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About Humans and Other Animals

Laurence Pringle

Perhaps you are old enough to remember when wolves were "bad," and people thought you odd to defend such terrible creatures. Now you can buy sweatshirts, posters, mugs, and scores of other products that depict wolves in noble poses. Their intelligence, close social bonds, and role in nature are widely appreciated. Public perception of wolves has changed, and environmental educators helped achieve this change of attitude, as they are today influencing feelings about other living things.

There are, of course, other forces that affect notions about nature in both children and adults. One is the animal rights movement. Studies show that the most ardent advocates of animal rights were raised in urban or suburban environments with little or no experience with hunting, farming, or wildlife in natural habitats. Their primary experience with nonhuman animals is with pets (or "companion animals" as some prefer to call them). We all know how precious a pet can be, so it is understandable that some members of the animal rights movement seek to protect every single individual animal from harm. However, environmental educators know, and teach, that nature creates and spends life lavishly. In nature the death of many individual animals is normal and necessary.

This fact represents a chasm between environmentalists and advocates of animal rights. The environmental movement has its supporters who make claims unsupported by evidence, but overall it rests on a foundation of scientific knowledge (ecology, evolutionary biology, etc.). The foundation of the animal rights movement seems to be mostly sentiment, and in this issue of *Nature Study* Ralph H. Lutts explores some reasons why strong feelings about individual animals may be based on "ecological lies." Edith A. Sisson ponders about rehabilitating injured or "orphaned" wild animals. She tries to save individuals but wonders about the effects of this effort, and recognizes that it is the survival of populations and species that is most important.

We have all had the experience of learning that last decade's "truth" about some natural phenomenon needs to be altered or discarded. Naturalists, teachers, and other environmental educators need to be aware of new understandings about life and processes in nature. In "Winter Survival," Paul Serrao shares some new discoveries about the winter adaptations of plants and animals. Several other articles in this issue of *Nature Study* also aim to remind readers of current views of ecologists and biologists. The articles about millipedes, earthworms, sharks, and bats do not hold startling news, but the creatures are emphasized for a purpose: They're not cute. In fact, in some people these creatures evoke cries of "Yuck!" or feelings of fear. However, scientific evidence reveals that they—and other unappealing organisms—are often more vital in the energy flow and food webs of ecosystems than creatures that people find appealing and worth saving.

Which brings us back to wolves. Scientific studies of their behavior and role in nature made it possible for people to give up the "big bad wolf" stereotype, but the rehabilitation of wolf reputation was comparatively easy because wolves are the ancestors of dogs. They're playful and furry; they're what biologists called "charismatic megavertebrates." However, good-sized, appealing animals are not necessarily the most important citizens of an ecosystem. The value of the lowly earthworm has been known for more than a century, but did you know that in some deserts scorpions are so plentiful that they outweigh all of the vertebrates combined? They play a major role in desert ecology.

The public perception of bats is now changing because of knowledge gained about their roles as predators, pollinators, and seed-dispersers. Remarkable progress has been made, though many people still feel that bats are scary, ugly, and a major health threat. Mammalogist Merlin Tuttle has said that he could have raised more money for an organization dedicated to killing bats than for the one he founded—Bat Conservation International.

Growing numbers of people recognize that even such unappealing animals as bats and sharks can be invaluable in nature. At the same time, one of the most charismatic of megavertebrates–deer—are now viewed as vermin by people in some regions because of the harm they do to orchards, ornamental shrubs, and gardens, and because they are hosts of ticks that transmit Lyme disease.

Somehow I am left with this picture: a plain-looking teenaged girl crying about her looks, and her parents trying to help. "You are beautiful to us, and some guys will find you beautiful. Besides, what you do, and the kind of person you are, is more important than being gorgeous." So, take heart, you bats, sharks, and other unappealing creatures, because biologists are discovering your real worth in nature, and environmental educators are helping people to appreciate real animals, not imaginary ones.

Laurence Pringle

***Laurence Pringle, guest editor of this issue of* Nature Study, *is a Board Member of ANSS and the 1983 recipient of the Eva L. Gordon Award. Educated at Cornell University as a wildlife biologist, he is the author of more than seventy books including these titles:* Dinosaurs: Strange and Wonderful; Vanishing Ozone: Protecting Earth from Ultraviolet Radiation; Coral Reefs: Earth's Undersea Treasures; Dolphin Man: Exploring the World of Dolphins;. *and* Fire in the Forest: A Cycle of Growth and Renewal.**

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Creatures of Fancy

Ralph H. Lutts

The turn of this century witnessed an explosion of public interest in nature and wildlife. It was fed, in large part, by an avalanche of new books about nature that were very different from the dull tomes of the past. "A new literature has been born," Liberty Hyde Bailey announced in *The Nature-Study Idea*, published in 1903. He pointed out that even the animal stories in this new literature of the Out-of-Doors were different. They were not designed to teach a moral lesson to the reader. Instead, he wrote, "they are told because they are worth telling. The real moral is the interest in the animal and the ways in which it contrives to live, not in some extraneous literary appendage that tries to make an application to human conduct. The new literature is founded on specific technical knowledge, but it embraces all the human sympathies."

courtesy of Ralph H. Lutts

A 1905 cartoon inspired by the nature fakers.

Books by authors such as Ernest Thompson Seton, Charles G.D. Roberts, Jack London, William J. Long, and many others were snapped up by eager readers. Most of these writers presented a sympathetic portrayal of individual animals that, they promised, was also scientifically accurate and based on observations of real animals in the wild. This was a more biocentric literature than the animal stories of the past.

It encouraged people to appreciate wild animals as independent beings with an individuality akin to humans.

These writers of nearly a century ago and today's environmental educators have much in common. They share the common goals of promoting environmental awareness and understanding, and encouraging public action to conserve wildlife. They also share the perilous path of promoting a combination of scientific knowledge, sympathetic understanding, and values that can motivate action. Those nature writers who came to be called "nature fakers" provide an object lesson for environmental educators.

"Literature does not grow wild in the woods," wrote the great literary naturalist John Burroughs in 1895. (Nor, for that matter, do the modern environmentalists and environmen-tal educators.) In *Wake Robin*, Burroughs wrote, "Every artist does some-thing more than copy Nature; more comes out in his account than goes into the original experience." The nature writer, he argued, is much like a honey bee. Just as nectar does not become honey until after it is processed by the bee, the experience of nature does not become literature until it is reflected upon and shaped by the author. "The literary naturalist does not take liberties with facts; facts are the flora upon which he lives. The more and the fresher the facts the better. I can do nothing without them, but I must give them my own flavor. I must impart to them a quality which heightens and intensifies them." Burroughs argued, in effect, that the nature writer must combine science and poetry, and remain faithful to each endeavor's standards of truthfulness.

In 1903, Burroughs launched an attack on some of the new nature writers who did not meet this standard. He proclaimed in *Atlantic Monthly* that Ernest Thompson Seton's book *Wild Animals I Have Known* was better titled *Wild Animals I Alone Have Known!* "Are we to believe that Mr. Thompson Seton, in his few years of roaming in the West, has penetrated farther into the secrets of animal life than all the observers who have gone before him?" he wrote. He pointed, for example, to Seton's extraordinary fox that jumped upon a sheep and rode

it for several hundred yards as a way to confuse the dogs that were hot on its scent—the same animal that tried to free her captive young and, unable to do so, fed it poison, knowing that death was better than captivity. There was also Silver Spot, the crow that counted to thirty and exercised personal leadership over its flock, which it commanded like a drill sergeant.

He dismissed William J. Long's "ridiculous book" *School of the Woods* as a sham. Long had gone so far as to state that animals teach their young just as do humans and that an animal's survival "depends, not upon instinct, but upon the kind of training which the animal receives from its mother." And the stories Long wrote of kingfishers and ospreys that caught fish and released them, injured but not dead, into little pools where their young could practice fishing under the careful instruction of the adults. He also had a story about a porcupine rolling downhill purely for fun. And there was the partridge that held roll call for its young and counted out nine to discover two missing. Long claimed that red squirrels had cheek pockets that could hold six chestnuts, when red squirrels have no cheek pockets at all. There was also Long's story about the fox that coaxed chickens out of a tree by running around and around the tree in circles until the chickens became dizzy and fell. "How the old humorist must have chuckled in his sleeve!" Burroughs jabbed, thinking of the old farmer who probably told the story to Long.

photo: Laurence Pringle

We must not confuse Disney deer with real animals living in real environments.

Long provided a spirited defense of his books, which made him the focus of a debate that spanned more than four years. His story about a woodcock that set its own broken leg and applied a mud and straw cast to it further fanned the flames. The last straw was his tale of a wolf that killed caribou with a single bite to the heart. President Theodore Roosevelt, Burroughs' admirer and behind the scenes defender, was outraged. In 1907, he finally spoke out publicly and declared Long a "nature faker." Long fought back, arguing that Roosevelt could not understand the heart of wild things, because "every time Mr. Roosevelt gets near the heart of a wild thing he invariably puts a bullet through it." This did not work, though, and Long was forced out of the nature writing business. His next books were histories of English and American literature.

Long was a dedicated and skilled outdoorsman, but he was a poor naturalist. He was not a fraud, despite frequent charges to this effect, because he genuinely believed that every-thing he reported was truthful. However, he allowed his expectations and fantasies to distort and color his conclusions about how animals behave in the wild. His deep love and appreciation of wild animals was not enough to make him a good nature writer. He needed to also be a careful observer of real animals in the wild. He demonstrated that an emotional attachment to wildlife is not sufficient—we must love real animals, not just animals as we would like them to be. *Bambi*, Walt Disney's finest work of art, is a case in point. It has done more to teach Americans and the world about woodland life than perhaps any other book or film. During the half century since it was first released, Disney's fawn has become a symbol of our love of nature and our desire to nurture and protect wildlife.

Yet, ironically, what the film teaches is a lie. *Bambi* masterfully manipulates popular sentiment by presenting a terribly distorted view of life in the wild. It depicts nature as an earthly Eden. We are captivated by the lyrical beauty of the forest and grow to love Bambi, Thumper, Flower and all of their woodland friends. But we poor humans have no place in their Eden. We are an evil force utterly alien to nature. Our guns kill Bambi's mother, our dogs attack his mate Faline, our campfire grows to devour the forest and destroy Bambi's home. True, winter is harsh and the grown Bambi must fight another buck for his mate, but these are temporary, non-lethal problems. Humans are the only source of death and destruction in the film.

The original novel by Felix Salten presented a very different vision of nature. When Bambi went on his first walk in Salten's book, he did not meet

Thumper, Flower and other cute creatures that he met in Disney's film. Instead, the first thing the original Bambi saw was a weasel kill a mouse. In short, Salten tried to present an ecological view of nature. Mr. Owl was not Thumper's friend. Mr. Owl eats little rabbits. This did not diminish the novel's anti-hunting message. If anything, Salten provided an even more powerful argument against hunting than did Disney. However, he presented it within a more realistic vision of Nature.

Disney was widely praised for the accuracy of his version of *Bambi*. The film set a new standard of naturalistic realism in animation. A pair of fawns was brought into the studio as models, and his artists were given special training in wildlife art. He hired a naturalist to spend months in the north Maine woods and prepare accurate renderings of the forest. Disney's goal, though, was realism in his art—not in his natural history or ecology. In the end, he presented a distorted and sentimental view of nature that went far beyond his improbable opossums that hang by their tails. He re-created nature to satisfy the desires of a public that wished for an Eden in the woods.

The film was and is an enormous success, earning nearly $500 million by 1989. (Of films released before 1969, only *Gone with the Wind* and *The Sound of Music* earned more for their distributors.) Fifty years of Disney's marketing magic, repeated releases of the film, dozens of children's books based on it, countless merchandizing spin-offs, and the recent release of the home video version have made Disney's *Bambi* a fundamental part of almost everyone's childhood. Generations of children have been introduced to *Bambi* during their most impressionable years and these children become adults. Bambi has become synonymous with deer.

So what? It is an extraordinary piece of animation and a joy to watch. It is an emotionally powerful film that promotes a deep love of nature. What harm can it do? The problem is that Disney's *Bambi* has been extraordinarily successful in promoting a deep love of an ecological lie.

Our environmental problems exist in the real world, not as fantasies on screens in darkened theaters. Many, perhaps most, people know little more about deer and nature than they learned from *Bambi*. This is not enough. We must not confuse the fantasy with reality. In order to protect wildlife, we need to understand living, breathing animals as they live in real environments. In this respect, it is not a matter of supporting or opposing hunting. Either way, we need to love, conserve, and preserve real animals, not the Disney versions. Promoting this multifaceted, integrated and ecologically honest approach to our environment is the challenge that we face as environmental educators. ❑

***Ralph H. Lutts, a member of the ANSS Board of Directors, is the 1993 recipient of the Forest History Society's Ralph W. Hidy Award. He is also the author of* The Nature Fakers: Wildlife Science & Sentiment *(Golden, Colorado: Fulcrum Publishing, 1990) and* "The Trouble With Bambi: Walt Disney's Bambi and the American Vision of Nature," *in the October 1992 issue of* Forest & Conservation History.**

***For further fascinating analysis of Bambi's impact on American sentiment, see* "The Bambi Syndrome," *by Matt Cartmill in the June 1993 issue of* Natural History.**

Marching Millipedes

Betty J. McKnight

I have observed millipedes in various eco-niches for many decades. And in my Field Natural History courses I have dutifully called them to the attention of my students and explained how they helped recycle organic matter, and how, unlike their somewhat similar fellow arthropods the centipedes, they can be safely handled and studied by even young children, both because they move slowly and they do not bite.

Having children study millipedes is not a new idea. If you check Anna Botsford Comstock's *Handbook of Nature Study*, first published in 1911, or Janet Nickelsburg's *Nature Activities for Early Childhood*, published in 1976, you will find it suggested that young children observe millipedes. These common backyard invertebrates have been part of the elementary curriculum for more than half a century. However, despite numerous references to using millipedes for science studies, I have found very few teachers, biologists or naturalists who pay any particular attention to them. They may be one of the most under-observed of the common backyard arthropods. If millipedes had significant economic importance, I suspect they would be well known to most everyone. But as it is, just how important they might be is not really known. Nor is there much known about their numbers, life styles and puzzling, recurring "marching migrations."

photo: Laurence Pringle

A millipede on the move—to where, and why?

In the 1993 edition of *Books In Print*, there are only two books listed under the subject "millipede." One of these books is for children, grades K through 4, and the other is a scientific pamphlet published in 1928. A third book is actually listed for pre-school through 3rd grade but is in fact out of print.

On the Undercliff Trail at Mohonk Mountain in eastern New York, where hundreds of rock climbing enthusiasts test their skills each year, I have observed a spectacular "migration-like" movement of literally hundreds of rather large black and red millipedes (possibly *Narceus americanus*). I observed this unusual event several times over a period of several years only because I happened to be walking on the path where this phenomenon occurs. It is not believed to be a true migration but no one seems to have any real idea just why it occurs. The millipedes seem to cross in large numbers in both directions passing each other like miniature streamlined trains hurrying to some assigned station. The striking thing about this is that there are at times so many millipedes that it is difficult not to step on them as you walk on the path. It seemed odd that they would risk this travel in broad daylight with so many people about. How long this activity persists, when it starts, why it starts or why it stops, are part of a long list of unanswered questions. At times more than fifty percent of these travelers never make it across the trail but fall victim to bicycles or the foot of a hiker. How common is this sort of event at Mohonk? I spoke to several avid naturalists who frequent that area. Most had never seen any such event and others remembered vaguely but hadn't really thought much about it. A research assistant at the Mohonk Reserve was kind enough to check Dan Smiley's extensive card file for me, and learned that Dan had become interested in this marching movement of the Mohonk millipedes and had made a count on October 18, 1979 in which he noted that more than 50 per cent of the millipedes observed were dead. (Presumably this was due to being stepped on by hikers but he did not indicate cause of death.) Professor Robert Fritz of nearby Vassar College has at times had his college biology

classes do some millipede counts at Mohonk. His students reported mean frequencies of 20 or 30 per square meter at different times, with a peak of 60 to 73 millipedes per square meter.

Gail Mihacko, a research assistant at Mohonk, was also kind enough to send me a newspaper article Dan Smiley had on file. This article was from the New Haven, Connecticut Register, dated July 21, 1981. The article describes the concern and even near panic of citizens from New Haven,who were calling in to report the invasion of hundreds of wormlike, brown, about an inch-and-a-half long millipedes:

"A millipede invasion has struck southern Connecticut, horrifying homeowners and mystifying entomologists who are not sure why the wiggly creatures are multiplying so fast..." "Until July, the millipede population was at its usual unobtrusive level" said the Connecticut Agricultural Experiment Station in New Haven. "Then they arrived: Herds of millipedes are showing up in New Haven, West Haven, East Haven, Hamden, North Haven, North Branford, Derby, Ansonia, Naugatuck, Shelton and Stratford...wormlike, brown, leggy, hard-shelled members of the arthropod family...about an inch and a half long,...two pairs of legs on most of its 30 or more segments...Millipedes can be quite a bit larger...breed in decaying vegetation and damp leaves: millipedes mean no harm...they are not known to cause disease...they do not gnaw on wood, tunnel, or cause any other property damage... They are more a visual nuisance than anything else... How long will they be here? Probably only a few more weeks... Pesticide placed strategically along foundation walls and on lawns should prevent any millipede visitors indoors."

How widespread these events are and of what ecological significance no one seems to know. But it concerns me that people would either be panicked by or would mindlessly destroy hundreds or even thousands of these harmless invertebrates which are an important part of our ecosystem, serving both as recyclers of organic debris and as food for other organisms.

In checking several references I was surprised to discover that several songbirds and some gamebirds eat millipedes and centipedes. Other closely-related species eat centipedes but have not been found to eat millipedes. One reference indicated that millipedes live from one to seven years but there seems to be little specific information about which do what. How old would they get if no one stepped on them?

We know that millipedes recycle organic materials, but what would be the impact on your compost pile if there were more millipedes or if you had none? If some birds eat millipedes would they eat more if more were available? Who else out there in the world of nature supplements their diet with a crunchy course of chitinous millipede "cube steak"?

Does the massive movement of millipedes impact in any way on the activities of mice, snakes, or other animals in the area? Is it possible that the millipedes on Mohonk are merely moving to better winter quarters in Fall and spreading out over a wider browsing area in Spring? No one can say at present.

Millipedes browsed the planet even before dinosaurs and certainly long before possibly their most dangerous enemy, man, who tends to kill off what he does not value or does not understand. If you are looking for a real hands-on research problem for your students, whether they are 3rd graders or college students, I recommend your students investigate the fascinating real world of the marching millipedes. ❑

photo: Laurence Pringle

Unlike centipedes, millipedes can be safely handled. They do not bite.

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Are Sharks in the Jaws of Oblivion?

Paul C. Radich

Of all of nature's creatures none causes more terror than sharks. The mere sight of a shark's dorsal fin breaking the surface of the water can send swimmers hurriedly scurrying for the beach. Yet this mightiest of all of underwater predators is itself in danger of extinction from another predator – namely humans.

Ironically it was the United States Government's encouragement of commercial shark fishing some fifteen years ago which has led to today's decline in the number of sharks. For example in 1976 only 46,887 pounds of the most popular edible species of shark – the thresher – was caught by commercial fishermen off the West coast. As the government-financed promotional campaign to eat more shark meat caught the public fancy, the thresher shark catch increased 50 fold to 2.3 million pounds in 1982. By 1989 the thresher shark had been overfished and the annual catch plunged an astonishing seventy-two percent to only 655,078 pounds. Today shark meat must be imported from South America to meet the demand in the United States.

The overfishing of sharks has a long history. In colonial times the basking shark was nearly fished to extinction off the coast of New England. The oil from the shark's liver was used as a source of fuel in lamps. Prior to World War II the soupfin shark was fished to depletion in San Francisco Bay. During the 1960's the Norwegian and Scottish stock of spiny dogfish shark was depleted to such levels that it was no longer economically feasible to fish for this species.

Because of the low reproductive rate and late maturity of sharks, overfishing may cause a shark population to completely collapse. Such was the fate of the porbeagle shark, fished into oblivion off the coast of Maine in the 1960's. This species of shark has never recovered.

Unlike their cousins, the bony fish, sharks give birth to fully formed young. The gestation period may be as long as one year in some species. As a general rule sharks do not reproduce prolifically. Some species give birth to only two offspring at a time. Reproduction in some species occurs only every other year.

Sharks generally have a slow maturation. In several species sexual maturity is not reached until 12 to 15 years of age. While these reproductive characteristics may have aided sharks to rise to the top of the marine food chain, they now poorly serve them in an era of overfishing.

The disappearance of a top predator in an ecological food chain can have disastrous consequences. The function of sharks is to cull the sick or weak from the species they prey on. They also keep the populations of prey species in balance. Without these critical functions being performed by sharks, every level of sea life may eventually be adversely affected

Sharks have a high utilitarian value and have been used by people for centuries. For example the hide of a shark is one of the toughest of all leathers. In its untreated form it has even been used as a substitute for sandpaper. Such accessories as attache cases, handbags, and billfolds can be made from shark hides.

The shark's white meat is much prized by upscale restaurants and commands premium prices. The lower quality dark meat can be made into sausages, and even the waste meat is used as animal feed. Perhaps no part of the shark is more highly prized than the fins. In the Orient shark's fins are considered an aphrodisiac and panacea for many ailments. They are traditionally used in soup to thicken and flavor it. Dried fins are now selling for as high as $53.00 per pound on the Asian market.

Because the value of the fins is now greater than the other parts of a shark, a particularly gruesome practice has arisen called finning. This is the act of cutting off the shark's fins and then returning it alive to the ocean. The ability of a shark to survive once its fins are removed is greatly reduced. Those living close to shore might well survive by eating slow moving bottom fish, but those living in the open ocean will sink to the bottom once their pectoral fins are cut off. It has been reported that sports fishermen in Florida have caught finless sharks on their lines.

Ironically just as sharks are decreasing in numbers their value to medical research is increasing. Sharks are resistant to cancer, heal rapidly and rarely are infected. Their immunological system seems to possess properties which make them immune to many of the debilitating conditions which afflict people. Already scientists have isolated components in shark cartilage which appear to stop the growth of tumors.

Off the coastal United States some four species of shark are currently fished commercially. One is the soupfin shark. It supported a large fishery in the 1930's and early 1940's. The primary reason for catching this species of shark was to extract the vitamin rich oil from its liver. With the development of synthetic Vitamin A during World War II, the soupfin shark fishery went into a decline. Currently most of the fishing for the soupfin shark centers off the Southern California coast. Annual yields of this species of shark are in excess of 220,000 pounds. The flesh of the soupfin shark is said to be excellent tasting.

In terms of amounts landed, the thresher shark now represents the leading shark species caught off

the West coast. Thresher sharks are considered to be highly migratory. They are very active predators who use their tail to first stun their prey before eating them. It is currently believed that the thresher shark population is more narrowly distributed than previously thought. If this is the situation, migration from adjacent waters will not be sufficient to sustain the current fishing pressure on this species of shark.

The spiny dogfish shark is one of the most abundant of shark species. It prefers the cooler areas of the world's oceans. Most spiny dogfish shark are caught in Puget Sound. Fishing boats operating there are responsible for 99% of the total catch. In the past the spiny dogfish shark was exported to European and Oriental markets or just reduced to fish fertilizer. Starting in 1975 a domestic market was developed for the flesh of the shark. However by 1979 total landings had peaked at over 10 million pounds and have now declined to less than 6 million pounds annually.

photo: Laurence Pringle

Overfishing may cause a shark population to completely collapse.

The Pacific angel shark dwells at the bottom of the sea near the coastline. Its habitat stretches from Alaska to Baja California. This shark is only active at night. During the day it buries itself in the bottom mud or sand with only its eyes and back protruding. The angel shark fishery is a relatively new one having its start in 1979. Currently most angel sharks are caught off Santa Barbara and around the Channel Islands of California. The future of this fishery is much in doubt. There is no evidence to suggest that fishable yields of angel shark exist beyond its traditional area of catch. The few facts which are known about this species suggest that it is very vulnerable to overfishing.

In an effort to halt the decline of sharks, the U.S. National Marine Service has proposed regulations for shark fishing. The new guidelines set quotas for the total commercial shark catch, and recreational fishermen will only be able to keep one shark per day. Also outlawed is the practice of finning. It is hoped that these new regulations will allow shark populations off the United States' coast to recover from their decline. However, shark overfishing, including finning, continues worldwide. After having existed for at least 400 million years, these magnificent creatures of the deep deserve to remain the top predators of the world's oceans. ❑

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Look for Millicent Selsam's (E.L. Gordon Award Winner) and Joyce Hunt's - A FIRST LOOK AT SHARKS, 1985 in your library. It is an easy reading book whose 32 pages are laden with Harriett Springer's excellent drawings that illustrate comparisons, vocabulary and questions, providing more information on the variety of sharks than an encyclopedia.

The Bat Club

Laurence Pringle

Bats seem ugly and even dangerous to many people. But scientists and others who know them understand that bats are usually harmless and help control insect populations. North American bats eat many tons of night-flying insects, including mosquitos.

In 1987, Debra Rust, a teacher in a Birmingham, Alabama, elementary school learned about the great value of bats. She shared her enthusiasm for bats with some of her students. One girl, Janie Miller, then in third grade, said, "Let's form our own Bat Club and start saving bats in Alabama!"

Soon the B.A.T. Club was formed. The name Stands for "Bats Aren't Terrible; Bats Are Terrific." By 1993 the club had about a thousand members. Most were students at the school where the club started, but parents and boys and girls from other schools have also joined.

One goal of the B.A.T. Club is simply to spread the truth about bats. They do this by giving programs at other schools, making posters and bumperstickers, and appearing on radio and television programs. Their school's superintendent said, "In 27 years in education, I have never seen such a complete 'attitude turn-around' as I have observed with these youngsters as they taught teachers, students, and parents in the school system and community that bats...are friends and preservers of our environment."

They write letters to political leaders in support of bat conservation. When a housing development threatened local bats, the efforts of the B.A.T. Club caused some changes in the plans. Nothing was built near a cave where a population of endangered gray bats roosted.

In some areas, bats face the same problem as bluebirds. They are scarce because they lack the right kind of shelter. B.A.T. Club members have sold bumper-stickers to raise money to buy bat houses—specially-designed houses give bats places to rest during the day.

The B.A.T. Club has given bat houses to nature centers, the Birmingham Zoo, and the Birmingham Botanical Gardens. Even if the houses attract no bats, they draw the attention of human visitors. Many people are surprised to learn that bats are such desirable wildlife. (Of course, club members do not advocate handling bats. Since a small percentage of a bat population may carry rabies, people are advised to never touch a bat that seems sick or injured.) The B.A.T. Club continues to spread the word that "Bats Aren't Terrible, Bats Are Terrific." ❑

photo: Charles Nesbitt

Members of the B.A.T. Club, of the Midfield (Alabama) Elementary School, put up a bat roosting house.

For more information about bats and bat conservation, write to: Bat Conservation International P.O. Box 162603, Austin, Texas 78716-2603. If you have specific questions about the B.A.T. Club, write to: Ms. Debra Rust, Midfield Elementary School, 416 Parkwood Street, Midfield, AL 35228.

(For interesting information about the American Bat Conservation Society, see article on page 34.)

Saving Wildlife, One by One:

Ponderings of a Wildlife Rehabilitator

Edith A. Sisson

Wildlife rehabilitation is dedicated to saving individual wild animals. We raise wild orphans, care for injured or other wild animals with problems, always with the goal of the eventual release of the animal back into its natural habitat. This may sound simple, but it is not. Problems exist from the beglnning determination as to whether or not the baby animal is truly orphaned, or what may be the problem with an older animal, to the final assessment of the animal's capablity to care for itself if released.

Here is a typical case. The telephone rings, let's say in the middle of breakfast. The caller wants to know what to do with two baby cottontail rabbits. While the breakfast cereal becomes soggy, the rehabilitator asks about reuniting the babies with their mother. Caller explains that a rabbit, probably the mother, has been run over on the street, and that the dog brought both babies onto the porch. The caller then adds that the babies have little fur and feel cold to the touch. That's the final clue to the rehabilitator, who suggests that the caller bring the babies in because they need immediate care, and are in all likelihood orphaned. The bunnies arrive soon, the rehabilitator postpones the day's plans to care for them, first warming them, then giving fluids until they are stabilized and can start a milk formula.

photo: Polly A. Fleckenstein

This orphaned grey squirrel seems to enjoy a formula substitute for its mother's milk.

By nightfall, however, one bunny has died. Was it due to the effects of exposure, injuries sustained when carried by the dog, or the unnatural human care? We can't know, but, at least the other survives alone, cuddling on a towel in a box, gently warmed by a heating pad underneath. In time soft, brown fur covers its earlier pink skin, and its miniature rabbit ears begin to stand up. After its eyes open it will be ready to start nibbling on solid food, and soon the rehabilitator will be relieved of the task of administering numerous formula feedings with a medicine dropper. The bunny has outgrown its box and now needs a safe cage, and also a diet that will approximate that which it would eat in the wild, and minimal contact with humans. Finally, when able to take care of itself, the young rabbit is released in a suitable habitat, near to where it was found, if possible. A small rabbit returns to the wild—a small "mission accomplished" for a rehabilitator.

Yet the other orphaned bunny did not make it–unfortunate, but not unusual. Some figures suggest that in wildlife rehabilitation the average success rate is only forty percent. After all, almost any adult wild creature that will allow a human to take it, is, in nature's eyes, already dead. Some of the animals admitted are in the process of dying, others may have suffered trauma and injuries beyond repair. Some are diseased, parasitized, or poisoned by toxins. And all have to adjust to the unnatural human environment, which for each species can produce its own trauma. For orphans this is the most difficult of all because the rehabilitator generally cannot replicate the baby's natural food and must find the nearest approx-imation, which is, at best, still unnatural to the baby. In some cases it is necessary to consult a veteri-narian. In all cases, rehabilitation of wildlife requires a tremendous amount of time and effort, as well as knowledge, skill, and dedication. A mother robin feeds its young about every twenty

minutes during daylight hours, but, needless to say, such a schedule is no easy task for a human.

Wildlife rehabilitators must furthermore comply with government wildlife regulations and local ordinances. They should be willing to assist people with wildlife questions on the telephone, and, if they cannot care for an animal they should offer callers alternative sources of help. Rehabilitators must have proper caging, housing, foods, medical supplies and other equipment. And always they must be cautious with the animals entrusted to their care, for a wild animal is never a pet, and may bite or kick or scratch, in spite of its age or condition. And even after releasing an animal, which is the purpose of the work, the rehabilitator has to accept the reality that the animal may not survive. Without radio collars or other tracking devices we cannot be certain.

photo: Laurence Pringle

The parent of a so-called orphan brought to a wildlife rehabilitator may have been temporarily out of sight of its parent.

The clearest need for wildlife rehabilitation is the saving of individuals of endangered or threatened species. Rehabilitation, coupled with captive breeding programs, has brought back such species as the peregrine falcon, which once tottered on the edge of extinction because of uncontrolled amounts of DDT in the environment. On the other hand, many of the creatures rehabilitated are not endangered and may be as common as a cottontail rabbit, but the individual dedication of rehabilitators, working alone or at a center, generally encompasses every species of wildlife. After all, we share the earth with all of its creatures, and furthermore, many people feel that saving wildlife is an environmental concern.

For me "reverence for life" sparks my part-time rehabilitation work. In the last rehabilitation year I cared for about 60 animals of 20 different species, and, for each animal admitted, count at least ten phone calls from people with concerns about other wildlife problems. Busy? Yes! Discouraging because many animals don't survive? Yes. But, rewarding? Another yes. I hope I helped some of the telephone caller's understanding of wildlife, and I was satisfied by the number of releases of the animals brought to me. Also rewarding was the opportunity for glimpses into the lives of the animals. Last year an orphaned crow, which had progressed to the point of learning to survive independently, gave me this memory, which happened just like a play, except I was watching through a window and the pasture served as a stage.

Scene 1: Enter rabbit from the right, bounding, hopping across. In a hurry? Rabbit exits left. Scene 2: Enter sleek, dark, large weasel-shaped animal from right. Sniffing. Trailing rabbit! A fisher, which I had never seen in daylight. Hungry, no doubt. Scene 3 takes over as "Crow" flies from roof to pasture."Crow, you'll be eaten," I think, as "Crow" swoops down, and suddenly dive bombs fisher, who turns around and exits where it entered. "Crow" settles down on a fence post, as if to proclaim the pasture his. I am left to marvel and ponder about predators and prey and the scaring of such a large fierce animal by a mere crow.

But there are paradoxes in the work of rehabilitation. I may release a rabbit that had been orphaned, and feel glad in the hope that it is still out there nibbling on buds or grasses. But on the other hand I know that nature overproduces, and if every baby bunny thrived to adulthood, we'd be knee-deep in rabbits before long. Disease or other health problems, loss of the mother, to say nothing of the role of young rabbits (as well as old ones) in many food chains in which rabbit is a valuable food source for many predators—all of these take their toll, so that the rabbit population remains relatively stable. Does saving an orphaned rabbit and releasing it upset this balance, even in the smallest of ways? Is there justification if the rabbit was made an orphan by human interference?

Some may feel nature is "cruel" in overproducing, but isn't it a practical, indeed a necesssary, technique? Modern society isolates us from the natural world, making it difficult to understand natural cycles, which can cause us to want to interfere when perhaps we shouldn't. People often take so-called orphans, failing to understand that the parent is giving good care but is temporarily

out of sight. Injured or other animals with problems may not live, even with professional help, and there is always the risk that such animals may transmit diseases to a human. Will the animal be able to be released? Generally for the purposes of protecting wildlife. as well as the public, licenses and permits are required by government agencies for anyone possessing wildlife. Unaware of these problems, however, many people feel the need to "do" something when they see a wild animal in distress.

To illustrate, here are accounts of three telephone calls, all received by me on a March afternoon. The first: "I've seen a golden crowned kinglet in the bushes, and isn't it too early for these birds to have migrated? What should I do?" I refrained from saying "ship the bird back south," but more realistically responded that making bird food available could do no harm, while admitting that I did not know the exact migration dates for these birds. Besides, maybe it was right "on time," because although much about nature is "known" there are always exceptions and changes. I was at least pleased that the lady had recognized the bird. (Or had she? Once someone brought me "an injured bird of a very rare species." Within the shoebox so carefully presented to me I was aghast to find a common pigeon, instead of an opportunity to save something rare. Because I cannot discriminate in my care for creatures, the pigeon was cured and released shortly thereafter with the local flock.)

Call number two involved the problem of a limping fox. "It came through our yard yesterday, and my wife saw it in a field this morning." I tried to explain the natural reasons that might cause the limp, an injury that might heal, old age ... but sensed that the caller really wanted me to drop everything right then, and come to locate the fox by a miracle, and, with another miracle to capture it and, of course, to heal the animal. I'm not a miracle worker; nature is, the more you think about it, but perhaps not to the satisfaction of the caller about the fox.

The third call was odd. "A black skunk has been sitting up in a tree in my yard. Is it hibernating there?" I asked the caller if she was certain it was a skunk. "Oh yes. I know skunks because I see them out back in summer, but this one seems to be all black, and it's been there since yesterday, hibernating." Despite my explanations about skunks' disinclination to climb, and how they may den up only for a few days in cold winter weather. I was making no headway, until I asked if she had binoculars. The affirmative answer was all I needed to suggest she go out and look to see if the animal might be a cat, which had been my suspicion all along. She never called back to the contrary, and I do hope that someone was able to produce a tall ladder or that the feline descended by itself.

Despite the surprising assumptions, the calls about the kinglet, the fox and the skunk-in-the-tree do show concern for the animals on the part of the callers. But, are there better ways to channel such concerns? Can we encourage people in our society to learn more about the ways of the natural world, so that such aspects as nature's overproduction, or predator-prey relationships, can be better understood? Can we better educate people about the effects of the well-known problems of habitat destruction or pollution on whole species of wildlife?

What small steps can be taken? How about putting a bell on the cat? Pet cats account for a high number of injured birds brought to rehabilitators. Put lids on garbage containers and stop a free food system. Such hand-outs contribute to the problem of high populations of some mammals, which can lead to disease as well as other problems such as confrontations between the feeders and a farmer who has killed a plump raccoon seeking ripening corn as a change from household leavings. Highways with solid center barriers are a death trap to small animals attempting to cross. How about requiring holes at intervals so the animals have a chance? Cut up plastic six pack beverage holders so an animal cannot get caught in the plastic rings. Avoid pesticides and herbicides whose toxins can affect wildlife. Do not cut down the old tree in the yard in nesting season.

Perhaps you may have some new ideas of your own about life style or other changes that may help, because human interference with the natural world endangers individual animals as well as entire species. Our concentration should be directed towards species, especially those particularly threatened by us. However, if you should call me about just one sparrow with an injured wing, I will still say, "Yes, bring it, and I will do the best I can," because after all, who knows, maybe one sparrow can make a difference. ❑

Edith A. Sisson of Concord, Massachusetts, has been a teacher, author, tree farmer, and wildlife rehabilitator for over 25 years.

Put Some Faces to those familiar ANSS names! *This photo was taken at a Board Meeting in Philadelphia in October, 1992.* From Left to Right: Phyllis Marcuccio, Joy Finlay, Robert Russell, Sasha Whitaker, Ralph Lutts, Betty McKnight, John Gustafson, Helen Russell, Laurence Pringle, Nancy Darmstadter, Frank Knight, Edith Sisson, Paul Spector.

Earthworms, Dirt, and Rotten Leaves: An Exploration in Ecology

Molly McLaughlin

Note to readers: This article is adapted with permission from a children's book of the same name, but is presented because it offers useful advice for investigators of any age, and also because it is a model for inviting children to "an exploration in ecology."

Why would anyone want to have anything to do with earthworms? They're not very big, and they're certainly not pretty. They live in the dirt and eat dead leaves.

But, in fact, their home and their habits and their not-too-charming appearance are exactly what make earthworms a lot more interesting than you might expect.

First of all, earthworms are a wonderful, streamlined example of how living things become adapted, or suited, to their environment. If you had to think up an animal especially designed to live underground and eat leaves, it would be hard to come up with anything better.

Second, the earthworm is a small animal that has a huge effect on its home environment. Earthworms make tunnels in the soil and mix up its different layers, they pull leaves under and bring topsoil up, they add fertilizer and move stones. Now the soil that's home to earthworms is also the residence of billions of other animals, and it's the place where plants grow. Since all animals, including humans, depend on plants for food, the soil is more than just dirt to us as well. It's at the very foundation of our food supply. And at the foundation of the most fertile and productive soil of all, there is the earthworm, whose activities make soil conditions more favorable for plant growth.

Third, as the earthworms go about their business eating old rotten leaves, they take part in one of the most important processes on our planet: the *recycling*, or reusing, of the basic chemical materials that plants and animals need to live and grow.

All living things are involved in this recycling — we all use "stuff" that's previously been part of something else. But earthworms, like many even smaller and less-charming organisms, are involved in a really essential part of recycling called *decomposition*. Decomposition is what happens when the materials in the bodies of dead plants and animals are broken down into the simpler parts that can be used again by new organisms. If this process of decay or decomposition didn't go on, the basic chemicals of life would stay locked up in the bodies of dead plants and animals forever, and eventually all the supplies would be used up and no new plants or animals could grow. So we all depend on decomposers, including earthworms, to keep us from running out of essential supplies.

Finding out more about this slimy, squirmy, but surprisingly important creature is the aim of this book. We will pay a lot of attention to how the worm looks and how it acts, but also to its home and its neighbors and how it fits in with them. After all, the earthworm doesn't exist in the world all by itself. Like every other living creature, it's part of a community of plants and animals, all connected with each other as they go about making a living in their particular environments.

Finding out how the earthworm fits into its community will help you understand how other animals fit into their own special situations as well. It's possible to read the book straight through; or you can use it like a guidebook and try the activities as you go along. Doing these experiments and making observations yourself will help you get a firsthand, closeup idea of what the earthworm is like. It will also give you practice in doing some genuine scientific investigation on your own. Making observations, asking questions, comparing notes, and taking guesses are some of the methods that scientists use to find things out, whether in fancy laboratories or in ordinary backyards. Depending on what's being investigated, the equipment used and the location of the research may be quite different, but the processes of investigation are very much like those we will use to study the earthworm and its neighborhood.

A final reason for watching worms is that they're so convenient. It might be more exciting to observe kangaroos or whales or other more rare and exotic animals, but you'd have to make a long trip and have some very special equipment. You can find earthworms almost anywhere. There are lots of them. And they can't possibly hurt you.

So, to begin, find a worm.

A Guide to Watching Worms

Unless you live at the North Pole or in a desert, it probably won't be too hard to find an earthworm and look at it. All you have to do is step outside and dig one up.

But just looking at a worm isn't the same as really looking at one—that is, watching it very carefully, paying close attention, and trying to see things you haven't noticed before. Such careful watching is called observing. This guide will give you some suggestions for observing earthworms. It will also help you to interpret your observations as you figure out why the things you observe might be important for the earthworm and its life underground.

The only equipment you really need for worm watching is a shovel or trowel for digging. You might also want paper for writing or drawing; and although you can see plenty with your own eyes, a magnifying glass will help you get a closer look.

Start by drawing a picture of an earthworm, putting in all the details you can remember. Or, think about how you might describe an earthworm to someone who had never seen one—a visitor from outer space, for example. This will give you some ideas of what to look for when you begin observing.

It's also a good idea to make a checklist of things that you especially want to notice. Leave some space for writing notes, and use your list as a guide to make sure you don't overlook anything while you've got the worm right there in front of you. The list will also help you remember what you've seen after the worm is out of sight. Later on you can use a similar checklist to observe other animals and then make some comparisons— how the various animals move, for example, or how their body shapes are different. Here are some suggestions for an earthworm observation guide. Be sure to add any ideas of your own.

Earthworm Observation Guide

1 What shape is the earthworm?
2 What color?
3 How long is it? (How did you measure it?)
4 Does the earthworm have legs? eyes? ears? nose? mouth? stripes?
5 Is there a difference between the top side of the worm and underneath? If there is, what is it?
6 Is there a difference between the front end of the worm and the tail? If there is, what is it?
7 How does the worm's skin feel?
8 Are there any other special features that you notice?
9 How does the worm move?
10 How fast does it go?
11 Does the worm ever move backwards?
12 What happens when the worm meets another worm?
13 What happens when the worm comes to a hole?
14 What does the worm do when it comes to an obstacle like a rock or a big clod of dirt?
15 Do you think the earthworm has a skeleton? Why or why not?
16 How long does it take the worm to burrow under the ground and disappear?
17 Where did you find the worm? Was it under the ground or on top, out in the open or covered up with something?
18 What else was in the vicinity where you found the worm? (Soil, rocks, sand, puddles, insects, polar bears, other animals, rusty bedsprings, or what?)
19 What did the worm do when you dug it up or uncovered it?
20 If you held it in your hand, what did it do then?
21 Surprises: Leave some space to write down observations you didn't think of beforehand, and questions you forgot to ask.

When your list is ready, the next step is finding a worm to watch.

With a few exceptions, you can usually find earthworms fairly easily in most parts of the world. If the weather is very cold or very dry, the earthworms burrow down deeper into the ground where the conditions are better. They don't seem to care too much for soil that's

photo: Laurence Pringle

Examine a worm closely to see its segments and clitellum, and to feel its tiny bristles, or setae. With just one worm you can begin to answer many questions.

highly *acidic*, as it is in pine forests, or for the sand at the beach. It may be a little harder to find worms if you live right in the middle of a big city where the soil is compacted or covered with concrete. But they're around, in yards and gardens and parks, so don't give up.

The best places to look are under piles of old leaves

photo: Laurence Pringle

Unless the weather has been very dry, you can often find earthworms close to the surface, right under decaying leaves.

photo: Laurence Pringle

An earthworm among decaying leaves on the forest floor. It is a small animal that has a huge effect on its environment.

or compost heaps. If you don't find any worms right away, look for holes or tunnels that show where they might have been, or for the small pellets of soil that they leave behind. While you're digging, you might accidentally chop right through a worm that happened to be in your way. If you do, don't feel too bad. Getting cut in half by gardeners is just one of the many accidents that can happen to a worm. Earthworms can often grow new tail sections if they're cut at a certain part of their bodies. But try not to do it on purpose, either. Earthworms do have nerves and are very sensitive; so even if they do grow new parts, getting cut in half probably doesn't feel too good.

Speaking of feeling good, you may be a little squeamish about picking up a worm if you've never done it before. In fact, some people never get used to it. Don't feel that you have to touch the worm if you don't want to. You can see just as much if you pick it up carefully with a shovel, a flat stick like a tongue depressor, or a plastic spoon. That way you won't suddenly change your mind and give the worm a big shock when you drop it. Remember that the worm can't possibly hurt you, but you can hurt it; so always be as careful and as gentle as you can.

When you finally discover a worm, lay it carefully on the ground and settle down to watch. Using your checklist as a guide, notice everything that you can. Make quick notes on your checklist, so that you won't forget any of your observations.

While you're watching, try to figure out how the things you see might help the earthworm to survive in its underground home. Like all living things, earthworms have developed certain unique features that help them to stay alive and make a living in their own special environment, or *habitat*. To survive, earthworms have to be able to get food and water, shelter, and protection from hazards; they need contact with other earthworms and some safety for their young. The specialized characteristics that help them do all these things in their underground habitat are called *adaptations*. Adaptations can be physical characteristics or ways of behaving; and many of the earthworms' survival tools are traits you can actually observe yourself.

If your worm is lying still, the first features you'll notice will probably be its long thin shape and dirtlike color. You may also see a wide whitish band around its body. This *clitellum* means that your worm is an adult and can mate with any other adult worm and lay eggs. Look closely at what seem to be stripes. They are really places where the worm's body is divided into rings, or *segments*. (Animals like this are called *annelids*, which means "ringed.")

If you have found an active earthworm, the most dramatic characteristic is probably the way it moves. Earthworms can bend and squirm, reach up into the air, curl around things, and go forward and backward. (Can you tell which end is which?) They can change shape from longer and thinner to shorter and fatter, and back again.

When the worm is traveling, watch how it stretches out and then pulls its body up, and how it pokes around to investigate obstacles in its path—sticks, clods of dirt, the edge of the hole you dug, or another worm. If it starts to dig under the ground, see if you can tell how it pushes the dirt aside and pulls its body into the burrow. Time it to see how fast it moves and how long it takes to disappear.

Imagine trying to move like this yourself, and think about how the earthworm must be built. An earthworm's movement is made possible by two sets of muscles. One set circles around each ring; and when these muscles squeeze together, they make the worm stretch out and get thinner. The other set of muscles is arranged along the

length of the worm, connecting the rings with each other. When the long muscles pull together, the worm becomes shorter and fatter or bends from one side to the other. The alternating action of these two sets of muscles makes the worm move along.

This very flexible motion and the earthworm's streamlined shape are adaptations that help it to push through the soil where it finds its food and other survival necessities.

You can find another feature that helps the worm move if you rub your finger very gently along its sides. Besides soft, moist skin, you may feel something kind of bristly or hairy. Each segment has eight of these tiny bristles, or *setae*. The setae are not legs, but they do provide traction to make it easier for the worm to move along.

To get an idea of how this helps, put the worm on an enameled pan or a plate. Notice how much harder it seems for the worm to move on a smooth surface than over the soil or on a damp paper towel full of rough places to grab onto.

Bristles help the worm to survive in another way as well. They make it a lot harder to pull the worm out of its burrow if it doesn't want to go. If you've ever watched a robin pulling a worm out of the grass, you may have wondered why the bird seemed to be having such a hard time when it's so much bigger and heavier than the worm. To find out for yourself, *gently* try to pull a worm out of the ground after it has decided to go under. Earthworms are a lot stronger than they look!

Another protective adaptation is the earth-worm's brownish color. This makes the worm much harder to see against the soil than if it were bright yellow, for example, and therefore helps to protect it from *predators*—animals that would like to eat it. Earthworms are also protected by their habit of staying under the ground except at night. These adaptations help to keep the worm from being eaten by predators that depend on sight; but of course they don't help at all against moles and other predators that live underground and don't need to see. Earthworms don't need to see either, since they spend most of their time under the ground where it's dark. You won't find any eyes on your worm, but they can tell light from dark and will react to light if it's bright enough, or if it shines on them for a long time. You can test this behavior by shining a bright flashlight on the worm, especially near the front. The worm may wriggle vigorously or try to move away.

You may also notice that the worms won't stay above ground in the sunlight for very long. Avoiding the light helps to keep the worms out of sight of predators; but it also helps them survive by protecting them from getting dried out by the sun. Earthworms have to stay moist in order to breathe. You won't find a nose on an earthworm, and there are no lungs inside. An earthworm "breathes" when oxygen from the air or water passes right through its damp skin into the blood vessels. Getting dried out is fatal for an earthworm.

You won't find ears on an earthworm, either, and it seems that they can't really hear sounds that come through the air. They are very sensitive to vibrations that come through the soil, though. In fact, some people who catch worms for fishing bait say that they can make the worms come out of the ground by drumming on it in a certain way.

One theory to explain this is that the worms may leave the ground because the vibrations could mean that a mole is coming. Since moles eat earthworms, getting out of the way would certainly be a useful adaptation.

To test earthworms' sensitivity to sound, Charles Darwin—one of the earliest and most famous earthworm observers—tried playing notes on a whistle. The worms didn't respond at all. But when he put the worms in a flowerpot on the piano and began to play, they got very excited probably because they could feel the vibrations coming from the piano through the soil in the pot. You might want to try this experiment yourself, to find out if your worms respond the same way.

After you have gotten to know one worm fairly well, try observing another one. Do they seem to be exactly alike, or do you think you might be able to tell them apart? When your worms have burrowed back under the ground, try drawing another picture. You'll probably find that you know a lot more about earthworms than you did before. ❑

Guest Editor

Laurence Pringle, guest editor of this issue of *Nature Study*, is a Board Member of ANSS and the 1983 recipient of the Eva L. Gordon Award. Educated at Cornell University as a wildlife biologist, he is the author of more than seventy books, including these titles to be published in 1995: ***Dinosaurs:*** *Strange and Wonderful;* ***Vanishing Ozone:*** *Protecting Earth from Ultraviolet Radiation;* ***Coral Reefs:*** *Earth's Undersea Treasures;* ***Dolphin Man:*** *Exploring the World of Dolphins;*. and ***Fire in the Forest:*** *A Cycle of Growth and Renewal.*

Winter Survival

John Serrao

Even though I was dressed in a heavy coat, woolen hat, thick gloves, and insulated boots, I was shivering from the near-zero temperature and frigid winds coming off the frozen lake. I tried to focus my binoculars on the big pines along the shorelines, but even this simple act was almost impossible with my numb fingers and watery eyes. Finally, I located the adult bald eagle—the object of my search on that January day in New York's Catskill Mountains—and, after setting up the spotting scope to get a closer look, I returned to the safety of my car.

On such days, I can't help but marvel that all kinds of animals survive such seemingly deadly conditions for months at a time. I've always been fascinated by the winter adaptations of northern wildlife and have tried to stay informed of new

photo: Laurence Pringle

People can bundle up, and return to a warm home, but how does wildlife survive?

research in this field for the past 20 years. Apparently, lots of other naturalists and scientists have also been fascinated in recent years, since a wealth of new information has appeared in books, scientific journals, and popular magazines. The findings of these investigators have been remarkable and, in some cases, downright unbelievable.

At the approach of winter's inhospitable weather and shortages of food, wildlife has three choices: leave the area for easier climates; hide away somewhere in a dormant state, to await the return of spring; or remain active and resist the harsh conditions. Migration is employed by most northern birds, bats, and even a very few insects (the monarch butterflies go to Mexico). But without wings, the rest of our animals select choice two or three. A few decades ago, there was much research in the area of mammalian hibernation and winter dormancy. In more recent years, however, the publicity has been mainly on the so-called "cold blooded" hibernators like insects, reptiles, and amphibians. These creatures are forced into inactivity during the cooler weather since their body temperatures fluctuate according to the temperature of their environment.

One of the true miracles of nature is how many insects and, as has been recently found, a few amphibians and reptiles, are able to spend the winter

photo: Helen Ross Russell

A cluster of ladybird beetles brightens a winter walk. They survive freezing temperatures as adult insects.

exposed to sub-freezing temperatures. Some of these species form glycerol, a natural anti-freeze that prevents the formation of ice in their bodies down to temperatures well below the freezing point of water. Northern insects are also capable of "super-cooling" — getting rid of "seed crystals" (nuclei around which ice crystals form) from the blood and gut. This is accomplished by binding embryonic seed crystals with glycerol or special anti-freeze proteins that prevent the crystals from growing. This super-cooling process depresses the freezing point of these insects 40 or 50 degrees or more below zero C., but it is also a very unstable state subject to the possibility of sudden death by "flash freezing."

There is another way for these dormant, cold-blooded creatures to survive the winter: allowing their bodies to freeze solid. This seemingly impossible feat has evolved not only in many insects but even in a few frogs and turtles (the majority of amphibians and reptiles spend the winter in deep

underground dens or the bottom of ponds where they're safe from sub-freezing temperatures).

How can an animal survive being frozen? Apparently, they have acquired the ability to prevent ice from forming within the individual cells (which would rupture the cell membranes and cause death)

photo: Laurence Pringle

Spring peepers are among the few amphibians that can survive being frozen in winter.

and restricting its formation to the fluids of the extracellular spaces, the body cavity, and the plasma. Special proteins and other ice-nucleating agents form in these spaces outside the cells and result in freezing there. The cells themselves are flooded with glucose which protects them from freezing.

So far, the gray tree frog, spring peeper, wood frog (which has the northernmost range of any amphibian), and chorus frog are the only amphibians found to be capable of surviving the winter frozen alive like this, and the only reptiles are the 3-toed box turtle and baby painted turtles (that hatch in September but remain in their nest inches below the ground until the following spring). These herptiles simply burrow under the moist, dead leaf litter or rotten logs and spend the winter with up to 65 percent of their body fluids frozen solid. There is no movement, respiration, or heartbeat until they reawaken in spring.

The third option available to northern wildlife for getting through the winter is remaining active and resisting the cold. This choice, of course, is limited to the warm-blooded animals — the birds and mammals (although a very few insects are known as "winter insects" and become active on mild winter days on the snow). Among the more fascinating recent findings in this area are the continuous overnight shivering of some small songbirds to generate body heat while they sleep; the controlled hypothermia of the chickadee, which lowers its body temperature up to 20 degrees F. each winter night to save fuel while it sleeps; the caching and thawing of left over prey by the great horned owl; the filling up of their crops with seeds and other foods at dusk by finches and grouse so they can slowly digest them and burn fuel overnight; the doubling of the survival rate of chickadees that utilize feeders in really frigid

photo: Laurence Pringle

Evergreens can photosynthesize late in the fall and early in the spring.

weather; the formation in some mice and shrews of specialized brown fat (stimulated by decreasing photo period and temperature) that is burned to produce heat over the winter; the possibility that turning white in winter may have more to do with the superior insulative abilities of hollow (pigment-less) hairs than with camouflage; and the discovery of the super-cooling ability of the Arctic ground squirrel during its hibernation—so far the only mammal found capable of this feat.

Plants have also been recently found to possess their own amazing winter survival adaptations. There are hardy trees which survive northern winters by super-cooling and avoiding freezing, and there are very hardy trees that take the extreme route of the gray tree frog, et al, and experience extracellular freezing. In these northern-most trees (Jack pine, larch, balsam fir, white spruce, black spruce, balsam poplar, paper birch, and quaking aspen), the cell liquids ooze out into the extracellular spaces and freeze there. This state is reached in a gradual series of steps called "cold acclimation" that begins with the shortening days of the fall and enables these trees to progressively withstand the colder temperatures that follow.

Once conifer trees become cold-acclimated they become dormant and don't photosynthesize in winter anymore, but, ironically, some of the deciduous trees like aspen and larch can still carry on very limited winter photosynthesis via chlorophyll in their bark. Being evergreen, however, carries one major advantage: these trees and shrubs don't need to replace all their leaves each year, thus saving an enormous amount of nutrients and energy. (Evergreens can also photosynthesize later into the fall before they become winter-dormant, and then earlier in the spring after dormancy is broken and weeks before the deciduous trees grow their new leaves.) This "evergreen advantage" not only allows these species to dominate cold northern environments but any harsh environment like bogs and alpine summits where conservation of nutrients and energy is very important.

These are just a few of the interesting new facts about life in winter. The following references have supplied this information and treat this subject in greater depth.

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This is the first in a series of reports on "keeping current" in natural history. The author, John Serrao, a Board member of ANSS, hopes to receive any interesting new articles on other aspects of nature from ANSS members for future columns. His address is 2113 Rosemont Drive, Tobyhanna, PA 18466-3606.

Another Winter Survival Strategy: New Brain Cells

Research conducted on wild chickadees reveals that these birds grow new brain cells in the fall -- exactly the time they need increased mental capacity in order to survive the winter. The study was conducted at the Rockefeller University Field Research Center in Millbrook, New York. In the fall, black-capped chickadees expand their home range from 3 to 30 acres, meet many other chickadees, and begin hiding stores of food. They hide small caches of seeds, and must remember the hiding places.

Dr. Fernando Nottebohm of Rockefeller University found that the hippocampus of the brains of free-ranging chickadees grew rapidly in October. Almost two percent of the neurons were replaced each day. Chickadees confined in an aviary with abundant food had about half as much growth in the hippocampus, the part of the brain that is the center for memory and spatial learning.

Black-capped chickadees can live a dozen years. This ability to "sharpen their thinking" in the fall helps them survive a dozen winters.

Laurence Pringle

❑

Lives Written in Snow

John Serrao

The closer I got to the mountain summit, the stronger the winds blew, making it seem even colder than the near-zero degrees F. temperature on that frigid February day. Even with woolen mittens, hat, and several layers beneath my heavy coat, I knew I wouldn't be able to last too long on the exposed summit in this kind of weather. When I reached the vista, I enjoyed a dramatically beautiful, wintry

photo: Laurence Pringle

The large footprints of a wild turkey.

landscape stretching as far as the eye could see—the snow-covered hills of the Poconos, with its frozen lakes and ice-encrusted treetops. But as magnificent as this scenery was, it wasn't my reason for making this trek. I wanted to photograph the tracks of animals in the snow, and this mountain had one of the highest diversities of wildlife in the region. I pulled my camera out from beneath my coat and went to work.

The dog-like footprints of coyotes were everywhere, each set of tracks running in nearly a straight line. The similar but much smaller tracks of a red fox crossed over one coyote track, making an excellent photographic comparison. Along the edges of the trail were the chicken-like tracks of a ruffed grouse and the much larger prints of several wild turkeys. Going from tree to tree were the tracks of gray squirrels, recognizable by their paired hind prints followed by the paired front prints. (In tree-climbing, hopping animals, both the fore and hind feet land in pairs, with the hind prints showing up in front of the fore prints.) Red squirrel tracks—similar but smaller than those of its cousin—were present all around the conifer trees. Almost everywhere I looked there were the tiny, paired footprints of white-footed mice, often accompanied by a straight line where the long tail etched the snow surface. Another small mammal, the short-tail shrew, left an extensive, sinuous maze of runways where it tunneled through the snow in its endless search for prey.

Both cottontail rabbit and snowshoe hare had left abundant evidence of their presence in the forms of droppings, snipped-off blackberry and blueberry branches, and their characteristic footprints—paired hind prints (much larger for the hare) but staggered fore prints. The tracks of another bark-eater, the porcupine, snow-plowed through the woods from its rocky den to a grove of hemlocks. And finally, the most ubiquitous tracks of all were the unmistakable hoof prints of white-tailed deer.

At no other season of the year do the animals of the northern United States make their presence so noticeable to humans. Most of our mammals are nocturnal, secretive, or burrowing, and if it weren't for their footprints in the snow, their presence in a region would never be suspected. The surface of the snow leaves a record of their nightly activities for naturalists and outdoor enthusiasts to follow.

The best way to learn the identification of tracks, of course, is to actually observe the animals making them. But since this is generally impossible for many species, the next-best ways are accompanying an experienced animal-tracker in the woods, or exploring alone with the aid of a field guide (Olaus Murie's is my favorite). This can be initially confusing, but with lots of patience and the help of various clues (habitat, feeding signs, etc.) the art of winter tracking can become one of the most enjoyable, rewarding, and informative outdoor pursuits.

There's much more to tracking than simply identifying the species that made the tracks. Following sets of tracks and carefully inspecting the immediate area for other signs of the animals' activities can furnish an enormous amount of interesting natural history. Experienced trackers often acquire more knowledge of the local wildlife than the most learned scientists. Squirrel tracks lead to holes in the snow where nuts and acorns were excavated, or, in the case of red squirrels, vast piles of pine and spruce cones with their scales stripped off. Porcupine tracks can easily be followed to their dens in rock cavities, where piles of dried, crescent-shaped droppings litter the openings and loose quills may be scattered about. It's not unusual to see or hear the porcupine itself hiding in the darkness.

Likewise, following the tracks away from the porcupine's winter den often leads to favorite trees where it's been feeding, as evidenced by bark

photo: Helen Ross Russell

Scats — another record of a visitor — in this case — cottontail rabbit.

photo: Helen Ross Russell

Red Squirrel Tracks. Tree climbers put their two front feet down together & swing their hind feet forward. Rabbits & other ground dwelling hoppers place one front foot in front of the other.

photo: Laurence Pringle

Rabbits feed on the bark of shrubs and small trees. Meadow mice also debark stems beneath the snow.

photo: Laurence Pringle

Cottontail tracks, with the marks of the large hind feet in front.

photo: Laurence Pringle

Ideal tracking conditions — a dusting of snow on a snow crust or ice — leaves distinct tracks, in this case, the five-toed prints of two fishers in the Adirondack Mountains.

photo: Laurence Pringle

The wing print of a great-horned owl and the remains of its prey, a cottontail rabbit.

photo: Laurence Pringle

White-footed mice usually leave a tail drag mark between their paired footprints.

scraped off the trunks and limbs, twigs littering the ground after being nipped off and de-budded by the arboreal porky, and even the animal itself snoozing way up in the top. I've seen porcupines feeding and sleeping in the tops of hemlocks, willows, and aspens, three of their favorite winter foods. I've also come across more gruesome feeding signs in the snow—a deer carcass surrounded by coyote tracks, a partially eaten muskrat dropped from a tree by a hawk or owl, rabbit fur, blood, and prints surrounded by fox tracks, and tracks of a white-footed mouse suddenly ending at a patch of blood-stained snow where large wing prints revealed that a hawk or owl

photo-Helen Ross Russell

Porcupine Work

swooped down and snatched it.

Tracks also reveal an animal's preference for habitat and shelter. Mink footprints almost always parallel a stream. One winter I watched a mink darting in and out from the overhanging banks of a stream and then disappear into a den within the exposed root system of a streamside maple. Last winter I followed a strange set of large, dog-like tracks (with five toes rather than four) that were suddenly interrupted by a long swath resembling a small toboggan slide going down to a stream—the tracks of a river otter! As I examined the banks of the stream I found several patches of droppings composed largely of shiny fish scales.

Cottontail tracks are generally confined to thickets, clearings, blackberry patches, and yards, while the signs of the much more elusive snowshoe hare are found in spruce swamps, bogs, or impenetrable scrub oak thickets. The tracks of both these animals are usually accompanied by their distinctive round, dry "pellets" and twigs or canes of their favorite food plants snipped off at a clean 45 degree angle by their sharp incisor teeth. Mice tracks often disappear beneath dead logs where they hide by day, and vole tunnels form well-used runways beneath thick dead grass and weeds, periodically interrupted by holes into the earth and "breathing holes" to the surface of the snow.

Toward winter's end, other tracks may become increasingly evident. Small, squirrel-like, hopping footprints emerge from a hole that wasn't there in the snow earlier in winter. This is where a chipmunk has finally left its winter den after a long sleep and has come out to examine the world. Deep in a rhododendron swamp late one winter I came across the huge, 5-toed, human-like footprints of a black bear on the disappearing snow. I followed them to a series of cavities opening into rock outcrops at the base of a mountain where the bear had probably spent the winter.

Perhaps my most exciting and interesting winter wildlife sighting was marked by the complete absence of footprints. For several weeks last year I visited a nearby bear den (discovered accidentally by a friend doing some winter hiking) to photograph its occupants—a mother and four cubs. Deep snows surrounded the hillside hole all winter, but not a single bear track was made until April when the family finally emerged to greet the beginning of spring. ❑

ANSS Co-sponsors Fall Conference

For many years, the annual conferences of the New York State Outdoor Education Association have been a major event for environmental educators in the northeast. On October 6-9 1995 the conference will be co-sponsored by the American Nature Study Society in Seneca Falls, NY, the site of the national park honoring women's rights.

The conference program will include approximately 75 workshops of interest to naturalists, outdoor educators, museum coordinators, teachers, camp counsellors, and administrators. Emphasis will be on hands-on activities applicable to the teaching situation. There will be field trips to wildlife refuges and wineries, and boat tours on the Finger Lakes and Erie Canal. "Fun stuff" includes storytellers, music, and art displays.

Mark your calendar! Information and registration materials will be sent out later. ❑

The Monarch Watch

Ken Brown

Each fall millions of Monarch butterflies begin one of the most spectacular migrations in nature—a 3,000 kilometer journey from summer breeding grounds to their remote, overwintering sites in mountains in Mexico. What guides them to roosts they have never seen before? How do they find their way? How do Monarchs from Colorado to New England all find the same roosts each year? What are the secrets to the migration of the Monarchs?

We know where the migration begins and where it ends. But we don't know how the Monarch accomplishes this amazing migration.

We're naturally curious about the answer, but curiosity is not the only reason we are seeking clues to the mystery.

Knowledge serves as our best guide in preserving and protecting our natural resources. As our knowledge of the Monarch increases, so does our ability to ensure that future generations will enjoy its magical flight.

Join us in solving the great mystery of the Monarchs. Everyone—butterfly enthusiasts of all ages—is invited to help.

–From "Monarch Watch" brochure

photo: Laurence Pringle

The monarch's amazing migration still holds many mysteries.

Children and adults alike love a good mystery, but only rarely can the same mystery capture the imagination of both the child and adult. Such a mystery must have clues simple enough for a child to grasp all the possibilities, yet pose a challenge for the adult. This mystery also must have no easy solution. As a clue is solved, another more curious question must arise naturally—and again, the child and adult must easily comprehend the new implications, remain hooked on solving the riddle and have an equal opportunity to contribute to the solution, meaning the child's answers have the potential to be as valid as the adult's.

The characters in this perfect mystery must have endearing qualities; they must stand out amid the competition with distinction in grace, character, strength, and beauty.

As for the plot, television and films have conditioned us to expect twists and turns, a dramatic, dangerous escape or chase and, best of all, a miraculous transformation. The main character definitely must become something much more than we first expected!

Hollywood and science educators only have to look in neighborhood backyard gardens and amid the wildflower meadows throughout North America for the cast of characters and one of the most familiar and intriguing mysteries in nature. The monarch butterfly and its annual migration supplies all the elements for this blockbuster summer mystery and science project.

Science education can be an exciting process of observation and discovery. Sadly, much of science education is neither discovery nor exciting, creating a two-fold problem for the science educator. First, exciting programs, rooted in sound, scientific principles, must be created. "Students should learn science in the ways that reflect the inquiry used by scientists to understand the natural world." (National Research Council, Committee on Science Education, Standards and Assessments, Discussion Summary,

1994.) As much as possible students should learn science by doing science. Equally as challenging, an effective marketing strategy must follow to overcome the negative attitudes towards science and sell both students and the public on the project.

Nobel laureate Karl Von Frisch, when asked why he had spent so much of his life studying bees, replied, "The answer to any such question must be that every single species of the animal kingdom challenges us with all, or nearly all, the mysteries of life." The monarch butterfly is just such an organism, with an extraordinarily rich and accessible biology.

photo: Ken Brown

Thousands of students are involved in investigating monarch butterfly migration.

Monarch biology is essentially an inexhaustible source of research questions—questions that can be framed so that all levels of students and the public can participate in the scientific process—a process very similar to the sleuthing of Sam Spade, Sherlock Holmes or the Hardy Boys.

The monarch butterfly has intrinsic value that makes it attractive for use with students and the public. First and most important, it is an animal that many people can and have experienced in their own environment. For example, people can more easily relate to monarchs than perhaps seaturtles or whales, as they grapple with concepts of migration and ecology. Secondly, the monarch has a remarkable life history. Eastern North American populations migrate in the fall from sites as far north as Canada to overwintering roosts in Mexico. In a 1992 issue of the Southern California Academy of Science Bulletin (Vol. 91, No. 1), H. Wells and P.H. Wells point out that the "high profile of the monarch butterfly cultivates appreciation of nature, sensitizes the public to ecological issues, and creates a positive image of science." It has been our experience that the beauty, popularity and unique biology of the monarch naturally stimulate public, including student, interest, giving educators in both the classroom and informal education centers such as environmental centers an opportunity to introduce a wide range of scientific concepts and methods.

HISTORY OF THE MONARCH WATCH IN THE UNITED STATES

Dr. Orley "Chip" Taylor of the University of Kansas and Brad Williamson, a biology teacher at Olathe East High School, Olathe, Kansas, first became aware of the educational potential of the monarch when they initiated a tagging project in the fall of 1992. As part of an effort to study migratory behavior and to draw attention to the phenomenon and conservation issues involved, they recruited volunteers to tag monarchs. The response was overwhelming with more than 4,000 students involved in the operation. As the project progressed, it became apparent that not only were school children and the public of great value in providing information on the migration, but that the monarch could acquaint students with scientific research and as the lead subject for numerous individuals, group, and class projects on insects.

In the fall of 1993, Taylor began working with Ken Brown, a producer of "Field Notes,"a weekly science education radio program and staff member of the Adirondack Park Visitor Interpretive Center in New York to bring the project to a national audience. Although Taylor and Williamson had expanded the educational components of the initial project into research on rearing monarchs and monarch biology, it was decided to focus on just the study of the monarch's fall migration for "The Monarch Watch, A National Search to Solve the Mystery of Monarch Migration."

Much needs to be learned about how monarchs from the entire eastern United States and much of eastern Canada converge and overwinter on a few mountain tops in Mexico. The means by which they navigate and the routes taken to reach Mexico are largely unknown. Many questions concerning the migration can be answered through a coordinated mark (tagging) and recapture and observation program.

Butterflies are caught, tagged and released in the field, and records are kept on sex, condition, and weather conditions. In addition to the tagging aspect, observations on the direction of the migratory flight pattern, wind speed, and weather conditions are recorded.

While the research questions are real, participation in the study has important educational purposes. First, it provides an example of how research is carried out. Migration research is particularly useful, because it illustrates the importance of cooperation in scientific research. Telecommunications will serve to enhance the ability to communicate among participants and provide participants immediate feedback on tagging results. Migration also draws attention to the fact that, in spite of their extraordinary abundance in some fall seasons (200 million migrants) the entire phenomenon is threatened by human activities. In Canada, milkweed, the host plant of the larvae, is considered a noxious weed and destroyed. Herbicides and insecticides affect monarch numbers in the United States and in some areas milkweed plants are being severely damaged by ozone. Monarch populations are particularly vulnerable in their wintering sites in the high-altitude fir forests of the Transvolcanic Range of Mexico; only two of the eleven known roosting sites are well protected from logging. The trees on which the monarchs cluster are valuable lumber sources, and local people need additional sources of income. If the roost sites are destroyed, monarch populations are likely to decline precipitously. These are not easy issues; there are many environmental problems where poverty contributes conflicts between preserving the environment and immediate human needs. Facing this issue in the context of an organism with which children and adults are familiar will help bring home important lessons. Thus, the monarch migration provides teachers and other educators with the opportunity to introduce a wide array of environmental issues.

While the Monarch Watch proved successful on a local and regional basis, a series of new and unique problems arose as plans were made to introduce the project to a national audience. Because the monarch is the most familiar and one of the more widely distributed butterflies in North America, the public and students easily identify with the project as they see monarchs everyday in their own backyards. The public's familiarity with this insect makes it a relatively "easy sell" as no references or special expertise are needed to:

(1) know what creature we're talking about and
(2) what we are attempting to do.

These aspects are particularly important in attracting the attention of the general public and elementary

photo: Ken Brown

It takes only a few seconds to glue a tag on a monarch's wing. Then the butterfly is released unharmed.

school teachers, especially those in the primary grades. While a first grader may have difficulty distinguishing a chickadee from a sparrow, the pupil will have no problem identifying the monarch.

Like many research projects, as one question is answered, new questions arise. In seeking a national audience, this factor had to be considered: how can the project leaders answer all the new questions raised by students throughout the country? Electronic mail provides a partial solution but the sheer number of potential inquiries from an estimated 10,000 monarch scientists could make it a full time job.

As the project was marketed, an effort was made to involve environmental or nature centers as regional hubs. It is hoped that these organizations could (1) handle many basic questions concerning monarch biology and behavior and (2) build new programs based upon the project's primary research questions. For example, a nature center could

publicize its involvement in the project and solicit area schools and the general public to become involved. The center could incorporate the project into an existing program or develop one specifically around the project. Initial reaction suggests the strategy has worked as many nature centers recognized (1) the scientific value of the project and (2) the public and the media's fascination with the monarch. This decentralized approach creates a potential win-win situation: participants, especially teachers, have a local resource to help answer questions and the center attracts new attention to itself by its link with the national effort.

The success of tagging and observation plays an essential role in creating continued excitement about the project. Tagged butterflies have been found 1,400 miles from release sites and the success rate of finding tagged monarchs greatly exceeds similar bird banding studies. Observations of tagged monarchs will be posted on electronic mail systems and distributed via a network of public radio stations cooperating in the project, creating an efficient system of feedback to participants. Once all the data is compiled, participants will receive a project summary, but electronic mail and radio helps creates a sense of immediacy to the project. Also, regional nature centers may distribute immediate results locally, generating continued interest in the project.

THE FUTURE OF THE MONARCH WATCH

The future is clouded in mystery. First, as of this writing, the project has been run on a shoe-string budget. Unless funding is obtained, it is impossible to predict how the project can sustain itself.

Second, with a nation-wide data base a series of new questions relating to the behavior of monarchs on a regional and national basis will surely arise. It is unrealistic to think a project of this scale can be handled on a national basis only. Since the project has attracted the interest of teachers from elementary through the college level, it is hoped that a network of universities and environmental centers can be established on a decentralized basis to work with elementary and secondary students on these new mysteries. The decentralized approach also promotes a true "ownership" among participants in the project. Electronic communications offers great potential for sharing findings and networking among all participants.

Third, the questions posed by the project are simple yet open-ended, allowing for individual teachers and other educators to use the project in diverse ways. Although the framework of the project directs people towards specific goals and questions, it does not give a step-by-step lesson plan, allowing the individual, especially teachers to be creative in integrating the project into existing curricula. Also, this approach encourages participants to formulate their own questions, making them not just casual participants but actual "scientists" involved in scientific inquiry. Once again, electronic communication will facilitate a sharing of educational approaches and hypotheses among participants.

The Monarch Watch seems to have discovered three keys for developing similar projects: (1) The questions posed involve real and meaningful scientific inquiry. (2) All ages of people are intrigued, easily understand the mystery, and relate to subject. (Good science often has a way of appealing to the curiosity of children and adults alike.) (3) It is educational, but most of all—it's fun. ❑

Ken Brown is the producer of the "Field Notes" radio program, broadcast on public radio stations, and serves as the East Coast coordinator of the Monarch Watch. For more information about Monarch Watch, write to: Monarch Watch, c/o Dr. Orley Taylor, Dept. of Entomology, 7005 Haworth Hall, University of Kansas, Lawrence, KS 66045. (Parts of this article were adapted from materials provided by Dr. Orley Taylor and Brad Williamson.)

photo: Clay Myers

A buckeye alights in a flower in the Higbee Butterfly Garden. (See following article.)

Creating the Higbee Beach Butterfly Garden

Eric Stiles, Karen Williams, and Laurie Pettigrew

The Higbee Beach Wildlife Management Area (WMA), located on the southern tip of New Jersey's Cape May peninsula, is world famous for bird watching. In recent years, the popularity of butterfly watching has skyrocketed nationally, and Higbee has emerged as a mecca. Higbee Beach offers an excellent opportunity to view breeding and migrating butterflies. In 1993, the NJ Division of Fish, Game & Wildlife's Endangered and Nongame Species Program (ENSP) decided to increase Higbee's butterfly watching opportunities by creating a butterfly garden.

The garden at Higbee Beach began during a mid-winter 1994 meeting with representatives from ENSP, New Jersey Audubon Society's Cape May Bird Observatory, and Flora for Fauna, a nursery specializing in plants for wildlife. From its onset, the project was intended to be a cooperative venture between organizations with similar objectives. We discussed the garden's objectives, its design, and implementation. Our goal was to provide a high profile, concentrated nectar source where visitors could view adult butterflies, and to educate people about butterfly life cycles. The garden would also act to compliment the numerous host plant species on the WMA.

The site (approximately 30 x 70 ft.) is typical of the area, with extremely sandy, nutrient poor soil. One corner of the garden is lower than the rest and is seasonally wet. These conditions were a primary consideration when choosing the plant species for the site. We needed plants that could survive on the area's ambient rainfall.

We considered several factors in garden design. In addition to the water limitations, pedestrian traffic flow from the parking lot to the trails of Higbee, and suitability of the plants as nectar sources for butterflies had to be addressed. The final design was a naturalistic planting of flowers in a random arrangement, with a path meandering through. The design provided plenty of access for visitors to enjoy the flowers and butterflies.

We selected plants using three main criteria: value as a nectar source for butterflies, tolerance of dry conditions, and the ability to compete with weeds in a minimal maintenance situation. As with any type of gardening, it is important to tailor the plants to the site; to do otherwise increases the work and resources that must be committed to insure success. For this project, water was not optional; it was unavailable, and labor was scarce as well, making weeding difficult. So plant species selection was especially important. The final plant list included species that would bloom from early summer through fall (see the table for a list of species used and their bloom period).

The garden's creation was a fairly straightforward process. Prior to planting, the soil was improved with 10 cu. yds. of composted leaves and grass clippings, delivered by the Cape May County Municipal Utilities Authority. This material is produced at the county landfill, where local yard waste is recycled into a soil amendment. The compost was incorporated into the soil with a tiller, thus increasing its organic content and water holding capabilities.

The garden was planted in mid-April, using volunteer labor. Paths were mulched with chipped Christmas trees, which suppressed weed growth. Small containers of perennials were planted and the area seeded with various species of annual and biennial flowers. We roped off the garden for one month after planting to allow seedlings to become established without the disturbance of foot traffic. Upon opening, educational signs were posted that described the life cycle of butterflies and the role the garden played in that cycle.

As expected, aggressive annual weeds were especially pervasive the first year. These species specialize in rapid colonization of disturbed soil. Even in a naturalistic garden, weeds are undesirable because they grow rapidly and shade the ground, making it difficult, if not impossible, for the desirable species to grow. Systematic removal of weeds over the course of the growing season, on a weekly or biweekly basis, was critical to the garden's success. Over time, the amount of weeding necessary will diminish as the flowers take over more of the growing space. Tilling was necessary to incorporate the compost, but aggravated the weed situation by exposing seeds to light.

Additional plants were placed in the garden in the fall, after temperatures had cooled (a little), and moisture was more available. Perennials planted in fall establish themselves prior to going dormant for the winter, and are ready to grow vigorously in the spring. Seeds were collected from tender annual flower species to replant in spring of 1995. Other species were let go to seed, providing food for the birds and next season's flowers.

The dead stalks will be allowed to stand through the winter, providing cover for birds and other wildlife; the entire plot will be mowed (not tilled) to about 4 inches in March, prior to the beginning of spring growth. We plan a continuing maintenance program, consisting of: thorough weeding about three times each summer; periodic replenishment of species that die out; and mowing to four inches in late winter.

As with every project, there are things that were done that in hindsight could have been done differently. In this case, the largest problem was the overwhelming presence of weeds. While tilling the

soil undoubtedly released many weed seeds, it was unavoidable. The compost that was added brought in its own load of seeds. If the project was being done again, a different soil enrichment, composted sewage sludge, would be used. This material lacks the weed seeds present in the compost. While this would not eliminate the weeding situation, it would reduce the number of seeds. Another improvement in the procedure would be to have a corps of volunteers organized to assist with the weeding prior to planting.

photo: Clay Myers

Children can be involved in all aspects of planning, planting, and caring for a butterfly garden.

Adopting a proactive maintenance routine would have increased the value of the nectar source to butterflies.

The garden was successful its first year: flowers were showy, butterflies nectared and it was enjoyed by many. This success was achieved without any chemical assistance (pesticides, herbicides, or fertilizers) and with only one watering when "dust bowl" conditions occurred shortly after the garden was planted. The water was carried in with a tank manufactured to carry water to livestock in a pickup truck.

Our goal of supplying a highly visible, concentrated nectar source was more than met its first year. Many visitors praised the diversity and number of butterflies using the garden. It can only get better as perennials mature and flower, increasing the amount and variety of nectar sources.

The Higbee Beach garden may be used as a model and modified according to the conditions of your site. When designing your garden, research the physical condition of your site, and tailor your wildflower species accordingly. Choose species that occur naturally in your region. Many reference books are available which will aid in your planning. (Some are listed below.) Finally, to ensure success in your plantings be sure to purchase from seed companies and nurseries that are reputable and that do not poach plants or seeds from wild areas .

NOTE: See review of Robert Pyle's "Handbook for Butterfly Watchers", P. 40

Bloom Period of Species Used at Higbee's Butterfly Garden

ALL SEASON
butterfly bush (p)
cosmos (s)

MIDDLE (July-Aug.)
brown-eyed susan (s)
butterfly weed (p)
globe thistle (p)
Indian blanket(s)
marsh mallow (p)
purple coneflower (p)
wild bergamot (p)

EARLY (June)
bee balm (p)
columbine (p)
rocket larkspur (s)
tickseed (p)

LATE(Aug.-Oct.)
blazing star (p)
New England aster (p)
mistflower (p)
seaside goldenrod (p)
sedum (p)

(p): plants
(s): seeds

SOURCES OF SEEDS AND PLANTS

Flora for Fauna. R.D. 3, Box 438, Friedreichstadt Ave. Woodbine, NJ 08270
Wildseed Farms, Inc., P.O. Box 308, Eagle Lake, TX 77434

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The Xerces Society and Smithsonian Institution. *Butterfly Gardening.* The Smithsonian Institution: Washington DC. ❑

Both Eric Stiles and Laurie Pettigrew work for the New Jersey Division of Fish, Game & Wildlife—Eric in the Endangered and Nongame Species Program, Laurie in the Bureau of Information and Education. Karen Williams is owner of Flora for Fauna. For more information, write to: Eric Stiles, Endangered and Nongame Species Program, P.O. Box 236, Tuckahoe, NJ 08250.

Planning and planting a butterfly garden can provide children with the kind of hands-on experience that connects them with other living things. They can see the connection between what they learn in the classroom and how it works in the real world. Learning is brought to life and made relevant and real. When students learn about the needs of wildlife, they can apply their knowledge to the needs of people.

Planting a garden for butterflies can be as simple as placing some key food plants in a window box or as detailed as the garden outlined in this article. Either way, children can be involved in all aspects of planning, planting, and caring for a garden. Have them research the needs of butterflies; identify food and nectar plants for the species you wish to attract; research the species commonly found in your area; chart the growth of your plants; observe the life cycle of a butterfly; experiment with the flower color, shape, and odor; keep a journal; write a poem; develop a presentation for the PTA. The list is endless.

When you open the classroom door and get outside everyone benefits. The simplest decisions made to help wildlife can have measurable results. Student interest is enlivened, basic skills are reinforced in a positive way and self-esteem is enhanced when students participate in a project and success in accomplishing a goal. Freshness is brought into teaching that too often becomes stale and commonplace.

Python in the Parlor

Pet Shops and Pets

Helen Ross Russell

A recent feature article in a Chicago newspaper reported that dogs and cats represented a 1 billion dollar annual expenditure in the United States. An entire page was devoted to breaking down that cost. First the basics: the purchase price of the pet, the shots, licenses, food, the training classes, the veterinarian's costs, then going on to list dishes, beds, shampoos, clothing—from simple coats for indoor dogs who do not grow a winter coat—and ranging from rubber footwear to diamond collars and mink jackets and other services like dog walking, dog sitting (if you are away all day your pet needs human companionship to drop by an hour or so). There are pet psychologists and pet beauty parlors. The article closed by saying people of the U.S. in the end of the 20th century "certainly love their pets."

Apparently the author felt that love could be equated with spending money and therefore, since we in the U.S. obviously spent the most, we love the most.

As I read the article I remembered two New York City scenes—one of an elegantly dressed woman with her toy poodle similarly attired, both with blue ribbons in their identically beauty-parlor colored hair, sitting on a Fifth Avenue park bench in Central Park. The other, of two homeless women sitting on a park bench next to the statue of Ghandi in Union Square Park with their homeless dog with his front legs in the sleeves of a child's discarded jacket. Was there any difference in the love expressed, or in the role that the animal played in lonely lives?

photo: Laurence Pringle

Feral cats — descended from pets abandoned in a summer resort area.

Yes, many people in the U.S. love THEIR pets. But do they love animals? This summer the American Society for the Prevention of Cruelty to Animals published a report of the dogs and cats who are not a part of the 1 billion dollar industry. They estimate that as many as 20 million unwanted dogs and cats are born in the U.S. each year. More that 1/4 of these are put to sleep in animal shelters, many others forage in garbage cans and are killed by traffic, packs of feral dogs hunt in rural areas, killing deer and other mammals and occasionally attacking a small child. Many millions of song birds are killed each year by feral cats.

According to the ASPCA one unspayed female dog and her descendents could produce 4,372 puppies in just 7 generations if they all lived. One unspayed cat and her offspring could produce 80 million kittens in 10 years. (A good activity for calculators.)

Surplus dogs and cats are frequently dumped on the countryside. People pick up a dog for their children for summer vacation and leave it behind when they return to their homes. People let unneutered animals run free, or mate their pet so their children can see the "miracle of birth" without anticipating the disposal of 4-6-8 or more offspring. Selfishness and irresponsibility can hardly be equated with love.

Of course, dogs and cats are not the only pets to be found in homes and schools of the U.S. Last year a python turned up in a Pennsylvania city. One hundred people filed papers claiming ownership. Probably none of them was the owner, for not infrequently people buy exotic pets and then find their care too demanding and their interaction unsatisfactory so they take them to a zoo or release them on the countryside.

By definition a pet is a tame animal treated lovingly or treated as a companion or play mate. The *Britannica* modifies this definition by saying that both "tame" and "fondness" must be qualified if one looks at today's pets. And how true this is!

I recently went to a pet shop to purchase some Elodea. The manager asked what fish or other animals would be sharing the space, "Goldfish". "You don't want plants for *goldfish*. Goldfish eat plants. We have plastic plants for goldfish." "I do not want plastic plants. I want my classes to know about plant/animal relationships". Shaking his head he led me to a large tank against the wall filled with plants. He reached in, selected a bunch and withdrew his hand with a string of loud profanity. Attached to his hand was a fish. He shook it vigorously and the fish fell off and began slithering across the wet floor. Grayish in color and dorsally flattened, it was about 33 cm. long.

"What is it?"

"A Dipnoi, an African lung fish."

"What is it doing here?"

"People like pets that are different."

A rare animal, snatched from the wild, with the

potential of growing 60-80 cms. long, certainly not tame, or loving, kept alive with a life support system that controls temperature, light and oxygen level. An animal that hides in the vegetation and, depending on species, may burrow in the mud.

In the front of the shop was a cage with a parrot, labeled "Amazon Parrot, hand raised". Sounds as though that parrot was the offspring of captive parrots, certainly not snatched from the rain forest. But wait! If his parents were here why did it need to be hand raised?

Recently the Department of the Interior reported seizing of Australian Cockatoo eggs valued at more than one million dollars. Carriers wore especially designed body vests to keep the eggs warm on the long flight from Australia. Once hatched they would have been "hand raised". Animal smuggling is second only to drug smuggling in magnitude, financial returns, danger, and in destructiveness. (The U.S. is the largest consumer of wild-caught birds). It is supported by people who willingly pay large sums of money for an animal that may not respond to them but that makes them seem unique, important, and rich.

photo: Laurence Pringle

"It's been fun having Mr. Toad as a visitor but I know that it is important for him to be able to help a female reproduce."

Several years ago a third grader arrived at Manhattan Country School with an American toad. I said "What a nice visitor. What kind of a home does he need? What can he teach us? How do I know it's he? After he has been with us two weeks where do you think we should release him?"

"We're not going to release him," said Ben, "He's MINE, I bought him in a pet shop with MY birthday money."

"How are you going to keep it healthy and alive all winter? It can't hibernate here in the classroom."

With that we began a study that led to a mini-habitat terrarium and a live insect rearing project involving the entire class. Spring came and with it articles about peepers peeping and toads trilling in ponds. It was time for more research and discussion and this time Ben said, "It's been fun having Mr. Toad as a visitor but I know that it is important for him to be able to help a female reproduce. Without him her eggs wouldn't be worth anything. My brother is going up to the farm next week. We can send Mr. Toad with him. I'd really like to take him up myself but that will be too late for him to be part of the mating get-together."

Kids all agreed. They also expressed pleasure in Mr. Toad's visit. And one child said, "It will be really good for Mr. Toad to be collecting his own food, because he'll be helping the environment."

Experiences with live plants and animals are an important part of education. Children isolated from living things grow up with fears and indifference. Many lessons can be taught with invertebrate animals, particularly insects. They occupy little space, have a brief and frequently dramatic life history, they are generally a part of the local environment, their reproduction, relationships, and changes can be observed in a short time.

Vertebrate animals require more space and care. For the classroom, guinea pigs, rabbits, white rats and mice, hamsters and gerbils are bred for sale. Hamsters and gerbils were discovered in the 1930's. Hamster females frequently kill the male if he approaches her before she is ready to mate. In the wild this would not happen because she would spit at him and he would run. In a cage he has no escape. The females can also be snappy little beasts. So though they are clean and attractive, a pair is not a good idea. Neither gerbils nor hamsters may be sold in Arizona or New Mexico. After all, they are still wild little animals coming from the deserts of the Mideast and could create the same kind of problems that rabbits have in Australia.

Animal studies should include habitat studies and relationships. Students should learn that it is irresponsible to bring animals from other countries and cage them for our homes and classrooms. In doing this we are tearing a hole in the interwoven pattern of Earth and threatening some species with extinction.

A test for selecting any pet should be where did it come from? Was it bred for pet shops or was it

captured and brought in for sale? A few of the beautiful tropical fishes are capable of reproducing in captivity; most of them can not. And of those that can, pet shops frequently get them from the wild for it takes less time and skill to collect than to rear.

Canaries, pigeons, and doves have been tamed for thousands of years, but bird feeders, nesting boxes, a series of short field trips to observe and record nesting robins, house sparrows, mallards, or other local birds can provide many worthwhile experiences without the strain and responsibility of a bird in the classroom.

photo: Laurence Pringle

Insects can be kept in a classroom for a few days, then released back in the wild.

Teaching responsibility is frequently listed as one goal for keeping pets. Responsibility should take many forms. Obviously responsibility starts with choice of the pet, followed by care of the pet including proper housing, food, temperature, and handling, and finally proper disposal. Whenever an animal enters a home or classroom we are talking about a lifetime commitment.

Insects are easy. Their life span is short, and for some of them the final goal is release, monarchs sent off to Mexico, buckeyes sent off to Florida, ladybird beetles released in an aphid colony, all with a feeling of accomplishment accompanied with a celebration. The chrysalis of a black swallowtail caterpillar, a wooly bear caterpillar, a spider cocoon, a mantis egg case, and all manner of small arthropods put in a hibernation insectory and placed on an outside window sill, roof or fire escape and brought indoors in the Spring to be observed and released, are sources of learning, excitement, and joy.

Larger animals take more planning but all local animals should ultimately be released into their natural habitat. Turtles, frogs, and garter snakes do not belong in the parlor or classroom any more than pythons do. Nor for that matter, in pet shops (where the sale of U.S. animals is illegal but does occur).

Two things occur when an animal is permanently caged: a hole is torn in the ecosystem, and reproduction is stopped. When someone tells me "I've had this turtle in my living room 20 years and it is happy there," I always ask, "And how many babies has it had?" As to love, a class expresses its love for the animal and for Earth by bringing its project full circle with great satisfaction as it provides a healthy situation not only for the animal itself, but also for the ecosystem to which it belongs. ❑

Note: Two good resources: "Amigo" and "Hawk I'm Your Brother" by Byrd Baylor, Eva L. Gordon Award winner.

Helen Russell is Editor of Nature Study. *She and her husband Robert live in Jersey City, N.J. She is the author of* "Ten Minute Field Trips" *and other nature books.*

NATURE AND ENVIRONMENTAL EDUCATION TIPS

In the days when farms stored manure in open pits everyone who had occasion to turn over the manure knew that it was full of small, slender, red earthworms. These worms differed from their larger earth-dwelling relatives in always living in their food. Today we recognize them as superb composters of garbage. The following Environmental Education Tip provides information on obtaining, housing, rearing, and observing these extremely efficient composters. For information on the common earthworm or nightcrawler, see the article "Earthworms, Dirt, and Rotten Leaves" (page 12), (or the book of the same title), by Molly McLaughlin. Then choose your worm or, better still, raise both kinds and compare.

Helen Ross Russell

Red Wiggler Earthworms in Residence

Judy Isacoff Thomas

Audience: Pre-K through Adult

Curriculum Areas: Science (Ecology, Zoology, Biology, Soil Science), Mathematics, Language Arts, Creative Arts, Sense of Wonder/Nurturing

Rationale: Earthworms are most delightful teachers of recycling, the wonder of natural processes and scientific method. They capture the imagination and heart of children and adults alike, making them ideal pets and classroom animals. Worms inspire unending hands-on interdisciplinary lessons.

Background: Worms are accessible. They are a part of most people's experience of the earth, whether in cracks in the sidewalk, in a garden bed or compost pile. Their wavey and pulsating movements are universal in form. We *feel* a primitive bond with the worm: our body parts expand and contract and move in waves, too. Worms are vital to life on earth. They are a part of the food chain called decomposers. Thanks to Mary Appelhof, author of *Worms Eat My Garbage**, published in 1982, a ground swell (so to speak!) of interest and activity has ensued around bringing earthworms into our homes and schools as working pets. Many Cooperative Extension agents offer vermiculture workshops, worm exchanges, and printed instructions. Mary Appelhof's latest book, *Worms Eat Our Garbage. Classroom Activities for a Better Environment**, encourages classroom teachers to set up worm composting containers by way of providing a rich selection of ongoing lessons in worksheet format. However, the simple presence and use of an indoor worm bin for transforming organic waste into planting soil—and providing opportunities for unstructured observation and exploration of its contents—will nurture the sense of wonder, develop earth-caring habits and enlighten and engage learners of all abilities.

Activities:

- Research the various kinds of earthworms by their common and scientific names: *Eisenia foetida:* red wiggler, redworm, manure worm, tiger worm; *Lumbricus terrestris:* nightcrawler, angle worm, night walker, rain or dew worm. Note their habits and needs. Figure out where to find them.
- Create a habitat for each kind of worm.
- The most direct way to learn all you need to know about vermiculture and its classroom applications to the red wiggler or manure worm is to read Mary Appelhof. The following sketch merely offers some tips.
- *Eisenia foetida,* adults averaging 1/8" x 3", is the star for indoors. This worm provides the greatest variety of hands-on learning opportunities. It turns quantities of food waste into earth. In mild weather it can be found outdoors in manure piles and compost heaps. For indoor study, harvest from these habitats or purchase a pound of worms from a garden supply catalog or Flowerfield Enterprises (10332 Shaver Road, Kalamazoo, MI 49002).
- *Eisenia foetida* will thrive indoors in any container that allows air to enter and excess moisture to drain away. A 12" diameter x 10" tall heavy plastic recycled plant pot to which a lid and tray are adapted could be a small demonstration model. Customized worm bins are attractive because of the ease of use: they cost about $50. (See worm purchase, above.)
- Place a few inches of bedding, such as shredded newspaper, in the bottom of the container, to absorb liquid and keep worms damp.
- Bury vegetable and fruit scraps. Moisten the bedding with water if it remains dry.
- To a bin that has about 4 sq. ft. of surface area, or one square foot for each pound of garbage per week, add a pound of worms.
- Cover the bin. Worms need dark, moist, warm conditions.
- Observe worms with the naked eye and with the aid of a 10x magnifier. How do mature and immature differ? Study their behavior, as when you expose them to light. Draw, write, sing, and dance about your worms!
- Look for evidence of the worm's life cycle: mating, cocoons, and young.
- Connect vermicomposting to the whole picture of recycling and garbage.

Materials:

worm bin commercial or adapted
red wigglers
shredded paper, hay or leaves for bedding
raw vegetable and fruit scraps
magnifying lens, ruler

* Reviewed in this issue ❑

Judy Isacoff Thomas, M.A., of Nature's Turn, is an environmental education and arts in education consultant in schools, colleges and other venues in the northeast. She recently presented "Out of the Classroom, INTO THE GARDEN" at the American Horticultural Society's international symposium.

House Sparrows

Helen Ross Russell

Curriculum Area: Ornithology, Science, Art, Language Arts
Pre-School to High School

Rationale: House Sparrows (also known as English Sparrows) are probably the most abundant birds in the world. They consistently live near people and can easly be observed. While some people resent these noisy ubiquitous exotics, they are easily available for study in cities, villages, and farm land anywhere. Observing their life activities can open doors to a lifetime hobby of birds.

Background: By the mid-19th century cities in Eastern United States had grown so large with row on row houses and scattered street trees that the vireos, warblers, woodland sparrows, and other small passerine birds had abandoned them. Without birds to collect insects for their young, trees were defoliated and caterpillars dropped on silken threads. People remembered that back in Europe there were little brown sparrows which lived in cities and busily collected insects for their young. So any number of letters went back to Europe asking friends and relatives to bring house sparrows with them. An unknown number of shipments arrived, but the birds did not adjust to their new surroundings.

Finally in 1852 the newly appointed ambassador to Portugal was given $200 that had been raised by the people of New York City and asked to have sparrows trapped and shipped to the city. The 100 sparrows that he obtained when he stopped in England arrived in Brooklyn that winter. Half of them were released immediately and the other half were housed in the tower of Greenwood Cemetery. When they appeared droopy and unhappy, someone took them home for the winter. The next spring when they were released they quickly found nesting sites, mated and raised families. House Sparrows lay 4 to 6 eggs at a setting and may raise as many as three families a year. Other cities purchased sparrows from England and Germany, but by 1869 New York had enough sparrows to sell them to other cities. In addition sparrows were spreading out. Juvenile sparrows never mate the summer of their birth. Instead focks of "teenage gangs" forage for food. Many times they flew into railroad boxcars for the night and awakened in a new area. Today these Weaver Birds that originated in Africa can be found all over Europe, Asia, North America, and South America. Though they were brought into the U.S. as city birds they can be found almost anywhere that people live. They will not be found in the woods.

Availabiity of nesting sites is a limiting factor in house sparrow presence They are communal birds nesting in groups, like people in apartment houses, independent yet close together. A young male must find a nest site before a female will mate with him. Their nests are roofed, with a front entrance—a total of 6 sides. So the males search for a place that demands minimal building. A favorite spot is the pipe found on many stoplight posts which are braced with guy wires. Each open end (2 on each post, 8 on a corner) provides a sparrow-sized area with the addition of a back wall, a soft bed for eggs and babies, and a barrier doorway in the front.

Eight families are an ideal number for one street corner since there must also be territory for foraging for seeds for adults and insects for the young. Other favorite places are in the ivy on buildings where horizontal branches provide a framework for floor and ceiling and building wall provides one nest wall; adjacent buildings with a narrow space separating them may have sparrow homes stacked on top of each other for 10 to 15 feet; houses with shutters frequently have one or two nests behind each one. In rare instances when the young male sparrows cannot find any human sructures to assist with their construction, they will build the zeppelin shaped nest that their African ancestors made for untold thousands of years. When this happens a dozen or more birds build in one or two trees in an area, and the nest size and continuous chattering of the birds entering and leaving makes them a conspicuous spot in the park.

Activities:

1. Male house sparrows with their black bib, white cheeks and chestnut nape can easily be told from the all-brown females. Take a walk around the block. How many females can you find? How many males? The young have the same plumage as the females during the first summer. Can you tell adult

House Sparrows (cont'd)

females from young by size? By behavior? Do some places have more sparrows than others? Can you find any reasons for this?

2. Watch a sparrow moving over the ground. How does it travel? How is this different from pigeon travel? How does it fly? Can you tell a sparrow from a pigeon or gull when it is flying? Make up a game using the walking and flying pattern of several birds.

3. If there are sparrows in your area, find a sparrow nesting site. Locate one nest and the pair that live in it. Watch them come and go. What are they doing? In spring they will be cleaning out the house they lived in all winter and putting in new materials. Who brings the nesting materials? What do they bring? Who makes the decisions on what is acceptable and what is not?

Bird nests are generally nurseries built for holding eggs and shelterng young, but house sparrows' nests are their all-year home. A nesting site is the property of a mated-for-life pair and remains in that ownership until one dies. The survivor then inherits the property and sits at the door calling to every member of the opposite sex that flies by until one responds.

4. When the house sparrow female has laid three eggs she starts sitting on them. She will lay one egg a day for one, two or three more days. Twelve days later the first three babies hatch. Father is very busy bringing in insects to feed them (they eat more than twice their body weight). When all the young have hatched, the mother also gathers insects. In five days their eyes are open, in 8 days their body is feathered, in 12 days wing and tail feathers appear and the male coaxes them out of the nest.

Watch the baby sparrows coaxing the adults for food (using the same body language that males will later use in courtship).

5. Look for other birds in your neighborhood. How many can you find? How do young differ from adults in size, coloration, behavior? How can you encourage them to stay in your area in winter? in summer? ❑

American Bat Conservation Society

The American Bat Conservation Society (ABCS) is a non-profit corporation supported by tax deductible contributions used for public education, research and conservation programs focusing on North American bats. Located at the National Bat Center at the National Backyard Wildlife Center in Rockville, Maryland, ABCS was founded in 1991. Society volunteers present educational programs that promote the value of American bats and bat conservation to the general public, government agencies, civic and fraternal organizations, school children and pest control operators. Society volunteers are working on several projects to heighten public awareness about American bats:

- The ABCS "Bat Hot-Line" (301-309-6610)
- Bat Conservation Status Reports (by State)
- Species Fact Sheets (40 Species)
- "American Bats Go to School" program
- Humane Alternatives to Roost Evictions
- When Bats Visit — How to Deal with a Close Encounter of the Bat Kind
- The Burpee-ABCS *Bat Garden Seed Collection*

The Society supports field research in the ecology, life history and conservation of North American bats. The Society is particularly interested in research ascertaining the impact of roost evictions and the impact of biological and chemical pest control measures on bat populations. Some projects are:

- Bat/Chimney Swift Roost Box Design Project
- Bat Watches and Counts
- Backyard Bat Detector
- American Bat Roost Registry
- ABCS Student Scholarship Fund

Send $3.00 for an information package about America's bats: Bat Gardening, Myths about Bats, Roosting Bats, Bat Roost Registration, Bats in the House, Bat Boxes, and *Absoutely Bats!* catalog. Mail to:

American Bat Conservation Society
P.O. Box 1393
Rockville, Maryland 20849 ❑

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BOOKS FOR YOUNG PEOPLE

A Walk in the Rainforest

Nevada City, CA: Dawn publications, 1992, 32 pages, $14.95 hardcover, $6.95 paper.

Kristen J. Pratt, illustrations by the author.

The content of this delightful book focuses on environmental issues related to rainforests. It was written and illustrated by the author as an independent study project when she was fifteen years old.

The reader, a child or adult, follows the travels of XYZ (the ant) as he explores the interesting plants and animals of the rainforest. In alphabetical order each large page has a plant or animal species to go with a letter of the alphabet. As each species is identified in large print the author makes effective use of alliteration. Also included is descriptive material in smaller print on each species.

The large colored illustrations are outstanding. They contain considerable information about the plants and animals and add a great deal to the book. An introduction contains basic information about the current status of the rainforests of the world. A large, two-page colored map of the world at the beginning of the book shows the location of subtropical monsoon rainforests and tropical rainforests. The book closes with a two-page illustration of a rainforest's floor, understory, canopy, and emergents.

Louise Ritsema

Skimmers

Downs Matthews, photographs by Dan Guravich
New York: Simon and Schuster, 1990

This is a delightful book for middle grade students on the unusual seabird, the black skimmer. The focus of the book is on a flock of displaced black skimmers that nest on an oyster shell parking lot of a Dow Chemical plant in Texas. Water is close at hand. Eventually the manager of the plant made it a protected area so the skimmers continue to nest there year after year. The flock has grown to number 2,000 skimmers.

Readers learn about the unusual beaks (lower bill longer than the upper half) and unusual feeding habits of black skimmers. There is an excellent description of the nesting habits of these birds and the development of the young. This book is illustrated with outstanding detailed, color photograph.

Louise Ritsema

The Call of the Siren: Manatees and Dugongs

Tim Dietz
Golden, Colorado: Fulcrum Publishing, 1992, 244 pages, $15.95 paperback

Boating is big business in Florida, with 3.5 billion dollars spent annually. Since 1974, 484 manatee deaths have been directly attributed to collisions with watercraft. These collisions with boats and barges account for approximately one in every four manatee deaths, with 1989 and 1991 recording the two highest yearly totals (fifty-one and fifty-three respectively), since manatee mortality rates were first compiled. And therein lies the dilemma. Whose interests do we, as world citizens, protect? Neither side means to harm the other. Boaters, responsible boaters, do not seek out manatees to kill or maim them with their propellors or choke them with their indigestible trash any more than the manatee would deliberately clog the waterways with its bulky, lumbering, presence. Both groups deserve protection of their rights—humans who use waterways commercially and/or recreationally, and these sea mammals who seek out comfortable (and life sustaining) water temperatures and a plentiful supply of food.

Manatees are well described by the expression "gentle giants". They are non-aggressive, choosing to flee from behavior they dislike, and present no threat to the safety of swimmers. They seem to enjoy human contact and their natural curiosity delights many who have the good fortune to interact with them. Their cousin, the dugong, cannot be said to possess this same trait of affability, as males are highly territorial and will engage in violent combat for breeding rights. As dugongs are night feeders, there are far fewer opportunities for human contact. Both manatees and dugongs can grow to over twelve feet in length and weigh up to 3,500 pounds. The dugong's body is, however, more streamlined and its muzzle—which has been likened to an elephant's trunk because of its shape and grasping abilities—is quite different from the manatee's smoother, rounder countenance. Both are herbivores, and both are grazers, causing some people to compare them to cows, and hence one of their nicknames—sea cow.

Author Tim Dietz attempts to educate people regarding the fragility of the manatee population and how we are unwitting contributors to their demise. The estimated manatee population in Florida is 1,856. While they do finally have protected status

there is still too little known about these mammals and their lifestyle and this ignorance adds to their mortality rate. Until, and unless, the law makers and enforcers, and the conservationists and naturalists, and the people who care about these sea creatures, speak up, and act, the fate of the manatee and the dugong will be that of another family member — Stellar's Sea Cow—extinction.

I would recommend *The Call of the Siren* to readers aged twelve and up. It strikes a good balance between interesting and informational reading material and would fit well into an educational unit on endangered species, human accountability, and the need for protection and the right to survival of all creatures.

Arly Bird Davis, student,
Central Connecticut State College

Jake's Journal

R.E. Kelley, 144 pages, paperback, $2.99
St. Petersburg, FL: Worthington Press, 1994

This is a story upper elementary youngsters will relate to. When the judge assigns 10 year old Jake and three year old Petey to the custody of their father for the summer he also gave Jake two large notebooks and told him that he expects them to be filled when he returns in the fall.

Jake, a Michigan city child, is sure that a summer spent at the end of a dirt road in a canyon in California with his father and a step-mother with "weird ideas" (she is an"animal rightsist") is going to be a complete disaster and that his assignment is unreasonable and impossible. Instead his two plus notebooks tell a sensitive story of people relationships, people-animal relationships, and animal relationships.

Helen Ross Russell

Bat Time

Ruth Horowitz
Illustrated by Susan Avishai
New York: Four Winds Press, 1991
32 pages, $13.95

The story in *Bat Time* confronts two stereotypes, since it is a young girl, Leila, who looks forward to that special twilight time when she and her father can watch insect-hunting bats flutter and swoop in their backyard. Neither her father, mother, nor Leila is bat-phobic, and Leila tries to correct a neighbor's notion that bats will get tangled in her hair.

This is a sweet picture book to read to children at bedtime, and can also be used in grades K-2 as a springboard for discussion and investigation of bats, real and mythical.

Laurence Pringle

Of Things Natural, Wild and Free

Marybeth Lorbiecki
illustrated by Kerry Maguire
Carolrhoda Books, Minneapolis, 1993
$14.95 hardcover. 64 pp.

"A Sand County Almanac, Aldo's book of essays, was published in 1949. Since then over a million copies have been sold. The book has been hauled up mountains, trundled into canoes, and stored at bedside tables. It has been translated into Chinese, French, Russian, as well as other languages. It is one of the best-loved books ever written about the environment."

This quote from the "Afterword" of this brief book about Aldo Leopold underscores a remarkable truth: if the environmental movement canonized saints, Aldo Leopold would be close to the head of the list. Although Leopold led a reasonably venturesome life, it is Leopold the philosopher that endures, continuing to challenge modern mankind to come to terms with our rightful place in the ecosystem. For adults captivated by Leopold's ideas and way with words, he is a real-life hero. It's not so easy to make a kid's hero out of him.

The book is biographical, starting with episodes in young Aldo's life with which youngsters 8 to 14 would relate. It highlights the major events in his career and family life. As the quote above indicates, it ends with a brief summary of the impact Leopold made on the way we look at nature.

A children's librarian I know "discovered" Leopold by reading this book, and promptly borrowed "A Sand County Almanac" to read for the first time. I'm not so sure the book would entice young readers in the same way. I suppose we can't expect youngsters to appreciate Leopold's philosophy. But spelling out why Leopold is important at the beginning of this book might have helped entice young readers to read his life's story with a better grasp of why it's significant, and hopefully prompt them to look him up when they get to high school or college.

John A. Gustafson

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Nature's Events: A Notebook of the Unfolding Seasons

John Serrao

Illustrated by John Wiessinger
Harrisburg, PA: Stackpole Books, 1992, 292 pages

In NATURE'S EVENTS, John Serrao has written engagingly about the timeless, unchanging features of the living world of nature, the features we anticipate each spring, summer, autumn and winter. And so we read about "awakening amphibians," "woodland wildflowers," "the autumn harvest," "insects on ice," and so on. As he explains, each month is divided into four weeks and a representative event is assigned to each week.

The featured players in John Serrao's seasonal events are not newfound acquaintances. Rather, they are old friends that he has spent hours searching out, observing, and recording in volumes of journal notes. This solid background gives an immediate stamp of authority to the text. As Edwin Way Teale would have said, John Serrao clearly has "been there."

But the author does not depend solely on his own knowledge and observations. Using carefully selected references (listed in a wide ranging bibliography) he expands and enriches his accounts. Therefore, it is at the same time an up-to-date reference work as well as a volume that can be opened at any page and read with pleasure.

Attractive line drawings by wildlife artist John Wiessinger are an important element in the book's appearance, for the introductory page of each event is graced by a sketch of the featured organism.

His prose style is direct, well punctuated, easy to read, and loaded with facts. In this sample, where he is writing about witch-hazel, note how many facts are packed into the text without losing readability.

"At the same time that its flowers appear, the fruits from last autumn's blossoms mature, having taken a year to fully ripen. These two chambered, nutlike capsules have a unique way of dispersing their two shiny black seeds. As each fruit dries during autumn's Indian-summer days, it shrinks and contracts, slowly splitting open and forcing its slippery seeds out like bullets between its moist halves. Some seeds are ejected as far as 50 feet away from the shrub with loud snapping noises, leaving the empty, open fruit capsules to remain on the branches all winter."

In his earlier (1986) book, author Serrao presented descriptions and walking guides to the geology, ecology and the biota of the Palisades Interstate Park, a New York-New Jersey park which has been called the finest, most scenic and accessible urban park in the nation. Not only did it establish him as a first rate nature writer, but it also demonstrated his impressive skill as a nature photographer. After you have dipped into NATURE'S EVENTS, you will want to add this to your library also.

It has not been easy for me to be objective when reviewing a book written by a favorite student and dedicated to me. But I tried mightily. In truth, this is another fine volume from a nature writer who is clearly on his way up.

Richard B. Fischer

So, You Like Turtles!

Donald Zeiller

available from the author
88 Norman Place, Tenafly, N.J. 07670
1994, 60 pages, softback, $8.95 postpaid

This unusual self-published book is advertised as "a 50-year experience of how to keep box turtles healthy, how to breed them, and how to develop healthy hatchlings," but it is more than that and should intrigue anyone interested in box turtles, wood turtles, turtle-conservation, or the story of how one person sustained and expanded on his childhood fascination with turtles.

When Don Zeiller was three, a box turtle wandered into his New Jersey backyard. His parents let him keep it, and another, for a few days. Then the turtles escaped, but Don was a lifelong captive of his curiosity and concern about land turtles. In his area, and in many others, suitable habitat is mostly gone, and he has created a large enclosure for turtles displaced by housing developments, injured by cars, or otherwise in need of help.

Detailed instructions and drawings tell how to construct a similar sanctuary—a nearly ideal home, including egglaying sites, for box and wood turtles. Since his turtles reproduce successfully, the book provides tips on helping hatchlings through their early, most vulnerable years. Don also writes about turtle enemies, which besides humans include raccoons, shrews, and botflies.

One fascinating aspect of this book are parts of Don Zeiller's carefully-kept records; for example, of egg-laying times and clutch sizes of two individual female box turtles, from the early 1960s or 1970s to the present. He also relates his early observation of the "wood turtle stomp," the behavior that causes earthworms to flee upward where they can be eaten by the stomper.

The title, *So, You Like Turtles!* is a challenge: do you like them enough to take action to help them and help save their habitat? There may not be many people who will be able or willing to match Zeiller's effort, but this book should be on the shelves of turtle lovers everywhere. It has an index and is illustrated with drawings and color photographs.

Laurence Pringle

Knee High Nature: Winter, A Guide to Nature, Activities, and Fun

Dianne Hayley and Pat Wishart
illustrations by Jo El Berg
Edmonton, Alberta, Canada T6E 1X5:
Lone Tree Publications, 1989, 169 pages

The authors state that their goals for the book are to "increase awareness and appreciation of nature, to encourage adults to share their knowledge with children, and to help create opportunities for children to share their sense of wonder with adults". This outstanding book especially for educators of young children certainly provides many opportunities to achieve these goals. It could also serve as a reference book for older children and other educators as it contains a great deal of information.

The authors have written the book for what they call the North-West: Alberta, British Columbia, Saskatchewan, Manitoba, Alaska, and the Yukon as well as Washington, Idaho, Montana, Wyoming, and the Dakotas. However, there are many aspects of the book that would also be useful in other parts of Canada and the United States.

The book contains a detailed table of contents which lists these main sections: winter birds, snow and ice, mice, voles, and rats; weasels; hares and rabbits; deer family and friends; wolves, coyotes, and foxes; and winter nights. The first section of the book, "Here Comes Winter," includes information on these topics: some animals migrate, deep sleepers (hibernation), light sleepers, life under ice, and the winter woods.

Except for the sections on "Snow and Ice" and "Winter Nights," all sections include specific information about each species presented. Usually the authors include a description of the species. as well as its location, food, predators, and reproduction. They conclude with interesting information called "Neat Notes." The scientific name of each species is included, and when a family of animals is being introduced the Kingdom, Phylum, Class, Order, and Family are listed.

These sections also include poems, songs, and stories, as well as Follow-Up Activities. Several Indian legends are included. There is a section called "How to Use the Books" — the plural referring to *Knee High Nature* titles about spring, summer, and fall — as well as suggestions on enjoying winter, working with groups, and winter walks.

The informative illustrations and the print used in the book are in blue ink on white paper. The outstanding detailed drawings add a great deal to the content of the book and some of them would be especially helpful in carrying out the activities. The book's design is extremely appealing. It has a spiral binding that makes it easy to handle, especially if you are working with a group outdoors.

Louise Ritsema

Trails, Tails and Tidepools in Pails

Docents of Nursery NatureWalks, 110 pages
1440 Harvard St., Santa Monica, CA 90404
$9.95 Plus $2.50 postage

A wonderful book for teachers and parents of little folk. Based on a love and understanding of children and respect for the natural world, the activities are all simple, short and nature based. Headings use verbs: Return, Borrow (a sowbug), Sit quietly, Pretend, Initiate, Enjoy, Search, Listen, Look for and Check!

The book contains a page of "cautions", and two indexes—one by age, one by subject. With few exceptions the more than 100 things in this California-developed book can be found anywhere. Rain, ponds, rocks, squirrels, birds, and sounds are universal and so is the need to foster observation, encourage love of the Earth and the excitement of discovery. A book rich in child-appropriate activities with an underlying message: "LET NATURE BE."

The layout with four or more type fonts on a page and black and white sketches, guides the reader in a lighthearted way into the realm of childhood.

Helen Ross Russell

A Field Guide to Eastern Butterflies

A Peterson Field Guide, by Paul Opler
illustrations by Vichai Malikul
Boston: Houghton Mifflin Co., 1992,
512 pages, $24.95 hardcover, $16.45 paper

Like many youngsters, my earliest experiences with nature were running through fields and vacant lots, chasing butterflies with a homemade net. Even in New York City's borough of Queens, my best friend and I managed to capture such elusive prizes as mourning cloaks on willows, buckeyes on plantains, black swallowtails on wild carrots, and monarchs on milkweeds in the late 1950s and early 60s when we were growing up. My parents still have my first collection of butterflies, spread out under glass in a large picture frame that my father built. Most of those beautiful butterflies are no longer found in my old neighborhood, choked out of their former haunts by the inevitable process of urbanization. Since becoming a professional naturalist in 1972, I've broadened my interests to include plants, herptiles, birds, mammals, and all living things, but butterflies remain a primary focus of my photographic and interpretive work.

The original guide that I used to identify my specimens—and perhaps the first book I ever owned—was Herbert Zim's little *Golden Nature Guide to Insects.* Later, I graduated to the *Golden Nature Guide to Butterflies and Moths* by Mitchell and Zim, and when I went to college I finally purchased the classic *Field Guide to Butterflies of Eastern North America* by Alexander Klots. This remained my butterfly bible throughout the 70s, 80s, and early 90s,

even after I acquired a more modern field guide in the Audubon series. I preferred the illustrations and organization of the Klots guide over the other, and, perhaps partly because of familiarity from decades of use, I found the first book easier to work with. But recently (1992), another butterfly guide has been published by Houghton-Mifflin: *A Field Guide to Eastern Butterflies* by Paul Opler. Gradually, this book has replaced my treasured and worn Klots guide as the vehicle of choice in identifying butterflies during my travels throughout the eastern states.

In the Roger Tory Peterson Field Guide Series, Opler's book includes completely new and revised nomenclature, geographical ranges, and specific habitat and life history information for each species.

Furthermore, one hundred new species of butterflies have been added that represent either additional records for the area's fauna (colonists from the tropics) or "new species" created by changes in classification. Every species of butterfly (524) found east of the Great Plains, from Greenland to Mexico, is described in this new book. Opler's range maps for each species (located under each species description throughout the text rather than clumped into a separate section) are a special bonus, although the shaded areas don't provide as accurate an idea of a species' range as would larger maps using separate dots, as many regional guides contain (such representations would render a field guide too bulky and unwieldy, anyway).

The most important part of a field guide, of course, is its illustrations, and both Klots' and Opler's are excellent. In the old guide, however, some of the pictures are black and white; they're not always arranged in taxonomic order (e.g., some plates contain species from several different families squeezed together apparently for convenience); and they're scattered throughout the book in various sections, making it somewhat cumbersome to search for particular butterflies without consulting the index. In Opler's guide, all the illustrations (painted in exquisite detail by Vichai Malikul) are in color, in taxonomic order, and contained in one central section of the book, making it a much easier task to identify a butterfly and learn its correct family and relatives at the same time. Unfortunately, as with all current field guides, very few of the larvae and pupae are illustrated, and naturalists are still lacking an easy way to identify caterpillars in the field. (The old *Golden Nature Guide* by Mitchell and Zim still contains the most caterpillar and chrysalis/pupa pictures. The "Peterson First Guide to Caterpillars" by Amy Parlett Wright, Houghton-Mifflin Co., 1993 illustrates 120 species.). One minor error in Opler's guide is the rendering of the two swallowtail chrysalids in the incorrect position (horizontal rather than vertical). (In the *Audubon Society Field Guide* by Pyle, the illustrations are all photographs, mostly excellent but sometimes a little dark or blurry. Their quality varies with the photographer, and dozens of people's photos were used, as opposed to a single artist's work in Opler. In addition, the Audubon Guide arranges the species largely on the basis of color and other physical similarities rather than taxonomy, e.g., "Boldly Patterned Butterflies".) Besides its 541 color paintings, Opler's guide contains over 100 color photos depicting some of the species in their natural habitats.

Like the Klots guide, Opler's features concise, general, introductory treatments on collecting butterflies; habitats and life zones; behavior and habits (basking, mating, feeding, etc.); life history; and morphology. The old Klots guide contained an extraordinarily insightful section entitled, "To Teachers and Nature Leaders," with instructions on group trips, exhibits, lesson preparation, and many other innovative ideas that are just as appropriate today. In Opler's book, equally useful sections deal with Butterfly Watching, Butterfly Gardening, Photography, and Butterfly Conservation. There is also a fine glossary, as well as an appendix with advice about responsibilities, laws, ethics, and guidelines for butterfly collectors.

In short, Paul Opler's guide is not just another edition of the original Klots book but a thoroughly revised, beautifully illustrated, complete and convenient field guide that sets a new standard for the identification of butterflies.

John Serrao

A Field Guide to Western Butterflies

A Peterson Field Guide, by James Tilden and Arthur C. Smith
Boston: Houghton Mifflin Co., 1986,
466 pages, $19.95 hardcover, $14.45 paper

The many features of the Peterson Series make this *Field Guide to Western Butterflies* a useful and reliable identification reference especially for the Great Plains and west to Hawaii, from Alaska to Northern Mexico. Of the 524 butterflies illustrated, 270 are in color, showing uppersides and undersides for most species, and always with one antenna. Arrows on the plates pinpoint distinguishing marks to look for. Brief notes on range, flight season, habitat, and food help to recognize a butterfly in the context of its environment. The index to host plants would be of interest to butterfly gardners as well.

With a growing emphasis on butterfly watching (vs. collecting), the assumption on page 1, that butterflies are best identified by a specimen in hand, is somewhat outdated. The authors go on to make assurances that collecting will not seriously reduce a species, and later, under Butterfly Conservation, agree that habitat destruction is the single most important factor in the decline of species. There is one mention of binoculars, and of observing living butterflies in the field. Certainly, books like this are based on the work of butterfly systematists studying large collections of butterfly specimens. Therefore, with a book like this, collecting and preserving is not necessary. In a revised edition, the details on collecting and preserving dead butterflies should be replaced with how to net and release, and watch, live butterflies with binoculars.*

Where there are regional guides, this complete guide is a valuable companion book for exploring adult butterflies and their habitats in the western half of North America. On its own, it is like the Peterson guides to identifying birds — the more it is used, the more useful it becomes.

Joy Finlay

**** See review of "A Handbook for Butterfly Watchers" by Robert M. Pyle, p. 40.***

A Handbook for Butterfly Watchers

Robert M. Pyle
Boston: Houghton Mifflin Co., 1992,
280 pages, $11.95

Most naturalists today seek more than just identifying and classifying their subjects of interest. Whether it's exciting, new information to stimulate the interest of an audience on a field trip, or some new fact that widens their own personal horizons, naturalists have expressed a demand to receive such fascinating discoveries in the world of nature, resulting in the publication of a whole new generation of nature handbooks in recent years (e.g., the *Stokes Nature Guides*). Designed to complement the popular identification field guides, these handbooks provide the reader with insights on various aspects of the subjects' behavior, habitat, life history, and ecology. They promote the careful and pleasurable stalking, watching, and studying of their subjects instead of simply ascertaining their identity and checking them off on a list. We all become much better naturalists by reading such books.

Bob Pyle's *Handbook for Butterfly Watchers* is perfectly suited to arouse the interest of both budding and veteran naturalists in these most beautiful and delicate creatures. After reading the handbook last winter I found myself eagerly anticipating the arrival of spring so I could go out into the meadows and gardens to experience many of Pyle's fascinating observations for myself.

Pyle reveals so many interesting and easily observed little tidbits about butterfly behavior that would normally be completely overlooked by most naturalists. Courtship flights, mating procedures, territoriality, basking, nectaring, puddling, evading predators, and many more behavioral aspects are discussed via the latest scientific findings and Pyle's own personal anecdotes. For example, Pyle reveals that butterflies have three different kinds of territorial flights: perching in a specific spot and darting out after an intruder or prospective mate; patrolling back and forth along a trail; and "hilltopping" — flying to the top of a hill and milling about. I've seen evidence of the first two, especially with mourning cloaks and red admirals, but now I'm looking forward to searching for examples of hilltoppers during my summer outings.

Among the other items covered via Pyle's award-winning writing style are defensive adaptations (camouflage, mimicry, warning coloration, flash coloration); overwintering and migration; attracting and getting close to butterflies (Pyle often entices wild butterflies to climb right onto his fingers to sip sweat!); how and where to find butterflies in all their life stages; equipment for catching, transporting, and rearing butterflies; butterfly gardening and photography; butterfly conservation, and the causes and consequences of their decreasing numbers (and extinction) in some areas; and the enduring miracle of metamorphosis. The differences between butterflies and moths; their differentiation into various families; their unique senses of smell (antennae) and taste (feet); and their universally admired colors and patterns are also explored. For more serious students, Pyle offers advice on keeping records and field notes; listing, mapping, and counting; teaching and leading field trips about butterflies; and his own personal itinerary of butterfly "hot spots" in the United States and worldwide.

As Pyle maintains, "everything a butterfly spends time at is compellingly worth watching .... So consider butterflies as actors. You will be surprised at the breadth of their roles, and pleased as they reveal themselves to be so much more than beautiful objects." And, in his epilogue, he describes a solitary visit to a lake in Washington's Olympic National Park, where he watched large numbers of Nelson's Hairstreak butterflies drinking sap and nectar from the maples. "As I watched them tip over to bask toward the southwest sun, interact, nectar, and otherwise carry on, I learned new things about this common butterfly," states Pyle. "I also learned something about myself, something always partly forgotten over the long winter. There is serenity to be found in butterflies. Watching Nelson's Hairstreaks that afternoon I achieved a degree of tranquility that I hadn't enjoyed for a long time. Perhaps it amounts to a kind of meditation, with butterfly as mantra. Or is it Thoreau's transcendental tonic? The peace of Pan? Whatever, it lent a profound personal serenity whose palliative effect I felt long afterward." This summer, as I stalk butterflies to capture Pyle's observations, I'll hope to capture this serenity as well.

John Serrao

The Naturalist's Garden

How to Garden with Plants that Attract Birds, Butterflies,and other Wildlife, Revised Edition
Ruth Shaw Ernst
Old Saybrook, CT: The Globe Pequot Press, 1993, 288 pages, $15.95 paper

This is a book for both the beginner and advanced gardener: an excellent reference book that covers construction of a small garden pool for waterlilies and fish to the selection of perennial border plants. It also includes plants for the wildflower enthusiast. It is a source book of ideas for planning a garden of trees, shrubs, and flowers that attract birds, bees, butterflies and other creatures. The book also has a philosophy of how to live with and enjoy the plants and creatures as a natural part of your garden.

Included are zone charts, lists of suppliers of garden tools, new plants, garden journals, and a good index.

This is a broad reference book that will answer and guide the user in creating and maintaining a garden that is not only a pleasure to the eye but also includes the natural world of insects, birds, and the cycle of living things.

Robert S. Russell

The Ants

Bert Holldobler and Edward O. Wilson
Cambridge, MA: Belknap Press/
Harvard University Press
1990, 734 pages, $65

This is an adult book written in a scientific vocabulary by two men who probably know more about ants than anyone in the world. There has been a lot of research since Wheeler did his early work and opened doors to the excitement of ant study. This book by Holldobler and Wilson is an excellent book for a secondary school, college, or teachers' library. A glossary, an index, and a table of contents that breaks down chapters; hundreds of graphs, drawings, and photographs and 12 colored plates make the book usable, understandable, and inviting. Suggestions for study and maintenance of ants invites involvement for science projects and research!

In *The Ants* you will find fascinating information about army ants, honey pot ants, harvester ants, slave making ants, farming ants, weaver ants, Bulls Horn Acacia ants, Pharoah's ants, little black ants, ants from every continent, from every ecosystem but the Poles (with the possible exception of Pharoah's ants that might temporarily travel there and live with occasional explorers). Ants are amazing, mind boggling animals who not only control the sex of their offspring but also their future occupations, who have all kinds of relationships (some extremely small species of ants are ectoparasites on other ants). Some ant colonies are host to a variety of other insects' parasites, some like the Bulls Horn Acacia ants, have a mutually beneficial relationship with a specific plant, keeping it free from destructive Homopterans while they feast on plant exudates made by Acacias and are protected within the hollow thorns. No matter what relationship we may be talking about, we can find at least one example among the world's tens of thousands of ant species.

Helen Ross Russell

Worms Eat My Garbage

Mary Appelhof
illustrated by Mary Frances Fenton
Flower Press
(10332 Shaver Road, Kalamazoo, MI
49002),1982, 100 pages, $8.95 plus $1.50
shipping

I was presented my first herd of earthworms six years ago by someone in my town who, as I understood it, had to board them out while she went away for the summer. I should have known something was awry when she sold me her copy of *Worms Eat My Garbage*.

This little book would answer all my questions about harnessing worms to turn food waste into fertile earth. It is the perfect handbook: informative, well-illustrated, humorous. The moment I looked at the worms and looked at the book I knew I had compelling news, engaging animals and a straightforward system to share with teachers and their students.

Once my benefactor sensed that I had practically adopted her worms, she made it clear that she did not especially want the worms back, but a share of the humus the worms produced would be greatly appreciated. Which is to say, living with worms isn't for everyone. But *Worms Eat My Garbage* is a must for anyone interested in recycling, raising worms for bait, or teaching, learning and wondering about the life of the awesome red wiggler.

Judy Isacoff Thomas

Worms Eat Our Garbage

Classroom Activities for a Better Environment

Mary Appelhof, Mary Frances Fenton
and Barbara Loss Harris
illustrated by Mary Frances Fenton
and Nancy Kostecke
Flower Press
(10332 Shaver Road, Kalamazoo, MI 49002)
1993, 214 pages, $19.95 plus $2.00 shipping

This 8 1/2" x 11" workbook contains about 150 pages of ready-made, single-page worm lessons complete with follow-through in a variety of formats. A dozen charts and record sheets and a diversity of useful background materials will satisfy the appetites of avid vermicomposters and dabblers alike.

Different from Mary Appelhof's first book about worm composting for the general public, *Worms Eat Our Garbage* is an interdisciplinary teaching tool and, as such, presents more than the how-to's of vermiculture. Leading with "The World of Worms," the text, illustrations, and guided observations detail the lives and habitats of wild as well as domestic earthworms and offer exercises that make clear how these worms differ from insect larvae. Scientific inquiry, hands-on mathematics, relevant language, and visual arts are all well represented.

"Worms at Work" structures every aspect of recycling organic waste as an integral school program. From attitude statements to zany drawings, there's something to motivate every learner. The final section, "Beyond the Bin" consolidates and extends the lessons of the first two sections with more puzzles, scrambles, creative writing, question & answer, graphs and design opportunities—quantity and quality assured.

Judy Isacoff Thomas

Born Naked

Farley Mowat
Boston: Houghton Mifflin Co., 1994,
256 pages; $21.95

There are thirty-two books by Farley Mowat listed inside his latest one of this year. This list plus all the literary awards, honorary degrees, medals, and other forms of recognition make for one of the longest columns of biographical notes about one individual in the Canadian book of *Who's Who*. *BORN NAKED* is Mowat's high spirited tale of how it all got started for him in his childhood years.

Mowat chronicles his boyhood, from the beginning in the "sweetest little green canoe that ever was", through a diet of porridge, soda biscuits, and honey until his father switched from bee keeper to librarian, and subsequent moves from Ontario towns to Saskatoon. There is a map inside the cover, so Farley's ventures can be tracked. Never one to be hampered by convention, nor hockey or baseball, Farley was unbelievably free to roam the countryside in all seasons. He was a registered bird bander and self claimed ornithologist by the age of fourteen. He was no "sissy nature kid"; he was serious in his intense passion to be with the birds and beasts he called "the Others". He created the Beaver Club of Amateur Naturalists, kept a pet rattlesnake in a dresser drawer (and raised mice for food in an adjacent drawer), wrote a bird column for the Saskatoon *Star Phoenix*, and collected eggs with a naturalist uncle on a scientific expedition to Hudson Bay. All this and more before his sixteenth birthday and his reluctant move with his parents back to Ontario.

As a memoir of the author's childhood, it is an interesting portrayal of the way things were in the thirties before campers and recreation vehicles, when migrating birds came in countless abundance and owls were varmints to be shot at for fun and bounty. Presumably, for the purpose of a good story, Mowat sometimes condenses the events of a season into a spectacular experience of one day. For example, when the prairie spring broke through in mid-May, Farley and friends (Murray, Bruce, and dogs Mutt and Rex) watched hundreds of whistling swans, ducks, geese and pelicans in great numbers; "a living carpet of shorebirds" near the slough, a marsh wren building a nest in the cattails; and waves of warblers in the leafing poplars. This kind of license with time or sequence need not detract from the awesome experiences being described. Instead, it provides opportunity for reading an author's expression from several perspectives and examining not only the author's intent, but the content too. For readers with poplar trees in their environs, check the sequence of catkins in bloom, leafing out, and catkins dispersing fluffy seed. Mowat tells how he and his camping pals had a great time trying to make angels in the fluffy stuff all over the ground in mid-May, before the leaves were fully out.

Beyond the interesting story of how Mowat's lifelong passion or "the Others" began, this book offers many teachable moments and points of departure for nature study, for conservation, for how attitudes have or have not changed, for a look at how one author has raised environmental awareness about wolves and whales, trapping and killing, or vocabulary building to include western plains words like "bluff" and "slough". Sections of the book would be readable to elementary grades. The collection of whole clutches of eggs for science would make for interesting discussion on definition, purpose, morals, or present regulations, in a biology class. Young naturalists would surely chuckle at Mowat's recollection of the museum he and his friends instigated. And all naturalists will appreciate Mowat's story of his boyhood, the happiest years of his life.

Joy Finlay

Secrets of the Nest,
The Family Life of North American Birds

Written and illustrated by Joan Dunning
Houghton Mifflin Company, New York 1994

This book is not a field guide to bird nests of the United States but rather a broader more reflective and personal view of the tremendous variety of nests, eggs and nesting habit. Its contents would be of interest to even elementary aged audiences, but its excellent descriptive, adventuresome style will intrigue even those not yet initiated into the enriching world of bird watching.

Joan Dunning's book, *Secrets of the Nest*, is a wonderful piece of natural history writing. Dunning easily captures the reader with her beautifully sensitive watercolors and black and white sketches. Each descriptive chapter reveals new and fascinating secrets of the diverse habits and evolutionary solutions that assure the successful survival of the next generation of each species. Her writing is like experiencing a personal field trip guided by an enthusiastic, informative and gifted leader.

Betty J. McKnight

❑

Naturalist's Notebook

Endangered Butterflies

SCHAUS SWALLOWTAIL. Named for a medical doctor who discovered it near Miami in 1898, Schaus Swallowtail soon disappeared and was considered extinct until rediscovered in 1935 on Lower Matecumbe Key. Its specialized habitat – wild hardwood hammocks where its larva feeds on wild lime and torchwood – is threatened by development.

REGAL FRITILLARY. Once fairly common, ranging from Maine to South Dakota and southward to Arkansas and Georgia, this beautiful species has disappeared completely over much of its former territory because of destruction of its natural prairieland habitat. Its larva feeds on violets.

FLORIDA ATALA. Distinguished by velvety black wings with green (male) or blue (female) spots, brick-red abdomen and hind wing patch, the Atala was believed to be extinct in the 1960's because of destruction of its larval food plant – palmlike coontie – and its hardwood hammock habitat. It has reappeared in recent years however, and is making a modest comeback.

MISSION BLUE BUTTERFLY. A subspecies of a little blue butterfly found in many western states, the mission blue survives only in several small and isolated populations in the Twin Peaks area of San Francisco peninsula, where its larva feeds on wild lupine. It is endangered because of destruction of its specialized habitat by development. Many other North American butterflies face extinction for the same reason.

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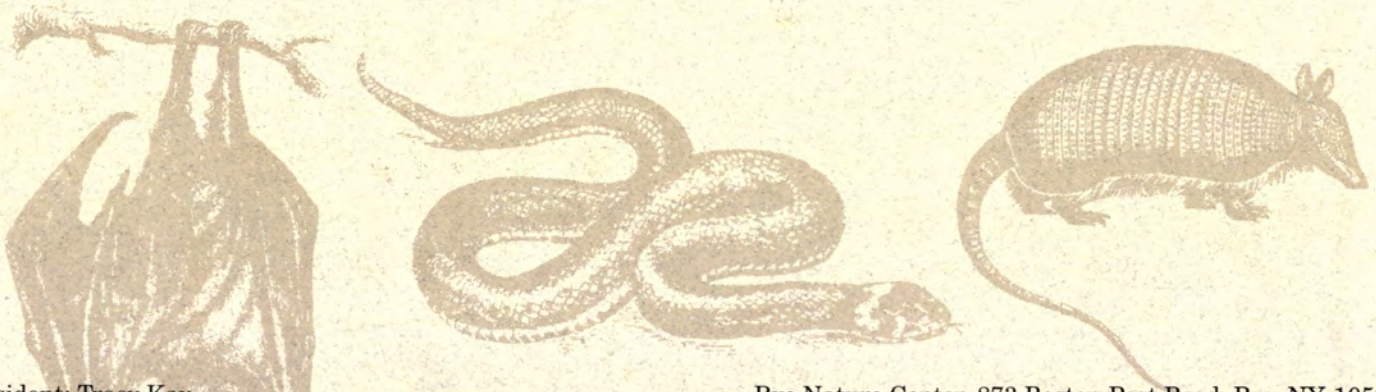

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