INTERNATIONAL WILDLIFE REHABILITATION COUNCIL

Volume 35, Number 2, 2015

# JOURNAL OF WILDLIFE REHABILITATION

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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:
**Black-tailed deer (*Odocoileus hemionus columbianus*).**


Left:
**A bald eagle (*Haliaeetus leucocephalus*).**


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# JOURNAL OF WILDLIFE REHABILITATION

Volume 35(2)


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The *Journal of Wildlife Rehabilitation* is published by the International Wildlife Rehabilitation Council (IWRC), PO Box 3197, Eugene, OR 97403 USA.



(ISSN: 2166-9198).

EDITORIAL

# Can Wildlife Rehabilitators Really "Do No Harm"?

**Guest editorial by Renée Schott, DVM, CWR**

As wildlife rehabilitators, we often aspire to the adage, "Above all, do no harm." This phrase, although of unknown origins and often misidentified as part of the Hippocratic Oath,[1] has been central to the education of human and veterinary medical students. With the ultimate goal of releasing animals back to the wild, wildlife rehabilitators know that "doing no harm"" is the fastest way to reach this goal and is morally just. But is this a realistic goal?

All wildlife patients are stressed every minute they are in the care of the rehabilitator.

They are in an unfamiliar, enclosed, unnatural environment, hearing unnatural sounds (including our voices), smelling unnatural odors, and constantly seeing and being restrained by predators (the rehabilitators). These experiences evoke a parasympathetic, or "fight-or-flight," response in our patients. Parasympathetic stimulation causes a cascade of physiological processes that are intended to aid the patient in fight or flight, such as elimination of cloacal/rectal contents, sending blood away from the gut/kidneys/other organs and sending blood toward the heart and muscles, release of stress hormones such as cortisol and adrenaline, and the stopping of digestive processes.[2] Stress can kill but, if it doesn't, many other physiological effects are detrimental to the animal, such as impaired growth in young,[3] impaired metabolism,[4] impaired immune system,[5] and slowed wound healing.[6] Stress has dangerous consequences, but we can decrease stress for our patients and minimize the chance of negative outcomes.



Western screech owl (*Megascops kennicottii*).

## Decrease stressors at all stages of rehabilitation.

***Sight:*** Seeing predators (including us) is extremely stressful. Create visual barriers in cages and approach prey animals in a nonthreatening posture (eyes diverted, walking sideways). When faced with a panicking animal in an enclosed room, simply shut the lights off for 5-10 minutes to calm its fight-or-flight response.

***Visual enrichment:*** Our patients are used to spending 24/7 surrounded by natural objects and landscape. Enrich an animal's cage with natural items (branches, logs, leaves, dirt, etc.) to give it something productive to do and divert its attention away from stress triggers.

***Hearing:*** Typical noises in a wildlife rehabilitation center (voices, objects clanking, doors slamming, etc.) are extremely unnatural and stressful for our patients. We can prevent our patients from being

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### Refugio Oil Spill

*SANTA BARBARA, California, USA (May 26, 2015)*—On May 19th, an oil spill occurred near Refugio State Beach, California. A unified command has been established for the response effort. It includes Plains All American Pipeline (the responsible party) and local, state and federal agencies, including the US Coast Guard, the US Environmental Protection Agency, the California Department of Fish and Wildlife, the Office of Spill Prevention, and the Santa Barbara Office of Emergency Management.

The unified command includes 956 people working together in support of the response, with 16 boats working on cleanup operations. Cleanup crews have removed over 10,000 gallons of oily water mixture, and our SCAT teams continue to comb the 7.8 miles of affected shoreline. As of May 26th, cleanup crews removed 310 cubic yards of oiled vegetation, 760 cubic yards of oiled sand, and 2,610 cubic yards of oiled soil.

As of May 25th, a total of 38 birds have been found affected by oil, and 13 birds have died since the response began. Twenty-six mammals have been found affected by oil, eight of which were dead.

The worst case scenario assumes that 105,000 gallons of crude oil were released into the environment.

### Status on Bird Conservation in the EU

*BRUSSELS, Belgium (May 20, 2015)*—The European Commission has adopted a new report providing the most comprehensive picture yet on the "State of Nature in the EU" which focuses on bird and habitat health. The findings show that the majority of birds have a secure status, and some species and habitats are doing better. Targeted conservation actions have brought successes, but a much greater effort is required for the situation to improve significantly.

Commissioner for Environment, Maritime Affairs, and Fisheries, Karmenu Vella, said: "This report is significant and timely. While it shows a mixed picture overall, it clearly demonstrates that efforts to improve vulnerable ecosystems can be highly effective. It also underlines the scale of the challenges that remain. We have to rise to those challenges, as the health of our nature is linked to the health of Europe's people, and to our economy."

Looking at birds, the report concludes that more than half of all wild bird species assessed (52%) have a secure status. However, around 17% of the species are still threatened and another 15% are near threatened, declining, or depleted. This includes once common farmland species such as the skylark (*Alauda arvensis*) and the black-tailed godwit (*Limosa limosa*).

The report also presents success stories of targeted conservation action led by the EU. The bearded vulture (*Gypaetus barbatus*) and the white-headed duck (*Oxyura leucocephala*) both have EU Species Action Plans, and benefitted from the EU LIFE Fund, and their numbers have seen substantial improvements. The EU Natura 2000 network of protected areas, which is 18% of the EU's land area and is the largest network of protected areas in the world, has also had an important positive influence on the conservation status of species and habitat types.

Source: *http://www.eea.europa.eu/publications/state-of-nature-in-the-eu*

### Study Finds Dolphin Adrenal and Lung Lesions Suggest Link to Deepwater Horizon Spill

*WASHINGTON, DC, USA (May 20, 2015)*—As part of an unusual mortality event investigation, a team of scientists has discovered that dead bottlenose dolphins stranded in the northern Gulf of Mexico since the start of the Deepwater Horizon oil spill have lung and adrenal lesions consistent with petroleum product exposure according to a paper published May 20th in PLOS ONE.

"This is the latest in a series of peer-reviewed scientific studies, conducted over the five years since the spill, looking at possible reasons for the historically high number of dolphin deaths that have occurred within the footprint of the Deepwater Horizon spill," said Dr. Teri Rowles, veterinarian and one of 22 contributing authors on the paper, and head of NOAA's Marine Mammal Health and Stranding Response Program, which is charged with determining the causes of unusual mortality events, also known as UMEs. "These studies have increasingly pointed to the presence of petroleum hydrocarbons as being the most significant cause of the illnesses and deaths plaguing the Gulf's dolphin population. This study carries those findings significantly forward."

Animals with untreated adrenal insufficiency are at risk of life-threatening adrenal crises. The adrenal gland produces hormones—such as cortisol and aldosterone—that regulate metabolism, blood pressure, and other bodily functions.

"Animals with adrenal insufficiency are less able to cope with additional stressors in their everyday lives," said Dr. Stephanie Venn-Watson, the study's lead author and veterinary epidemiologist at the National Marine Mammal Foundation, "and when those stressors occur, they are more likely to die."

Barataria Bay, Louisiana, was one of the most heavily oiled coastal areas from the Deepwater Horizon oil spill, and the new study shows that half of the dead dolphins examined from Barataria Bay that stranded between June 2010 and November 2012 had a thin adrenal gland cortex, indicative of adrenal insufficiency. One in every three dolphins examined across Louisiana, Mississippi, and Alabama had this lesion. In comparison, only seven percent of the dead stranded reference dolphins, collected from other coastal regions outside the Deepwater Horizon oil spill area and time frame, had a thin adrenal cortex.

In fact, almost half of the dolphins with this otherwise rare adrenal lesion

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stressed by not talking in the wards and keeping startling noises to a minimum. Tools like white noise machines may also help drown out unnatural noise and reduce an animal's startle response.[7]

***Smell:*** Many species have an incredible sense of smell, and odors of perfumes or predators can be extremely stressful. This is why housing predators and prey species in the same room, despite visual barriers, is never ideal.

***Taste:*** Although we may need to supplement diets with unnatural foods such as dog food, having natural food items in a patient's diet is important to improve nutrition and decrease stress.



Coyote pup *(Canis latrans)*.

***Touch:*** Natural items in a patient's cage is not only good for normal visual stimulation but also for normal tactile stimulation.

### Perform a thorough physical examination (PE) on admission.

This is paramount in decreasing the overall stress a patient endures while in rehabilitation for several reasons.

Decrease stress *during* your PE by not talking, choosing a quiet room, having all your tools/equipment ready, and keeping your "hands-on" time to less than 30 seconds by having a standard PE routine. A thorough PE must be balanced with the patient's stress level, which must be constantly monitored throughout the exam. Any sign of stress (increased respiratory rate, increased heart rate, open-mouth breathing, excessive vocalization, etc.) is grounds for pausing the exam.

Catching *all* injuries on admit means you can determine a prognosis as soon as possible. If a patient comes in with an injury that would render it nonreleasable but you miss it on the admit examination, it will spend the last days of its life stressed until you find that injury. Euthanizing nonreleasable patients on admission is one of the kindest things we can do for these patients.

### Provide analgesia.

The rehabilitator also needs to keep in mind that all animals feel pain and most wildlife hide signs of pain in order to survive in the wild. Assume anything that would be painful to you would be painful to the animal and appropriate analgesics should be provided. Pain is stressful and contributes to the physiological cascade of events mentioned earlier.

Can we as wildlife rehabilitators truly do no harm when *all* of our patients are stressed and stress can cause impaired growth, slowed wound healing, immunodeficiency, and death? No, we are doing harm every day we have a wild animal in rehabilitation. Balancing stress with the probability of release is an ethical decision rehabilitators make on a daily basis. We hope that by minimizing stress we can minimize that harm and ultimately release our patient back into the wild, helping the ends to justify the means.

**Renée Schott, DVM, CWR**

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# Rehabilitation practices and post–release findings on hand-reared fawns

**Peggy Cheatham and Marnie Allbritten**



Columbian black-tailed deer (*Odocoileus hemionus columbianus*).

**ABSTRACT:** Beginning in 1996, Umpqua Wildlife Rescue (UWR) established a deer fawn rehabilitation program for both Columbian black-tailed deer (*Odocoileus hemionus columbianus*) and Columbian white-tailed deer (*Odocoileus virginianus leucurus*) in Douglas County, Oregon. Fawns were ear-tagged and observed over a period of 15 years. These fawns, when raised using a protocol that minimized contact with humans, integrated successfully into native deer herds. For the purposes of this paper, "successful integration" was determined through observation of normal behavior post-release, including foraging, fear of humans, acceptance into the herd hierarchy, mating, and raising subsequent offspring to independence without additional human interference. Ear-tagged individuals have been observed in the wild for as long as 13 years.

**KEY WORDS:** fawns, deer, wildlife rehabilitation, rehabilitation practices, release data

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## Introduction

The rehabilitation of deer fawns can be a controversial issue. Many wildlife professionals in the state of Oregon believe that deer fawns are difficult to raise wild and, when released, usually do not survive or reproduce successfully.[3] For this reason, most young deer when presented to local state offices are euthanized.[3] At the opposite end of the spectrum, many members of the public believe they have the expertise to raise deer fawns, and this also results in fawn deaths due to poor husbandry or habituation to humans.

Historically, few wildlife rehabilitators have had the resources to observe their released fawns long enough to prove fawn survival to reproductive adulthood.[1] This has led to misapprehensions regarding fawn rehabilitation and a generally negative attitude towards cervid rehabilitation among state wildlife agencies.[2]

With the permission and cooperation of Tod Lum, District Biologist with the Oregon Department of Fish and Wildlife in Roseburg, Oregon, the Principal Investigator (PI; Peggy Cheatham) was granted appropriate permits to raise, mark, and release fawns on an unfenced 40-acre rural site located in Douglas County, Oregon. This 15-year longitudinal study provided an opportunity to document behavior, reproduction, and mortality of fawns post-release.

Two species of deer occur in the Roseburg, Oregon, area: Columbian black-tailed deer (*Odocoileus hemionus columbianus*) and Columbian white-tailed deer

*J. Wildlife Rehab.* 35(2): 7–14. 

(*Odocoileus virginianus leucurus*).[3] Fawns from both species were rehabilitated and observed post-release for over 13 years during the course of this study.

Black-tails are the more abundant of the two species in the state of Oregon.[4] White-tails were listed as endangered in the 1970s and are still a "listed species" in the Columbia Gorge area that borders both Oregon and Washington.[5] The Douglas County population was de-listed in 2003.[6] The black-tailed population continues to predominate in southern Oregon[5,7] (including Douglas County), and far more black-tailed fawns than white-tailed fawns are received during a normal rehabilitation season.

## Natural History

White-tails can be distinguished in the field from black-tails by their shorter ears, white eye-rings, and extremely long, wide tail which can extend to the hock, with a dorsal surface that is often the same color as their bodies. The average adult white-tailed buck weighs 115-150 pounds, and does weigh 85-105 pounds. White-tailed bucks' antler tines originate from a single beam.[5,8] Black-tails have very large ears, no eye rings, and a short, narrow tail that is black on the dorsal surface. The average adult black-tailed buck weighs 100-135 pounds, and does weigh 80-95 pounds. Black-tailed bucks have dichotomously branched antlers.[5,9]



Columbian white-tailed deer fawn (*Odocoileus virginianus leucurus*).

Life histories of the two species are similar. In both, the preponderance of social contact between the sexes occurs during the breeding season; young bucks disperse from the family group at sexual maturity and join a bachelor herd; does live in small family groups consisting of an older doe, her female adult relatives, and their fawns. The herd will stay within a familiar home range most of their lives, unless weather, danger, or habitat destruction forces them to relocate. Even after disturbance, they will often return to their established home range.[9]

Black-tails inhabit the area between Central California and British Columbia. They thrive on the forest edge and in oak meadows, eating many non-native and native shrubs and grasses. These deer often avoid open meadows and pastures since these areas lack hiding and shelter cover.[9] White-tails survive in two distinct populations: the Lower Columbia River population, and the Douglas County population in southwestern Oregon. This species of white-tail is strongly associated with riparian areas. In the Douglas County area, white-tails can be found along the creek bottoms, in brushy, wet areas on the valley floor, and in the North Umpqua River Basin where oak savannah grasslands, annuals, forbs, and browse are abundant.[4]

## Breeding Behavior and Fawn Development

The black-tail breeding season in the Pacific Northwest begins earlier (October–November) than the white-tail breeding season (mid-November–mid-December). The average black-tail gestation period is 187 to 212 days; the average white-tail gestation period is 187 to 222 days. Black-tailed fawns in the Pacific Northwest are born from mid-May through June; white-tailed fawns are born from June through July.[8,10,11]

Wild newborn fawns spend up to 96% of their time in hiding cover. For the first week of life, the fawn will drop to the ground after nursing or when startled, lying very still if discovered. Between five and six days of age, most fawns will flee if disturbed. Fawns are virtually odorless for the first few weeks of life, and it is believed the doe avoids the fawns' bedding area except during feeding, thereby reducing the presence of her natural scent that would attract predators to her young.[12]

For the first two weeks of life, the fawn does not ruminate. Although the rumen and the reticulum are present, they are not needed for doe milk digestion. Instead, an esophageal groove (a tightly folded tissue segment across the top of the rumen and reticulum that extends from the fawn's esophagus to the omasum) takes the milk directly to the stomach. At this stage, fawns cannot digest browse or grass and are dependent on their mother's milk for nourishment. For this reason, fawns deprived of their mother in the wild cannot survive on their own until they are five weeks of age or older. Their rumens are not developed enough to allow them to efficiently digest vegetation. However, fawns older than five weeks are able to survive without maternal milk as they can eat and digest sufficient amounts of vegetation to nourish themselves.[12,13] For this reason, fawns are left where found, and a

grain and vitamin-mineral supplement is offered daily along with a source of water for a period of several weeks or more.

## Captive Fawn Management

In general, members of the public bring fawns in for rehabilitation believing they have been "abandoned." Genuinely orphaned fawns (those whose mothers' deaths are confirmed) are the next most frequently presented. Lastly, fawns are presented with injuries due to human causes (e.g., hit by car, caught in fence, etc.).

There are many challenges in fawn rehabilitation and among the most difficult is determining whether to accept a fawn for intake. The initial phone call from the finder usually gives the rehabilitator all the relevant information to determine whether the fawn should be left in the wild or brought in for care. The Umpqua Wildlife Rescue (UWR) hotline volunteer will ask a series of questions such as, Why do you think the fawn needs assistance? How big is the fawn? Have you seen a mother nearby, etc.?

At UWR, the preferred protocol with uninjured animals is to leave the fawn in place, or return it to the original location, for at least 24 hours; the exception is when a deceased lactating doe has been found nearby or a fawn is significantly injured. This protocol helps to prevent unintentional "fawn-napping" and gives does a chance to reunite with their offspring. In the PI's experience, fawns rarely do well in captivity when removed from their home range at greater than six weeks of age. At this point in their development, they have normally been integrated into a maternal family group and are familiar with their food and water sources. It is the PI's opinion that it is far less stressful to leave them in their familiar territory than to chase, capture, and confine a fawn older than six weeks of age. They do have the ability to survive and thrive at this age.

### *Captive Diet*

Maintaining balanced nutrition in captive fawns can be a challenge. Providing a substitute milk diet that has the proper types and amounts of proteins, fats, and other nutrition needed to sustain life and normal growth has taken considerable study. Since black-tailed does and white-tailed does do not have identical milk, formulating good substitutes has been a priority.

Two different types of formula have been used over the course of this study. During the first few years (1996-1998), a powdered deer milk replacer formula was purchased from the National Food Laboratory, Inc. (Dublin, California), with mixed results. A comparative analysis of the fats, proteins, and carbohydrates in the milk of black-tailed, white-tailed, and the deer milk replacer was undertaken by Rhiannon LaFaerique, UWR's principal mammal rehabilitator. Using available literature on the fat, protein, and carbohydrate composition of both black-tailed and white-tailed doe milk,[17,18] a comparison with the commercial deer milk replacer was done. Based on the results of this analysis, LaFaerique developed a new formula based on goat milk fortified with heavy cream and protein powder. (Formula labeled "Goat milk" in Table 1.) Both black-tail and white-tail fawns are fed this formula along with a probiotic at each feeding. Newborn fawns that may not have been fed by their mother are given colostrum for the first 24 hours upon intake. Fawns are given an initial dose of type C&D Anti-toxin to help combat diarrhea due to stress and diet change. Table 1 provides a comparison of milk and formula nutrients.

**TABLE 1. NUTRIENT COMPARISON OF MILK AND FORMULA USED IN DEER FAWN REARING.**

| Milk/Formula | Fat | Protein | Carbohydrate |
|---|---|---|---|
| BLACK-TAILED | 45.4 | 37.5 | 15.0 |
| WHITE-TAILED | 34.0 | 35.0 | 20.0 |
| GOAT MILK | 33.0 | 32.0 | 30.0 |
| DOE REPLACER (COMMERCIAL) | 29.0 | 29.0 | 29.0 |

**TABLE 2. AVERAGE NORMAL BODY WEIGHT FOR A COLUMBIAN BLACK-TAILED FAWN.**

| Age | Average Weight (lbs) | Age | Average Weight (lbs) |
|---|---|---|---|
| 1–3 DAYS | 5 | 8 WEEKS | 18 |
| 2 WEEKS | 8 | 12 WEEKS | 26 |
| 4 WEEKS | 10 | 16 WEEKS | 35 |
| 6 WEEKS | 14 | | |

**TABLE 3. AVERAGE NORMAL BODY WEIGHT FOR A COLUMBIAN WHITE-TAILED FAWN.**

| Age | Average Weight (lbs) | Age | Average Weight (lbs) |
|---|---|---|---|
| 1–3 DAYS | 6 | 8 WEEKS | 20 |
| 2 WEEKS | 9 | 12 WEEKS | 27 |
| 4 WEEKS | 11 | 16 WEEKS | 38 |
| 6 WEEKS | 15 | | |

### *Age, Weight, and Body Temperature*

A weight chart has been developed to assist rehabilitators determine black-tailed and white-tailed fawn age at intake based on fawns (n = 60) accepted for rehabilitation from locations in Douglas County, Oregon, over a 15-year period (Tables 2 and 3). Each fawn was weighed on admission and bi-weekly thereafter. During the initial development of this chart, several of the fawns admitted were obviously newborns, based on wet umbilical cords and soft hooves; one fawn was actually delivered by a bystander from a hit-by-car doe. As a result, it was possible to establish a "newborn" baseline. The average normal body temperature for both black-tailed and white-tailed fawns is 101–102°F.

### *Housing*

Initially, fawns are kept in isolation for a period of two weeks, if signs of illness are present. Otherwise, the fawn is kept isolated for a period of two to three days. This allows the fawn to adjust to

**TABLE 4. POST-RELEASE DATA.**

| Year Rec'd | Black-tailed Intake | Black-tailed Release | White-tailed Intake | White-tailed Release | Post-release Births |
|---|---|---|---|---|---|
| 1996 | 6 | 5 | 3 | 3 | 12 |
| 1997 | 9 | 5 | 2 | 1 | -- |
| 1998 | 3 | 3 | 1 | 1 | -- |
| 1999 | 4 | 3 | 3 | 3 | 29 |
| 2000 | 4 | 2 | 1 | 1 | -- |
| 2001 | 9 | 3 | 1 | 0 | 16 |
| 2002 | 0 | 0 | 0 | 0 | -- |
| 2003 | 0 | 0 | 1 | 1 | -- |
| 2004 | 0 | 0 | 0 | 0 | -- |
| 2005 | 4 | 1 | 1 | 0 | -- |
| 2006 | 0 | 0 | 1 | 1 | 5 |
| 2007 | 8 | 5 | 0 | 0 | 2 |
| 2008 | 4 | 3 | 0 | 0 | 1 |
| 2009 | 7 | 3 | 2 | 2 | -- |
| 2010 | 5 | 1 | 1 | 1 | -- |
| 1996–2010 | 63 | 34 | 17 | 14 | 65 |

its new environment while being observed for any signs of illness. During this period of isolation, fawns are housed indoors in a barn stall approximately 6'x8'x4'. A heat lamp is placed in one corner of the stall, and a shallow pan of water is available at all times.

Once it is determined that the fawn is healthy, it is transferred to the general holding area, and it will remain with the other fawns throughout the remaining rehabilitation period; the only exception to this protocol is in the event a fawn becomes ill or is injured while in the fawn pen. Fawns are housed in the barn at night until they are approximately one month of age, with access to clean, dry stall areas with straw bedding. A heat lamp with a protective bulb guard attached high on the wall is turned on at night and on chilly days.

Fawns have access during daylight hours to an attached, enclosed, outdoor browsing yard. The size of the pen is determined by the average number of fawns being housed at any one time, following Wildlife Rehabilitation

**TABLE 6. COLUMBIAN WHITE-TAILED FAWN REHABILITATION DATA 1996-2010.**

| Intake Date | Tag ID | Sex | Release Date | Last Sighting | Post-Release Births | Date of Known Deaths |
|---|---|---|---|---|---|---|
| 06-21-96 | Orange 10 | M | 01-03-97 | 01-03-97 | --- | --- |
| 06-23-96 | Blue 01 | M | 01-03-97 | 01-16-97 | --- | 01-1997 |
| 06-25-96 | Blue 02 | M | 01-03-97 | 01-03-97 | --- | --- |
| 06-07-97 | Orange 15 | F | 09-17-97 | 04-01-98 | --- | 04-1998 |
| 06-19-97 | --- | F | --- | --- | --- | 07-1997 |
| 07-02-98 | Purple 36 | F | 09-27-98 | 10-17-99 | --- | --- |
| 06-24-99 | White 1091 | F | 10-08-99 | 01-31-12 | 15 | --- |
| 07-07-99 | White 1093 | M | 10-08-99 | 01-05-00 | --- | --- |
| 07-07-99 | White 1094 | F | 10-08-99 | 08-01-07 | 12 | 08-2007 |
| 06-13-00 | Blue 21 | F | 09-25-00 | 01-01-01 | --- | --- |
| 06-11-01 | --- | F | --- | --- | --- | 08-2001 |
| 08-02-03 | Yellow 04 | M | 02-09-04 | 09-14-06 | --- | --- |
| 06-03-05 | --- | F | --- | --- | --- | 07-2005 |
| 07-14-06 | Gold 11 | F | 01-01-07 | 10-10-11 | 5 | --- |
| 06-22-09 | Brass 08 | M | 11-09-09 | 02-01-10 | --- | 02-2010 |
| 06-22-09 | Brass 09 | F | 11-09-09 | 02-01-10 | --- | 02-2010 |
| 06-18-10 | Red 91 | M | 8-22-10 | 02-08-12 | --- | --- |
| 06-29-10 | --- | M | --- | --- | --- | 08-2010 |

**TABLE 5. COLUMBIAN BLACK-TAILED FAWN REHABILITATION DATA 1996-2010.**

| Intake Date | Tag ID | Sex | Release Date | Last Sighting | Post-Release Births | Date of Known Deaths |
|---|---|---|---|---|---|---|
| 05-29-96 | Orange 09 | M | 10-08-96 | 09-01-99 | --- | --- |
| 06-04-96 | Orange 04 | M | 10-08-96 | 01-16-97 | --- | --- |
| 06-05-96 | Orange 06 | F | 10-08-96 | 09-01-02 | 6 | 12-2002 |
| 06-06-96 | --- | F | --- | --- | --- | 06-1996 |
| 06-15-96 | Orange 05 | F | 10-08-96 | 09-01-00 | --- | 09-2000 |
| 06-15-96 | Orange 08 | F | 10-08-96 | 01-01-02 | 5 | 01-2002 |
| 05-19-97 | --- | F | --- | --- | --- | 06-1997 |
| 05-31-97 | Orange 11 | M | 09-30-97 | 10-16-97 | --- | 11-1997 |
| 06-06-97 | --- | F | --- | --- | --- | 06-1997 |
| 06-07-97 | Orange 03 | M | 09-17-97 | 03-01-01 | --- | --- |
| 06-07-97 | Orange 07 | F | 09-17-97 | 10-07-97 | --- | --- |
| 06-16-97 | --- | F | --- | --- | --- | 09-1997 |
| 06-18-97 | Orange 13 | M | 09-17-97 | 10-17-97 | --- | --- |
| 06-20-97 | --- | M | --- | --- | --- | 07-1997 |
| 06-25-97 | Orange 12 | M | 09-17-97 | 10-09-97 | --- | --- |
| 06-10-98 | Purple 37 | F | 09-27-98 | --- | --- | 09-1998 |
| 06-11-98 | Purple 39 | M | 09-27-98 | 12-10-99 | --- | --- |
| 06-30-98 | Purple 38 | M | 09-27-98 | 12-02-00 | --- | --- |
| 06-01-99 | Blue 1095 | F | 10-08-99 | 05-16-04 | 2 | 05-2004 |
| 06-06-99 | Blue 1090 | M | 10-08-99 | 10-25-00 | --- | --- |
| 06-24-99 | --- | M | --- | --- | --- | 06-1999 |
| 06-24-99 | Blue 1092 | M | 10-08-99 | 12-01-01 | --- | --- |
| 07-06-00 | Blue 24 | F | 09-25-00 | 03-01-01 | --- | 03-2001 |
| 06-09-00 | --- | --- | --- | --- | --- | 06-2000 |
| 06-09-00 | Blue 22 | M | 09-25-00 | 03-01-01 | --- | 03-2001 |
| 06-14-00 | --- | M | --- | --- | --- | 09-2000 |
| 05-26-01 | --- | M | --- | --- | --- | 08-2001 |
| 05-27-01 | --- | M | --- | --- | --- | 08-2001 |
| 06-01-01 | Yellow 01 | M | 10-30-01 | 09-01-05 | 2 | --- |
| 06-05-01 | --- | M | --- | --- | --- | 06-2001 |
| 06-06-01 | Yellow 02 | M | 10-30-01 | 12-01-03 | --- | --- |
| 06-22-01 | --- | F | --- | --- | --- | 08-2001 |
| 06-24-01 | --- | M | --- | --- | --- | 06-2001 |

CONTINUED ON PAGE 12

Minimum Standards[13] guidelines. Ideally, the area is large enough for fawns to romp and play, with native browse growing inside for ad lib feeding. The PI currently has four outdoor yards surrounded by 6' high solid walls, ranging in size from 10'x15' (150 $ft^2$) to 20'x25' (500 $ft^2$). Outdoor pens are built with solid cedar boards to create a visual barrier, based on the recommendations of Mary C. Forness,[14] who conducted a four-year study limiting physical and visual contact with humans. Post-release, the study fawns foraged naturally and exhibited fear of humans. The visual barrier approach has proven quite useful for fawn rehabilitation

**TABLE 5,** *CONTINUED*. **COLUMBIAN BLACK-TAILED FAWN REHABILITATION DATA 1996-2010.**

| Intake Date | Tag ID | Sex | Release Date | Last Sighting | Post-Release Births | Date of Known Deaths |
|---|---|---|---|---|---|---|
| 06-24-01 | Yellow 03 | F | 01-31-02 | 12-15-11 | 14 | --- |
| 07-21-01 | --- | F | --- | --- | --- | 08-2001 |
| 05-08-05 | --- | F | --- | --- | --- | 07-2005 |
| 05-12-05 | --- | F | --- | --- | --- | 07-2005 |
| 05-30-05 | Yellow 05 | M | 09-05-05 | 10-01-06 | --- | --- |
| 06-01-05 | --- | F | --- | --- | --- | 07-2005 |
| 05-17-07 | --- | F | --- | --- | --- | 07-2007 |
| 05-18-07 | Orange 100 | F | 09-28-07 | 12-01-07 | --- | 12-2007 |
| 05-29-07 | Orange 99 | M | 09-28-07 | 09-30-08 | --- | --- |
| 06-20-07 | --- | F | --- | --- | --- | 07-2007 |
| 06-18-07 | --- | F | --- | --- | --- | 07-2007 |
| 06-09-07 | Orange 98 | F | 09-28-07 | 11-12-10 | 2 | --- |
| 07-07-07 | Orange 97 | M | 09-28-07 | 12-01-07 | --- | --- |
| 08-20-07 | Orange 96 | M | 09-28-07 | 12-20-07 | --- | 12-2007 |
| 06-01-08 | Brass 95 | F | 11-01-08 | 10-01-10 | 1 | --- |
| 06-16-08 | --- | M | --- | --- | --- | 06-2008 |
| 06-21-08 | Brass 94 | F | 11-01-08 | 11-15-08 | --- | --- |
| 06-26-08 | Brass 93 | M | 11-01-08 | 08-30-10 | --- | --- |
| 05-28-09 | --- | M | --- | --- | --- | 09-2009 |
| 05-29-09 | --- | F | --- | --- | --- | 06-2009 |
| 06-05-09 | Brass 06 | M | 11-09-09 | 11-23-09 | --- | 11-2009 |
| 06-05-09 | Brass 07 | F | 11-09-09 | 11-15-09 | --- | 11-2009 |
| 06-10-09 | --- | F | --- | --- | --- | 06-2009 |
| 07-11-09 | Brass 10 | F | 11-09-09 | 11-15-09 | --- | 11-2009 |
| 06-07-10 | --- | M | --- | --- | --- | 06-2010 |
| 06-08-10 | --- | M | --- | --- | --- | 06-2010 |
| 06-12-10 | Red 92 | F | 08-22-10 | 09-01-11 | --- | --- |
| 06-13-10 | --- | M | --- | --- | --- | 08-2010 |
| 06-29-10 | --- | M | --- | --- | --- | 08-2010 |

when contact with humans is kept to a minimum after three to four weeks of age. To further prevent visual and physical contact with humans, fawns are fed formula from a bottle rack attached to the outside of the fence. Bottles slip through a small hole in the fence, allowing the fawns to nurse without associating food with humans. The bottles will rattle up and down from the outside of the pen, which allows the feeder the ability to know whether or not all the fawns are eating. Water buckets are placed inside the fence when fawns are absent and filled using a hose threaded through a hole in the fence. A feed tray with grain and supplements slides under a raised spot at the bottom of one of the entry gates. Native browse items such as blackberry vines, wild rose, hawthorn, maple, and seasonal fruits are provided daily.

### Release Criteria

All fawns in this study were given an ear tag prior to release, using different colored tags for each fawn season (year). No tag numbers were duplicated in any single year; this method allowed easy identification of both the release year and the individual, facilitating documentation of observed integration into the local deer herd, reproduction, and mortality. The PI notes though tagged deer are more visible to the public, there have been very few of the tagged deer reported to state officials during her 15-year study.

Fawns were released in the fall when the oldest was at least four months of age. Authors' observations suggest that captive fawns reared together bond with one another and should be released together if possible to ensure higher survival rates. Most fawns are released on site (soft release). The deer pen door is simply barred open and fawns are allowed to meander out of the yard at their own pace. The door is left open for a couple of months with a grain/vitamin supplement offered along with a fresh source of water. The location of the study site allows released fawns access to hundreds of largely undeveloped rural acres with several resident herds of wild deer.

If a soft release is not possible, finding the proper release site is even more crucial–ideally, the release site should be similar to the rehabilitation habitat, with familiar food sources, climate, and elevation. Releasing fawns in a location where they will encounter deep snow is not recommended. Wild-reared, first-winter fawns in snowy conditions depend on the herd matriarch to lead them down to safe wintering grounds. Without an adult to lead them to safety and teach them winter survival strategies, fawns are often doomed to starvation in their first year.[9,15]

### Post-release Observations

Although no other studies were found that could be used to compare longitudinal survival statistics of either black-tails or white-tails, there were a number of studies that tracked survival of wild black-tailed and white-tailed fawns for the first 7-12 months of life. Since several of these studies did not include early mortality (approximately the first four weeks) in their data, and since several of the studies occurred in the Pacific Northwest, the authors felt the survival data from these studies could provide a rough comparison at best, between post-release rehabilitated fawns and wild fawns.

The Oregon Department of Fish and Wildlife Big Game Statistics Report reported a survival rate of 0.32 for wild-raised black-tailed fawns in the Melrose Hunt Unit of the Oregon Department of Fish and Wildlife, which comprises the area along I-5 beginning north of Curtin and ending at Canyonville. The east-west boundaries include the towns of Elkton, Umpqua, Melrose, Tenmile, Elkhead, and Dixonville (tracking fawns from the fall of their birth year to spring of the following year). In 2011, the Makah tribe in the Olympic Peninsula recorded a survival rate of .33 over a period of 50 weeks. Rehabilitated black-tails had an overall survival rate of .56 (52 weeks post-release). It should be noted that the property used for this 15-year post-release study is located in the Melrose Hunt Unit. White-tails in the area were studied extensively just prior to their de-listing in 2003. Ricca et al.[7] followed radio-collared, wild-reared, white-tailed fawns for six months, reporting an overall survival rate of .62, compared to a survival rate of .57 for post-release rehabilitated white-tailed fawns over a 12-month period.

### Conclusion

Although varying habitat, forage, and weather conditions obviously influence fawn survival from year to year, overall the data suggest rehabilitated black-tailed and white-tailed fawns have an equal or better survival probability than members of their wild-reared cohort. In addition, the PI has documented integration of rehabilitated deer into wild herds and subsequent reproduction. It is interesting to note that, though many fewer white-tailed fawns were admitted to the study than black-tailed fawns, the white-tailed have produced nearly as many fawns post-release as the black-tailed. Observation over many years shows that Columbian white-tailed does generally have their first fawns at 1½ years of age, while Columbian black-tailed does generally produce their first fawns at 2½ years of age. White-tailed does produce more sets of twins than the black-tailed does. Post-release, rehabilitated does of both species survived to 2–13 years of age and successfully raised over 50 wild fawns.

With proper methods, it is possible to raise orphan fawns and successfully release them back to the wild. Post-release, they can form natural bonds with wild-reared deer, produce offspring, and thrive.

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**Peggy Cheatham** has been a licensed wildlife rehabilitator with Umpqua Wildlife Rescue for over 20 years, having spent 18 years as the primary fawn rehabilitator in Douglas County, Oregon.

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# Food choice of red-shouldered hawks (*Buteo lineatus*) in a rehabilitation setting: behavioral insights from novel methods

**Jaime Coon, Monica Atkin, Lindsay Gabriel, and Wiline M. Pangle**



**ABSTRACT:** Behavioral research on food preferences in rehabilitation settings can optimize resources and increase the effectiveness of a rehabilitation organization. We tested the food preference of red-shouldered hawks (*Buteo lineatus*) at the Wildlife Recovery Association in Shepherd, Michigan, USA. We hypothesized that hawks prefer small, dark mice similar to the rodents that make up the majority of their diet in the wild, and that hawks' food choice and defensive behaviors may be affected by acclimatization to humans. Using novel methods consisting of a concrete testing platform, we presented mice and rats of different colors to the hawks and observed their feeding and defensive behaviors. Hawks preferred mice 100% of the time, but did not have an obvious color preference. Individuals that had been in captivity for larger percentages of their lives exhibited higher calling frequencies and, unexpectedly, higher defensive behavior frequencies. The ease with which we were able to determine food choice and associated behavior for wild birds with our testing platform method shows promise for future studies about food choice in a captive setting and provides further opportunities to optimize resources for rehabilitation centers. Importantly, wildlife rehabilitation organizations should feed as wide and varied a diet as possible, but our results show that rats may not be the ideal prey to offer, especially if budgets are limited.

**KEYWORDS:** raptors, rehabilitation, human acclimation, food choice

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## Introduction

Wildlife rehabilitation organizations are a critical component of effective ecosystem management. These organizations provide injured wildlife with the medical and social services necessary to return to the wild as functioning members of natural communities. Rare species may be especially vulnerable to human disturbance and may be more susceptible to problems associated with low population sizes such as genetic drift, inbreeding, and demographic stochastic events. It is therefore crucial that individuals from species of conservation concern that are harmed by poaching, pollution, or vehicle collisions be returned to their environment to support robust population sizes and overall ecosystem health.[1,2]

Many rehabilitation groups specialize on a specific species group to best serve the needs of those species. In Michigan, 10 of the 81 licensed wildlife rehabilitators (over 12%) work specifically with raptors.[3] Raptor-focused organizations play important roles for ecosystem management. First, many raptors have seen population declines during the

*J. Wildlife Rehab.* 35(2): 15-22. 

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**FIGURE 1.** Image of a three year old, non-releasable, male red-shouldered hawk (Bird 1 in this study) at the Wildlife Recovery Association in Shepherd, MI

20th century and are listed on federal or state lists as threatened or endangered.[4,5] While raptors represent only 6% percent of Michigan's birds, they make up 21% of threatened, endangered, or extirpated Michigan bird species.[6,7] Second, birds of prey often play a keystone role in their respective ecosystems. As a top predator over wide geographic ranges, they can be used as environmental sentinels for anthropomorphic disturbance.[4] By rehabilitating and returning raptors to their habitats, the rehabilitation facilities are helping the overall health of ecosystems.

Unfortunately, despite the significant role they play for conservation, nonprofit organizations such as rehabilitation organizations are frequently underfunded and understaffed.[8] Rehabilitation organizations must provide for basic needs, including cage upkeep and food, in addition to expensive medical and behavioral services. Resource availability problems are well known for nonprofit organizations, and the food resources available to rehabilitation organizations often vary considerably (Wildlife Recovery Association 2013, personal communication). Behavioral research about the preferred food choices for wildlife in rehabilitation settings can simultaneously optimize food resources and increase the effectiveness of the conservation goals of the program.

There are very few examples of raptor food choice in a captive setting,[9] and we have found to this day no study about food choice aimed at improving the effectiveness of raptor rehabilitation organizations. The presence of significant biases in indirect prey choice observations in the wild (such as inferring diet from pellets or kill site analyses) has been called into question for multiple raptor species, with the most effective way to determine wild food choice shown to be direct observations of food consumption for several raptor species (bearded vulture;[10] goshawk;[11] bald eagle, Mersmann et al.;[12] Bonelli's eagle;[13] harrier[14]). Directly observing prey acquisition in the wild can be difficult and time consuming, and observing behavior in rehabilitation settings may prove more efficient and useful. In particular, hawks at rehabilitation organizations provide a unique opportunity to observe natural behavior because "partially wild" birds are likely to behave naturally in captivity.[15] Importantly, methods used in other raptor food choice studies, including forceful gullet examination,[15] excision from deceased samples,[16] and nest observations[17] are often not appropriate for birds in rehabilitation settings and are not practical for rehabilitation organizations, so developing tools that will be useful for rehabilitation organizations is necessary.

With several hawk species available at our study location, we chose to study the food choice as well as the vocal and defensive behaviors of the red-shouldered hawk (*Buteo lineatus;* Fig. 1) due to its large geographic range, conservation status, and its important ecosystem role as a top predator.[2] This hawk can be found across eastern North America, along the coast of California, and into northern Mexico,[18,19] and while the red-shouldered hawk is not listed federally, it is facing declines in many areas of its range and is listed as threatened in Michigan, the location of this study.[20,21] Red-shouldered hawks' diet in the wild consists mostly (65%) of small rodents, but they have also been observed eating lizards, snakes, amphibians, even roadkill,[22–24] and their diets vary regionally.[25,24] The only captive feeding experiment on this species, to our knowledge, found that two captive birds ate a little more than 10% of their body weight every day.[26] However, these results were obtained with raw beef as the food source, so the results cannot be applied to natural prey items.

Red-shouldered hawks have a repertoire of vocalizations and defensive behaviors that have been shown to depend on the situation. Vocalizations include chirping and grunting noises, as well as the more common high screams.[17] High screams last about three seconds and are produced in varying circumstances; they seem to be most commonly used as a territorial call in hostile situations and often in response to human presence.[17] Defensive behaviors have mostly been measured for this species at the nest, with behaviors ranging from leaving while making noise, perching near the nest

and calling, and physically attacking the intruders, including both humans and nest predators such as crows or owls.[27] While these hawks seem sensitive to disturbance from human presence,[28] Bloom and McCrary[29] have shown that red-shouldered hawks are either tolerant or even aggressive, with calling behaviors and direct confrontation behaviors. If the birds live in more developed areas, they can become acclimated to human activity and do not necessarily avoid people.[18] Defensive behavior on non-nesting, captive birds is not available to our knowledge.

The objectives of this research were to (1) examine red-shouldered hawk food choice in a rehabilitation setting to optimize the resources of rehabilitation organizations, (2) explore the ability of our novel methods to measure behavioral responses to food choice, and (3) determine the practicality of rehabilitation organizations using our methods for themselves. We hypothesized that the red-shouldered hawks prefer small, dark mice because this is the most similar to the food they eat in natural settings. We predicted that the raptors would choose their natural prey given the choice between small dark mice, small white mice, a large dark rat, and a large white rat. We further evaluated our methods by measuring behaviors during an observation period, testing the prediction that hawks more acclimated to people would be more comfortable calling and show fewer defensive behaviors during the observation period.

## Methods

### *Study site and study species*

All experiments and observations took place at a licensed wildlife rehabilitation organization called the Wildlife Recovery Association (WRA) in Shepherd, Michigan, USA. This organization has both education and rehabilitation permits from the Michigan Department of Natural Resources and the United States Fish and Wildlife Service.

Our sample for this study comprised four red-shouldered hawks with varying levels of human exposure and years at the rehabilitation facility (Table 1). Three of the birds in the sample were non-releasable, meaning they have an injury that prevents them from being released into the wild. Non-releasable hawks are often used for public education, although only two of the birds in our sample have been on the program circuit at this date. One of the birds was releasable and had had minimal contact with people.

### *Experimental design*

In every trial, we presented each bird with a choice between four food items on a simple testing platform: (1) a large, white rat; (2) a large, dark brown rat; (3) a small, white mouse; (4) a small, dark mouse (Fig. 2). These food items were provided from the rehabilitation organization's usual sources, which consist of frozen mice and rats donated from research laboratories. Each food choice was presented at the four corners of two concrete cinder blocks placed together, making a square (41 cm by 41 cm). The staff at the WRA fed the birds with their normal food on the testing platform for a week ahead prior to the testing so the birds could become acclimated to the feeding setup. Each bird was in a separate numbered enclosure, with enclosure number corresponding to bird number (Table 1). The hawks were not fed the day before the study to ensure they would eat when presented with the food choices. We tested each bird once or twice a week for five weeks, resulting in a total of six trials for each bird. After the food choice was presented to the birds, we watched through existing hidden viewing holes to determine food choice, which we defined as the first food item the hawk chose and ate completely. We also recorded vocalizations and defensive behaviors during a ten-minute observation period after food was placed in their enclosures. We counted calls and screeches and did not record chittering or chirping. Defensive behaviors were defined as puffing and flying to a hidden location in the enclosure. Each week, the food was rotated through the cardinal directions to control for the location of the food choices on the testing platform as a potential confounding variable (Fig. 2). If the birds did not eat in the initial 10 minutes, we checked back after another 30 minutes and, if necessary, the WRA biologists checked back every hour until the hawks made their food choices.

**TABLE 1. THE RED-SHOULDERED HAWKS SAMPLED IN OUR STUDY WITH CHARACTERISTICS CONSIDERED HERE.** ALL DATA WERE PROVIDED BY THE WILDLIFE RECOVERY ASSOCIATION.

| BIRD ID | SEX | APPROX. AGE (YEARS) | TIME AT FACILITY (YEARS) | PERCENTAGE OF LIFE IN CAPTIVITY | STATUS |
|---|---|---|---|---|---|
| 1 | M | 3 | 3 | 100% | Non-releasable |
| 2 | M | 8 | 5 | 63% | Non-releasable |
| 3 | F | 13 | 10 | 77% | Non-releasable |
| 4 | F | 1 | 0.16 (2 m) | 16% | Releasable |

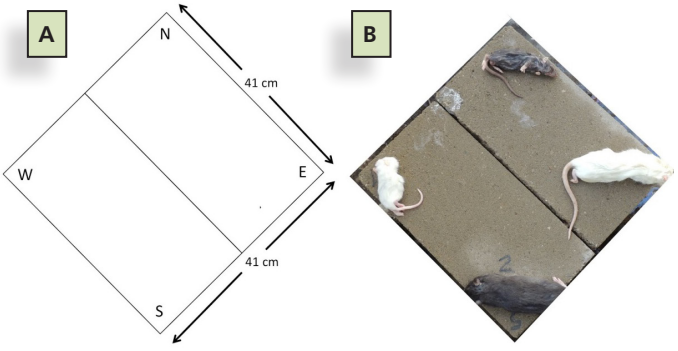


**FIGURE 2.** A schematic of the testing platform utilized in the food choice experiments of red-shouldered hawks, including the dimensions and directional labelling of the two cinder blocks (A) and an actual photo of the testing platform before the test (B). (B) is displaying a brown mouse at the north position, a white rat at the east position, a brown rat at the south position, and a white mouse at the west position. The position of the food choices were rotated for every trial.

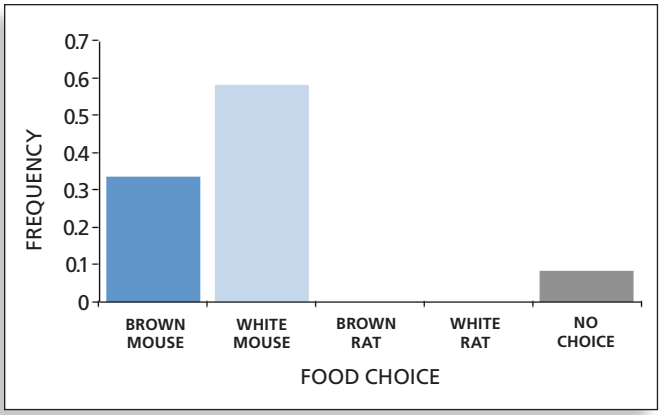


**FIGURE 3.** Food preference of four red-shouldered hawks observed at the Wildlife Recovery Association over six trials for each bird. We recorded the food choices, and then tallied the overall number for each choice and divided by the total number of choices (24 individual trials). Percentages are shown on the graph.

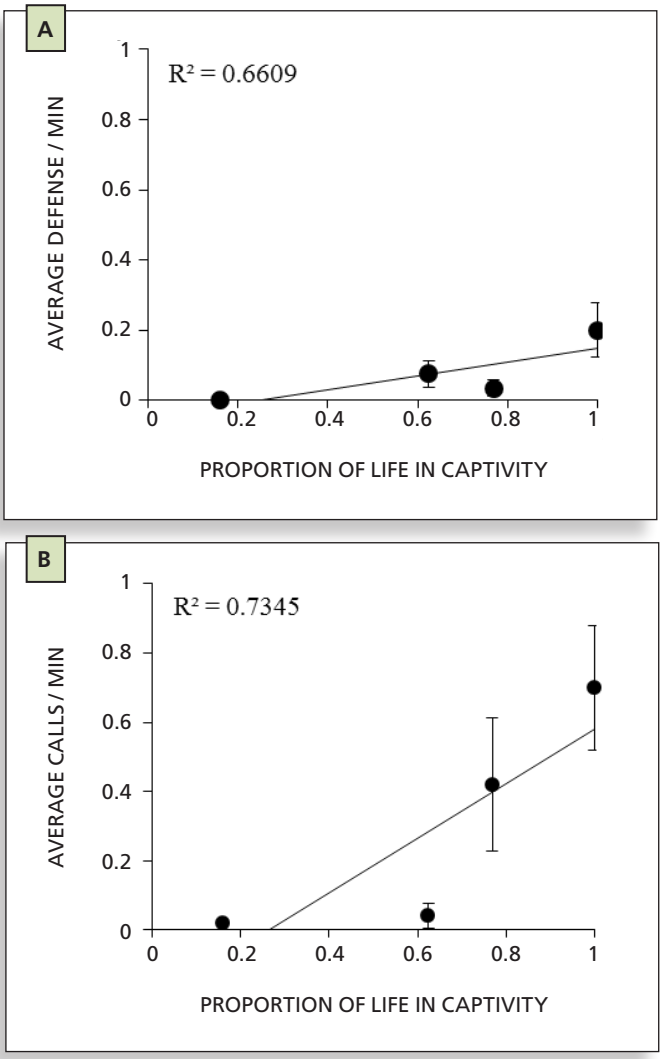


**FIGURE 4.** Red-shouldered hawk vocalization rates (A) and defensive behavior rates (B) in relationship to the proportion of life spent in captivity for each of the four birds observed at the Wildlife Recovery Association. We averaged the behavior rate taken during the ten-minute observation period for each bird over six trials. R2 and standard errors are shown on the graph.

### *Data analysis*

We analyzed our hypothesis that raptors prefer small, dark mice by comparing the percentage of time each food item was chosen over all six trials to determine if any food choice trends or patterns were present. We calculated (1) the percentage of life in captivity and (2) time in captivity (in years) for each bird based on information from the WRA biologists' records to see if food choice and human acclimation could be related. If the hawks that have been at the facility longest or have been in captivity for the highest percentage of their lives showed no preferences or fewer preferences for natural food, the prediction that human acclimatization affects food choice would be supported.

We tested the potential for our methodology to provide behavioral information through analyzing the hypothesis that red-shouldered hawks acclimated to people are more comfortable being observed. We again compared calling and defense behavior rates to (1) percentage of life in captivity and (2) time in captivity (in years). For each of these comparisons, we created a scatterplot, found a line of best fit, and ran a linear regression in Microsoft Excel to test for statistical significance ($r^2$). If the hawks that have been at the facility the longest or have been in captivity for the highest percentage of their lives indicate higher levels of vocalizations and lower levels of defensiveness, then we will have provided preliminary support for this hypothesis.

To control for error, we also compared calls per minute and defensive behaviors per minute to other variables. We used scatterplots to compare temperature, age, and visit number to calls per minute and defense per minute and ran linear regressions in Excel to test for statistical significance ($r^2$). We calculated averages and standard deviations of male calls/minute and female calls/minute. Using SAS® software,[30] we ran a mixed model for vocalizations/minute and defensive behaviors/minute using a mixed-effect model (PROC MIXED in SAS 9.4), with hawk identity as a repeated measure and hawk sex as the explanatory variable in both models. All analyses were completed with an alpha-level of 0.05.

## Results

We found that the hawks preferred mice over rats during every single trial, but the hawks' choice between white mice or brown mice was not clear (Fig. 3: white rat = 0%, brown rat = 0%, white mouse = 58%, brown mouse = 33%, no choice = 8.3%). There may be a slight preference for white mice over brown mice, but we cannot make a strong generalization due to our sample size. None of the birds chose to eat rats of either color, so all of the birds regardless of years or percentage of life in captivity preferred the mice prey species. However, while all birds chose the white mouse the most often, there was no clear pattern relating the most natural food color (brown) to either (1) percentage of life in captivity or (2) years in captivity.

Our proposed methods provided a single, clear food choice in 87.5% of the presentations. On one occasion, the wild bird (bird 4) pecked at parts of the rats after consuming both the brown and white mice first. One of the hawks did not make any food

choices within an eight-hour period on two occasions, after which the testing platform became too messy to make a food choice determination the following day (categorized as "no choice"). Otherwise, during all other trials, the hawks ate only one of the four food choices during an eight-hour time span, usually consuming the mice within three hours.

We found that the hawks that have been in captivity for a longer percentage of their lives exhibited higher defensive rates per minute (Fig. 4A, $r^2$= 0.66). The hawks that have spent the largest percentage of their lives in the facility also exhibited more vocalization behaviors per minute (Fig. 4B, $r^2$= 0.73). The number of years in captivity did not affect either vocalization rates or defensiveness rates (vocalization/min $r^2$= 0.072, defense/min $r^2$= 0.015). We cannot make generalizations due to the potential confounding effects of individual difference.

Hawk vocalization rate was not affected by temperature ($r^2$= 0.084), age ($r^2$= 0.0077), or visit number ($r^2$= 0.010). Similarly, the defensive rates were also not affected by temperature ($r^2$= 0.0043), age ($r^2$= 0.085) or visit number ($r^2$= 0.093). However, we did observe some behavioral differences between the sexes. The males had a higher average vocalization rate than females (Fig. 5, male calls/min $\bar{x}$ = 0.37±0.46, female calls/min $\bar{x}$ = 0.23±0.048) and a higher defensive behavior rate (Fig. 5, male defensiveness/min $\bar{x}$ = 0.14±0.16, female defensiveness/min $\bar{x}$ = 0.015±0.038). The repeated measures Analysis of Variance (ANOVA) showed an insignificant relationship between calls/minute and sex (p-value = 0.50), and marginal significance for the differences in defensiveness/minute between the sexes (p-value = 0.054). These sex differences show a pattern worth noting, but despite marginal significance for defensiveness/minute, it is difficult to determine biological significance with our small sample size.

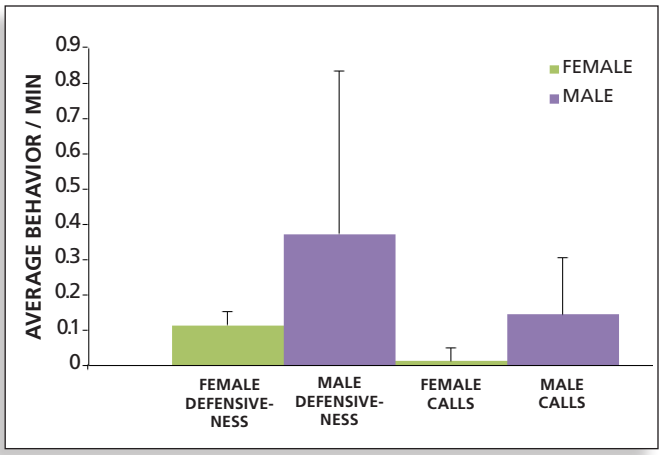


**FIGURE 5**. Comparison of the frequency of calling and defense behaviors of red-shouldered hawks between males and females observed at the Wildlife Recovery Association. We averaged the calling and defense behavior rates taken during the ten-minute observation period for the male and female birds. Standard deviations are shown on the graph. Male calls/min were slightly higher than female calls/min (male calls/min $\bar{x}$ = 0.37±0.46, female calls/min $\bar{x}$ = 0.23±0.04) and had a higher defensive behavior rate (male defensiveness/min $\bar{x}$ = 0.14±0.16, female defensiveness/min $\bar{x}$ = 0.0125±0.035). A repeated-measures ANOVA showed that there were no significant sex differences for calling (p-value = 0.50), and marginally insignificant for defensive behavior rate (0.054).

## Discussion

Our data partially support the prediction that the hawks would choose small, dark mice over the other choices. The red-shouldered hawks showed a clear size/species preference (mouse vs. rat), but an unclear color preference (brown vs. white). Importantly, not a single hawk chose to eat a rat of either color for any of the six trials, but interestingly the results were less clear between brown and white mice even though brown rodents are more common in the hawks' natural habitat.

Because of the overwhelming preference of mouse over rat, we were unable to statistically compare time spent in captivity to food choice. Surprisingly, regardless of how long the birds had been in captivity, none of them chose to eat rats of either color. This is also surprising because adult rats have higher gross energy (kcal/g) than domestic mice (6.37 vs. 5.25 respectively).[31] Three out of the four hawks we studied were non-releasable and had been at the facility for three to ten years. The one releasable red-shouldered hawk, a juvenile, had only been at the facility for two months, but exhibited mixed prey preferences between the white and brown mice. We can assume that the hawk had never seen a white mouse before coming to the rehabilitation center, but the hawk was still able to deduce that it was an acceptable food item.

Color and degree of human acclimation did not seem to have a significant effect on hawk food choices, but instead size or species (rat vs. mouse) may be what the red-shouldered hawks used to determine acceptable food items. Future studies need to determine whether the food size (large vs. small) or the food species (rat vs. mouse) is more important, as well as test other food sources, such as frogs or crickets, to further our understanding of food choices in raptors. It is also possible that our results could be explained by some sort of conditioned aversion toward rats due to previous experiences with rodenticide.[32] Additionally, although the rats we used in our study were considerably larger than the mice, we did not record the exact size and weights of the prey items offered, and there may have been some variations within species in nutritional contents, with smaller or younger prey containing higher fat content for instance; this could potentially explain why smaller mice were preferred over larger rats. Habituation may have played a role for the hawks that have lived at the rehabilitation center for a number of years, but the bird that had lived at the center for less than two months showed similar preferences.

We tested the hypothesis that the hawks acclimated to people will show a higher level of comfort when under observation, predicting that the birds with more exposure to people would exhibit higher vocalization rates and lower defensiveness rates. Hawks that had spent a larger percentage of their lives at the center did show a higher frequency of calling while being observed. However, defensive behaviors increased as the percentage of life spent in captivity increased, the opposite of what we predicted.

Qualitatively, we noticed the hawks that were more acclimated to people were more likely to exhibit *any* type of behavior, including defensive behavior and calling, flying around the enclosure, moving from perch to perch, puffing, and preening. We confirmed this suspicion with the WRA biologists, who had also observed these behavioral differences. It is possible that raptors who have been living in rehabilitation organizations for a larger percentage of their lives are more comfortable being observed and thus are more likely to move around their enclosure, where less acclimated hawks may be more likely to sit still to avoid detection while under observation. The number of years spent in captivity did not have any impact on the behaviors observed, while the percentage of life in captivity did impact calling and defensive behaviors. It is possible that the number of years does not matter as much as the percentage of the life in captivity when determining the effect of acclimation to people on hawk behavior.

To control for extraneous variables, we also compared defensive and vocalization behavior rates to age, temperature, and visit number to see if the hawks were getting more comfortable with us over time, and did not find any relationships. There was a sex difference, with males showing more defensive and vocalization behaviors than females. Sex seems to be another factor that influences the presence of vocalization and defensive behaviors, and future studies should include equal samples of males and females to control for this difference.

Due to our small sample size, we could not control for individual differences when examining vocalization and defensive rates. However, in addition to some interesting behavioral trends related to human acclimation and a clear preference for mice over rats, we showed that utilizing a testing platform for presenting food choices provided an opportunity to observe behaviors and test hypotheses that may inform rehabilitation practices. In our exploration of these novel methods, the use of our concrete testing platform design and an effective ten-minute study interval with following periodic check-ins worked very well without too much effort. Of the total 24 choices that were made, almost 90% of the time the hawks chose one food item and ate it entirely, leaving the other food choices on the testing platform for up to eight hours after the initial testing period, allowing for food choice to be easily identified.

## Conclusions

It seems that white and brown mice may be used interchangeably by wildlife professionals during the rehabilitation process while avoiding the use of rats of any color for feeding red-shouldered hawks. However, it is important to consider whether using white mice to feed wild hawks might have unforeseen consequences on the ultimate goal of releasing a well-equipped bird back into the wild. The use of white mice for feeding may negatively affect releasable birds because white mice are not typically available in the wild. The hawks may become acclimated to a non-natural food source and this may later affect their wild hunting behavior and perhaps foraging success. Importantly, wildlife rehabilitation organizations should feed as wide and varied a diet as possible, but our results shows that rats may not be the ideal prey to offer, especially if budgets are limited. Future studies should (1) expand on our findings by providing more variable food choices to the hawks and the nutrient content of these items, (2) examine the potential health effects of a limited diet on hawks, and (3) explore whether aversion to rats is potentially due to previous experiences with rodenticide.

The ease with which we were able to determine food choice in these wild birds shows promise for future studies about food choice in a captive setting for red-shouldered hawks and for other raptors. The materials (two concrete cinder blocks) were relatively inexpensive, available at most hardware stores, and easily assembled into a testing platform. Most of the hawks made their food choice within three hours (sometimes within ten minutes), and almost always left the remaining three options in their place on the testing platform for eight hours or more, making food choice determinations quite simple and clear. Raptor rehabilitation organizations could easily utilize this methodology themselves if they needed information to optimize food resources for hawks and perhaps other raptor species.

We have not found to this day any other studies that explore raptor food choice alongside human acclimation in rehabilitation settings. Scientists have an opportunity to both support facilities and discover new behavioral insights through research in rehabilitation settings. Because of the rehabilitation context of our project, we were able to access and study a rare species, up close and personal. Rehabilitation and public education birds provide a unique opportunity to test the relative acclimation of these organisms to humans, which may be able to be applied to conservation scenarios in nature as wildlife and people are increasingly coming into close contact. Additionally, the low availability of funding for these organizations means that optimizing their relative rehabilitative effectiveness and resource-use will help in the conservation of species of concern. Rehabilitation organizations provide services to the general public, wildlife species, and to scientific inquiry, and we believe that scientists should in turn support these organizations through optimization research.

## Acknowledgments

We would like to thank Barb Rogers and Joe Rogers of the Wildlife Recovery Association for allowing us to conduct our study on their premises and providing assistance in the implementation of our project, and the Central Michigan University Biology Department for providing funding for cinderblocks. The Wildlife Recovery Association has federal permits for educational use (Joseph Rogers SPPSLD-711643) and rehabilitation (Barbara Dee Rogers REHAB-48173A). We also thank two anonymous reviewers for many useful suggestions on previous versions of the manuscript. This project was originally designed and conducted for an undergraduate biology course, Animal Behavior (BIO 518) at Central Michigan University.

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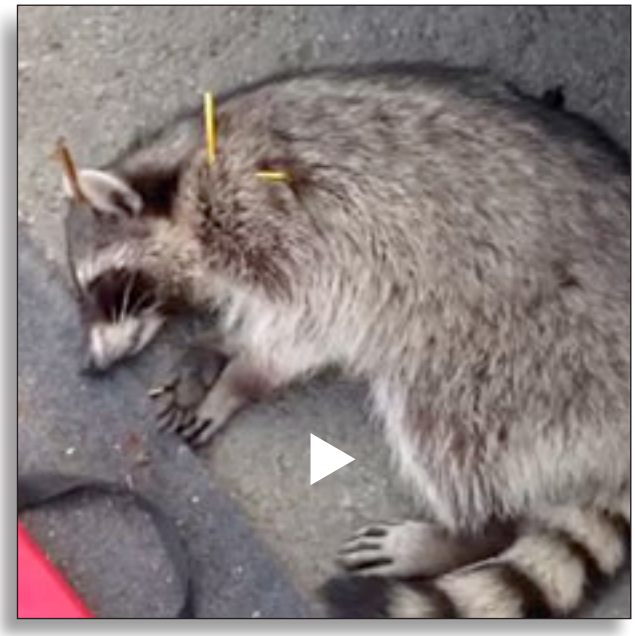
# The Link between Animal Cruelty and Interpersonal Violence

**By Deb Teachout, DVM**



Found collapsed in a West Oakland parking lot, the adult male raccoon was shot with multiple bolt darts from a crossbow. The image is from a brief video, (linked here) taken by a bystander, which appeared on local media in an effort to find the perpetrator.

In January, 2015, West Oakland, California, an adult male raccoon was found stumbling and bleeding in a church parking lot after being shot multiple times by someone using a crossbow. Five high-impact aluminum bolt darts penetrated his body; one of them piercing his skull. Several Good Samaritans discovered him, documented his injuries on video, and brought him to WildCare, an urban wildlife hospital and rescue based in Marin County. Medical staff at WildCare tried to save the raccoon, but his injuries, particularly his penetrating skull injury, were too severe for recovery and he was humanely euthanized. His body was sent to the California Department of Fish and Wildlife for a necropsy. Kelle Kacmarcik, a wildlife solutions manager at WildCare, was quoted as saying "This is one of the more traumatic and malicious injuries I've seen."[1]

Maybe because of the overt maliciousness of the act, and maybe because they had good video, many local news outlets covered this case and featured the 13-second video recorded by the Good Samaritans.

The Animal Legal Defense Fund (ALDF), a national nonprofit advocating for stronger enforcement of animal anti-cruelty laws and advancing the interests of animals through the legal system, immediately offered a $5000 reward for information leading to the arrest and conviction of the perpetrators who shot the raccoon. Why did they offer such a big reward? Because animal cruelty must be taken seriously. Violence is violence. Animal cruelty often goes unreported, including urban wildlife crime; however, all 50 states now have misdemeanor and felony animal cruelty provisions. There is a clear public trend favoring humane treatment of animals and a nationwide consensus that egregious animal abuse should be treated as a serious crime. For example, in California, where this raccoon was maliciously shot, under California Penal Code §597, anyone who "maliciously and intentionally maims, mutilates, tortures, or wounds a living animal" can face misdemeanor charges—one year in county lockup and/or a $20,000 fine—or felony charges amounting to up to three years imprisonment and/or a $20,000 fine.[1]

There's also another equally important reason for the substantial reward. It has to do with the well established link between animal cruelty and human interpersonal violence. As Stephen Wells, Executive Director of ALDF, stated, "People who harm animals often go on to harm humans as well. We call on anyone with knowledge of this cruel act to come forward for the safety of other animals and the people of this community."

It used to be that violence towards animals was viewed separately from other forms of violence, but in the last two decades the interest in relationships between animal abuse and violent behavior in humans has created a growing and compelling body of research that confirms animal abuse as a predictor and indicator for future violent acts towards humans, especially spouse, child, and elder abuse. Acts of animal cruelty committed by youths are no longer considered a benign stage of growing up but instead are regarded as indicators of conduct disorder requiring early intervention by mental health and social service professionals. A widely accepted concept termed "The Link" states that people are at risk when animals are abused and animals are at risk when people are abused. It focuses on individual acts of animal cruelty, abuse, or neglect. "The Link" concept has created a specialized field that promotes collaboration of professions such as human social services, veterinarians, law enforcement, and animal protection agencies in order to reduce family and community violence as well as animal cruelty.

The FBI takes the connection between animal cruelty and violent crime very seriously. According to FBI Special Agent Alan Brantley, Behavioral Science Unit, "A lot of what we do is threat assessment. Something we believe is prominently

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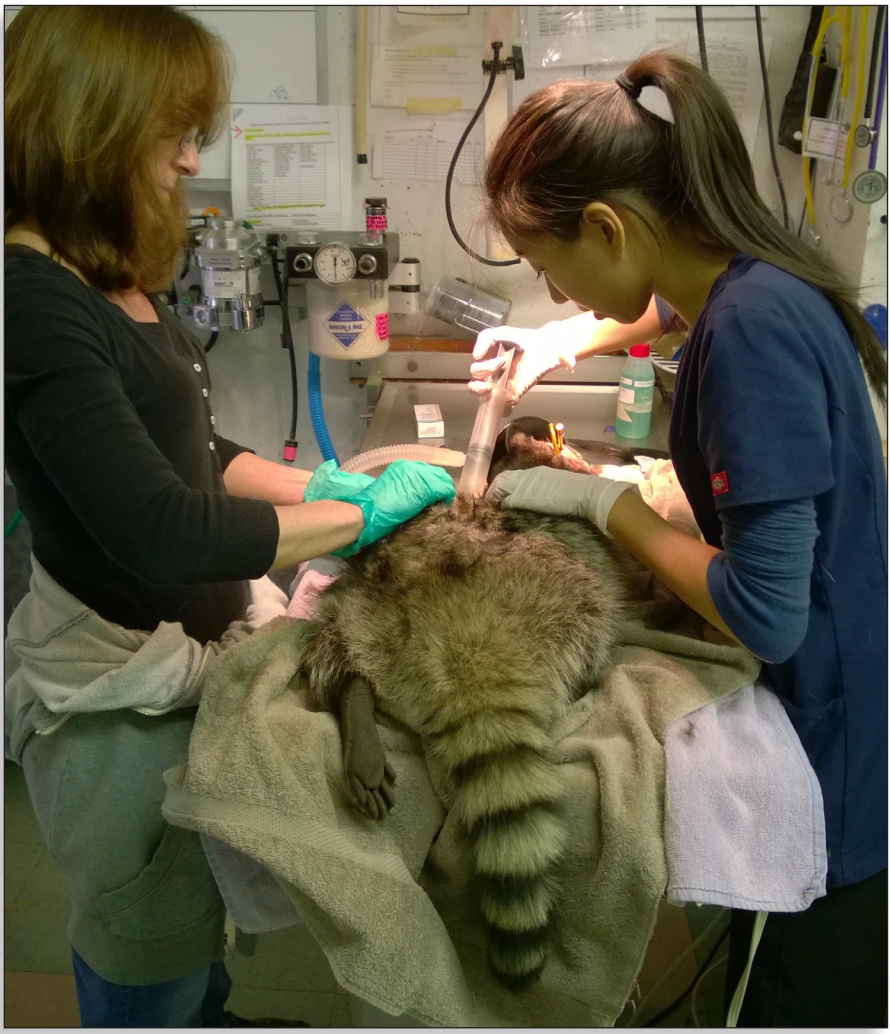

displayed in the histories of people who are habitually violent is animal abuse." When asked how many serial killers had a history of abusing animals, Special Agent Brantley's response was, "The real question should be, how many have not?"[2]

This association between animal cruelty and interpersonal violence is not new —anthropologist Margaret Mead (1901-1978) stated, "One of the most dangerous things that can happen to a child is to kill or torture an animal and get away with it."

In recognition of the importance of animal cruelty and its link to human interpersonal violence, the FBI's National Incident Reporting System has removed animal cruelty crime from the combined "other offenses" category and given it its own separate class where crimes such as simple/gross neglect, intentional abuse or torture, organized abuse such as dog or cock fighting, and animal sexual abuse will be recorded. Animal crimes will be detailed in the FBI's annual Uniform Crime Report, the most comprehensive source of crime statistics in the United States. This important step, which starts this year, will allow data and statistics on animal crimes to be tracked and likely will strengthen the enforcement of animal cruelty laws nationwide.

Laws and society are evolving in what is considered to be ethically and morally right in the treatment of animals in part because we are learning that animals have rich emotional lives, and they experience pain, distress, fear, and suffering in ways similar to ours. We realize they have inherent value and lives they want to live. Law enforcement officers in the past usually held the old attitude, "It's just an animal…" Now they think, "Who will the offender harm next?" Investigations of animal cruelty crimes often uncover family violence, drugs, other violent crimes, and weapons.

Effective response to animal cruelty requires a holistic approach, and wildlife rehabilitators certainly have a part to play. We have all seen malicious acts of violence —the slashed or punctured turtle shells, the bullets in the bodies of hawks, the pellets in the spines of squirrels, the arrow through the goose's neck. They are not only heartbreaking, they are warning signs.

There's an app to help. Both ALDF and the National Sheriff's Association in conjunction with the Humane Society of the United States have created apps to help people report animal cruelty. They are ALDF LiveSafe and ICE BlackBox respectively and can be downloaded from GooglePlay or the Apple Store.

Animal cruelty is part of the cycle of violence in families and communities. If you see it, record it and report it.

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## Rodent reservoirs of future zoonotic diseases

BA Han, JP Schmidt, SE Bowden, and JM Drake. *PNAS.* 2015; published ahead of print May 18, 2015.

The increasing frequency of zoonotic disease events underscores a need to develop forecasting tools toward a more preemptive approach to outbreak investigation. We apply machine learning to data describing the traits and zoonotic pathogen diversity of the most speciose group of mammals, the rodents, which also comprise a disproportionate number of zoonotic disease reservoirs. Our models predict reservoir status in this group with over 90% accuracy, identifying species with high probabilities of harboring undiscovered zoonotic pathogens based on trait profiles that may serve as rules of thumb to distinguish reservoirs from nonreservoir species. Key predictors of zoonotic reservoirs include biogeographical properties, such as range size, as well as intrinsic host traits associated with lifetime reproductive output. Predicted hotspots of novel rodent reservoir diversity occur in the Middle East and Central Asia and the Midwestern United States.

## Linking habitat suitability to demography in a pond-breeding amphibian

B Unglaub, S Steinfartz, A Drechsler, and BR Schmidt. *Frontiers in Zoology.* 2015;12:9.

Elucidating the relationship between habitat characteristics and population parameters is critical for effective conservation. Habitat suitability index (HSI) models are often used in wildlife management and conservation practice assuming that they predict species occurrence, abundance, and demography. However, the relationship between vital rates such as survival and reproduction and habitat suitability has rarely been evaluated. In this study, we used pond occupancy and mark-recapture data to test whether HSI predicts occupancy, reproduction, and survival probabilities. Our model species is the great crested newt *(Triturus cristatus)*, a pond-breeding amphibian protected under the European Habitats Directive.

Our results show a positive relationship between the HSI and reproduction probability, whereas pond occupancy and survival probabilities were not related to HSI. Mortality was found to be higher during breeding seasons when newts are in ponds than during terrestrial phases of adult newts.

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**Great crested newt (*Triturus cristatus*).**

Habitat suitability models are increasingly applied to wildlife management and conservation practice. We found that the HSI model predicted reproduction probability, rather than occurrence or survival. If HSI models indicate breeding populations rather than mere species occurrences, they may be used to identify habitats of higher priority for conservation. Future HSI models might be improved through modelling breeding populations vs. nonbreeding populations rather than presence/absence data. However, according to our results the most suitable habitat is not necessarily the habitat where demographic performance is best. We recommend that conservation practitioners should use HSI models cautiously because there may be no direct link between habitat suitability, demography, and consequently, population viability.

## Repeated stressors in adulthood increase the rate of biological aging

M Hau, MF Haussmann, TJ Greives, C Matlack, D Costantini, M Quetting, JS Adelman, AC Miranda, and J Partecke. *Frontiers in Zoology.* 2015;12:4.

Individuals of the same age can differ substantially in the degree to which they have accumulated tissue damage, akin to bodily wear and tear, from past experiences. This accumulated tissue damage reflects the individual's biological age and may better predict physiological and behavioral performance than the individual's chronological age. However, at present it remains unclear how to reliably assess biological age in individual wild vertebrates.

We exposed hand-raised adult Eurasian blackbirds *(Turdus merula)* to a combination of repeated immune and disturbance stressors for over one year to determine the effects of chronic stress on potential biomarkers of biological aging including telomere shortening, oxidative stress load, and glucocorticoid hormones. We also assessed general measures of individual condition including body mass and locomotor activity.

By the end of the experiment, stress-exposed birds showed greater decreases in telomere lengths. Stress-exposed birds also maintained higher circulating levels of oxidative damage compared with control birds. Other potential biomarkers such as concentrations of antioxidants and glucocorticoid hormone traits showed greater resilience and did not differ significantly between treatment groups.

The current data demonstrate that repeated exposure to experimental stressors affects the rate of biological aging in adult Eurasian blackbirds. Both telomeres and oxidative damage were affected by repeated stress exposure and thus can serve as blood-derived biomarkers of biological aging.

### Summer diet characteristics of North American river otters *(Lontra canadensis)* in central Illinois

GR Fretueg, TJ Martin, C Widga, and DR Ruez Jr. *The American Midland Naturalist.* 2015;173(2):294–304.

North American river otters *(Lontra canadensis)* frequently visit latrines where they deposit urine, feces, and anal secretions as olfactory signals. River otter scat was collected from latrines to identify prey at the Emiquon Preserve and the Emiquon National Wildlife Refuge located along the Illinois River near Havana and Lewistown in Fulton County, Illinois. Remains of prey from dissected scats were compared to osteological resources to taxonomically identify the remains. Fish were present in 85.4% of the dissected samples. Common carp *(Cyprinus carpio)* were the most common fish preyed upon during the study, occurring in 69.8% of all dissected samples. Crayfish were present in 77.1% of samples. Amphibians, insects, filamentous algae, green-winged teal *(Anas crecca)* or blue-winged teal *(A. discors)*, and muskrat *(Ondatra zibethicus)* were also consumed. The minimum number of individuals (MNI) consumed was also determined based on the prey remains present. The results of a two-tailed Fisher's exact test demonstrated there were significant differences in the percentage of prey consumed by otters at Emiquon and in previous studies conducted in Whiteside County, Illinois, and Alberta, Canada.

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North American River Otter (*Lontra canadensis*).

### Conspecific aggression by beavers *(Castor canadensis)* in the Sangamon River Basin in central Illinois: Correlates with habitat, age, sex, and season

JC Crawford, RD Bluett, and EM Schauber. *The American Midland Naturalist*. 2015;173(1):145–155.

Conspecific aggression may play an important role in partitioning resources and maintaining territories among beavers *(Castor canadensis)*, yet few studies have examined physical evidence of agonistic encounters. We trapped and examined pelts from 147 beavers harvested between 2006 and 2012 from the Sangamon River ($n$ = 96) and tributary streams ($n$ = 51) in central Illinois. We modeled the influence of sex, age class, season (predispersal or dispersal), and habitat (river or tributary stream) on the number of recent injuries caused by conspecifics. One-third (51/147) of beavers had ≥1 injury; of those, the median number of injuries was 2.0. Kits had fewer injuries than adults ($\beta_{kit}$ = –2.24 ± 0.63), but yearlings and subadults did not ($\beta_{yearling}$ = 0.02 ± 0.38, $\beta_{subadult}$ = –0.22 ± 0.48). Beavers on small streams had only one-quarter of the injuries recorded for beavers on the river ($\beta_{stream}$ = –1.34 ± 0.82). We failed to detect differences in injuries between the sexes. Our results suggest both sexes participate in territorial defense through physical confrontations and such encounters can be costly to both dispersing juveniles and resident adults.

### Diet of the recovering Ohio bobcat *(Lynx rufus)* with a consideration of two subpopulations

C Rose and S Prange. *The American Midland Naturalist.* 2015;173(2):305–317.

Bobcats *(Lynx rufus)* are a native carnivore of Ohio, but by 1850 were extirpated or nearly so following pioneer settlement of the state. The first modern record of a bobcat in Ohio was an adult male killed in 1946. Distribution accounts indicate that population re-establishment began around 2000. Today the bobcat is protected, and verified sightings, camera surveys, and genetic analyses point to two subpopulations: a fast growing, self-sustaining eastern subpopulation, and a more slowly growing southern subpopulation. We evaluated stomach contents of 120 adult and subadult bobcat carcasses to help understand the disparity in subpopulation growth rates and inform proper bobcat management. We identified prey species morphologically. We quantified prey species taken and converted their frequencies to caloric intake estimates. We calculated dry weight estimates of prey groups and compared them between bobcat age classes, sexes, regions, and across seasons. We examined regional diet differences further by calculating diet and condition indices. Eastern cottontail *(Sylvilagus floridanus)* occurred most often. White-tailed deer *(Odocoileus virginianus)* supplied the greatest caloric value. Small rodents and insectivores were the most common prey group. Adults consumed more, as defined by weight, meso-mammals and large rodents than did subadults. Diet composition did not differ between sexes. Weight of large mammal intake differed significantly between winter and summer, being greater in winter. Diet composition and prey group weights did not differ regionally. Dietary niche breadth of the southern subpopulation indicated more even consumption of prey groups than the eastern, whereas food niche overlap between

regions was high. The condition index of eastern and southern bobcats also did not differ. We present the first rigorous analysis of bobcat diet in Ohio and infer that diet is not a likely driver of disparate subpopulation growth rates of this recovering species.

### Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability

SR Loss, T Will, SS Loss, and PP Marra. *The Condor.* 2014;116(1):8–23

Building collisions, and particularly collisions with windows, are a major anthropogenic threat to birds, with rough estimates of between 100 million and 1 billion birds killed annually in the United States. However, no current US estimates are based on systematic analysis of multiple data sources. We reviewed the published literature and acquired unpublished datasets to systematically quantify bird–building collision mortality and species-specific vulnerability. Based on 23 studies, we estimate that between 365 and 988 million birds (median = 599 million) are killed annually by building collisions in the US, with roughly 56% of mortality at low-rises, 44% at residences, and <1% at high-rises. Based on >92,000 fatality records, and after controlling for population abundance and range overlap with study sites, we identified several species that are disproportionately vulnerable to collisions at all building types. In addition, several species listed as national Birds of Conservation Concern due to their declining populations were identified to be highly vulnerable to building collisions, including golden-winged warbler *(Vermivora chrysoptera)*, painted punting *(Passerina ciris)*, Canada warbler *(Cardellina canadensis)*, wood thrush *(Hylocichla mustelina)*, Kentucky Warbler *(Geothlypis formosa)*, and worm-eating warbler *(Helmitheros vermivorum)*. The identification of these five migratory species with geographic ranges limited to eastern and central North America reflects seasonal and regional biases in the currently available building-collision data. Most sampling has occurred during migration and in the eastern US. Further research across seasons and in underrepresented regions is needed to reduce this bias. Nonetheless, we provide quantitative evidence to support the conclusion that building collisions are second only to feral and free-ranging pet cats, which are estimated to kill roughly four times as many birds each year, as the largest source of direct human-caused mortality for US birds.



Blue-winged teal (*Anas discors*).

### Effects of grassland biomass harvest on nesting pheasants and ducks

JM Jungers, TW Arnold, and C Lehman. *The American Midland Naturalist.* 2015;173(1): 122–132.

Grasslands enrolled in conservation programs provide important habitat for nesting game birds and waterfowl, but conservation grasslands have been targeted as a source of biomass for bioenergy and this could impact nesting birds. We studied the effects of biomass harvest on nest success and density using 109 blue-winged teal *(Anas discors)*, mallard *(Anas platyrhynchos)*, and ring-necked pheasant *(Phasianus colchicus)* nests found in southwestern Minnesota during 2009 (pretreatment) and 2010 (posttreatment). Grassland biomass was harvested in late autumn of 2009 with production-scale machinery. Harvest treatments included controls (0% biomass removal), partial harvest (50 or 75% biomass removal), and full harvest (100% biomass removal) from 8 ha plots. Nest success averaged 31% and was not influenced by biomass harvest. Daily survival rates were greater for nests located closer to wetlands. Estimated total nest density (0.42 nests ha–1; corrected for survivorship) was similar across harvest treatments, but within-plot analysis revealed nest density was greater in unharvested refuge regions. Estimated nest density was positively correlated with vegetation height and the spatial extent of wetlands surrounding each plot. Harvesting relatively small-scale patches of conservation grasslands in late autumn does not appear to be detrimental to nesting ducks and pheasants the following spring, but managers should consider leaving unharvested refuges near wetlands when harvesting large continuous tracts.

### Coccidioidomycosis and other systemic mycoses of marine mammals stranding along the central California, USA coast: 1998-2012

SE Huckabone, FMD Gulland, SM Johnson, KM Colegrove, EM Dodd, D Pappagianis, RC Dunkin, D Casper, EL Carlson, JE Sykes, W Meyer, and MA Miller. *Journal of Wildlife Diseases.* April 2015;51(2):295–308.

A wide range of systemic mycoses have been reported from captive and wild marine

mammals from North America. Examples include regionally endemic pathogens such as *Coccidioides* and *Blastomyces* spp., and novel pathogens such as *Cryptococcus gattii,* which may have been introduced to North America by humans. Stranding and necropsy data were analyzed from three marine mammal stranding and response facilities on the central California coast to assess the prevalence, host demographics, and lesion distribution of systemic mycoses affecting locally endemic marine mammals. Between 1 January 1998 and 30 June 2012, >7,000 stranded marine mammals were necropsied at the three facilities. Necropsy and histopathology records were reviewed to identify cases of locally invasive or systemic mycoses and determine the nature and distribution of fungal lesions. Forty-one animals (0.6%) exhibited cytological, culture- or histologically-confirmed locally invasive or systemic mycoses: 36 had coccidioidomycosis, two had zygomycosis, two had cryptococcosis, and one was systemically infected with *Scedosporium apiospermum* (an *Ascomycota*). Infected animals included 18 California sea lions *(Zalophus californianus)*, 20 southern sea otters *(Enhydra lutris nereis)*, two Pacific harbor seals *(Phoca vitulina richardsi)*, one Dall's porpoise *(Phocoenoides dalli)*, and one northern elephant seal *(Mirounga angustirostris)*. Coccidioidomycosis was reported from 15 sea lions, 20 sea otters, and one harbor seal, confirming that *Coccidioides* spp. is the most common pathogen causing systemic mycosis in marine mammals stranding along the central California coast. We also report the first confirmation of *C. gattii* infection in a wild marine mammal from California and the first report of coccidioidomycosis in a wild harbor seal. Awareness of these pathogenic fungi during clinical care and postmortem examination is an important part of marine mammal population health surveillance and human health protection. Temporal–spatial overlap may be observed for pathogenic mycoses infecting coastal marine mammals and adjacent human populations.

### Apparent field safety of a raccoon poxvirus-vectored plague vaccine in free-range prairie dogs (*Cynomys* spp.), Colorado, USA.

DW Tripp, TE Rocke, SP Streich, RC Abbott, JE Osorio, and MW Miller. *Journal of Wildlife Diseases.* 2015 Apr;51(2):401–410.

Prairie dogs *(Cynomys spp.)* suffer high rates of mortality from plague. An oral sylvatic plague vaccine using the raccoon poxvirus vector (designated RCN-F1/V307) has been developed for prairie dogs. This vaccine is incorporated into palatable bait along with rhodamine B as a biomarker. We conducted trials in August and September 2012 to demonstrate uptake and apparent safety of the RCN-F1/V307 vaccine in two prairie dog species under field conditions. Free-ranging prairie dogs and other associated small rodents readily consumed vaccine-laden baits during field trials with no apparent adverse effects; most sampled prairie dogs (90%) and associated small rodents (78%) had consumed baits. Visual counts of prairie dogs and their burrows revealed no evidence of prairie dog decline after vaccine exposure. No vaccine-related morbidity, mortality, or gross or microscopic lesions were observed. Poxviruses were not isolated from any animal sampled prior to bait distribution or on sites that received placebo baits. We isolated RCN-F1/V307 from 17 prairie dogs and two deer mice *(Peromyscus maniculatus)* captured on sites where vaccine-laden baits were distributed. Based on these findings, studies examining the utility and effectiveness of oral vaccination to prevent plague-induced mortality in prairie dogs and associated species are underway.



Prairie dogs (*Cynomys spp.*)

### The prevalence and clinical significance of *Chlamydia* infection in island and mainland populations of Victorian koalas *(Phascolarctos cinereus)*

JLS Patterson, M Lynch, GA Anderson, AH Noormohammadi, A Legione, JR Gilkerson, and JM Devlin. *Journal of Wildlife Diseases*. 2015 Apr;51(2):309–317.

*Chlamydia* infection is known to impact the health of koalas *(Phascolarctos cinereus)* in New South Wales (NSW) and Queensland, but the clinical significance of *Chlamydia* infections in Victorian koalas is not well described. We examined the prevalence of *Chlamydia* infection and assessed associated health parameters in two Victorian koala populations known to be *Chlamydia* positive. The same testing regimen was applied to a third Victorian population in which *Chlamydia* had not been detected. We examined 288 koalas and collected samples from the urogenital sinus and conjunctival sacs. Detection and differentiation of

*Chlamydia* species utilized real-time PCR and high-resolution melting curve analysis. *Chlamydia pecorum* was detected in two populations (prevalences: 25% and 41%, respectively) but only from urogenital sinus swabs. *Chlamydia* was not detected in the third population. *Chlamydia pneumoniae* was not detected. *Chlamydia pecorum* infection was positively associated with wet bottom (indicating chronic urinary tract disease) in one *Chlamydia*-positive population and with abnormal urogenital ultrasound findings in the other *Chlamydia*-positive population. The prevalence of wet bottom was similar in all populations (including the *Chlamydia*-free population), suggesting there is another significant cause (or causes) of wet bottom in Victorian koalas. Ocular disease was not observed. This is the largest study of *Chlamydia* infection in Victorian koalas, and the results suggest the potential for epidemiologic differences related to *Chlamydia* infections between Victorian koalas and koalas in Queensland and NSW and also between geographically distinct Victorian populations. Further studies to investigate the genotypes of *C. pecorum* present in Victorian koalas and to identify additional causes of wet bottom in koalas are indicated.

### Modeling the environmental growth of *Pseudogymnoascus destructans* and its impact on the white-nose syndrome epidemic

HT Reynolds, T Ingersoll, and HA Barton. *Journal of Wildlife Diseases.* 2015 Apr;51(2): 318–331.

White-nose syndrome (WNS) has had a devastating effect on North American bat populations. The causal agent of WNS is the fungal pathogen, *Pseudogymnoascus destructans* (*Pd*), which has been shown to persist in caves after the eradication of host populations. As nonpathogenic *Pseudogymnoascus* spp. display saprophytic growth and are among the most commonly isolated fungi from caves, we examined whether *Pd* could grow in cave sediments and the contribution such growth could have to WNS disease progression. We inoculated a range of diverse cave sediments and demonstrated the growth of *Pd* in all sediments tested. These data indicate that environmental growth of *Pd* could lead to the accumulation of spores above the estimated infection threshold for WNS, allowing environment-to-bat infection. The obtained growth parameters were then used in a susceptible-infected-susceptible mathematic model to determine the possible contribution of environmental *Pd* growth to WNS disease progression in a colony of little brown bats *(Myotis lucifugus)*. This model suggests that the environmental growth of *Pd* would increase WNS infection rates, particularly in colonies experiencing longer hibernation periods or in hibernacula with high levels of organic detritus. The model also suggests that once introduced, environmental *Pd* growth would allow the persistence of this pathogen within infected hibernacula for decades, greatly compromising the success of bat reintroduction strategies. Together these data suggest that *Pd* is not reliant on its host for survival and is capable of environmental growth and amplification that could contribute to the rapid progression and long-term persistence of WNS in the hibernacula of threatened North American bats.

### Development of an automated dispenser for the delivery of medicinal or vaccine-laden baits to raccoons *(Procyon lotor)*

TJ Smyser, JV Redding Jr, CM Bevis, LK Page, and RK Swihart. *Journal of Wildlife Diseases.* 2015 Apr;51(2);513–518.

Medicinal baits are distributed to manage zoonotic diseases, including raccoon *(Procyon lotor)* rabies, but efficient distribution strategies are needed for suburban environments. We developed an automated dispenser that transfers fishmeal polymer baits at user-specified intervals from a magazine to a receptacle fitted with a filter that exploits raccoon dexterity to limit consumption by nontarget species. We introduce the concept of automated dispensers and describe bait removal success rates for raccoons versus nontarget species. We monitored visitation with remote cameras after deploying a dispenser, programmed to present two baits per night, in three disjunct forest patches in northwest Indiana. Raccoons removed 72% of baits; nontarget, white-footed mice *(Peromyscus leucopus)* removed 11%; Virginia opossums *(Didelphis virginiana)* removed 9%. Bait removal success varied significantly between raccoons (76%) and opossums (21%), improving bait delivery specificity relative to hand baiting. Accumulation of baits in receptacles resulted in excess (more than one) bait consumption (39% of baits consumed by raccoons were excess), suggesting design improvements are needed to present additional baits only after previous baits have been consumed. Automated dispensers successfully sustained bait availability throughout the operational period. Subsequent research is needed to determine whether a sustained availability of baits achieved with automated dispensers is more effective for the treatment of raccoons in suburban environments than traditional distribution methods.

### Chemical immobilization of free-ranging fallow deer *(Dama dama)*: Effect of needle length on induction time

UA Bergvall, P Kjellander, P Ahlqvist, Ö Johansson, K Sköld, and JM Arnemo. *Journal of Wildlife Diseases.* 2015 Apr;51(2):484–487

We evaluated impact of the needle length, sex, and body condition on chemical immobilization induction time in 50 (29 males and 21 females) free-ranging fallow deer *(Dama dama)* in Sweden, 2006–11. Induction time is probably the single most important factor when immobilizing free-ranging wildlife with the use of a remote drug-delivery system. Induction times should be short to minimize stress and risk of injury, and to ensure that immobilized animals can be found and clinically monitored as soon as possible. We measured the distance between the darting location and where we recovered the immobilized animal and also the time occurring between the two events. We used two types of needles: 2.0×30mm or 2.0×40mm barbed needles with side ports. The most important result is that a 10mm-longer dart needle can reduce the retrieval time substantially (>20 min) until an animal is under monitoring. On average after

the darting, the retrieval time decreased from 51 to 29 min and the distance decreased from 519 m from the darting location to 294 m. We suggest that a needle length of 40 mm is preferable for immobilization of wild fallow deer, especially for animals in over-average–to–fat body condition.

### Arthritis in an egret *(Egretta intermedia)* caused by *Salmonella typhimurium* and its potential risk to poultry health

MS Kang, OM Jeong, HR Kim, Il Jang, HS Lee, and YK Kwon. *Journal of Wildlife Diseases.* 2015 Apr;51(2):534–537.

A dead intermediate egret *(Egretta intermedia)* was found on the shore of a stream in South Korea in January 2013. *Salmonella typhimurium* was isolated from purulent exudates in the foot joints, demonstrating bacterial arthritis. The isolate was similar to a poultry isolate determined by pulsed-field gel electrophoresis.



Intermediate egret (*Egretta intermedia*).

### Assessing the release success of rehabilitated vervet monkeys in South Africa

AJ Guy, D Curnoe, and OML Stone. *African Journal of Wildlife Research.* 2015;45(1):63–75.

Eight post-rehabilitation vervet monkey troop releases were assessed with regard to their outcomes, environmental aspects of release sites, and consistency with IUCN guidelines for nonhuman primate reintroductions. Based on our criteria, none could be considered successful as survival rates were too low. Troops with the best outcomes were close to the mean wild troop size. Despite release sites falling into two major groups in terms of climate, land cover, and anthropogenic landscape alteration, we found no clear association between site characteristics and projected long-term survival. A number of IUCN guidelines were not followed. Recommended improvements include implementation of quarantine, disease screening and environmental enrichment, better assessment of release sites, and fitting all individuals with tracking devices to monitor for >1 year.

### Aleutian mink disease virus in striped skunks *(Mephitis mephitis)*: Evidence for cross-species spillover

LA Nituch, J Bowman, PJ Wilson, and AI Schulte-Hostedde. *Journal of Wildlife Diseases.* 2015 Apr;1(2):389–400.

Aleutian mink disease virus (AMDV) causes a parvovirus infection, initially characterized in American mink (*Neovison vison*), that may have harmful effects on wild populations of susceptible animals. In North America, where American mink are native, the origin, host range, and prevalence of AMDV in wild species is not clear. We studied striped skunks *(Mephitis mephitis)* and raccoons *(Procyon lotor)* to determine whether species sympatric with mink are potential reservoirs in the transmission of AMDV to wild mink and mink farms. Antibodies to AMDV were detected in 41% of skunk serum samples (143/347) and AMDV nucleic acids were detected in 32% (14/40) of skunk spleen samples by PCR, indicating that AMDV exposure and infection were frequent in skunks. We detected no AMDV antibodies in 144 raccoon blood samples. Phylogenetic analysis revealed a newly identified AMDV haplogroup consisting of isolates from Ontario skunks and a free-ranging domestic mink from Ontario. Our findings of frequent AMDV infection in skunks, close genetic similarity between skunk and mink AMDV isolates, and evidence of AMDV transmission from skunks to mink support the hypothesis that skunks may be acting as alternative hosts and reservoirs of AMDV to wild mink through cross-species virus spillover.

### Efficacy of different cooling methods for capture-induced hyperthermia in antelope

J Sawicka, A Fuller, LG Fick, RS Hetem, and LCR Meyer. *African Journal of Wildlife Research.* 2015;45(1):100–110.

The capture of wild animals is a stressful event which may cause a capture-induced hyperthermia, resulting in morbidity or mortality. We investigated whether various cooling techniques were effective at lowering the body temperature of hyperthermic animals. To achieve this, we implanted miniature temperature-sensitive data loggers into the abdomens of 12 blesbok *(Damaliscus pygargus phillipsi)*. Five animals were cooled by dousing with water of different temperatures (4°C, 17°C, 28°C) and fanning after dousing with 28°C water. Seven animals were cooled by ice packs, a fine mist spray of 28°C water, intravenous (IV) infusion of one liter of 4°C saline solution or 28°C water-dousing. The body temperature after capture was significantly elevated to as high as 41°C to 42°C. Water-dousing interventions significantly decreased minimum body temperature, but there was no difference in the minimum body temperature reached or the magnitude of cooling between the different water temperatures or by the addition of fanning. The ice packs also lowered body temperature, whereas mist spraying did not. The use of ice packs and dousing with water between 4°C and 28°C were the most effective techniques to reduce capture-induced hyperthermia in blesbok. Water-dousing, when done appropriately, is the most practical and effective method to cool an animal with capture-induced hyperthermia. ■

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appeared to have died without another clear explanation for their death.

In addition to the adrenal lesions, the scientific team discovered that more than one in five dolphins that died within the Deepwater Horizon oil spill footprint had a primary bacterial pneumonia. Many of these cases were unusual in severity, and caused or contributed to death.

Ongoing studies assessing changes in these lung and adrenal gland lesions over time will help to address questions regarding how long these chronic conditions may last.

### Attack on Marine Mammal Rehab Center Prompts Animal Protection Law

*SACRAMENTO, California, USA (May 20, 2015)*—Speaking to the American Society for the Prevention of Cruelty to Animals (ASPCA) Paws Celebration, Assembly members William P. Brough (R-Dana Point), David Hadley (R-Manhattan Beach), Matthew Harper (R-Huntington Beach), and Patrick O'Donnell (D-Long Beach), introduced Assembly Bill (AB) 1543 to increase penalties for animal cruelty and offset the costs of rehabilitation and recovery for abused and injured animals.

"As coastal representatives, we must ensure that rescued animals being treated for severe injuries are protected, and enact severe penalties for those who attempt to further hurt them," said Brough. "We can't prevent what has already happened, but we can say that enough is enough."

An attack last month at the Pacific Marine Mammal Center in Laguna Beach left 15 sea lions with severe chlorine burns. The animals were already being treated for severe injuries suffered after washing ashore nearby. This shocking incident is just one of many disturbing acts of animal cruelty that have occurred throughout California.

In order to deter future incidents, AB 1543 also requires appropriate counseling for those who commit these crimes.

"Malicious attacks against animals have no place in our society and I am pleased to co-author Assemblyman Brough's legislation to combat this growing problem in California," said Senator Patricia Bates (R-Laguna Niguel). "By increasing fines on perpetrators and providing them with the counseling they need, we can save more animals in the long run."

### International Hainan Gibbon Rescue Plan

*LONDON, England (May 18, 2015)*—An international team of more than 100 scientists, policy makers, and community representatives, led by international conservation charity the Zoological Society of London (ZSL), has published a report outlining the vital steps needed to save the Hainan gibbon (*Nomascus hainanus*) from extinction. With only 25 individuals remaining in less than 20 square kilometers of forest in China's Hainan Island, the Critically Endangered Hainan gibbon is one of the rarest animals in the world.

The last surviving Hainan gibbon population contains only three social groups, in which male and female gibbons still sing duets with each other at dawn. This species faces a high risk of extinction due to its isolation and tiny population size – it could potentially become the first ape species to be wiped out by human activity. Experts hope the comprehensive report will galvanize and encourage authorities and communities to take immediate and effective action.

Dr Samuel Turvey, Senior Research Fellow at ZSL, who co-chaired the major international conservation planning meeting in Hainan that produced the report, said, "Ensuring a future for the Hainan gibbon is one of the most important global priorities in mammal conservation. If the right steps are carried out now, it's not too late to save this incredible species. I hope that the Hainan gibbon will be used in the future as an example of a conservation success story."

The report identified over 40 key actions needed to boost gibbon numbers and ensure their long-term survival, including enhancing monitoring systems to keep track of remaining individuals, creating canopy bridges between forest fragments to expand their habitat range, and limiting disturbance by people in forested areas.

Professor Long Yongcheng, head of the IUCN's China Primate Specialist Group, said, "The Hainan gibbon is an indicator of good forest health and ecological stability, and so protecting the species also helps to conserve Hainan's environment and its international green image."

There were more than 2,000 Hainan gibbons in the 1950s. During the late 20th century, their numbers were devastated by hunting and the loss of their forest habitat for logging and rubber plantations. Only about 30 gibbons remained in the 1980s. While both the gibbons and their habitat are now protected under Chinese law, they are still potentially threatened by human disturbance, and by a lack of connected forest habitat to allow expansion of their population. A typhoon or disease outbreak also has the potential to wipe out the entire tiny population.

### Wildlife Rehabilitator Included in USFWS Endangered Species Champions



Anthony F. Amos of the Animal Rehabilitation Keep, UTMSI-Port Aransas

*WASHINGTON, DC, USA (May 15, 2015)*—The US Fish and Wildlife Service announced the 2014 Recovery Champions, 69 groups and individuals making a significant contribution to conserve and protect endangered plants and animals. Among the award winners honored was Anthony Amos of the Animal Rehabilitation Keep in Port Aransas, Texas.

"If we want to sustain the diversity and abundance of our nation's fish, wildlife, and plants for future generations, we have to find places for them to coexist with humans on the landscape. That's why wildlife conservation is as much about working with people as it is about protecting animals and habitat," said US Fish and Wildlife Service Director Dan Ashe. "The leaders we honor as Recovery Champions understand that crucial truth, and continue to build and strengthen partnerships with community leaders and institutions to make a real difference for imperiled wildlife."

Over the course of more than 30 years, Anthony Amos has served as a major contributor to our knowledge of shorebirds, sea turtles, and manatees along the central Texas coast. Mr. Amos compiled an incredible long-term data set of bird and sea turtle observations that has proven invaluable to the recovery efforts of many species. He has worked tirelessly to rescue and rehabilitate sea turtles and birds, including piping plovers, red knots, brown pelicans, and bald eagles. He is an outstanding spokesman for wildlife conservation in the Texas Coastal Bend region, and his dedication to wildlife rescue has been an effective outreach and education resource for listed sea turtles and birds.

*Source: http://www.fws.gov/endangered/what-we-do/recovery-champions/#*

## White-nose Syndrome Treatment Trialed

*HANNIBAL, Missouri, USA (May 20, 2015)*—Scientists and conservationists gathered Tuesday evening outside the historic Mark Twain Cave Complex in Hannibal, Missouri, to release back into the wild some of the first bats successfully treated for deadly white-nose syndrome (WNS).

The 150 bats released Tuesday were part of the first field trials of a novel way to protect bats from WNS, which is caused by a cold-loving fungus, *Pseudogymnoascus destructans (Pd). Pd* was introduced into the United States about ten years ago and has killed more than 5.7 million American bats in the eastern half of the US and Canada.

*Pd* invades the nose, mouth, and wings

PHOTO © DB RAUDABAUGH. CC BY-SA 3.0 LICENSE.

Colony of *Pseudogymnoascus destructans (Pd)* on SDA medium.

of bats during hibernation, when bats' immune systems are largely shut down. Research indicates that the fungus may lead to dehydration, causing them to wake more frequently and burn precious fat reserves. This leads to starvation. Science has yet to develop an effective, ecologically appropriate means of combatting the fungus, which may kill up to 100 percent of bats in an infected cave, but the recent field trials are the most promising yet.

In 2012, Dr. Christopher Cornelison and several colleagues at Georgia State University found that a common North American bacterium, *Rhodococcus rhodochrous*, had the ability to inhibit the growth of some fungi. They found in the lab that *R. rhodochrous,* without directly touching the *Pd*, could nonetheless strongly inhibit its growth.

Dr. Cornelison, US Forest Service wildlife biologist Dr. Sybill Amelon and research plant pathologist Dr. Daniel Lindner have been conducting laboratory research on the application of this bacterium since 2012, and this past winter conducted field trials in Missouri and Kentucky caves. Funding for this research was provided in part by Bat Conservation International (BCI), the US Forest Service, and the Tennessee Chapter of The Nature Conservancy (TNC).

The bats released Tuesday survived exposure to WNS in last winter's trials. Participants at the bat release have expressed cautious optimism. "While more research is needed before we know if our current discovery in an effective and environmentally safe treatment for White-nose Syndrome, we are very encouraged," said the US Forest Service's Michael T. Rains, who directs the Service's Northern Research Station and the Forest Products Laboratory. "We are extremely grateful for the support of Bat Conservation International and The Nature Conservancy, and honored to be collaborating with Georgia State University on research that has potential to reduce mortality of bats in the face of this devastating disease."

"Through our partnership with BCI, The Nature Conservancy believes biocontrols can hold the key to a cure for WNS. We want to do more to accelerate this type of work," said Gina Hancock, state director, The Nature Conservancy in Tennessee.

## Oldest Bald Eagle on Record Was a Relocated Bird

*NEW YORK, USA (June 12, 2015)*—New York State Department of Environmental Conservation (DEC) staff responded to a report of a dead eagle alongside a road in Henrietta, Monroe County, on June 2, 2015. The USGS Banding Lab Longevity Records indicate that it was the oldest banded bald eagle encountered in the US to date, at 38 years of age.

According to records, the bird was a male nestling brought from Lake Puposky in northern Minnesota as part of New York's Bald Eagle Restoration Program, one of five birds raised and released at the Montezuma National Wildlife Refuge in year two of the program. He was banded at a few months of age in August of 1977. In 1981, at breeding age, he began nesting at Hemlock Lake, now part of Hemlock-Canadice State Forest. Known as 03142, the eagle successfully fathered many eaglets fledged from that site for many more years.

Peter Nye, retired DEC Wildlife Biologist and spearhead of the restoration program reflected on its history, "When we banded 03142 on August 5, 1977, we had no idea how very special and significant this young bald eagle would become to our nascent bald eagle restoration program. Based on his recent recovery near this site,

we have to assume he has been the resident male, breeding here for the past 34 years. That's quite a stretch, and likely a record in itself. His longevity, 38 years, although ingloriously cut short by a motor vehicle, is also a national record for known life-span of a wild bald eagle. All I can say is, hats off to you, 03142; job well done!"

Following a US ban on the chemical pesticide DDT in 1972 and prohibitions against taking or killing bald eagles in the federal Endangered Species Act of 1973, New York State initiated the Bald Eagle Restoration Project in 1976 to reestablish a breeding population.

One unproductive nest remained on Hemlock Lake in Livingston County. Attempting to reestablish a breeding population in New York State, DEC released 23 fledgling bald eagles at Montezuma National Wildlife Refuge from 1976–1980. In 1980, the resident male of the state's last native pair at Hemlock Lake was shot to death near the nest.

Over 13 years, 198 nestling bald eagles were collected from nests in other states, raised with minimal human contact (known as "hacking"), and released in New York. The eagles flourished, and many returned to New York to nest. The program concluded in 1988, having surpassed its original goal of 10 nesting pairs of bald eagles in New York. Today, the state supports 350 pairs of nesting bald eagles.

The record eagle, found with a freshly killed rabbit nearby, had succumbed to one of the leading causes of eagle deaths in New York State: a vehicle collision. These account for more than 30 percent of recorded mortality.

## Migratory Species a Target of Wildlife Crime

*BONN, Germany (March 3, 2105)*—Migratory wildlife species are increasingly becoming targets of crime. Fully protected species are illegally killed, hunted, and traded by organized criminals, threatening the survival of many migratory birds and animals such as elephants, big cats, antelopes, cetaceans, fish, and marine turtles.

Wildlife crime ranks alongside drug smuggling, human trafficking, and the illegal arms trade as one of the largest international criminal activities.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is calling for urgent action. "It is time to step up action to put an end to these acts committed contrary to both national and international laws," said Bradnee Chambers, CMS Executive Secretary.

About 100 elephants are killed every day for ivory and meat. Those killed in Africa annually number from 20,000–25,000 out of an estimated population of 600,000. The hunting of elephants, rhinos, and tigers is mainly driven by wealthy consumers worldwide. More than 40 percent of snow leopards in Central Asia have likely been lost due to trophy hunting since 1990. Poaching of Saiga antelopes skyrocketed after the Soviet Union's dissolution in the 1990s, their numbers falling to only 50,000 from previous levels of around 1 million animals.

Wildlife crime targets not only iconic African and Asian animals, but also migratory birds in the heart of Europe—birds exposed to greater risk because they gather in large numbers, at specific locations, at predictable times, making them easy targets for human exploitation.

### *Solutions*

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) works with governments to ensure the animals' safe passage across international borders. At the 11th Meeting of the Conference of the Parties to CMS in November, 2014, a resolution on the prevention of illegal killing, taking and trade of migratory birds was adopted.

An new international task force will ally with governments to focus attention on illegal activities, and advise on how to ensure adequate legislation is in place and enforced in compliance with existing international commitments on bird protection.

At the conference, countries also agreed on another resolution for greater cooperation among countries and agencies.

In addition to raising awareness, the solutions need to involve all interested parties to preserve migratory wildlife as a unique part of biodiversity. ■

# TAIL END

**I tell you, it was *worth* overwintering with the Bolshoi. You should see my plié!**

Canada goose (*Branta canadensis*).
PHOTO © ALAN HOWELL. USED WITH PERMISSION.

## INSTRUCTIONS FOR AUTHORS

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

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

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

**Kieran Lindsey, Editor**
**jwr.editor@theiwrc.org**

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

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

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

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

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

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**Wild, banded bald eagle #629-03142 ends reign as oldest on June 2, 2015.** Hatched in Minnesota, and raised and released at Montezuma National Wildlife Refuge in New York, he fathered many offspring and was significant in the restoration of his species. He was 38 years old at the time of his death in Henrietta, New York, near his long-time nesting grounds at Hemlock Lake.

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