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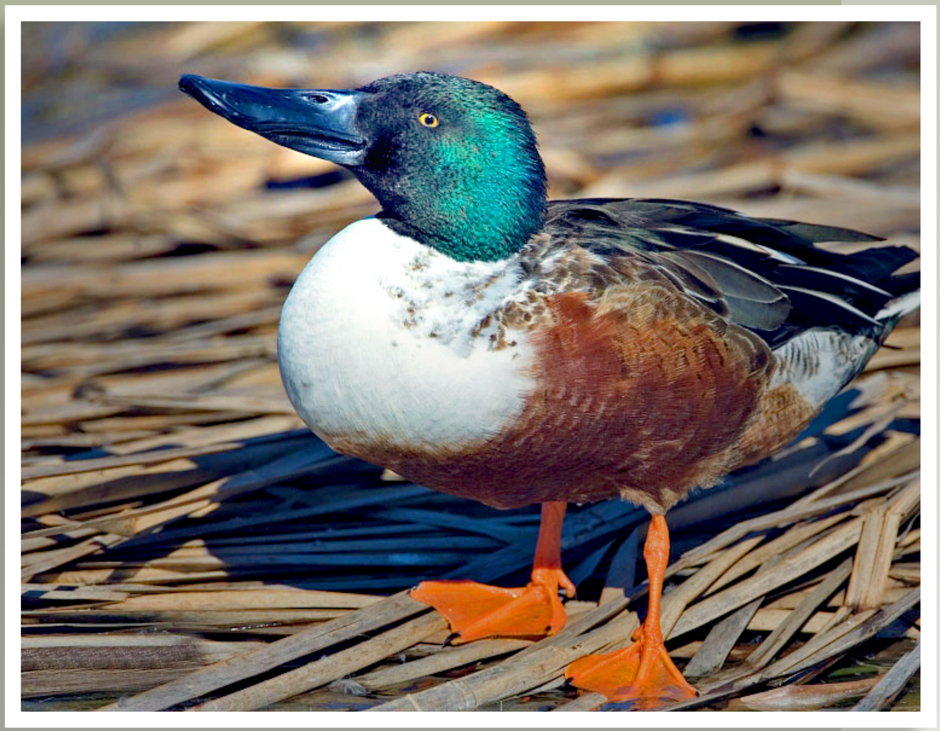
IN THIS ISSUE: Hand-rearing Two Orphaned Lion Cubs...Management of Vehicle-Injured Roe Deer for Release...Treatment of Armadillo Rescued from Illegal Trafficking...Bat White-Nose Syndrome in France...Geographic Expansion of *Baylisascaris procyonis*

ABOUT THE JOURNAL

THE ***JOURNAL OF WILDLIFE REHABILITATION*** is designed to provide useful information to wildlife rehabilitators and others involved in the care and treatment of native wild species, with the ultimate purpose of returning them to the wild. The journal is published by the International Wildlife Rehabilitation Council (IWRC), which invites your comments on this issue. Through this publication, rehabilitation courses offered online and on-site in numerous locations, and an annual symposium, IWRC works to disseminate information and improve the quality of the care provided to wildlife.



On the cover:
Nine-banded armadillo *(Dasypus novemcinctus).*
PHOTO © CESAR PANIAMOGAN, JR. USED WITH PERMISSION.

Male northern shoveler *(Anas clypeata).*
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Outreach

Intakes are ramping up all around the northern hemisphere. When life is speeding toward you at 100 mph, it's not always easy to stay sane, much less keep the big picture in mind. But take your eyes off the road and you might miss something important.

When someone appears at your door, cardboard box in hand, what do you see? One more hungry mouth to feed? More evidence of human impact on the "natural" world? Another idiot who doesn't know the first thing about wildlife and is now going to take up precious time telling you what s/he has named the creature they've dragged out of their attic or hit with their car (as if THAT were the most important thing you need to know!)?

Step on the brake, slow down and look again, because the person standing before you is actually a gift.

Wildlife organizations spend huge amounts of time and money attempting to access to something that you, as a wildlife rehabilitator, get without even trying—a fresh pair of ears. You see, the usual audience for wildlife information is primarily self-selected, so the people who hear the message are the same folks who always hear it. You'll hear them referred to as "the choir" because they show up to hear the sermon no matter what. But ask any pastor/priest/rabbi/imam/roshi—or the director of a wildlife conservation organization—and they'll tell you the greatest challenge is reaching the rest of the community. The ones who would rather sleep in or do the crossword puzzle or watch NASCAR.

Most people like wildlife and find the natural world interesting. It's just that there's so much else vying for their attention. "Sure," they'll say, "wild animals are cute or beautiful or whatever but, you know, what does that have to do with me and my life?"

Then, a raccoon crawls into their attic to have her babies. Their kid shows up with several scrawny-necked nestlings cradled in his palm. A squirrel dashes out in front of their truck or a packrat decides to turn their car into a grain elevator. And suddenly, wildlife is quite tangibly relevant to their life.

And that's where rehabiliators come in, because these accidental wildlife advocates find their way, somehow, to you. Excited about their close encounter with something as exotic as E.T., they're full of questions and you have the answers. Answers that can nurture a fledgling interest in wildlife, born out of chance, and help it grow.

I recently stumbled into an opportunity to practice what I preach. I was tuned in to NPR's popular *Car Talk* show one Sunday morning when someone called to ask about keeping wild animals out of their car. As hosts Tom and Ray struggled valiantly to offer a solution, I thought, "I could help them with that." So I sat down and wrote an email to their producer offering my services as resident wildlife expert. Together, we created an FAQ page on *Wildlife and Your Car*. I'm now available to help with questions on the air, on their website, and in their newspaper column.

I could never have predicted that automobiles—which inflict so much damage on our wildlife populations—could be a secret door to the world *beyond* the choir, yet I now find myself in the enviable position of having access to a new, national audience hungry for information on living with wildlife.

You never know when engines and opportunities will knock. Just remember, not all gifts come with a bow on top.

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Disney Helps Orphaned Bambis

Dateline: February 10, 2011

TAUNTON, SOMERSET (UK)—Real-life Bambis, cared for by the Royal Society for the Prevention of Cruelty to Animals (RSPCA) Rescue Center, are getting help from the Walt Disney Corporation. The company has made a donation to help the charity improve facilities for orphaned deer, coinciding with the first Blu-ray release this week of *Bambi: Diamond Edge*.

The center supports around 30 deer annually, orphaned by accidents, some needing 24-hour care. The shed will allow naturally shy and nervous deer to be treated away from other animals and with as little human contact as possible to ensure they remain wild before their release.

West Hatch center manager Peter Venn said: "We can now be sure the deer we look after are kept in conditions where they can recover as quickly as possible. We can release them back into the wild sooner, so they get back to their natural environment, the best place for them to thrive."

The program is led by Emily Atkinson, who hand-rears sick, injured, and orphaned young deer before they are tagged and released.

A Disney spokeswoman said: "The donation will aid the development of deer rehabilitation, which will help extend the existing equipment and accommodation for deer to help with the wonderful work the center already does."

Rehab Otter at Grandfather Mountain

Dateline: February 9, 2011

LINVILLE, NORTH CAROLINA (USA)—Luna is an 11-month-old otter found abandoned in the yard of a Burke County family last March. After keeping several hours' watch for the mother, the family called rangers at South Mountain State Park. Those rangers contacted Michelle Ray, an independent, licensed wildlife rehabilitation specialist from Lincolnton who then took Luna to her home.

During this time, a new animal holding facility was being built at Grandfather Mountain, a 600-acre scenic attraction and nature preserve located near Linville, North Carolina. Ray called Grandfather's habitat staff to see if they were interested in having another otter. The organization is working toward accreditation by the Association of Zoos and Aquariums.

Luna moved in after the building was complete in November, after a month and a half of quarantine and an introduction process with Grandfather's other otters: Oconee, Santee, and Nottaway.

"Luna is extremely playful and curious," said Habitat Manager Christie Tipton. "She is loving her new giant pond, and I think that visitors will find her to be much more active than Grandfather's other otters."

The introduction process with Oconee, Santee, and Nottaway began in January when the three otters were moved down from the Otter Habitat. Introducing otters is a very difficult process as they are very territorial and aggressive. This effort was not easy and was marked with successes and failures. Santee was the biggest bully towards Luna, while Nottaway eventually accepted the young otter.

"Once Nottaway established his dominance with Luna, everything was fine," said Tipton. "After the troubles with Santee, we decided to wait on introducing Luna and Oconee."

Tipton and her staff plan to try another introduction with Luna and Santee months from now when Luna is a bit more mature and has fine-tuned her defensive skills. The ultimate goal is for all four otters eventually to be together in the Otter Habitat.

Bear Cubs Released into Truckee Area Wilderness

Dateline: February 6, 2011

GARDNERVILLE, NEVADA (USA)—The California Department of Fish and Game (CDFG) successfully returned two black bear yearlings to a remote wilderness near Truckee. Both female cubs were orphaned last summer. One cub was illegally dumped last June on the front porch of Ann Bryant, executive director of the BEAR League. Weighing only 12 pounds, the cub was emaciated and starving. The other cub was reported by a citizen who kept seeing it alone and bawling near Markleeville last August. A DFG investigation determined the bear was an orphan.

"It weighed about 30 pounds and was unusually lethargic for a cub," said Cristen Langner, CDFG's bear biologist in the Tahoe Basin. Both cubs were taken to Lake Tahoe Wildlife Care (LTWC), a wildlife rehabilitation facility licensed by CDFG. While at LTWC, they were fed and housed in a way that prevented them from becoming habituated to humans so that they could be returned to the wild when they were old enough to care for themselves.

Wildlife Rehabilitation Coordinator Nicole Carion oversaw the cubs' care and arranged for their release in suitable habitat, away from human activity. CDFG staff Ryan Carrothers, Shelly Blair, Marc Kenyon, Sarah Deaton, Cristen Langner, and David Casady transported the sedated bears, then placed them in a man-made den at a wild and secluded location nestled in the Sierra Nevada.

The operation concluded as planned, with the cooperation of University of California at Berkeley and Sagehen Creek Field Station staff. When released, the two yearlings weighed about 70 and 85 pounds.

Marc Kenyon, CDFG statewide bear program coordinator, points out people should never assume a young animal in the wild has been abandoned by its mother. In many cases, human interference with wildlife will result in abandonment by their species, and sometimes their inevitable captivity or death.

"In the vast majority of circumstances,

cubs or other wildlife that appear to be abandoned are simply being cared for by their mother from afar. She's usually off obtaining the nutrition required to rear her offspring," Kenyon said. "But in the rare circumstance when something unfortunate happens, CDFG has the ability and expertise to ensure appropriate care for the young until they can be safely released into the wild, such as with these cubs. I fully expect them to become wild bears when they wake up in their new home this spring."

Wildlife Rescue Center of the Hamptons Celebrates 10th Anniversary

Dateline: February 4, 2011

NEW YORK CITY, NEW YORK (USA)—Toasting a decade of wildlife rehabilitation efforts, The Wildlife Rescue Center of the Hamptons brought its festive, philanthropic spirit to New York City's Volstead Restaurant and Lounge with a special cocktail reception.

The East End organization, known to many for its summertime fundraisers, celebrated the milestone with supporters at a chic winter soirée; on screens placed throughout the space, guests watched footage of past rescue efforts and triumphs while nibbling gourmet bites and sipping a signature cocktail—the Wildlife Rescue Hurricane—specially crafted for the evening.

Executive Director Ginnie Frati thanked guests during the evening and praised the diligent work of her team. "When we first opened our doors 10 years ago, I had no idea what an impact we would make on the wildlife of the East End. It's been people like you, supporting us, that will enable us to continue on for many years to come and to never turn away an injured animal."

The Wildlife Rescue Center of the Hamptons, Inc. is a 501(c)(3) not-for-profit organization dedicated to the rehabilitation of wild animals impacted by encroachment of humans on their habitat. A grass-roots organization, the Center has grown from a few concerned friends to a group today of over 1,000 members and supporters. The Center is a full-time, professional wildlife hospital staffed by licensed rehabilitators, biologists, animal behaviorists, and volunteers. It is located in an area that is a unique and irreplaceable ecosystem consisting of salt and fresh water wetlands, pine barrens, deciduous forest, and meadowland. The hospital at the Wildlife Rescue Center is designed exclusively for wild animals. Unlike veterinary hospitals, the space is free of any ambient noises or smells to stress the wildlife recovering within.

Animal Activists Doubt Logic of Translocating Elephants

Dateline: February 1, 2011

GUWAHATI (INDIA)—Wildlife activists in the state are raising questions over the decision to translocate Deepa, a 6-year-old rescued female elephant who died during her translocation to Manas National Park on Sunday, after they came to know that she was dropped from a similar exercise in 2008 because of her health condition.

Deepa was part of a group of six elephants who were to be moved to Manas from the Bokakhat-based Centre for Wildlife Rehabilitation and Conservation (CWRC). She died after being sedated to be loaded on a truck meant to take her for reintegration with a wild herd at the national park. Veterinarians, who conducted a postmortem on Deepa, declared congestive heart failure as the cause of her death. However, samples were sent to Guwahati Veterinary College for further confirmation.

Meanwhile, the state forest department has ordered an inquiry into the death of the elephant. The inquiry, which will be headed by chief conservator of forests (wildlife) S. P. Singh, has been directed to submit a report within a week. Wildlife activists are raising doubts over the soundness of the decision for including Deepa in the translocation program because International Fund for Animal Welfare (IFAW) said she was dropped from an earlier translocation program in 2008 on health grounds. In 2008, eight elephants were translocated from CWRC to Manas. IFAW said that, though Deepa was scheduled to be released at Manas in 2008, she was dropped from the plan to be reintegrated into the wild due to detection of "problems" during her health screening then.

"I do not understand the logic of making Deepa a part of the translocation program if she was dropped from a similar plan on health grounds in 2008. I think the decision to include her in the latest translocation program reflects on the fact that the entire exercise was hurriedly done. It raises the question of whether proper health check-ups were done. Deepa [her handlers] should not have been given permission for translocation. Her death is very unfortunate," said Dr. Kushal K. Sarma, a wildlife expert who specializes in elephant health.

IFAW said that Deepa's recent veterinary report showed her health condition was stable and she qualified for the translocation.

Six elephants were to be translocated from CWRC to Manas under a collaborative project of the Wildlife Trust of India–IFAW, state forest department, and the Bodoland Territorial Council. Following Deepa's death, the remaining five elephants were moved to Manas. All six elephants, including Deepa, were orphaned calves rescued by CWRC after they became detached from their natal herds either due to human–elephant conflict, floods, or abandonment in tea gardens by the main herd.

Sarma, in fact, was stridently opposed to the idea of releasing rescued elephants to the wild, especially those reared by human beings. "The success rate of releasing rescued elephants that are reared under human care is dismal across the globe. I don't understand the reason for releasing human-raised elephants at a time when the forest department is also making attempts to tame elephants from the wild in order to reduce human–jumbo conflict." ■

Veterinary Aspects of Hand-rearing Two Orphaned African Lion (*Panthera leo*) Cubs: A Revision of Procedures

F. Najera, L. Revuelta, and K. J. Kaufman

ABSTRACT: This paper describes the methodology used to conduct hand-rearing in two orphaned African lions born in captivity. The emphasis on dietary management and medical problems that arise during the process, as well as preventive medicine recommended for this species at this age, are described in this paper. The methods used were considered satisfactory, resulting in two individuals who were weaned to a healthy condition.

KEYWORDS:
Hand-rearing, neonate, *Panthera leo*, weaning

Statement of problem

The African lion *(Panthera leo)* is a species well represented in zoological institutions worldwide. When lions are in permanent captivity, there are situations that can force hand-rearing of newborns. The status of the neonate itself can dictate hand-rearing, situations such as congenital or hereditary disease, infectious or noninfectious disease, and trauma or injury (Read and Meier 1996; Grupo Asesor de Aspectos Sanitarios (del Lince Iberico) [GAAS] 2004; Aceituno *et al.* 2008).

Adult African lion *(Panthera leo)*

Among the causes affecting the mother in the care of their offspring or cubs, we can consider the following: dystocia, vaginal or uterine infections (or both), mastitis, inability to secrete milk, and retained placenta (Read and Meier 1996; GAAS 2004), and abnormal maternal behaviors that could endanger the cub's life such as rejection of their offspring (Aceituno *et al.,* 2008).

Discussion

Serious consideration should be given to the choice of hand-rearing an infant *versus* nurture of the mother. Whenever possible, the neonate should stay with the mother for reasons both physiological and behavioral (Cruz 1996; Hedberg 2002). Cubs which do not stay with the mother for at least the first 2 days of life are unable to obtain an efficient immune system, because they receive the majority of the maternal immunity from the colostrum (Cruz 1996; Hedberg 2002). These cubs are susceptible to any disease or poor prognosis during the first 2 mo of life (Rivas and Vargas 2007). To deal with the failure of passive transfer, we can administer serum from the mother orally, if the mother is healthy, during the first 12 hr of the neonate's life; this can ensure a proper supply of maternal antibodies (Yamada *et al.* 1985; Rivas and Vargas 2007; Rivas *et al.* 2009).

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FIGURE 1. Manchaenpata ("spot on leg"), cub "M," and Rabo Raro ("rare tail"), cub "R." Both were 21 days of age in this photo. M had a birth weight of 1,580 kg and R weighed in at 1,520 kg. According to co-author Fernando Najera, "M is the cute one on the left, R is the cute one on the right."

The lack of transfer of passive immunity can also be treated by administering adult lion serum to the cubs, subcutaneously, as described in domesticated cats *(Felis catus)* (Levy *et al.* 2001) and Iberian lynxes *(Lynx pardinus)* (Rivas *et al.* 2009).

On the behavioral level, if the cub is able to stay with its mother, this will provide stability to give the correct socialization—essential to avoiding behavior problems with the animal's conspecifics when reintroduction is performed (Read and Meier 1996).

Four male African lion *(Panthera leo)* cubs were born to a lioness in our zoological institution. The pregnant lioness was being watched by a remote camera and seemed to be stressed during the delivery. She showed no attention to the newborns and was pacing during the birth of each cub. After 2 hr had passed after the delivery of the last newborn, and seeing the lack of interest the female had towards the cubs, we decided to intervene by removing the neonates from the maternal cage. The first physical examination took place next to the maternal cage and revealed that 2 of the animals suffered patent urachus (a congenital anomaly of the urogenital system) and died within hours. The other two neonates (Fig. 1) had a normal medical examination with pink mucous membranes, capillary refill time less than 2 sec, normal hydration status, normal cardio-respiratory auscultation, and a pulse and body temperature without irregularities. We proceeded to clean the umbilical area with 2% chlorhexidine and then took them to the Center's nursery.

Materials and Methods

After removal of the neonates and a subsequent clinical examination, it is paramount to ensure their body temperature; because the thermoregulatory center is not yet mature, hypothermia can be one of the leading causes of death at this age. For the first 7 days, it is mandatory to keep a temperature between 26–29°C in the compartment (incubator, wooden box) where the cubs stay, and then from 24–26°C during the next week (Hedberg 2002; Aceituno *et al.* 2008). It is highly advisable that neonates be kept in a place with a temperature gradient so that the cub can move freely from the hottest area to the coldest area of the compartment (GAAS 2004).

The first feeding of a neonate should be based on an oral electrolyte solution (Meier 1986; GAAS 2004; Aceituno *et al.* 2008). By using an electrolyte solution for the first feeding, one can observe the neonate's suckling reflex; if active, this would reduce the risks of any aspiration into the lungs (Rivas *et al.* 2009).

Several commercial electrolyte solutions are available, e.g., Glucolyte® and Pedialyte®. Once we have ensured that the first feeding is normally swallowed, with proper suckling reflex, we begin to introduce the milk formula. Introducing the milk formula should be very gradual. It is known that the composition of mother's milk changes during the course of lactation (Oftedal 1984); the mother's milk is more diluted during the first 2–3 days (Rivas *et al.* 2009). We recommend giving the first diluted formula in a 1:4 ratio (one-fourth part formula and three-fourths part electrolyte solution). Then we gradually increase the strength of the formula until we reach a final ratio of 2 parts formula and 3 parts mineral water (2:3) as described for other wild felids (GAAS 2004), or we follow any distinct manufacturer recommendations for each milk replacer used.

MILK TYPE	PROTEINS (%)	FAT (%)	CARBOHYDRATES (%)
KMR	7.6	4.5	4.7
Esbilac	5.0	6.7	2.4
"Home-made" milk[1]	6.38	3.70	not available
Maternal lion	9.3	17.5	3.4

[1]Iben and Liebetseder 1994.

TABLE 1. Comparative percents of distinct nutrients in four types of milk.

INGREDIENT	QUANTITY
Milk	700 ml
Egg yolk	30 g
Cod liver oil	5 g
Low-fat milk curds	255 g
Vitamin–mineral pre-mix[1]	10 g

[1]Asta-Hunde Animad Veterinarpharmazeutika GesmbH. ("Asta Dog," Animal Veterinary Pharmaceuticals, is the name of the vitamin premix used by Iben and Liebetseder [1994]).

TABLE 2. Ingredients in "home-made" milk replacer for kittens (Iben and Liebetseder 1994).

TABLE 3. Additional "home-made" formulations that have been used in breeding exotic felines (Harumi *et al.* 1996).

FORMULA 1		FORMULA 2	
INGREDIENT	QUANTITY	INGREDIENT	QUANTITY
Water	250 ml	Water	50 ml
Cow's milk powder	200 ml (80%)	Prepared powdered cow's milk	200 ml
Soy milk	50 ml (20%)	Egg yolk	1
Egg yolk	1	Honey	1 tsp
Honey	1 tsp	Mineral oil	1 tsp
Vitamin complex (Kalyamon® B12)	5 drops	Table salt	1 pinch
Mineral oil	1 tsp	Vitamin complex (Kalyamon® B12)	10 drops
		Terragran Junior®	10 drops

One of the main points to consider for captive rearing of non-domestic felids is the choice of formula. In our case, and due to the impossibility of formulating a milk replacer ourselves, we chose KMR® (PetAg® International, Hampshire, Illinois USA) because of the literature reviews which support the use of this formula for wild felids (Meier 1986; Hedberg 2002; GAAS 2004; Rivas *et al.* 2009). In addition, KMR is the most suited to the protein needs of this species, although this milk replacer still presents a lack of protein (1.7% less in comparison with lion's milk, which is 9.3% protein). See Table 1 for a comparison between the composition of two formulas widely used for hand-rearing non-domestic carnivores, a "home-made" milk replacer made for kittens (Iben and Liebetseder 1994), and the mother lion's milk (Hedberg 2002). The ingredients for the "home-made" milk are given in Table 2 (Iben and Liebetseder 1994). Table 3 provides two additional "home-made" formulas for exotic felines (Harumi *et al.* 1996).

One of the main differences between the two commercial milk replacers is the composition of amino acids and, more specifically, the presence of taurine in KMR, essential to the development of felids. The lack of taurine is associated with retinopathy and heart disease in wild and domestic cats (Howard *et al.* 1986; Hoskins 1996; Hedberg 2002; Hedberg *et al.* 2007). Some felids do not tolerate KMR, probably because of the high amount of carbohydrates that make it difficult to digest. In this case, Esbilac® (PetAg) can be used with the supplementation of taurine (250 mg of taurine per day; Hedberg 2002). The authors encourage the use of taurine supplementation when it is lacking in an available formula.

The protocol followed in our center during the first week of life is to feed every 3 hr during day and night. During the second and third week, the cubs are fed every 3 hr during the day and every 4 hr at night. From the fourth week on, the cub can be fed every 4 hr during the day and every 5–6 hr at night, making for

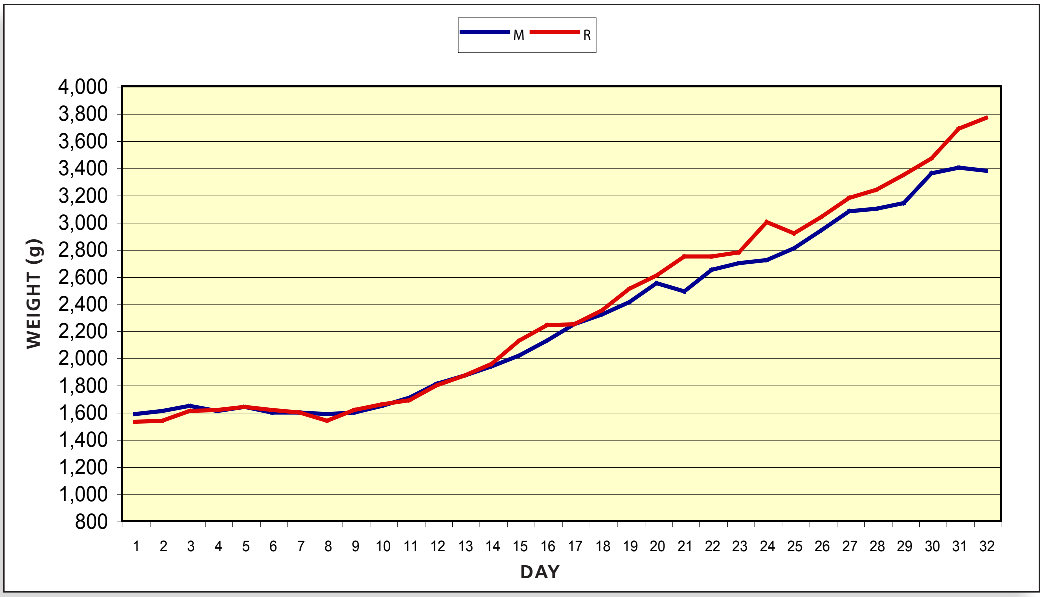
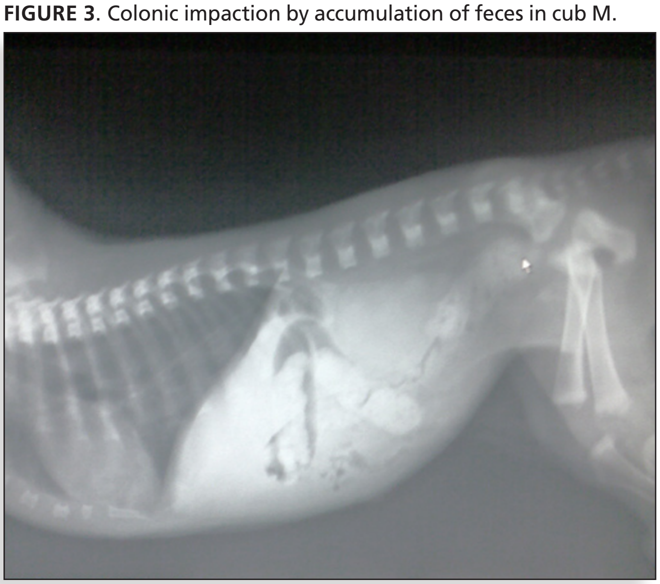


FIGURE 2. This graph shows the growth of cubs M and R over time to almost weaning age. All weights were taken in the morning before the first feeding.

six total feedings per day (Meier 1986; Hedberg 2002; Aceituno *et al.* 2008). The daily amount of formula the neonate requires should be between 10% and 20% of its body weight (Meier 1986; Hedberg 2002; Aceituno *et al.* 2008). A daily ration of formula greater than 35% of body weight can cause digestive disorders, among others (Meier 1986). Among felid cubs, lions and tigers are especially eager for their feedings—but if they were to receive all the amount of food they want, it would cause digestive problems in a very short time (Hedberg 2002).

Good indicators for knowing that hand-rearing is being successfully achieved are that the cubs are active, healthy, and gaining weight (Fig. 2). The average preferred weight gain for lions is between 100 and 200 g/day (Hedberg 2002). The weight of the two neonates was measured daily and always before the first feeding in the morning; this daily practice helps determine if hand-rearing is being performed correctly (Hedberg 2002; GAAS 2004).

FIGURE 3. Colonic impaction by accumulation of feces in cub M.



During the development of the cubs, we observed a slight decrease in weight during days 6–8; this decline did not continue over time. If the weight of the cubs had continued to decrease, they would have had to be evaluated for medical problems. Continuous weight loss may also have been intrinsic to the concentration of milk formula; in that case, revising the formula to an appropriate concentration should resolve the problem (Meier 1986).

It is important to massage the neonate urogenital area for at least the first 2 wk, needed to stimulate urination and defecation at this age and normally done by the mother. This process can be carried out with cotton wool soaked in warm water and should be practiced before and after every feeding. The normal stool color is usually yellowish to brown; if it is greenish, the problem is an excess quantity of the milk formula supplied and, if white, it is due to malabsorption of the milk formula (Rivas and Vargas, 2007). If there is neonatal diarrhea caused by a dietary imbalance, avoid over-concentration of the milk formula and again use an oral electrolyte solution (Hedberg, 2002) to provide electrolytes that are lost through diarrhea. Once the stools become more consistent, progressively revise the formula to reach the desired concentration. If a dietary imbalance is not the origin of the diarrhea, a complete examination should be performed to rule out a viral, bacterial, or parasite origin.

Another common digestive problem during hand-rearing is constipation (Cullen 1958, Meier 1986; Andrews 1998; Rivas and Vargas 2007) (Fig. 3). If the process of clearing constipation takes more than 36 hr (Andrews 1998), the oral use of mineral oil (e.g., Hodernal®) or olive oil (approx. 5 ml/kg) is recommended. Either oil can be added to the food formula to achieve the desired effect. The use of oral laxatives, such as lactulose, at a dose of 1 ml/4.5 kg (Hoskins and Dimski 1996) also tends to be helpful, although overuse will lead to diarrhea. Application of an enema based on saline and tempered water at a dose of 5 ml/kg (Hoskins and Dimski 1996), is also described (in domestic cats). This practice was used in our hospital during an episode of constipation of one of the two cubs, "Manchaenpata" ("M"), with satisfactory results.

Weaning is one of the most critical times during the captive rearing of cubs because some animals poorly tolerate the change to solid food. Weaning can begin by introducing lean meat (1-day-old chicken or turkey) mixed with milk formula (Hedberg 2002; GAAS 2004) starting about 3–4 wk of age or according to the eruption of deciduous dentition. Felines can start with about 25–30 g of meat/day with a gradual increase as the weeks progress. The milk should be removed after the cubs are fed the milk and lean meat mixture for one week, gradually reducing the amount of milk each day until they reach 6 wk of age.

Once the milk is removed from the lean meat mixture, it is important to add crushed bones to the meat to provide the daily requirement of minerals. Adding bone can avoid diseases typical of this stage such as rickets (Chesney and Hedberg 2009) or metabolic bone disease (van Rensburg and Lowry 1988; Herz and Kirberger 2004). The use of vitamin–mineral compounds (e.g., Mazzuri®) should also be considered to enhance their presence in the chosen diet; this can help avoid some of the vitamin deficiencies described in this species (O'Sullivan *et al.* 1977; Shamir *et al.* 2008).

Preventive medicine is important at this age and in this species. Infectious diseases have been reported in free-ranging and captive lions. In terms of the relevance to prophylactic immunization, we emphasize the following infectious diseases that are well described in wild and captive lions: canine distemper (Appel *et al.* 1994; Harder *et al.* 1995; Roelke-Parker *et al.* 1996; Myers *et al.* 1997; Kock *et al.* 1998; Wack 2003; Endo *et al.* 2004; Driciru *et al.* 2006; Guiserix *et al.* 2007); panleucopenia (Studdert *et al.* 1973; Hofmann-Lehmann *et al.* 1996; Wack 2003; Driciru *et al.* 2006); calicivirus (Hofmann-Lehmann *et al.* 1996; Kadoi *et al.* 1997; Fowler and Miller 2003; Driciru *et al.* 2006); rhinotracheitis (Hofmann-Lehmann *et al.* 1996, Wack 2003; Driciru *et al.* 2006); and feline leukemia and feline immunodeficiency virus (Spencer *et al.* 1992; Hofmann-Lehmann *et al.* 1996; Wack 2003; Endo *et al.* 2004; Driciru *et al.* 2006).

The vaccination protocol in exotic felids recommends using killed or inactivated vaccines (Read and Meier 1996; Wack 2003). In Spain, to date, we have been able to find a quadrivalent inactivated vaccine against rhinotracheitis, calicivirus, panleukopenia, and feline leukemia from Fort Dodge Animal Health (a division of Pfizer, Madrid, Spain). Vaccination should start at 8 wk of age and continue every 2 wk until 16 wk of age, then a booster given at 6 mo and 1 yr of age. This vaccination schedule is intended for neonate lion cubs that will remain in lifetime captivity or for those animals which would benefit from vaccination because they will be released in an area with a high prevalence of those diseases for which they would be vaccinated.

For those animals which cannot be released, and are going to be kept as a part of an educational program, we recommend tri-annual boosters (Wack 2003). Other protocols recommend vaccine administration every 3–4 wk during 6 to 16 wk of age for those animals that will remain in captivity (GAAS 2004; Law 2003). In this case study, because the limited immunity of the two cubs was known, it was decided to start vaccination at week 2 of age and boosters were given every 20 days. Because of the interference of the vaccines with maternal antibodies, this protocol is not recommended for healthy cubs being raised by their mother.

There are parasitic diseases reported in lions for which it is mandatory to develop the correct prophylaxis. Parasites have been reported in this species in the wild and in captivity (Dinnik and Sachs 1972; Peters *et al.* 1973; Ocholi *et al.* 1989; Müller-Graf 1995; Kinsel *et al.* 1998; Lopez-Rebollar *et al.* 1999; Bjork *et al.* 2000; Penzhorn *et al*. 2001; Fowler and Miller 2003). Ascarid nematodes (Ascaridae) seem to be an insidious problem in captivity (Wack 2003). Anthelmintic drugs used for domestic cats are also effective for exotic felids (Prescott 1981; Wack 2003). Our Center protocol uses febendazol (Panacur®) or pyrantel pamoate (Canex®) at the same dose as for domestic cats. For prevention of external parasites, we use fipronil (Frontline®) topically, or ivermectin (Ivomec®) subcutaneously at a dose of 200 µg/kg.

Another important factor in the rearing process is prevention of behavioral problems. If adult lions are kept in an institution where cubs are being hand-raised, it would be ideal to allow the cubs ongoing contact with them under appropriate security measures. In our facilities, once the cubs open their eyes, and their ear canals are functional, and the environmental temperature is suitable for them, the cubs are introduced for short periods of time into an enclosure next to the adult facilities. These exposures allow the cubs to observe, smell, and hear all of the group in their future, permanent enclosure (and *vice versa*) without the risk of being injured by an adult. At 6-1/2 mo of age, we have been able to successfully introduce cubs into the same facility as some of the females, and after 10 mo they were living together with the entire pride.

Results

The set of measures developed for hand-rearing of the two lion cubs was considered satisfactory, both for physiological and behavioral aspects. Although the milk replacer used in this paper was considered successful for the hand-rearing, the authors recommend further studies in order to create a milk replacer for neonates more similar to lion milk. The guidelines the Center used for feeding, management of medical problems most commonly associated with this condition, preventive medicine (vaccinations, de-worming), and techniques used to avoid potential behavioral disorders in the future proved effective for the hand-rearing and maintenance of these two lion cubs.

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Fernando Najera examining a cub named Leon.

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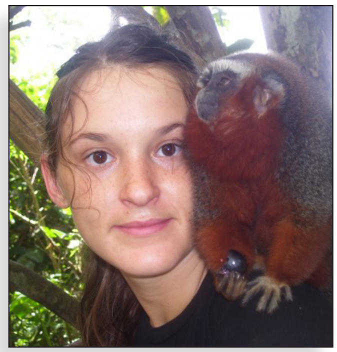
Luis Revuelta



Krystle Kaufman

The Management of an Injured Roe Deer (*Capreolus capreolus*) with a Metacarpal Fracture and Cortical Blindness Resulting from a Vehicle Collision

Livia Benato and Steve Bexton

ABSTRACT: Wild deer are frequently involved in collisions with motor vehicles. This paper describes the veterinary care and captive husbandry of a juvenile roe deer *(Capreolus capreolus)* which had been injured in a vehicle collision and also serves to highlight some of the general principles of deer rehabilitation. Cervids require specialized facilities, if they are to be rehabilitated, as they are easily stressed and risk further injury to themselves and to human handlers. This deer suffered a metacarpal fracture that was stabilized by external casting, as well as traumatic cortical blindness which resolved spontaneously with time. It made a full recovery and was subsequently released.

KEY WORDS: *Capreolus capreolus*, cortical blindness, deer-vehicle collision, DVC, metacarpal fracture, rehabilitation, roe deer.

Introduction

Deer–vehicle collisions (DVCs) are widespread across Europe and North America and are increasingly common as traffic volume and vehicle speeds increase (Danielson and Hubbard 1998). Several studies have investigated the types and numbers of incidents, predisposing factors, and the efficacy of preventative measures (Groot Bruinderink and Hazebroek 1996; Langbein and Putman 2006; Langbein 2007; Mastro *et al.* 2008). Many DVC recording schemes exist, but many incidents are unreported and accurate records are often lacking (Groot Bruinderink and Hazebroek 1996; Langbein and Putman 2005). There are 31,000 to 45,000 annual DVCs in England and Wales (Langbein 2007), with around 60,000 in Sweden (Seiler 2004) and over 225,000 in Germany (Kerzel 2005). In the United States, there are approximately 1.5 million DVCs per year (Conover 2001), causing around 1.3 million deer fatalities (Conover 1997).

PHOTO ©ISTOCK/KAPHOTO, USED WITH PERMISSION.

Adult roe deer *(Capreolus capreolus).*

Comprehensive records of DVCs involving fallow deer (*Dama dama*) in Ashdown Forest, England showed that over half were killed outright, and over a third survived the impact but sustained severe injuries necessitating dispatch at the roadside (Langbein 2007). DVCs therefore constitute a major animal welfare issue and are a significant cause of mortality in wild deer (Langbein 2007).

Following a vehicle collision, injured deer often remain at the roadside, temporarily unaware of their surroundings due to reduced consciousness, concussion, blindness,

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or shock. If one can safely do so, these deer should be assessed where found to avoid the additional stress and discomfort caused by movement. Statistically, the majority will be seriously injured and require immediate euthanasia, by firearm or lethal injection, to prevent further suffering (Langbein and Putman 2005). Common traumatic injuries that carry a grave prognosis include spinal fractures and dislocations, pelvic fractures (especially in females due to the risk of dystocia), and long bone fractures which are compound, contaminated, or both (Green 2003).

Justifications for moving the casualty include a dangerous location, examination difficulty, minor injuries, and when further investigation is needed such as radiography. A suitable facility must be available locally and, ideally, analgesia or tranquillization should be given beforehand. It is inadvisable to transport an injured deer without suitable restraint, both because of the risk of exacerbating its injuries and the danger of it becoming mobile in a moving vehicle.

Cervids are highly nervous and difficult to manage in captivity, resulting in a risk of injury to animal and handler (Porter 1990). Even small deer have powerful muscles and can kick and jump with great speed and surprising force. Hooves and antlers (if present) are sharp and capable of inflicting severe injury (Green 2003). Major surgery and prolonged convalescence are contraindicated in adult deer due to the negative welfare effects on such fractious animals (Green 2003). However, injured deer can recover with the proper care and suitable facilities. In the authors' experience, juveniles tend to do better than adults because they are relatively calmer and, thus, are less likely to injure themselves and will heal quicker.

Disabled deer are occasionally retained in permanent captivity, but this should only be done after serious consideration of their environmental requirements and subsequent quality of life. There are also reports of three-legged deer able to cope, survive, and breed successfully in the wild (Green 2003).

Case Report

A juvenile female roe deer (*Capreolus capreolus)*, aged approximately 8–10 wk old and weighing 7.8 kg, was presented after being hit by a road vehicle. She was in shock and had a closed fracture of the left metacarpal bone, with swelling of the distal limb, and numerous superficial grazes.

Methods

Intravenous Hartmann's solution was given at a rate of 10 ml/kg/hr to combat hypovolemia. Initial therapy consisted of a one-off, long-acting antibiotic injection (amoxicillin) and vitamin E–selenium toward reducing the risk of post-capture myopathy (Williams and Thorne 1996). Pain was alleviated by restricting the deer's movement, splinting the fracture site to reduce bone movement, and injections of carprofen (Rimadyl Large Animal Solution, Pfizer Ltd., Sandwich, Kent, U.K.) at a dose of 1 mg/kg on alternate days for the first week (Green 2003).

Preliminary radiographic assessment was possible without sedation by temporarily covering the head and eyes with a cloth hood–blindfold to reduce anxiety. X-rays showed a simple mid-shaft fracture of the metacarpus with favorable healing potential (Fig. 1) and a temporary splint dressing was used for support.

Initially, the deer was kept confined in a small plastic shipping crate (1.2 m × 1.0 m × 0.8 m) to restrict movement. Deep hay bedding was used for grip, comfort, and warmth, and disturbance

FIGURE 1. Initial radiograph; fracture of left metatarsus.

FIGURE 2. Fracture repair after 1 wk.

FIGURE 3. Fracture repair after 2 wk.

FIGURE 4. Fracture repair after 3 wk.

was kept to a minimum.

After 24 hours, the deer was bright and alert but was unresponsive to visual stimuli. Examination revealed absence of the menace response (reflex blinking in response to a visual threat). The pupils were equal and of normal size for the light conditions and responded normally to bright light by constriction. The palpebral (blink) reflex was present when the eyelids were touched, and funduscopic examination revealed no obvious abnormalities such as papilloedema or hemorrhage. These findings were suggestive of cortical blindness, which was probably a result of head trauma.

PHOTO ©ANDREW FORSYTH, RSPCA. USED WITH PERMISSION.

FIGURE 7. Roe deer being released after a total of 10 wk in captivity.

General anesthesia was induced using the triple combination of medetomidine at a dose of 60 µg/kg (Domitor solution, Pfizer Ltd.), ketamine at a dose of 1.5 mg/kg (Ketaset solution, Fort Dodge Animal Health, Southampton, Hampshire, U.K.), and butorphanol at a dose of 0.1 mg/kg (Torbugesic 1% injection, Fort Dodge Animal Health), all combined in a single intramuscular injection (Fletcher 1995). The deer was kept in sternal recumbency to prevent ruminal tympany, with the head supported upright to prevent gastric reflux. Attempts were made to align the fracture by traction and manipulation, and a lightweight thermoplastic casting material (Vet-lite,® Runlite S.A., Micheroux, Belgium) was used for support. Atipamezole injection (Antisedan,® Pfizer Ltd.) was used at a dose of 300 µg/kg to reverse the anesthetic and, after recovery, the deer was immediately able to bear weight on the affected limb.

FIGURE 5. Fracture repair after 4 wk.

FIGURE 6. Fracture repair after 10 wk.

Food was provided *ad libitum*. Natural browse was collected daily from hedgerows; mostly bramble (*Rubus fruticosus*) and hawthorn (*Crataegus monogyna*), which roe deer prefer (Green 2003). Alfalfa and a proprietary goat mix were also offered, but consumed less. Disturbance was kept to a minimum to reduce stress and the risk of further trauma, as well as the possibility of habituation to humans. It is also important that deer are housed well away from the sights, sounds, and smells of dogs.

Results

After 7 days, the deer was alert and reacted normally to noise and touch by stopping eating and becoming distressed. However, there was still no reaction to visual stimuli, including the menace response. Further radiographs, taken under anesthesia as before, showed early fibrocallous formation and adequate fracture alignment (Fig. 2). The cast was replaced and the deer was moved to a larger enclosure that was far remote from human activity, where it had only minimal disturbance during replenishment of food and water. The new enclosure measured 3 m × 2 m and had deep straw bedding and internal walls lined with thick (55 mm) styrofoampadded stock boarding to cushion against injury. Further remote monitoring was possible via closed-circuit television cameras and showed increasing activity levels over the following days.

The deer's eyesight seemed to return in stages; initially, it reacted to light, then it would watch silent movements, until eventually it started to react normally with fear and panic to human presence. The return of full visual acuity took 20–25 days. Weekly cast changes were necessary because dressings became wet with urine (Porter 1990). Brief anesthesia allowed inspection, radiography (Figs. 3–4), and cast replacement.

After a total of 30 days in captivity, examination under anesthesia revealed the deer had a stable callous, which was confirmed radiographically (Fig. 5). She was moved to a large outdoor enclosure measuring 35 m × 35 m with 2.5-m high solid stockade fencing to prevent escape; two similar-aged roe deer were also provided for company. The enclosure's natural vegetation afforded plenty of cover, and the deer was observed to avoid obstacles in its new, unfamiliar environment, confirming that she could see. The larger area also allowed more exercise to regain muscle strength. After a total of 10 wk in captivity, the deer was darted to allow a final, pre-release assessment that included radiography (Fig. 6). She was also ear-tagged for future identification and released with a similar-aged male roe deer into mixed deciduous woodland close to where she had been originally found (Fig. 7).

Management Implications

Injuries from vehicle collisions are a common cause of roe deer presentations for veterinary examination. Wild deer are fractious and prone to stress and, therefore, difficult to manage in captivity. The prognosis for a full recovery and the time taken to achieve this are the prime considerations when dealing with deer casualties. Prolonged periods in captivity are contraindicated due to the stress involved and the possibility of further self-injury. A balanced compromise is needed between the animal welfare costs of releasing an injured deer (pain, dysfunction, impaired mobility, and increased predation risk) and the stress of keeping it in captivity until recovered.

Temporary cortical blindness following head trauma is not uncommon in roe deer and, in the authors' experience, vision usually returns over 2–3 weeks (unpubl. observations in 28 deer). Blindness immediately following a DVC should, therefore, not be considered an automatic indicator for euthanasia if other injuries are minor. The eyesight seems to return gradually and in stages, with apparent reaction to light, followed by movement detection before full vision returns. An assessment of vision should form an essential part of the examination of deer casualties and is an important pre-release consideration. Such temporary blindness can often have positive animal welfare benefits by reducing awareness and stress, and may even be a survival mechanism in nervous species such as roe deer.

Traumatic bone fractures are a common injury in DVCs (Nisbet *et al.* 2010). Generally, compound fractures, especially if already contaminated, carry a guarded prognosis for healing. Deer with multiple fractures, especially if associated with prolonged recumbency in order to heal, are poor candidates for recovery. Radiography may be necessary to assess the severity and potential for healing (Lewis 1994). Some researchers advise against fracture fixation in deer, due to their ability to heal spontaneously and because of the need for a rapid return to the wild (Fletcher 1987; Green 2003). Conservative management consisting of rest and minimum disturbance is sufficient for many fractures to heal (Fletcher 1987), although, in the authors' experience, injured deer remain active and thus impair fracture repair. Alternatively, deer with a single fracture above the tarsus–carpus can be immediately returned to the wild to allow natural repair (Green 2003). However, the authors are uneasy with this approach because, although some probably do recover, the incidence of nonunion, malunion, and other problems is unknown. Deer with distal limb fractures may require a limb amputation and release as soon as possible afterwards (Green 2003). Fixation methods involving prolonged aftercare and lengthy captivity are not recommended (Green 2003). If fracture stabilization is necessary, it should allow weight bearing as soon as possible (Jones 1994; Toews *et al.* 1998). The priority is a rapid return to the wild, but surgical implants need subsequent removal, which prolongs the time spent in captivity. Additionally, rigid fixation can lead to disturbed limb growth in the young animal (Jones 1994).

Studies have described the successful management of metacarpal fractures in cattle and horses by using external casting (Tulleners 1986, 1996; Nemeth and Back 1991). A thermoplastic casting material was used in this case to provide the necessary support (Claeys *et al.* 2007) that would also facilitate rapid healing and minimize the time spent in captivity. The fracture healed well, with good alignment and no limb shortening (Fig. 5).

The young age of the deer was a major consideration in the choice of method of fracture stabilization, and also in the decision to treat at all, as young deer heal rapidly and are also more tolerant of captivity and less likely to further injure themselves. Care is needed, however, to avoid inducing tolerance of humans; this could compromise post-release survival. A balance is needed between intervention to monitor healing and progress and minimization of human contact and disturbance.

The weaning age of roe deer in captivity is variable, with foraging starting at 2 wk (Wallach *et al.* 2007) and some hand-reared fawns weaning as early as 2 mo old (Bradley 1971). Observations of the food consumption in this case suggested milk was no longer required and the additional handling to administer it was counter-productive.

Post-capture myopathy (PCM) is a well-documented metabolic condition which can affect many species, including wild ungulates, following stress and exertion, e.g., capture, restraint, and transportation (Williams and Thorne 1996; Montané *et al.* 2002). Tranquilizers can be used to reduce stress, improve welfare, and decrease the risk of developing PCM (Mentaberre *et al.* 2010; Nisbet *et al.* 2010). In particular, long-acting neuroleptics can be useful to reduce anxiety (Ebedes and Raath 1999), but can also make assessments of neurological function and behaviour difficult due to their effects on the central nervous system. However, their use is contra-indicated in the very young, the very old, and animals with head trauma or hypovolemic shock (Kaandorp 2005). In the authors' experience of hospitalized wild deer, the benefits of these drugs has been difficult to assess, and they are no substitute for monitoring for signs of anxiety and disturbed behaviour, with modification of management practices in response.

Conclusions

We offer the following criteria for making a decision to rehabilitate wild deer: 1) Suitable facility available, 2) a good chance of making a full recovery in a relatively short time, 3) injuries such that regular interventions are not necessary, and 4) the age of animal (juveniles cope better in captivity and also heal rapidly).

Ideally, there should be systems in place so that live deer casualties can be attended promptly, by a suitably experienced person, for assessment and decision on the best course of action that will avoid unnecessary suffering.

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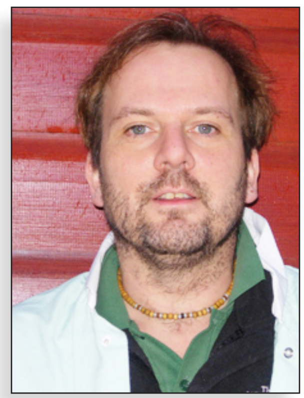

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Early Hours of Treatment in a Neonate Nine-Banded Armadillo (*Dasypus novemcinctus*) Rescued from Illegal Trafficking in Ecuador

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A NOTE TO OUR READERS: The reprint below was originally printed in a Spanish language journal and has been through several translations into English. We appreciate your patience with our attempt to provide you with access to information that might otherwise be unavailable. —Editor

SUMMARY: This paper presents the case of a baby nine-banded armadillo *(Dasypus novemcinctus)* that was rescued from illegal wildlife trafficking in the province of Pastaza (Ecuador) and was delivered to the Center for Wildlife Rescue Flor de la Amazonia Wayra Urku (km.35 via Arajuno, Puyo-Pastaza, Ecuador). This animal had, at the time of rescue, severe hypothermia and dehydration, was treated, and later was introduced to a change in diet deemed ideal for raising it. In this review we discuss the different ways to approach the case and the treatment chosen to avoid a premature death of the animal. It is believed that the proper protocol was chosen to correct the initial unstable state and for effective hand-rearing until the animal was suitable for release.

KEYWORDS: nine-banded armadillo, hypothermia, dehydration, hand-rearing

Introduction

Armadillos are considered the most primitive living placental mammals from the Neotropical region. Under the recent proposed classification of mammals of Wilson and Reeder (2005), and following the criteria of McKenna and Bell (1997), armadillos form the new order *Cingulata*, discarding previous criteria where armadillos were included along with aardvarks and anteaters in the common order *Edentata* or *Xenarthra*, respectively (Tirira 2007).

The nine-banded armadillos are widely distributed in Ecuador and are often hunted for their meat; their shells are used for other purposes (e.g., musical instruments). This has resulted in low numbers in armadillo populations in those places where armadillos are hunted (Tirira 2007).

For identification purposes, it is useful to study the back, which is covered with a bony armor having nine (but also 8 to 11) rows of bony plates located in the middle of the body (Tirira 2007). The head is fitted with an armored shield on the forehead. Ears are very close together and do not have bony plates between them. The eyes are small. The tail is smaller than the size of the head and body combined. The front legs have four toes with strong claws and the hind legs have five toes (Tirira 2007).

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Materials and Methods

The Center for Wildlife Rescue Flor de la Amazonia Wayra Urku receives native, wild mammals, birds, and reptiles that are injured or in need of veterinary care, as well as those injured or orphaned through illegal trafficking in wildlife. In this case, the young, female nine-banded armadillo brought to the center was rescued from trafficking, presumably after the mother was killed, a common situation when babies or juveniles of any species are seized.

The nine-banded armadillos have a wide spectrum of body temperature according to several investigators; temperatures can range between 30–36°C (Arruda and Arruda 2009; Almeida and Fialho 1924; Eisentraut 1932; Wislocki and Enders 1935; Enders and Davies 1936; Johansen 1961; Burns and Waldrip 1971; Mercer and Hammel 1989). At the time of rescue, the baby armadillo presented with severe dehydration and a hypothermia of 29.3°C. In addition, our patient presented coma, bradycardia, and bradypnea. The mucous membranes were pale colored with a capillary refill time longer than 2 sec and a delay in the retraction of the fold of skin, with sunken eyeballs and dried mucous membranes. With this information, we determined a dehydration state of between 6–8%.

The anal mucous membrane showed obvious signs of diarrhea with bits of undigested food (e.g., worm) that had been fed during their initial, illegal captivity. The estimated age of the animal was difficult to quantify precisely because armadillos are a species in which young are born well developed, with open eyes and teeth made up of permanent teeth homodontos, i.e., there is no difference between the juvenile and adult teeth (no deciduous dentition as most mammals; Tirira 2007).

At the time of intake examination, the baby armadillo weighed 220 grams. The common weight at birth is 100 grams (Fowler and Miller 1986), which made us assume (along with its size) that the animal was not more than 2 wk old. The first step taken was to reinstate the normal body temperature. Subcutaneous fluids were used to rehydrate the animal. The intravenous route was not possible because of an inability to catheterize a vein due to the small size of the veins. Also, because of the hypotension of the patient, it was practically impossible to visualize the typical places used for venipuncture in armadillos (jugular, cephalic, saphenous; Moore 1983), so we decided to use the subcutaneous route rather than intravenous rehydration. We also ruled out the intraosseous route because it can lead to osteomyelitis, and we had no ability to ensure proper aseptic technique in the center.

Recovery of the individual's body temperature to normal was the first necessary step to prevent death of the animal so that we could begin fluid therapy. If we had started with subcutaneous fluids without first reaching the normal body temperature of the patient, subcutaneous fluids absorption would be practically null because of hypoperfusion of peripheral tissue during a state of hypothermia. To achieve an animal's body optimum temperature, one can use hot water bottles, thermal blankets (not in direct contact with the individual to avoid burns), and ventilation of hot air or tempered fluids, among other practices. In our case, due to the lack of some tools and the small size of the animal, we decided to place the baby in a latex glove and then soak it in water at a temperature of 38–40°C, thus achieving a more rapid effect and homogeneous warmth over all portions of the animal's body surface.

After intermittent dives over a period of twenty minutes, we achieved her recovery of consciousness and had increased the animal's temperature to 35.8°C. After that, we began subcutaneous fluid therapy. For dehydrated infants, it is recommended to use a mixture of dextrose 0.9% and NaCl 2.5% (Hoskins 1996; to correct the hypoglycemia typically concomitant of this state). It is necessary to calculate the losses from dehydration and diarrhea in order to determine the appropriate volume to be infused. Using the subcutaneous route, the sites of puncture should be the lateral zones of the individual, with particular attention to the volume to be injected. It is strongly recommended that multiple points of infusion be used. Once the animal had recovered hydration status, we changed to the oral rehydration route as the next step toward continued hand-rearing.

In armadillos, orogastric intubation is regarded as a reliable method to administer liquid, foods, or serum in neonates (Fowler and Miller 1986). Our protocol was designed to feed our patient only with oral rehydration solution during the first 12 hr or until diarrhea subsided. As proposed by Fowler and Miller (1986), we supplied oral rehydration with Oralyte® or Pedialyte® in an amount not exceeding 30–40 ml/kg, the volume the stomach can hold in a neonate. In our case, it was proposed that the rehydration solution-based diet be administered orally every 2 hr until remission of diarrhea, at which point we could start with the formula. We used a flexible urogenital cat catheter as an orogastric intubation tube. A no. 8 French feeding tube can be use if the individual weighs at least 100 grams (Fowler and Miller 1986).

The tube can be lubricated with petroleum jelly and then inserted into the animal's mouth, hoping to induce the animal to swallow it (hence, this technique cannot be used in unconscious animals). The tubing should be previously measured to ensure it reaches the patient's stomach (an extension to between the sixth and eighth intercostal space is usually sufficient). Following the introduction of the tube, it is important to ensure proper placement before infusing any liquid. We recommend introducing the outside tip of the feeding tube into a beaker with water so that, if bubbles are observed, it means that the internal end is in the respiratory tract and could cause an aspiration pneumonia; it should be reinserted.

The infusion rate of fluids through the tube must be slow enough to not cause the patient's stomach to dilate and result in reflux of contents into the esophagus (the author proposes a rate of approximately 1 ml/30–40 seconds). After completing the infusion volume at each adminstration, it is necessary to inject air into the tube to completely empty its contents into the stomach, because this will decrease the risk of aspiration pneumonia while extracting the tube from the animal.

Our patient, after a period of 18 hr of oral rehydration and after remission of the diarrhea, was considered ready to begin receiving the oral feeding formula. The diet of these animals in captivity is well known in adulthood (Wampler 1969; Storrs and Grier 1973; Meritt 1976, 1985; Fowler and Cubas 1996; Fowler and Miller 2003; Rosa *et al*. 2009), but it is difficult to find literature that proposes adequate formulas for baby armadillos. Among the minimal guidance in the literature, we recommend Esbilac® milk diluted in water in a proportion of one part milk to three parts water (1:3; Fowler and Miller 1986). In addition, the compound used in the Sao Paulo Zoo, which successfully raised a 25-day-old baby, consisted of milk powder (presumably for human consumption), eggs, honey, and vitamins (Wampler 1969; Storrs and Grier 1973; Meritt 1976, 1985; Fowler and Cubas 1996).

Our baby was given an initial mixture of the formula Enfamil LactoseFree® and oral rehydration in an initial dilution of 1:5 parts of milk and rehydration fluid, respectively, a concentration based on the consistency of the feces. The milk was chosen according to the protein, fat, and carbohydrate concentration, but the products we used were only those targeting human consumption. The absence of lactose in the preparation was intended to prevent diarrhea caused by malabsorption of this sugar.

After three doses of milk powder, in 2-1/2-hr intervals, we saw a proper stool consistency. Thereafter, we progressively increased the amount of mixture given while maintaining a concentration of 1:3 milk and water. It is interesting to note the need to add vitamin K to the food of armadillos, a species that is more susceptible to possible diseases when lacking this vitamin (Wampler 1969; Storrs and Grier 1973; Meritt 1976, 1985; Fowler and Cubas 1996; Fowler and Miller 2003).

Discussion

Although we had a short time of working with this patient, we chose to maintain a correct course of action to reverse clinical hypothermia and the dehydrated state of the neonate. Because of the absence of sucking reflex (of teats) and the lack of appropriate tools to fit the shape of the patient's mouth, the most appropriate option for raising the patient was to conduct orogastric intubation as our only choice in feeding. It is important to emphasize the difficulty of the chosen technique, and its possible consequences for being a poor practice because of the potential for aspiration pneumonia, which is the main medical complication during rearing of these babies. It would be useful to conduct further studies and reviews of hand-rearing of this species, especially if there are reports of breeding armadillos in captivity while keeping the parents (Job *et al*. 1984, 1987; Carvalho *et al*. 1997).

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White-Nose Syndrome Fungus *(Geomyces destructans)* in Bat, France

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ABSTRACT: White-nose syndrome [WNS] is caused by the fungus *Geomyces destructans* and is responsible for the deaths of >1,000,000 bats since 2006. This disease and fungus had been restricted to the northeastern United States. We detected this fungus in a bat in France and assessed the implications of this finding.

Biologists are struggling to understand a recent emerging infectious disease, white-nose syndrome (WNS) (Turner and Reeder 2009), which potentially threatens >20% of all mammalian diversity (bats) (Simmons 2005). WNS is a deadly epidemic that has swept through the northeastern United States over the past 3 yr and caused the death of >1,000,000 bats, with decreases reaching almost 100% in some populations (Consensus Statement 2009).

Little brown bat *(Myotis lucifugus)* showing symptoms of white-nose syndrome.

This disease is associated with hibernating, cave-roosting bats. A visually conspicuous white fungus grows on the face, ears, or wings of stricken bats; infiltration of the hyphae into membranes and tissues leads to severe damage (Meteyer *et al.* 2009). Bats that exhibit WNS have little or no fat reserves, which are essential for their survival throughout and after hibernation (Blehert *et al.* 2009). The fungus associated with WNS is a newly described, psychrophilic (cold-loving) species *(Geomyces destructans)* (Gargas *et al.* 2009). It is closely related to *G. pannorum*, which causes skin infections in humans (Gianni *et al.* 2003).

Although it is not known whether the fungus is primarily responsible for the deaths of bats or is a secondary infection, it is directly associated with deaths of bats (Blehert *et al.* 2009). Bacteriologic, virologic, parasitologic, and postmortem evaluations for the cause of death did not identify any other agents, which reinforces the suspicion that this fungus is the causative agent (Meteyer *et al.* 2009, Blehert *et al.* 2009). To date, WNS has been found only in the northeastern United States. However, researchers have suggested its presence in Europe. We investigated whether *G. destructans* is present in bats in Europe and assessed the implications of its presence.

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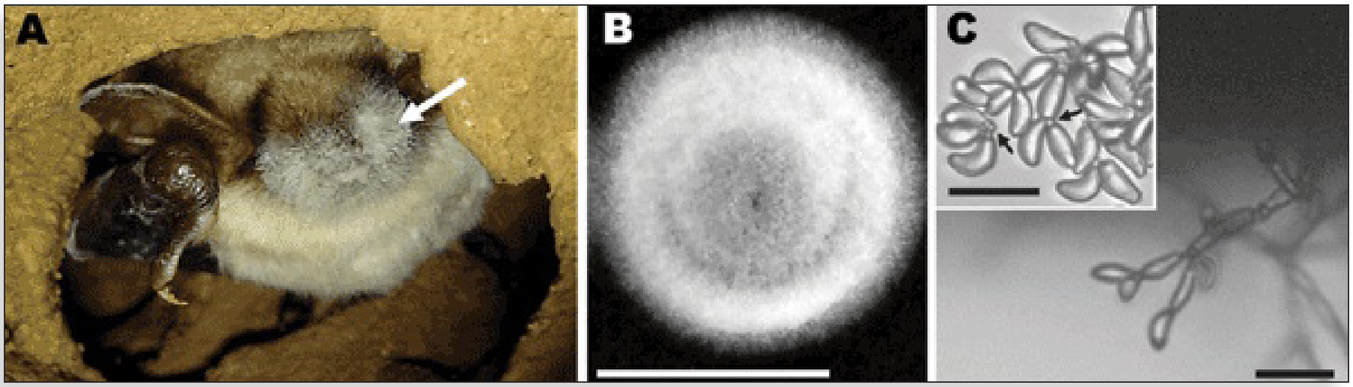

FIGURE 1. A) *Myotis myotis* bat found in a cave on March 12, 2009 in France, showing white fungal growth on its nose (arrow). **B)** Fungus colony on malt extract medium after incubation for 3 weeks at 10°C. Scale bar = 1 cm. **C)** Clusters of unstained spores of *Geomyces destructans*. Spores in the inset were stained with lactophenol cotton blue, which shows the truncate spore base (arrows) and surface granulation. Scale bars = 10 µm.

The study

During intensive monitoring of bat hibernation in France, one bat (*Myotis myotis*), found on March 12, 2009 near Périgueux (45°8'N, 0°44'E), showed a powdery, white fungal growth on its nose (Fig. 1, panel A) that is characteristic of WNS. Sterile, dry cotton swabs were used to collect fungus material from the nose of the bat. The bat was then weighed, measured, and released. Swabs were moistened with 50 µl of sterile water and streaked onto plates containing potato dextrose agar supplemented with 0.1% mycologic peptone. Plates (9 cm in diameter) were sealed with parafilm and incubated inverted at 10°C. A dense fungus growth developed within 14 days (Fig. 1, panel B).

Cultures were established by transferring inoculum to other mycologic media including malt extract agar and Sabouraud agar. Colonies on malt extract agar were initially white, but after spore production and aging, they quickly darkened from the center to a dull gray, often showing a faint green hue. Spores were hyaline, irregularly curved, broadly crescent-shaped (typically 6–8 µm long and 3–4 µm wide), and narrowed at each end, one of which was broadly truncate, often showing an annular frill (Fig. 1, panel C). Fungal cultures have been deposited in the culture collection of the Industrial Microbiology Department of University College, Dublin (Reference IMD Z2053).

Microscopic examination of the original swab samples showed numerous spores with the above-mentioned features.

TABLE 1. Primers used for PCR amplification and sequencing of fungus in bats, France.*

GENE	PRIMER SEQUENCE (5' → 3')	PCR
ITS	TCCTCCGCTTATTGATATGC	Forward
	GGAAGTAAAAGTCGTAACAAGG	Reverse
SSU rRNA	CTGGTTGATTCTGCCAGT	Forward
	AAACCTTGTTACGACTTTTA	Reverse
	CCGGAGAAGGAGCCTGAGAAAC †	
	AACTTAAAGGAATTGACGGAAG †	
	CTCATTCCAATTACAAGACC †	
	GAGTTTCCCCGTGTTGAGTC †	

* ITS = internal transcribed spacer; SSU = small subunit.
† Used for sequencing only.

The psychrophilic nature of the fungus and its species-specific morphologic features led to the conclusion that this fungus was *G. destructans*, which was recently isolated from WNS-positive bats in the northeastern United States (Gargas *et al*. 2009).

Two molecular markers were sequenced from six randomly chosen fungus cultures to confirm species identity. DNA was extracted by using a Blood and Tissue Kit (QIAGEN, Hilden, Germany), following the manufacturer's instructions with slight modifications (after step 3, we added an incubation time of 10 min at 70°C). The internal transcribed spacer (ITS) regions (ITS1, 5.8S, and ITS2) and the small subunit (SSU) of the rRNA gene were amplified separately.

Polymerase chain reactions [PCRs] were performed in 25-µl volumes containing 1 ml of DNA (10–75 ng/ml), 1.5 mmol/L $MgCl_2$, 0.4 mmol/L of each primer, 0.2 mmol/L dNTP, 1× PCR buffer, and 1 U of Platinum Taq DNA Polymerase High Fidelity (Invitrogen, Carslbad, California USA). Identical PCR cycling conditions were used for both fragments: an initial step at 95°C for 15 sec, 10 cycles at 95°C for 30 sec, 60°C (reduction of 2°C every two cycles) for 1 min and 45 sec, and 72°C for 1 min; 30 cycles at 95°C for 30 sec, 50°C for 1 min and 45 sec, and 72°C for 1 min; and a final step at 72°C for 10 min. PCR products were purified and sequenced in both directions by using primers listed in Table 1. Complementary sequences were assembled and edited for accuracy by using CodonCode Aligner version 3.0.3 [CodonCode Corporation, Dedham, Massachusetts USA].

The ITS and SSU sequences from the six WNS fungus cultures were identical. They were deposited in GenBank as single sequences: ITS (GQ489024) and SSU (GQ489025). Sequences obtained for the two genetic markers showed a 100% sequence identity with the described *G. destructans* fungus (Fig. 2, panels A, B). Thus, morphologic and genetic data support the presence of *G. destructans* infection in a bat in France.

Conclusions

Our results show that the WNS fungus was present in a bat in France and have implications for WNS research, bat conservation, and emerging infectious disease control. We suggest three possible

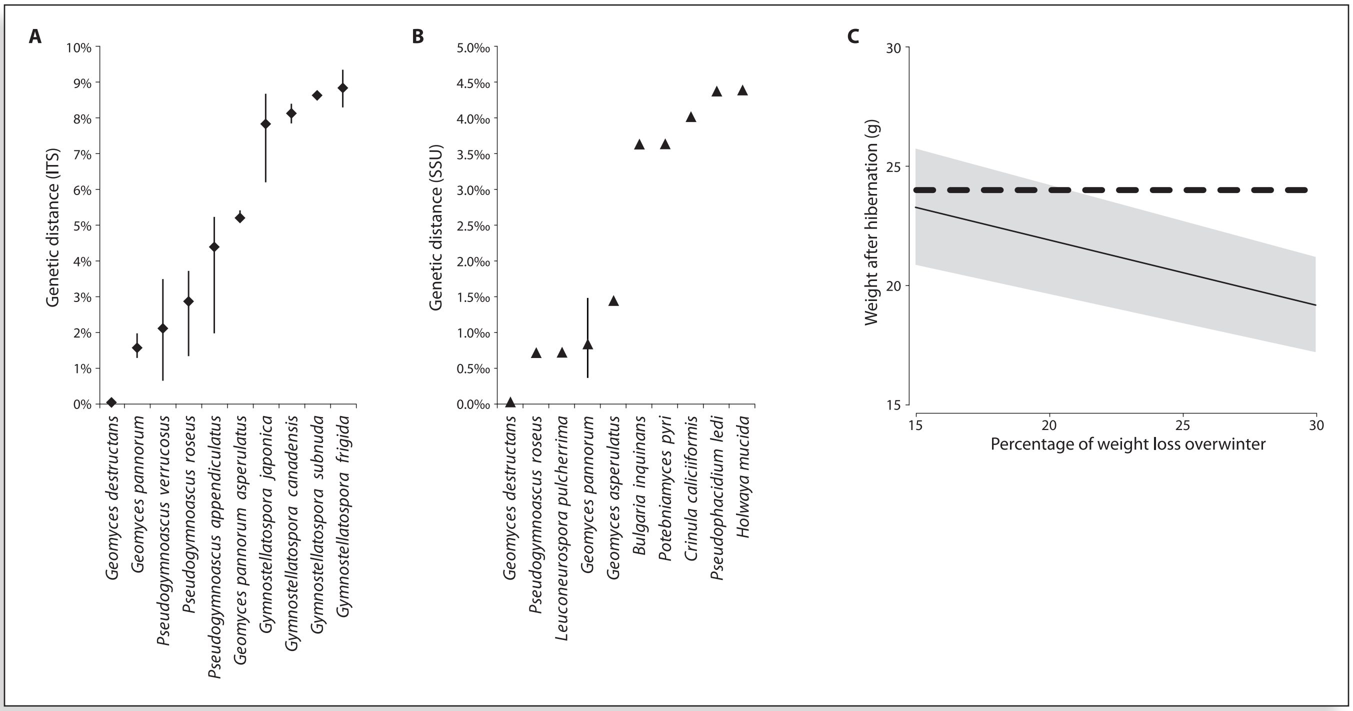

FIGURE 2. Genetic distance between fungus **A)** internal transcribed spacer (ITS) (474 nt) and **B)** small subunit (SSU) rRNA (1,865 nt) gene sequences and other closely related fungus species present in GenBank. Results are based on pairwise sequence comparisons with gaps and missing data removed. Error bars in panels A and B indicate mean ± SD. **C)** Estimation of weight of *Myotis myotis* bats after hibernation as a function of the range of percentage of weight loss reported. Posthibernation of a bat's weight was estimated from prehibernation measured weights (n = 155 bats) minus winter fat loss. A strong positive relationship exists between body mass and fat mass during prehibernation (Kunz *et al.* 1998). Fat reserves between 15% and 30% of body mass at the onset of hibernation have been reported to be necessary for *Myotis* species to survive winter (Johnson *et al.* 1998). The posthibernation weight (Wpost) was thus estimated as Wpost = Wpre – (Wpre × Wloss/100), where Wpre is prehibernation weight and Wloss is percentage of body mass lost during hibernation. Mean ± SD prehibernation weight of 155 bats captured in France during August–October 2009 (27.42 ± 2.87 g) was used for the estimate. Black dashed line represents the mean, gray area represents the mean ± SD, and the black dashed line represents the 24-g weight of the bat caught in France with white-nose syndrome, posthibernation. The bat was in good condition (24 g) because it weighed more than the expected average for a posthibernating bat, despite having *Geomyces destructans* growth on its snout.

scenarios for our findings. The first scenario is that the fungus has only recently arrived in Europe and all bats in Europe are now at risk for infection. Thus, conservation steps must be taken to minimize the spread of this disease, especially because this disease is specific for hibernating bats. After the hibernation period, *M. myotis* bats may migrate up to 436 km to reach their summer roosts (Dietz *et al.* 2009), a behavior that could quickly increase the chance of fungus transmission. A second scenario is that the fungus has been present in Europe for a long time. Because mass deaths have not been observed in bats in Europe, these bats may be immune to WNS. Therefore, identification of mechanisms of this immunity will advance understanding of this disease and fungus resistance in mammals. The third scenario is that the *G. destructans* fungus is not the primary cause of death but acts as an opportunistic pathogen in bats already immunocompromised by other pathogens such as viruses or bacteria (Turner and Reeder 2009) Comparison of pathogens in bats in Europe and the United States infected with *G. destructans* should identify the primary causative agent.

The bat in our study showing fungal growth was not underweight (Fig. 2, panel C), as is typical of bats in the United States with WNS (Meteyer *et al.* 2009). This finding favors the second or third scenarios. Also, a 6-yr (2004–2009) annual monitoring program of wintering bat populations at the site and at five sites within a 2-km radius did not show any cases of WNS, or deaths, and showed stable bat populations. The three scenarios indicate that studying *G. destructans* in bats in Europe and the United States is necessary to understand and control this disease.

Another fungus, *Batrachochytrium dendrobatidis*, is the etiologic agent responsible for chytridiomycosis (Voyles *et al.* 2009), which currently threatens >50% of all amphibian species and is primarily responsible for the global decrease and extinction of >200 amphibian species in the past decade (Fisher *et al.* 2009). Because bats account for >20% of mammalian diversity (Simmons 2005) and play major roles in ecosystem functions, we need to understand, monitor, and control the progression of WNS. Otherwise, we may be faced with similar unprecedented and irreversible losses of mammalian biodiversity and entire ecosystems. Because bats control insect populations throughout the world (Federico *et al.* 2008; Kalka *et al.* 2008; Williams-Guillen *et al.* 2008), a large decrease in bat populations would result in insect proliferations that would damage agricultural crops and spread many insect-borne diseases.

Acknowledgments

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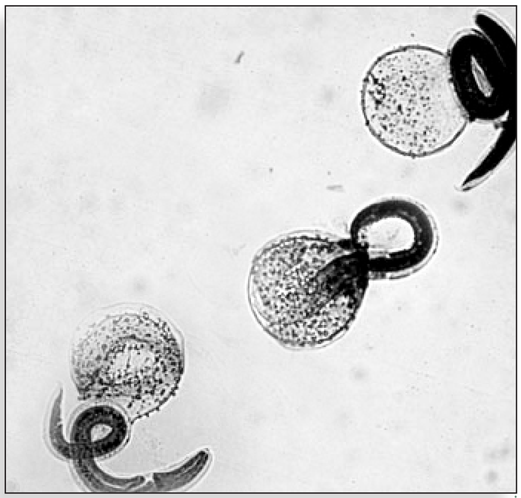
Geographic Expansion of *Baylisascaris procyonis* Roundworms, Florida, USA

Emily L. Blizzard, Michael J. Yabsley, Margaret F. Beck, and Stefan Harsch

University of Georgia, Athens, Georgia, USA (E. L. Blizzard, M. J. Yabsley); Goose Creek Wildlife Sanctuary, Tallahassee, Florida, USA (M. F. Beck); and SPCA Wildlife Care Center, Ft. Lauderdale, Florida, USA (S. Harsch).

ABSTRACT: *Baylisascaris procyonis* roundworms are common parasites of raccoons (*Procyon lotor*) in several regions of North America, Europe, and Asia. These parasites are increasingly recognized as a cause of larva migrans in humans, an infection that often results in severe neurologic sequelae or death. In addition, larva migrans has been documented in almost 90 species of wild and domestic birds and mammals. In the United States, *B. procyonis* roundworms are most prevalent in the midwestern, northeastern, and Pacific western states. Numerous surveillance studies have been conducted in the southeastern United States, and *B. procyonis* roundworms are most common in the mountainous regions of Virginia, Kentucky, and West Virginia (Kazacos 2001, Owen *et al.* 2004, McCleery *et al.* 2005, Souza *et al.* 2009). Geographic expansion of *B. procyonis* roundworms has been recently documented in Georgia. In 2002, 22% of raccoons sampled in DeKalb County, Georgia, a highly urbanized area near Atlanta, were positive for the parasite (Eberhard *et al.* 2003) and, recently, 10% of raccoons sampled in Clarke County, Georgia were positive (Blizzard *et al.* 2010). Whether this expansion is due to natural spread of the parasite among raccoons or to translocations of infected raccoons into naive areas is unclear. We document expansion of *B. procyonis* roundworms into northwestern and southeastern Florida.



In 2006 and 2007, nine ascarids (>3 inches) were collected from the feces of an unrecorded number of raccoons admitted to a rehabilitation center in northern Florida. In September 2008, December 2009, and June 2010 one ascarid each was found in the feces of a 4- and a 6-mo-old raccoon from Leon County, Florida and in a 6-mo-old raccoon from Wakulla County, Florida after routine treatment with pyrantel pamoate (20 mg/kg). In July 2010, a juvenile (6-mo-old) raccoon from Broward County, Florida, which had been admitted to a rehabilitation center, passed several ascarids (two collected for testing) in its feces after ivermectin treatment (0.2 mg/ml) for mange. The 14 ascarids were preserved in 70% ethanol and adult males were identified as *Baylisascaris* spp. on the basis of their morphologic characteristics (perianal rough patches). The ascarids were subsequently confirmed as *B. procyonis* by sequence analysis of the 5.8S rRNA gene or the internal transcribed spacer (ITS)-1 and ITS-2 regions (Zhu *et al.* 1998; Zhu *et al.* 2007). The complete sequences of the 5.8S rRNA gene and the ITS-2 region from two ascarids from northern Florida and one from southern Florida were identical to *B. procyonis* sequences (GenBank accession nos. AJ001501 and AB051231, respectively). ITS-1 sequences from the two ascarids from northern and southern Florida were 99.1% (424/428; AB053230) to 100% identical (AJ00745 and ascarids from Georgia, Kentucky, and Texas; Blizzard *et al.* 2010), respectively, to *B. procyonis* sequences.

Several previous studies did not detect *B. procyonis* roundworms in raccoons or at latrine sites in central Florida ($n = 51$ from Glades, Highlands, Hillsborough, and Orange counties), southern Florida ($n = 90$ from around Miami and $n = 64$ fecal samples on Key Largo), and numerous counties throughout Florida ($n = 177$) (Forrester 1992; Kazacos 2001; McCleery *et al.* 2005). Historically, *B. procyonis* roundworms have been absent throughout most of the Southeast, but the parasite was recently detected in north-central Georgia (Eberhard *et al.* 2003; Blizzard *et al.* 2010). How the species became established in Florida remains unclear. Establishment could have resulted from natural dispersal of infected raccoons from *B. procyonis*-endemic areas; however, recent examination of several raccoon populations in southern Georgia failed to detect such infections (Blizzard *et al.* 2010). Alternatively, the parasites could have been introduced from the movement of infected raccoons, exotic pets (e.g., kinkajou [*Potos flavus*]), or natural wildlife intermediate hosts (Kazacos 2001).

Additionally, because domestic dogs can serve as definitive hosts, an infected dog from a *B. procyonis*-endemic area may have passed eggs into the environment (Kazacos

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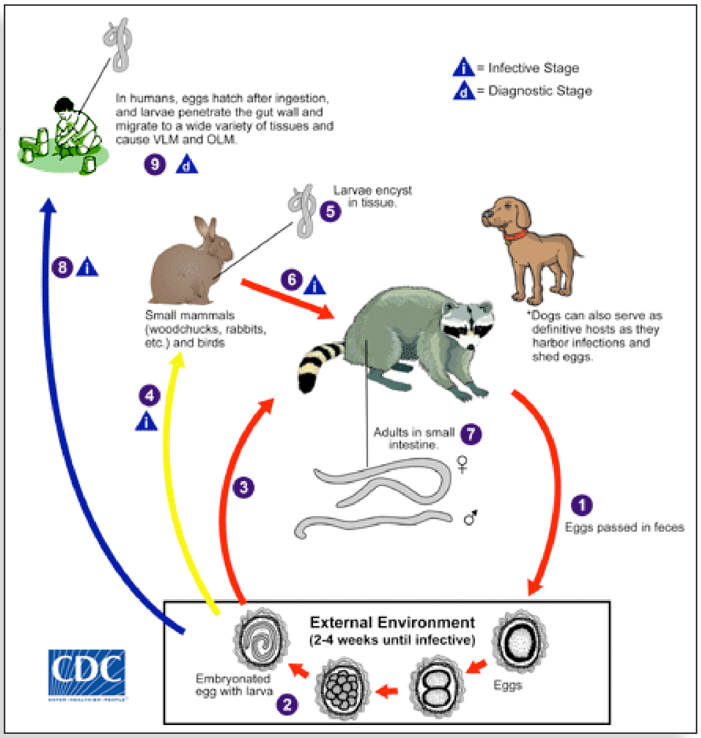

Life cycle of Baylisascaris procyonis in the environment. *Baylisascaris procyonis* completes its life cycle in raccoons, with humans acquiring infection as accidental hosts (dogs serve as alternate definitive hosts, as they can harbor patent and shed eggs). Unembryonated eggs are shed in the environment , becoming infective in 2–4 weeks. Raccoons can be infected by ingesting embryonated eggs from the environment. Over 100 species of birds and mammals (especially rodents) can act as paratenic hosts for this parasite: eggs ingested by these hosts hatch and larvae penetrate the gut wall and migrate into various tissues where they encyst. The life cycle is completed when raccoons eat these hosts. The larvae develop into egg-laying adult worms in the small intestine and eggs are shed in raccoon feces. Humans become infected when they ingest infective eggs from the environment; typically this occurs in young children playing in the dirt. Migration of the larvae through a wide variety of tissues (liver, heart, lungs, brain, eyes) results in VLM and OLM syndromes, similar to toxocariasis. In contrast to *Toxocara* larvae, *Baylisascaris* larvae continue to grow during their time in the human host. Tissue damage and symptoms of baylisascariasis are often severe because of the size of larvae, their tendency to wander widely, and the fact that they do not readily die. Diagnosis is usually made by serology, or by identifying larvae in biopsy or autopsy specimens.

2001). Veterinarians in Florida should be aware of this possible zoonosis and carefully examine ascarid eggs detected in fecal specimens because *B. procyonis*-infected dogs often have mixed infections with *Toxocara canis*, *Toxascaris leonina*, or both, which have morphologically similar eggs (Kazacos 2001). Physicians, veterinarians, and wildlife biologists in Florida should be aware of this serious pathogen and the likelihood that its range will increase, as highlighted by the recent detection of *B. procyonis* roundworms in a kinkajou from southern Florida (K. R. Kazacos *et al*., unpub. data).

This study also highlights the importance of wildlife rehabilitation centers as resources for the study of wildlife–zoonotic diseases. Animals admitted to rehabilitation centers are often ill or injured, which may increase pathogen shedding or transmission. Additionally, young raccoons are likely to be infected with *B. procyonis* roundworms, and kits as young as 3 mo of age can be patent. Numerous fatal *B. procyonis* larva migrans infections have occurred among animals in rehabilitation centers and zoological parks. These infections were likely acquired when animals were housed in enclosures previously occupied by infected raccoons or when bedding or food became contaminated with *B. procyonis*-infected raccoon feces. In *B. procyonis*-endemic areas, cages used to house raccoons should be thoroughly decontaminated by flaming or cages should be dedicated for use by raccoons. Because *B. procyonis* roundworms can spread to other animals, persons in contact with raccoons should be alert to potential transmission routes and apply appropriate biosecurity procedures.

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Avian Influenza Viruses and Avian Paramyxoviruses in Wintering and Breeding Waterfowl Populations in North Carolina, USA

V. H. Goekjian, J. T. Smith, D. L. Howell, D. A. Senne, D. E. Swayne, and D. E. Stallknecht. *Journal of Wildlife Diseases* 47(1): 240–245, 2011.

Although wild ducks are recognized reservoirs for avian influenza viruses (AIVs) and avian paramyxoviruses (APMVs), information related to the prevalence of these viruses in breeding and migratory duck populations on North American wintering grounds is limited. Wintering ($n = 2{,}889$) and resident breeding ($n = 524$) ducks were sampled in North Carolina during winter 2004–2006 and summer 2005–2006, respectively. Overall prevalence of AIV was 0.8% and restricted to the winter sample; however, prevalence in species within the genus *Anas* was 1.3% and was highest in black ducks (7%; *Anas rubripes*) and northern shovelers (8%; *Anas clypeata*). Of the 24 AIVs, 16 subtypes were detected, representing nine hemagglutinin and seven neuraminidase subtypes. Avian paramyxoviruses detected in wintering birds included 18 APMV-1s, 15 APMV-4s, and one APMV-6. During summers 2005 and 2006, a high prevalence of APMV-1 infection was observed in resident breeding wood ducks (*Aix sponsa*) and mallards (*Anas platyrhynchos*).

Comparative Digestion of Food among Wildlife in Texas: Implications for Competition

J. J. Elston and D. G. Hewitt. *The Southwestern Naturalist* 55(1): 67–77, 2010.

Success in competition for a limited food resource can be determined in part by how efficiently a species digests food. We conducted *in vivo* trials to compare digestive performance by a guild of mast-consuming species in southern Texas: wild boar (*Sus scrofa*), white-tailed deer (*Odocoileus virginianus*), collared peccary (*Pecari tajacu*), wild turkey (*Meleagris gallopavo*), raccoon (*Procyon lotor*), and southern plains woodrat (*Neotoma micropus*). Four individuals of each species were fed commercial pellets and chromium-marked fiber to determine rates of passage. Dry matter and intake of digestible energy, and digestibility of detergent fiber, crude protein, and gross energy (metabolizability for turkeys) were determined for each species. Mean retention and time of passage of 95% of marked fiber were calculated. Digestibility and time of retention by wild boars was similar to foregut-fermenting species and equal to or greater than smaller hindgut fermenters. White-tailed deer and collared peccaries showed similar capabilities of digestion and retention and also had higher digestibilities of fiber than did small hindgut fermenters. Turkeys and raccoons had fast rates of passage and showed little digestion of fiber. Southern plains woodrats had intermediate digestibilities and times of retention. Wild boars are expected to be effective competitors for mast because of their digestive efficiency, large body size, and potential for consumption of large quantities of food.

Collared Peccary *(Pecari tajacu).*

Documentation of the Rabies Virus in Free-ranging Fisher *(Martes pennanti)* in Pennsylvania

J. L. Larkin, J. C. Wester, W. O. Cottrell, and M. T. DeVivo. *Northeastern Naturalist* 17(4): 523–530, 2010.

Mammalian carnivores are the primary hosts for the rabies virus in terrestrial disease cycles. While rabies prevalence in *Vulpes* spp. and *Urocyon* spp. (foxes), *Mephitis mephitis* (striped skunk), and *Procyon lotor* (raccoon) is well documented in Pennsylvania, the reintroduction of *Martes pennanti* (fisher) provides another potential vector of this disease. We used a direct, rapid immunohistochemical test to examine brain material from 46 free-ranging fishers collected throughout Pennsylvania from 2002–2008. Five fishers had brain material unsuitable for rabies testing, 40 fishers tested negative for the disease, and one individual tested positive. The individual that tested positive was an adult male that was found to be positive for the Eastern raccoon strain of rabies. This individual was trapped and radio-collared in July 2006 as part of a research project examining fisher resource selection. Researchers monitored this individual weekly, starting July 2006 until October 2006, when it was found dead beneath a brush pile. As fisher populations continue to expand throughout portions of the northeastern United States, their potential as a vector of rabies should not be overlooked.

A Survival Estimate of Midwestern Adult Eastern Box Turtles Using Radiotelemetry

A. F. Currylow, P. A. Zollner, B. J. MacGowan, and R. N. Williams. *The American Midland Naturalist* **1651:** 143–149, 2011.

Eastern box turtles (*Terrapene carolina carolina*) are widespread in U.S. eastern deciduous forests, yet many populations are experiencing dramatic declines. Herein, we present an

CONTINUED ON PAGE 32

Up For Discussion: When You Only Have One

Healthy young (neonate, juvenile) animals who find their way into rehab should be raised with conspecifics and ideally all the individuals should be of similar age and/or development—on this much everyone can agree. But what if there are no available cohorts? Is it appropriate to combine individuals from closely related species? Should rehabilitators compare and combine intakes? In other words, transfer animals to form cohort groups? Are puppets, mirrors, and other "tricks of the trade" good enough to address behavioral and social needs?

THE QUESTION:

Recognizing that protocols are species-specific, how do you deal with "onlies"?

THE RESPONSES:

I have had some pretty good successes networking with other rehabbers. Several years ago I admitted a 3-week old coyote pup. After emailing and phoning, I discovered no others among other eastern Pennsylvania rehabbers. Through the internet I found a rehabber in New York who specializes in coyotes and was able to get permission from the Pennsylvania Game Commission to transfer the coyote to him. I received updates on the coyote's progress and eventual release, which was wonderful, and now have a new friend in NY! (The trip to meet the rehabber was a hysterical experience: in order to save money, I loaded the little pup into a carrier in my car—a Mazda Miata. Four hours of howling was enough to put me over the edge!)

I have sometimes put different squirrel species together for a short period of time, if they are young enough to not yet have distinct personalities. I usually receive more conspecifics within days.

I think that we should all try to do the best we can to raise species with others of their kind, including allowing volunteers or friends to help in their transport to other areas. I'm sure that there are some areas, though, where this would not be practical. I only rehab mammals, and I can tell you that I will never again raise a single fox—I learned *that* lesson the hard way. (Luckily, another rehabber was able to "wild" him up.)

Deb Welter
Diamond Rock Wildlife Rehabilitation Clinic
Malvern, Pennsylvania, USA

If a young, displaced raptor cannot be re-united with its family in the wild and there are no available cohorts for it, and assuming it is already conspecifically imprinted, I see no problem in housing the young with similar species young who are also already conspecifically imprinted. They will, at least, be exposed to other birds eating the same type of food and learning to hunt the same type of prey. Having adults also present, however, raises the risk of the adult killing the young of another species. These combinations of species should be done with care, however. One might think Swainson's hawks and red-tails are similar species, both being big *Buteos*, but the fact is that one species migrates thousands of miles and the other is fairly sedentary; one prefers range locusts as the primary prey and the other favors rodents.

The best choice (*in extremis)* would be for nearby rehabilitators to compare intakes and combine like-species cohorts if possible, or expose the young to conspecific adults.

Puppets, mirrors, and other "tricks of the trade" are never good enough. If they are the only option available short of euthanasia, these techniques should be undertaken with the greatest of care to minimize human imprinting or taming and optimize skills needed for the wild. So much depends on the age of the birds that using such techniques effectively requires detailed understanding of the process.

Penny Elliston, CWR
Wildlife Rescue of New Mexico
Albuquerque, New Mexico, USA

We often receive killdeer, in spite of our efforts to keep the babies where they are (knowing mothers feign injury or worse to attract people away from the juveniles). These high-stress birds don't do well at all, and we never have more than one when we need them.

We have found that baby dove (any species) nestle with the little killdeer and their meek behaviors, while not conspecific, are a much better match than a feather duster or a mirror!

Our release rate skyrocketed after starting this practice. We look forward to seeing how this pattern continues.

Steve Pruitt, CWR
Alicia Pruitt, CWR
Wild Bird Rescue, Inc.
Wichita Falls, Texas, USA

IWRC presents new discussion topics in our member e-newsletter and encourages every member to respond to the questions. Replies may be edited for space and clarity.

ABSTRACTS CONT'D FROM PAGE 31

assessment of annual survival for adult eastern box turtles that were radio-tracked over a period of 2 yr. Using a known-fates Kaplan-Meier estimator, the baseline annual survival estimate for adult eastern box turtles in Indiana's south-central region is 96.2%. Annual survival rates varied slightly between the hibernal period (95.6%) and the active period (96.7%). These initial data provide wildlife managers with a baseline from which a recovery period can be calculated. In areas where road mortality and human interface are high, this estimate should be adjusted to ensure the time for recovery is adequate. Further research is recommended over generations and age-classes to better inform management of this protected species. ■

2011 IWRC Symposium

CALL FOR PAPERS

THIS COMING NOVEMBER more than 150 wildlife rehabilitators, veterinarians, conservationists, and other wildlife professionals will gather in Fort Lauderdale, Florida, USA to discuss their experiences of wildlife rehabilitation at the International Wildlife Rehabilitation Council's 2011 Annual Symposium. The Symposium provides an excellent opportunity for wildlife professionals to meet and exchange ideas, skills, and products relating to wildlife rehabilitation.

Agenda The Symposium will be held from Tuesday, 8th to Saturday, 12th November, 2011. Presentations will run from Thursday to Saturday. There will be two tracks; one will be a series of workshops and presentations on Planning and Assisting in Emergencies, while the other will be a series of open sessions. We are now seeking submissions for presentations for both tracks.

For the open sessions, we are looking for talks on a variety of subjects related to wildlife rehabilitation, such as those listed below. Anyone wishing to present a talk should submit an abstract for review by the Symposium committee. If your talk is accepted, the committee will then contact you to confirm the date and time of your presentation.

Suggested subject areas include:

- *Business:* fundraising, management plans, etc.
- *Veterinary:* necropsy, new techniques
- *Legislation:* working with your country/state/province officials
- *Research:* post-release monitoring, new diets
- *Conservation:* projects
- *Environmental Enrichment*
- *Rehabilitation:* species-specific presentations on birds, mammals, reptiles, etc.
- *Animal welfare*
- *Tools of the trade:* new databases

Abstracts Your abstract should include the TITLE and AUTHOR(S) and be on the order of 200 words. If there is more than one author, please indicate who will be presenting and provide a preferred contact email and postal address. In addition, please include a brief (one paragraph) biography of the author(s)' experience as it relates to the presentation.

Use a 12-point font and, if possible, Times New Roman style. Use single line spacing, full justification, and do not indent paragraphs.

Electronic Formats If submitting an electronic version of an abstract, send your submission as an MS Word document if possible or use a Microsoft-compatible format. Please also supply an extra version of your submission as an RTF or plain text file. If you cannot provide an electronic version of your submission, please ensure that you have given all the relevant information requested, as your abstract will be retyped. Abstracts may be edited for grammar or length. Safe receipt of your abstract will be acknowledged.

For More information Contact Adam Grogan at *agrogan@rspca.org.uk* or the IWRC at *office@theiwrc.org.*

2011
IWRC ANNUAL SYMPOSIUM

November 8–12, 2011
Ft. Lauderdale, Florida USA

Deadline for Submissions
1 June 2011

PHOTO © UCUMARI. CREATIVE COMMONS, ANIMALPICTUREGALLERY.NET.

Bobcat *(Felis rufus).*

Presentations begin Thursday, Nov. 10.

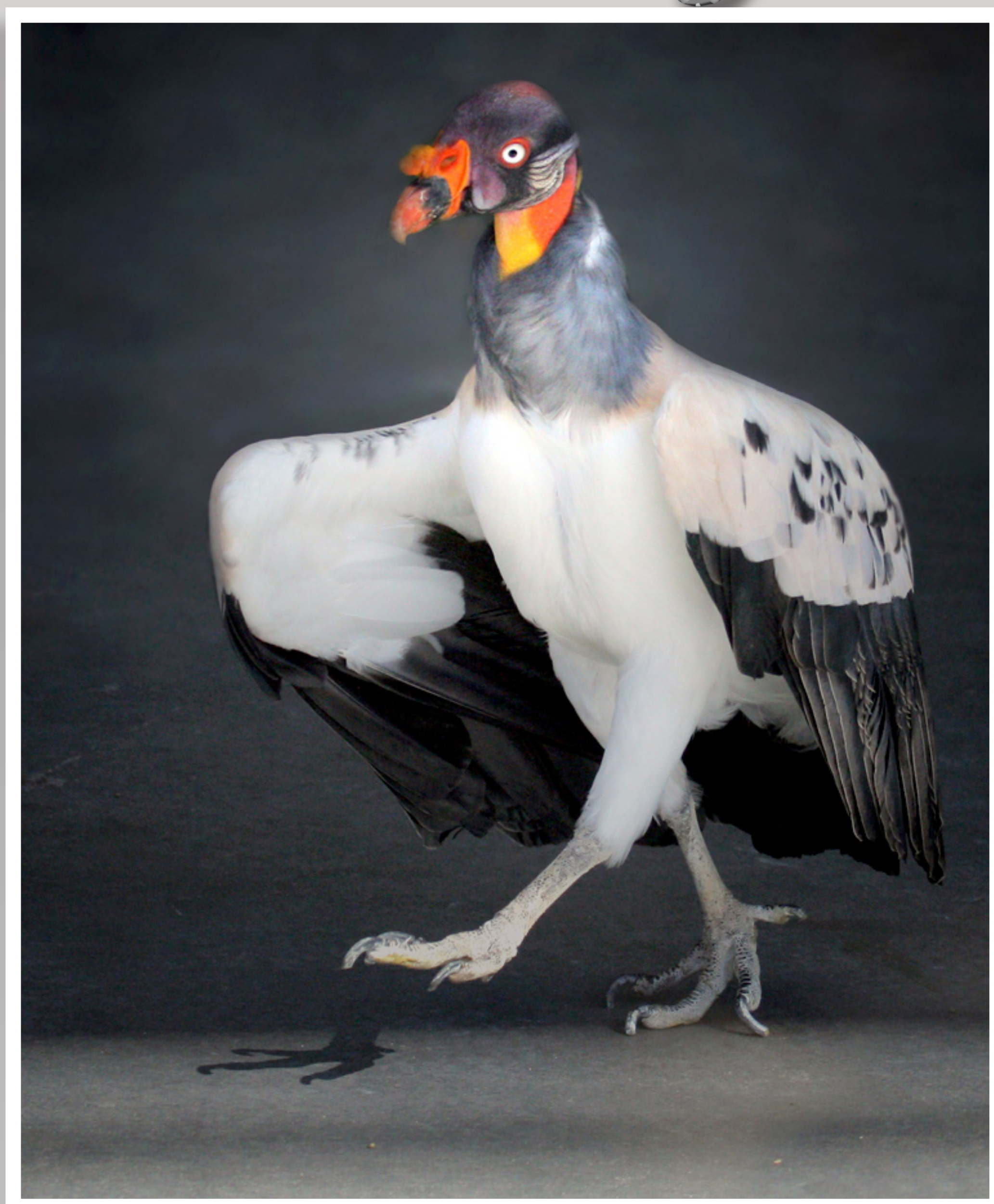
Major Tracks:
Emergency Planning and Assistance
Open Sessions: Varied Topics

Please submit abstract by email, to:

Adam Grogan
agrogan@rspca.org.uk

INTERNATIONAL WILDLIFE REHABILIATION COUNCIL
www.theiwrc.org

TAIL END



KING VULTURE (SARCORAMPHUS PAPA). PHOTO ©J. LEMONS, BUDOGRAPHICS. USED WITH PERMISSION.

"All together now! You put your right foot in, you put your right foot out, and ya shake it all about..."

Winning caption by N. Demyttenaere, founder and director of Thayers Wood, Central New York.

We've posted the next issue's Tail Ends photo on the web at: www.theiwrc.org/journal-of-wildlife-rehabilitation/tailends/
Submit your clever caption to *jwr.editor@theiwrc.org* by May 31.

INSTRUCTIONS FOR AUTHORS

POLICY Original manuscripts on a variety of wildlife rehabilitation topics (e.g., husbandry and veterinary medicine) are welcomed. Manuscripts that address related topics, such as facility administration, public relations, law, and education are invited as well.

Associate editors and anonymous reviewers, appropriate to the subject matter, evaluate each submitted manuscript. Concurrent submission to other peer-reviewed journals will preclude publication in the *Journal of Wildlife Rehabilitation* (JWR). The International Wildlife Rehabilitation Council (IWRC) retains copyright on all original articles published in the JWR but, upon request, will grant permission to reprint articles with credit given to the IWRC–JWR.

SUBMISSIONS All submissions should be accompanied by a cover letter stating the intent of the author(s) to submit the manuscript exclusively for publication in the JWR. Electronic submissions are required; hard-copy manuscripts are not accepted. The manuscript file should be attached to the submission letter (which can be the body of your email) and sent to:

Kieran Lindsey, Editor
jwr.editor@theiwrc.org

MANUSCRIPT Manuscripts should be MS Word documents in either PC or MAC platform (*no PDF files*).

Manuscript should be typed in Times Roman, 12 pt., double-spaced throughout with one-inch margins.

Include the name of each author. Specify the corresponding author and provide affiliation, complete mailing address, and email address. The affiliation for all authors should be included in a brief (maximum of 100 words) biography for each that reflects professional experience related to rehabilitation or to the manuscript subject matter, rather than personal information. Biographies may be edited due to space limitations.

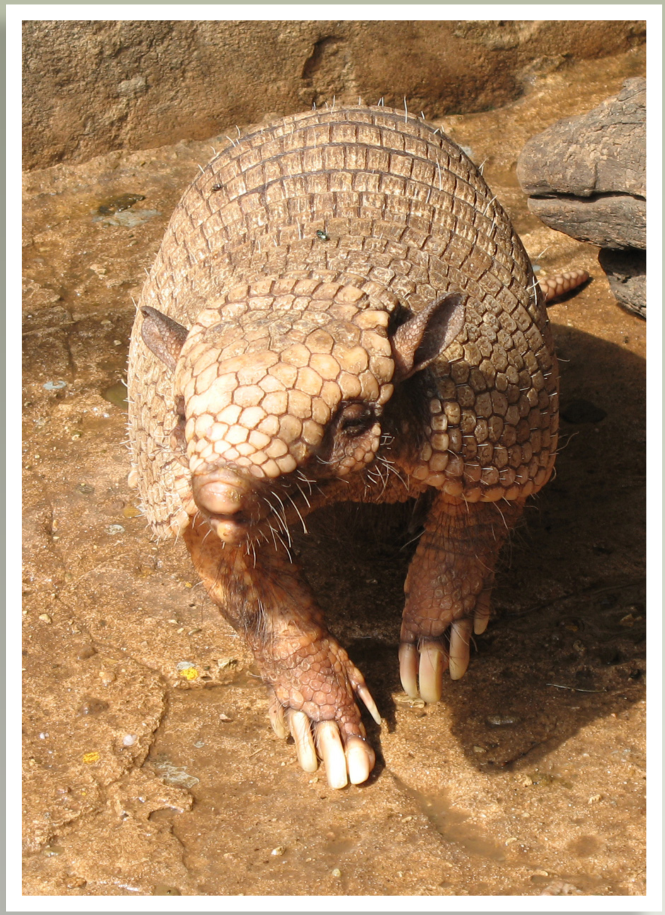
Include an Abstract that does not exceed 175 words and choose several (up to 14) key words.

Templates have been developed for the following submission categories: case study, technique (including diets), research, and literature review; authors may request a copy of one, or all, of these templates from the Editor (jwr.editor@gmail.com) before developing a manuscript for submission to the JWR.

STYLE The JWR follows the Scientific Style and Format of the CBE Manual for Authors, Editors, and Publishers. The complete "JWR Author Instructions" document is available at:

http://www.theiwrc.org/journal/submissions.html

or by email request to the Editor. This document provides formatting guidelines for in-text citations and the Literature Cited section; the JWR textual requirements for tables, figures, and photo captions; and describes quality and resolution needs for charts, graphs, photographs, and illustrations.



Six-banded armadillo *(Euphractus sexcinctus).*

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