REHABILITATION
WILDLIFE COUNCIL

WILDLIFE JOURNAL

Journal of the Wildlife Rehabilitation Council

Fall, 1982



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BUMBLEFOOT PROBLEMS IN BIRDS

By Barbara Sawyer, DVM

San Joaquin Raptor Center, Merced, California

Bumblefoot is seen primarily in large cage birds, waterfowl, and penguins, but it is of clinical importance in captive raptors, being seen more commonly in falcons than in the hawks and seldom seen in owls.

ETIOLOGY

In 80 to 90 percent of the cases, the bacteria isolated in pure culture is *Staphylococcus aureus,* although other organisms such as *Pseudomonas, Proteus, Streptococcus* and *coliform* can be grown.[5] In the chronic stages of the disease mycotic involvement of *Candida albicans* or *Asperguillus* can be seen.[3]

PATHOGENESIS

The pathogenesis of this debilitating disease involves chronic trauma or constant pressure to the raptor foot, thinning the protective barrier of stratified squamous epithelium and keratin. Once the initial break in the epithelium has allowed bacteria to enter, the resultant cellulitis may be encapsulated by the bird. Often this ruptures, allowing infection to spread to tendon sheaths and ligaments, with the final sequelae being pyogenic arthritis, osteomyelitis, and septicemia.

Due in part to the lower body temperature and/or the relatively poor blood supply of the foot, foot lesions in birds are not as resistant to infection as wounds elsewhere on the body.[1] The development of the bird's immune system may control the progression of the lesions[5] in that a bird whose immune system is fully competent may be able to eliminate the bacteria at the initial stage of infection rather than attempting to "wall off" the bacterial invasion by encapsulation.

PREDISPOSING FACTORS

There are many predisposing factors to bumblefoot. Overweight birds that are not active and heavy-bodied birds with small weight-bearing surfaces (e.g. gyrfalcon or peregrine falcon) are more prone to traumatize the epithelium due to constant pressure on the pads. Vitamin A is essential for epithelial development and integrity. Diets deficient in Vitamin A can lead to epithelial damage and corn development. Since birds can store Vitamin A for several months, this deficiency is not seen immediately but only after prolonged captivity without proper nutrition.

Unsanitary cage conditions with fecal contamination of perches contribute to the build up of pathogenic bacteria. Any trauma or injury to the foot can allow bacteria to enter, for instance, with talons that are too long, on perches of inadequate diameter or with poor perch design or utilization.

CLINICAL SIGNS

Clinical signs of the disease may vary according to the stage of infection. A swollen metatarsal pad with or without a small ulcerative lesion ("corn") is seen first and may spread to involve the entire digit. The foot may be swollen, warm and painful on palpation with scabs on the plantar surface with caseous or purulent exudate beneath. More severe lesions can inhibit weight-bearing and cause gross deformity of the foot.

DIAGNOSIS

The diagnosis is based on the distinctive clinical signs and culture of the exudate. Avian pox can be distinguished from bumblefoot by the proliferative and noninvasive nature of pox lesions as well as the often concomitant oral or facial lesions that accompany pox.

TREATMENT

Treatment must be prompt and vigorous to insure best results because treatment of chronic lesions can be very discouraging. Depending on the stage of the lesions, therapy will vary in intensity and length of time. Early treatment with padded dressings and appropriate parenteral and topical antibiotics (based on culture and sensitivity of the exudate) is important, as chemotherapy is less successful once encapsulation has started, and this can occur as early as three to five days after initial tissue damage.[1]

Depending on the results of the sensitivity testing, a number of antibiotics can be used, including gentamycin, chloramphenical and ampicillin. Antibiotics can be combined with topical steroid and dimethyl sulfoxide (DMSO) therapy. It is important to wash the foot well each time before applying such a mixture so contamination is not taken into the lesion. With early and mild lesions soaking the foot in betadine is helpful. The foot should be padded with cotton and gauze and kept wrapped with the dressing changed daily. With any treatment, swelling should decrease within five days; if there is no response, therapy needs to be reevaluated.

Supplemental Vitamin A should be given.

Because of the relationship of the immune system to the progression of the lesions, immunotherapy has been tried in conjunction with vaccination against the *Staphylococcus* organism. Encouraging success has recently been reported from the Boston Zoo with a combination of an antibiotic (minocyclene), an immunomodulator (Levamisole) and *Staphylococcus* vaccination.[7] In early cases this combination has shown encouraging clinical efficacy.

Prognosis is more guarded in chronic cases where encapsulation has occurred because systemic antibiotics are ineffective due to impaired circulation. Surgery is a last resort considering the extensive involvement of the foot and the poor healing of the epithelium. If the lesion is localized and osteomyelitis has not spread, amputation of a digit may be helpful as long as the back toe is not involved for the raptor cannot hunt or perch well with the rear toe missing. Surgery can be done to open the lesion and remove all infected and necrotic tissue. If the whole foot is involved and osteomyelitis is present, the bird may need to be euthanized. Amputation of the entire foot is not a viable option in most birds because the remaining foot will develop severe bumblefoot lesions fairly soon, having to support the entire weight of the bird constantly.

Good nursing care is important to keep the foot clean and the bird in good weight with a minimum of stress.

PREVENTION

The best treatment for bumblefoot is prevention. Many of the contributing factors can be eliminated or alleviated while the birds are in our care.

Diets should be fed that are nutritionally sound and balanced for all vitamins, especially A. Whenever possible, stress should be kept to a minimum for the captive birds.

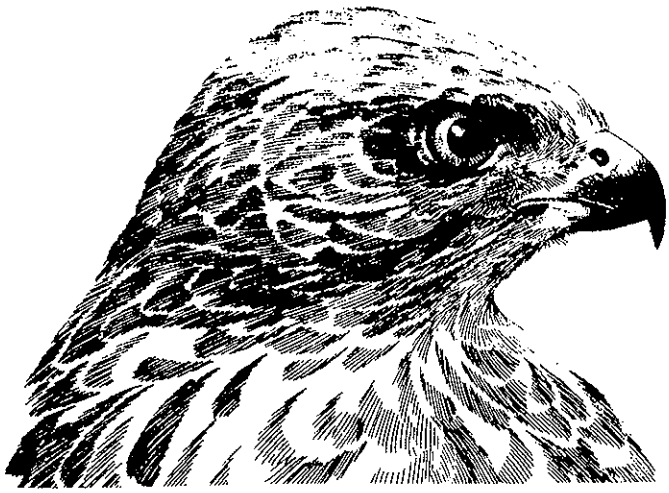
Minimize trauma to the feet by having perches of uneven thickness and varying surfaces. Free-flying aviaries are best because the birds can move at will and select a variety of perching surfaces. Perches should be of adequate diameter for the size of the bird—too small a perch may allow the back talon to damage the metatarsal pad. If necessary, the back talon may be coped with a nail trimmer. Smooth dowels are not advisable for perches because the foot needs some abrasiveness to stimulate normal sloughing of epithelium which in turn helps maintain epithelial integrity. Natural wood perches have worked best in our flight cage.

If a bird must be tethered, the ring perch is better for the feet than a block perch, especially for falcons. On a block perch, the fecal contamination can aggravate any problems. Sissel rope is often used on ring perches, with the size of the rope varying with the bird (e.g. ½″ rope can be used for eagles, ⅜″ for hawks, ¼″ for kestrels). Astroturf has been used as well, although there have been a few cases where it has irritated the feet. Concrete is a poor substrate for feet for prolonged contact, especially for heavier birds. All perches and cages should be kept clean to decrease bacterial build-up and contamination.

Feet on birds should be checked at least twice a week to pick up early lesions. Bumblefoot is a complex entity but with proper management and prompt detection and treatment of early lesions it can be controlled and eliminated.

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Dr. Barbara Sawyer

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FOSTER-PARENTING OF ORPHANED RACCOONS

By Jay Holcomb, Clinic Director

Marin Wildlife Center, San Rafael, California

CASE HISTORY

Every summer the Marin Wildlife Center is inundated with orphaned raccoons. The Center raises 60 to 75 baby raccoons a year, most of which are taken from attics or live-trapped. The work load is strenuous and the financial burden is overwhelming, so we are always in search of more efficient rehabilitation techniques.

In the spring of 1982, the Center received three 3-week old raccoon kits that were found without their mother in an attic. A quick investigation showed that the mother raccoon had been trapped the previous week and released miles away. The babies were dehydrated, covered with external parasites, and suffering from an estimated 50 percent weight loss. Our clinic staff began nursing these babies back to health.

After four weeks of intensive care, the kits showed sufficient weight gain, were physically stronger and becoming increasingly tame. Normally, we have no difficulty in keeping raccoon kits wild, but young mammals subjected to extensive handling risk losing their natural fear of man. These particular kits had opened their eyes to see humans, and unfortunately had to be handled often as part of their care. My main concern at that point was to get the babies wild again.

While assisting the San Francisco (California) SPCA with some orphaned birds, I noticed a large raccoon in a nearby cage. The raccoon stood on its hind legs as I approached and I realized it was a lactating mother. She had been live-trapped and was to be relocated that day. A wild mother raccoon was just what our three tame babies needed, and the SPCA allowed me to take her.

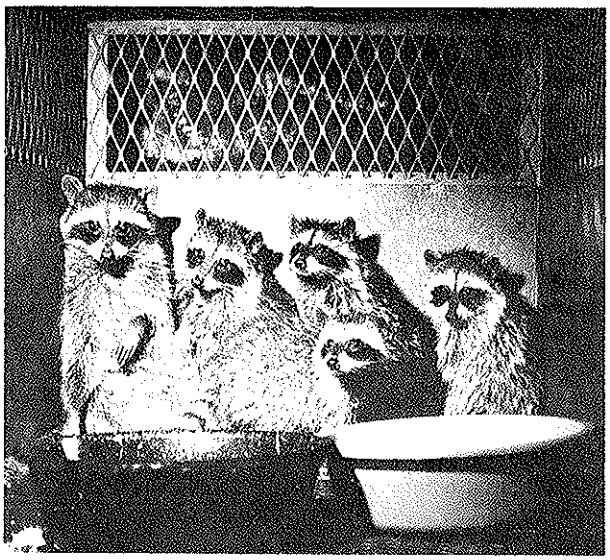
I decided to place the female raccoon in the babies' cage rather than to introduce them to her. She would be entering their territory, so if a confrontation developed, the kits would have the security of being in their own cage. When the female was placed in the cage, the kits growled and charged her. She tucked her head to the side to avoid being bitten but made no attempt to fight back. I sat and watched for ten minutes while the babies snarled and hissed at the intruder. The adult continued avoiding the kits' behavior by curling up and ignoring them. I decided to leave them alone and to make periodic checks. Soon they were all asleep; the female in one corner and the pile of babies in another.

At that point, the young were receiving three bottle feedings a day and were starting to eat some food from a bowl. I cut them down to two feedings in the hope that hunger would force them to the female for food. For four days they growled and avoided the adult. The morning of the fifth day one of the babies nursed on its new mother. By the sixth day all three were sleeping and nursing on their foster mother. However, they would still run to the cage door when a human came near.

Our usual conditioning technique (growling and charging) for approaching potentially tame raccoons, plus total isolation from humans except for routine care, finally worked. In three weeks, the babies and their foster mother were deeply bonded and all would growl when approached. The babies would hide or shy away when humans came near.

After four weeks with their foster mother, the young raccoons were healthy and wild and ready for release. I took them to a good raccoon release site and turned them loose. The mother quickly escorted her family down the creek into the the brush.

During the time this mother and new family were getting acquainted, we were also raising four other raccoon litters. I called the San Francisco SPCA and asked them to contact me whenever they received live-trapped lactating females and created four new families. They were the first of ten raccoon families we created and released this year.



A wild female raccoon and her four once-tame foster kits show fear at the nearness of the photographer.

INTRODUCING ORPHANS AND NEW MOTHERS

All of the kits we introduced to wild mothers had already received routine immunization for distemper. They were housed in a cage with a nesting box for at least twelve hours prior to the introduction. The cages used were 3 ft. by 2½ ft. by 2 ft. The animals had room to move about, but were confined to a den-type situation. When the foster mother was introduced we observed activities in the cage for 15 to 20 minutes. We have never seen aggressive behavior from the adult females. The startled kits were the nasty ones.

It usually took from one to three days for the kits to adapt to their new mother. Once they accepted her, they formed a seemingly natural bond. In two cases, the babies ran to the adult and threw their arms about her. They chirped their acceptance while licking and caressing their new mother. In all ten cases, the adult females were patient and gentle. At a crucial time in the kits' lives, it was rewarding and encouraging to watch a family bond form.

Twice we received young trapped raccoons, approximately two months of age. When a family of raccoons the same age was available at our Center, we placed the new babies together with the already established family group. The newcomers were frightened at first, but were adopted into the family and adjusted within 48 hours.

Raccoon kits not yet on a solid diet were checked frequently during their first week with their new mother to make sure they were nursing. An adult female might be in a late stage of lactating when trapped, leaving her without milk for very young babies.

THE RELEASE

Releasing the family was the most crucial part of this experiment. One false move and the mother might become frightened and run, leaving her new family. Releasing one to six week old babies was also risky. The kits were too young to climb and had to be placed in a protected area or den. Several of the families we released were three and four weeks old. Although the ideal age for release is two months or older, a shortage of cage space necessitated their early release. It is not uncommon for a female raccoon to be ousted from an attic or garage and to have to take her young elsewhere. So, with the belief that raccoons are adaptable animals, we reluctantly found temporary dens for those young families.

Looking for old hollow trees in a remote area, I found some burnt redwoods with large areas of soil dug out around the bases. I set the mother raccoon's cage at the entrance of one of these "dens", and allowed her to see me placing the kits inside. The babies usually growled or chirped and in each case the mother was frantically attempting to reach her kits. I stood behind the mother's cage and waited for her to get to her young before I slowly backed away with the cage. Wild mother raccoons are easily frightened and it is important to be unobtrusive and quiet.

I watched each family for 15 to 20 minutes. The adult would check the area around the tree, and sometimes climb a little, always keeping verbal contact with the kits. I was never able to stay at the release site long enough to see the adult move her kits to a different location. But I checked each release site early the following morning and there was never any sign of the family where I had left them.



Older kits can be released into easily-climbed trees with their new mother.

When releasing families with older kits, two months or more, I chose trees that were easy for the kits to climb. I placed the young one by one into the tree, taking care not to panic them into jumping. I then released the mother, opening the cage from behind and allowing her to follow the babies up the tree. I then backed away and watched from a distance. In all our releases, mother and young investigated the tree together. I always left the area soon afterwards.

OVERVIEW

Foster-parenting animals is not a new discovery. Raptor specialists have been placing orphaned chicks back into active nests for years. Songbird rehabilitators have used crippled and domestic adult birds to raise orphans. Tame, unreleasable coyotes have been used with good success in the foster-care of abandoned pups.

The advantages of foster-parenting of orphaned raccoons are great. Pairing trapped wild adult females with orphaned kits insures the kits the best possible future. The problem of imprinting is gone. The babies' chances in the wild are much greater under the protection and training of an adult. You also avoid the potential cataract and metabolic problems that can be caused by use of artificial diets. And financially, foster-parenting reduces the expenses incurred by a wildlife center.

There are problems, however. It may be difficult to provide adequate cages in sufficient quantity to house separate raccoon families of any number. There is also the very upsetting knowledge that the trapped raccoon's natural young will probably die. That is something over which we have no immediate control. All the adult raccoons used by the Marin Wildlife Center this year were "nuisance" animals which were privately trapped for relocation. Under no circumstances should a raccoon be trapped for the sole purpose of foster-parenting.

CONCLUSION

The "raccoon problem" is becoming increasingly serious. Raccoons have been labeled "pests" and many people exterminate them as casually as they do mice and rats. The "raccoon problem" is actually a "people problem", with the raccoons being the innocent victims. For example, in Marin County, California, most of the old nesting trees have been destroyed, so the raccoons make their dens in attics, walls or basements. Because raccoons are so appealing, people take great joy in feeding them. Even when warned of the consequences, most people will continue to do so.

Feeding creates dependent raccoons. Once they have an easy, reliable source of food, these raccoons no longer forage and compete for their meals. And since there is not much competition and lots of food available, litters of three to five young survive. In a natural situation, not all these young would survive, due to territorial pressures and predators.

We now have large populations of raccoons living in crowded situations. They soon start raiding garbage cans, fish ponds and the food bowls of outdoor pets. Many raccoons become bold enough to enter houses in search of food, creating new problems. They may even attack family pets.

Crowded conditions also create disease potential. Canine and feline distemper, endemic in the wild population, can erupt to epidemic proportions when overcrowding is intense. Yearly distemper epidemics are common in Marin County and other areas.

There is only one answer to the "raccoon problem": education. People must realize that they are part of the ecosystem, and not the manipulators. We rehabilitators have the responsibility of protecting our wild brothers. Part of that responsibility means talking with people—often very stubborn people—in our communities. The responsible people are the ones who will make a difference. A humane, positive approach in dealing with wildlife problems benefits animals and people alike.

We can influence the attitude of the public through our educational programs and the examples we set.

UPDATE ON ESBILAC & CATARACTS

By Jan White, Chairperson

WRC Species Paper Committee

During 1979, while compiling information for the WRC species paper, *Raccoon Rehabilition,* several rehabilitators expressed concern over the possibility of a link between the feeding of Esbilac as a sole diet for young orphaned raccoons, and cataracts. At that time there was not enough information known to include any specific recommendations.

However, the December 1, 1981 issue of the Journal of the American Veterinary Medical Association (JAVMA), contains the results of a 5 year study on nutritional cataracts in Timber Wolves by Samuel Vainisi, DVM, et. al. The study reports a possible link between cataract formation and arginine (amino acid) deficiency in young wolf pups. While various diets were tried, including Esbilac only, Esbilac with lard, and Esbilac with Vitamin C. . . they had problems with cataract formation in all three of these diets. When, at 4 weeks, the animals who were developing cataracts were placed on dry dog food fortified with ground beef, there was a remission of the cataracts. Other diets included supplementation of casein, arginine, tryptophan, and lactose separately. Cataracts developed in all the pups on these additive diets except those receiving arginine and lactose.

While the theories relating to why and how these problems arise are ongoing, the problems can apparently be prevented by avoiding the sole use of the formula for an extended period of time. In the case of raccoons, by the time they are three weeks old, their eyes are open and they can begin eating foods other than formula.

During this study, the worst problems occured with pups started on milk supplement diet at an early age (less than 7 days). The study suggests that during the development of the lens, there is a critical time at which the lens is more susceptible to nutritional stresses. Since rehabilitators receive infant raccoons at a variety of ages, some are being fed milk replacement during this time when lens development may be critical.

While we must feed milk replacements, early supplementation with dog food, with weaning as soon as possible is recommended. In the study, lens opacities showed improvement when dog food was fed after only 10 days.

The results of this study coincide with the feedback rehabilitators have given the WRC Species Paper Committee. That is, raccoons fed formula for extended periods of time appear to be more likely candidates for cataracts than are raccoons who have dog food supplemented at an early age (two to three weeks) and are subsequently weaned from formula as soon as possible.

THE IMPORTANCE OF BANDING REHABILITATED BIRDS

By Ron Schlorff, Wildlife Biologist,

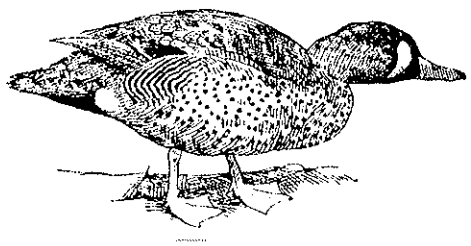
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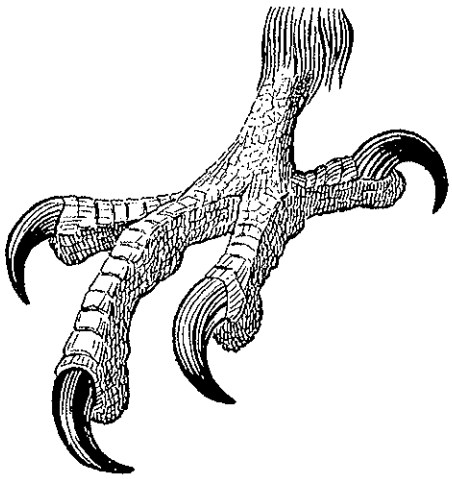
Bird banding studies have long been recognized as critical to our understanding of certain aspects of species biology and ecology. Perhaps the primary reason for undertaking banding studies is to learn more about the movement patterns of various bird species. With a sufficient number of band returns, much can be learned about migration routes, wintering and breeding grounds, and stop over points of migratory birds. Banding studies are valid even for resident bird species, those that do not travel to any great extent during their lives. Through banding and marking we can learn something about local movements, habitat use, longevity, and mortality factors affecting bird populations.

More can be said about these various means of acquiring data through banding studies, but I think the point is made that bird banding can be a very useful tool to students of ornithology and agency biologists. How about the rehaber though? Yes, the rehaber can contribute very valuable information and help answer some of the many questions concerning birds that can only be obtained through banding.

Banding can be a powerful tool in an ornithologist's repertoire. But, in order to use that tool, one must get a bird in hand. For some species, such as the smaller songbirds, this is not too difficult a task. For others, such as raptors, herons and egrets, and seabirds, the job is more difficult. For some larger species, such as waterfowl, turkeys, and cranes, often a long period of baiting is required before birds can be cannon-netted prior to banding. The job is so specialized, for example, that the California Department of Fish and Game employs biologists whose primary duty is to net and band birds, principally waterfowl.

Every day, rehabilitators come into contact with a great variety and volume of birds; everything from the Endangered American Peregrine Falcon to hummingbirds of various species may be handled. Here is a unique opportunity to take advantage of the bird's (hopefully temporary) immobility and affix a U.S. Fish and Wildlife Service aluminum band to its leg. The process is not quite as simple as I just made it sound and ther are some important "bookkeeping" duties involved, but the rewards in acquired data can be great. Aside from the standard kinds of data I mentioned earlier, rehabers may have an opportunity to find out how well a previously injured bird did once released back to the wild. It would be gratifying to know that a bird, injured in its first year, survived to maximum life span once you cared for its wounds and released it to the wild. Unfortunately, opportunities to find out this kind of information would be quite rare indeed. For every 200 birds banded you may expect perhaps only 2–4 returns, if that many. But, small as these odds are, it would be virtually impossible to find out what happened to a released bird otherwise, especially if it's a highly mobile species and prone to leave the release site entirely.





In conclusion, I wish to reiterate that rehabers of birds all over the world should take advantage of the fact that they already have a bird in hand—sometimes the most difficult aspect of banding—and send that raptor, seabird, or robin off with a shiny new aluminum bracelet.

Bird banding does require experience and skill to ensure such things as proper fit of the band, proper reporting procedures, etc. Further information can be obtained by contacting the Bird Banding Laboratory, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Laurel, Maryland, 20811. They can provide information on bird banding permit holders you may be able to contact in your local area and how to obtain a permit for your own wildlife rehabilitation group.

I should mention that in California a State banding permit is required in addition to the Federal permit to band raptors and resident game birds. If banding endangered or rare species and birds that have fully protected status, as provided by the State Legislature, it will be necessary for the bander to enter into a Memorandum of Understanding with the Department of Fish and Game.

REHABILITATION NOTES: BEAVER *(Castor canadensis)*

By Debbie Marcum, Associate Editor

Austin, Texas

INTRODUCTION

The following information represents a sampling of substitute formulas, diets, caging facilities, release criteria, and specialized care for the Beaver. It is meant to be used as a guideline, not as an absolute. For any mammalian species, substitute formulas and diets should be based on what is already known about the species via research data. All mammalian species should receive a balanced dietary staple, and supplemental food items, such as fruits and vegetables should be limited to 10 percent of the total diet. Although a vitamin-mineral supplement is often used, care should be taken not to overdose Vitamins A and D. A salt spool can be made available after the animal is weaned. This species does not require special skill instruction or vaccinations.

DESCRIPTION

- *Adult:* Up to 1.2 m (48 in.) long, including tail; 18.2 to 27.2 kg. (40-60 lb.); largest rodent in North America; semi-aquatic. Fur color varies from light blonde to jet black; should feel smooth and slippery when wet. Ears and nose are valvular, closing tightly when the animal goes under water. Eyes are protected by transparent eyelids that allow it to see under water. Folds of skin, one on either side of the mouth, meet behind the front incisors and virtually seal off the rest of the mouth, allowing the beaver to eat under water. Forepaws are as flexible as human hands and are used for digging, not swimming. Hind feet are fully webbed; two inside nails on each hind foot have double nails, called "combing claws," that are used in grooming.
- Single cloacal opening for all functions of scent, reproduction, and excretion.
- Two scent glands (castors) produce castoreum which waterproofs the fur.
- Cannot be sexed externally unless the animal is a lactating female.
- *Normal Body Temperature:* 99 degrees to 101 degrees F.
- Herbivorous.
- *Senses:* Sense of smell most acute, followed by hearing; eyesight is relatively poor; sense of taste is well-developed.
- Chiefly nocturnal, appearing shortly before sundown.
- Colonial; average beaver family consists of the two adults, three kits (babies), and three yearlings. Young stay with family unit up to two years.
- *Average Life Span In The Wild:* 10 years.

BIRTH AND YOUNG

- *Gestation:* Approximately 107 days. Young generally born April–July.
- *Litter Size:* Average of four.
- *Appearance of Newborn:* Eyes open; fully furred miniature of the adult; incisors have erupted. Can swim without urging when only 13-hours-old.
- *Approximate Birth Weight:* 369 to 454 gm. (13–16 oz.); 8.2 to 10 kg. (18–22 lb.) by one year of age.
- *Approximate Birth Length:* 305 to 381 mm. (12–15 in.) total length.
- Eats plant material while on formula.
- Follows parents to feed on vegetation when 0.7 to 0.9 kg. (1½–2 lb.)
- *Age Weaned in the Wild:* 6 to 8 weeks of age.
- While in captivity this species is vocal in expressing pleasure and displeasure. Touching noses is a sign of greeting and affection, and it will want the rehabilitator to cooperate.

FORMULA-FEEDING

- Based on available milk analysis data for beaver, the following substitute formulas were developed, and are listed in descending order according to their proximity to the natural milk (solids, fat, protein, carbohydrates.)
- *Substitute Formulas:* (1) 1 part Esbilac 1:2 (mixture of 1 part powdered Esbilac and 2 parts water) and 1 part half and half cream; (2) Esbilac 1:2. Unwashed, soft, native water plants and algae from unpolluted water should be made available during the formula period.
- *Feeding Intervals and Amounts:* Every 4 to 5 hours; no night feeding unless animal's condition warrants it. The amount fed will depend upon the size of the animal and the formula being fed. High caloric diets require less quantity intake. Generally, rodents should receive 35 percent to 40 percent of their body weight daily. Stomach should appear gently rounded, not taut, after eating. It is better to underfeed than overfeed. To avoid risking aspiration pneumonia, the young animal should be fed formula while on its stomach or side in a normal nursing position, and not held on its back as a human child might be held. Burp after feeding.
- *Feeding Instruments:* Human baby bottle (regular or premie nipple); Playtex Nurser.
- *Stimulation and Elimination:* Species usually eliminates on its own and resists manual stimulation; generally will eliminate in water.
- *Weaning Formula:* Substitute formula mixed with Gerber Rice Cereal or Gerber High Protein Cereal. Lab blocks (cubes), which are sold in pet and feed stores as food for rats and mice (Wayne Lab Blox), can be introduced by the time the animal

weighs 0.9 kg. (2 lb.) If the beaver is not yet able to balance on its hindquarters and hold the food, the rehabilitator should hold it for him.

• *Weaning:* Generally by the time the animal weighs 1.4 kg. (3 lb.).

• *Post-Weaning Diet:* Lab blocks (ad libitum) as the dietary staple; 10 percent supplementation of fruit and/or vegetable chunks such as apples and carrots, grains, natural breads; feed in heavy crock bowls or on a heavy tray in evening. If using a powdered vitamin-mineral supplement, it can be administered by rinsing apple chunks in water, then rolling them in the supplement. Native branches and vegetation, utilized by the species, should be available at all times.

CAGING

• *Until Weaned:* Inside. No supplemental heat unless condition warrants it. Bathtub equipped with a plastic trash can (approximately 13 inches dia., 14 inches long) at one end. Toddler papers provide absorbent bedding. A small, stuffed animal should be provided for a single beaver. A litter tray of water at the other end of the tub may or may not be utilized by the animal.

• Provide fresh, unwashed water plants and native twigs daily.

• It is imperative that the bathtub be kept free of excrement in order to reduce the potential of urine burns.

• Promote swimming twice a day to aid the animal's well-being and reduce castoreum buildup. Place the animal in a large sink or comparable container full of cool/lukewarm water. If necessary, hold the animal's tail to promote movement and submersion; dry. Place a towel on the floor and allow the animal to groom. Note: This species is used to following its parents into the water, and will probably physically and vocally resist being forced to swim by itself. This display should not deter the rehabilitator.

• *Weaned-Release* (by 4 months of age): Outside. Facility should include a minimum of a standard-size bathtub, large horse trough, or equivalent that can be easily drained. The plug should be secure or the animal will empty the tub. Note: Plastic wading pools will be destroyed by the beaver as it tries to regulate the water level. A plastic astroturf-like mat, secured over the end of the tub, can serve a twofold purpose. It enables the animal to get out easily, and the floating end serves as a hiding place. The outdoor facility should contain adequate floor space (wood works well; wire is very hard on feet) and a large, wooden nest box equipped with hay. It should offer protection from the elements. Provide large branches and water plants common to the species.

• Since beaver will eliminate in water, the tub will need to be filled, drained, and refilled at night; scrub periodically.

• When caged outside, the beaver will benefit from being taken out of its cage daily to walk and explore in a secluded area.

RELEASE

• This species should be released prior to the onset of cold weather. Its instincts to gather food and prepare its dam can make it increasingly restless and difficult to contain.

• Other than routine acclimation, this species does not require any special release preparation. Note: Dam building is instinctive, and the stimulus is provided by the sound of running water.

• *Habitat:* Streams, river systems with a supply of trees and vegetation.

• Choose an area that is known to have beaver colonies, and release in the vicinity of, but not directly by, a colony.

• Release at dusk near the water's edge.

SPECIALIZED CARE

• An initial fecal exam is advisable.

• *Method of Giving Oral Medication:* Mix a small amount of Nutri-Cal and pulverized lab blocks; add medication and roll into bite-size balls; can be refrigerated.

• *For Diarrhea Not Associated With Illness:* Pepto Bismol, Kaopectate have been used. Consult a veterinarian regarding other treatments.

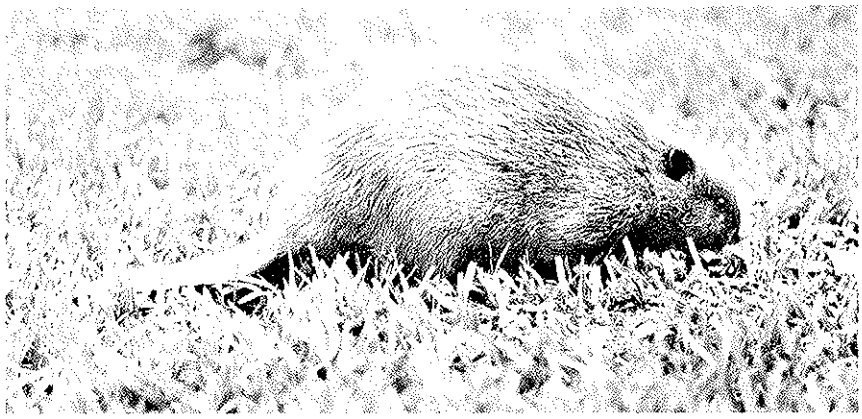
• *Abrasions, Urine Burns:* The latter usually appear as small, raw sores on the underside of the tail or bottom of feet; Gentian Violet Blue Methylene Dye or comparable product that adheres to aquatic, semi-aquatic mammals.

• Do not use any drug that is not tolerated by members of the rodent family.

• *Symptoms That May Indicate Pneumonia:* Labored breathing, cough, loss of appetite, runny nose and/or eyes; may have a fever. Consult a veterinarian without delay.

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Two days before release—4 months old. Animal weighed 15 lbs., body was 21 inches long; tail 7½ inches.

USING PHYSICAL THERAPY AND EXERCISE IN RAPTOR REHABILITATION

By Terry Schulz and Nancy Horowitz

University of California, Davis (UCD), Raptor Center

One of the major problems facing the raptor rehabilitator when dealing with traumatic injuries is the prevention of joint stiffness. An injured bird allowed to perch quietly following fracture immobilization will not voluntarily exercise the affected limb. Lack of movement usually results in joint stiffness which prolongues or in some cases prevents release. Therefore, initial treatment of fractures should be followed by a carefully planned and carried out aftercare. Physical therapy procedures for injured raptors has received little attention. However, the basic principles used in other animals can be adopted and applied to raptors.

The benefits of physical therapy include:
1. Reduction of edema; 2. soften and stretch fiberous tissue; 3. restore circulatory efficiency; 4. increase range of joint motion; 5. increase muscular strength; 6. retrain muscular dexterity.

It is the veterinarian's responsiblity to assist the rehabilitator by diagnosing the degree or severity of damage. The report should include the presence and extent of edema, contusion, sensory loss, motor loss, etc. By understanding the anatomy it is possible to determine how the injury will affect function.

In general, physical therapy should be started as soon as possible depending on the condition of the animal. It may be necessary to reduce edema prior to surgery in the case of compound fractures. Treatment should begin as soon as immobilization is complete in the case of simple fractures. The numbers of treatments per day and length of treatments depend on the condition and response of the animal. If improvement is not observed with daily treatment within a week, treatment should be discontinued or changed. Wing fractures which are immobilized with body wrap techniques may be more prone to joint stiffness because there is no way for the wing to be stretched or exercised during convalescence. Early wing stretching and massage techniques can be applied to wing fractures immobilized internally or externally.

Prior to any exercise therapy program a complete evaluation of the bird should be made by a veterinarian. The evaluation should include:

1. Medical History; 2. physical examination including: a. fracture site, b. respiration, c. blood pressure, d. posture, e. deformities, f. edema, g. inflammation, h. determination of range of motion of the joints.

Exercise prescribed without competent evaluation and carried out by inexperienced personnel may actually cause harm to the patient. If exercise results in additional swelling or pain at the fracture site, it should be discontinued until the swelling is reduced and then gradually resumed. Unlimited exercise should not take place until union (healing) has occured (4–6 weeks) and the limb has been conditioned by gradual physical therapy techniques.

The main goal of the physical therapy program is to prevent as much loss of function as possible. If this can be done, the prognosis for restoration to normal flight capabilities will be greatly improved and the rehabilitation process will be accelerated. The first phase of aftercare of fractures (i.e. treatment of acute symptoms) should be done initially by the veterinarian. Some rest may be required before starting the therapy program. The amount of time will depend on the individual problem. The initial phase of the therapy should be aimed at reducing edema and preventing loss of joint motion. This can be accomplished in the following ways:

1. The application of ice packs and compression. This method, however, is only applicable for recent injuries. Although seldom used in the treatment of raptors, cold packs are the treatment of choice for early reduction of swelling and muscle spasm in other warm blooded animals. The treatment is usually 15–20 minutes, four times a day. Edema can also be reduced by a light gentle massage technique with the stroke toward the heart and proximal to the fracture. Massage also increases circulation and promotes relaxation. All massage should be followed by assisted exercise. This should be done with extreme caution however, to prevent further soft-tissue trauma. Heat increases circulation and metabolism, analgesia and sedation. Assisted passive exercise therapy helps to maintain normal range of joint motion during convalescence. Unassisted active exercise is more beneficial as it increases stamina and endurance. Strength is increased during exercise which includes some resistance, and endurance will increase with repetition.

2. Active motion or passive exercise to assist in return flow circulation and maintain range of motion and muscular strength. This can be done best with an assistant who is a competent raptor handler. The person applying the manipulation should have full knowledge of the bird's normal range of motion. The patient's eyes should first be covered with a hood or stockinette to reduce stress. The bird is held in a supine (belly up) position. The "therapist" holds one hand against the carpal joint of the affected wing. The other hand gently pushes the elbow joint toward the hand holding the carpus. This procedure will extend the wing and prevent loss of joint motion. The extended position

should be held for approximately five minutes to start and later increased to two treatments per day for 10 minutes each.

The objective of the second phase of the therapy program is to restore function. This will include removal of remaining edema, stretching and softening of fibrous tissue, restoring circulatory efficiency and increasing muscular strength and dexterity. This is accomplished by eliciting automatic reactions and reflexes. Methods include activating the vestibular system (equilibrium response) by fast and slow tilting. Two techniques used with some success are holding the bird by the legs at the joint and elevating the bird up and down. This can also be accomplished by placing the bird on a "see-saw" type exerciser (Fig. 1). The bird is hooded and tethered to prevent visual stress and escape. The perch is then lowered abruptly and raised slowly. The fast downward movement will elicit a voluntary wing extension.

The next step involves active voluntary exercise. This involves frequent periods of repetitious exercise to increase strength and coordination and develop endurance. A new method using a harness is now being used with success at the UCD Raptor Center. (Fig. 2). The harness allows freedom of wing movement without impinging on the sternal respiratory movements. The bird can be stimulated to fly from perch to perch in a relatively small area without the need for a large flight cage. Flying a bird on a fishing line is another method used to exercise raptors. Large Buteos, i.e. (Red-tailed hawks, etc.) and eagles are attached to an 80 lb. test, 200 yd. length of good quality line. Both legs are secured with traditional jesses and swivel. The fishing line is secured to a locking trigger clasp which is attached to the swivel. The method requires a large open (200 yds. minimum) brushless area to prevent snagging of the line. A good quality, large spool capacity, ocean type reel is necessary for this method. The condition and function of all equipment must be checked prior to flying a bird. This may prevent premature escape due to malfunction or deteriorating equipment.

Large flight cages with perches at each end provide an enclosed exercise area. The bird is stimulated to fly from perch to perch repeatedly until it is exhausted. This type of exercise should be gradually increased. The respirations (number of breaths/min.) should be recorded before exercise and immediately after. Also record the number of respirations/minute following a brief three-minute rest period. Birds which are in a state of good health recover to normal breathing more rapidly.

By placing food on the ground in large enclosures with high perches, the bird must fly vertically to return to the perch. This may improve the flight muscle strength but will not do much for endurance and stamina. There must be daily repeated flights which push the bird to its limits of exhaustion each time. If this is done, the bird's chances for survival will be greatly enhanced when it is eventually released.

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Figure 1. Raising and lowering the bird on this see-saw apparatus stimulates the bird to voluntarily exercise its wings.

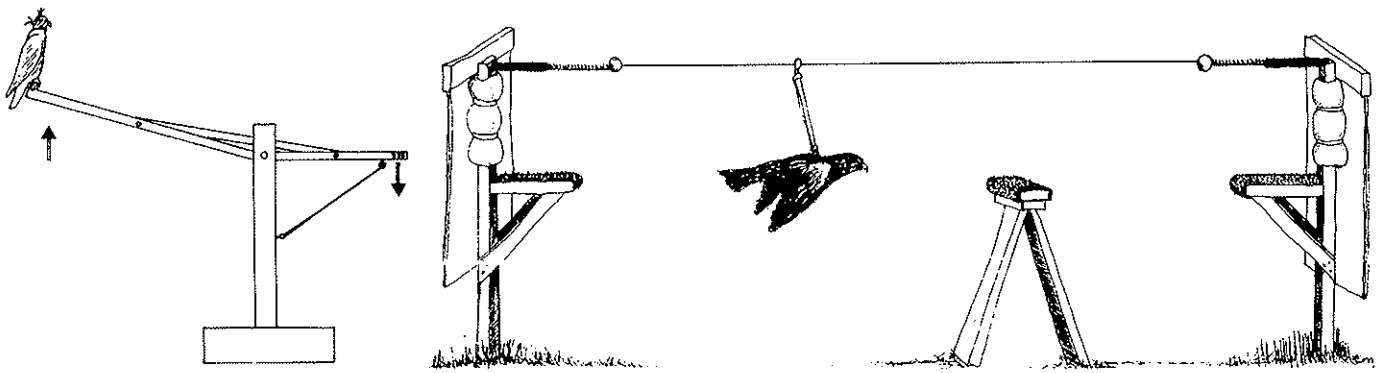


Figure 2. Use of the flight line increases stamina, endurance and coordination. A moveable perch can be used for shorter flights.

WILDLIFE REHABILITATION SYMPOSIUM

March 23–27, 1983

Sheraton-Naperville Hotel, 1801 Naper Blvd., Naperville, IL. 60540. Sponsored by The National Wildlife Rehabilitators Ass'n; Friends of The Furred and Feathered; and the Business and Professional Institute of the College of DuPage; and the Treehouse Wildlife Center

KEYNOTE SPEAKERS: Murray Fowler, University of California, Davis; Katherine McKeever, the Owl Rehabilitation Research Foundation.

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AVIAN POX: A REVIEW

By Jim Hill, DVM, Veterinary Pathologist

Veterinary Pathology Consultant, Los Altos, California

INCIDENCE AND DISTRIBUTION

Avian pox is a common disease of domestic poultry and has been reported in more than sixty species of wild birds, representing twenty families. The infection is prevalent worldwide and birds of all ages, sexes and breeds are susceptible to the virus. Pox of birds is not of public health significance, as mammals are not affected.[3]

SIGNS

Avian pox is a viral disease characterized by a pronounced transitory inflammatory process with proliferation of the epidermis of the skin and mucous membranes. Scabs are formed of the degenerated epithelium. In some cases, diptheritic membranes may develop in the mouth, esophagus and nasal cavity.[3] A typical pox infection may be in one of three forms or in a combination, and includes 1. cutaneous lesions of the head and featherless areas, such as the legs, feet and vent; 2. diptheritic lesions of the mouth cavity and nasal passages; and 3. systemic infection with various inflammatory lesions developing in the liver, pancreas, salivary glands and other organs of epithelial origin.[3]

With the cutaneous form, the characteristic lesion is the formation of nodules that first appear as small white foci, and then may rapidly increase in size and become yellow (Fig. 1). The lesions may coalesce and become rough and dark brown. After about two weeks, the lesions have areas of inflammation at the base that become reddened and ulcerated. There is formation of a scab which may last another week, or possibly two weeks. If the scab is removed early in its development, there is a moist exudate underneath, covering a bleeding, raw surface. When the scab drops off naturally, a smooth scar may be present; in mild cases of the disease, there may be no noticeable scar.[3]

The diptheritic form is characterized by white, opaque nodules which develop on the mucous membranes of the oral cavity and nasal passages. These nodules become a yellow, cheesy, necrotic, diptheritic membrane. If the membranes are removed, the surface bleeds.[3]

DIAGNOSIS

Usually histopathologic examination of either the skin nodules or diptheritic lesions demonstrates characteristic intracytoplasmic inclusions, sufficient for a diagnosis of avian pox infection. To prepare tissues for diagnosis, the tissue should be immersed in buffered 10 percent formalin. The volume of formalin should be ten times the volume of the submitted tissue, and the tissue should be no thicker than 5 millimeters.

PROGNOSIS

Mortality is usually low in natural infections, although it may be high if a virulent virus is present or if the disease is complicated by parasitism, other infections or poor husbandry conditions. Birds affected with the cutaneous form of the disease are more likely to recover than those with the diptheritic and systemic forms.[3]

TRANSMISSION

Infection occurs primarily through mechanical transmission of the virus to small injuries or scratches in the skin. A true carrier state does not exist, but the virus may exist as a latent infection.[3] Birds may become infected directly by contact with infected birds, or indirectly by contact with contaminated food, water and inanimate objects, such as cages and perches. Mosquitoes are also capable of transmission of the virus from bird to bird and have been responsible for widespread outbreaks, particularly during the summer months.

INCUBATION PERIOD

The incubation period of the natural diseases varies from about four to ten days.

TREATMENT

There is no specific medical treatment for birds infected with avian pox viruses.[3] Birds that have new cutaneous nodules present, which are not interfering with vision, breathing or feeding, are best left alone to reduce environmental stress. If the cutaneous and diptheritic lesions are interfering, then it is recommended that they be gently removed and the lesion sites swabbed with Betadine solution. Some people have found beneficial results by applying ioxuradine to the lesions. They feel it decreases the length of time the lesions remain on the bird.

CONTROL

Since outbreaks may develop as a result of mosquito vectors, efforts should be directed at mosquito control or preventing their access to captive birds by screening.[6] In some aviaries, the infection may also be dust-born, and therefore the control of dust may be an important factor.[6] In an aviary situation, diseased and healthy birds should be separated and diseased birds isolated in separate screened cages. Prevention of skin trauma as a result of self-inflicted injuries because of improper caging or perching devices, as well as cannibalism or featherpicking, can be controlled by providing ample and safe cage space.[1] The cleaning and disinfection of contaminated objects, such as perches and feeding stages, will help reduce indirect transmission

of the virus.[4] Sometimes the closing of feeding stations for at least a month may help to prevent direct and indirect transmission of the disease.[4]

IMMUNITY AND VACCINATION

Vaccination may be indicated in certain situations. Birds recovered from pox infection are usually immune to reinfection with that strain. Cross-immunity is proved for several strains of avian pox virus.[6] On occasion, it may be useful to try vaccination in situations where pox occurs in captive wild birds. Unfortunately, there has been little use of vaccines in wild birds.[2] However, much work has been done on the vaccination of poultry and other domestic birds, including pheasants.[3] Careful consideration must be made of strain selection, since avian pox viruses show variable pathogenicity for different avian species.[6]

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Fig. 1—Head of mature mourning dove *(Zenaidura macroura)* with cutaneous pox nodules (Arrows).



Regional News . . .

WRC SKILLS SEMINARS FOR WEST COAST ORGANIZATIONAL MEMBERS

WRC has scheduled a series of advanced skills seminars designed to further the training of wildlife center directors, team leaders, and supervisors. Initial registration has been received from 18 centers. At this time there are still limited openings in the following sessions:

II. Restraint of Wild Animals, Dec. 10; III. Clinical Pathology In Wildlife Care, Jan. 14; IV. Physical Examination & Initial Care, Feb. 11; and VII. Pathology & Gross Necropsy, May 13.

Sessions V. Nutrition & Disease Treatment Regimens, Mar. 11; and VIa. Special Problems in Raptor Rehabililtation, Apr. 15, have no laboratories and have open enrollment to interested wildlife rehabilitators.

Costs are $10 per seminar per person. Those wanting registration packets and curricula should write the Council, or call the seminar coordinator, Jan White at (707) 429-HAWK for information.

Seminar instructors include: Gary Bogue and Pat Gullett, DVM (II.); Tami Biateck, AHT (III.); Sandra Emmanuelson, DVM (IV.); Murray Fowler, DVM (V.); Terry Schulz (VIa.); Pat Gullett, DVM (VII.)

(Those wishing to have information printed in the Journal's Regional News section should send it to: Debbie Marcum, WRC Journal Regional News, 9310 Clearock Dr., Austin, Texas 78750. What's happening on the East Coast? South? Far North? Midwest? Canada? Europe? Come on, rehabbers. . . enlighten us all!)

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