities. In between are all the foods with all the essential and beneficial nutrients that allow an animal to survive and thrive, and that also contain substances that can be detrimental in large quantities.

Thus, the many thousands of secondary compounds found in plants can be medicine or poison, depending on kind and amount. One way that animals optimize their health is by actively avoiding potent toxins in their environment. Engel proposes that they do so by a combination of inherent preferences conferred by natural selection, trial and error, and learning from their parents. On this subject, she provides us some excellent advice:

> We can conclude that familiarity with potential foods is key to avoidance of poisoning. Wildlife managers therefore need to be careful about introducing, relocating, and moving wild animals to unfamiliar areas.... This is equally important when releasing hand-reared wild animals back to the wild. Early exposure to local poisonous plants is extremely important for young animals that will one day have to discriminate safe from unsafe food on their own. We cannot assume this ability is innate.

Even food plants often have some detrimental secondary compounds. Thus, animals typically must deal with the unavoidable toxins that accompany plant-derived nutrients.

An important strategy for minimizing toxin ingestion is geophagy, or eating dirt, specifically for its clay content. Various clays have specific binding properties for various toxins; when eaten, the clays carry toxins safely out of the animal in its feces. There is evidence, ranging from circumstantial to incontrovertible, that humans, gorillas, chimpanzees, forest elephants, parrots, wolves, and rats eat clay for medicinal purposes.

Another role of geophagy is undoubtedly nutritional (for obtaining minerals)—rehabilitators with the wisdom to provide dirt to their charges know that there may be no species that doesn't intentionally sample it.



Engel reports on preventive and defensive behaviors that animals use to cope with pathogens. Immediately after entering the world, animals require inoculation with life-giving gut flora. Engle points out that early exposure to a variety of microbes and substances also appears to prepare the immune system for proper function later in life. A too-clean early environment can result in adult problems. On the flip side of the coin, hygienic behaviors are entertainingly detailed.

One of her more striking narratives describes the persuasive evidence that chimpanzees, bears, geese, and carnivores rid themselves of intestinal worms by physically scouring them, i.e., by eating indigestible coarse and/or hairy leaves that physically carry the worms out of the gastrointestinal tract. The chapter on ways in which animals cope with ectoparasites is also comprehensive and satisfying.

However, there are inevitably a few nits to be picked with the book. There are some technical errors, such as the characterization of thiamin as an amino acid. Some of the chapters are light on substance and heavy on speculation. The transition between fact and logical leap isn't always clear.

Some important aspects of wild health are given short shrift, although

admittedly there is no clear line between assuring survival (e.g., finding shelter in a cold rain) and preserving health. The role of basic nutrition, and how animals ensure that their requirements are met and that their health is optimized by food, are not treated in depth. (However, she describes some very interesting "fringe" phenomena, such as a variety of herbivorous ungulates that munch on living vertebrates, or bones, to satisfy their mineral requirements. This reviewer is also aware of video documentation of wild North American white-tailed deer eating ground-nesting birds, and of the routine witnessing of a domestic horse eating live frogs.)

Engel doesn't describe the fact that parasites must strike their own balance, obtaining all they can from their host, while not depleting it so badly that it dies, although she does note that healthy animals typically have small but controlled parasite loads. Nor does she adequately acknowledge the many complex factors that determine an animal's longevity in nature.

Despite these omissions, Engel does attempt to include, if briefly, other important issues. She mentions the crucial connection between our eating, medical and agricultural practices, and the health of humans, our animals, and the global ecosystem.

Wild Health is an imperfect and incomplete book, but it is a unique and spellbinding compilation of fact and perspective. It holds a wealth of implications for better managing the health of animals in our care, and for our own health, as well. It is highly recommended reading for all rehabilitators, and for anyone who would like to have her/his faith renewed in the wisdom and ability of nature to heal what ails us.

JWR

Reviewer Janine Perlman, Ph.D., is an avian rehabilitator. She has conducted laboratory research in biochemistry and molecular genetics for twenty years.

Open Minds

COPING WITH BURN OUT

by Beth Dillingham

Education efforts with wild animals and children are not easy. Recently, I was on the road doing zoo conservation outreach programs for four days in rural communities around the state of New Mexico. I had several small animals with me, along with slide programs and education biofacts. I had been sharing a hotel room with a ferret, a variety of herps (including a snake, a sand turtle, and a toad), as well as a lorikeet and a myna bird. I had to haul boxes of teaching materials, animals, and animal food from the hotel to the van to the school—and then back again each night. For those of you who don't know, ferrets are nocturnal and are not the best roommates when you are tired. This particular myna bird talks a lot; it is very disconcerting to hear a mimic of a male voice say "hello" in the dead of night!

Schools start early, and so I had to get up even earlier in order to clean cages, feed the animals, load the van, drive to the school, unload the van, and then set up before the school day begins. The kids were wonderful, but by the end of five presentations with more than 100 children at a time, I could barely talk. Projecting your voice loud enough to be heard by 150 kids in a gym is tough.

One day during this trip I dropped my slide carousel. It had a broken top, and all 70 slides fell to the ground. I had to do the best I could without my visual aids that day. That night I spent an hour and a half putting the slides back in order for the next day's presentations. The next morning, I had an unusual offer of help from the school custodian while on the way to my first presentation. The first thing he did was accidentally dump out that same slide program on the sidewalk.

Teaching is a very hard job. It is exhausting to interact with lots of people. When you are teaching about something you are passionate about it takes even more energy. If you are a wildlife rehabilitator and an educator you are susceptible to burn out. The lack of resources and the constant problems you have to solve as a rehabilitator are frustrating. The bureaucratic requirements and restrictions you have to operate in are a nightmare. The human negligence and cruelty that results in injured animals is infuriating. And let's not forget the backward environmental consciousness of some of the political powers that be. When you add the difficulties of trying to educate with few resources, limited time, and the economic cost of these efforts, it's amazing that people keep doing this work.

Despite these enormous obstacles, however, we must all find a way to stay involved for the long haul. I am not an expert in the phenomena of burn out but I have had encounters with it in my own life and so hope to share some tips.

Defining the Problem

First of all: what is burn out? According to New York psychologist Herbert J. Freudenberger, Ph.D., "burnout is a state of fatigue or frustration brought about by a devotion to a cause, a way of life, or a relationship that failed to produce the expected reward." (See http://155.187.10.12/fun/burnout.html)

Dr. Freudenberger writes:

> Burn out is a problem born of good intentions, because it happens when people try to reach unrealistic goals and end up depleting their energy and losing touch with themselves and others. The onset of burn out is slow. The early symptoms include a feeling of emotional and physical exhaustion: a sense of alienation, cynicism, impatience, negativism, and feelings of detachment to the point that the individual begins to resent the work involved and the people who are a part of that work. In extreme cases, the individual who once cared very deeply about a project or a group will insulate him- or herself to the point that he no longer cares at all.
>
> The irony of burn out is that it happens to the same person who previously was enthusiastic and brimming over with energy and new ideas when first

involved in a job or a new situation. This type of person generally has a very high expectation of what can be accomplished. As time goes by and all of the goals aren't achieved, the enthusiasm dies and a sort of listlessness sets in. Instead of lowering objectives or accepting reality, frustration is bottled up and the individual tries even harder. The result is burn out."

My own experience of burn out because of my involvement in addressing environmental concerns echoes these symptoms; those certainly were very unhappy times in my life. Because people involved in wildlife rehabilitation and environmental education are faced with difficult and sad circumstances, it is easy to burn out and turn away from this work. We need everyone to stay involved to add their unique skills and abilities to the resolution of these problems over the long haul.

Stopping Burn Out from Stopping You

According to Dr. Freudenberger, "Most experts agree that when you recognize burn out, you need to make some changes in your life." His website lists the following as solutions to the problem of burn out.

- Establish some long- and short-term goals that are realistic. Write them down.
- If you have been neglecting your health, change your eating habits and begin to exercise more.
- Set aside some time each day for relaxation exercises and allow yourself time to "just let it happen."
- Renew your friendships with other people. Talk to them about your feelings. Don't keep your frustrations and anger bottled up.
- Analyze how you spend your time. Try to incorporate some time management techniques into your life.
- Learn to say no when you're asked to do more than you can handle.
- Learn to delegate responsibility to others. You are not indispensable.
- Find the sense of humor you've probably lost. Learn to laugh at yourself and at the situation.
- Most of all get in touch with yourself, your values, and what you want out of life. Learn to recognize when you are driving yourself too hard and when you are depleting your inner resources.

One thing that has helped me sustain my energy and passion for my work is to ***acknowledge the small accomplishments and victories***. Each time you release an animal back into the wild after helping it heal, celebrate that accomplishment. Each time someone brings you something to help—because they care about what happens to an animal acknowledge that as a sign of hope. Every time you do an education program, take in those looks of concern and interest on the faces of people who have an interest and compassion for the animals you are teaching about.

These things may seem small when you look at the big picture goals, but we can only get there one step at a time. Remember, you can never know the full impact of your education efforts. The results of your education effort may appear years away. I have had the opportunity to find out that former students have chosen careers in the field of environmental education or environmental studies. These people have let me know that some of the experiences they had with me had something to do with those decisions. I had no idea at the time that what we were studying was affecting them. ***So remember, your work means more than your realize.***

If you are overwhelmed or over extended with the work you are trying to do—***get help***. There are lots of people out there who want to be involved in meaningful work and have the right skills to be helpful to your program. Be careful that you find those people who will be helpful, as there are also folks who may take more energy than they contribute to the work.

Get the tools you need to do your work. A picture does paint a thousand words, and I highly recommend good slides for your education presentations. It is worth the time to prepare written scripts so that you don't have to figure out what to do each time you give a presentation, and you can give the education materials to other volunteers to do the education work some of the time. In addition to slides, your tools may include a wagon, cart, or hand truck to move your materials from the house to the car to the classroom. The power of seeing a live animal is also unmatched.

Take a break if you need to. Or just remember to take vacations regularly. Recently I visited friends in California who live near the Monterey Bay. We went on a whale-watching trip. It was in January, the peak of the grey whale migration season. We saw 40 grey whales on their trip south to Baja. We also got to watch a pod of at least 500 short beaked common dolphins in the bay. The dolphins played alongside the boat while they were rounding up a school of sardines. It was a wonderful sight. I spend a lot of my time teaching about environmental problems, and it did me a world of good to see a bunch of healthy animals thriving in the wild.

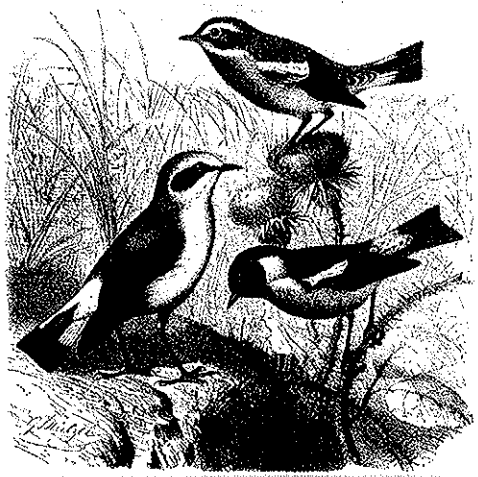
Do things for yourself that refresh you both physically and mentally—and keep you inspired to continue the important work you do for wildlife. The wild creatures can't afford to lose your help. JWR

Beth Dillingham has taught in both classroom and informal learning settings for fourteen years. She ran an environmental education center in the Sandia Mountains in New Mexico, and is currently the education coordinator for the Rio Grande Zoo. She may be reached at thebnm@earthlink.net.

NEO-REHABILISMS...

gram strain
frustration that results from trying to understand "gram positive/gram negative"

talong
an overgrown nail



A MESSAGE FROM THE BOARD OF DIRECTORS

2002 has been a year of reorganization for IWRC. The world of nonprofit organizations has changed, and IWRC has had to change to meet the challenges of 2003 and beyond. Although the overview presented here shows a loss for the year, it is worthy of note that the trend is definitely upward. During the first half of 2002, our financials showed a $19,000 loss; however by the end of the fourth quarter we had recouped almost half that amount, to end the year with a negative balance of approximately $8,000.

The future looks bright for 2003 and beyond, as we automate and streamline to save money and to present a more environmentally friendly profile. A perfect example is our magazine. Where the older newsletter cost $2,000 for the first quarter (contract, printing, and mailing costs,) the Publications and IT volunteers have delivered three issues of *IWRC-online Magazine*—at more than 30 pages per issue—at no cost. This is equivalent to a $6,000 gain for those three quarters.

Yes...we can do more with less!

International Wildlife Rehabilitation Council

INCOME AND EXPENSE STATEMENT (UNAUDITED)

For the year ending 31 December 2002

	INCOME	EXPENSES	
Conference	$ 34,632	$ 36,039	($ 1,407)
Journal	125	29,940	(29,815)
Literature	10,909	15,306	(4,397)
Membership	55,009	26,415	28,594
Newsletter	0	5,015	(5,015)
Skills seminars	67,082	46,800	20,282
Fundraising	22,032	7,798	(7,240)
Administrative	4,156	30,199	(26,040)
Income (Expense)			**($ 8,143)**

BALANCE SHEET (UNAUDITED)

31 December 2002

ASSETS	
Current Assets	
Checking	$ 25,808
Petty cash	9
Prepaid postage	547
Inventory	17,608
	$ 43,972
Fixed Assets	
Office equipment & computers	$ 1,488
Office furniture	25,723
Accumulated depreciation	(20,346)
	$ 6,865
Total Assets	**$ 50,837**
LIABILITIES	
Current liabilities	**0**
Long-term liabilities	**0**
EQUITY	
Earned previously	**$ 58,980**
Earned current	**(8,143)**
Total equity	**$ 50,837**
TOTAL LIABILITIES & EQUITY	**$50,837**



FACT SHEET

Rehabilitation Notebook:
House Finch Conjunctivitis (*Mycoplasma gallisepticum*)

Causative Agent
House finch conjunctivitis (*M. gallisepticum*) is caused by a bacteria-like microorganism. This organism was first isolated from wild house finches from the Washington, DC, area in 1994 and has since spread throughout the entire eastern range of house finches; the disease has not, however, spread west of the Rocky Mountains.

Clinical Signs and Lesions
- Swollen eyelids due to swollen mucous membranes.
- Discharge from the eyes and nose that ranges from clear to cloudy and watery to mucoid.
- Crusty exudate around the nostrils and on the beak.
- Weight loss/underweight.
- Decreased activity (lethargy and depression).
- Difficulty eating.
- Rubbing of eyes on branches and birdfeeder surfaces.
- Impaired vision, causing the birds to collide into objects.
- Secondary bacterial infection and/or purulent material in the tissue around the eyes.
- Rarely blindness and death.

Common Hosts
- House finch, purple finch goldfinch, and other finches (grosbeaks, siskin)
- Chickens and turkeys (different strain)
- Although the above are the most common "natural" hosts of house finch conjunctivitis, the disease is not limited to them. Starlings, blue jays, mockingbirds, and others also get a mycoplasmal conjunctivitis that causes the same clinical signs, although it is caused by *Mycoplasma sturni*.

Transmission
House finch conjunctivitis is transmitted through direct contact (bird to bird) or by air-borne dust or droplets. One major source of spread is thought to be infected birds congregating at birdbaths and bird feeding establishments. As infected finches migrate, they spread the disease to distant locations.

Seasonality
Conjunctivitis is most commonly seen during the colder months of the year (January and February), although outbreaks have also been documented in August and September and other months.

Diagnostics
- Infection is confirmed by isolation of the organism in culture media, or by PCR.
- *M. gallisepticum* is a difficult organism to grow due to its fastidious nature, the intimate dependence on the host species it colonizes, and slow growth on artificial media.
- Lesions and microscopic findings of eyelids, nasal tissue and the trachea are used for diagnosis.
- The best specimens are obtained from fresh lesions on live birds.
- Serologic testing for antibodies is also valuable.

Treatment and Release of Rehabilitated Birds
- Birds with conjunctivitis can be treated with the appropriate antibiotic for an appropriate period of time, and be cured of clinical signs. Consult with a veterinarian regarding treatment.
- Treatment is controversial as birds who survive the infection can become carriers of the disease.
- When carriers are released into the wild, they *may* serve as a source for initiating a new outbreak.
- These factors must be considered when rehabilitating infected birds.

How You Can Help Control the Spread of Avian Conjunctivitis
- Routinely clean and disinfect birdfeeders and baths with household bleach. For feeders that have heavy use, a 10% solution of household bleach should be applied weekly to reduce contaminated surfaces. Tube feeders pose a higher risk for transmission.
- Strict hygiene and isolation of infected birds during hospitalization.
- Disinfection of cages that housed infected birds prior to reuse.

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

DITTO A REPRODUCEABLE PUBLIC SERVICE ANNOUNCEMENT



preventing disease at your Bird Feeder

Salmonellosis, trichomoniasis, avian pox, aspergillosis, and conjunctivitis are diseases that commonly affect birds that visit backyard bird feeders. Sick birds are less alert and less active. They feed less and often cower on a feeder, reluctant to fly. Their feathers look ill-kept. Sick birds are more vulnerable to starvation, predation, dehydration, and severe weather. Eventually, these diseases are fatal.

Disease is one of many natural processes affecting wild species. You can minimize the risks and spread of avian diseases at your bird feeders by taking the following precautions:

1. **GIVE THEM SPACE.** Avoid crowding by providing ample feeder space. Lots of birds using a single feeder looks wonderful, but crowding is a key factor in spreading disease. Crowding also creates stress that may make birds more vulnerable to disease. Several feeders at wide intervals helps disperse the visitors.
2. **CLEAN UP WASTES.** Keep the feeder area clean of waste food and droppings. A broom and shovel can accomplish a lot of good, but a vacuum such as you might use in your garage or workshop will help even more.
3. **MAKE FEEDERS SAFE.** Provide safe feeders without sharp points or edges. Even small scratches and cuts will allow bacteria and viruses to enter otherwise healthy birds.
4. **KEEP FEEDERS CLEAN.** Use feeders that are made of a material that can be sterilized (e.g., polycarbonate). Clean and disinfect feeders by fully immersing them in a 10% bleach solution (one part household bleach: 9 parts water) for 2–3 minutes. Allow to air dry. Once or twice a month should do, but weekly could help more if you notice sick birds at your feeders.
5. **USE GOOD FOOD.** Discard any food that smells musty, is wet, looks moldy or has fungus growing on it. Disinfect any storage container that holds spoiled food and the scoop used to fill feeders from it.
6. **PREVENT CONTAMINATION.** Keep rodents out of stored food. Mice can carry and spread some bird diseases without being affected themselves.
7. **ACT EARLY.** Don't wait to act until you see sick or dead birds. With good prevention you'll seldom find sick or dead birds at your feeders.
8. **SPREAD THE WORD.** Encourage your neighbors who feed birds to follow the same precautions. Birds normally move among feeders and can spread diseases as they go. The safest birdfeeders will be those in communities where neighbors cooperate with equal concern for the birds.

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

The IWRC brings you this information from the National Wildlife Health Center (http://www.nwhc.usgs.gov)

TAIL END

by Astrid MacLeod



GRANT'S ZEBRA PHOTO: GARY M. STOLZ/USFWS

"Do you think this makes my butt look fat?"

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 continent of North America.

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