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JOURNAL of Wildlife Rehabilitation

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Sample

Using Natural History in Wildlife Rehabilitation . . . p. 3

Guidelines for Authors

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 purpose of returning them to the wild. All feature articles are subject to a review process, and our staff and reviewers work with authors to produce the most accurate information possible in our ever-changing field.

The *Journal of Wildlife Rehabilitation* has various feature categories. We solicit submissions in the form of feature articles, rehabilitation notes, book reviews, news articles related to major events in the field, and selected case studies. Articles on veterinary medicine as it relates to wildlife rehabilitation are also welcome. We would like to expand the *Journal of Wildlife Rehabilitation* to include wildlife rehabilitation articles from countries outside the United States and welcome inquiries regarding such articles. We also have two short features we use for basic information: "For The New Rehabber" and "Simple Things That Make a Difference." They are intended for basic information or new ideas that are easily demonstrated with a short text and photos. All authors receive a $25 honorarium for each article accepted for publication or provide a one year membership or renewal.

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1. An original and two copies of the manuscript should be submitted to the Editor, IWRC, 4437 Central Place, Suite B-4, Suisun, California 94585, USA. The manuscript should include references, photo legends, and footnotes, and should be typewritten, double-spaced, if possible. The author's name, address, and phone number should be placed on at least the first page of the article so it can be readily identified and the author contacted. Please note that each article should be accompanied by an abstract. If tradenames are used for products mentioned the author must indicate whether the product is ™ or ®. A product table at the end of the article should give readers the name and address of the companies involved and generic name or category of product.

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3. Manuscripts are received with the understanding that they have not been accepted for publication elsewhere. **It is the author's obligation to obtain permission or reprint rights if the submitted copy has been published elsewhere.** All accepted manuscripts are subject to editing. Unused manuscripts will be returned.

4. A separate page should be submitted with a short synopsis of information on the background of the author. Included should be the name, address, rehabilitation organization, phone number of the author and a biographical paragraph. Where appropriate, please list any academic degrees, special training, or experience that is relevant to the article (i.e., physical therapy—RPT, etc.) Articles pertaining to areas of veterinary medicine that involve tasks or decisions requiring a licensed veterinarian (e.g., soft tissue or orthopedic surgery) require a veterinarian as either the author or a co-author.

5. Black and white photographs are preferred for use in the *Journal of Wildlife Rehabilitation*. When no other option is available, color prints can be converted but this is costly and to be avoided when possible. Photo credits should be listed with the photographs.

6. Acknowledgments are limited to people who have contributed to the article in a major way.

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Editorial . . .

Wildlife Rehabilitators and Rabies Vectors

Spring is in the air and the babies are sure to follow. As the veteran troops gear up to handle the onslaught, the question once again is raised, what about rabies vector species? In California, those species are bats and skunks, and I have worked with both. In fact, over the years, experienced wildlife rehabilitators have carefully handled rabies vector species out of necessity—we felt an obligation to separate the untrained public from the potential problem. As a result, many of us received pre-exposure rabies shots and developed management systems that did not allow any exposure to the animals for which we cared. We worked with the health department in reporting all potential human exposures and became a part of the public health team.

Wildlife rehabilitators were sad to see the raccoon rabies epizootic on the east coast and the hysteria that followed. In many states, wildlife rehabilitators have not been treated as part of the team or seen as part of the solution. Instead they were treated either as part of the problem or like incapable unskilled idiots that were likely to prolong the outbreak. In state after state, edicts were handed down that wildlife rehabilitators could not accept raccoons. They were to direct people to leave the animal alone or call a public officer to come out and kill it. The intent was to keep potentially rabid animals from both the naive public and wildlife rehabilitators. We all knew what would happen.

There were voices of reason and numerous debates on the wisdom of this policy. In particular, Jo Balliet, a licensed New Jersey wildlife rehabilitator and IWRC State Representative, spent many hours discussing the topic with various officials over several years and has been successful in setting up procedures that allowed licensed rehabilitators to work with raccoons. These were difficult years—the epizootic continued to spread and so did the level of alarm.

Lately, I have been seeing a few rays of hope. Although oral rabies vaccine has been used on wild populations of European foxes for many years, little interest was shown in the US until this epizootic spread like wild fire. For years, I had been vaccinating every skunk that was trapped and relocated as well as those that were brought in for rehabilitation. I knew I could not hope to vaccinate the local population. What I did know was that I was likely to have released a number of skunks that would not act as vectors for some unknown period of time. Using a killed vaccine I knew that I would not give the skunks rabies and was following the time honored maxim "do no harm." My hope was that I was setting up some sort of buffer with vaccinated skunks. I don't know if what I did had any effects on the population. The low level of rabies in our country did not change over the years in which I operated a wildlife rehabilitation center. However, the idea of vaccinating a population in the face of an outbreak seems to me to be a positive step and one that I am glad to see.

Then I got a hold of the Sunday *New York Times* (March 13, 1994). It said the state of Connecticut "is lifting a ban on treating the animals (raccoons, skunks and foxes) this spring because the policy—aimed at reducing the public's exposure to rabies— backfired." This is because the animals refused by trained wildlife rehabilitators were then kept by the public who wanted them saved. Predictable. So it seems the public health team has again been broadened to include the wildlife rehabilitator—and not a minute too soon. In Connecticut, wildlife rehabilitators are required to get their rabies preventative shots, isolate the animals and keep good written records. Sound familiar? Well, I guess for every few steps forward we must expect one backward. I for one am glad to see us all moving ahead again. Many thanks to the many wildlife rehabilitators including Gloria Salvatore (North American Wildlife Association) and Laura Simon (Connecticut Wildlife Rehabilitators Association) for their leadership on this delicate issue. This was an issue that required "true grit" and I think it is important to recognize those who have it!

-Jan White, DVM-

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Natural History: The Square One For Wildlife Rehabilitation

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ABSTRACT

The knowledge of a wild animal's natural history is an integral part of the successful rehabilitation and release of that animal. This article deals with the considerations that should be given to individual species, as well as case studies that provide some solutions to some difficult rehabilitation situations. Included are pointers that help the rehabilitator to learn to use an animal's natural history in all phases of rehabilitation.

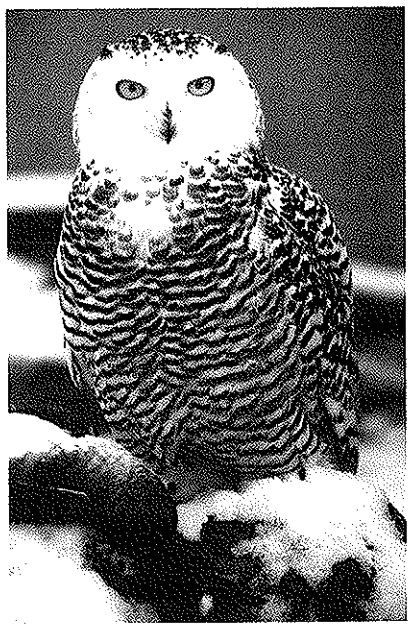
KEY WORDS: natural history, wildlife rehabilitation, territorial defense, visualization and creativity

Introduction

natural history — nat/u/ral his/to/ry 1. the study of an animal's life, usually in a popular manner. 2. systemic study of natural objects: animals, vegetable or mineral

An animal's natural history affects every aspect of its life and well-being in captivity; from how and what it is fed, to the facility in which it is housed and the conditions surrounding its release. The more years spent in the area of wildlife rehabilitation, the clearer it becomes that the knowledge of a species' natural history is especially important to the successful rehabilitation of that animal. Is it the most important aspect of successful rehabilitation? Er-r-r-r... Let's have a look at the situation. Many times, I get calls from rehabilitators concerning a wildlife problem that wouldn't be a problem at all if the individuals involved had been aware of the animal's natural history and had applied that knowledge from the beginning of the rehabilitation process. Some problems are easy to correct, but others are not, and these ultimately cause an unsuccessful rehabilitation effort. Occasionally it is the beginning rehabbers that call with questions, but many problems are from experienced people. Even veterinarians or wildlife agencies, sources that we assume have all the answers, are prone to make the same errors as all the rest of us.

I am certainly not intending to be critical of any of "us" as rehabilitators or veterinarians or of any agency, state or federal, but instead I offer an observation that too frequently is overlooked. Simply put, knowledge of the natural history of an animal can make our rehabilitation efforts more successful, thus facilitating getting our patients back into the wild where they can fill their niche in nature.



First Response

Most of the time, we react automatically to save an animal. Like a member of a precision drill team, syringes and feeding tubes fly into our hands as we simultaneously warm a carrier or habitat that will house our patient. This is as it should be, at least in critical cases. In fact one criterion for exceptional wildlife rehabilitators is that instinctive reaction. Most of our time and energy is funnelled into the survival aspect for the first few hours or days of the animal's admission, or at least until after the critical period has passed. Problems that result from the lack of understanding of natural history can come up with an animal a few days, weeks, or sometimes even longer into the rehabilitation or post release process.

Rehabber Sensitivity

Unfortunately, there is another element that creeps into the care and rehabilitation of animals, and that is one of our own "sensitivity." We must not feel defensive when it is suggested that we may not have all the answers when it comes to wildlife. This is particularly true with elements of wildlife natural history. It is natural to assume that because we have worked with a particular species for awhile, we know what it needs. I suggest that we not make that assumption. The information needed to allow us to successfully rehabilitate and release animals is available. But it may be severely limited or it may be wrong. Many species' behaviors are still a mystery. The simple things, such as number of offspring, or the not so simple things such as the explanation of cyclic highs and lows of reproduction or prey availability are still in need of exploration. Popular opinion or speculation can masquerade as fact.

Public Wildlife Concepts

The protection of wildlife is a relatively new concept. Raptors have only been fully protected since the early 1970's (USFWS amended March 10, 1972, Migratory Bird Treaty Act). It hasn't been many years since wildlife was considered a walking grocery store, or an amusement offering target practice for the bored or young. People tended to fear wild animals, particularly the carnivores or ones with aggressive reputations. Vast numbers were shot on sight, poisoned or tortured in traps under the auspices of protecting one's family or livestock. Unfortunately this activity still occurs, although less than before. The value of these wild creatures that we rehabilitators protect and shelter is only beginning to be realized and understood by the general public.

Wildlife rehabilitators are at the forefront of that concept! Universities that once focused only on domestic animals or livestock are enlarging their scope to include wildlife as well. Once, the value of animals was judged almost exclusively in terms of economics. "What can they provide for us?", was a typical question. Rarely pondered was the environment, aesthetics, or need for balance in nature. When considering these facts, it is easier to recognize that some of the information we need may still be in the process of being learned. Research biologists may indeed have information useful to us in their piles of data. They may have every intention of writing it up and publishing someday soon, so everyone will have the benefit of the knowledge they have gained, but they have not yet had the time to do so. I say this from personal experience, as I look over at my stacks of raw data sitting neatly by my computer. Happily, many of the species that we regularly treat are well researched and documented. Therefore, we must educate ourselves well.

Wildlife Experts

As rehabilitators, the public expects us to be purveyors of all aspects of wildlife care and information. From general care and nutrition to the capturing of frightened animals following an injury, we are called on to solve wildlife woes for the public and, for the most part, we do a superb job. Unfortunately, we sometimes sell ourselves that "bill of goods" and think of ourselves the same way the public does. We take on the impossible task of being experts in all things with all species. We expect that, no matter what species is involved, we can care for it! -- even if we are unfamiliar or uncomfortable with the particular animal involved. When this opinion is instituted and we attempt to "do the best we can" for the animal, no matter what, we are courting disaster! The outcome is frequently not as we intended for the animals we work so hard to save. It is this outcome that we must focus on from the beginning.

So what do we do? How do we know it all? Obviously, we cannot. We can't be experts in all areas. Not even the best and brightest can do that! Consider that Albert Einstein was totally baffled by his own tax forms! The wisdom is of course in realizing that fact and knowing when to seek out others with greater experience with the species in question and referring to books or other sources.

Solutions: Visualization and Creativity

Now suppose you have every book ever written on the animal you are caring for. It is a good start, but let us also suppose that this animal in your care happens to be one of those with the misfortune of being classified as "low profile," an unattractive creature that happens to be cursed with a bad public image. It could even be that this species resides naturally in a hostile or remote environment. Let's pretend that people know little about this animal. What do you, as wildlife rehabilitator par excellence, do? Well, you think! You consider every known aspect of this animal. You IMAGINE yourself in its environment. You IMMERSE yourself, via imagination, into its life! You close your eyes and VISUALIZE. What does it look like there? Are there rugged cliffs with sharp rocks jutting out, or is the terrain soft and sandy? What is the temperature in this natural habitat? Is migration or hibernation a factor with this species? If so, what time of the year are you dealing with and will this change your release dates or housing needs? What is the natural light cycle for this animal? Be aware of and sensitive to this issue, particularly with Arctic species. What is it eating and how does it go about securing its food? Is it a deep diving animal or a surface feeder? What are the physical features of this animal? Does it have a long beak that will prevent it from drinking from a shallow water dish or short legs that will create a dangerous situation if exposed to a deep watering pan? When does this animal eat? Is it a night feeder? If so, remember to offer him food during the evening hours instead of making him adhere to your schedule. Is this a solitary creature or gregarious? What other animals would be around him in the wild state? What are his natural enemies? If confinement is within the time of the year of the animal's mating cycle, consider if a peculiar behavior exhibited is " unusual" or "unpredictable" or if it can be associated with the mating or pre-mating activity (Evans, 1987). Challenge yourself to consider every aspect of his life in the wild and then do what you can to emulate those conditions in the captive situation!

Examples

Consider the loon and the Common Murre. Both of these birds had poor rehabilitation results until methods were developed by creative rehabilitators that allowed for the birds' own natural history. The injured loon in our care with its heavy body and legs meant for swimming and power diving, not for walking on land, easily develops keel sores. It spends most of its life in water or bog areas when nesting. In captivity, it isn't always possible to have the bird in water at all times. How then do you imitate that condition as closely as possible? Loons that rest on frame-supported netting allow the keel to be supported without pressure. They don't develop the keel sores that have been such a notorious loon rehabilitation problem (Holcomb, 1988). Common Murres provided with artificial rock cliffs to cling to, as they would in nature, are less likely to develop the joint complications that turn a potentially releasable murre into a permanent cripple. Smooth flat surfaces, typically found in rehabilitation enclosures, cause these legs made for teetering on rock faces to develop joint problems from unnatural weight distribution (White, 1991).

The breeding behavior and number of siblings is also an important part of rehabilitation. Dr. Mike Wallace, lead scientist with the California Condor Recovery Program, shared with me the importance of this. In the wild, condors don't have to cope with siblings at the nest as they are raised as single individuals. Grouping several chicks together in an effort to not imprint the captive raised chicks created fighting and other asocial behavior problems until their "only child" status in nature was remembered. Simple, perhaps, but so easy to forget until problems surface. Now, California Condor chicks are raised within sight of one another, but with clear barriers between so they cannot physically interact (Wallace pers. comm., 1993).

Very young mammals are provided with ano-genital reflex by their mother as she gently licks the abdomen (Beaver, 1990). In their natural environment this serves to not only provide the needed stimulation for defecation, but allows the



mother to nurture her young, and strengthens the bonding between mother and youngster all while keeping the infant clean and preventing predation of the nest due to telltale fecal odors.

Sometimes we need to consider not only the natural history but the situation with which the animal will have to cope once returned to the wild. Raising tame deer, for instance, which eat from one's hand and frolic with the kids, then releasing them to the wild as they reach independence ... just before hunting season in most areas of the country, makes very little sense (Forness, 1984).

One of the saddest photos I have ever seen was a media shot of a rehabilitator and a wild goose that they were trying very hard to "save." With both legs caught in a trap the goose underwent amputation of both feet and was photographed sitting on his rump, stumps of his legs bandaged and pointed out. The story ended a few months later when the goose died during the third surgery, another amputation ... each having taken a little more leg and bone because the goose kept trying to stand on his stumps and got infections. The goose was blamed for being uncooperative, continually standing on his stumps. Obviously the rehabilitator was being unrealistic and didn't consider the natural history of the goose (nor the welfare, but that is another story). A simple fact is geese are heavy bodied birds that stand on their legs!

Raptors

Raptors have many differences when it comes to natural history. Personality traits, territorial defense, and habitat selection are part of their natural history, and must be given careful consideration. Coopers hawks and Goshawks are notorious for being high strung and excitable. Considering this trait they need to be housed accordingly during the rehabilitation process. Solid sided enclosures will allow the release of a sane and well feathered bird at the end of the rehabilitation process. If you don't have such an enclosure, find someone that does and network. To end up with a broken feathered replica of an accipiter, even with a healed primary injury, is still a failed rehabilitation effort (Gibson, 1986).

Perch differences are important with raptors too. Most falcons are cliff dwelling birds and rarely use branch type perches in nature. The long elegant toes so useful to their success in hunting prey are ungainly when folding around branch perches. Therefore block or shelf perches are required for larger falcons Consider foot width as well as toe length for each raptor -- species and gender can make a difference. Talon injuries and bumblefoot frequently occur when inappropriate perches are used due to unnatural weight distribution and the pressure points that result (Redig, 1993).

Field Lessons

My greatest lesson in a creature's natural history was from my research project on Bald Eagles following the Valdez Oil Spill. Tradition among Raptor Biologists held that the Bald Eagle was an "airhead" type of bird. It was difficult to capture, and more of a biter than the Golden Eagle. I was expecting an uninspiring experience with birds that acted like feathered versions of T.V.'s Peggy Bundy. It wasn't long into my project that I recognized the negative descriptive terms used by my peers were actually a reflection of the frustration they felt with a high strung bird that was difficult to capture and therefore frustrating, especially in a research sense. The Balds turned out to be high strung alright and "untraditional" in response to the usual trapping methods, but offered us some valuable glimpses into the adaptability of their species during an environmental stress situation. Using adaptability as an indication of intelligence, I gained a whole new respect for these great birds. They taught us a great deal that summer. We found out that young birds don't share in prime territory. Youngsters were delegated to the interior of Alaska where carrion was plentiful. Prime adults aren't as likely to feed from carrion, preferring instead to catch fresh fish (Gibson, White, 1990). Turns out the biologists that categorized the birds early on proved to be less adaptable. Even after they were full adults, living in prime territory, they still ate hot dogs and potato chips!

Territorial Defense

Prior to release of any animal, be aware of the territorial defense aspect of con-specifics and the importance of pair bonding (Bloom et.al, 1993). With the Bald Eagle project, we followed rules that the birds' own natural history dictated. The birds that were captured and removed from their territories for cleaning (oil from the spill) were returned to the SAME territory so as not to add more stress to the already stressed animal (Robards, Hodges, 1976). Special attention should be given to the subject of territorial defense when releasing rehabilitated animals into a known occupied territory. Certainly the time of the year is an important consideration also.

Continued on page 16

Rehabilitation Notes: Northern Harrier *(Circus cyaneus)*

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Introduction

The Northern Harrier (or Hen Harrier as it is named in Britain) is a diurnal ground-nesting raptor that hunts in marshes or dry open country in the United States, Canada, Europe and Asia. The genus name, *circus*, is Latin and means to circle in the air (Terres, 1980). The species name, *cyaneus* is also a Latin word meaning dark blue (Terres, 1980). This is likely a reference to the coloring of the adult male harrier. When compared to other harriers, the Northern Harrier is one of the least specialized (Grossman, Grossman and Hamlet, 1964) but as with harriers, open space for hunting is a major habitat requirement.

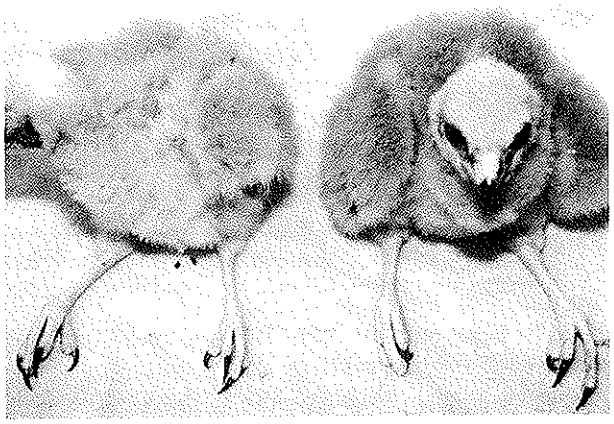
Northern Harriers are a joy to behold in flight. Whether coursing back and forth along a creek area or diving for prey, they are easy to spot and great fun to watch. "Sky dancing," moreover, is one of their specialties. Frances Hamerstrom has written and drawn a nice description of these often spectacular flights which are associated with courtship, in her book, *Harrier: Hawk of the Marshes*.

Wildlife rehabilitators often receive Northern Harriers when they are inadvertently chopped up by harvesting machinery during late spring or early summer because their nests (and young) are on the ground along with the crops. In some cases, the farmers find the nests before they cut and bring the eggs or young in for rehabilitation. This practice has enabled the authors to obtain a numbers eggs and hatchlings and develop growth data for these notes.

These birds can be long-lived, with recorded life spans in the wild of up to 16 years and 5 months (Hammerstrom, 1986). Interestingly, females generally have higher annual survival rates (up to 90%) compared with males (72%) (Johnsgard, 1990).

Adult Description

- Total length is 17.5"(44.45 cm) to 24" (60.96 cm). Northern Harriers have a wingspan of 3.5 to 4.5 feet (1.06 m to 1.37 m). Adults are sexually dimorphic, however, juveniles can be sexed by comparing tarsi widths which are thicker in the female (Hammerstrom, 1986). The female is brown above with tawny streaks on the head, white and buff on the mantle, sides of neck and wing coverts. Her wings, when viewed from above, appear dark gray-brown. Her tail is a medium olive-gray and is barred with dark gray-brown.



Harrier chicks: Male (L) Female (R)

Normal female weights range from 370 g to 568 g. (Terres, 1980).

• Males are dove-gray above and have the same gray color on their faces and chest. The entire undersurface of the wings, except the dark tips of primaries and barred secondaries is white. The tail feathers are lightly streaked with thin horizontal dark stripes. Adult males have yellow irises. Normal weights for males range from 362g to 390 g. (Terres, 1980).

• Both sexes, even as juveniles, have distinctive white rump patches which assist in quick field identification.

• Hen Harriers in Europe are similar to their North American counterparts in size and coloring. However, the females and immatures of both sexes are more heavily and completely striped. The immature male "resembles the adult North American male" and the adult male Hen Harrier is lighter above, has a pure white belly and an unbarred tail (Grossman, Grossman and Hamlet, 1964).

Juvenile Description

• Hatch weights are 17-22 g. Upon hatching, neonatal down is present and young are an ivory white color. As they grow, they look as if they are mostly legs! They first stand at about 13-17 days of age (Millham, 1994).

• Juveniles look like the female expect that they are a cinnamon color underneath on their chest and belly. In North America, one can age females to the year by their eye color until they are five years old (Hammerstrom, 1986). The brown iris color tends to turn amber in the second year and then each subsequent year the percentage of brown flecks decreases until by the fifth year, the iris is yellow.

Natural Diet

• The natural diet of the Northern Harrier is mainly mice. However, it will also eat rats, small snakes, lizards, crayfishes, insects, small birds, and even carrion. Terres notes their opportunistic nature in hovering at the front line of a prairie fire in order to catch escaping mice!

Nesting, Egg laying and Incubation

• The female builds the nest on the ground usually near low shrubs or in tall reeds, weeds, or commercial crops such as alfalfa. The nest consists of a platform of dry sticks, weeds, or grasses. The nest may be on a grassy knoll or can be built up in a wet area or be placed over water.

• In North America, eggs are laid between March and July. The number laid varies between 2-10 with 4-6 being more common (Palmer, 1988). Incubation is done by the female startomg wotj tje forst egg and lasts for about 30-34 days. Eggs do not often hatch together (q 24-48 hours apart), except in the case of small broods, and so nests often contain siblings of various ages. Pin feathers appear at about 10 days of age. Young can fly at 30-35 days but have been observed to wander on foot in and around the nest at a very early age (Hammerstrom, 1986). They seem to exhibit this kind of behavior in the face of the shrill cry of the younger nestmates. Hammerstrom, who has studied this species for several decades, notes that it likely has a protective function to prevent the youngest chicks from being injured by larger, more active and heavy siblings.

• The nestling phase is followed by a fledgling period of 42 days when young are still dependent upon their parents (Johnsgard, 1990). Males, smaller in size, typically fledge at about 32 days, whereas the larger females may not do so until the 42nd day (Johnsgard, 1990). Northern Harriers generally disperse from the nest site in 21-50 days from fledging. Where they wander, they tend to do so alone, rather than with their siblings or parents (Johnsgard, 1990).

Nestling Housing and Care

• Neonates are satisfactorily housed in a variety of ways. The elements for successful housing are: warmth, cleanliness, absorbent bedding, and non-slip surfaces to prevent splay leg (e.g., sink matting, Fisher Scientific). In general, birds at hatch are kept at about 100° F and the temperature is reduced by about 1° per day as the birds increase in size, grow feathers, and begin to thermoregulate. Notes on wild females indicate they incubate young for at least the first 5 days (Palmer, 1988). Traditional neonatal incubators, chick brooders, or home-made versions have all been used successfully. Be sure the birds cannot get too close to the heat source. Most incubators have places to add water to provide proper humidity. Their environment should be cleaned at least once daily. They should be exposed to the normal photoperiod for the latitude and time of year.

• Raptor chicks should be reared with minimal human contact once they are able to focus their eyes. Single chicks should be integrated into an existing group that are similarly aged. It is important to weigh them regularly (prior to the

IWRC NEWSLETTER

UPDATE ON RABIES AND WILDLIFE REHABILITATION IN THE MID-ATLANTIC AND NORTHEASTERN UNITED STATES

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6 Eldorado Drive
Tabernacle, New Jersey 08088

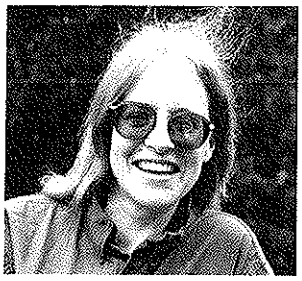
With the exception of Vermont and Maine, all mid-Atlantic and north-eastern states have reported the biotype of rabies which affects mainly raccoons. Until the oral rabies vaccine becomes commercially available and is used for total rabies eradication, the disease in raccoons is here to stay. Where it entered north-eastern New Jersey in late 1989, the disease is peaking again and is projected to do so in four-year cycles in much the same pattern as when it originally spread, at an epizootic level, through the state. The good news is that New Jersey wildlife rehabilitators, with the support of the Division of Fish, Game and Wildlife, continue to rehabilitate, on a professional level, raccoons, the reservoir species, as well as the "spillover" species such as skunk, woodchuck and fox. A similar policy applies in Massachusetts and is projected to apply in Maine when the rabies biotype is diagnosed there. After a three year moratorium, Connecticut agencies have granted permission for the rehabilitation of birth year high-risk species. The states of Maryland, New York and Vermont continue to ban all rehabilitation efforts for high-risk species. Other states in the region (Virginia, Delaware, Pennsylvania and New Hampshire) have varied policies which allow some level of rehabilitation of those species. It has been demonstrated in New Jersey that wildlife rehabilitators can establish a sound rabies protocol for rehabilitating high-risk species. Those rehabilitators are in a pivotal position as a barrier between rabies and the well-meaning but untrained public by handling individuals of those species. Furthermore, rehabilitators are well equipped to educate the public with correct rabies information, by telephone, mail and direct contact. Police departments, news media and animal agencies at the local county, state, regional and national levels, can also benefit from the expertise and experiences of wildlife rehabilitators in their areas.

HSUS SEMINARS STRESS HUMANE CONTROL OF NUISANCE WILDLIFE

PC Hanes, IWRC Newsletter Editor
Central Texas Wildlife Institute, Inc.
HCR 64 Box 30
Hamilton, Texas 76531

The Humane Society of the United States hosts four annual seminars on Humane Methods for the Control of Urban Nuisance Wildlife. These seminars, led by Guy Hodge, Director of the Department of Data and Information Services for HSUS, feature presentations on many aspects of urban nuisance wildlife.The seminars are a valuable contribution to the education of animal control officers, wildlife rehabilitators and shelter representatives. Discussions of control methods and products and their efficacy, home-made solutions that can be fixed up at little cost, and improvements to standard techniques provide a rich insight into humane methods for dealing with public complaints about wildlife. It is essential to note that "nuisance wildlife" has many meanings, from the individual who is offended by the mere presence of an opossum in his yard to the homeowner who has raccoons in his attic. In all cases, presenters stress assessing the actual extent of the nuisance and any damage caused by wildlife, then educating the public to deal with the problem without destroying the animal. Understanding the behavior of the "nuisance" animal is the most important step in humane control of wildlife damage. This theme was stressed again and again by Guy Hodge, Dr. John Hadidian, Dr. Donald Burton and Dave Pauli, who led the seminar recently held in Houston. The 1995-96 seminars will be held in Lincoln, NE, Atlanta, Philadelphia, Chicago, San Francisco, Denver and two other cities. More information on these seminars can be obtained by writing **the HSUS, 2100 L Street NW, Washington, DC 20037.**

"A Pocket Guide to the Humane Control of Wildlife in Cities and Towns", a publication of the HSUS, is available from IWRC Publications, 4437Central Place, Suite B-4, Suisun,CA 94585 for $6.95+ $2.50 for shipping and handling. This book outlines methods for dealing with nuisance wildlife, supplies and suppliers, and other useful information.



A CLOSER LOOK AT:

Marnie Allbritten,
IWRC PRESIDENT, 1994

Marnie Allbritten, the new President of the Board of Directors of IWRC, is presently a biologist with the Oregon Department of Fish and Wildlife. She has been a mental health counselor, a daycare teacher, a free-lance writer and a musician.

As a co-founder of Umpqua Wildlife Rescue, an all-volunteer network of wildlife rehabilitators, Marnie has been an active wildlife rehabilitator since 1 986. Her specialty is raptors. Her favorites are barn owls and golden eagles.

Marnie considers wildlife rehabilitation one small way to help change the world. Her pet peeve is people who sell wildlife for pets. She believes that education is the best way to preserve our natural resources for present and future generations.

As President of IWRC, Marnie has firm goals, long and short-term, for the organization. Primary among these is greater financial security and power for the organization. Marnie wants IWRC to become an endowed organization with funds available to pursue projects that will increase knowledge of all wildlife rehabilitators. Such projects would include radio-tracking post-release studies of mammals and birds that are commonly brought in for rehabilitation. 'This would enable us to learn more about pre-release needs for these species", says Marnie. "Many animals rely on learned behavior as much as instinct for survival. More post-release data will enable us to make adjustments to housing, diet and survival training for all species."

Along with this, Marnie would like to see rehabilitators establish more credibility within the scientific community. "Rehabilitators have a great deal of information to share with the field and lab scientists. We need to open more channels to get this information to them. More emphasis needs to be placed on collecting and presenting rehabilitation data in a scientific manner."

More immediate goals are a diet study for common species of birds, which she is undertaking with Susan Heckly of the Lindsay Museum, and following up on proposals to band rehabilitated migratory birds for post-release data. She is looking forward to radio-tracking screech owls for a post-release study of her own.



FORUM CORNER

Marge Gibson
IWRC Board of Directors
N2160 W Rollwood Road
Antigo, WI 54409-9019

Dear IWRC members:

This month will mark our second attempt at an advice column for wildlife rehabilitators. (Gary Bogue wrote a few such columns a decade ago.) I am really looking forward to the column and the interaction and communication that will come from it. The replies uill take time to answer through the newsletter considering press-time, so if you have a question that needs immediate attention please contact someone at IWRC (707) 864-1762 for the Wildlife Hotline) or me by phone (715) 623-4015 for help. Sorry, we cannot answer anonymous letters in the column but will withhold your name if you request. If there is a question you have been wanting to ask, ask away! If I don't know the answer, I promise to find someone that does.

Advisingly yours,
Marge Gibson

Dear Marjorie:

I have a question that indirectly involves the Raptor Feeding Box described in Volume 15, Number 4 issue of the *Journal of Wildlife Rehabilitation.* Do you have any experience with babies raised as single birds? Can they be too isolated from contact (physical)? I always try to find a rehabber with a baby of similar size and species, but that is not always possible. Could absolute isolation be a potential problem, creating maybe a psycho raptor? I realize this may sound like a stupid question, but if I want to learn and upgrade my work, I feel like I just have to jump in and look dumb sometimes.

Sincerely,
Lynne McCoy
Morristown, TN

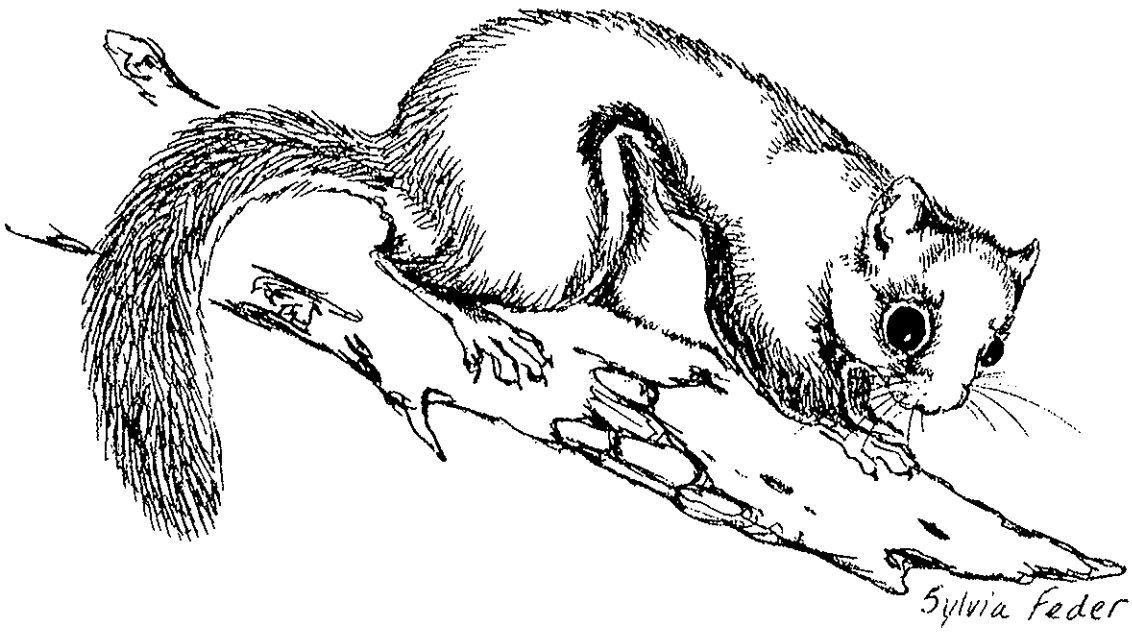
Dear Lynne:

Thank you for your letter. Actually yours is a question l have pondered many times. First off, NEVER be afraid to ask, or apologize for asking, a question, even if you think it is "dumb". Most of us started as backyard rehabilitators, just some of us longer ago than others. Your comment about upgrading your work is music to my

International Wildlife Rehabilitation Council

Summer Sale Catalog

Summer 1994



Take advantage of our low sale prices, during IWRC's annual literature clearance. We need the space! Increase the size of your information libraries while you help us lower our inventory. Summer sale prices are available to MEMBERS ONLY!!

This sale form MUST accompany all orders, and must be received no later than August 31, 1994 in order to receive the sale prices. Any orders received after that date will be invoiced at the regular rates. IWRC member discount does not apply to summer sale merchandise.

Annual Overstocked Literature Sale

Our annual literature sale on selected items will be in effect until August 31, 1994. Only those items listed in the sale catalog will be sold at these reduced prices.

1991 Conference Proceedings, Vancouver BC, Canada: "Handle With Care"

Papers include: How to Make Your Wildlife Education Programs More Effective by Marge Gibson; Home Care and Wildlife Rehabilitation by Marnie Allbritten; Squirrel Rehabilitation Project by Carol McIntyre; Handling and Restraint of Wildlife Species by Florina Tseng, DVM; Seal Pup Rehabilitation Program by Laurence Braun; Rehabilitation of Orphaned Sea Otter Pups by Julie Hymer; Rehabilitation of the Beaver and Muskrat by Cheryl Millham; Rehabilitation of the Coyote (*Canis latrans*) by Jeanne Wasserman; Study of 129 Coracoidal Traumas, Successes Without Intervention by Kit Chubb; Current Protocol for the Rehabilitation of Oil Affected Waterbirds by Jan White, DVM; Care of Coots, Rails, Plovers, and Sandpipers by Meryl Faulkner; Aspergillosis in a Rufous Hummingbird Colony by Chris Harvey-Clark DVM; Avian Hematology: An Overview of Specimen Processing, Sample Evaluation, and Interpretation by Victoria Joseph, DVM; Basic Public Speaking for the Rehabber by Alyssa A. Ottomeier; Raising More Money in Hard Times by Bill Marshall; Hand-Rearing Techniques for Raptors by Claire H. Hager and Walter C. Crawford, Jr.; Rehabilitation of Orphaned Raptors: The Fostering Alternative by Brian Woodbridge; An Investigation Into the Health Status of Bald Eagles of British Columbia by Ken Langelier, DVM.

Regular Price: $20 ***Limited copies available*** **Sale Price: $10**_____

The Effects of Oil on Wildlife 1990

A collection of papers taken from a two day symposium held in Washington, DC in October 1990. Please see complete listing of papers in our Spring/Summer 1994 Catalog.

Regular Price: $25 **Sale Price: $15**_____

1992 Conference Proceedings, Naples, Florida: "Under Our Wing"

Papers include: The Ecological Significance of Wildlife Rehabilitation by Dr. John H. Fitch; The Value of Medical Management of the Florida Panther in Assessing a Population Decline by Deborah Jansen & Dr. Melody Roelke; Environmental Education-A Back to the Future Approach for Protecting WL & Their Ecosystems in the Next Decade by Walter Crawford, Jr.; WL Rehabilitators & State WL Agencies-Uneasy Allies or Fast Friends by Marnie Allbritten; Video: An Effective Tool for Fundraising in the 90's by Dale Carlson & Hope Douglas; Fundraising made Easy & Other Fantasies by Douglas Dunn; Computers for WL Rehab by Tom Millham; Computer Networks & Databases for Rehabbers by Bill Marshall; Rehabilitation, Computers & Communication by RG Hanes; Emaciation: Unraveling the Mysteries of Recovery by Louise Shimmel & Jan White, DVM; Treatment of Pododermatitis in Cormorants by Chris Harvey-Clark, DVM; Rescue & Rehabilitation of Burrowing Owls in Silicon Valley by Joan Priest; The Slit-Wrap Wing Wrap by Joan Priest; The Reintroduction of Endangered Species-Combining Rehabilitation & Species Preservation in the 90's by Walter Crawford, Jr.; Raising Hell, Raising Bobcats by PC Hanes; Treatment of Burned Raccoons: A Case History by Susan Heckly; Initial Care of Northern Elepahnt Seal Pups by Dawn H. Smith, AHT & Michael Stone, MS; Isoflourane: A Safe & Effective Anesthetic For Marine & Freshwater Turtles by Sarah Shaw, Sandra Leone-Kabler, Dr. Peter Lutz, & Dr. Alexis Schulmar; Euthanasia by Joanne Richards, DVM; and Itraosseous Fluid Administration in Birds by Janna Wynne, DVM.

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OTHER ITEMS

Drug Dosage Wall Chart

Wildlife Flow Chart--1991 Dosages provided or reviewed by Keath Marx, DVM; Michael Murray, DVM; Janna Wynne, DVM; Steve Sanders, DVM; and Jan White, DVM

This 11" by 17" coated flow chart shows what steps should be taken upon receiving an injured animal. Starting at the bottom of the chart, and, depending on what condition the animal is in, various protocols are followed on up through the chart. There is also a list of antibiotics and their dosages for easy reference.

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(Please refer to your 1994 Spring/Summer Catalog for index of articles)

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____A Preliminary Survey of Avian Haematozoa at the WL Rehab Service in Fairfield, Ca., M. Rock

****SPECIAL** - This item has been recently revised and we are selling out the previous issues: **3 copies only Wildlife Restraint Handbook,** 1989 Edition. Original price $20.00/each, now $5.00 each!!

NOTE: Due to a price increase to us by the publisher after our Spring/Summer 1994 catalog went to press on the publication ***Zoonoses & Communicable Diseases Common to Man & Animals***, the price has been changed to **$30.00**.

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ears and certainly to everyone at IWRC. The field of wildlife rehabilitation is so new, relatively speaking, that we can all learn. Learning from each other is one of the prime methods and has the added bonus of enriching our lives with new friends and a support network that is so important in wildlife rehabilitation. On to the heart of the matter... While we have no solid evidence with the avian species, we can look to and draw from examples set with primates. Those that were given all the necessary elements of life, including sanitary conditions, proper nutrition, correct temperature, etc., everything but nurturing, still suffered from "Failure to Thrive Syndrome". From this example, we can assume it would not be the best thing for the little guys to be isolated in a box with no stimulation. Some methods to cope with the problem might be nurturing or preening with a cotton-gloved hand, mirrors, taped vocalizations or even environmental sound tapes (no human voices) or a combination of all methods. They should have some visual contact with the outside world that will someday be their home. It is only the people and the association with feeding that we avoid in an effort to prevent imprinting. Raptors as solitary predators would fare better in an isolated situation, but again, total isolation with no external stimuli would not be natural. Natural is what we are attempting to emulate. Certainly the best thing to do would be what you have done in the past, and that is to find another rehabber with chicks of a similar age and similar species to be raised together. (Very best would be to foster them to wild, same-species nests, if you know of one that has chicks of a similar age that is not already overcrowded). Good luck this season and stay in touch.

Sincerely,
Marge Gibson

Dear Forum Corner:

When wild animals must be confined to a general veterinarian's hospital, how stressful is it for them to be closely associated with domestics, such as cats and dogs, which many times are their natural enemies? What about the "people noise" that occurs in this environment? What is the best solution for the veterinarian to keep the stress low?

Sincerely,
Judy Grove
Brasstown, NC

Dear Judy:

An excellent thought, Judy, and one rehabilitators should give thought to. Many times people, even professionals, act out of habit without giving individual species' traits careful consideration. It is not to say that they are careless, just reacting in their normal fashion, grouping all animals together as like organisms. Most general veterinarians are used to treating domestic animals, cats and dogs with a few gerbils and ferrets thrown in. Domestic animals are comfortable with and bred to interact with humans. Those vets with exotic animal backgrounds are generally more aware of the needs of exotic species and are therefore able to apply the knowledge and sensitivity necessary for caring for a wide variety of species. Wildlife falls into the "exotic" category, rather than "domestic". When working with someone not accustomed to wild creatures, it is up to the rehabilitator to help develop that sensitivity towards wildlife. It is the veterinarian's primary focus to be involved with the animal's medical condition and not as closely involved with the natural history aspects of the animals we bring in for treatment. When you think about it, the kennel cages are safe, easy to clean and escape-proof. These are all positive things; it is just the companionship of the kennel room that is the problem. Wild animals aren't bred to interact with dogs and cats in a comfortable way. This is particularly true with injured wild animals recently taken into captivity. You might point out or supply alternative housing methods and suggest the reasons for the need to keep stress to a minimum. Owls, with their facial disks and sensitivity to sound, really need to be well away from meowing cats and barking dogs. Hawks of course are sensitive as well, but more so in the visual arena. Sometimes a towel fixed over the kennel cage door can provide enough of a barrier. That works if the kennel room isn't filled with lonesome howlers or anxious felines. For these times, you might suggest a carry kennel or even a cardboard carrier in the back room for the night to minimize the stress. In my experience, the "human sounds" are not as much of a disturbance, especially in the veterinary setting, where voices are generally quieter than in a home situation. It is important to recognize that veterinarians and rehabilitators need to function as a team. The veter- inarian obviously provides the medical and surgical treatment, and the rehabilitator provides the rehabilitation of the animal and release into the wild. Any veterinarian who gives his or her time to help with wildlife deserves our thanks and gratitude. Suggestions you may have to create a better comfort level for your rehab patient should reflect this attitude. You just might want to give your veterinarian a subscription to the **Journal of Wildlife Rehabilitation** *for Christmas to bolster the wildlife interest. Good luck to you,*

-Marge Gibson-

Marge would like to hear from rehabbers who are experiencing problems with free-ranging or feral cats in their areas as pertains to wildlife. Write to her at N2160 W. Rollwood Rd., Antigo, WI 54409. 715-623-4015.

A BOOK OF INTEREST

Suggested by Donald Burton, DVM

The Wildlife Restraint Manual published by International Wildlife Veterinary Services, Inc., 1850 N. Main, Salinas, CA 93906. The book costs $79.00 and includes updates. The book comes in a binder, with pages numbered within chapters for ease of incorporating updates.

STUCK ON A "TACTILE REPELLENT"?

At the recent HSUS seminar in Houston, Guy Hodge appealed to rehabilitators and animal control officers to help provide information on the use of several products being sold as nuisance wildlife "solutions". Of particular concern are products known as "tactile repellents", sticky substances that are supposed to prevent birds from lighting on ledges and sills. Guy is especially interested in hearing from rehabilitators who have experience with birds being brought in after contact with these repellents. Apparently, the birds can get the repellent on their feathers, and, while attempting to groom it off, spread it to their mouths, eyes and nostrils. If you have seen evidence of this happening, please document your experiences, with photographs, descriptions of treatment and end result and send the information to **Guy Hodge at the HSUS, 2100 L Street NW, Washington, DC 20037.**

REHABBING CAN BE CONTAGIOUS

Polly Brunken
Wildcare, Inc.
P.O. Box 10825
Ft. Worth, TX 76114

(reprinted with permission from The Wild Side, newsletter of Wildcare Inc)

If you hang around a rehabber long enough, you might just find yourself acting like one. My six year old son is a case in point. While vacationing in Colorado last summer, my boy had, like all kids, accumulated a large pile of rocks that he was determined to take home with him on the airplane. I explained that he could only take a few of the little ones, and he agreed that 70 pounds of rocks was a little too much to carry on a plane. Later I saw him off by himself, rolling the rocks down the hill, saying with each roll, *"There, little guy, go back home." I asked him what he was doing, and he looked up and replied, "I'm releasing them back into the wild".*

IWRC JOBLINE

Assistant Director of Animal Care
The Marine Mammal Center

Responsibilities: Duties include husbandry and medical treatments of sick and injured marine mammals, training and overseeing of volunteer animal care staff, clinical laboratory procedures and assistance in coordinating rescues.
Requires: Animal Health Technician (AHT or equivalent preferred), experience with wildlife a plus.
Salary: Depends on experience of the candidate.
Application period closes: Open.
Contact: Send resume to:
The Marine Mammal Center, Marin Headlands/ GGRNA, Sausalito, CA 94965.

Wildlife Clinic Supervisor Position
Volunteers for Wildlife

Responsibilities: To manage the operation of the wildlife clinic. Responsible for overseeing a group of trained wildlife care volunteers involved in the treatment and rehabilitation of injured wildlife. Responsible for coordination of release of recovered wildlife.
Requires: A minimum of a BS degree in animal sciences, natural resources, or wildlife management. Strong academic credentials in one or more of the following: Ornithology, Biology, Zoology, Nursing, Veterinary or Natural Sciences. At least two years prior work experience at a licensed wildlife rehabilitation facility necessary. Excellent communication, teaching and interpersonal skills required. Candidate must be well-organized and able to manage a number of people.
Salary: Based on experience and benefits.
Application period closes: June 1, 1994
Contact: Executive Director, Volunteers for Wildlife, 27 Lloyd Harbor Road, Huntington, NY 11743.

Update on the Proposed Title 14 Changes

In the editorial in Vol. 16, No. 4, *"Wildlife Rehabilitation and Research"*, it was noted that all raptors and mammals were proposed to be banded or tagged prior to release in the new pending regulation changes. The Department of Fish & Game has revised that proposal to restrict such banding and tagging to planned studies. This was requested by numerous parties who commented on the proposed changes and is appreciated by all.

first daily feeding) to ensure they are growing normally.

• As the birds mature, they need larger quarters to allow them to move about. Airline kennels, large cardboard boxes lined with unprinted newspaper, or other equivalent housing are all appropriate. Once self-feeding (10-16 days), they should be transitioned to outside living. If hacking is to be done, birds should be placed in the hack box 10-14 days prior to fledging which normally occurs at about 31-34 days. Moving the birds to the site at this stage is necessary to establish fidelity to the site.

• If birds are not being hacked, they should be placed in an exercise flight pen to gain flight skills and stamina. Opportunities to practice hunting should also be given at the same general age that the birds learn to hunt in the wild.

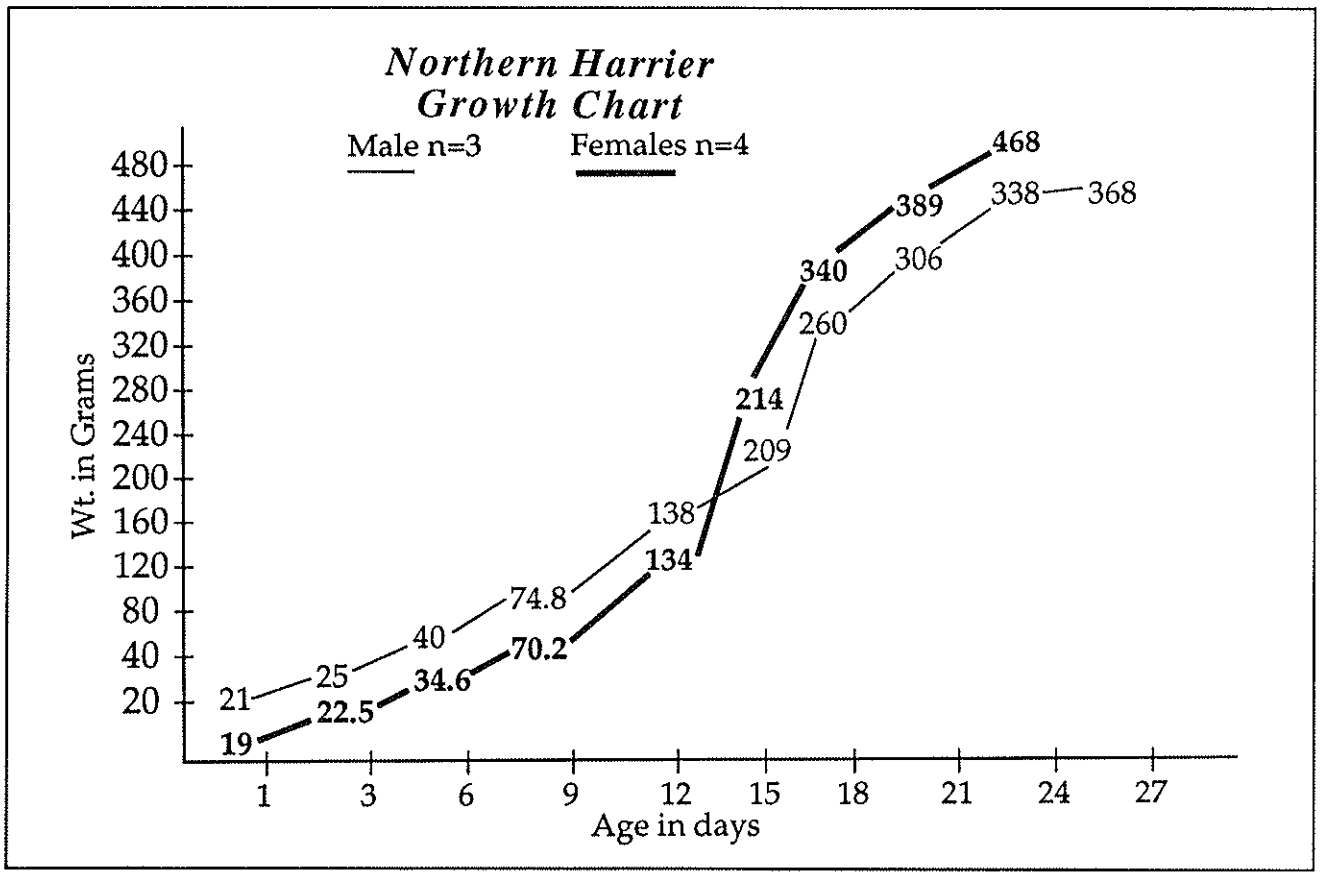
Adult Housing

• The temperment of this species in captivity is best described as "nervous." They are less difficult than kites to house, but certainly can be problematic in the wrong environment.

• Harriers have long tails that should be protected with tail sheaths when they have to be confined for initial or medical care (Bogue and Garcelon, 1977). They are excitable birds and should be housed in such a way as to reduce unnecessary stresses or disturbances. Once their medical problems are handled, they can be graduated into larger housing for recovery and eventually into flight pens for conditioning (IWRC, 1993).

• These birds are very active in flight enclosures and care must be taken in the design to prevent potential self-inflicted injuries. For example, traffic, human or otherwise should be directed away from the pen. When they do fly into the sides of a pen, they will grab at any available surfaces. Make sure there is nothing to grab. Minimum flight pen sizes for this species are 40'L x 10'W x 15'H (IWRC, 1993). Ideally, the pen should be 12-20' wide. L-shaped pens are recommended so that birds can be evaluated for their ability to turn. Double doors significantly reduce any chance of escape.

• Perches appropriately padded with 3/8" sisal rope or Monsanto™ Daisy Mat astro-turf are used for this species. Fake grass, the shorter, softer artificial turf tends to mat and can abrade the feet and is not recommended. Perch diameters should match the size of the bird's foot. Natural perches with bark attached may be used if they are the correct diameter and if they are replaced when worn (at least annually). At least one perch should be placed in a weather-protected area of the pen while the other can be exposed to the ele-



ments. Remember, if one perch is higher than the other, the higher perch will be preferred.

- Flooring should allow for drainage as well as soft landings. Pea gravel works well when applied in a deep layer (24" or 60.96 cm) (Morzenti, 1993). Natural grasses are also used in large flight pens.

Juvenile Feeding

- Newly hatched chicks should not be fed until they have defecated and will raise their heads to beg for food (Hobson, 1993).
- Birds are fed on demand during the daylight hours. Usually, this entails 6-7 feedings per day for very young chicks. Whole animals (minus the tail, skin and jaw bones) can be ground up or smashed with a mortar and pestle and fed. Fur is not necessary for chicks when very young. Birds are fed 4-5X their basal metabolic rate which is calculated using the formula Wt. (in Kg.).^{75} x 78.3 x 4 (or 5)= Kcals to be fed in 24 hours. Food should be prepared fresh as needed. As they grow, the amount of food consumed per feeding increases and the feeding schedule decreases to an eight hour period (Hobson, 1993). By the time the birds are about 14 days of age they begin to self-feed on cut up pieces of whole animals (with skin and all bones). They can then be reduced to four feedings/day. Chicks should be kept clean to prevent them from picking at each other for left over food pieces.
- Natural food items make the best diet. Avian vitamins are routinely given in the recommended amounts for good measure. However, if food items (mice) are reared in artificial lighting, vitamin D supplementation is required to prevent metabolic bone disease. Day-old chicks have been used successfully to rear young raptors, although most rehabilitators prefer to use mice when possible. However, when chicks are used to rear fast growing neonatal raptors, 100-150 mg calcium should be supplemented per 40 grams of chick eaten or 300 mg of bone meal/100g chick fed which comes to 1/16 teaspoon per averaged sized chick.

Hacking Juveniles

- Hacking is the preferred method for release. Standard hacking procedures are followed. Birds should be placed in a predator-proof box with an open view of the release area some 10-14 days before the normal fledging date. Birds are held in the box until the normal fledgling date (for the oldest chick). Just before dawn, the box is quietly opened and the birds discover their freedom, taking flight when they are ready. Since the clutch is often comprised of birds of different ages, birds may fledge at different times. Birds are fed until they no longer seek food from the hacking platform. Generally, they will disperse from the site in 3-4 weeks.

Release Criteria

- Diurnal; release during the day. Weights should be at least that of the adult male or female.
- As with other raptors, packed cell volumes should be above 40% and preferably closer to 45%. Plasma proteins should be 3.4-4.0 g/dl (Redig, 1993).

Products Mentioned in the Text

"Sink matting," a stretchy non-slip plastic 1/4" net mesh mat used to provide flooring for chicks. Available from Fisher Scientific, 2170 Martin Ave., Santa Clara, CA 95050 (800) 766-7000.
Monsanto Daisy Mat™, a plastic polyethylene astroturf doormat that provides good cushioning for feet. Available from Monsanto, St. Louis, Missouri, 63146.

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The Digestive System of the Monogastric Herbivore: With Comparisons to the Ruminant

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ABSTRACT

There are three main digestive systems found in modern day mammals:

1. True herbivores (ruminants) - have a four-chambered stomach
2. True carnivores - have a simple one-chambered stomach (omnivores have a modification of this system)
3. Monogastric herbivore - a combination of the simple stomach found in carnivores with a modification of the ruminant system to deal with the indigestibility of plant material. Rabbits, rodents and horses have this digestive system. To increase the nutrient absorption level of plant matter, some monogastric herbivores engage in a necessary behavior called "coprophagy," which is a modification of the ruminant "cud-chewing." Injured or otherwise debilitated animals that normally utilize coprophagy to absorb vitamins (especially B and K) and proteins will require vitamin supplements to prevent nutritionally-based problems such as low growth rates, an inability to properly digest food (which can cause intestinal infections), involuntary muscle twitching and paralysis.

KEY WORDS: Digestive system, herbivore, ruminant, rodents, lagomorphs, ungulates, coprophagy, vitamin supplementation.

Introduction

The digestive system of mammals developed as an evolutionary adaptation to the diets available to the different species. The three main types of digestive systems found on in modern day mammals are:

1. True Herbivore (ruminants) - includes the herbivorous artiodactyls such as cattle, sheep, deer and antelope. These animals have a four-chambered stomach and long intestinal tract. The teeth are adapted for cutting and slicing vegetation. Incisors are present on the lower jaw, but generally absent in the upper jaw. Canine teeth are absent[1]. Molariform teeth (molars and premolars) are flattened, as a modification for consuming plant material.

Large columes of low protein, high fiber plant material comprise the diet (although variations are seen at different seasons of the year). Complete digestion of food can take up to three or four days. Food is swallowed without much chewing by the true herbivore. It quickly enters the reticulum and then is passed to the rumen[2]. After fermentation and partial digestion, the food goes back to the reticulum where it is compacted into a mass, or cud, which is regurgitated. The "cud" is reingested, but bypasses the first two chambers. Instead, the food goes to the omasum and then the abomasum, or " true stomach". Nutritients are absorbed from the forestomach and the small intestine. Undigestible products are excreted as waste.

2. True Carnivore - Includes species in the order Carnivora. Bears and raccoons, which have a somewhat omnivorous diet have the carnivore digestive system. Other omnivores such as primates and pigs have a modified carnivore digestive system which will not be dealt with in this discussion.

Animals with the carnivore-type digestive system consume predominantly animal matter (at least 80% in the normal diet).Vegetable matter is consumed from the stomach contents of the killed prey. Other plant matter may be consumed when animal matter is scarce. Bears and raccoons, which consume more of a piscivorous (fish) diet, may not receive certain nutrients from their prey, so consume more plant matter as it is needed.

The digestive system is comprised of a one-chambered stomach and relatively short small intestine. The dental formula includes incisors, canine teeth and sharp, blade-like molariform teeth adapted for killing prey and shearing animal flesh. Digestion of a meal can be completed in a few hours. The diet usually consists of small volumes of high protein, low fiber food.

3. Monogastric Herbivores - predominantly plant-eating mammals with a simple stomach that may engage in coprophagy to further absorb nutrients from the diet. Rodents and lagomorphs comprise this group. Perissodactyls-(horses, tapirs and rhinos) also may have the monogastric herbivore digestive system but may not engage in coprophagic behavior. They have developed other adaptions for absorbing nutrients which will not be discussed in this paper.

Even though many species of rodents have a somewhat omnivorous diet (especially flying squirrels, chipmunks and grasshopper mice), the anatomy and physiology of their digestive system puts them into this group. The degree to which coprophagy is performed is determined by the proportion of plant material in the diet. Many species consume increased amounts of animal matter when the quality of plant matter is poor and they are not receiving enough protein and/or essential amino acids. This phenomenon has also been observed in deer (ruminant). When nutritional quality of food has been extremely poor, deer have been known to consume birds as well as chew animal bones (Wemmer, 1987).

In addition, rodents in captivity (rehabilitation centers) generally consume more plant material in the diet than may be true of the natural diet. So whether or not the animal consumes an omnivorous diet in the wild, if it consumes a significant amount of plant material while in rehabilitation, it will need to reconsume digesta for optimum absorption of vitamins B and K. The author has observed coprophagic behavior in the following species: Fox squirrel, Eastern Gray, California Ground Squirrel, Beaver and Nutria. This behavior was not observed in Northern Flying Squirrels, which have a predominatly omnivorious diet in captivity as well as in the wild.

Canine teeth are absent in the dental formula of monogastric herbivores, with the exception of horses. Horse canine teeth, however, are not used for shearing, as seen in the carnivores. Instead, the teeth have been modified by becoming incisoriform in shape to help with cutting plant material. Molariform teeth of rodents, and perissodactyls have a somewhat flattened crown, and are adapted for cutting and slicing vegetation. Rodent and lagomorph incisors have also adapted to the needs of the diet. The increased length is an advantage for gnawing woody plants, which is taken to the extreme in the beaver.

Other digestive systems such as those seen in the marine mammals and insectivores are modifications of one of the preceding digestive tracts, based on whether the diet is predominantly plant or animal matter.

For the purposes of this discussion, comparisons have been made between the monogastric herbivore and the ruminant systems since they are the most closely related.

Ruminant Digestive System

This system consists of a four-chambered stomach. After food is swallowed, it moves down the esophagus, through the reticulum and into the rumen, where fermentation ocurs. The cellulose (indigestible, structural portion of the plant) is attacked by microorganisms that inhabit the rumen. After the mass is fermented and partially digested, it is regurgitated back through the reticulum and up the espohagus for further mastication (chewing) in the mouth. Fermentation gases (methane and carbon dioxide) are also eructated (belched) from the reticulum. After mastication, the food is reswallowed, but bypasses the first two stomach chambers. Instead, it moves to the omasum for further churning. Water from the digesta is absorbed at this point. The first three chambers are collectively called the "forestomach," the function being to prepare the food for digestion in the abomasum (true stomach). The pH of the forestomach is approximately 6.0 which is necessary for the microorganisms to survive. When food enters the abomasum, the pH becomes very acidic as a result of the presence of hydrochloric acid (HCl). Here the pH is 2.0 (similar to monogastric stomach). The microoganisms are killed at this point since they cannot survive in acidic conditions. In the ruminant, the microorganisms are absorbed as nutrients.

The glandular regions of the abomasum (cardiac, fundic, pyloric) correspond to the glandular regions in the non-ruminant stomach. The forestomach (rumen, reticulum, omasum) correspond to the esophageal region in the monogastric system. [see Figure 1].

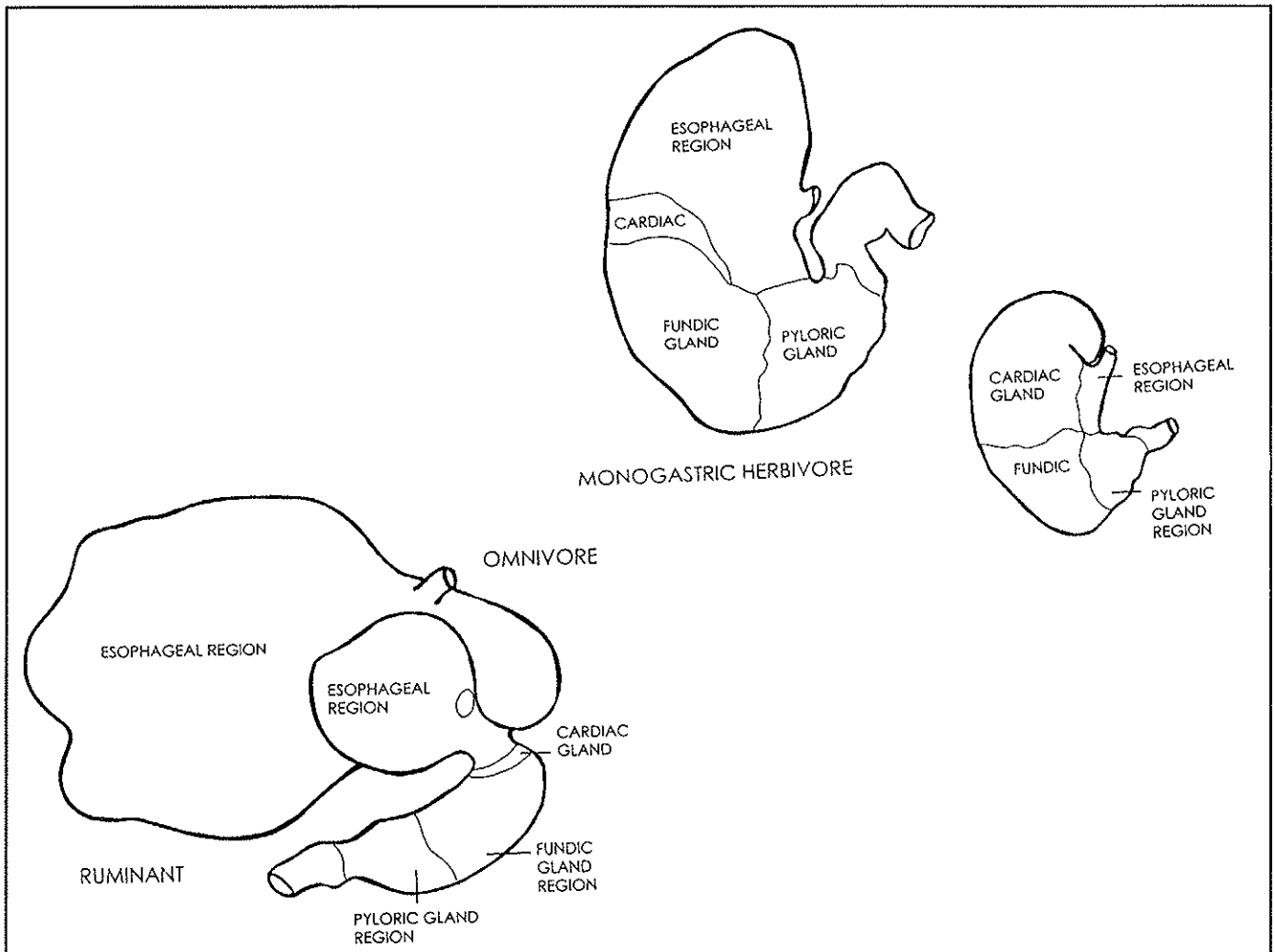


Figure 1. Stomach regions of a mongastric herbivore, omnivore and ruminant. *Drawn from: Anatomy and Physiology of Farm Animals by R.D. Frandson, 1981.*

Both ruminants and monogastric herbivores must break down the cellulose of the plant in order to absorb the protein within the plant cells. Herbivores have developed a specialized alimentary canal to deal with cellulose digestion. Perissodactyls, ruminant artiodacyls, rodents and lagomorphs utilize fermentation processes. Microorganisms that live in the alimentary canal break down the cellulose with specialized cellulolytic enzymes (Vaughan,1986). The monogastric herbivores utilize microorganism-aided fermentation in the small intestine and enlarged cecum. Protein is then digested and absorbed and waste excreted.

In the ruminant, the rumen contains microorganisms and enzymes to break down the cellulose. Large food particles float on top of the fluid within the rumen and then pass to the reticulum for regurgitation and remastication. The animal chews the cud, swallows again and continues the cycle until all of the food particles are unable to float on top of the rumen fluid. Chemical and mechanical breakdown of the food eventually lets it pass to the small intestine so nutrients can be absorbed (Vaughan, 1986). This complex system enhances the nutritional yield and allows ruminants to survive on relatively poor quality food.

Monogastric Herbivore System

The monogastric herbivore has a stomach with only one compartment, but it is subdivided into four areas that each with its own function:

1. Cardia - anterior gland next to the esophageal regon. It contains sphincters that form a junction between the esophageal region and the rest of the stomach. The main function is to allow passage of food into the stomach.
2. Fundic gland - located between the cardiac and pyloric glands. Contains gastric glands and functions somewhat in the fermentation of plant material in coprophagic stomach.
3. Pyloric gland-located at the terminal end

of the stomach. Contains sphincters that form a junction between the stomach and the small intestine. The main function is to allow passage of food out of the stomach.

Cardiac and pyloric glands produce mucus in the stomach. This mucus acts as a protective coating over the epithelial cells to prevent their digestion by stomach acids.

The fundic gland has specialized cells that secrete digestive enzymes:

1. pepsinogen (when activated by HCL produces pepsin, the major proteolytic enzyme that breaks down protein into absorbable amino acids)
2. renin (important in nursing mammals in clotting milk to allow a continuous flow into the small intestine).

The cardia and pylorus are sphincters which control the passage of food through the stomach (the cardia allowing food in, the pylorus allowing it to leave). The fundus is the large bulge near the cardia that functions somewhat in fermentation of plant material. The esophageal region compares to the forestomach in the ruminant. In the monogastric herbivore, the esophageal region is quite large. In omnivores such as pigs, this region is small, and is almost non-existent in carnivores (see Figure 1).

Stomach glands are also categorized, based on function and location.

1. Cardiac glands - located in the area of the stomach closest to the cardia.
2. Fundic glands - (gastric glands) - found in the main areas of the stomach.
3. Pyloric glands - found in the region near the pylorus.

Cardiac and pyloric glands produce mucus in the stomach. This mucus acts as a protective coating over the epithelial cells to prevent their digestion by the stomach acids.

The fundic gland has specialized cells that have their own functions:

a) body chief cells - synthesize and secrete pepsinogen.
b) neck chief cells - mucus cells that are similar to the cardiac and pyloric gland cells.
c) parietal cells - produce hydrogen chloride (HCl) and secretes it into the stomach.

Pepsinogen + HCl → Pepsin. Pepsin acts on the proteins in the stomach to break them down into absorbable peptides (Frandson, 1981).

The small intestine connects to the stomach by the pylorus. The small intestine is divided into three non-distinct parts: a) duodenum, b) jejunum, c) ileum. In monogastric herbivores, the terminal end of the ileum connects to a blind sac called the "cecum." It is here that partially digested food is stored until it can be re-ingested by the animal (see Figure 2).

In carnivores, the ileum connects to the colon. In humans, the cecum is almost non-existent but has a small diverticulum called the appendix.

In order to make nutrients from plant material accessible, some monogastric herbivores engage in a behavior called "coprophagy" which literally means "feces-eating." After swallowing the food the first time, the food travels through the stomach and small intestine to the large cecum. Fermentation of the food takes place in this area until the animal re-ingests it. While in the cecum, a mucilaginous material covers the particles of partially digested food. The animal, while engaging in a grooming-type behavior, will lick the anal area. This stimulates the cecum to pass down the pellets, which may be analogous to the action of a gumball machine. The pellets pass from the cecum to the anus where they are taken and re-swallowed. These pellets are not excrement, nor do they come in contact with excrement, since feces do not enter the cecum.

The time of day coprophagy takes place is usually linked to the normal rest period of the species. Crepuscular and nocturnal species engage in coprophagy during daylight hours, diurnal species do it at night.

After the partially digested food pellets are ingested the second time, the food goes into the small intestine for absorption of many nutrients, especially vitamins B and K and proteins, which cannot be absorbed during the first passage through the digestive tract. Studies have indicated rats restricted from engaging in coprophagy developed vitamin B and K deficiencies (Schmidt-Nielsen, 1988). Decreased growth rates may be seen in animals if it is prevented. Schmidt-Nielsen also observed an inability to properly digest food and utilize protein in rabbits that did not perform coprophagy. These conditions corrected themselves when coprophagy resumed (Schmidt-Nielsen, 1988).

Animals in normal health should have no trouble performing coprophagic behavior. However, animals that have debilitating conditions such as paralysis of the hind limbs (from spinal trauma) may require a multi-vitamin supplement that contains the B complex vitamins. Brewer's yeast, a nutritional yeast containing the B complex, can be sprinkled on the food daily at the rate of 1/2 tab for animals that weigh under two pounds. Animals the size of beaver and porcupine can be given two tablets daily.[3] Brewer's yeast comes in 71/2 grain tablets and is easily obtained in health

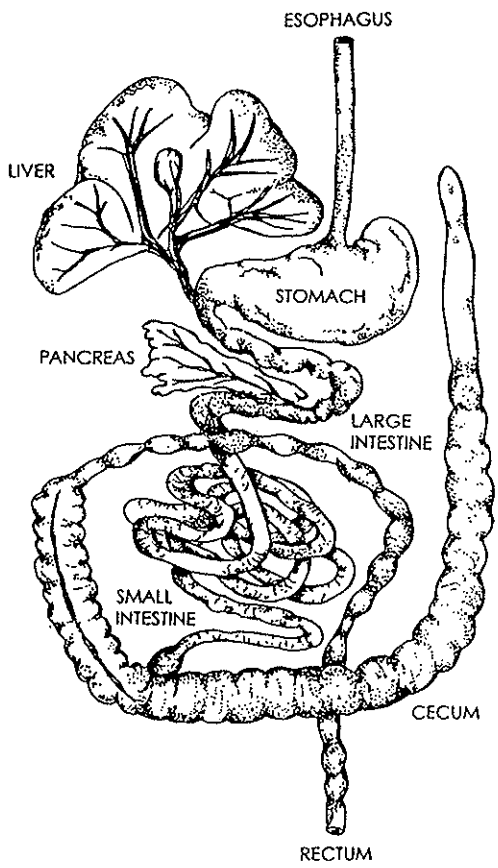


Figure 2. Digestive System of a Monogastric Herbivore. *Drawn from: Animal Physiology: Mechanisms and Adaptations by R. Eckert. 1988.*

food stores or animal feed stores. B vitamins are water-soluble, so whatever the animal doesn't need will be excreted in the urine.

A deficiency of B vitamins in monogastric herbivores can result in any of the following conditions:

1. lowered growth rates
2. an inability to properly digest food which can lead to intestinal infections
3. involuntary muscle twitching
4. paralysis (in severe cases)

Footnotes:

1. Some cervids (deer and elk) have lower canine teeth which are modified somewhat to act as another pair of incisors. Elk have upper canines.

2. In the case of nursing ruminants, the suckling behavior elicits a thirst response that shunts the milk from the reticulum directly to the omasum via the esophageal groove.

3. Injectable Vitamin B complex (when it contains 12.5mg/ml Thiamin HCl) can be given IM to rodents that weigh at least 10 pounds (beaver, etc.) Give 4.0-6.25 mg/10 lbs. (0.3-0.5ml/10lbs). Use cautiously since it can cause anaphylaxis in doses above 50 mg. Give 1 injection q 48 hrs. until animal exhibits grooming-type behavior around anal area.

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Author Profile

Kerrin Grant has earned a BS in Biology with an emphasis in parasitology and wildlife medicine. Presently she is a graduate student in wildlife science. She has training in veterinary technology and the care of captive wildlife and has been involved in wildlife rehabilitation for twelve years. Kerrin has been a licensed rehabilitator since 1987. Her specialty is the care of waterfowl and herbivorous mammals. She has written articles on the care of small mammals and has taught classes for rehabbers on the care of baby mammals, squirrels, beaver and river otter.

Continued from page 6

Conclusion

Knowledge of an animal's natural history is certainly an important part of wildlife rehabilitation that cannot be overlooked. Which part of wildlife rehabilitation is most important? The question is the type that forms an endless loop much like the question of "What comes first, the chicken or the egg?" An animal that has had the benefit of state-of-the-art veterinary care and released with poor feather condition or muscle tone has little chance of survival (Chaplin et. al., 1993). A healthy and well-fed creature that has no clue of how to hunt or obtain food on his own is doomed when released into the wild environment. Instincts don't just "take over" like miracles! Hunting and survival is a skill that takes practice to learn (Mueller, 1994). Wildlife rehabilitation is complex and more involved than most people are aware. All aspects of animal care and management are important. One without the other can cause failure of your efforts and the death of your rehabilitation patient. There is no question an animal's natural history is an integral part of rehabilitation that cannot be separated from a quality program.

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Author Profile

Marjorie Gibson has been involved in wildlife research, education and rehabilitation for over 30 years. In that time she founded and directed the Orange County Bird of Prey Center, Orange County, CA. and has served as raptor consultant to major theme parks in all areas of the country. While working as a Medical Technologist, she was involved with a study on pesticide-related problems with farm workers in Arizona. It was at that time she became interested in researching the effect of pesticides on wildlife as well. Along with her husband, Don Gibson, a pathologist, they pioneered work in organophosphate poisoning of birds of prey, setting baseline values for many raptor species in blood chemistry and hematology in the process. Marge is the author and coauthor of several published scientific articles concerning behaviorial aspects of many raptor species including Red-shouldered Hawks, Red-tailed Hawks, Barn Owls and Golden Eagles. Following the Valdez Oil Spill, Marge served as Project Leader for the Bald Eagle recovery and health assessment team in Prince William Sound, Alaska. Since 1990 and a move back to her home state of Wisconsin, Marge has founded the Raptor Education Group Inc. and committed more time to the research and education aspect of wildlife rehabilitation. She serves on the Board of Directors of IWRC and the Wisconsin Rehabilitators Association.

Book Review

Rescue and Rehabilitation of Oiled Birds

Erna Walraven
Taronga Zoo
Zoological Parks Board of New South Wales
P.O. Box 20
Mosman NSW 2088
Australia
1992 140 pages
ISBN 0 7310 0048 X $30 (Australian funds)



The most recently published book on oiled bird rehabilitation comes from down under! It is a handy and well organized primer (field manual) that will serve wildlife rehabilitators well who are trying learn how to care for oiled birds. The book is visually pleasant with excellent illustrations and double spaced text that is easy to read. It is designed for easy reference with detailed table of contents, resource lists, products lists, and a bibliography. The book has a moisture resistant cover and metal spine for handy use. There is, moreover, an index.

The book layout is well done. There is a logical flow of information beginning with the effects of oil and contingency planning through emergency procedures in the field, cleaning, waste disposal, rehabilitation and release. The reader will find numerous charts including the weights of Australian birds (only a few of which are present in the continental US), oral rehydration by bird size, and numerous lists of equipment and supplies needed for a response. Of course some of the products are not likely to be found on the North American continent but then our foreign members often have the same problem with the products we list. Another chart details emergency procedures and serves to remind us all that oiled bird rehabilitation is a process of many stages.

It is easy to read a manual such as this and for a brief moment think that the novice is prepared to set up a response. The manual seeks to give guide posts in this process but, like all the other manuals, is not sufficient to train someone to do oiled wildlife rehabilitation. That is a process that requires supervision and experience. The book reminds readers that veterinary staff are necessary and that although wildlife operations are the responsibility of the wildlife authorities, these same authorities may not have either the necessary veterinary or rehabilitation experience and therefore require outside assistance.

The book has a nice section on the incident command system and decribes staffing requirements well. To the novice, these sections alone make a response seem overwhelming. However, if they ever have to join in on one, they will have a sense of the command structure and operations procedures likely to be in use both in the US or in Australia!

As is the case with all books in a new and rapidly evolving field, the reader must evaluate the material before them. For example, in California oil spills, blood samples are routinely taken from the birds so it would be inappropriate to use plastic (a petroleum product) ponchos on them. Ponchos must be used wisely because as the birds dry, they may overheat in them. We wrap dead birds in aluminum foil to prevent petroleum product contamination. As for the medical protocols, I have two major concerns. In our experience through many large and small spills, oral rehydration twice daily is not going to save the most birds. When birds are being fed by gavage they are fed caloric mixes three times daily and rehydration solution three times daily. This is one case where more is better. The second concern is the lack of hematology to detect commonly seen anemias in crude oils. It is unclear what types of oils commonly affect Australian birds, but the reader should be aware that crude oils can profoundly damage red blood cells, which are then removed from circulation leaving the bird temporarily incapable of hunting. For this reason, packed cell volumes should be taken regularly from all birds affected by crude oil. There is a nice section on identification of avian hematozoa from blood smears. While there can be an increase in blood parasites in oiled birds, problems with depressed red cell counts, increased white cell counts (from secondary infections) and a reversal of the heterophil: lymphocyte ratio are far more common in our experience. For information on these topics, the reader should consult other sources.

Another rehabilitation concern is the housing. The author describes accurately problems that can be encountered with inappropriate flooring and recommends lawn, sand, soft rubber matting or newspaper (short-term only). While the book clearly states that soiled floors are unacceptable, in housing where the feces do not fall away from the birds, keeping them unsoiled is a huge challenge. We wonder if they are aware of the net-bottom housing so commonly used in wildlife rehabilitation. Birds that sit in their own urates (uric acid) rapidly strip out feathers which impairs waterproofing. In the cold waters off the Pacific coast of the United States, our birds soon become hypothermic. However, they do cover some small housing details, such as providing steps in and out of wading pools, which make all the difference in the world.

Given that the wildlife rehabilitator must engage in critical thinking when reading the literature and that no manual produced to date covers all aspects of this complex work, we feel comfortable recommending the purchase of this book. For the novice, it provides a nice framework from which one can grow.

-Susan Patton-

-Jan White, DVM-

PS. Please remit $10 Australian Funds for postage to North America and $8.00 elsewhere.

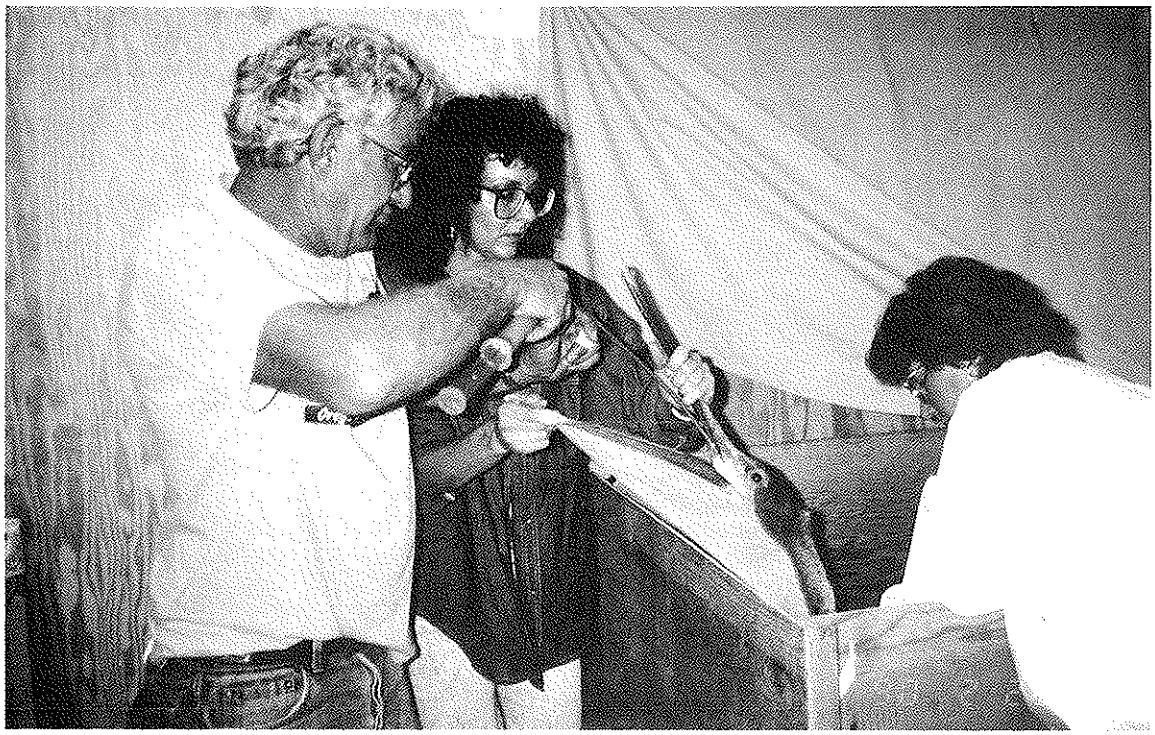
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Photo Courtesy of Marge Gibson