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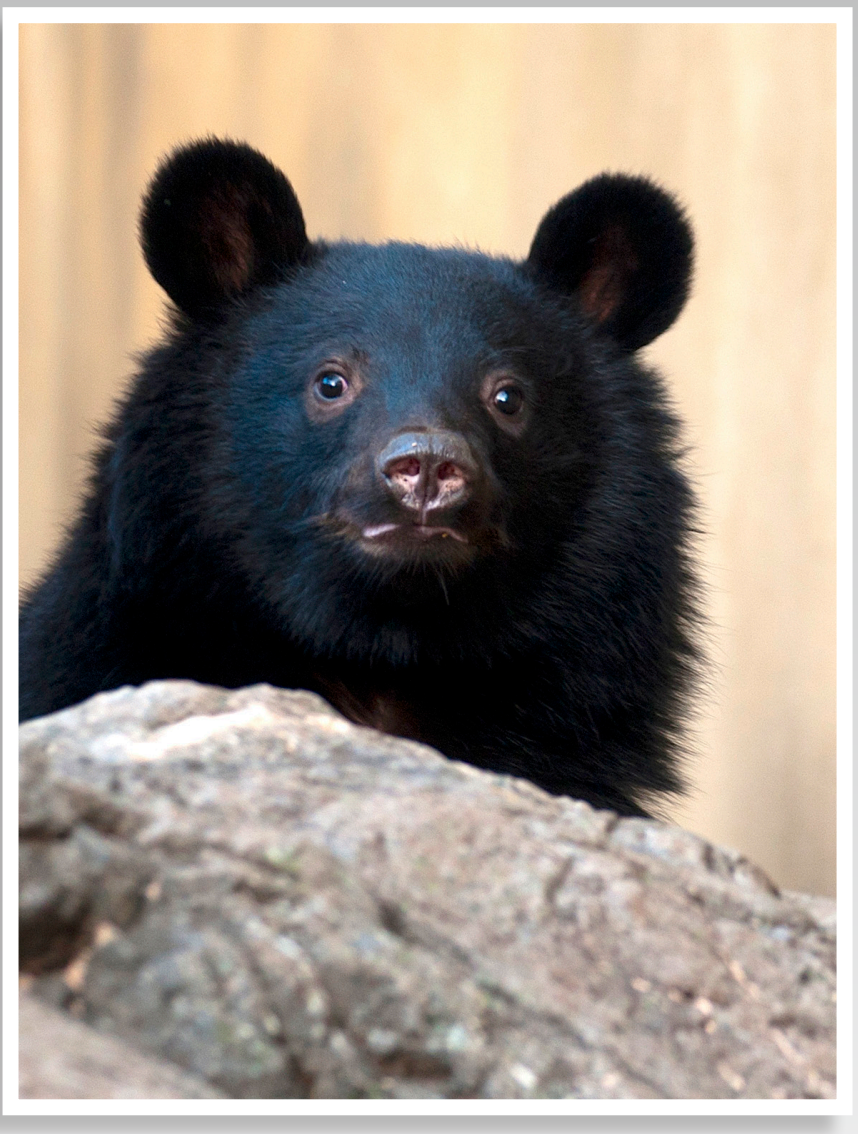
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ABOUT THE JOURNAL

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:
Chacma baboons *(Papio ursinus).*
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Left:
Japanese black bear (*Ursus thibetanus japonicus).*
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EDITORIAL

Immigration and Naturalization

When we try to pick out anything by itself, we find it hitched to everything else in the universe.

John Muir's simple but effective explanation of how the world works may be the most familiar piece of nature writing ever penned. I was introduced to the quote while still in grade school and became reacquainted with it when I enrolled as a wildlife biology major at Texas A&M University. I still remember nervously sliding into my seat in a large lecture hall for the first class of my first semester—Fundamentals of Ecology—and feeling instantly more at ease when I saw these familiar words projected on the opening PowerPoint slide. "Ah… I know this. I can do this."

Natural resources management undergraduate programs commonly include some kind of introductory class built around the widely accepted concept of a "web of life." Any time we toy with one strand in that web, students are told, it will impact the rest of the web in ways both anticipated and unforeseen.

Then, most of the remaining courses in the degree program center around toying with strands of the web to meet human goals, primarily either increasing plant and animal species of interest (often for harvest) or reducing species deemed "pest" or "nuisance."

One could argue, I suppose, the sooner biologists-to-be realize life is messy, the better.

I was reminded of this tendency to acknowledge the validity of the web of life when it's convenient, and ignore it the rest of the time, when I received a letter to the editor (page 5) questioning the ethics of rehabilitating and then releasing introduced species. I started to ponder the ways in which we classify wildlife—native, endemic, indigenous, non-native, alien, introduced, invasive, exotic, accidental—and why.

A quick check of several reference books in my library defines "native" as "plants and/or animals occurring in a location without any help from humans." Using this definition, cattle egrets (*Bubulcus ibis*) are considered native North Americans even though they arrived and began to establish breeding populations here less than 60 years ago. The same would be true for any internal or external parasite stowaways on those mid-century 'Egret Airline' trans-Atlantic flights.

European starlings (*Sturnus vulgaris*, a.k.a. common starling), on the other hand, retain their introduced/exotic status despite having lived and bred in North America since the early 1890s. The difference? Cattle egrets made the trip unaided (we think) by *Homo sapiens*. Starlings had a helping hand and so, apparently, can never rid themselves of the human stain.

Let me be clear—I don't advocate moving species from continent to continent or even region to region like pawns and rooks on a chessboard. While I'm no expert on this topic, I am reasonably familiar with the scientific literature, and I can't honestly think of a single intentional introduction of either an invertebrate or vertebrate species that has gone as planned. There are always unintended consequences and, in some cases, the results have been disastrous. Based on this poor track record alone, I would suggest any introduction plan should be viewed with a huge amount of skepticism—if not outright animosity.

But I am concerned that completely excluding human beings from playing any role in the natural process of species dispersal suggests that people are somehow set apart from the other inhabitants of this planet. In other words, we humans are, ourselves, an exotic species. The implications of such a perspective are far-reaching and profound… and not, in my opinion, in a good way.

Kieran J. Lindsey, PhD
Editor

Conservancy of SW Florida Prepares to Open Wildlife Hospital

NAPLES, Florida, USA (April 19, 2012)—The Conservancy of Southwest Florida will soon open the new von Arx Wildlife Hospital at the Nature Center in Naples. Near completion, the Hospital will allow the Conservancy to greatly expand its ability to provide advanced care to wildlife.

The 5,000-square-foot facility will include separate recovery areas for mammals, reptiles, and birds; an animal nursery; and new operating and X-ray rooms. It will also feature a new education center where guests can attend special wildlife programs and watch behind-the-scenes treatment via closed-circuit television.

The hospital will be one of the first new buildings to be completed as part of the Conservancy Nature Center renovation, and represents the organization's commitment to positively impacting the environment through sustainable building and operation practices.

"From the beginning, we envisioned a wildlife hospital and Nature Center at the Conservancy that would utilize technologies and building practices that reflect the organization's mission of protecting our land, our water, and our wildlife," said Dolph von Arx, former chairman of the Conservancy of Southwest Florida Board of Directors. "Critical to this effort has been our partnership with Johnson Controls, a global leader in delivering solutions that increase energy efficiency in buildings. The company will be integrating the energy systems across the Nature Center to reduce costs and ensure optimal performance. By instituting innovative, sustainable building practices such as geothermal solutions, PV solar panels, an energy management system, and LED lighting, the von Arx Wildlife Hospital sets the standard for green construction and design. We highly anticipate the von Arx Wildlife Hospital will receive a Gold LEED Certification from the U.S. Green Building Council this year."

Andrew McElwaine, president and CEO of the Conservancy of Southwest Florida, also announced a new corporate partnership with Arthrex, a leading provider of surgical products and services for orthopedic care, who will provide surgical products for the clinic.

The von Arx family donated US$1.5 million to the "Saving Southwest Florida" capital campaign, providing the lead gift to fund the new hospital. Other major donors funding the clinic include Barbara W. Moore, Sidney and Nancy Sapakie, Fred and Sue Schulte, Deki Stephenson, Edward and Susan Yawney, and an anonymous donor. Additional support was provided by Dr. Robert Schultheis and Chuck and Jean Zboril. The total cost of the new hospital is US$2.1 million.

BP Seeks Approval for Class-Action Settlement

NEW ORLEANS, Louisiana, USA (April 19, 2012)—BP and attorneys for more than 100,000 people and businesses presented a federal judge with a class-action settlement designed to resolve billions of dollars in claims spawned by the 2010 oil spill in the Gulf of Mexico.

BP is asking U.S. District Judge Carl Barbier in New Orleans to give preliminary approval to the agreement. The judge

CONTINUED NEXT PAGE

LETTERS TO THE EDITOR

Dear Editor and Fellow Wildlife Rehabilitators,

'Acting in an environmentally responsible manner'—this is a phrase and a practice we wildlife rehabilitators should be very familiar with and which is used as a keystone in setting the procedures and standards with our rehabilitation practices.

I'm sure we all agree with the above comment, but what has happened?

During the last California Department of Fish and Game's Regional Wildlife Rehabilitation meeting it was disclosed that, in 2011, the animal most treated and released by California wildlife rehabilitators was a non-native, detrimental, invasive species, the Virginia opossum (*Didelphis virginiana*).

Doesn't anyone else see something wrong here?

The species most treated and released by California licensed wildlife rehabilitators was a non-native, detrimental, invasive species.

Whatever happened to 'acting in an environmentally responsible manner?'



PHOTO © JIM ISAACS. USED WITH PERMISSION

There is so much verified documentation of the negative effects this species is having on our native species, yet we are still treating and releasing this invasive species to decimate our native species and their habitat.

Doesn't anyone else see something wrong here?

Time for us all to practice what we preach and start acting in an environmentally responsible manner.

Thank you,

David Thraen, Executive Director
All Wildlife Rescue and Education, Inc.
Long Beach, California USA
www.awre.org

hasn't indicated when he will rule.

The agreement spells out several compensation levels, with cleanup workers eligible for up to US$60,700 plus money to cover medical bills. BP estimates it will pay about US$7.8 billion, but the settlement has no cap. It will likely be one of the largest class-action settlements ever. The Plaintiffs' Steering Committee maintains they would be able to obtain larger awards if their claims go to trial.

The details of the 100+ page agreement are consistent with the deal announced in March of this year, but the reaction was mixed, leading to the possibility that many businesses and individuals might not take part. For example, Dean Blanchard, a shrimp processor in Grand Isle, Louisiana, said shrimp processors in the hardest-hit areas should get more money.

"They want to make it a one-size-fits-all, and it's not," Blanchard said. "They're looping too many people together. I have lost millions of dollars. They can never bring me back." Blanchard says he would opt out and predicted others would do the same.

The agreement doesn't resolve other claims brought by the federal government and gulf states against BP and its partners on the Deepwater Horizon drilling rig over environmental damage from the spill, nor does it resolve claims against Switzerland-based rig owner Transocean and Houston-based cement contractor Halliburton.

Judge Barbier is expected to hold a "fairness hearing" on the settlement before deciding whether to approve it. The agreement calls for paying medical claims from workers and others who say they suffered illnesses from exposure to the oil or dispersal chemicals, none of which were paid from the US$20-billion compensation fund created by BP.

Aviary for Both Exotics and Natives Proposed

PALMERSTON NORTH, North Island, New Zealand (April 19, 2012)—A proposal to rebuild the aviaries at New Zealand's Victoria Esplanade will include a wildlife rehabilitation center. International zoo architects Becca Hanson and David Roberts have been tapped to develop a concept plan for the proposed New Zealand Wildlife Health Centre aviary.

The city council has not yet approved the aviary and conservatory projects, but sums of NZ$828,000 and NZ$498,000 are in the draft long-term plan.

The rehabilitation aviary would provide a recovery facility for native birds such as kiwi, native falcon, and takahe, after treatment at Massey University and before their release back into the wild. It would be a first in providing the public an opportunity to see the rare birds and learn their stories. "There is no project like this anywhere in the world," Ms. Hanson said. Communicating their individual stories—how they were hurt, their medical treatment, and why their recovery was important—will be vital to the project's success. Ms. Hanson was impressed with the enthusiasm of the project's partners from the council, Massey University, the Department of Conservation, and Rotary clubs.

Hanson and Roberts have been involved in the redevelopment of Auckland Zoo since 1994 and have also done projects at Wellington Zoo, giving them an understanding of New Zealand native fauna and flora. They believe the new facilities can be built preserving existing features at the Esplanade, such as the exotic birds currently housed there.

The concept plan includes a new conservatory, a site for the bonsai collection, a refreshed sensory garden, and new enclosures for the resident exotic birds, well separated from the recovering natives. Ms. Hanson said visitors would have a unique experience, different every visit as birds were released and others came in.

A detailed budget has not been prepared, but a more formal presentation will inform decision-making on whether the project goes ahead.

Wildlife Center Begins Construction on New Facility

PALM CITY, Florida, USA (April 18, 2012)—The Treasure Coast Wildlife Center recently poured a 40- by 60-foot concrete slab for the construction of its maintenance shop building. The slab marks the first step toward the development of the Wildlife Center's new facilities, on Citrus Boulevard in Palm City, which will include a wildlife hospital, an administration building, and a discovery center. The new center will provide a safe haven for wildlife rehabilitation along with innovative educational tours and classes for the public. For more information about the Treasure Coast Wildlife Center, visit www.TCwild.org.

Lake Tahoe Wildlife Care Hopes to Expand

SOUTH LAKE TAHOE, California, USA (April 15, 2012)—All the cages are empty at the Lake Tahoe Wildlife Care Center (LTWC), but the house and property are still busy with preparations for the arrival of bear cubs, owls, hawks, eagles, coyotes, river otters, squirrels, and porcupines. Injured and orphaned wildlife species that find their way to the center each year may soon have a different destination. The husband-and-wife team Tom and Cheryl Millham has been maintaining the center out of their home for 34 years and are ready for change.

"We've hit our limit," Cheryl Millham said. After years of searching and inquiring about properties, they may have found a suitable place in Meyers, and hope to raise funds to buy the property.

"We are studying every possible option based on needs," said El Dorado County supervisor Norma Santiago, who's been involved with LTWC since early in the position. "By keeping it where it is, they're very limited."

The Millham's have treated more than 24,000 animals, returning more than 14,000 to the wild. They are the only certified bear rehabilitation center in the state. Their backyard has six pens including an elaborate series of tanks for the river otters, an aviary, and a larger netted space for birds of prey.

The master plan for the expanded wildlife care center includes spaces for education,

CONTINUED ON PAGE 23

The Provision of Supplementary Heat for Hand-raised Harbor Seal Pups (*Phoca vitulina*)

A. M. MacRae, M. Haulena, and D. Fraser

PHOTO © JAMES R. PAGE. USED WITH PERMISSION.



Harbor seal in Oak Bay Marina, Victoria, BC.

ABSTRACT: Harbor seals pups *(Phoca vitulina)* brought to wildlife rescue centers are often in poor body condition and may have difficulty maintaining body temperature. This study examined (1) whether such pups would position themselves close to an available heat source and (2) whether animals provided with supplementary heat would have greater weight gains and survival compared to animals without heat. Of 66 pups (<9 kg, ≤2 body condition score, <10 days old), 24 received supplementary heat for 21 days and 42 served as controls for the same time period. Behavioral observations showed that animals spent 61 ± 3.8% (least squares [LS] means ± standard error means [SEM]) of observations on the heated side of the enclosure when ambient temperature was <16°C and that heat-seeking declined as ambient temperature increased. Heat made no significant difference in weight gain or survival, although small animals (≤7 kg) and those fed a lower-calorie, fish-based diet tended to do better with heat than without. We conclude that supplementary heat can be used safely, with possible benefits, for low-weight harbor seal pups raised on artificial diets at cool ambient temperatures.

KEY WORDS: Hand-raised, harbor seal pups, heat-seeking behavior, supplementary heat, thermoregulation.

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Introduction

In British Columbia, many harbor seal pups (*Phoca vitulina*) are stranded every year and several hundred are admitted to wildlife centers for rehabilitation. These animals are usually unweaned and are often ill, injured, or in poor body condition. In captive care, they can have low weight gains (Wilson *et al.* 1999; Duerr 2002) and high mortality rates in certain years (Lander *et al.* 2002) for a variety of reasons. Weight of the pups at admittance to rehabilitation facilities is often lower than published mean birth weights of harbor seal pups in the wild (Larmour 1989), likely because of separation from their mothers. Pups in poor body condition, with a thin blubber layer, may have difficulty maintaining core body temperature (Markussen *et al.* 1992; Bowen *et al.* 1994).

At birth, harbor seal pups have approximately 11% body fat with a blubber layer that is approximately 1.4 cm thick (Bowen 1991). This fat is a source of stored energy and provides insulation (Oftedal *et al.* 1991). Having an adequate blubber layer is particularly important, as harbor seal pups are precocial and often follow their mothers into cold ocean water just hours after birth (Lawson and Renouf 1985). Pups in poor body condition have a relatively higher surface-to-volume ratio compared

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to animals with adequate fat stores and may have to expend more energy to maintain normal body temperature (Bowen *et al.* 1994).

Supplementary heat is used in rearing young mammals of many species and has been shown to help promote growth and survival (Curtis 1983). Additionally, many mammals will seek heat when ill (Kleitman and Satinoff 1981; Akins *et al.* 1991). Harbor seal pups presented to rehabilitation facilities in poor body condition may also benefit from the provision of a supplementary heat source. For example, the provision of heating pads has been suggested to reduce calorie consumption for seal pups that are severely emaciated (Townsend and Gage 2001). Behavioral observations conducted at the Vancouver Aquarium Marine Mammal Rescue Centre, British Columbia, Canada showed that seal pups at the facility frequently shivered or adopted body positions likely to conserve heat (hunched posture, flippers tightly tucked under or against body).

The objectives of this study were to determine 1) whether animals provided with supplementary heat would use it in an adaptive manner and 2) whether animals provided with supplementary heat would have greater weight gains and higher survival rates until weaning when compared to animals without heat. The study included seal pups on two different diets; this allowed an additional analysis of whether the animals' responses to heat varied with nutrition.

Materials and Methods

Animals

A total of 98 stranded harbor seal pups were recovered along the British Columbian coastline by staff of the Vancouver Aquarium, or were brought to the facility by members of the public, between June and September of 2008. All pups were unweaned and estimated to be less than 10 days of age. Body weight at admission averaged 7.7 ± 1.3 kg (mean ± SEM; range 5.4–11.4 kg).

Housing and handling

Animals were kept at the Vancouver Aquarium's Marine Mammal Rescue Centre following standard procedures of the facility. The pups were singly housed in plastic tubs (approximately 61 × 92 × 61 cm) with plastic floor grates raised 5 cm above the floor of the tub. Tubs were kept under large tents with walls that could be raised and lowered to moderate ambient temperature. Enclosures were cleaned daily. Once the pups were weaned onto a diet of whole fish and were healthy (normal blood values, not receiving medical treatment), they were moved to fiberglass pre-release pools (approximately 23,000 L with a haul-out area) in groups of up to eight.

Eight of the tubs were equipped with supplementary heat provided by Canarm® infra-red brooder heat lamps (model HLC; Canarm, Brockville, Ontario, Canada) with Philips infra-red 175-watt bulbs. Lamps were hung from overhead cables. The lamps were positioned 46 cm above the plastic floor-grates so that pups could not touch them and so that lamps could be raised clear of the tubs when necessary. Lamps were positioned centrally at one end of each tub (either west or east as determined at random) to establish a thermal gradient between the heated and unheated halves of the tub.

Radiant temperature (the temperature likely to be perceived by the animal) was determined using a black globe thermometer (model 210-4417; Novalynx Corporation, Grass Valley, California, USA) for a series of ambient environmental temperatures in each half of the enclosures. On average, radiant temperature was 9°C higher than ambient at pup height directly under the lamp and, on average, about 6–7°C higher in the remaining area of the heated half of the enclosure. Radiant temperature was approximately 2°C higher than ambient in the unheated half of the enclosure.

All animals were weighed (in plastic totes) at admittance (day 0) and then twice per week until release. Weights were measured between the first and second feeds each day on a digital scale accurate to the nearest 10 g. Most pups had wet fur at the time of weighing due to morning cleaning of the animals' enclosures. If animals were not already wet, the fur was wetted for consistency. Additional weights were taken as needed for animals that showed signs of illness or that had lost weight since last being weighed.

As part of another study, pups were randomly assigned at admittance to one of two diets, either an artificial milk replacer (30% fat, 7.7% protein, 3.1 cal/g) or a fish-based formula (21.4% fat, 6.1% protein, 2.3 cal/g) as described by MacRae *et al.* (2011). Pups were fed formula via gavage at approximately 7:00 and 10:30 a.m. and at 2:00, 5:00, and 7:30 p.m. Upon arrival at the facility, they were first rehydrated by gavage feeding with an electrolyte solution and were then gradually switched to full-strength formula by mixing formula with the electrolyte solution in subsequent feeds. Most animals were on full formula by their fifth feed after admittance. Pups were fed approximately 11% of body weight (110 g/kg body weight) per day. Pups were weaned onto whole herring after the end of the diet study when their teeth had erupted and they were estimated to be between 20 and 30 days of age.

Because heat was expected to be most beneficial for underweight animals, the experiment was limited to pups with admission weights of <9 kg and body condition scores of 1 or 2 (i.e., [1] ribs and spinous processes visible, or [2] can be felt easily without pressure) on a scale of 1 to 5. All pups were judged to be <10 days old based on the appearance of the umbilicus (pink and fleshy indicates an animal <2 days old, umbilicus continues to dry until it typically falls off at 7–10 days of age; Boulva 1975). Any pups with serious injuries were omitted. Sixty-six animals met the above criteria. When an animal meeting these criteria was admitted to the facility, it was placed in a heated tub if one was available. Because only 8 tubs had heat, the next 1–2 similar pups were typically assigned to unheated tubs. In total, 24 pups were kept in heated tubs and 42 in unheated. Heat was provided for 21 days. Ambient temperature in the facility was recorded at the start of every observation session using a digital maximum–minimum thermometer. Heat lamps were turned off at the end of daily observation sessions or any time that ambient temperature reached

25°C. Pups were carefully monitored for signs of heat stress during the day. Lamps were also turned off and raised during cleaning and when pups had swimming sessions. Every night, heat lamps were lowered and turned on via a timer at 9:00 p.m. so that pups had heat overnight.

During the 21-day period that animals received supplementary heat, observations of animal position and orientation in relation to the heat source were recorded daily from 07:00 until 11:00 a.m. at 15-min intervals. A pup was scored as being in the heated half of the tub if it had more than 50% of its body in that half.

After the third feed (2:00 p.m.) each day, pups were usually given about 5 min for a swim by filling tubs with fresh water (cold water tap) and then draining them. After tubs had been drained, heat lamps were turned on for 12 min. Observations of pup position (heated or unheated side) were recorded every minute for 10 min, in the same manner described above, starting 2 min after the heat lamps were turned on. Lights were turned off and raised after observations were completed. Pups were not allowed to swim if injured or sick or if they had full lanugo (the downy hair present on newborns). Harbor seals typically lose the white fetal pelage (lanugo) *in utero* (Oftedal *et al*., 1991), and those born with it tend to be smaller (Cottrell *et al.* 2002) and may be less developed at birth (Bowen *et al.* 1994). Because the lanugo coat only maintains its insulative properties when dry, pups with this coat have difficulty thermoregulating when immersed in cold water (Davydov and Makarova 1965).

Statistical analysis

Animals were not included in this analysis if they died within the first 2 days after being admitted. One pup with heat was excluded from the analysis of behavioral observations due to an incomplete set of observations. Data from the 23 animals observed with heat from day 0 (admittance) to day 21 were used to determine if animals would seek heat at cooler ambient temperatures. Ambient temperature was first categorized into the following temperature ranges, selected to give a similar number of observations in each range: 1) <16°C; 2) 16–18.9°C; 3) 19–21.9°C; and 4) ≥22°C. The proportion of observations when seals were in the heated half of the tub was calculated for each seal at each temperature range over the 21 days. Five animals had fewer than 10 body-position observations for one temperature range; in these cases, those observations were excluded but the remaining three temperature ranges for those animals were included. The effect of temperature category (categorical, df = 3) on the percentage of observations in which an animal was under the heat source was then analyzed using a mixed model (SAS v9.1; SAS Institute Inc., Cary, North Carolina, USA). Results from this model are presented as LS means. A one-tailed binomial test was used to test whether the percentage of observations at each temperature category was significantly different from 50%.

A chi-square (χ^2) analysis was used to compare survival of animals with or without supplementary heat; it was based on the 66 animals (heat $n = 24$, no heat $n = 42$) that either survived until, or died before, day 21.

Regression analysis was used to compare the average daily weight change of pups with and without heat; a separate analysis was used for each diet, i.e., milk-replacer and fish formula (SAS v9.1). The analysis was based on seals that were fed full formula for ≥14 days and survived until weaning. These included pups fed milk-replacer, seven with heat and 10 without heat, and pups fed fish formula, seven with heat and seven without heat.

Results

Heat-seeking behavior was observed in pups at low ambient temperatures and declined as temperature increased. Animals spent 61 ± 3.8% (LS mean ± SEM) of observations on the heated side of the enclosure when ambient temperature was <16°C. This value declined steadily with increasing ambient temperature to only 36 ± 4% when the temperature reached ≥22°C (Fig. 1). Statistical analysis showed a significant difference between the four temperature categories in the percentage of observations in which animals were on the heated side ($P < 0.001$). Percent of observations spent on the heated side was significantly different from 50% for both the lowest temperature category (<16°C) and the highest (≥22°C; $P = 0.05$, binomial test, one-tailed; Fig. 1).

One to sixteen observation sessions were conducted after swim sessions for 19 of the animals provided with heat. The pups spent a mean (±SEM) of 67 ± 6% of observations on the heated side of the enclosure, with 14 of the 19 seals spending more than 50% of observations after swims on the heated side ($P = 0.032$, binomial test, one-tailed).

Mortality rate was low (10%) for larger pups (>7 kg) and identical for both heat and no-heat treatments (Table 1). More

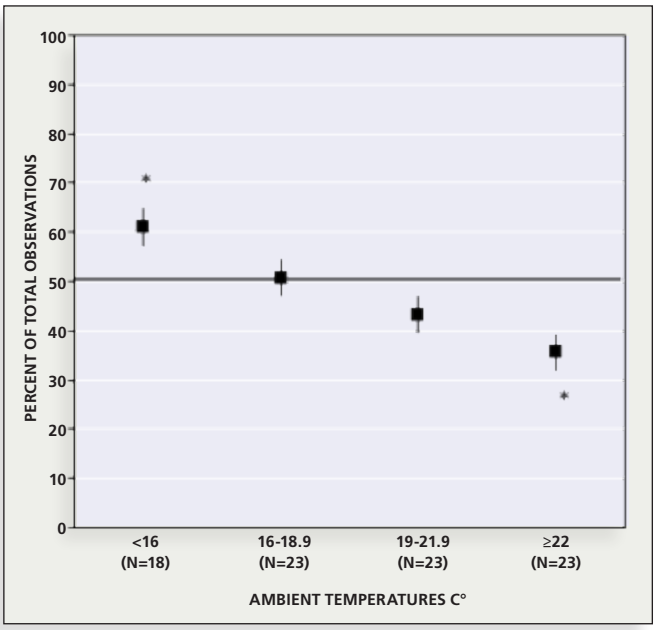


FIGURE 1. Percent of total observations (LS mean ± SEM) in which 23 harbor seal pups were observed on the heated side of their enclosures at four categories of ambient temperature. Significant difference from 50% indicated by an asterisk (*).

TABLE 1. NUMBER OF HARBOR SEAL PUPS (*N* = 66) WEIGHING ≤7 KG OR >7 KG THAT LIVED OR DIED BEFORE DAY 21, WITH OR WITHOUT A SUPPLEMENTARY HEAT SOURCE.

SIZE CATEGORY	HEAT			NO HEAT		
	LIVED	DIED	%DIED	LIVED	DIED	% DIED
Pups≤7 kg	10	3	23%	10	8	44%
Pups >7 kg	10	1	10%	22	2	8%

of the smaller pups died in the no-heat treatment (8/18) than in the heat treatment (3/13), but the difference was not significant by the χ^2 test (Table 1).

The pups fed milk-replacer had extremely variable changes in body weight, but most gained weight (80 ± 10 g/day with heat; 85 ± 15 g/day without heat). Pups fed fish formula had little or no weight gain. Gains averaged 6 ± 8 g/day for pups provided with heat, but pups without heat lost weight; on average, –6 ± 6 g/day. On either of the two diets, there was no significant difference in weight gains between those provided with heat and those without.

Discussion

This study shows that, if heat is provided at one end of even a small enclosure, pups will position themselves in a seemingly adaptive manner, clearly using heat when ambient temperature is below 16°C and clearly avoiding it when ambient temperature is 22°C or higher. The pups also selected the heated area just after being cooled by swimming in cold water. Small animals without a store of insulative fat may have difficulty thermoregulating and may be in a negative energy balance when exposed to cold temperatures. The action of moving close to a heat source when ambient temperatures are low, or after being chilled from swimming, likely represents an attempt at energy conservation.

Data on survival and weight gain provided no definitive differences between treatments but were consistent with the hypothesis that heat may benefit smaller, malnourished animals. There was a trend for better survival among small pups (≤7 kg) if they had heat. Smaller animals may benefit more from a heat source, as they must expend more energy for thermogenesis (Harding *et al*. 2005). An animal's thermo-neutral zone (the range of ambient temperatures at which no additional metabolic energy is required to maintain body temperature) is a function of body size, level of insulation, and the ratio of body surface-area-to-volume (Bartholomew 1977). Outside its thermo-neutral zone, an animal must increase its metabolic rate to regulate its temperature (Worthy 2001). Small animals with a greater ratio of surface-area-to-volume experience greater rates of heat loss, and a seal with inadequate blubber stores may be more susceptible to thermal challenges.

Immature animals require additional energy above their maintenance requirements for growth (Lavigne *et al.* 1986; Worthy 2001). When compared to the 400–800 g/day gains of mother-raised animals (Bowen *et al.* 1994; Cottrell *et al.* 2002), neither of the artificial diets seemed to provide adequate energy to sustain pups' metabolic maintenance and potential growth. In particular, the fish formula used in this study is a poor approximation of the fat-rich (~50%), energy-dense harbor seal milk (Lang *et al.* 2005).

Although only moderate ambient temperatures were recorded during the study period, the results allow cautious extrapolation. Presumably, the supplementary heat would be used even more in colder conditions and, in fact, seals were consistently seen directly under the heat lamps during occasional observations in cool, nighttime hours. The results also suggest that the practice of turning lamps off on warm days (above 25°C) was warranted. We hope this study helps rehabilitation facilities further refine their care of harbor seal pups in a manner that considers the systematic use of supplementary heat as part of husbandry protocols. The use of heat is also applicable for other pinniped species, especially for those animals admitted as neonates or without adequate blubber stores.

Conclusions

We conclude that harbor seal pups reared for release prefer, and may benefit from, access to a supplementary heat source, especially in the case of those animals in poor body condition, fed low calorie diets, and maintained at cool ambient temperatures.

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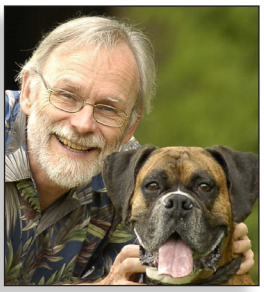
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Methicillin-Resistant *Staphylococcus Aureus* Skin and Soft Tissue Infection in a Wild Eastern Grey Squirrel (*Sciurus carolinensis*): A Case Study

Jennifer N. Niemuth and Anthony A. Pilny

ABSTRACT: A sub-adult, sexually intact female eastern grey squirrel *(Sciurus carolinensis)* was examined at the Animal Specialty Center (Yonkers, New York, USA) because of injuries sustained during a fall. The squirrel was mentally inappropriate, had caudoventral abdominal and inguinal soft tissue swelling, and had a distal left femoral fracture. One week after surgical fixation of the fracture, the squirrel was found to have an abdominal abscess, as well as a skin and soft tissue infection, at the surgical site. Culture revealed methicillin-resistant *Staphylococcus aureus* (MRSA). The squirrel was treated with antimicrobials, daily wet-to-dry bandages, and supportive care. The left femur was amputated 21 days after the initial surgery. The squirrel made a full recovery. MRSA infection is becoming increasingly important in all areas of veterinary medicine. Appropriate hygiene and biosecurity measures should be taken in all cases when bacterial infection is suspected, and MRSA should be considered as a differential diagnosis. Due to the increasing human–wildlife interface, MRSA infections should also be considered among the differentials for all wildlife cases.

KEYWORDS: Eastern grey squirrel, methicillin-resistant *Staphylococcus aureus,* MRSA, *Sciurus carolinensis.*

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Introduction

In humans, invasive methicillin-resistant *Staphylococcus aureus* (MRSA) disease is significantly related to healthcare, with approximately 85% of infections associated with the healthcare system (Klevens *et al.* 2007). Intercontinental spread of MRSA strains, and community-associated MRSA strains that have become more virulent, have recently been documented (Taiwo 2009).

Invasive MRSA infections pose multiple treatment challenges and can be fatal. MRSA is now considered an important pathogen in veterinary medicine and, while infections in pets remain uncommon, they are becoming more frequent (Weese 2005). Animal risk factors for MRSA infection are similar to the factors associated with human hospital-associated MRSA infections (Duquette and Nuttall 2004). Cases in dogs (*Canis lupus familiaris*) and horses (*Equus ferus caballus*) appear to be over-represented (Middleton *et al.* 2005), but MRSA has also been documented in cats (*Felis catus)*, a guinea pig (*Cavia porcellus*), rabbit (Order Lagomorpha), turtle (Order Testudines), bat (Order Chiroptera), parrot (Order Psittaciformes) (Walther *et al.* 2008), and a captive elephant calf (*Loxodonta africana*) (CDC 2009). Considerable differences have been documented between human, and some animal, MRSA strains (Loeffler and Lloyd 2010), but other strains from dogs and cats appear identical to human hospital-associated MRSA strains (Leonard and Markey 2008). While there is limited information on zoonotic transmission, there is evidence that it can occur (Loeffler *et al.* 2005; Leonard and Markey 2008; CDC 2009; Faires *et al.* 2009). In The Netherlands, MRSA from an animal reservoir, likely pigs (*Sus* spp.) or cattle (*Bos primigenius*), is accountable for greater than 20% of all human MRSA infections (van Loo *et al.* 2007).

Case Study

A sub-adult, sexually intact female eastern grey squirrel (*Sciurus carolinensis*) was presented to the Animal Specialty Center in Yonkers, New York, United States for surgical treatment of a left femoral fracture. The squirrel was found, after she had fallen, by a park ranger in City Hall Park, New York, NY. The squirrel was given to a wildlife rehabilitator and was presented to one of the authors (A.A.P.) for evaluation. Physical examination revealed that the squirrel was mentally inappropriate, had caudal abdominal and inguinal soft tissue swelling over the ventral midline fat pad, and had a closed left femoral fracture. Radiographs confirmed the abdominal soft tissue swelling and showed a simple distal metaphyseal left femoral fracture. A complete blood count, chemistry panel, and bile acids were submitted and had no significant findings, based on documented values (Hoff *et al.* 1976) as well as on the authors' experience with numerous healthy, ill, and injured grey squirrels. Referral to the co-authors' other veterinary practice was recommended for surgical fixation of the fracture, a splint was placed, and the squirrel was discharged with meloxicam (Metacam; Boehringer Ingelheim Vetmedica, St. Joseph, Missouri, USA) at a dose of 0.2 mg/kg p.o. q24h and sulfamethoxazole+trimethoprim (Sulfatrim Pediatric Suspension; Alpharma, Baltimore, Maryland, USA) at a dose of 30 mg/kg p.o. q12h.

The squirrel was presented for surgery 13 days after initial evaluation. A physical examination revealed no significant changes. The squirrel was pre-medicated with

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buprenorphine HCl (PharmaForce, Columbus, Ohio USA) at a dose of 0.05 mg/kg in a subcutaneous injection. Anesthesia was induced and maintained through administration of isoflurane (IsoFlo; Abbott Animal Health, Abbott Park, Illinois, USA) vaporized in oxygen via mask. The squirrel was placed in dorsal recumbency and the left hindlimb was aseptically prepped for surgery. The left femoral fracture was stabilized using two 22-gauge spinal needles (BD, Franklin Lakes, New Jersey, USA) in a cross-pinning technique. The muscle was closed by use of 3-0 polydioxanone (Ethicon, Inc., Cornelia, Georgia, USA) in a simple interrupted pattern. The subcutaneous tissues were closed by use of 3-0 polydioxanone (Ethicon, Inc.) in a simple continuous pattern. The skin was closed by use of 4-0 poliglecaprone in a continuous subcuticular pattern and with stainless-steel skin staples (Teleflex Medical, Research Triangle Park, North Carolina USA). A soft, padded bandage was placed on the affected limb. A balanced electrolyte solution (Normosol-R; Hospira, Inc., Lake Forest, Illinois) was administered at a dose of 26 ml/kg as a subcutaneous injection. Recovery from anesthesia was without complication and the patient was discharged to the rehabilitator later that day with instructions to keep exercise restricted. Meloxicam and sulfamethoxazole+trimethoprim were continued as previously prescribed.

Seven days post-operatively, the squirrel was seen for a recheck examination and a bandage change. The squirrel had become lethargic and had stopped self-feeding. Physical examination revealed dehiscence of the surgical site, necrosis and infection of the soft tissue and skin, and exposure of the femur and intramedullary pins. An open, draining abscess was also discovered on the caudoventral abdomen at the site of previous swelling. Radiographs revealed that the abscess did not communicate with the peritoneal cavity. Aerobic cultures of the surgical site and abscess were obtained. Both areas were flushed with copious sterile saline and a soft, padded bandage was placed. The patient was discharged with doxycycline monohydrate (Vibramycin; Pfizer Labs, New York, New York USA) at a dose of 5 mg/kg p.o. q12h pending culture results. Meloxicam and sulfamethoxazole+trimethoprim were continued as previously prescribed.



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Figure 1. Photograph of a MRSA-infected squirrel 10 days post-operatively and prior to initiation of treatment with wet-to-dry bandages and the addition of enrofloxacin to doxycycline treatment. At this time, the intramedullary cross-pins had been removed.

Ten days post-operatively, the squirrel was again seen for a recheck examination and a bandage change. Physical examination revealed no significant change from the previous exam (Fig. 1). The intramedullary pins were removed. Necrotic tissue from the abdominal abscess was debrided and both wounds were flushed with copious sterile saline. Wet-to-dry bandages were placed over the wounds and the squirrel was admitted to the hospital for supportive care and daily bandage changes with planned amputation.

Culture results of both wounds revealed infection with MRSA. Resistance was reported by the reference lab (Antech Diagnostics, Lake Success, New York, USA) for ampicillin, amoxicillin/clavulanic acid, cephalothin, and methicillin. Susceptibility was reported for chloramphenicol, clindamycin, erythromycin, enrofloxacin, gentamicin, neomycin, sulfamethoxazole+trimethoprim, and marbofloxacin (Antech Diagnostics). Treatment with enrofloxacin (Baytril; Bayer Corporation, Shawnee Mission, Kansas USA) at a dose of 5 mg/kg p.o. q12h was initiated, and two doses of buprenorphine HCl at a dose of 0.03 mg/kg were administered as a subcutaneous injection every 8 hr. Doxycycline monohydrate and meloxicam treatment was continued. sulfamethoxazole+trimethoprim treatment was discontinued due to lack of a clinical response, despite favorable *in vitro* sensitivity.

Wet-to-dry bandages were changed daily for the next four consecutive days, remained unchanged for 3 days, and then were changed daily for an additional two consecutive days. At that time, healthy granulation tissue was noted in both wounds and purulent discharge had ceased.

Twenty-one days post-operatively, the squirrel was re-anesthetized using the same protocol. A mid-diaphyseal left femoral amputation was performed. The muscle was closed by use of 3-0 polydioxanone (Ethicon, Inc.) in a simple interrupted pattern. The skin was closed by use of 4-0 poliglecaprone (Ethicon, Inc.) in a continuous subcuticular pattern and with stainless-steel skin staples. The abdominal abscess was allowed to heal via second intention. The patient was discharged to the rehabilitator with instructions to keep exercise restricted. Meloxicam was continued for an additional 7 days. Doxycycline monohydrate and enrofloxacin were continued for an additional 10 days.

At staple removal, 10 days post-amputation, the squirrel was bright and alert and was reported to have a good appetite. Both wounds had completely healed. The squirrel is currently housed in a sanctuary, is neurologically normal, and has not had any further complications one year post-operatively.

Discussion

Currently, there are no documented reports of MRSA infection in free-ranging wildlife that is free from human contact. MRSA has been found in black rats (*Rattus rattus*) living on pig farms in The Netherlands (van de Giessen *et al.* 2009). Methicillin-sensitive

S. aureus strains have been reported in wildlife that are in contact with humans; specifically exudative, ulcerative dermatitis in red squirrels (*Sciurus vulgaris*) commonly fed by humans in the United Kingdom (Simpson *et al.* 2010a, Simpson *et al.* 2010b).

In our specific case, we suspect that the squirrel was already infected with MRSA when it was rescued. The caudal abdominal swelling observed upon initial physical examination was thought to be due to traumatic injury and steatitis but, in retrospect, was likely inflammation associated with the early, invasive MRSA infection. None of the humans involved in this case are known MRSA carriers. No other cases of MRSA infection were being treated concurrently in the hospital. Previous cultures of various areas of the surgery department were negative for any aerobic bacteria. Human interaction with wildlife through supplemental feeding is a common practice in New York City parks and is possibly the source of infection for this squirrel.

Appropriate antimicrobial therapy, wound care, and supportive therapy were the basis of treatment for this case. The use of wet-to-dry bandages facilitated both wound debridement and the establishment of a granulation bed, but also required 11 days of treatment before the wound was healthy enough to safely attempt femoral amputation. For future cases, the use of vacuum-assisted closure may provide a shorter treatment interval which could make limb salvage possible. Additionally, the use of a topical, controlled-release antimicrobial microsphere product could prevent post-surgical wound infection (Fallon *et al.* 1999).

In the authors' experience, an unusual number of the grey squirrels that are presented for evaluation by local rehabilitators have neurological abnormalities of varying severity. In the majority of cases, no causative agent or etiology is identified despite diagnostic testing including imaging, biochemical analysis, and toxicologic and serologic screening as well as necropsy and histological examination. Empirical treatment has been attempted for a variety of conditions such as vestibular disease, hepatic encephalopathy, diabetic ketoacidosis, and parasitosis (e.g., *Baylisascaris procyonis*, *Toxoplasma gondii*) with no consistent results. In this case, it was suspected that the neurologic symptoms were related to the initial head trauma. The squirrel's eventual full recovery may support this hypothesis.

Management Implications

Education of clients and staff is the most important step in preventing the further spread of MRSA infections. Our patient was hospitalized in an isolation suite with an established protocol by which the technical staff used appropriate personal protective equipment and biosecurity measures. The client was instructed on proper disinfection protocol, i.e., to wear gloves while treating the patient, to avoid touching their own face after touching the patient or contaminated items, and to prevent the patient's belongings from being used for other patients at the rescue center.

MRSA infection is becoming increasingly important in all areas of veterinary medicine, and we believe this topic directly relates to the American Veterinary Medical Association's (AVMA) recently established One Health Initiative (AVMA 2011). The main purpose of this task force is to help with the treatment and prevention of cross-species disease transmission and medical conditions. Appropriate hygiene and biosecurity measures should be taken in all cases when bacterial infection is suspected, and MRSA should be considered as a differential diagnosis. Due to the increasing human–wildlife interface, MRSA infections should also be considered among the differentials for all wildlife cases. The difficulties of treating invasive MRSA infections can be compounded when the patient is a wild animal. Education of staff and clients is essential to treating the individual patient as well as in preventing further spread of MRSA. Further studies focusing on bidirectional transmission of pathogens such as MRSA, and their impact on human, domestic animal, wildlife, and environmental health, will be imperative to our One Health Initiative.

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Survey of Infections Transmissible Between Baboons and Humans, Cape Town, South Africa

Julian A. Drewe, M. Justin O'Riain, Esme Beamish, Hamish Currie, and Sven Parsons

Introduction



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The Cape Peninsula in South Africa is home to many species of wildlife, including ~470 chacma baboons (*Papio ursinus*) that are a major tourist attraction and a source of chronic conflict for local residents. Urban and agricultural land transformation has encroached markedly on the preferred natural habitat of baboons (Hoffman and O'Rain 2011), and the 16 remaining troops on the Peninsula have been forced into marginal areas and are geographically isolated from all other baboon populations (Fig. 1). The loss of preferred habitat, coupled with expanding numbers and a preference for high-caloric food items, results in baboons entering residential areas daily to raid dustbins (garbage containers), enter homes, and attack humans in an effort to secure human-derived food (Fig. 2).

The close contact between baboons and humans results in a high potential for the transmission of infectious diseases (Gillespie *et al*. 2008) from baboons to humans (zoonoses) and from humans to baboons (anthroponoses). Globally, disease transmission between humans and wildlife is occurring at an increasing rate, posing a substantial global threat to public health and biodiversity conservation (Daszak *et al*. 2008; Jones *et al*. 2008). Although a study of baboon parasites in Kenya found none directly attributable to exposure to humans (Hahn *et al*. 2003), the human parasite *Trichuris trichiura* has recently been identified in the Cape Peninsula baboon population; this finding represents the first evidence of likely anthroponotic infection of baboons (Ravasi 2009). Diseases such as measles and tuberculosis are highly prevalent among the local human population (WHO 2009) and have the potential to pass to baboons. The risks for infectious disease transmission between baboons and humans remain unclear. The aim of this study was to determine which diseases are currently present in the Cape Peninsula baboon population [in order] to inform decisions relating to baboon management, welfare, and conservation and the health risk to local humans and baboons. Ethical approval was gained from the Royal Veterinary College Ethics and Welfare Committee.

The Study

Twenty-seven baboons (15 male, 12 female) from five troops were screened for 10 zoonotic infections in April 2011. A nonstratified power analysis indicated that this sample

ABSTRACT: Baboons on South Africa's Cape Peninsula come in frequent contact with humans. To determine potential health risks for both species, we screened 27 baboons from five troops for 10 infections. Most (56%) baboons had antibodies reactive or cross-reactive to human viruses. Spatial overlap between these species poses low but potential health risks.

KEY WORDS: anthroponoses, chacma baboons, cross-species disease transmission, hepatitis A virus, *Papio ursinus,* zoonoses

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Figure 1. Cape Peninsula in South Africa, showing position and name of the different regions that have baboon troops. Baboons were sampled from those regions denoted by an asterisk. Green denotes natural land and gray shows the current extent of urban and agricultural land on the Peninsula.

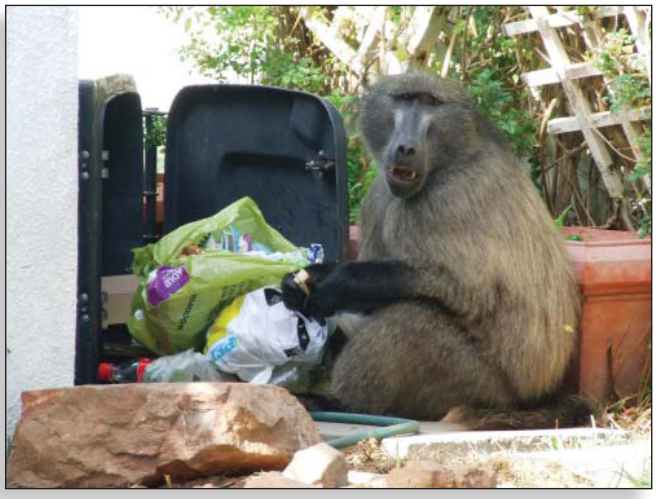


Figure 2. Baboon raiding a dustbin in the residential suburbs of Cape Town, South Africa.

would provide >95% confidence of detecting infections if they were present at a prevalence of >10%. Pathogens were chosen for screening according to a literature review of infections in primates of potentially serious anthroponotic or zoonotic risk. Older animals were preferentially sampled because these were thought most likely to have been exposed to diseases. Fourteen adult baboons (7 males >7 yr of age, 7 females >5 yr of age), 7 subadult baboons (2 males 5–7 yr of age, 5 females 4–5 yr of age), and 6 juvenile baboons (6 males <5 yr of age) were sampled. Nonrandom sampling was done to increase the chances of detecting diseases, if present, and was considered appropriate because the aim of this study was to determine presence or absence of infection, not prevalence of infection.

Baboons were individually trapped in cages and anesthetized for blood sampling. Samples of feces from each baboon were collected from the cage floor. After reversal of anesthesia and a suitable recovery period, the baboons were released in sight of their troop.

Automated enzyme-linked fluorescent assays (Vidas; bioMérieux, Marcy l'Etoile, France) were used to test for antibodies against measles, hepatitis A virus (HAV), cytomegalovirus (CMV), and Epstein-Barr virus (Table 1). The manufacturer's positive controls (human serum specimens containing IgG) were used. A serum neutralization test was used to screen samples for poliovirus antibodies. An interferon-gamma release assay for tuberculosis was conducted by using the QuantiFERON-TB Gold In-Tube test (Cellestis, Carnegie, Australia). This assay has been used previously for detection of *Mycobacterium tuberculosis* infection in chacma baboons (Parsons *et al*. 2009). Test results were interpreted according to the manufacturer's criteria for human patients. Feces samples were stored at 5°C for up to 24 hr before being cultured for *Salmonella* spp., *Shigella* spp., *Yersinia* spp., and *Campylobacter* spp. by using standard techniques (Nizeyi *et al*. 2001).

Results

Results are shown in Table 1. Fifteen (56%) baboons had antibodies reactive or cross-reactive to at least one human virus; CMV, HAV, and Epstein-Barr virus. Seven (26%) baboons had antibodies reactive or cross-reactive to two of these viruses. Baboons in every troop were positive for at least one viral infection, but considerable variation was found among troops (Table 2). One troop (Da Gama) showed a higher than average rate of exposure to HAV; 6 (75%) of 8 of the HAV antibody-positive baboons were in this one troop, despite this troop's representing just 7 (26%) of the 27 baboons in the sample. All three baboons sampled from another troop (Red Hill) had antibodies against CMV (Table 2). No pathogenic bacteria were found. Because intermittent shedding of fecal pathogens means that sampling animals on a single occasion may miss cases of infection (Morner 2001), negative fecal culture results should not be considered definitive.

Conclusions

This study provides evidence of the potential for cross-species trafficking of select pathogens. Widespread evidence of reactive

or cross-reactive humoral immune responses to human pathogens was found in wild baboons. The detection of antibodies reactive or cross-reactive to HAV in 30% of baboons tested is a potential cause for concern. Because HAV is spread by the fecal–oral route, many opportunities might exist for direct and indirect transmission between baboons and humans; e.g., baboons frequent picnic sites and enter houses and cars in search of food. The frequency with which such contacts result in the transmission of HAV should be investigated because of the potentially fatal consequences of human infection with HAV, particularly for immunocompromised persons such as those co-infected with the human immunodeficiency virus [HIV]. Furthermore, as pathogens pass back and forth across species lines, the potential for changes in pathogenicity and host specificity exists, which can result in serious adverse effects on human and wildlife health.

TABLE 1. RESULTS OF DIAGNOSTIC TESTS FOR EXPOSURE TO 10 INFECTIOUS DISEASES IN 27 WILD BABOONS, CAPE PENINSULA, SOUTH AFRICA, APRIL 2011*

INFECTION	DIAGNOSTIC TEST	NO. (%) BABOONS TESTING POSITIVE
CMV	ANTI-CMV IGG ELFA	9 (33)
HAV	ANTI-HAV TOTAL IMMUNOGLOBULINS ELFA	8 (30)
EBV	ANTI-EBV EARLY AND NUCLEAR ANTIGENS IGG ELFA	5 (19)
MEASLES VIRUS	ANTI-MEASLES VIRUS IGG ELFA	0
POLIO VIRUS	SERUM NEUTRALISATION TEST	0
TUBERCULOSIS	WHOLE BLOOD GAMMA INTERFERON TEST	0
SALMONELLA SPP.	FECAL CULTURE†	0
SHIGELLA SPP.	FECAL CULTURE†	0
YERSINIA SPP.	FECAL CULTURE†	0
CAMPLYOBACTER SPP.	FECAL CULTURE†	0

*CMV, cytomegalovirus; ELFA, enzyme-linked fluorescent assay; HAV, hepatitis A virus; EBV, Epstein-Barr virus. †Single fecal cultures performed on samples from 21 baboons only.

TABLE 2. DISTRIBUTION OF ANTIBODY-POSITIVE BABOONS BY TROOP, CAPE PENINSULA , SOUTH AFRICA, APRIL 2011*

BABOON TROOP	PREDOMINANT HUMAN HABITAT TYPE	NO. BABOONS TESTED	NO. (%) CMV POSITIVE	NO. (%) HAV POSITIVE	NO. (%) EBV POSITIVE
RED HILL	URBAN RESIDENTIAL	3	3 (100)	1 (33)	1 (33)
DA GAMA	URBAN RESIDENTIAL	7	3 (43)	6 (86)	1 (14)
SMITSWINKEL BAY	SCENIC TOURIST ROUTE	3	1 (33)	0	1 (33)
TOKAI JT	FOREST PLANTATION	6	0	1 (17)	2 (33)
TOKAI MT1	FOREST PLANTATION	8	2 (25)	0	0
TOTALS		**27**	**9**	**8**	**5**

*The locations of each baboon troop are indicated in Figure 1. CMV, cytomegalovirus; HAV, hepatitis A virus; EBV, Epstein-Barr virus.

The considerable variation in virus immunity among baboon troops (Table 2) warrants further study. The difference was particularly pronounced in the two most-sampled troops in which HAV antibody prevalence varied from 0% (0/8 baboons in the Tokai MT1 troop; in a forest) to 86% (6/7 baboons in the Da Gama troop; in an urban area). Future work should target these groups for more extensive sampling (ideally, all baboons should be sampled) to more accurately determine the prevalence of infection and to investigate risk factors for virus exposure. A suitable hypothesis for testing would be that zoonotic infection prevalence in baboons is positively correlated with the proportion of urban land in their habitat.

The results of this study suggest that baboons on the Cape Peninsula pose a low but potential risk for transmitting zoonoses and that they might be at risk from anthroponoses. The findings should not be interpreted as definitively showing baboon exposure to human viruses because the serologic tests did not distinguish between human and baboon variants of the viruses, and some cross-reactivity may have occurred. Virus isolation would be needed to determine the virus types. Nonetheless, there is ample evidence that disease of human origin can be devastating for primate populations (Palacios *et al*. 2011; Köndgen *et al*. 2008). Further research is required on the Cape Peninsula to quantify the incidence of infections in baboons and humans, to examine the variation in levels of infection among baboon troops, and to measure the frequency of contact between species. Estimating the probability of cross-species disease transmission is challenging (Lloyd-Smith *et al*. 2009), but this information would be of tremendous use in informing baboon management plans with the aim of reducing the risks for infectious disease in humans and baboons.

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Let An Otter Do It

By Deb Teachout, DVM

Two important, linked (at least in my mind) events happened recently. One was a death; the other was the birth of a new IWRC course on re-uniting and fostering raptors. These events both represent significant milestones in learning how we best teach young wildlife to be wild. We learn to admit that we can't teach this and, instead, we learn techniques in stepping aside for a more qualified instructor.

Not very often does the death of an animal hit the major news outlets, but when it does, I always have to read the obituary. On Saturday, March 3, 2012 the Monterey Bay Aquarium [Monterey, California, United States] announced the death of Toola, a female sea otter. She was the first captive sea otter to serve as a surrogate mother, and she changed the way injured and orphaned young sea otters were rehabilitated at the aquarium's Sea Otter Research and Conservation Program. Before her, orphaned otters raised at the aquarium became too acclimated to people and could not be released. Toola spent most of her life at the aquarium raising orphaned sea otter pups that were successfully returned to the wild.

In July, 2001, a pregnant Toola was rescued at the age of about 5 years when she was stranded on a California beach suffering from a neurological disorder caused by the protozoan *Toxoplasma gondii*, a parasite spread by cat feces and a real threat to sea otters. After her rescue, she gave birth to a stillborn pup. At about the same time, the aquarium received an orphaned 2-week-old sea otter pup. The staff decided to place the two together and Toola took it from there. According to the San Francisco Chronicle, she nursed the orphaned pup like he was her own, taught him to open clamshells with rocks, how to eat a crab without getting pinched, and other tricks of sea otter life (Jones 2012). That pup is still alive, is king of a pack at a place called Elkhorn Slough, and has fathered innumerable pups himself. Toola required twice a day anticonvulsant medication to control her seizures and, therefore, could not be released. She was the first captive sea otter ever to serve as a surrogate mother for stranded pups, and over about 10 years in captivity she raised 13 pups. Her fostered pups have gone on to give birth to seven pups of their own, five of which weaned successfully. The last two of her pups are to be released later this year.



PHOTO ©MONTEREY BAY AQUARIUM / RANDY WILDER. USED WITH PERMISSION.

Toola, famed sea otter (*Enhydra lutris*) who performed as surrogate mother *extraordinaire* at Monterey Bay Aquarium for more than a decade.

In rehabilitating sea otters, as is true with many other species of wildlife, life in captivity for even a short time can create an animal that is too accustomed to interacting with humans and, therefore, cannot be released. As Steve Shimek, director of the Otter Project, a Monterey nonprofit, put it, "Toola was the animal who led us to the solution over how best to raise otter pups: Let an otter do it. She was a wonderful mother and a wonderful teacher and we're thankful for everything she did" (Jones 2012). Toola apparently died from kidney problems at the age of 15 or 16. A dedicated mom till the end, she cared for her last pup on Friday, and she died early Saturday morning.

Mothers and fathers definitely do know best when it comes to raising offspring that can survive in the wild—and that is the motivation behind the reuniting and fostering process being championed by progressive wildlife rehabilitators. According to wildlife rehabilitator Anne G. Miller, developer of the new IWRC raptor reuniting course and author of *Calls of the Wild: Using Recorded Calls and Other Tools to Reunite Juvenile & Adult Raptors*, reuniting healthy young wild animals with parents should be "an obligation, not an option" in nearly all situations. She feels that juveniles raised by their own parents learn valuable skills, such as prey recognition and predator avoidance, that are hard, if not impossible, to teach in a rehabilitation setting. Older juveniles benefit from

CONTINUED ON NEXT PAGE

parental protection during the time they are becoming independent (Miller 2011).

As Laura Simon of the Humane Society of the United States expressed at the 2011 IWRC Symposium in Ft. Lauderdale, Florida, it is indeed a new paradigm where rehabilitation success is measured not in terms of intake–release statistics but, instead, in the number of animals successfully reunited and *kept out* of rehab facilities. In this scenario, rehabilitators will be freed up to provide a higher quality of care for animals that cannot be reunited and must be admitted for care.

Members of the wildlife rehabilitation field continue to learn how to give injured and orphaned wildlife their best shot at living the life they were meant to live. Surrogates such as Toola represent a giant leap in understanding from a decade ago and, now, reuniting and fostering is the new frontier of wildlife rehabilitation. We know mom and dad can raise them better than we can; therefore, we have the moral obligation to help them do so.

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Deb Teachout is a veterinarian in Illinois, United States, whose practice serves both domestic and wildlife patients. She is a past member of the IWRC Board of Directors, an associate editor for JWR, and a long-time animal advocate.

Call by Call, Day by Day

by Prudi Koeninger and Kathy Milacek

Previously, we've explored what it takes to start a virtual wildlife conflict resolution hotline [31(3)], how to get the word out to the community and handle the call volume when you succeed [32(1)]. Now we'll turn our attention to the nuts-and-bolts of daily operations.

Coordinating referrals

Initially, the hotline volunteer was charged with coordinating referrals and contacting our wildlife rehabilitators. However, we found this made the process unnecessarily complicated, requiring multiple calls between the volunteer, their supervisor, the wildlife rehabilitators, and the public—all of whom were trying to get a single animal placed. Hotline volunteers would become overwhelmed when they couldn't close out a call. Rehabilitators would become frustrated when they couldn't get through to the hotline volunteer because the line was busy.

As much as we wanted to make the connection between public and rehabilitator through the hotline, we found it necessary to begin giving out the rehabbers' contact information—often two or three rehabilitators based on either the location of the caller or the species—asking them to keep trying until they talk to someone who can accept the animal. We instruct the caller to get back to us if they are unable to connect with a rehabilitator so we can move on to Plan B.

Coordinating volunteers

When your organization is 100% volunteer-operated, it's important to create a welcoming and supportive work environment. Stress reduction has been crucial for volunteer effectiveness and retention. It's important to "control" the number of calls you can accept, setting limits based on your available volunteers, hours of operation, and intake capacity of local wildlife rehabilitators.

Our greatest challenge was determining how to handle vacant shifts, such as when a volunteer calls out sick, has a family emergency, or goes on vacation. During an hour-long shift, a volunteer may handle up to 20 calls. An even more difficult decision faced by our organization was what to do when a volunteer leaves the organization, creating a shift vacancy for several weeks while we search for a replacement. In the past, hotline supervisors covered these vacant shifts, but it became difficult to find committed supervisors for a full- or half-day's worth of shifts—no one wanted that job. When the supervisor couldn't cover the vacant shift, the next volunteer would not be happy to begin their shift with a backlog of 20 messages, and who can blame them?

Our hosted PBX phone system option for "parking" calls during a vacant shift has proven helpful in this regard. When the system is in 'park' mode, the public cannot leave a voicemail but they are given instructions; in this case, we created a message directing callers to our website for answers to the most common problems and a list of local wildlife rehabilitators (Figs. 1–3, right). If a caller did not find an adequate answer on the website, they were directed to call the hotline back when we expected to have a live volunteer on the line, usually within about an hour.

In the next installment, we'll discuss opportunities to work with your local animal control, animal welfare, and state agencies. ■

Prudence "Prudi" Martin-Koeninger and Kathy Milacek are founders (2003) and directors of the Dallas-Fort Worth, Texas (USA) Wildlife Coalition, which operates a community-supported urban wildlife conflict solution hotline that has logged 55,000 residential calls to date. Kathy is a Texas Master Naturalist. Prudi operates Rascal's Retreat, a home-based wildlife rehabilitation center.



FIGURE 1. Screenshot of DFWWC website home page.



FIGURE 2. Screenshot of DFWWC avian information page.



FIGURE 3. Screenshot of DFWWC link to wildlife rehabilitator information page.

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wildlife rehabilitation, and a sanctuary for non-releaseable wildlife. The 16-acre site would cost at least $US1.9 million. The Millhams want the new location to be a place the public can visit and see wildlife. Their current location is too small to offer tours and much of the wildlife at the center is in rehabilitation and cannot be disturbed.

"It's incredibly important for not just our local residents, but nationally and internationally it's important for people to understand what our wildlife is here in Lake Tahoe," said LTWC board vice president Sue Novasel.

"We want to make sure we accommodate them the best we can because the entire community will benefit," said Santiago.

Rehabilitation Center Opens Consignment Store

BOULDER, Colorado, USA (April 4, 2012)—The Greenwood Wildlife Rehabilitation Center, a Lyons (Colorado)-based nonprofit,, is growing its retail presence in Boulder by opening a high-end consignment shop and expanding its thrift store. The thrift store and consignment shop will split the 8,400-square-foot space and should further help the organization as the cost of rehabilitating animals increases, said Linda Tyler, executive director of Greenwood.

"The thrift store is a big beneficiary (to the nonprofit)," she said. "Last year, we raised US$96,000 that went directly to Greenwood. We never would want to give up a successful concept like that."

After researching the growth potential for thrift and consignment stores, general manager Roseanne Ashley found both concepts posted sales gains, with consignment stores recording double-digit revenue growth. "I think it's a trend throughout the country... [people] don't have the freedom to just give their items away," Ashley said.

Greenwood's officials and volunteers also saw another trend: Their customers were dropping off items at the thrift store and then at a consignment retailer, she said. "We decided to give them an opportunity to stop in one store," she said. ■

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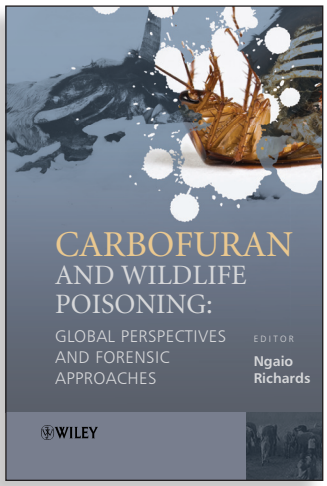
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BOOK REVIEW

Carbofuran and Wildlife Poisoning: Global Perspectives and Forensic Approaches

Ngiao Richards, Editor

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This comprehensive, timely volume deals specifically with use of the insecticide carbofuran and the global wildlife mortality and morbidity it has caused. Introduced to the market in 1967 by FMC Corporation [Philadelphia, Pennsylvania USA] under the trade name Furadan, carbofuran has caused untold wildlife mortality ever since. Its intentional misuse to kill predators was the primary impetus for this book.

Carbofuran is a broad-spectrum carbamate insecticide used to control insects in many field crops including potatoes, corn, and soybeans among others. Its mode of action is to inhibit the enzyme acetylcholinesterase, critical for normal functioning of the nervous and muscular systems, and it is one of the most acutely toxic of the carbamate insecticides. As little as 7.5 mg can kill a domestic cat, 0.47 g an adult lion. It is also a powerful endocrine disruptor shown to impair reproduction in wildlife. As a systemic insecticide, it accumulates to insecticidal concentrations in plant tissues. Animals feeding on any part of the plant are poisoned. Carbofuran also exhibits a high secondary poisoning hazard, poisoning opportunistic predators and scavengers consuming prey killed by carbofuran exposure or carcasses baited with carbofuran.

Carbofuran ranks first among all pesticides for number of mortality incidents reported by the American Bird Conservancy's Avian Incident Monitoring System (AIMS). While banned in the United States, Canada, and the European Union, it is widely available in other parts of the world, and its increased use in Africa and Asia has resulted in the alarming increase of wildlife mortality.

International contributions from 43 authors who are researchers, policy-makers, conservationists, and forensic scientists, comprise this book's nine chapters with reference sections, an appendix, and a comprehensive reference section at the end. The book covers wildlife mortality stemming from both legal and illegal uses of carbofuran; reviews experiences and approaches in wildlife rehabilitation, forensic, and conservation fields; and discusses global response to the extensive wildlife mortality occurring across five continents.

Chapter 1 (Donovan *et al.*) reveals the history, toxicology, and global uses of carbofuran. Chapter 2 (Mineau *et al.*) discusses toxicity, diagnosis, and rehabilitation of affected wildlife. Chapter 3 (Lalah *et al.*) is one of the most compelling, chronicling carbofuran's illegal use in Kenya. The section on the role of carbofuran in the decline of carnivores there is particularly striking. Chapter 4 (Venkataramanan and Sreekumar) deals with human–wildlife conflicts in India and resulting carbofuran poisonings, and includes diagnostic and forensic techniques, case studies, and possible conflict mitigation. The regulation and illegal uses of carbofuran in Europe is covered in Chapter 5, including case studies from six European countries. Carbofuran canine units and the gathering of forensic evidence are of particular note. Chapter 6 (Tingay *et al.*) provides perspectives on wildlife poisoning in Ireland and the UK with a focus on Scotland, in particular human–wildlife conflicts resulting from intentional poisonings, a case study of raptor mortality, and the monitoring of illegal uses. Chapter 7 (de Almeida and de Almeida) outlines the environmental impact on birds by Latin American wheat and rice farmers using carbofuran. Chapter 8 (Mineau *et al.*) relates a history of its impacts on birds in North America, as well as the registration history of carbofuran, secondary poisoning, and illegal uses in the USA and Canada. Chapter 9 (N. Richards, ed.) summarizes previous chapters and offers recommendations for moving forward.

The variety of experiences and volume of information from five continents on intentional and unintentional poisonings of wildlife, the rehabilitation of exposed wildlife, forensic developments, conservation approaches including monitoring techniques, and the efforts to ban or reduce the use of carbofuran create a substantial resource. The fact that the book includes numerous global case studies provides added value to those interested in a global perspective.

Overall, this book is generally well-written, organized, and edited. Clearly, this book emerges as the definitive reference on this particular subject. This book will be very useful for wildlife toxicologists, field biologists and other field researchers, NGOs and other conservation organizations, wildlife veterinarians and rehabilitators, and wildlife law enforcement agencies. The cost of this book may be prohibitive for some, but that is to be expected for a 304-page book written on such a specific topic. However, I believe that carbofuran stakeholders everywhere will find it to be an essential resource and will wish to purchase it anyway.

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Using Community Surveillance Data to Differentiate Between Emerging and Endemic Amphibian Diseases

S. Young, L. F. Skerratt, D. Mendez, R. Speare, L. Berger, and M. Steele. *Diseases of Aquatic Organisms* 98(1):1–10. 2012.

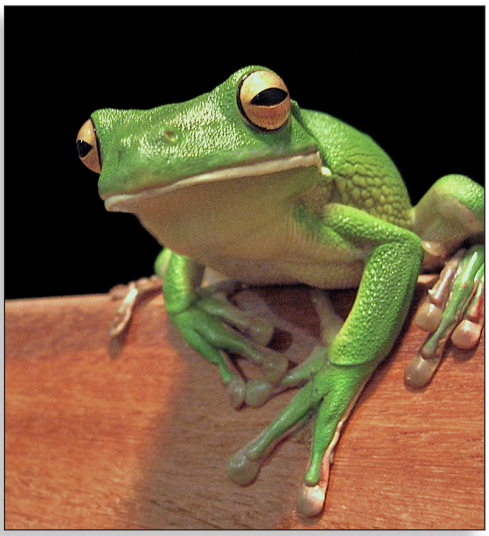


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White-lipped tree frog *(Litoria infrafrenata).*

We analyzed submission data from a wildlife care group during amphibian disease surveillance in Queensland, Australia. Between January 1999 and December 2004, 877 white-lipped tree frogs *Litoria infrafrenata* were classified according to origin, season, and presenting category. At least 69% originated from urban Cairns, significantly more than from rural and remote areas. Total submissions increased during the early and late dry seasons compared with the early wet season. Frogs most commonly presented each year with injury, followed by 'other,' sparganosis, and irreversible emaciation of unknown etiology. This is the first report of *Spirometra erinacei* infection in this species. A high prevalence (28%) of visible *S. erinacei* infection was found in emaciated frogs, but this was not statistically different from that in non-emaciated, diseased frogs (25%). However, 14 emaciated specimens that were necropsied all had heavy *S. erinacei* infections, and the odds of visible sparganosis were statistically greater in emaciated frogs compared with injured, non-diseased frogs. We provide a detailed case definition for a new endemic disease manifesting as irreversible emaciation, for which *S. erinacei* may be the primary etiological agent. The lack of significant spatial or temporal patterns in case presentation suggests that this is not a currently emerging disease. We show that community wildlife groups can play a valuable role in monitoring disease trends, particularly in urban areas, but identify a number of limitations associated with passive syndromic surveillance. We conclude that it is critical that professionals be involved in establishing syndromic case definitions, diagnostic pathology, complementary active disease surveillance, and data analysis and interpretation in all wildlife disease investigations.

Novel Relapsing Fever Borrelia Detected in African Penguins *(Spheniscus demersus)* Admitted to Two Rehabilitation Centers in South Africa

M. J. Yabsley, N. J. Parsons, E. C. Horne, B. C. Shock, and M. Purdee. *Parasitology Research* 110(3): 1125–1130. 2012.

The African penguin, *Spheniscus demersus*, the only penguin species that breeds in Africa, is endangered, and several diseases including avian malaria, babesiosis, and aspergillosis are common in some populations. From 2002 to 2010, spirochetes morphologically consistent with *Borrelia* spp. were observed on thin blood smears from 115 of 8,343 (1.4%) African penguins admitted to rehabilitation centers in the Western Cape and Eastern Cape provinces of South Africa. Prevalence rates were significantly higher among chicks and juveniles compared with adults and for birds sampled during the summer months of October to February compared with winter months. The majority of infected birds were ultimately released, despite lack of antibiotic treatment; however, at least one bird is believed to have died of borreliosis based on characteristic gross and microscopic lesions. Analysis of partial *flaB* gene sequences indicated this was a relapsing fever Borrelia most similar to a *Borrelia* sp. detected in soft ticks from a seabird colony in Japan. This represents the fourth report of a relapsing fever *Borrelia* sp. in an avian species and highlights the need for additional studies of potentially pathogenic organisms infecting the African penguin in South Africa.

Molecular Sub-Typing Suggests that the Environment of Rehabilitation Centers May Be a Potential Source of *Aspergillus fumigatus* Infecting Rehabilitating Seabirds

J. D. Burco, K. A. Etienne, J. G. Massey, M. H. Ziccardi, and S. A. Balajee. *Medical Mycology* 50(1): 91–98. 2012.

Aspergillosis remains a major cause of infection-related avian mortality in birds that are debilitated and undergoing rehabilitation for release into the wild. This study was designed to understand the source of avian aspergillosis in seabirds undergoing rehabilitation at selected northern California aquatic bird rehabilitation centers. Air, surface, and water sampling was performed between August 2007 and July 2008 in three such centers and selected natural seabird loafing sites. Average air *Aspergillus fumigatus* counts were at least nine times higher in samples obtained from the rehabilitation sites ($M = 7.34$, $SD = 9.78$ CFU/m^3) when compared to those found at natural sites ($M = 0.76$, $SD = 2.24$ CFU/m^3), $t(205) = -5.99$, $P < 0.001$. A total of 37 *A. fumigatus* isolates from birds with confirmed aspergillosis and 42 isolates from environmental samples were identified, using both morphological and molecular methods, and subsequently sub-typed using an eight-locus microsatellite panel with the neighbor-joining algorithm. Results of the study demonstrated the presence of five clonal groups, 13 genotypically related clusters, and 59 distinct genotypes. Six of the 13 genotypically related clusters contained matching genotypes between clinical isolates and local environmental isolates from the rehabilitation center in which these birds were housed. We present evidence that the environment of rehabilitation centers may be a source for *A. fumigatus* infection in rehabilitated seabirds.

Further Evidence for the Post-Release Survival of Hand-Reared, Orphaned Bats Based on Radio-Tracking and Ring-Return Data

A. Kelly, S. Goodwin, A. Grogan, and F. Mathews. *Animal Welfare* 21(1): 27–31. 2012.

We recently used radio-tracking to demonstrate short-term, post-release survival of five orphaned, hand-reared pipistrelle bats. Here, we present further evidence of short-term post-release survival and also demonstrate longer-term survival using re-sighting data of ringed common *(Pipistrellus pipistrellus)* and soprano *(Pipistrellus pygmaeus)* pipistrelle bats. Ten bats (five common and five soprano pipistrelles) were radio-tracked for between one and 10 days. Three of these were retrieved after one, two, and four days, respectively. In addition, five of the 39 (13%) ringed bats returned to their release boxes between 38 and 1,389 days after release, at least two of which survived over the winter in the wild. A sixth ringed bat was retrieved 27 days after release after becoming trapped in a house. We also identified potential barriers to successful rehabilitation. Two of the 10 bats radio-tracked in the current project became trapped within buildings and another bat had to be retrieved following entanglement with debris. We, therefore, recommend that attention be paid to giving bats an opportunity, prior to release, in identifying and using small exit holes similar to those found in buildings and loft spaces. We also recommend allowing bats to self-release following prolonged pre-release flight training in a large flight cage situated in suitable bat habitat.

Seroprevalence of Tularemia in Wild Bears and Hares in Japan

A. Hotta, K. Tanabayashi, Y. Yamamoto, O. Fijita, A. Uda, T. Mizoguchi, and A. Yamada. *Zoonoses and Public Health* 59(2): 89–95. 2012.

Tularemia is a zoonotic disease caused by *Francisella tularensis*. The distribution of the pathogen in Japan has not been studied well. In this study, seroprevalence of tularemia among wild black bears and hares in Japan was determined. Blood samples collected from 431 Japanese black bears (*Ursus thibetanus japonicus*) and 293 Japanese hares (*Lepus brachurus*) between 1998 and 2009 were examined for antibodies against *F. tularensis* by micro-agglutination test or enzyme-linked immunosorbent assay. By subsequent confirmatory tests using western blot and indirect immunofluorescence assay, eight sera from Japanese black bears were definitely shown to be seropositive. All of these eight bears were residents of the northeastern part of the main-island of Japan, where human tularemia had been reported. On the other hand, no seropositive Japanese hares were found. These results suggest that Japanese black bears can serve as sentinels for tularemia surveillance and may help understand the distribution of *F. tularensis* throughout the country. This is the first report on the detection of antibody to *F. tularensis* in black bears of Japan.

Assessment of the Release of Rehabilitated Vervet Monkeys into the Ntendeka Wilderness Area, KwaZulu-Natal, South Africa: A Case Study

A. J. Guy, O. M. L. Stone, and D. Curnoe. *Primates* 53(2): 171–179. 2012.

In South Africa, vervet monkeys (*Chlorocebus aethiops*) are frequently persecuted, resulting in large numbers of injured and orphaned animals. Rehabilitation centers aim to care for these monkeys and ultimately return them to the wild whenever possible. However, it is unknown whether rehabilitation is successful in its goal of creating wild-living, independent, self-sustaining troops due to limited published research in this area. This study describes the release and subsequent fate of a troop of rehabilitated vervet monkeys over a 6-mo period. A troop of 16 monkeys was released into the Ntendeka Wilderness Area, a protected part of the Ngome Forest, by the WATCH (Wild Animal Trauma Centre and Haven) rehabilitation center in KwaZulu-Natal, South Africa. Monitoring data were evaluated with regard to survival, mortality, suitability of the release site, breeding, condition, troop composition, behavior, group dynamics, ranging patterns, and the effectiveness of monitoring tools. The release was considered to be a partial success in that the troop exhibited behavior, group dynamics, and ranging patterns similar to wild conspecifics. However, the survival rate was low and the troop was judged to be non–self-sustaining. The main problems identified were the limited lifetimes of radio collars which resulted in missing animals and caused monitoring to be cut short, illegal hunting activities, predation, and a small troop size with few adults. The authors recommend improvements that may increase success such as retaining troops in release enclosures for longer periods, releasing a larger troop with more adults that more closely matches wild troop composition, selecting a release site at least 3 km from the nearest human settlement, and the use of GPS collars to allow for a longer monitoring period encompassing all seasonal conditions. Furthermore, all primates for release should be medically screened so as to avoid potential negative impacts on wild populations.

Mustelid Herpesvirus-2, a Novel Herpes Infection in Northern Sea Otters *(Enhydra lutris kenyoni)*

M. Tseng, M. Fleetwood, A. Reed, V. A. Gill, R. K. Harris, R. B. Moeller, T. P. Lipscomb, J. A. K. Mazet, and T. Goldstein. *Journal of Wildlife Diseases* 48(1): 181–185. 2012.

Oral ulcerations and plaques with epithelial eosinophilic intranuclear inclusions were observed in northern sea otters (*Enhydra lutris kenyoni*) that died or were admitted for rehabilitation after the 1989 Exxon Valdez oil spill (EVOS) in Alaska, United States. Transmission electron microscopy demonstrated the presence of herpesviral virions. Additionally, a serologic study from 2004 to 2005 found a high prevalence of exposure to a herpesvirus in live-captured otters. Tissues from 29 otters after the EVOS, and nasal swabs from 83 live-captured otters in the Kodiak Archipelago, were tested for herpesviral DNA. Analysis identified a novel herpesvirus in the gamma subfamily, most closely related to Mustelid herpesvirus-1 from badgers. Results indicated that this herpesvirus is associated with ulcerative lesions but is also commonly found in secretions of healthy northern sea otters.■

Call for Papers



This coming November more than 150 wildlife rehabilitators, veterinarians, conservationists, and other wildlife professionals will gather in Appleton, Wisconsin. The International Wildlife Rehabilitation Council's Annual Symposium provides an excellent opportunity for wildlife professionals to meet and exchange ideas, skills, and products relating to wildlife rehabilitation.

The Symposium will be held from Monday, 12th to Saturday, 17th November, 2012. Presentations will run from the Thursday to Saturday. The overall theme for the symposium will be **The Science of Wildlife Rehabilitation**. There will be one plenary session on the first morning, then two tracks a day for the rest of the symposium. We are now seeking submissions for presentations for all tracks. As well as a series of open sessions covering the subjects listed below, we also plan to run a track on the rehabilitation of reptiles and so we are particularly interested in receiving abstracts for presentations on this subject.

Suggested subject areas include: Veterinary, Legislation, Research, Conservation, Environmental Enrichment, Rehabilitation, Animal Welfare,

Anyone wishing to present a talk should submit their 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. If there is more than one author, please indicate who will be presenting and provide a preferred contact e-mail and postal address. The brief (one paragraph) biography of the author(s) should include experience as it relates to the presentation.

All abstracts will be available for delegates in booklet form and so should be submitted electronically as a MS Word document or using a Microsoft compatible format. Use 12-point font and, if possible, Times New Roman style. Use single line spacing, full justification and do not indent paragraphs.

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- Abstract (Summary of presentation) 250 words
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TAIL END



INDIAN PALM SQUIRREL (*FUNAMBULUS PALMARUM*) AND SPOTTED OWLET (*ATHENE BRAMA*). PHOTO ©SANDEEP SOMASEKHARAN. CREATIVE COMMONS LICENSE.

"Okay guys, I'm gonna show you how owl tipping is done."

Winning caption by Tara Jernigan, Murfreesboro, Tennessee, USA.
Thanks, Tara!

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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.

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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.

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Pigeon Guillemot *(Cepphus columba)*, California seabirds.
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