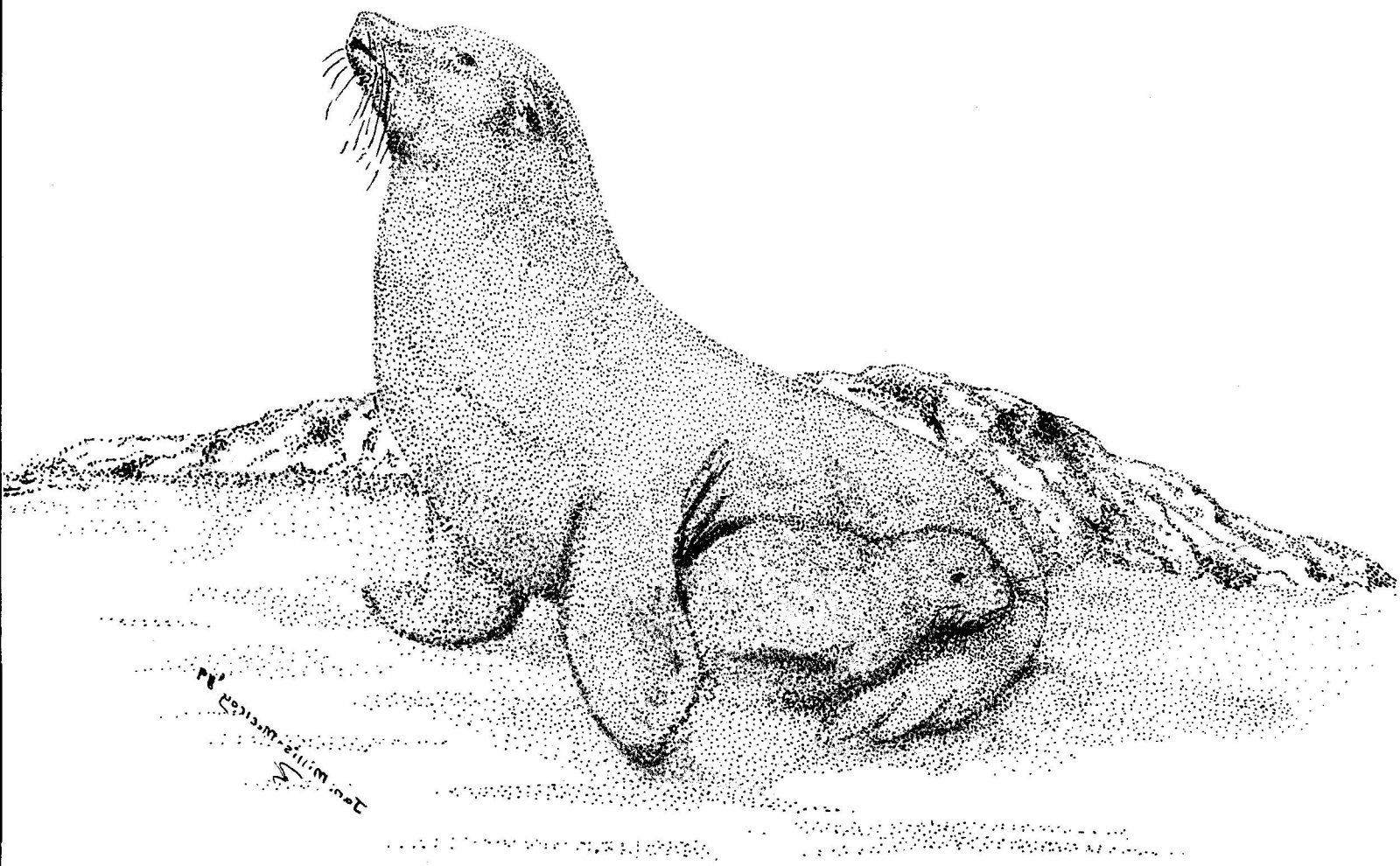
Winter 1989 Vol. 12 No. 2

WILDLIFE JOURNAL

Journal of the International Wildlife Rehabilitation Council



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"BEYOND A BIRD IN THE HAND"

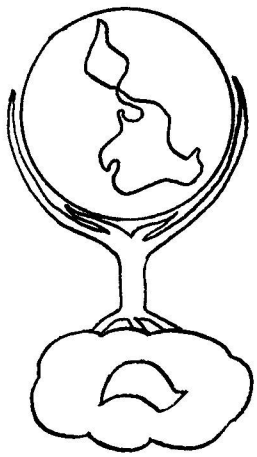
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The Partnership of Wildlife Rehabilitation and Conservation Education

International Wildlife Rehabilitation Council

Conference, 1990

Washington, D.C. October 19-21st



Papers are in the works on:
*Raccoon, Deer, Javelina, Fox, Bobcat, Otter
*Goldfinch, Roadrunner, and Dove
*Avian Hematology and Clinical Pathology
*1989 Alaskan Oil Spill: Short & Long-term Effects
*Reptiles and Their Rehabilitation
*The Expanding Need for New Sources of Funds
*The Ever-Present Problems of Day to Day Operation

The Conference Committee would like to expand the focus on a subject only peripherally covered before — Conservation Education.

§ When people leave an animal with you, do they leave your facility committed to preserving the habitat that supports animal life?

§ How, within your limited time frame, do you impress upon people that, more important than the grebe or warbler they have brought you is the preservation of the wetlands or tropical forest that species **must** have to survive?

§ If you have the answer to these questions, we want to hear from you! You may contact the IWRC Conference Chair, Jonolyn McCusker at 11631 E. Calle Javelina, Tucson, AZ 85748 (602) 296-5920 or call our national office (707) 428-4972 for further information. If you don't have the answers, but have suggestions or questions, we still want to hear from you!

WILDLIFE JOURNAL

Summer 1989 Vol. 12, No. 2

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Cover drawing courtesy of Jan Millis McElroy.

The *Wildlife Journal* is designed so you can use a 3-hole punch and store back issues in a binder for easy reference.

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Editorial . . .

The Odyssey Continues . . .

In the Spring *Wildlife Journal*, I began reporting on the things I had learned in my recent travels to wildlife rehabilitation programs in Minnesota, Missouri, Massachusetts, New Hampshire and Florida. I will continue sharing my experiences in this issue.

In late February, I began a three week rotation at Tufts Veterinary School (Grafton, MA), where I took care of a Big Brown Bat, a young Porcupine with a fractured radius and ulna, a Red-tailed Hawk with brain damage, a Great Horned Owl with a fractured humerus, and an assortment of critters with other maladies. While there I learned how to place an intramedulary (IM) pin in the coracoid and other decidedly medical skills-but it was the simple things that I really appreciated. I had never housed and fed a bat on a long-term basis before. In California, where I have a wildlife care facility, bats are a major vector of rabies and are not safe to rehabilitate. This bat had been prematurely awakened in late winter and the weather was too cold to release it. We housed it in a reptile cage complete with a slab of bark to hang on and kept it at about 70 F. I learned about normal bat behavior and vocalizations from observing it. I learned how to get it to eat in captivity and what to feed it. We basically teased it with a crushed, wiggling mealworm on a long set of hemostats. I quickly learned that if the bat wanted to eat, I had to keep the worms coming one after another as it ate in a sort of "feeding frenzy" and once that was interrupted, it refused food until it was hungry again. It ate 7-15 mealworms a day, so I would line up the mealies, crunch their heads, dip them in water and vitamins, and keep them entering its mouth like logs in a saw mill. Using this system, we were able to maintain its weight and keep it until spring came to the east coast.

I learned from Dr. Charles Sedgwick how to calculate drug dosages based on an animal's metabolic rate, i.e., allometric scaling. He even showed me how to project the normal heart rate and other physiological data based on the same concepts. It was a new tool for me that we could use in our efforts to save wildlife.

The porcupine was definitely my favorite. It had lost one eye and broken the opposite leg. It was incredibly tolerant of the students and even allowed for carefully executed radiographs without the use of anesthesia.

On two occasions I traveled north to New Hampshire to visit with Loretta Torsey at the Wings of the Dawn Sanctuary. While there I saw first-hand the damage porcupine quills can do to a predator. She had a Great Horned Owl that came into her center with many quills in its mouth and throat. The veterinarian anesthetized it and chased after those quills attempting to remove them. About 10 days later, the bird died suddenly and when Loretta necropsied the carcass, she found more quills - one of which had gone right through the heart! Apparently, they migrate much like the foxtail awn seen as a foreign body on the West Coast, which enters and leaves a path of destruction through the animal.

One of the things that struck me about working so far north was a basic working condition: temperature. Each morning, we would take fresh water out to the outside animals only to find it frozen solid in 2 hours. That was a new experience for this California rehabilitator!

In mid-March, Jay Holcomb, IWRC President, and I converged in St. Louis for the annual board meeting of the NWRA. While there we went out to the Missouri Wildlife Rescue and saw the new site for their facility

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San Miguel Sea Lion Virus

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IWRC Associate Editor
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Introduction

San Miguel Sea Lion Virus (SMSV) was first isolated in 1972 from California Sea Lions (*Zalophus californianus)* at one of their rookeries in the Channel Islands off the southern California coast. An extensive research project had begun to determine the cause of an increasing incidence of premature parturition among this population. These premature pups were often born alive but suffered from respiratory and locomotor difficulties and eventually died. Various possible causes were found in the pups and their mothers, including organochlorine pollutants, a Leptospirochete bacteria (*Leptospira interrogans* var. *pomona*) and finally, SMSV. This constituted the first isolation of a virus from a pinniped species and only the second isolation of a virus from a marine mammal (the first being an enterovirus isolated from a California Gray Whale). In addition, its physiochemical make up and morphology was similar to the agent causing Vesicular Exanthema of Swine (VES). All of these findings stimulated considerable speculation and research into the epizootiologic relationship of the two viruses. SMSV also became the first virus from a marine mammal that was capable of producing disease in a terrestrial mammal.

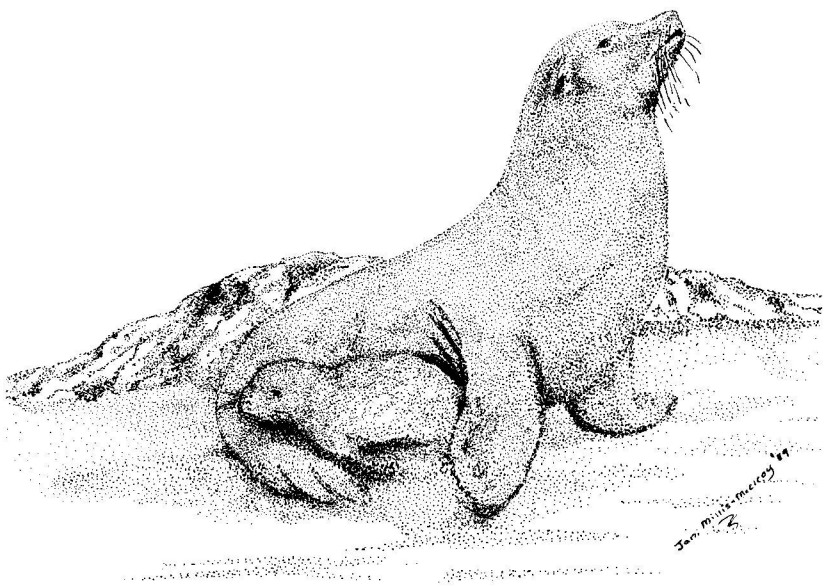
Etiologic Agent

SMSV and VES are both Picornaviruses, in the same family of viruses as foot-and-mouth disease (FMD) and swine vesicular disease (SVD). Each of these causes vesicular lesions in swine that are indistinguishable from each other. SMSV and VES are further classified into the genus *Calicivirus*, whose members are characterized by the calyces or cup-like structures on their surface, as well as other unique properties. They are non-enveloped, single-stranded RNA viruses, 35-40 nm in diameter.

Both SMSV and VES have many distinct antigenic variants or serotypes; SMSV has 13 so far, and VES has 19. Besides California Sea Lions, SMSV has been isolated from the Northern Fur Seal *(Callorhinus ursinus),* Northern Elephant Seal *(Mirounga angustirostris),* Pacific Walrus *(Odobenus rosmarus divergens)*, and Steller Sea Lion *(Eumetopias jubatus).*

Pathology

The clinical signs in pinnipeds that have been attributed to SMSV are typically vesicular lesions on the flippers of California Sea Lions and Northern Fur Seals, although there are usually no signs at all.



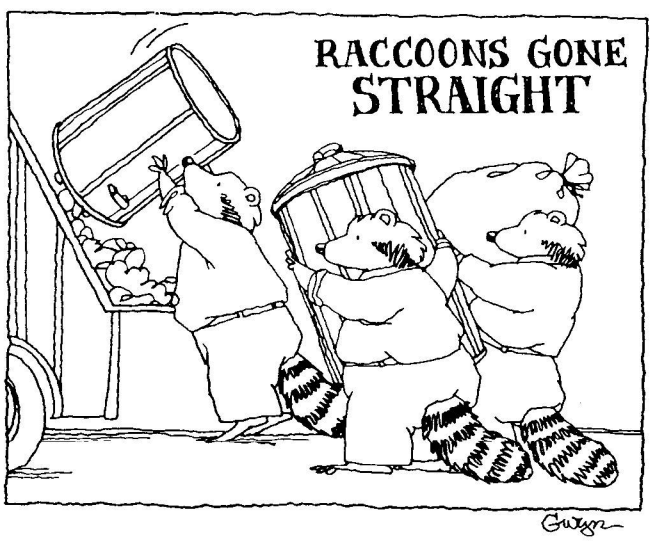
Other findings that are associated with SMSV infection are premature parturition and abortion in California Sea Lions. This differs from swine where fevers were seen in experimentally infected animals.

Findings on necropsy have included focal hepatic necrosis, interstitial pneumonitis and mild encephalitis. The virus has been isolated from the throat, rectum, lymph nodes, liver, pancreas and spleen, as well as from the flipper vesicles.

Epizootiology

At first, the source of SMSV appeared to be the California Sea Lion because this species possesses eight of the 13 serotypes of the virus and they spend a substantial portion of their life on land, thus forming a natural bridge between the land and sea. It was later discovered that several species of terrestrial mammals, including swine, foxes, sheep, donkeys, and buffalo living wild on the Channel Islands also have serologic evidence of infection with SMSV. Researchers then argued that the population of sea lions living in this area (less than 100,000) is too small to produce and maintain such a large number of SMSV serotypes. Furthermore, males from this population migrate northward along the coast to the islands of British Columbia and yet the first 20 years of outbreaks of Vesicular Exanthema of Swine (VES) were confined to California.

A more likely reservoir of the virus was discovered in 1976 with the isolation of a new serotype of SMSV from Opaleye fish *(Girella nigricans)*, also called the Blue-eyed Perch or the Catalina Perch. This species is found in shallow California waters with rocky bottoms and kelp beds. Interestingly, their habitat lies almost entirely within the breeding range of the California Sea Lion, one of their natural predators. In addition, Opaleye fish are the intermediate hosts for the sea lion lungworm (*Parafilaroides decorus*), acquiring the infection by ingesting sea lion feces containing the lungworm larvae. It has been postulated that these lungworm larvae may actually be carrying the virus between the sea lion and the fish. Experimental evidence has shown this to be a possibility, although experimental infection of the virus has also been passed to sea lions from Opaleyes containing the virus but not the parasite larvae.



Opaleye also make a likely reservoir because: 1) experimental infection of their isolate caused disease in swine identical to VES, 2) they are geographically limited to those same regions where the majority of the California outbreaks of VES occurred, and 3) raw fish scraps were a much more common feed for swine than was sea lion meat. Furthermore, Opaleye live for at least 10 years and lungworm larvae may remain encysted and viable in their gut wall for most of this time, waiting for the fish to be eaten by a sea lion. Thus, the fish has a long time to accumulate lots of encysted larvae infected with various serotypes of SMSV.

Until recently, it was believed that SMSV was not enzootic to marine mammal populations living in the far northern waters. It was assumed that viruses isolated from Northern Fur Seals in the Pribilof Islands had been carried there by the few fur seals that migrate from the Channel Islands where they may have interacted with California Sea Lions. It was believed that these infections were transient epizootics and that the virus could not overwinter in the Bering Sea populations due to a lack of suitable hosts or viable transmission cycles. Then in 1977, a new calicivirus was isolated from walrus feces in the Chukchi Sea. The fact that walruses do not naturally come into contact with Northern Fur Seals, nor do they share feeding habits, suggests the existence of an as yet unknown calicivirus reservoir in northern waters.

Most recently, antibodies to seven serotypes of SMSV were discovered in Steller Sea Lions in Alaska, although there were no clinical signs. This is significant due to the wide distribution of this species. Steller Sea Lion populations are in the northern Pacific rim which overlaps with the Northern Fur Seal population around the Aleutians and Pribilof Islands and with the California Sea Lions along the coast of California. There are two questions that remain unanswered. First, is there a relationship between the Steller Sea Lion and its prey and/or parasites that is analogous to that in the California Sea Lion? And secondly, is the infection in Steller Sea Lions main-

tained exclusively by intraspecies or interspecies transmission among pinnipeds?

Relationship to Vesicular Exanthema of Swine (VES)

VES first appeared in 1931 in Orange County, California and the 19,000 pigs involved were slaughtered according to foot-and-mouth disease protocol for that was the initial diagnosis. It next appeared one year later in San Diego County, and was contained, only to reappear in northern California the following year. The origin of the etiologic agent was never discovered, but the one common factor in each outbreak was the practice of feeding uncooked garbage to the swine. This garbage was often obtained from restaurants, some of which were known to serve seafood. Some swine may have even been fed sea lion carcasses that had been shot by fishermen who thought the sea lions were interfering with fishing operations.

Following the discovery of SMSV in California in 1972, and the numerous studies that were stimulated, several lines of evidence began to emerge which suggested that these calicivirus serotypes circulating in southern California coastal water in the 1930's constituted the origin of VES. This evidence included: 1) the close physical, chemical and biological similarities between SMSV and VES, 2) the confinement of VES for so many years to California, 3) the presence of colonies of SMSV-infected pinnipeds at various locations along the California coast, 4) the occurrence of vesiculation and abortion in pinnipeds infected with SMSV, 5) the production of vesicular lesions in pigs inoculated with SMSV, 6) the occurrence of natural spread of SMSV from swine inoculated with SMSV to contact swine, 7) the occurrence of a natural infection of SMSV in a domestic swine herd (in Sonoma County, California) and 8) the once relatively common practice of feeding uncooked marine products to swine.

Conclusion

In the last 25 years, it has become apparent that the caliciviruses are far from species-specific, as once believed. Interspecies transmission of a marine calicivirus is now generally believed to be responsible for outbreaks of VES earlier this century and the variety of susceptible host species is clearly broadening. Of great interest is the potential for infectivity to humans as serum neutralizing antibodies to SMSV have been detected in several laboratory researchers who have worked extensively with SMSV. Three different isolates have produced vesicular lesions in African Green Monkeys, and a new calicivirus serotype has been isolated from five species of primates (Pygmy Chimpanzee, Lowland Gorilla, Spider Monkey, Douc Langur, and Silver Leaf Langur) at the San Diego Zoo in California.

It is important to further understand the complex interrelationships between SMSV and VES and their various host species so that accidental spread of the disease to unadapted species, including humans, can be prevented.

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Old Address Ends for IWRC

As of August 31, 1989, the old mailing address for IWRCis no longer valid. We have had the P.O. Box 3007 in Walnut Creek, California for about 15 years but have given it upas of the end August. We have a centralized office in Suisun, California that has been in operation for 18 months and hope that everyone knows that address. It is 1171 Kellogg St., Suisun, CA 94585.

Membership Changes for the IWRC

Jan White, Executive Director

At the May 20th, 1989 board meeting, the IWRC Board of Directors reviewed the existing membership program and made some changes we think will benefit our members and our programs. We have been growing steadily over the last 15 years and we have noticed that the membership program does not fit the people it serves as well as we would like. We hope the membership will like the new structure.

We have retained our **basic individual membership** for individuals who wish to be members. This category is intended for people who are actively working in the field of wildlife rehabilitation in administration, conservation, management, education, research, humane work, or veterinary or allied professional practice. Each individual member has voting privileges, receives the *Wildlife Journal* quarterly, and is eligible for discounts on IWRC literature and events.

However, we now have so many more opportunities on a national level for training and conferences that we have added a **family membership** to include spouses/significant others living in the same household. Both adults will now be able to get conference and skills seminar discounts at events instead of just the individual member. Each household will still receive one *Wildlife Journal* quarterly and one annual ballot for elections. Both members can purchase literature at member discount rates.

We have retained an **organizational/institutional membership** which is open to non-profit corporations or public agencies affiliated with a branch of local, state, or federal government actively supporting or operating wildlife rehabilitation programs. One representative from the organization is authorized discounts for literature sales, IWRC events, and receives one *Wildlife Journal* quarterly and one annual ballot for elections. Additionally, organizations are listed separately in the IWRC Membership Directory. It should be noted that people joining as individuals **cannot** be listed as an organization in the directory. Additionally, organizations can send **two** representatives to IWRC events at their authorized discount—other volunteers and staff must be members separately to receive membership discounts.

We now have a new **affiliate/corporate membership** for businesses or foundations that are not actively involved in wildlife rehabilitation but wish to provide financial support for IWRC programs. This is a non-voting category but these members do receive the *Wildlife Journal* quarterly if they desire. Since they are not active in the field, they do not receive membership discounts on literature sales or IWRC events.

We have on-line now a new membership computer system that will allow us much better access to current information on members. We thank all of our members for their patience during this time of transition. Now with the new system, we can issue our Membership Directory which we hope to have to you soon. We will be able to better track the membership types and benefits as well as handle more efficiently our membership inquiries. Questions regarding memberships should be directed to our national office at (707) 428-IWRC.

On the East Coast, Dianne Pearce at the Chesapeake Wildlife Sanctuary, has been coordinating our outreach efforts to new people and has on her computer system many of the licensed rehabilitators who are not yet IWRC members. Her system is utilized for direct mail efforts for membership and our conferences. We thank her and her staff for the many long hours they have devoted to this important effort. Our plan is to attempt to merge the systems (IBM and Macintosh) sometime soon so we can have the two lists interacting as people join. In the meantime, if you get two conference notices, it is because these systems are not yet integrated.

We are continually trying to serve our members. We are challenged by the number of faithful members as well as all the new people who are joining. Over the last two years we have centralized our activities in our new national office and cut the handling time for literature sales in half. With the new membership system, we expect membership handling will be much faster as well. As funds allow, we will continue to seek ways of serving our members more efficiently and to add new services. Your comments and suggestions are always appreciated.

Rehabilitation Notes:

Rehabilitation Notes: House Finch (*Carpodacus mexicanus*)

Ed Shaw, BA
Karen Gardiner
Suisun Marsh Natural History Association
Suisun, California

Introduction

The common House Finch (*Carpodacus mexicanus*) is found predominantly in the western United States from Nebraska and Oklahoma to California. In 1940, this bird was shipped illegally to the East Coast as the so-called "Hollywood Finch" by southern California cage bird dealers. When the US Fish and Wildlife officials stepped in, many of these birds were released, and thus began a wild population which is rapidly spreading throughout the eastern United States.

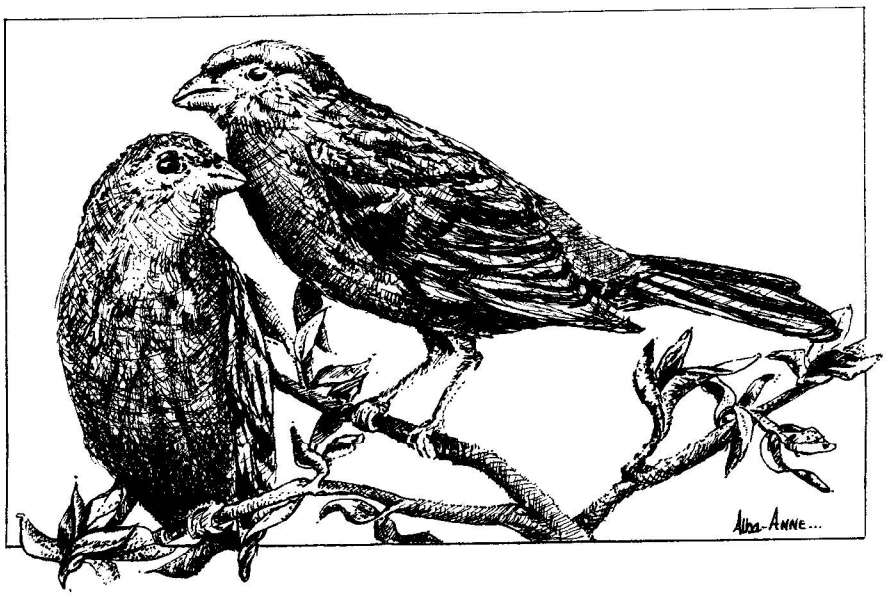
The House Finch is adaptable to many different types of habitats. They are abundant in farmlands, oak scrub forests, and marsh lands, as well as along highways, and around buildings and homes in urban areas, especially where water is available. Before the onset of winter, about October, the finches will flock together and can be seen feeding in large numbers on plowed fields and residential lawns.

Some other names by which the House Finch may be known are the Burion, Crimson-fronted Finch, Guadalupe House Finch, McGregor's House Finch, Mexican House Finch, red-head, and the red-headed Linnet. Some of these names demonstrate the vastness of this bird's range.

The House Finch is very commonly presented to the wildlife rehabilitator as a nestling as a result of having fallen from the nest or as a whole nest since they sometimes nest in fairly low, accessible places. As fledglings, they are often caught by cats, and thus present a more serious problem to the rehabilitator.

Description

Adults: The adult male House Finch has brown upper parts, with a bright red crown, breast and rump. They are often confused with the deeper red colored Purple Finch (*Carpodacus purpureus*), but these lack the striped flanks of the House Finch. The female is gray-brown above, whitish and striped below. Both are about 5 to 5 3/4 inches long with a 5 1/2 to 6 inch wing span.



Weight ranges from 20-25 grams.

Juveniles: At this age they resemble the adult female in coloration, having her somewhat mottled, striped breast. They have small gape flanges at the corners of their mouths. The inside of the mouth is bright red.

The average life span is seven to eight years (Terres, 1980), however one banded female, released in Pomona, California was trapped and released in Sacramento, California, 10 years, 10 months later.

Natural Diet

The primary diet of the House Finch is about 86% seeds, the rest being insect matter. The seeds are typically those of shrubs, sedges and forbs such as Dandelion (*Taraxacum vulgare*), Curly Dock (*Rumex crispus*), Sweet Fennel (*Foeniculum vulgare*), Bull Thistle (*Cirsium lanceolatum*), and many others available at various seasons and locations. Where available, these birds can be found feeding on the fruits of cactus, and the blossoms and buds of some plants including those of many fruit trees. The insects eaten are aphids, small spiders, and various small flying insects.

Nesting and Young

The breeding season begins in February in the southern part of the range and spans throughout the summer until about August. The breakup of the large winter flock signals the beginning of the breeding season. The male's red coloration deepens, and his courtship ritual involves following the female, fluttering his wings, and singing a flowing, warbling song.

Nests are built by the female utilizing various materials such as grasses, small twigs, hair, string, cotton and wool fibers. She generally chooses a location approximately five to seven feet from the ground, although this can vary considerably. The female seeks such places as the abandoned nests of towhees, orioles, phoebes, in the dense outer foliage of trees and shrubs, and in the hidden crevices of buildings and houses. They may nest singly or in groups of five or more nests in one tree.

Finches may have one or two broods a year, depending on their location, with climate being a major determining factor. Between two and six eggs are laid, with four or five being the usual clutch size. The eggs are blue with white speckles and are incubated solely by the female, while being fed by the male, for a period of 12 to 16 days. The newly hatched finch is completely bald except for a few tufts of down on his head and back. Weighing only about one gram, he is totally dependent on his parents for care and feeding, which is shared by both the male and female. The young are fed regurgitated dandelion seed and insects throughout the day. The authors observed a combined total of 37 visits by the male and female to their nest of three young, in a span of eight hours. The young House Finch is ready to fledge at between 11 and 19 days, with an approximate weight of 18-20 grams.

Nestling Care

For the first seven days a small plastic laundry-type basket (10 x 14 inches) with a fine screen top works well as housing if no incubator is available. (See the *Wildlife Journal* Winter 1988 "Songbird Housing" article for details on this type of housing.) A small plastic butter tub lined with tissue can be used to simulate the nest. Heat and humidity are essential for the young nestling's survival. One method of providing these essentials is to place a heating pad on a low to medium setting (depending on the ambient air temperature and the amount of padding between the pad and the nestlings). Temperature should range between 85 and 90 F. A small bowl containing a moistened sponge should be placed in the basket to provide adequate humidity. Incubators generally have water bins inside them that can be filled periodically to provide humidity.

Feedings should start in early morning and continue throughout the day, every 15 to 30 minutes for 14 hours daily. The crops should be filled, allowed to empty, and then refilled. This species is known to gape even when its crop is so full one can see food in the back of the throat.

It is also essential to keep the birds clean and free of food or fecal matter, as this ruins their feather structure, and can predispose them to bacterial infections. This can be accomplished by wiping feathers with a wet Q-tip™.

Although this species of bird has been successfully raised on a variety of diets, the one discussed in this paper is the one used to develop the growth chart (Figure 1). For hatchlings to the age of seven days, the diet is a liquid mixture that consists of one cup moistened Science Diet (Canine Growth Formula), two cups water, 1 cc Avitron (bird vitamins) and 2 cc's of vitamin B complex. This is blended together to form a pancake batter-like consistency. This mixture is fed to the baby through a 1 cc syringe, at the end of which is attached the base portion of a small red rubber catheter which has been cut to 3/4 of an inch in length. This allows for clean administration of the tube mixture, as the finch's mouth is quite small and box shaped. Although they generally gape quite readily, the feedings can otherwise be quite messy. Remember, a clean bird is a healthy bird. Please note that moistened foods with grain components at warm summer temperatures will ferment quickly. Store in the refrigerator and take out small portions to be used within two to four hours.

At eight to ten days of age, the birds have partially developed

their feathers. The ambient temperature can now be lowered to room temperature (70 F) as the birds can thermoregulate in this range. Attention to cold temperature is important in areas where night temperatures are low.

At this age, the consistency of the tube mix should be slightly thicker. This can be accomplished by simply reducing the amount of water in the mix by one-half cup (i.e., 1 1/2 c.). This increases the Kcal per cc of mixture fed and is consistent with the growing bird's increased need for calories and decreased need for water. Small pieces of moistened Science Diet (Canine Growth Formula) can be hand fed periodically using tweezers or hemostats. Feedings should be given every 20-30 minutes for at least 14 hours daily.

Fledgling Care

At 12 to 14 days of age, the birds should be almost fully feathered, and they can be moved into a regular finch-type cage. Tube mix should gradually be replaced as their food source with moistened Science Diet (Canine Growth Formula), which should be hand fed and offered at all times in the cage for self-feeding. The food tends to dry out in a warm environment and water is added to keep the food a spongy consistency. When pressed, water should exude from the piece of dog food. Food should be changed completely at least twice daily, depending on the ambient air temperature.

Enticing them to take pieces of the food from tweezers, rather than actually placing it in their gaping beaks, will encourage them to self-feed. This is often a frustrating process which requires patience by the rehabilitator. It is especially hard when the bird is initially presented for care while at this age. They literally throw food out of their mouths when initial attempts to feed them are made. One may have to use a syringe and catheter and feed as if presented at a younger age until the bird has adjusted to the fact that it is being fed by a new system. Careful weights taken daily are an important guide to whether the bird is getting enough food. This is the age that many die in captivity. It is especially hard to have patience with these birds if they are in a room with species who eat more eagerly. These birds often appear to the new rehabilitator to eagerly attempt eating, but upon examination, will have lost a substantial amount of food to the cage floor and will have empty crops and decreasing weights. Careful attention to this situation will yield a much better result.

Seeds can now be added to the diet and are simply mixed into the food. Commercial finch mix works well, but placing natural food plants in the cage will enhance the self-feeding process. The frequency of hand feedings should be gradually reduced until self-feeding is achieved. Daily weighing will assist the rehabilitator in spotting those birds who are not getting enough food at this critical transition time. Fine gravel to aid digestion, and natural shrubbery to simulate their natural habitat can be introduced into the cage. This allows the birds to practice some of their innate feeding behaviors before they are released to the wild and gives them areas of cover to take refuge from human activities.

Once it is clear that the birds are self-feeding, they should be moved into outside cages to acclimate them to natural conditions. Once again, these cages should contain gravel, shrubbery, preferably more than one type of natural food item, moistened Science Diet and seeds. The seeds can be separate from the moist food at this time so they are preserved and do not have to be changed so often. Moistened Science Diet should still be changed at least twice daily depending on the ambient air temperatures as it, like most other wet foods with grain components, will ferment.

Often at this time, rehabilitators will place various species of small birds in flight aviaries. Care should be exercised so that risk to the birds is minimized. English Sparrows have been observed to peck at the toes of the House Finches and can cause substantial damage to the birds. Larger birds can bully or injure the smaller ones and thus mixing of species should be done with caution and supervision.

Water should be placed in a shallow pan (e.g., pie pan) to allow the birds an opportunity to bathe and to encourage preening. This will help waterproof the birds prior to release. It will also give them an option to cool off and/or drink water if subjected to warm summer days.

While outside, contact with humans should be reduced to a minimum. This is the time the bonds between the rehabilitator and the bird are really broken. They should, after a few days, fly away from humans entering their enclosure. They should be exposed more to natural sounds and have reduced human-associated sounds. Usually 7-10 days outside will give the bird adequate time to acclimate to outside temperatures and to socialize appropriately to their own species in the absence of humans.

Release

Several factors should be taken into account when considering release. The birds should be at least three weeks of age and self-feeding with a minimum weight of 18 grams. Their feathers should be clean, in good condition, and fully waterproofed. Their hemogram should reveal a packed cell volume of 45-50% with total proteins (by refractometer) of 2.5-4.9 g/dl.

When choosing a release site, there should be an abundant food and water supply, as well as other members of their species. These are diurnal birds, so they should be released early in the day, when good weather prevails.

Diseases

There are several endoparasites known to affect the House Finch. Some of the more common are coccidiosis, trichomoniasis, *Haemoproteus*, *Plasmodium*, gapeworm (*Syngamus trachea*), *Capillaria*, and tapeworms.

The general physical condition of the bird will be the likely determinant of whether some of these parasites will be pathogenic and as a result, require treatment. Others are very pathogenic, and are probably the cause of the bird's arrival at the rehabilitation center.

When deemed necessary, the stomach worm, *Capillaria*, can be treated with piperazine, administered orally at the rate of 100-500 mg/Kg in a single dose, with a repeat treatment in two weeks (Harrison, 1986). There has yet been no effective treatment found for the blood parasite *Haemoproteus*, but like *Capillaria*, it is generally non-pathogenic in finches. (Wynne, 1989)

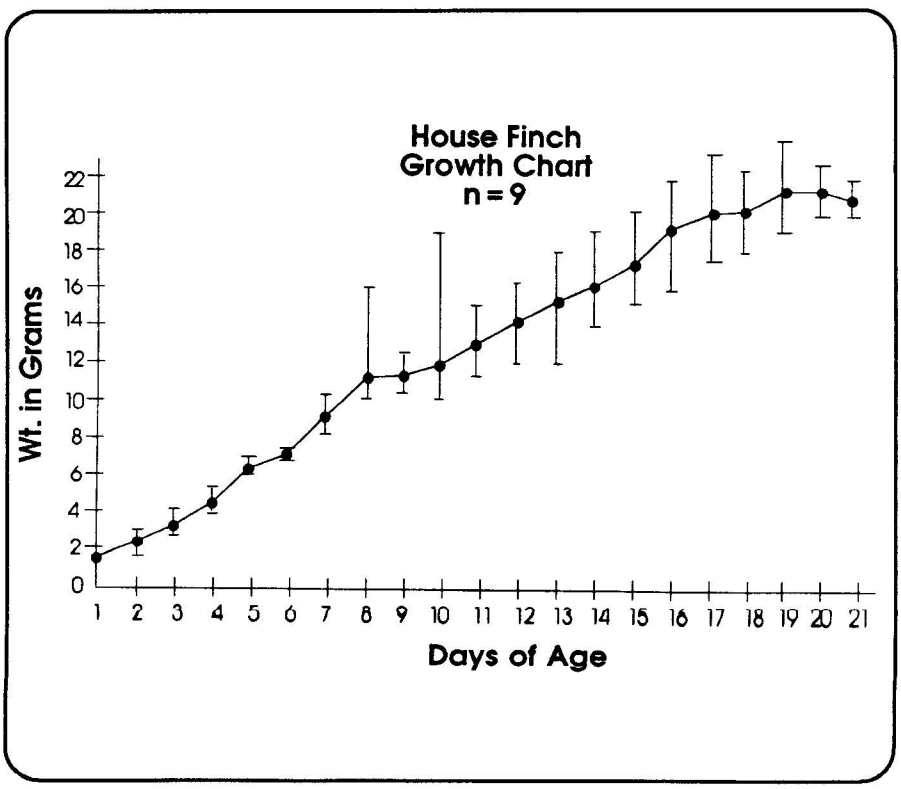
Weight loss, uncontrolled tremors, and anemia are often signs of *Plasmodium* infection, a blood parasite. The organism stains readily on blood smears with Wright's stain. Treatment is difficult as the only drugs know to be at all successful are chloroquinine drugs, and these are quite toxic to the animal, especially when overdosed. Dosing a 12-20 g bird can be difficult when the theraputic range and the toxic range are so close. Dosages given in larger species are discussed by Wynne (1988).

Coccidia are protozoa which affect the intestinal tracts of a great number of species, both avian and mammal. Signs of coccidiosis in birds include a greenish runny stool, severe weight loss, and signs of central nervous system damage. Coccidiosis can be fatal if untreated, but can be detected by direct fecal smears or fecal flotations. The treatment used involves a coccidiostat such as Albon™ (Sulfadimethoxine 5%). Our birds have been treated when necessary with a dose of 55 mg/kg given once as a loading dose and then followed once daily at a dose of 27.5 mg/Kg for five days.

Trichomoniasis is a common protozoan disease which is often contracted from other birds at feeders or from using the same feeding implement and going from bird to bird in a rehabilitation setting. It affects the mouth and crop, causing obstructions. Signs include whitish, plaque-like lesions in the mouth, a swollen crop, and weight loss. Flagyl™ (Metronidazole) is given at a dose of 30-50 mg/Kg twice daily for five days. The problem in the United States with this drug is the liquid suspension is not available (we acquire ours from Mexico) and breaking the pills down can be inexact. Other rehabilitators have used the IV solution (Lypho Med Inc.™) given orally (Shimmel, 1989).

The nematode known as gapeworm (Syngamus trachea), which attaches itself to the trachea in birds, is much less common in finches and other seed eaters than in insect- and worm-eating birds, because the insects and worms are secondary hosts to the nematodes. Only one finch presented for rehabilitation in the past five years has been diagnosed with gapeworm at our facility.

Tapeworms, like the gapeworm, are less common in finches than in insect eaters, however, due to the fact that young finches are fed insects by their parents, there are occasions when the rehabilitator will encounter a finch infected by tapeworm. Signs range from general debilitation to severe diarrhea. The bird may appear to be eating a healthy quantity of food, but continues to lose weight. A fecal flotation can be used to diagnose the presence of these worms. Worm segments may be demonstrated by direct examination of feces in some cases. Treatment orally with Yomesan™ given once and repeated in 10-14 days usually is quite successful.



Special Problems

Although the House Finch is in general a fairly easy bird to care for, some problems do present themselves. Quite often the nestling arriving for care is cold and dehydrated. This occurs as a result of having fallen from the nest and remaining uncared for over a period of time. Dehydration can be easily detected in young birds by gently blowing the feathers up away from their ventral abdomen and observing the skin in this area for wrinkles. When hydrated, their skin is smooth and when dehydrated they have deep wrinkles.

To rehydrate the baby, administer 10% of its body weight of slightly warmed Lactated Ringers solution subcutaneously. The reader is referred to the article by Janna Wynne (1988) for details on this procedure in fledgling song birds. Place the baby in an incubator or over a heating pad as described under nestling care. Ambient temperature should be 85 to 90 F. Small amounts of Lactated Ringer's solution (make the mix runny) can be added to the first two feedings to complete the rehydration process. Once hydrated and warm, it will be much more likely to take food willingly. Feeding dehydrated birds anything but very watery food is contraindicated until hydrated. However, once hydrated, they must be switched over to higher calorie food mixes or they will fail to thrive.

Another problem, which presents itself during the weaning process, is teaching self-feeding to the fledglings. They often reach a point in which they refuse to accept hand feedings, and at the same time are unwilling, or unknowledgeable, about self-feeding. Weight loss will inevitably occur, and the weights should be monitored closely. If too much weight loss occurs, supplemental syringe feedings, as previously described may be necessary. The sooner self-feeding can be taught, the less likely this problem seems to occur. Always keep moistened kibble and seeds in the cage, and whenever hand feeding, show them where the food is coming from. Patience is required to be successful in this endeavor.

Birds that fledge in the wild are quite often the victims of cats or dogs. Those that survive the initial attack and are presented for rehabilitation are not only wounded, but have been inoculated with bacteria from the mouth of the predator. We have tried various methods of treatment for these birds. By the time we can culture an organism, the bird will have usually died from infection. Often the culprit bacteria is *Pseudomonas* which is refractory to numerous antibiotics.

Working on a herd health basis, we have established a protocol with our veterinarian to stabilize these injured birds with dexamethasone (1 mg/lb) as needed, and Lactated Ringer's™ subcutaneously (10% of body weight) and begin the bird on amikacin at a dose of 5 mg/Kg. We make a stock bottle of dilute solution that is 2.5 mg/ml (it is sold at 50 mg/ml). Since amikacin is an aminoglycoside and is nephrotoxic, we always supplement these birds with 5% of their body weight in Lactated Ringer's subcutaneously daily. This helps to keep the drug concentration from building up in the kidney where damage can occur. The birds are kept on this drug for four to five days and they are usually well enough to discontinue it at that time. Should this not be the case, a uric acid test for kidney function should be performed or consideration given to changing to another antibiotic. We noticed that our survival rate on these birds was much improved when we changed to this protocol. Even at that, a loss rate of 40% in the first 24 hours is still likely. After the first 24 hours, the odds improve steadily for the bird, provided the injuries it sustained are reparable.

Summary

Raising wild finches can be frustrating, exciting, disappointing, and, upon witnessing their release, very rewarding. If you have patience and work diligently, it can be done.

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Table 1. Percentage Composition of Some Seed Utilized by Finches

Diet Table	Moisture	Protein	Fat	Fiber	Ash	N.F.E
Common Millet	8.93	12.77	3.27	8.95	3.78	62.30
Spray Millet	11.76	14.50	5.56	11.24	5.50	51.44
Milo	12.36	12.11	3.63	2.39	1.43	68.08
Buckwheat	12.62	10.02	2.24	8.67	2.02	64.43
Rape Seed	7.30	19.54	45.00	5.95	4.21	17.99
Anise	12.78	18.12	11.60	13.35	8.20	33.45
Fennel	17.19	16.28	11.75	13.75	8.60	32.34
Poppy	4.22	21.10	50.02	5.40	6.86	9.96

*N.F.E., or nitrogen-free extract, is the difference between 100 per cent and the sum of the percentages of moisture, protein, fat, fiber, and ash.

IWRC To Initiate State Representation

The IWRC Board of Directors at its May 20th meeting decided to institute a new state representative system for members. If there are interested members from Canada or Mexico, we will consider local representation for them at this time as well. The purpose of the system would be to increase information flow between the wildlife rehabilitators in each state and IWRC and its many activities. Representatives would help keep the Board of Directors informed of state needs, activities and developments while they would carry back to the rehabilitators in their state the opportunities afforded by IWRC (events such as the skills seminars and conferences as well as membership services).

We plan to hold a state representative meeting annually just prior to our national conference to discuss business and issues affecting members nationally. During 1989-90 we will be taking applications for these volunteer positions and letting members know who their state representatives are and how they can be reached. Our first meeting will be held in Washington, D.C., just prior to the next IWRC conference in October 1990.

We are looking for people who network well with other rehabilitators in their area, have good communications skills, and are interested in serving as state representatives. Interested persons should send a resume to Jay Holcomb, President, IWRC, 1171 Kellogg St., Suisun, CA 94585. Appointments will be made by the president for these positions. Applicants will be mailed pertinent information upon request.

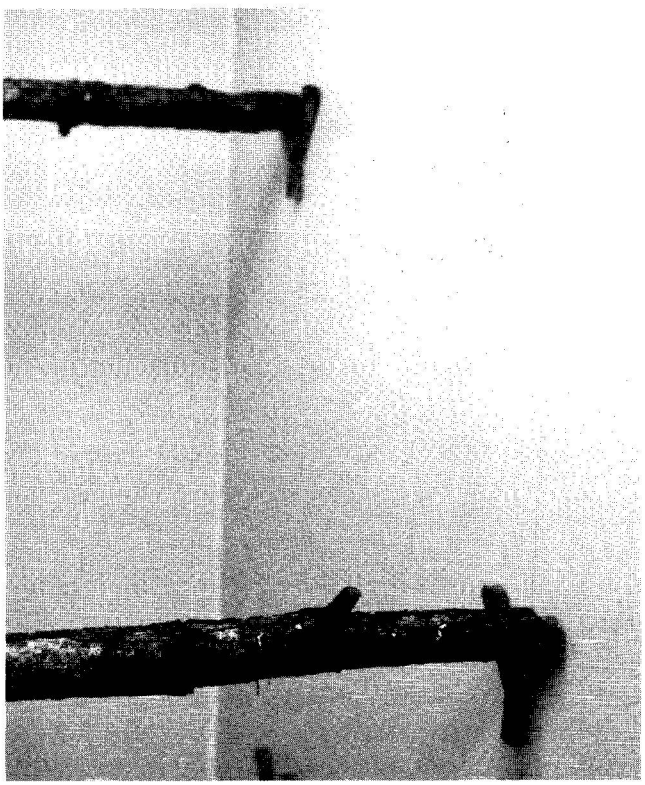
Simple Things That Make a Difference

Y Perch Holders

Jan White
Executive Director, IWRC

Do you like using natural perches, but find them disadvantageous to use because they are generally nailed into place? This also makes them hard to remove and clean or to change regularly without damaging the cage. Recently, on a trip to the Nature Conservancy in Naples, Florida, I saw a neat idea to share. I know how well these work because we used them in our new outside aviaries at the Suisun Marsh Natural History Association facility for the last two years. However, I had not seen them used inside.

These wooden Y perch holders were sealed with a sealant and then permanently attached with screws into the formica lined wall of the inside aviaries. The natural wood perches were cut to fit flush to the walls. The Y perches were put at different heights in the cage so that birds coming out of cage rest following wing injuries can have low perches as an option when needed.



Three Y-perch holders shown with two perches in place.



Close up of a Y perch illustrating the attachment to the formica wall.

Continued from Page 2

as well as their existing facilities. The director, Suzie Sutton, does a lot of opossum work (over 1000 opossums in 1988 alone!) She has really saved herself and her volunteers a lot of grief by recruiting foster moms to handle the tons of possum orphans she receives annually. It has also increased the numbers of live babies she can return to the wild. We are of course trying to get her to write an article on this!

Suzie mentioned that two of the major problems she sees in opossums are sarcoptic manage and *Physaloptera*. She wondered what drug we were using to treat *Physaloptera* as her usual product Omnizole™ had recently become unavailable. She has subsequently switched to Equizole™ paste, a similar available product. She has to dilute it .10cc paste in .9 cc water, and repeat in 3 weeks, but it works. For sarcoptic manage she tried Ivomec™ (Ivermectin 1%) diluted in propylene glycol to 0.1% and given at 0.2 mg/Kg initially to be followed by a dose at 0.1 mg/Kg one to two weeks later. However, in the six o possums she tried it indeath occurred in 6-12 hours. These animals had other problems so she doesn't really know if it was a drug reaction but she wondered if anyone else had had a problem. If you have tried Ivomec™ in opossums, please let us know if there was any problem, what dose was given, and how many opossums it was used on.

My next stop was warmer grounds, as I traveled to the Nature Conservancy in Naples, Florida. I spent the better part of a week working with Casey Garrett and her staff, looking at ways to better serve wildlife. This was a bit more like home to me as I routinely work with many of the large marsh birds and raptors in the Suisun Marsh where I practice. We also had a windy storm blow a Great Horned owlet out of a tall tree. Having reviewed an article written for the Wildlife Journal (Vol. 6, No. 1) by Dan Ludwig on returning Great Horn Owls to their parents, we quickly constructed a platform with drainage and enlisted the help of the local volunteer fire department. The firemen climbed up the tree (which was behind a home that opened onto a golf course) and nailed it up firmly. Both Great Horned Owl parents curiously observed this human activity from pine trees about 25 feet away. We placed some pine needles in the platform and put the owlet back. We all left the area and the family reunited. It was a great feeling to make this situation right again!

I got to see some innovative things while at the Conservancy. I especially liked the homemade CO2 chamber they had constructed for the humane euthanasia of feeder mice and took pictures for a short article in an upcoming *Wildlife Journal*. I also got several good ideas for a new section we plan to call "Simple Things That Make a Difference." It was certainly a wildlife center in transition, rising from one level to the next. This alone made the journey refreshing. As my week there ended, the massive oil spill occurred in Alaska, and I flew home to finish the last 10 weeks of veterinary school and to await my next assignment - which I hoped would not be that spill. You see, usually spills are cleaned up in a few weeks or so. Unfortunately, . . . that was not to be and Alaska **was** the next stop. More on that in another editorial.

-Jan White-

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Name: _____ **Occupation:** _____ **Wk: ( )** _____ **Phone: Hm: ( )** _____

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Letters to the Editor

Dear Editor:

I would like to thank Jane Stevens for her wonderfully thought provoking letter (*Wildlife Journal* Vol. 12, No. 1). It hit me at a personal level. I was frustrated and upset over losing a special little opossum. He was a staff favorite who had overcome serious injuries. Necropsy revealed why we lost him, and Jane's letter helped us understand the emotional loss of any animal we invest with our time, hope, and energy.

The ultimate decision for life or death is made by the animal. It is the rehabilitator's job to comprehend what the animal is telling us, and assist it whenever possible.

I have known animals who defy medical science by living despite tremendous odds against it, and animals who choose to die for reasons known only to themselves.

In most cases we must trust the animal's own inner decision and respect their judgement. Thank you for such an interesting and provocative letter.

Sincerely,
Mrs. Barbara Rosenman, Pres.
Kentucky Wildlife-Line, Inc.

Dear IWRC:

The Golden Gate Raptor Observatory (GGRO) in San Francisco is a program of study, conservation and education built around the migration of more than 10,000 birds of prey through the Marin Headlands each fall. The Golden Gate Raptor Observatory is currently trying to produce a video describing raptor handling and banding techniques. We are attempting to create a video which could be used by anyone who may be involved in raptor handling and banding.

Needless to say, improper handling can be dangerous and stressful for these birds. We would like to provide a consistent method of handling the raptors while taking accurate data (i.e., measurements, weight). The tape will show the methods we use during our banding process.

We are trying to locate other groups which would benefit from viewing and having this tape. Like the GGRO, many organizations incorporate volunteers, and it is not always practical to teach people the basics using live birds. If your organization would be interested in this video, please send a letter to: Golden Gate Raptor Observatory c/o Sheryl Stucky, Fort Mason, Building 201, 3rd Floor, San Francisco, CA 94123. We would also be interested in hearing from you regarding any information or thoughts you may have which might be included in the tape.

Thank You,
Sheryl Stucky

This letter was sent to our Associate Editor, Debbie Marcum, in response to her request to Pet Ag Inc. for a smaller package of Multi-Milk.

Dear Mrs. Marcum:

Thank you for your letter of September 25, regarding the status of a smaller package of Multi-Milk. We will be able to provide a 1 1/2 lb. can of Multi-Milk by December 1, 1989. I am sorry for the delay in making the smaller package available, but this should resolve the problem. Thank you for your patience in this mattter.

Very truly yours,
William J. Monson, Ph.D.
Vice President, Research
& Development

I am sure this is good news to many wildlife rehabilitators! Thank You Debbie! She tells me that we can order it from Pet-Ag, Inc. at 1-(800) 323-6878.

Book Review

Cold Moons
Aeron Clement
Delacorte Press/Bantam Doubleday
Publishing Group, Inc.
666 Fifth Ave. New York, New York
$ 16.95, 333 pgs., 1987

Cold Moons is a story that is all too familiar to wildlife rehabilitators and conservationists. It is the story of a species' struggle for survival when it comes into conflict with man.

Cold Moons tells of the systematic extermination of the badger population in England and Wales in 1975 when an outbreak of Tuberculosis (TB) in cattle was associated with the presence of TB lesions found in the lungs of badgers populating the area. Legislation was enacted to sanction the hunting and extermination of badgers by the use of poison gas with the end goal being the complete eradication of the badger population.

The action centers around a heroic band of badgers who struggle against all odds to relocate their sett (community) to an earthly paradise free from the persecution of man. They encounter many set-backs and tragedies as they fight to migrate against the relentless pursuit of the government appointed extermination squad. Unlike many real encounters between man and animals, in *Cold Moons*, the badgers emerge victorious.

Some of the behavior and actions attributed to the badgers will be hard to accept for those knowledgeable about wildlife, but it is a well written, exciting and enjoyable book to read for the entertainment value. This is the type of book that I would read on the airplane or on a vacation, and then would go back again and read a few years later when I wanted some escapist reading for the day. I would make it a permanent addition to my bookshelf. It is impossible to read *Cold Moons* without evoking the inevitable comparison to *Watership Down*. While *Cold Moons* may never be destined to become the classic that *Watership Down* is, it does make entertaining reading for animal lovers.

Deborah L. Siday,
Vice President, IWRC

Available in December!
1989 Proceedings
"IWRC on the Move"

Papers included in the book include: Animal Bites/Tick Borne Diseases by Steve Waring D.V.M., Housing Avian Insectivores During Rehabilitation by Paul & Georgean Kyle, Deer Fawns as Victims of Fire Ants by Ann Connell, Care of Insectivorus Bats by Susan Barnard, Exotics in Wildlife Rehabilitation by P.C. Hanes, Swifts by Paul and Georgean Kyle, Who Cares About Sea Turtles ? by Carol Allen, Why Wildlife Rehabilitation? by Allen Tennant.

Guidelines For Exercise In Rehabilitated Raptors

Susan B. Chaplin Ph.D.
Dept. of Veterinary Biology
University of Minnesota,
St. Paul, Minnesota

INTRODUCTION

Injured raptors that undergo medical treatment and cage confinement experience a decline in physical fitness during their convalescence. The primary goal of the rehabilitation period is to assist releasable individuals in regaining their fitness by exercise. Recently, we have described a performance test for some common raptor species using blood lactate response to standardized exercise as a criterion of fitness (Chaplin et al., 1989 a,b). We reported that blood lactate levels in a well conditioned bird peak at 2 min. post exercise and return to pre-flight levels by 10 min. post exercise. In addition, we demonstrated that the 2 and 10 min. levels decrease throughout the conditioning period, indicating increased aerobic capacity through short-distance work (Fig. 1). We have used the peak (2 min.) and recovery (10 min.) blood lactate values of flight conditioned ("fit") birds and of a falconry hawk to gauge the endpoints of flight training for birds undergoing rehabilitation.

However, the distance of the standardized exercise in our earlier study (800 ft) was arbitrarily chosen, based on the established routine of the rehabilitation staff at The Raptor Center at the University of Minnesota. In a subsequent study (Chaplin et al., MS), we have detemined the appropriate distance for flight conditioning of rehabilitated birds in a more quantitative manner. This was accomplished by constructing a power output-blood lactate profile for two species, Red-tailed Hawks and Great Horned Owls. This is a commonly used performance test that plots lactate response to increasing work load. The inflection point in the curve represents the anaerobic threshold, the point at which there is increased reliance on quick production of energy (ATP) for muscle contraction by generation of lactate. The appropriate distance for exercise could then be determined as that distance just below the anaerobic threshold, which race trainers have found produces the greatest gains in aerobic fitness. In 10 well-conditioned Great Horned Owls and 7 well-conditioned Red-tailed Hawks, we found that the anaerobic threshold was approximately 1300 feet (Fig.2), suggesting that individuals undergoing flight training should be exercised at distances less than this anaerobic limit.

A second difficulty of our earlier study was that we used the same endpoints of flight training for all individuals tested: 2 min. lactate of 100-150 mg/dl; 10 min. lactate values of 40-80 mg/dl. However, it is apparent that heavier individuals work harder than lighter individuals in flying the same distance. Therefore, we might expect variation in the lactate endpoints of fit individuals based on their body size. To remove the effect of body size on lactate response to exercise, we plotted the relationship of blood lactate and amount of work performed by each individual during exercise (i.e., the product of cost of flight and distance flown; Fig.3). From these regressions, we have established the acceptable values of 2 and 10 min. lactate levels for individuals of known body morphology (body mass and tip-to-tip wingspan) exercised over known distances (Fig. 3 and Table 1).

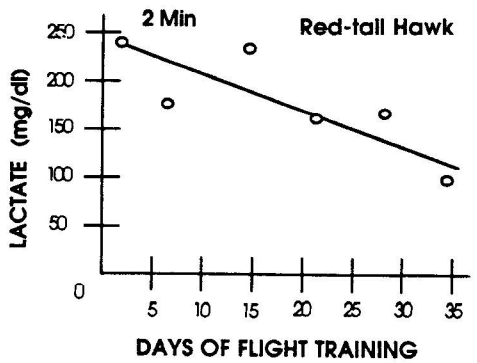


Figure 1. Decrease in blood lactate response (at 2 min) to standardized exercise during the training period in a Red-tailed Hawk, indicating improvement in aerobic capacity with short-distance exercise.

GUIDELINES FOR EXERCISE

From our exercise studies, we have derived some guidelines for flight training that we feel best promote aerobic conditioning as well as muscular strength in rehabilitated birds.

1. *Exercise to bring the bird into shape for release.* Don't start training until right before you intend to release the bird. Once the bird is physically and physiologically ready for release, it must not sit (even for a week) or it will begin to lose its conditioning.

a. For winter release birds (e.g., Great Horned Owl or Barred Owl), cold acclimate the bird first (3 weeks, minimum), then flight train while still maintaining the bird outdoors. This may faclilitate the flight training and will ensure adequate winter preparation.

b. Don't overtrain. If lactate values do not improve with exercise, either change the frequency or length of exercise (see #4 below). If there is still no change, re-evaluate for mechanical problems.

2. *Exercise on a regular schedule.* Once exercise is started, keep to the schedule. Even one week without exercise sets the birds back. Three weeks without exercise will necessitate starting over with the conditioning program.

3. *Exercise in a standard fashion* as much as possible. This is doubly critical if blood samples for lactate levels are drawn following exercise. The exercise is similar to interval training and consists of several repetitions with rests in between. The actual distance flown is not as important as the way in which the exercise is performed: work alternated with brief rests. This sort of exercise builds aerobic capacity!

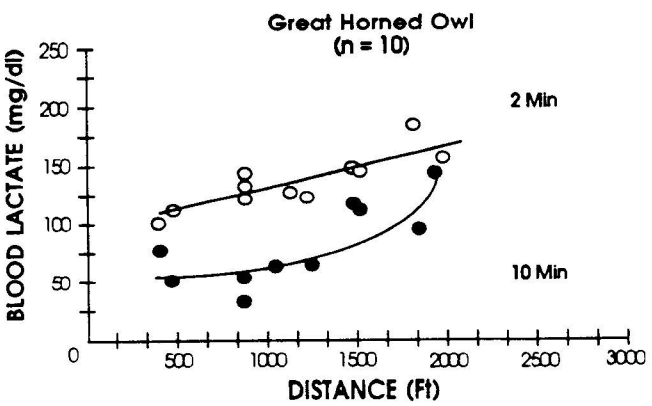


Figure 2. Change in levels of blood lactate measured 2 and 10 min. post exercise in 10 Great Horned Owls as a function of total distance flown during the exercise. The inflection point in the 10 min curve indicates greater anaerobic effort.

a. Hallway: Allow 15-20 sec. between flights of 50-80 feet. Avoid long pauses of several minutes between flights. Don't encourage double or triple flights of the hallway. This makes the bird anaerobic very quickly.

b. Outdoors:

1. When first starting to exercise the bird outdoors on a creance, allow it to fly up from the ground, and for 50-100 feet. Do 5 flights at this distance. If the bird cannot fly from the ground, pick it up and gently toss it. If the bird is very strong and can do more than 5 flights, proceed to step 2 on the next flight day. Allow about 1 minute rest time between flights; avoid long pauses between flights.

2. Later in flight training, the bird should be tossed into the air and ecncouraged to fly 150-200 feet, land (put resistance on the line), and should then be picked up and brought back to the middle of the field for the next attempt. Repeat this 5 to 7 times for the large-bodied birds (e.g., Great horned Owl, Snowy Owl, Great Gray Owl, and Red-tailed Hawk, Rough-legged Hawk, Bald Eagle), 5 to 10 times for the smaller-bodied birds (Red-shouldered Hawk, Swainson's Hawk, Northern Harrier, falcons, accipiters, Long-eared Owl, Short-eared Owl, Barred Owl). Judge the number of repetitions to be attempted by how long each flight is. If the bird begins to fly shorter and shorter distances following each toss

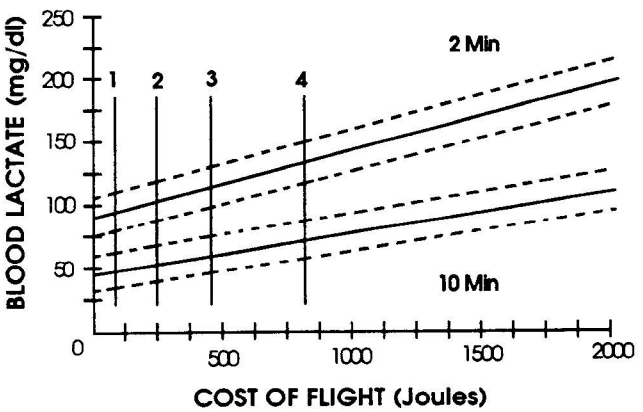


Figure 3. Regression of 2 and 10 min. lactate values for 20 well-conditioned raptors (7 species) and cost of flight, calculated for each individual based on its body mass, wing span, and distance flown. Dashed lines on either side of the regression lines indicate 95% confidence intervals. Values for particular species flown specific distances are indicated by vertical lines. 1: Saw-whet Owl, Screech Owl, Kestrel: 500-1000'; 2: Saw-whet Owl, Screech Owl, Kestrel: 2000'; Barred Owl: 500'; 3: Barred Owl: 1000'; 1.3 Kg Great Horned Owl: 500'; 1.2 Kg Red-tailed Hawk; 4: 1.3Kg Great Horned Owl, 1.2 Kg Red-tailed Hawk: 1000'.

(indicating lactate buildup), do not fly any further. The rest time between flights will be that time needed to retrieve the bird (usually 1 to 2 min). Toss the bird again immediately after returning to midfield.

3. End of training. Same procedure as in step 2, but begin flying the bird every day the week before release. Look for ability to pull the line against resistance, gain altitude, etc.

4. *Vary the frequency and length of exercise* according to the bird's needs.

a. Light exercise early will prevent excessive muscle damage and allow time for muscle repair. More intensive conditioning later will build aerobic capacity and muscle strength. Exercise at intensities beyond the anaerobic threshold (lactate build-up) is not productive and should be avoided!

Recommended exercise schedule:

1. Early: short distances (500 feet), 2 times/wk.
2. Mid: longer distances (1000-1500 feet), 3 times/wk.
3. Late: longer distances (1500-2000 feet), daily during the last week before release.

b. Change the regime depending on the bird's ability to handle exercise without lactate buildup (as indicated by inability to fly the prescribed distance the required number of times).

c. Large-bodied individuals (Great Horned Owl >1300g and Red-tailed Hawk >1200g, etc.) should not be exercised at distances greater than 1500 feet. This distance is about their anaerobic threshold (above which there is more lactate accumulation).

d. Smaller birds or birds with light wing loading (i.e., light body weight per cm of tip to tip wingspan), such as a Kestrel, Saw-whet Owl, Screech Owl (flown indoors), Northern Harrier or Long-eared Owl (flown outdoors) can be flown up to 2000-2500 feet when near the end of their flight conditioning period.

5. Utility of hallway exercise: Flight training of all species can be started indoors, if they can learn to fly in the hallway. However, multiple short-distance flights are probably adequate for conditioning only small-bodied species, such as Saw-whet Owl, Screech Owl, or Kestrel. Longer distance flights (by creance flying) should be part of the exercise program for all other species, because they simply don't work hard enough over the short hallway distance.

6. Lactate samples:

a. Blood samples should be taken when the bird can fly 1000 feet without strain. Fly the bird 1000 feet, either in the hallway or outdoors in a standard fashion (e.g., 10 flights of 100 feet with 20 seconds rest time in between flights). Catch the bird immediately after conclusion of exercise, restrain on its back, and take blood samples from the brachial vein (0.1-0.2 ml.) at 2 and 10 min. post exercise. Avoid unecessary fiddling with the bird or loud noises, as these will influence the lactate values. A light-weight towel placed loosely over the head or eyes may help calm the bird, but be careful not to restrict air flow.

To determine blood lactate, refer to directions given in the Sigma Lactate Assay Kit, or to Chaplin et al., 1989a. The resulting lactate values should be compared with the predicted standard for the species to determine how much additional flight training is needed. (See Fig. 3 or Table 1.)

b. Blood samples should be taken just prior to release to verify the condition of the bird. Either fly the bird 1000 feet and look for improvement over the earlier sample, or fly the bird 2000 ft (for large-bodied birds, use 1500 ft instead) and compare the resulting lactate values with the standard for the species (Table 1).

c. Interpretation of data: If both the 2 and 10 min. lactate values are too high, or if the 2 min. value is normal but the 10 min. is high, the bird needs more exercise at distances less than that tested. In both cases, the lactate peak may be very broad, and so much lactate is being generated that it requires a long time to dissipate. If the 2 min. lactate is high but the 10 min. lactate is within the acceptable range, begin exercising at the next highest level. The bird can still be considered for release if the 2 min. lactate is high, as long as the 10 min. value is within normal range. High 2 min. lactate values are also indicative of high power output or sprint capacity; they do not necessarily reflect poor aerobic capacity.

The following cases are examples of flight training regimes for some hypothetical patients:

a. Large-bodied, fat, feisty female Great Horned Owl (weight >1700g, tip-to-tip wingspan of 130 cm, relatively heavy wing loading) has recovered from nasty humeral fracture that necessitated extensive orthopedic repair. Bird has been in the clinic for 6 months and in the flight room for 2 months and can fly to a high perch.

The bird is probably overweight and stiff. The first few times it is exercised, do some passive stretching of the wings (full extension with the bird on its back), before it is flown in the hallway. The bird should be flown only twice a week, and no more than 500 feet (10 hallway flights) with a 20 sec. rest in between flights. Stop the exercise when the bird no longer makes it all the way down the hallway to the perch. The low intensity and frequency of the exercise will

enable the bird to repair muscle damage that occurs the first few times it is flown.

Increase the frequency of hallway flying to three times a week by the second or third week, depending on the bird's strength during any one exercise session. When the bird can easily negotiate the 10 hallway flights, move the exercise outdoors. Further indoor flight at this point will not improve the bird's aerobic conditioning.

The first few times the bird is flown on the creance, flush the encouraging it to fly longer distances. Continue three times a week on a regular basis, until the bird can make 7 long distance (200 feet) flights without strain (1500 feet = anaerobic threshold in this bird). Evaluate conditioning by comparing 2 and 10 minute lactate values following 1000-1500 foot exercise with the standard for female Great Horned Owls. Continue exercise on a regular basis, increasing the frequency to 5 times per week (same distance and repetition as above), the week before release.

b. Male Red-tailed Hawk, admitted to the clinic two months earlier with tibiotarsal fracture. No wing injuries. No malnutrition or parasite complications. Feathers in good condition; bird weighs 1000g and has 110cm tip-to-tip wingspan (relatively light wing loading). Test flight in hallway indicates that the bird is strong and easily overflies the perches at either end of the hallway.

Begin flight conditioning by flying this bird outdoors on a creance, short distances two times a week. Flush the bird from the ground or toss from the hand for 100-200 foot flights. Repeat 5 times with 1 min. rests between flights. During the second or third week, begin tossing the bird from the center of the field for longer flights. Repeat flights 5-7 times with 1-2 min. rests. If the bird is exceptionally strong at this point, begin flying daily, in preparation for release. Lactate samples should be taken to verify condition (following 1500 or 2000 foot distance exercise).

Table 1. Ideal blood lactate concentration in some selected raptor species as a function of distance flown.

SPECIES	500FT. 2min/10min	1000FT. 2min/10min	2000FT. 2min/10min
Saw-whet Owl 110g; 48cm WS	90 48	92 49	96 51
Screech Owl 140g; 55cm WS	90 48	93 49	97 52
Long-eared Owl 300g; 90cm WS	92 49	96 51	104 56
Barred Owl 700g; 100cm WS	99 53	109 58	130 70
Great Horned Owl 1300g; 122cm WS	109 58	130 70	172* 93*
Great Horned Owl 1700g; 135cm WS	115 62	142 77	185* 100*
Kestrel 120g; 55cm WS	90 48	92 49	96 51
Harrier 470g; 120cm WS	93 48	99 53	110 59
Red-tailed Hawk 1000g; 110cm WS	104 56	121 65	154 84
Red-tailed Hawk 1400g; 130cm WS	110 59	131 71	175* 95*

Blood lactate concentrations given in mg/dl for 2 and 10 minutes post exercise. * Indicates a great deal of anaerobic effort; this distance is too great for this size bird.

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