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ARTICLE

Reasons why animals are admitted to wildlife rehabilitation centers in Canada

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Abstract

A retrospective analysis was performed using more than 21 000 patient records from three large centers across Canada in order to determine the reasons for the presentation and outcome of wildlife brought into wildlife rehabilitation centers in Canada. Results suggest that up to 97% of wild animals brought into wildlife rehabilitation centers are thought to be directly or indirectly linked to anthropogenic causes. Trauma was the leading reason recorded for 61% of all cases admitted to wildlife rehabilitation centers. Orphaned wildlife was also a key reason why animals were admitted to wildlife rehabilitation centers in Canada. This research will help wildlife rehabilitators and agencies be aware of the reasons for animal admission to rehabilitation centers and provide opportunities to develop mitigation strategies to potentially minimize human impact on indigenous wildlife.

Keywords

Wildlife rehabilitation; wildlife; rehabilitation; injured wildlife; anthropogenic

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BIO

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Introduction

Wildlife rehabilitation is the treatment and temporary care of injured, diseased, and displaced indigenous animals and the subsequent release of healthy animals into appropriate habitats in the wild (Miller 2012). The goal is not to rehabilitate every animal at any expense; rather, wildlife rehabilitation practices seek to return healthy animals to their appropriate habitat. This functionality includes being able to recognize and obtain the appropriate foods, select mates of their own species and reproduce, and display appropriate behavior, including fear of potential dangers (e.g., people, cars, cats, dogs, etc.) (Ministry of Natural Resources and Forestry 2020).

It is well known that wildlife are killed and injured due to anthropogenic activity. Vehicle collisions are thought to be the cause of an estimated 80 million avian fatalities every year and 976 million deaths per year due to collisions with windows (Erickson et al. 2005). In Canada, approximately 25 million birds are killed by collisions with windows every year (Machtans et al. 2013), and it is estimated that 13.8 million birds are killed by vehicles every year (Bishop & Brogan 2013). An estimated 2.5 to 25.6 million birds are killed every year by collisions with transmission lines in Canada (Rioux et al. 2013). In another study, more than 30% of snapping turtles (*Chelydra serpentina*) observed on roads were killed by vehicles (Haxton 2000). Poaching and road mortalities could result in the population decline of snapping turtles and other chelonian species given the later age at which they can reproduce.

Other examples of anthropogenic problems include illegal hunting activities, rodenticide ingestion by raptors, lead toxicity from fishing or spent lead shot, wind turbines (affecting habitat destruction as well as direct mortality), and construction activities that displace animals (Miller 2012; Zimmerling et al. 2013).

The objective of this paper is to look at the role of wildlife rehabilitators in Canada and identify the direct and indirect human impacts on wildlife or the anthropogenic reasons why animals may be brought into a wildlife rehabilitation facility.

Wildlife rehabilitation in Canada is regulated on a provincial basis by various agencies, with many migratory birds regulated by the Canadian Wildlife Service. In other words, wildlife rehabilitators must be authorized to rehabilitate wild animals in their respective provinces and that authorization often dictates that species may be rehabilitated.

The field of wildfire rehabilitation has experienced rapid growth over the past 30 years. In the early 1980s, the International Wildlife Rehabilitation Council and the National Wildlife Rehabilitators Association Boards of

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Directors established minimum standards for both individual rehabilitators and rehabilitation centers (Miller 2012). These standards have been widely adopted by many state and provincial wildlife agencies that regulate this field.

Wildlife rehabilitation centers take many forms: They may be large, multistaffed, or volunteer-based nonprofit organizations or individual wildlife rehabilitators caring for these animals in a small, self-funded operation. For the most part, wildlife rehabilitators in Canada receive no government funding to support ongoing operations. That is, wildlife rehabilitators must raise funds to support the nutritional, housing, medical, and surgical requirements of the animals in their care.

Wildlife rehabilitation primarily deals with individual wild animals. However, wildlife rehabilitation efforts can positively impact populations of animals in times of mass disaster, such as oil spill response activities (Barham et al. 2006), botulism outbreaks, or forest fire response as well as wildlife rehabilitation efforts in working with endangered species.

Wildlife rehabilitators can be considered on the "front line" of wildlife disease surveillance. In many cases, they act as the first point of contact for the public in answering questions regarding what to do if someone finds a sick, injured, or orphaned wild animal. With many diseases having a wild animal origin, wildlife rehabilitators find themselves submitting samples to veterinary laboratories and working with scientists to help disseminate knowledge regarding new and emerging diseases. Wildlife rehabilitators have played an important role in tracking the spread of disease or reporting new diseases. A skunk adenovirus was discovered in porcupines in Nova Scotia as a result of the rehabilitator and medical team working with researchers to identify an illness not encountered before (Bourque et al. 2019). One of the first outbreaks of the West Nile virus in waterfowl in Canada was reported at a wildlife rehabilitation center in Ontario (Cox et al. 2015). This is an area of further development and collaborative opportunity as we work through the One Health concept connecting the health of humans, animals, and the environment.

Furthermore, wildlife rehabilitators have been working together with the public and provincial agencies to help solve human-wildlife conflicts, such as providing resources to address injured animals, as well as providing educational information on how to cohabitate with urban wildlife. Wildlife rehabilitators have unique knowledge and expertise in many areas, such as capturing and stabilizing wildlife in the event of an oil spill response (Berg 2003).

Wildlife rehabilitators play an important role as the interface among sick, injured, or orphaned animals and a member of the general public. More often than not, a member of the public will take an orphaned animal into their own hands to rear if they cannot find a wildlife rehabilitator to admit that animal. While members of the public have positive intentions, the outcomes can sometimes be catastrophic for wild animals. Problems such as nutritional metabolic bone disease that permanently alter bone growth (Fig. 1) or habituation can be a death sentence for that animal in terms of its ability to be released and survive in the wild. But the wildlife rehabilitator is often the help that the person is desperately seeking if they have found a sick, injured, or orphaned animal. Members of the public routinely call into the wildlife hotline of a center—many in tears—searching for someone to help the sick, injured, or orphaned wild animal.

While many orphaned animals are brought into wildlife rehabilitation centers, not all are without parents. Sometimes members of the public will bring in wild animals thinking that they are orphaned; however, they are not. This is particularly true in the case of young rabbits and fawns whereby the mother will leave the immature animal unattended for prolonged periods. Wildlife rehabilitators play an important role in helping to educate the public to best assess whether or not the animal is orphaned and should be brought to a wildlife rehabilitator.

In Canada, aggregate information regarding reasons why wild animals are admitted to rehabilitation centers is undocumented. To help answer this question, data from approximately 20 000 wildlife rehabilitation records were analyzed to determine the reason for admission to three wildlife centers spanning the country from British Columbia, Ontario, and Nova Scotia.

Materials and methods

Three authorized wildlife rehabilitation centers provided 3 years of data for analysis in this retrospective study. A center in British Columbia, Ontario, and Nova Scotia participated in the study.

Twenty-one categories were identified as reasons why animals were admitted to wildlife rehabilitation centers in Canada based on information contained in the medical record or as coded by the wildlife rehabilitation center (Table 1). These data were also sorted by species and final disposition results.

Given limited detailed information to further analyze the categories above, the following assumptions were made in terms of direct and indirect human involvement in the analyses.

- Assumption 1: Other predator attack (code 9), illness or emaciation (code 11), and environmental factors (code 18) are excluded from direct or indirect human involvement.
- Assumption 2: Cat and dog attack (codes 7 and 8), other predator attack (code 9), illness or emaciation (code 11), environmental factors (code 18), and other

Fig. 1 Radiograph of a Virginia opossum with severe nutritional metabolic bone disease from an improper diet. Note the two broken legs that have healed improperly. This baby opossum was fed watermelon as a diet for more than 2 months by a well-intentioned member of the public.

domestic animal interaction (code 19) are excluded from direct or indirect human involvement.

Results

A total of 21 157 animals were identified comprising 331 species; 573 animals were recorded as unknown species with 988 animals not identified or the species information recorded was illegible.

Several categories were combined where the reasons for admittance were thought to be similar in terms of etiology. For example, dog, cat, and other domestic animal attacks were combined.

Other predator attack (code 9), illness or emaciation (code 11), and environmental factors (code 18) were excluded from direct or indirect human involvement.

Cat and dog attack (codes 7 and 8), other predator attack (code 9), illness or emaciation (code 11), environmental factors (code 18), and other domestic animal interaction (code 19) were excluded from direct or indirect human involvement.

Table 1 Category definition and assignment of codes.

Code	Reason for admission identified
1	Hit a stationary object: wind turbine, window strike, fan
2	Vehicle collision (motorcycle, truck, car, watercraft, bicycle)
3	Electrocution
4	Hazardous noxious substance (oil, sticky traps, glue)
5	Entrapment (trap, entanglement—e.g., nets, fences, pipes, chimneys, fishing tackle)
6	Gardening, lawnmower, farm equipment accident
7	Cat attack
8	Dog attack
9	Other predator attack (conspecific, wild animal, nondomestic)
10	Projectile (shot—rifle, pellets, arrow)
11	Illness or emaciation (loss of body condition)
12	Trauma—unknown reason
13	Orphan
14	Kidnapped
15	Fall from nest
16	Human interference other than kidnapped (unauthorized to hold wildlife, construction/trapped at home)
17	Habitat destruction
18	Environmental factors (e.g., weather/storms)
19	Other domestic animal interaction
20	Toxicants

Table 2 Breakdown of a number of cases by category definition.

Code definitions		Total # recorded	% of total
1	Hit a stationary object or fan/wind turbine: window strike, walls, fan	1029	4.86%
2	Vehicle collision (motorcycle, truck, car, watercraft, bicycle)	1933	9.14%
3	Electrocution	43	0.20%
4	Hazardous noxious substance (oil, sticky traps, glue)	71	0.34%
5	Entrapment (trap, entanglement—e.g., nets, fences, pipes, chimneys, fishing tackle, string)	485	2.29%
6	Gardening, lawnmower, farm equipment accident	133	0.63%
7	Domestic cat attack	1416	6.69%
8	Domestic attack	316	1.49%
9	Other predator attack (conspecific, wild animal, non-domestic)	247	1.17%
10	Projectile (shot/rifle/pellets, arrow)	30	0.14%
11	Illness/emaciation (loss of body condition, illness)	698	3.30%
12	Trauma—unknown reason	6287	29.72%
13	Orphan	6134	28.99%
14	Kidnapped	432	2.04%
15	Fall from nest	175	0.83%
16	Human interference (unauthorized to hold wildlife, construction/trapped in homes, inappropriate human possession)	874	4.13%
17	Habitat destruction	96	0.45%
18	Environmental factors (e.g., weather/storms)	260	1.23%
19	Other domestic animal interaction	379	1.79%
20	Toxicants including lead toxicity	119	0.56%
	Total	**21 157**	**100%**

Table 3 Combining similar categories.

	Code definitions	Revised # recorded	Revised % of rotal
1	Hit a stationary object or fan/wind turbine: window strike, walls, fan	1029	4.86%
2	Vehicle collision (motorcycle, truck, car, watercraft, bicycle)	1933	9.14%
3	Electrocution	43	0.20%
4	Hazardous noxious substance (oil, sticky traps, glue)	71	0.34%
5	Entrapment (trap, entanglement—e.g., nets, fences, pipes, chimneys, fishing tackle, string)	485	2.29%
6	Gardening, lawnmower, farm equipment accident	133	0.63%
7	Domestic cat, dog, or other domestic predator interaction	2111	9.98%
9	Other predator attack (conspecific, wild animal, nondomestic)	247	1.17%
10	Projectile (shot/rifle/pellets, arrow)	30	0.14%
11	Illness/emaciation (loss of body condition, illness) or trauma—unknown reason	6985	33.02%
13	Orphan or kidnapped (e.g., accidental orphan)	6566	31.03%
16	Human interference (unauthorized to hold wildlife, construction/trapped in homes, inappropriate human possession)	874	4.13%
17	Habitat destruction or fall from nest	271	1.28%
18	Environmental factors (e.g., weather/storms)	260	1.23%
20	Toxicants including lead toxicity	119	0.56%
	Total	**21 157**	**100%**

Table 4 Cases with possible direct or indirect human involvement (Assumption 1).

Total cases		21 157
Codes where there may not be human involvement 9, 11, 18		507
Revised count with these 3 codes removed		20 650
% Human related (indirect or direct)	97.60%	20 650
% not human related	2.46%	507

Table 5 Cases with possible direct or human direct involvement (Assumption 2).

Total cases		21 157
Codes where there may not be human involvement 7, 8, 9, 11, 18, 19		3316
Revised count with these 6 codes removed		17 841
% Human related (indirect or direct)	84.33%	3316
% not human related	15.67%	886

The following groups of animals were compiled spanning seven categories. Birds represented the majority of animals brought into wildlife centers (55.5%) with terrestrial mammals being second (37.2%).

A number of species at risk in Canada were admitted to rehabilitation centers. These represented 341 animals spanning 14 species.

The following species are listed on Schedule 1 of the Canadian federal Species at Risk Act (SARA) and were treated at wildlife rehabilitation centers:

Special Concern
- Mole, eastern (*Scalopus aquaticus*)
- Vole, woodland (*Microtus pinetorum*)
- Grebe, horned (*Podiceps a*uritus) Western population
- Grosbeak, evening (*Coccothraustes vespertinus*)
- Phalarope, red-necked (*Phalaropus lobatus*)
- Falcon anatum/tundrius, peregrine (*Falco peregrinus anatum/tundrius*)
- Snake, milk (*Lampropeltis triangulum*)
- Turtle, snapping (*Chelydra serpentina*)

Threatened
- Owl, barn (*Tyto alba*) western population
- Swallow, barn (*Hirundo rustica*)
- Swift, chimney (*Chaetura pelagica*)
- Nighthawk, common (*Chordeiles minor*)

Endangered
- Myotis, little brown (*Myotis lucifugus*)
- Flycatcher, Acadian (*Empidonax virescens*)

Approximately 46% (7171, 1190/18 202) were released, transferred, placed, or the outcome was pending.

Discussion

Based on more than 21 000 wild animals admitted to three wildlife rehabilitation centers across Canada, it is estimated that 84.3% (17 841/21 157) to 97.6% (20 650/21 157) of cases are likely a result of direct or indirect human involvement. The value of 84.3% excludes animals that were admitted due to attacks by domestic dogs, cats, or other domestic animals. While many animals are allowed outdoors, thousands of wild animals (particularly in the spring) are killed every year by domestic animals. Many animals admitted to rehabilitation centers are fledgling birds or baby rabbits, hares, or squirrels. Domestic house cats are likely responsible for the greatest number of bird mortalities in Canada (Loss et al. 2013). The higher value of 97.6% is attributed to owners being responsible for their pet's interactions and impact on wildlife. It is estimated that feral cats are also responsible for hundreds of millions of bird mortalities every year (Loss et al. 2013). A tiny fraction of the birds that survive these injuries are ever

Table 6 Types of animals admitted.

Type of animal	# of animals identified	# of animals of unknown species	Total	% of total
Terrestrial mammals	7747	126	7863	37.2%
Marine mammals	60	0	60	< 1%
Semi-aquatic mammals	61	0	61	< 1%
Aerial mammals (e.g., bats)	158	0	158	< 1%
Birds	11 264	485	11 749	55.5%
Reptiles	247	10	257	1.2%
Amphibians	11	0	11	< 1%
Not identified or missing on records			988	4.7%

Table 7 Number of species based on types of animals admitted.

Type of animal	# of species identified
Terrestrial mammals	31
Marine mammals	2
Semi-aquatic mammals	4
Aerial mammals (e.g., bats)	4
Birds	272
Reptiles	10
Amphibians	8

Table 8 Species at risk.

Risk classification	# of animals	# of species identified
Special concern	206	8
Threatened	111	4
Endangered	24	2
Total	341	14

Table 9 Disposition of Animals (where such values were recorded).

Disposition description	Total #	% of total
Total animals that were dead on arrival/never admitted	975	5%
Total animals that died in care	6073	32%
Total animals that were euthanized	3768	20%
Total animals that were placed or released or transferred	7171	39%
Total unknown outcomes or still pending	1190	7%
Total animals admitted	18 202	100%

admitted to wildlife rehabilitation centers. Furthermore, actions aimed to control populations of feral cats such as the Trap-Neuter-Return program do not alleviate the adverse effects that feral cats have on wildlife (Longcore et al. 2009).

Trauma for unknown reasons accounted for 29.7% (6287/21 127) of cases admitted to the rehabilitation centers. When trauma for unknown reasons was combined with trauma from vehicle or stationary object collisions; cat, dog, predator, and other domestic animal attacks; electrocution; hazardous and noxious substance (e.g., glue traps); entrapment (e.g., fishing tackle, string, fences); gardening accidents; projectile; falls from nests; habitat destruction and weather events, the number of animals admitted for trauma reached 61% (12 900/21 157), with the majority of remaining cases being orphaned wild animals. Approximately 11% or about one in 10 trauma-related reasons for admittance was due to cat attacks (1416/12 900).

Collisions with vehicles cause morbidity and mortality for wildlife. According to the Traffic Injury Research Foundation (2012), roads with higher posted speed limits may have more wildlife vehicle collisions. For every large animal that is reported as killed on the roads in British Columbia, three additional killed wild animals will go unrecorded as the animal leaves the roadside area to die (Wildlife Collision Prevention Program 2016). However, typically only large animals, such as deer and moose, are reported as wildlife vehicle collisions. These represent a very small fraction of all wildlife vehicle collisions (Ontario Road Ecology Group 2010). Almost all of the reptiles (95%, 244/257) admitted to wildlife rehabilitation centers were as a direct result of a vehicle collision.

While explicit coding to identify injuries due to collisions with wind turbine developments is not standardized, it is estimated that 23 300 birds are killed from such collisions in Canada (Zimmerling et al. 2013). Similarly, it is estimated that 2.5 to 25.6 million birds are killed every year due to collisions with transmission lines (Rioux et al. 2013).

The term kidnapping refers to accidental orphan admittance. In other words, the animal was taken from its parent when it likely did not need to come in for rehabilitation. This practice is not uncommon in cases of fawns and neonate rabbits where the mother leaves the young alone for long periods during the day and members of the public believe they have been orphaned. Fledgling birds that have just left the nest and the parent(s) are still feeding the young bird are often mistaken by members of the public as an injured bird and are brought into wildlife centers. True orphaned animals are identified when the parent is not around or found dead, and/or the baby animals will likely die without intervention. It is possible that the 31% (6134, 432) of orphaned and accidental orphaned (i.e., kidnapped) animals admitted to rehabilitation centers could have been orphaned as a result of the mother killed due to direct or indirect human involvement (e.g., mother shot in a hunting incident, hit by a car, poisoned, etc.) but the details of why the animals are orphaned are not always apparent by the finder nor the rehabilitator.

It was surprising to see how low the results were for admittance due to toxin given much information in the literature of toxicity reports from lead in raptors and water birds. This could be because the wildlife centers (at the time of data collection) did not have diagnostic equipment to test for these toxins. In one study, 25.6% (762/2980) of Bald eagle carcasses submitted for evaluation revealed lead toxicosis as the likely cause of death (Russell 2014).

Not all records listed the final disposition of the animal. Out of 18 202 records, 39% (7171) of animals were released, transferred, or placed with another 7% (1190) alive with a pending outcome. Reasons for euthanasia and death in care vary greatly based on the species admitted, the nature and injury, as well as resource limitations and protocols implemented in various wildlife facilities. For example, in times of a disease outbreak, such as raccoon distemper virus or parvo virus in a nursery, some wildlife rehabilitation centers will elect to depopulate the entire litter of animals to prevent the spread of the disease to healthy, immunocompromised animals. In other cases, most wildlife rehabilitation centers will immediately euthanize animals for which there is a poor chance to return to the wild as a healthy animal, such as an open fracture involving a joint of a raptor or complete loss of eyesight in an animal.

There are limitations and biases of these data. Many injured wild animals may not make it to a wildlife rehabilitation center and will succumb to their injuries in the wild. For example, at the time of writing this paper, there were two deer that were spotted over several weeks with protruding arrows from their body and no longer coming to feeders based on their usual routine (Fig. 2). It is possible that these animals succumbed to their injuries and are not included in data collected from rehabilitation centers. These represent a mere fraction of injured animals that will likely succumb to their wounds or illness without intervention. As mentioned, a Wildlife Collision Prevention Program study (2016) showed that for every one large animal killed by a vehicle, three more will likely

Fig. 2 Deer with an arrow at a feeding station.

succumb to death as they wander off the road injured, but not immediately killed. Such examples (and many others) lead to survivor bias.

While every attempt was made to reduce confirmation bias, this is a retrospective study, and some assumptions were made in terms of the correlation of direct and indirect human impact. The reasons for admittance did not consider intent versus accidental injury to animals, such as those injuries by gardening equipment, projectile (e.g., shot), or glue traps. Nonetheless, in such cases, the assumptions were made that there was some kind of human involvement resulting in the animal's injury.

Furthermore, not all wildlife rehabilitators are permitted to admit all species. Therefore, the number of cases is likely underrepresented, and reasons for admittance could change based on the species permitted for admittance under the wildlife rehabilitator's authorization.

In addition, coding errors, incorrect species identification, and spelling errors may alter the findings of these data. Assumptions were made based on the best available information provided by those entering data. Finally, while data were analyzed from more than 21 000 medical records, data from only three larger rehabilitation centers were evaluated. Certain species that exist in one part of Canada do not exist in another part of Canada (e.g., Eastern cottontail rabbits of Ontario are not indigenous to Nova Scotia).

Conclusions

Analysis of more than 21 000 patient records from three wildlife rehabilitation centers across Canada demonstrated that up to 97% of wild animals brought into wildlife rehabilitation centers are thought to be directly or indirectly linked to anthropogenic causes. Trauma was the leading reason recorded for 61% of all cases admitted to rehabilitation centers. Orphaned wildlife was also a key reason why animals were admitted to wildlife rehabilitation centers in Canada.

This research will help wildlife rehabilitators and agencies be aware of the reasons why animals are admitted to rehabilitation centers in Canada and provide opportunities to develop mitigation strategies to potentially minimize human impact on indigenous wildlife.

There are opportunities to expand upon this research by broadening the number of wildlife rehabilitation centers used to evaluate reasons for admission to rehabilitation centers as well as encouraging wildlife rehabilitators to utilize electronic records and standardized coding to avoid some of the potential bias.

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ARTICLE

Evaluating the efficacy of 16 surfactants for removing petrochemicals from feathers

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Abstract

New detergents are developed, and existing products are reformulated on a regular basis. To ensure that the most effective products are used for decontaminating oiled wildlife, periodic assessment is necessary. Sixteen surfactants previously determined (Ambrose & Tegtmeier 2015) to be subjectively effective at removing oil from feathers (based on appearance and water repellency of the feather) were selected for this objective evaluation. This study used the methods developed and described in previous studies (Bryndza et al. 1991; Miller et al. 2003) to assess these 16 products. Standard quantities of feathers were uniformly oiled with a synthetic oil containing components found in many petroleum spills, then subjected to a "wash," and rinse process with 1, 2, and 3% dilutions of each of the 16 products. The residue remaining on the washed feather samples was extracted with solvents and analyzed by gas chromatography to determine the quantities of each component present. The resulting data provide a measure of efficacy of each surfactant, allowing for recommendations regarding product use for cleaning oiled birds.

Keywords

Surfactant; petrochemical; oiled wildlife

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Abbreviations

GC: gas chromatography
RSD: relative standard deviation

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BIO

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Introduction

In order to restore insulating capabilities and water repellency to oil-contaminated feathers, the feathers must be completely freed of both oil and cleaning agents (Dein & Frink 1986; Miller & Welte 1999). The most important considerations for thorough cleaning are the effectiveness of a given product at removing petroleum at physiological temperatures and the ease of rinsing away the cleaning product (Frink & Miller 1995). Other considerations for the practical use of a surfactant include commercial availability, potential toxicity to the species being washed, cost, and the logistics of supply and handling (Welte et al. 1991; Bryndza et al. 1995).

In 1990, Bryndza et al. developed an objective method of evaluating surfactant efficacy for removing petrochemicals from contaminated feathers (Bryndza et al. 1991). The results of that study, as well as similar studies conducted on cleaning products in 1995, 2003, and 2006, demonstrated that Dawn® dishwashing liquid detergent (Procter & Gamble, Cincinnati, OH) was more effective than other agents at removing a synthetic oil from uniformly oiled feathers in a laboratory situation (Bryndza et al. 1991; Bryndza et al. 1995; Miller et al. 2003; Miller et al. 2006).

Subjective evaluation of 25 new products (Ambrose & Tegtmeier 2015) was used to select the products chosen for this objective testing.

Materials and methods

Sixteen cleaning products were selected for evaluation based on prior objective testing and the results of the subjective testing by Ambrose & Tegtmeier (2015) (Appendix A, Table 1). The subjective testing was completed approximately 3 years prior to this trial; consequently, not all

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the same products were available, and some formulations may have changed. Bear Paw™ Nature Cleanse was no longer available, so the product Bear Paw™ Hand Cleaner was used in the objective testing. The CitraSolv™ CitraDish® Natural Dish Soap used in the subjective testing is now sold under the brand HomeSolv™ CitraDish® Natural Dish Soap (but is advertised to be the same product). Mixed Chicks® "detangling" shampoo was tested by Ambrose and Tegtmeier; this formulation is no longer available so Mixed Chicks® "clarifying" shampoo was used for this study. All other products were the same name and manufacturer as those used in the subjective testing; indeed, many were the same bottles. It is possible, though unlikely, that some components may have denatured in the period between the two trials.

All products were placed into uniform bottles and assigned an identification letter (A–P) to eliminate potential bias on the part of the investigator (Ricko). The final list of all products tested is presented in Appendix A, Table 2.

Objective testing

To conduct an objective evaluation of these products, the method described by Bryndza et al. (Bryndza et al. 1991; Bryndza et al. 1995) was used, with some procedural changes resulting from improved technology and more accurate laboratory equipment. For the method to be reproducible, a mixture of commonly available hydrocarbons was made to serve as the contaminating "oil." This synthetic oil contained equal amounts (by mass) of 13 components representing the types of molecules found in light petroleum mixtures such as kerosene, mineral oil, diesel fuel, home heating oil, and light crude oil. The same types of chemical structures and functional groups are present in heavy crude oils and tars as well, making this mixture versatile enough to appropriately represent a wide range of petroleum fractions (Bryndza et al. 1991).

The feathers were oiled by dissolving the synthetic hydrocarbon mixture in a volatile solvent (methylene chloride) and allowing the feathers to stand in the mixture (as described in Appendix B, "Oiling of Feathers"). The methylene chloride acted as a carrier for the hydrocarbon mixture, creating a true homogeneous solution that was able to contact all feather surfaces, thus providing a more uniform oiling of the feathers. After standing for an hour, the excess oil was drained, and the last traces of the volatile solvent were removed under vacuum at room temperature.

Experiments were conducted to determine the consistency of oiling by this method. The oil was extracted from the feathers by treating them with acetone and then with a methylene chloride solution containing 1 mg/mL 1-octadecene, as described by Bryndza et al. (1991). The decanted solution was evaluated by GC, allowing the components to be measured as the weight of oil/weight of oiled feathers. This procedure was executed eight times to demonstrate that the oiling of the feather samples was uniform.

The remaining feather samples were then "cleaned" using a reproducible wash/rinse/extraction procedure to determine the effectiveness of each of the cleaning products at removing the deposited compounds (see Appendix B, "Testing of Cleaning Agents"). The oiled feather samples were initially shaken with cleaning solutions and then with two water rinses to simulate the subjective clinical process of washing and rinsing oiled birds in a reproducible manner. All cleaning products, feather samples, and water rinses were maintained at 40°C (104°F), as this temperature approximates avian body temperature and has been shown to be effective in cleaning birds by standard protocols. The 16 cleaning products were evaluated in this manner at three different concentrations (3, 2, and 1%). Local tap water (hardness = ca. 3 grains/gallon or 0.05 ppm) was used to prepare the solutions and to rinse the feathers after washing.

After the rinse, the feather samples were extracted first with acetone (to remove water and some residual oil) and then with a solution of methylene chloride containing a known amount of the nonvolatile internal standard 1-octadecene (used to analyze the amount of each component present on the feathers after washing and rinsing).

The combined acetone and methylene chloride extracts were dried with anhydrous magnesium sulfate ($MgSO_4$) (to remove water from the extraction) and then filtered to remove the $MgSO_4$. The amounts of the individual components present in a filtered solution of oil residue and 1-octadecene were determined by quantitative GC.

A control was provided for each of the three sets by conducting the process on three feather samples without the addition of a cleaning agent (10 mL of water was added in place of the 10 mL cleaning solution).

Results

Uniformity of oiling

As seen in Table 1 and illustrated in Fig. 1, the RSD of the components revealed the feathers to be oiled within approximately ±12.5% of a mean value for 12 components (the ethylcyclohexane was found too volatile to reproducibly quantify). This was less uniform than previous studies, which were all within 10% of a mean value (Bryndza et al. 1991; Bryndza et al. 1995; Miller et al. 2003; Miller et al. 2006).

Table 1 Measured sample concentration (mg/mL) of oil components on eight randomly selected samples of oiled feathers.

Uniformity of Oiling											
Component	Measured Sample Concentration (mg/mL)									SD	RSD (%)
	UC-1	UC-2	UC-3	UC-4	UC-5	UC-6	UC-7	UC-8	Average		
2-Ethylnaphthalene	184	67.7	61.9	78.4	104	76.5	133	112	102	41.0	40
2-Methylheptane	201	208	268	175	233	264	194	275	227	38.2	17
cis-Decalin	134	140	134	136	104	147	119	105	127	16.1	13
Ethylcyclohexane	314	NA[a]	ND	ND	ND	ND	ND	ND	314	NA[b]	NA
Mesitylene	60.2	55.8	57.8	56.4	55.3	64.4	56.9	61.1	58.5	3.15	5.4
n -Butybenzene	59.4	61.1	53.6	57.2	51.2	60.2	56.4	53.9	56.6	3.52	6.2
n -Butylcyclohexane	53.1	48.1	47.9	47.0	46.8	49.5	49.2	52.3	49.2	2.34	4.8
n -Dodecane	65.2	66.0	63.3	65.2	24.9	67.4	57.2	52.3	57.7	14.2	25
n -Eicosane	94.9	42.6	40.2	43.2	61.1	37.1	60.8	55.3	54.4	18.9	35
Naphthalene	207	173	188	193	165	195	197	186	188	13.5	7.2
o -Xylene	52.8	54.2	62.2	53.4	56.7	71.0	51.2	61.1	57.8	6.62	11
p-Cresol	23.9	23.4	28.9	23.9	17.1	26.8	19.8	20.7	23.1	3.80	16
Tetralin	759	974	877	921	564	850	578	666	774	157	20
TOTAL	**2209**	**1914**	**1883**	**1850**	**1483**	**1909**	**1573**	**1701**	**1815**	**227**	**12.5**

[a] ND = no peak detected
[b] NA = not applicable

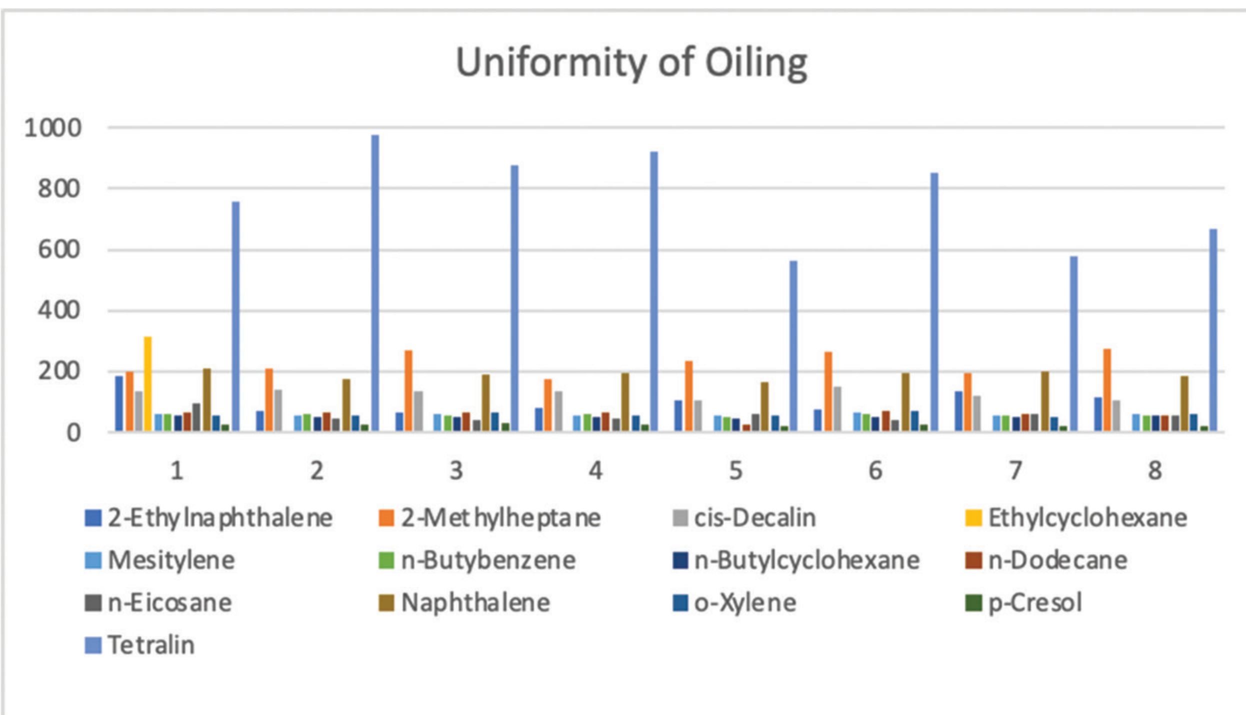

Fig. 1 Illustration of the sample concentration (mg/mL) of oil components on eight randomly selected samples of oiled feathers (Evaluation of Uniformity of Oiling).

Controls

The three control washes produced inconsistent results (Table 2 and Fig. 2). Total residues ranged from 1716 to 11 546 mg/mL. Ratios of the components were generally consistent between controls #2 and #3, but the quantities varied considerably. Values of components in control #3 were 1.5 to 2 times the values of components in control #2, with the exception of naphthalene and ethylcyclohexane. Naphthalene in control #3 was 3.5 times that of control #2, and ethylcyclohexane was 562 mg/mL in control #3, but not detected in control #2. Neither was ethylcyclohexane detected in control #1, nor was any n-Eicosane detected in control #1. Furthermore, the values of the components in control #1 varied from 3.5 to 15 times those of control #2.

Table 2 Amount (mg/mL) of each synthetic oil component remaining on the feathers after the three control washes (water only, no detergent).

Component	Measured Sample Concentration (mg/mL)		
	Control #1	Control #2	Control #3
2-Ethylnaphthalene	364	104	204
2-Methylheptane	1251	287	513
cis-Decalin	863	145	249
Ethylcyclohexane	ND[a]	ND	562
Mesitylene	401	65.1	108
n-Butybenzene	389	63.4	95.7
n-Butylcyclohexane	331	52.1	94.8
n-Dodecane	352	66.9	128
n-Eicosane	ND	48.9	67.9
Naphthalene	1734	151	359
o-Xylene	380	53.3	115
p-Cresol	293	19.2	33.4
Tetralin	5187	659	1349
TOTAL	**11546**	**1716**	**3878**

[a] ND = no peak detected

Efficacy of cleaning agents

A summary of the GC analysis showing the relative amounts of each component (in mg) remaining on the 2.0 g samples of oiled feathers after cleaning is shown in Tables 3–5. The control data reported represent the amounts of contaminants remaining on feather samples after three washes with water alone, that is, in the absence of detergents. Tables 3–5, respectively, report results obtained using 3, 2, and 1% v/v solutions of detergents for the wash step. Table 6 summarizes the total weight of contaminants remaining on feather samples (the sums of the columns in Tables 3–5) after washing and rinsing as a function of the cleaning agent and concentration. While this is a simplistic method that does not attempt to correlate chemical structure with ease of removal, it does give a single numerical evaluation to a

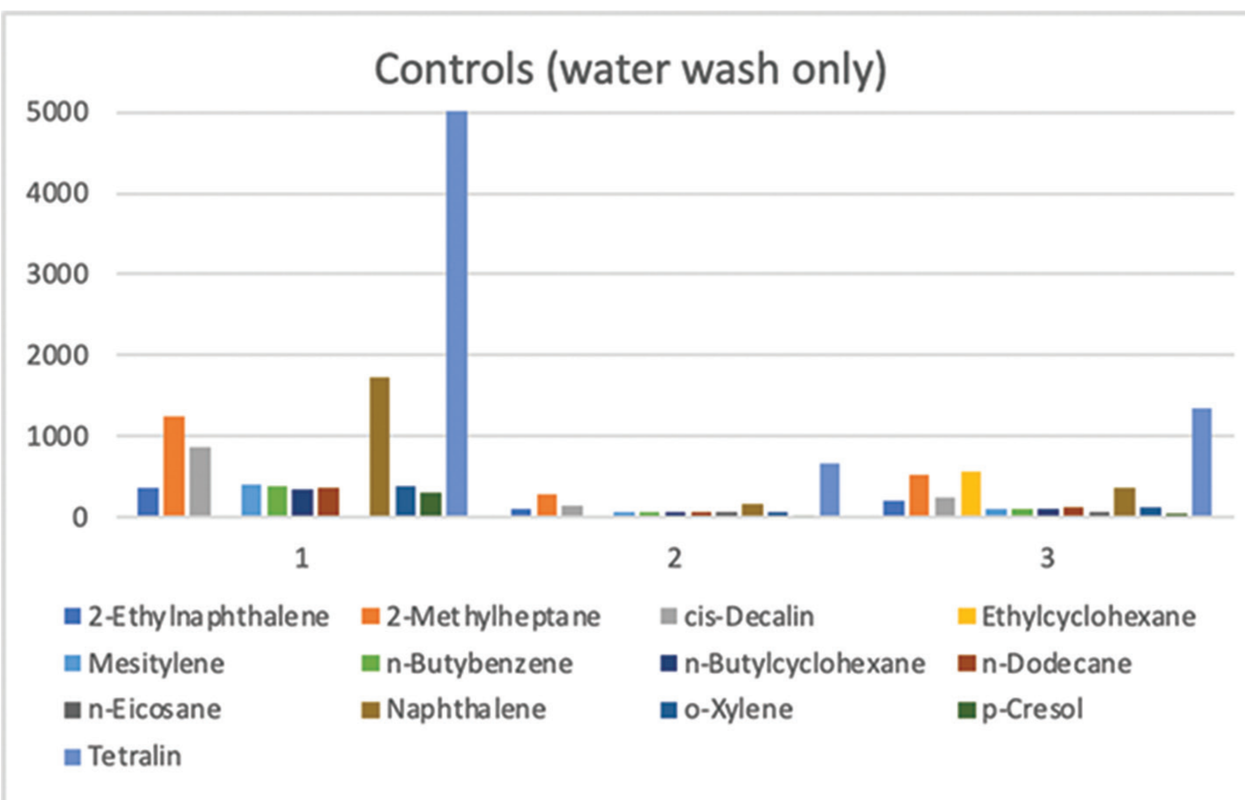

Fig. 2 Illustration of the amount (mg/mL) of each synthetic oil component remaining on the feathers after the three control washes (water only, no detergent).

Table 3 Amount (mg/mL) of each synthetic oil component remaining on the feathers after the detergent washes (1% detergent solutions).

Component	1% Cleaning Solutions																
	Measured Sample Concentration (mg/mL)																
	Control	1% A	1% B	1% C	1% D	1% E	1% F	1% G	1% H	1% I	1% J	1% K	1% L	1% M	1% N	1% O	1% P
2-Ethylnaphthalene	364	47.8	54.2	47.2	63.9	92.8	91.3	84.9	33.7	106	126	134	75.4	66.0	83.1	87.2	45.4
2-Methylheptane	1251	131	199	100	283	301	510	187	35.7	355	326	ND	0.224	236	159	144	ND
cis-Decalin	863	57.0	105	53.1	178	159	277	28.3	26.2	172	140	390	109	1827	58.4	70.8	16.0
Ethylcyclohexane	ND[a]	ND	ND	ND	ND	ND	ND	ND	ND	ND	184	ND	ND	ND	ND	ND	ND
Mesitylene	401	27.1	52.0	22.2	61.5	59.1	141	14.2	11.7	67.3	61.6	51.2	52.4	79.0	25.6	20.9	9.20
n-Butybenzene	389	2.74	50.1	23.4	32.5	61.7	18.9	93.9	11.9	73.8	67.7	2.11	50.9	78.2	55.7	32.9	15.0
n-Butylcyclohexane	331	24.3	43.4	2.03	59.8	42.4	117	25.3	9.67	59.7	58.6	38.6	1.60	68.3	28.7	35.8	13.4
n-Dodecane	352	24.2	52.0	23.0	72.2	74.9	115	1.60	13.1	77.8	68.0	75.2	11.9	92.2	39.2	35.1	1.25
n-Eicosane	ND	21.4	29.5	19.2	37.6	40.4	40.1	41.3	11.1	58.3	57.9	66.6	45.1	36.6	49.5	36.4	16.8
Naphthalene	1734	116	154	106	153	177	209	165	67.9	184	150	170	165	176	193	121	101
o-Xylene	380	28.7	47.1	21.2	70.3	59.4	132	2.64	10.2	77.6	68.5	174	16.2	74.6	35.2	18.6	5.02
p-Cresol	293	18.8	22.5	21.3	22.0	18.0	51.0	28.2	18.4	21.3	15.0	4.76	24.8	17.7	29.5	24.5	25.8
Tetralin	5187	401	556	374	478	1030	112	334	176	966	664	ND	524	620	806	649	244
TOTAL	**11546**	**900**	**1365**	**813**	**1512**	**2116**	**1815**	**1007**	**426**	**2218**	**1987**	**1106**	**1076**	**3372**	**1564**	**1277**	**493**
[a] ND = no peak detected		4	9	3	10	14	12	5	1	15	13	7	6	16	11	8	2

Table 4 Amount (mg/mL) of each synthetic oil component remaining on the feathers after the detergent washes (2% detergent solutions).

Component	2% Cleaning Solutions																
	Measured Sample Concentration (mg/mL)																
	Control	2% A	2% B	2% C	2% D	2% E	2% F	2% G	2% H	2% I	2% J	2% K	2% L	2% M	2% N	2% O	2% P
2-Ethylnaphthalene	104	18.3	30.7	24.6	49.8	46.7	69.1	66.4	16.2	91.7	98.7	57.9	61.5	33.2	131	ND[a]	NA[b]
2-Methylheptane	287	24.1	38.7	27.6	69.6	68.3	93.1	106	24.1	299	348	149	133	67.5	357	ND	NA
cis-Decalin	145	14.4	23.0	18.9	41.8	37.2	63.7	51.2	14.6	104	132	59.0	57.6	31.4	148	ND	NA
Ethylcyclohexane	ND	ND	ND	ND	ND	ND	412	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Mesitylene	65.1	7.02	10.8	8.69	18.6	17.6	29.9	23.9	6.48	51.8	61.7	29.7	29.6	15.4	77.2	3.70	NA
n-Butybenzene	63.4	6.68	10.2	8.41	19.6	17.0	30.9	25.0	6.32	50.1	60.2	27.4	28.2	13.9	42.9	43.4	NA
n-Butylcyclohexane	52.1	5.42	8.39	6.83	16.2	13.2	23.7	20.4	5.53	45.8	48.9	23.2	23.1	11.9	77.1	ND	NA
n-Dodecane	66.9	6.25	10.4	9.03	21.1	16.1	28.1	26.7	7.26	48.7	58.9	23.8	26.5	12.9	72.4	ND	NA
n-Eicosane	48.9	5.71	8.52	7.69	15.9	12.8	23.8	20.5	6.72	33.6	45.3	18.1	18.3	12.5	57.9	ND	NA
Naphthalene	151	36.2	50.5	42.9	110	85.6	132	121	32.4	165	134	127	133	63.3	147	8.67	NA
o-Xylene	53.3	6.99	10.3	8.00	16.6	16.5	26.2	23.2	6.02	56.0	63.7	31.8	30.0	15.1	90.0	ND	NA
p-Cresol	19.2	17.9	16.5	16.0	17.1	13.5	13.8	18.3	18.1	20.8	13.9	17.6	23.6	18.6	12.9	16.7	NA
Tetralin	659	99.2	173	143	349	306	511	451	96.3	547	570	489	446	233	545	512	NA
TOTAL	**1716**	**248**	**391**	**322**	**746**	**650**	**1458**	**954**	**240**	**1513**	**1636**	**1054**	**1011**	**529**	**1759**	**584**	**NA**
[a] ND = no peak detected		2	4	3	8	7	12	9	1	13	14	11	10	5	15	16	

[b] NA = not applicable; due to an unknown error, no internal standard was present in Sample P and the data will not be reported

Table 5 Amount (mg/mL) of each synthetic oil component remaining on the feathers after the detergent washes (3% detergent solutions).

Component	3% Cleaning Solutions																
	Measured Sample Concentration (mg/mL)																
	Control	**3% A**	**3% B**	**3% C**	**3% D**	**3% E**	**3% F**	**3% G**	**3% H**	**3% I**	**3% J**	**3% K**	**3% L**	**3% M**	**3% N**	**3% O**	**3% P**
2-Ethylnaphthalene	204	18.2	24.2	15.4	27.0	20.4	29.6	20.9	12.9	111	54.2	30.0	42.8	21.5	118	27.8	18.9
2-Methylheptane	513	19.3	45.0	32.2	44.6	40.6	43.5	41.8	26.0	255	243	ND[a]	ND	19.0	191	41.5	40.6
cis-Decalin	249	12.6	21.0	15.3	21.3	17.0	24.3	18.8	11.6	102	97.9	2.49	42.6	15.1	94.4	23.8	18.2
Ethylcyclohexane	562	ND	413	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mesitylene	108	6.00	10.0	7.09	10.1	8.33	11.7	9.24	5.40	41.2	46.0	16.1	21.6	6.67	38.4	11.5	9.21
n-Butybenzene	95.7	5.98	9.73	6.57	9.57	7.65	11.0	8.41	5.14	42.1	39.2	ND	20.0	6.71	42.1	11.2	8.69
n-Butylcyclohexane	94.8	4.70	7.75	6.05	8.07	6.54	9.31	7.31	4.60	36.7	39.9	ND	4.02	5.49	32.5	8.87	6.76
n-Dodecane	128	6.36	10.2	7.01	10.6	7.37	12.7	8.15	5.56	51.7	45.5	0.0323	16.3	7.84	41.0	11.7	7.38
n-Eicosane	67.9	6.94	8.13	8.46	8.36	6.64	11.3	7.44	5.40	44.9	42.4	9.64	15.1	8.52	34.9	8.15	6.13
Naphthalene	359	36.2	55.7	34.5	53.0	42.4	52.8	42.5	25.1	145	134	76.2	105	41.0	141	73.9	47.7
o-Xylene	115	5.55	9.71	7.16	10.1	8.39	12.1	9.34	5.68	42.0	46.3	16.4	14.9	5.78	38.5	10.6	9.36
p-Cresol	33.4	18.3	22.9	20.4	20.8	18.1	12.2	15.6	19.7	34.3	27.9	24.5	31.2	16.0	26.8	24.0	25.4
Tetralin	1349	89.9	137	91.4	152	112	161	111	70.4	620	530	188	294	98.6	567	162	117
TOTAL	**3878**	**230**	**774**	**251**	**375**	**295**	**391**	**301**	**197**	**1525**	**1347**	**364**	**607**	**252**	**1366**	**415**	**315**
[a] ND = no peak detected		2	13	3	9	5	10	6	1	16	14	8	12	4	15	11	7

given washing protocol. Based on these numerical values, detergent H (Palmolive® Ultra Strength™) left the least amount of oil after washes with each of the three dilutions (Table 6).

Discussion

Uniformity of oiling

The differences in oil distribution are most likely due to variation in feathers—for example, those with broken shafts would have trapped more oil inside the shafts than those with intact shafts. It is also possible that the feathers experienced more clumping as a different type of container was used for this study than in previous studies. Ethylcyclohexane was only found in the first sample; this volatile compound most likely dissipated from the other samples (Table 1 and Fig. 1). This variation suggests that there may have been sufficiently different amounts of oil on the feather samples to affect the outcome of the washing trials or possibly that the procedure was not conducted in exactly the same manner each time.

Controls

The results from the three controls run varied greatly from the expected consistent values obtained in past studies. The differences in total amounts of oil remaining on the feathers could be explained by nonuniformity in oiling of the feathers; however, the variation in the components of each oil remaining on each sample cannot be explained. Inconsistency in sample handling or treatment may have occurred between the controls, as well as between each sample, potentially invalidating all results. The investigators can provide no explanation for n-Eicosane and ethylcyclohexane appearing in at least one control but not in the others, except for possible variation in treatment of the samples (e.g., longer exposure to air allowing for more evaporation of these volatile components).

Efficacy of cleaning agents

The results in Table 6 and Fig. 3 show dramatic differences in oil removal among the cleaning agents tested. The four products that were consistently the most effective in removing the oil were H, P, A, and C (Palmolive® Ultra Strength™, Citrus Fresh Dish Soap, Dawn® Ultra Dishwashing Liquid Original Scent, and Fairy Liquid Original, respectively). Of these, only the Dawn® Ultra was ranked in the top four on the subjective feather testing, most likely due to differences in the oils used in the subjective (light crude oil) vs objective (synthetic oil) trials. The other three top-ranking detergents from the subjective feather testing ranked 8th, 9th, and 13th in the objective testing (products B, D, and M in Fig. 3), suggesting these products may be more effective at removing light crude oil than the synthetic oil. Excluding the 1% run for product M (HomeSolv™ CitraDish®), this product did very well on both the subjective and objective testing; future testing should include further objective testing of this product.

A laboratory error occurred during the 2% run for product P (Citrus Fresh Dish Soap) so the efficacy of this run was not determined. While the product was very effective in the 1 and 3% runs, it cannot be considered for future testing as manufacturing has been discontinued and the product is no longer available.

Further examination of Table 6 and Fig. 3 demonstrate, as expected, most of the products removed more oil when the cleaning agent was used at higher concentrations. Product N (Bitu-Ox™), however, performed worse at the 2% concentration than at either 1 or 3%. This was likely due to nonuniformity in oiling of the feather samples or other experimental error. At the concentrations tested, Bitu-Ox™ failed to remove oil as effectively as 13 of the other products, regardless of the concentration. Similarly, product B (Joy® Ultra Lemon Dish Soap), performed worse at 3% concentration than at either 1 or 2%. This again may have been an experimental error and should be repeated in future testing. If the error is actually in the 3% run rather than the 2% run, this product has good potential as an effective surfactant for cleaning feathers.

Tables 3–5 show that five cleaning products, I, J, L, M, and N (Amodex® Stain Remover, Renew All Purpose Cleaner, Bear Paw™ Hand Cleaner, HomeSolv™ CitraDish®, and Bitu-Ox™, respectively) left more residues of certain components than the control, that is, they removed less of these oil components than water alone. Most of these higher residues were left when the cleaning products were used at lower concentrations, suggesting the products may have been below critical micelle level (insufficient detergent to surround and remove the oil on a molecular level), resulting in a polarity that repelled the water and trapped the oil on the feathers, thereby preventing the oil from coming off in the rinse. Of these products, only HomeSolv™ CitraDish® functioned well enough at the higher concentrations to be considered for future testing.

Additional subjective trial

Due to the questionable nature of the objective test controls and cleaning results, a blind trial was arranged to

Table 6 Total amount (mg/mL) of synthetic oil (sum of the 13 components) remaining on the feathers after the 1, 2, and 3% washes with the 16 detergents, A–P.

Product	Residue (mg/mL) after washing			
	3%	2%	1%	Average
A	230	248	900	459
B	774	391	1365	843
C	251	322	813	462
D	375	746	1512	878
E	295	650	2116	1020
F	391	1458	1815	1221
G	301	954	1007	754
H	197	249	426	291
I	1525	1513	2218	1752
J	1347	1636	1987	1657
K	364	1054	1106	841
L	607	1011	1076	898
M	252	529	3372	1384
N	1366	1759	1564	1563
O	415	584	1277	759
P	315	NA	493	404
Control	3878	1716	11546	5713

NA = Not Applicable; due to an unknown error, no internal standard was present in sample P in the 2% run

subjectively evaluate the performance of Palmolive® Ultra Strength™ vs Dawn® Ultra.

General procedure

Four previously frozen Canada goose (*Branta canadensis*) carcasses (died or euthanized due to presenting injuries) were thawed and examined to confirm that none had visible feather damage or contamination. The carcasses were each floated for 24 h in one of four tubs containing 4 L of water plus 120 mL HD SAE 30 motor oil to simulate the contamination of a bird swimming in oiled water. Each carcass was then washed by the same team of two experienced washers who were not informed of which detergents they were using (see Appendix C for the method used to wash and rinse the oiled carcasses).

An additional experienced wash person was asked to evaluate the washed carcasses. This evaluator was not informed of which products were used in the testing and was simply asked to examine the carcasses and rank them from most waterproof to least waterproof. The results, shown in Table 7, found that Palmolive® Ultra Strength™ cleaned the carcass more effectively than the other products.

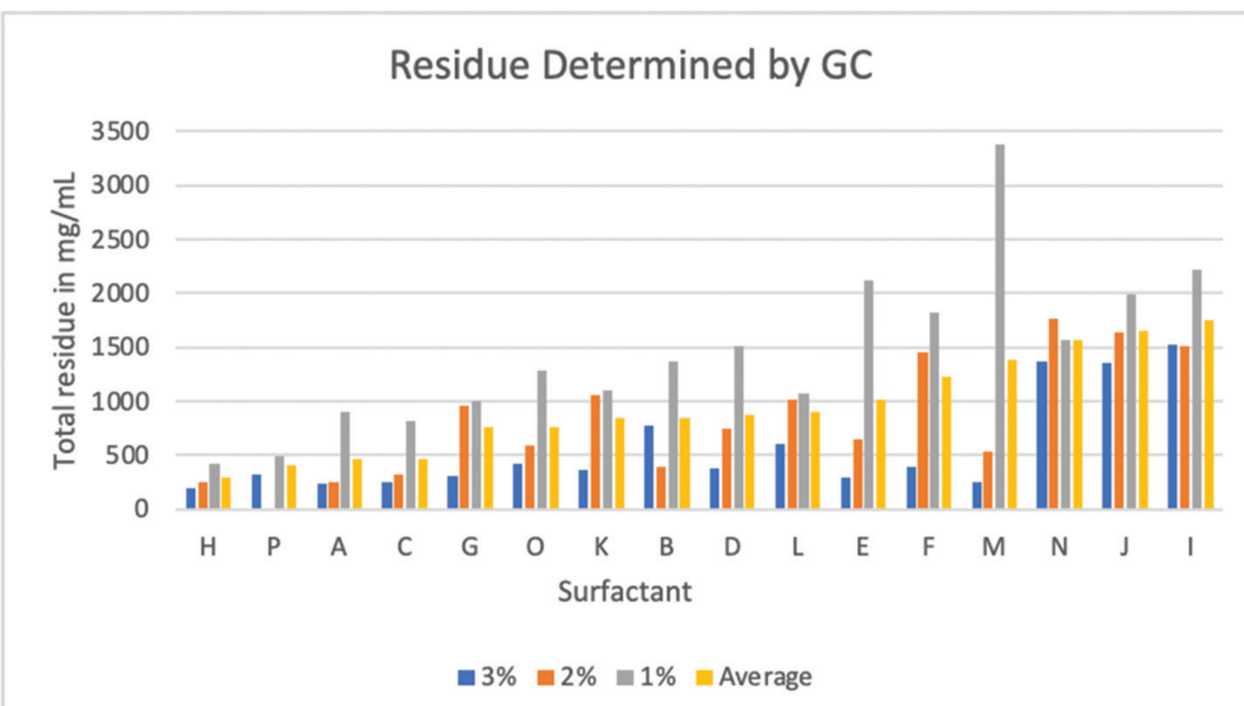

Fig. 3 Illustration of the total amount (mg/mL) of synthetic remaining on the feathers after the 1, 2, and 3% washes with the 16 detergents, A–P.

Table 7 Time spent in each washtub and rinse and subjective observations made by the washers and evaluator for each of the cadaver washes.

Trial	Wash time tub 1	Wash time tub 2	Water soak	Rinse @104F	Results—washers comments (during process)	Results—evaluator's comments (after)	Evaluator's Ranking
1	3 min 35 sec	3 min 0 sec	1 min	13 min 14 sec	1st tub discolored quickly; sudsy; rinsed well	Surface wet; Wet to skin when sprayed	3rd
2	3 min 15 sec	2 min 22 sec	1 min 45 sec	16 min 45 sec	Water got cloudy quickly and felt "dense" ; very sudsy; worked harder at the rinse, but did come clean	Water beading well; dry to skin; down stays dry when misted.	2nd
3	3 min 30 sec	2 min 40 sec	1 min 4 sec	10 min 30 sec	Smells nice/fresh, like bubble-gum, but also an underlying chemical odor; rinses with very little effort	Water beading well; dry to skin; down stays dry when misted. Stays fluffier longer after handling than #2	1st ("tie" with #2 based on appearance; ranked first due to shorter rinse time)
4	3 min 22 sec	3 min 0 sec	1 min 5 sec	14 min 25 sec (not fluffy, but no more soap coming off)	Smells like: floorcleaner, gin & tonic, citrusy. Not as sudsy as #2 or 3; acts similar to #1; easier to rinse than #2, not as easy as #3. Vent area not rinsing well	Down on breast is repelling water really well. Got surface wet when handled. Wet to skin in vent area.	4th

1 = Bright Green, 2 = Dawn Ultra, 3 = Palmolive Ultra Strength, 4 = Ajax Ultra

Conclusions

The three "trials"—the subjective testing using a light crude oil, the objective testing using the synthetic oil, and the final carcass wash using a motor oil—all showed that both Dawn® Ultra and Palmolive® Ultra Strength™ are effective at removing the oils from feathers.

While the objective testing appears to be fraught with errors, the Palmolive® Ultra Strength™ consistently left the least residue from the synthetic oil based on the GC results. The single wash test and subjective evaluation were consistent with these findings.

To verify these results, the objective testing will be repeated for the three available top-ranking products (Palmolive® Ultra Strength™, Dawn® Ultra Dishwashing Liquid Original Scent, and Fairy Liquid Original) and the HomeSolv™ CitraDish®. Additional carcass washes using a variety of oils will also be conducted to compare the efficacy of the products on the different contaminants.

Acknowledgments

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Disclosure Statement

The author reports no conflict of interest.

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Appendix A

Results of subjective testing and product information

Table 1 Average scores for the 16 top-ranked products in the subjective testing for short- and long-term exposure conducted by Ambrose & Tegtmeier (2015).

Surfactants	Avg. Score in Short-term Trial	Avg. Score in Long-term Trial
HomeSolv™ CitraDish®	4.0	3.9
Dawn®Ultra	3.9	3.7
Method®	3.8	3.6
Joy®Lemon*	3.7	3.9
Dr. Bonner's Pure Castile Soap	3.6	3.3
Renew All Purpose Cleaner	3.5	2.6
Palmolive®Ultra Strength™	3.4	2.6
Seventh Generation™	3.3	3.3
BioGreen Clean®	3.2	2.8
Bitu-Ox™	3.2	2.9
Mixed Chicks®Shampoo	3.2	2.5
Charlie's Soap®	3.1	3.1
Citrus Fresh Dish Soap	3.0	2.8
Amodex®*	2.8	3.3
Fairy Original*	2.8	4.0
Bear Paw™ Nature Cleanse*	2.3	3.1

Those with asterisks were more effective at cleaning the feathers with "aged" oil (long-term) than the freshly oiled feathers (short-term).

Table 2 Manufacturer information for the 16 products used for the objective testing.

ID	Product	Manufacturer	Location
A	Fairy Original Washing Up Liquid	Procter & Gamble	West Thurrock, England, UK
B	Joy®Ultra Lemon Dish Soap	Procter & Gamble	Cincinnati, OH 45202 USA
C	Dawn®Ultra Dishwashing Liquid, Original Scent	Procter & Gamble	Cincinnati, OH 45202 USA
D	Method®Dish Soap	Method®Products, Inc.	San Francisco, CA 94111 USA
E	Mixed Chicks®Shampoo	Mixed Chicks®, LLC	Canoga Park CA 91303 USA
F	Pure Castile Soap	Dr. Bronner's	Vista, CA 92081 USA
G	Seventh Generation™ Dish Soap Natural	Seventh Generation™	Burlington, VT 05401 USA
H	Palmolive®Ultra Strength™	Colgate-Palmolive Company	New York, NY, 10022 USA
I	Amodex®Stain Remover	Amodex®Products, Inc.	Bridgeport, CT 06605 USA
J	Renew All Purpose Cleaner	Vanguard-Eco Biotechnologies, LLC	No Longer Available
K	Bio Green Clean®	Bio Green Clean®	Lake Placid, NY 12946 USA
L	Bear Paw™ Hand Cleaner*	Bear Paw™ Inc.	Knoxville, PA 16928 USA
M	HomeSolv™ CitraDish®Natural Dish Soap**	HomeSolv™, LLC	Danbury, CT 06813-2597 USA
N	Bitu-Ox™	Greenway Products, LLC	Mahwah, NJ 07430 USA
O	Charlie's Soap®	Charlie's Soap®, Div. Sutherland Products, Inc.	Stoneville, NC 27048 USA
P	Citrus Fresh Dish Soap	Life Tree	No Longer Available

Appendix B

Objective/quantitative evaluation process

Preparation of feathers

Feathers were collected from the breasts of carcasses of six snow geese[1] (*Chen caerulescens*), none of which displayed any evidence of oil contamination. Approximately 122 g of breast feathers were plucked, carefully separated from the down, and stored in polyethylene bags.

Preparation of oil

The synthetic oil was prepared by mixing 69.3–85.1 mg of each of the 13 components (quantity was based on product purity) in a 2-L glass jar.

Oiling of feathers

One liter of the synthetic hydrocarbon mixture was dissolved in 1 L of methylene chloride. The feathers were added to this solution and mixed for 2 min by shaking the jar. The jar was left to sit for 1 h with occasional shaking. The solution was decanted, and the feathers were pressed onto a vacuum filter. The funnel containing the feathers was covered with a paper towel secured with a rubber band, and the funnel was placed into a Vacuum Atmospheres antechamber for 30 min to remove the last traces of the volatile solvent under dynamic vacuum at room temperature.

The feathers were then removed from the vacuum and placed into sealed bags (used to prevent losses of volatile components) in a covered desiccator. A slight vacuum was drawn, and the feathers were allowed to "age" overnight in the desiccator.

The oiled feathers were weighed into glass jars (2.00 ± 0.1 g in each jar), and the lids were taped shut. A total of 59 sample jars was prepared.

Experiments were conducted to demonstrate the uniformity of the oiling of the feather samples. Eight jars were chosen at random, and the samples were treated with 10 ml acetone (to remove any water), shaken for 60 s, and decanted. The feathers were then treated with 50 mL of a methylene chloride/1-octadecene solution (0.2 mg/mL), shaken for 60 s, and decanted. The methylene chloride was used to extract the oil, and the 1-octadecene acted as an internal standard to quantify the oil components. The feathers were placed on a vacuum filter, and 1 mL of the extracted solution was placed in a GC vial. GC was used to quantify the components of the oil in the extraction relative to the 50 mg/sample internal standard amount of 1-octadecene present.

Testing of cleaning agents

To each jar containing a 2-g sample of oiled feathers, 10 mL of a cleaning solution was added at 40°C (2, 1, or 0.5% solutions). The jar was shaken vigorously for 30 s, and the solution was decanted. Ten milliliters of 40°C water was added to the jar/feathers, shaken vigorously for 30 s, and decanted. A second 10 mL of 40°C water was added to the jar/feathers, shaken vigorously for 30 s, and decanted. Ten mL of acetone were added to the jar/feathers (to remove any water) and shaken vigorously for 60 s, then decanted onto a filter frit containing approximately 2 mg of magnesium sulfate ($MgSO_4$). A final 50 mL of methylene chloride/1-octadecene (0.2 mg/mL) was added to the jar/feathers and shaken vigorously for 60 s and then emptied onto the filter to remove the solids. The jar was rinsed with methylene chloride to remove any remaining oil, and this rinse was poured over the feathers to further extract any residues. A 1-ml sample of the filtered residue was then placed in a vial, capped, and analyzed by GC within 24 h.

Creating a control for the process. For each dilution (1, 2, and 3%), the procedure was repeated on a 17th sample as a control, using 10 mL of water in place of the 10 mL of cleaning solution.

Evaluation. The GC results provided the components of oil residue (in mg) remaining on the feathers as compared to the internal standard (1-octadecene). The GC results for each cleaning product were totaled and entered in Table 6 (illustrated in Fig. 3).

Appendix C

Method for carcass[2] wash and evaluation

Washtubs were prepared using 58 ounces of detergent in 15 gallons of water in the first tub (3% solution), 38 ounces of the same detergent in 15 gallons of water in the second tub (2% solution), and 15 gallons of water with no detergent in the third tub. All water used was tap water from the same source, and the water temperature of each tub was 105–106°F (40.5–41°C). Rinse water was also tap water from this same source, at 105–106°F.

The wash team consisted of two experienced individuals who were directed to wash the bird for as long as they felt necessary in each of the first two tubs, moving to the next tub (second or third) when they were ready to do so. They then rinsed the bird in the warm water tub for 1 min before moving to the spray rinse station. After removing their wash gloves and rinsing their arms and aprons, the team commenced rinsing the carcasses and continued until they thought the bird was completely rinsed. The amount of time each bird was kept in each tub and in the rinse was recorded (Table 7).

This process was repeated three times for a total of four washes. Each set of tubs was prepared in the absence of the wash team, so that neither wash person knew which detergent was used.

After all four carcasses were washed, another experienced washer was asked to inspect the cadavers, evaluate them for waterproofing, and then rank them in order of most to least waterproof. This evaluation was done by a simple visual exam of the contour feathers, then a visual exam of the down, and finally by misting the feathers repeatedly with tap water and observing the amount of water and time necessary to wet the feathers.

Notes

[1]Tri-State's charter precludes the use of living animals in experiments that may harm them. The feathers used in this study were plucked from the carcasses of six snow geese, all of which had been either received dead on arrival at Tri-State or were euthanized on arrival due to the extent of their traumatic injuries. None had any evidence of oil contamination.

[2]All carcasses used for the final wash and evaluation were obtained in a similar manner and had no prior evidence of oil contamination.

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ARTICLE

Avian anaesthesia and analgesia

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Abstract

Wildlife rehabilitators are often presented with injured birds. We recognize that birds are not dogs and cats and, therefore, require specialized protocols for anaesthesia and analgesia. This paper discusses recent research on anaesthesia and analgesia in birds, with a focus on a multimodal approach to treatment. Rehabilitators will need to work closely with veterinarians to provide the best care for wild bird patients.

Keywords

Avian; anaesthesia; analgesia; physiology

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Introduction

Those who have federal rehabilitation permits for avian species often need to treat birds that are in pain, or that need anaesthesia, for a variety of reasons. Procedures requiring excessive restraint, surgery, wound care, physical therapy, bandage changes and, in some cases, the initial exam may require anaesthesia in order to decrease stress to the bird. Rehabilitators must work closely with veterinarians to develop protocols for pain control (analgesia) in wild patients and to provide safe and effective anaesthesia when procedures are needed. Being familiar with wild birds and their safe capture and restraint, rehabilitators may be asked to help monitor anaesthesia for their veterinarians. Anaesthesia requires close attention to the bird and proper communication with the veterinarian performing the procedure.

Unique avian anatomy and physiology

When considering anaesthetic procedures for avian patients, it is critical to be aware of the unique physiology of birds compared to mammals. The upper airway has the nares (nostrils), which continue into the choana, which is the opening seen in the top of the mouth. When the bird's mouth is closed, the choana sits opposite to the glottis, the opening into the trachea, located at the base of the tongue, creating a direct airway from the nares through to the trachea. Birds do not have an epiglottis like mammals, and in most species, the opening of the glottis is actually larger than the diameter of the mid to lower trachea (which is important when considering an endotracheal tube for gas anaesthesia). Birds have complete tracheal rings, which means that endotracheal tubes with cuffs can cause mucosal damage when inflated. Non-cuffed tubes are recommended (Sinn 1994; Lawtown & Howlett 2000; Tully 2009; Lierz & Korbel 2012).

There is a myriad of species variation in anatomy, and some species are obligate mouth-breathers with no external nares. This includes gannets, cormorants, anhingas, frigate birds, pelicans and many diving birds; the mouths of these species need to be kept open during restraint. Many waterfowl species have a syringeal bulla, an enlargement of the trachea at the syrinx that is important in vocalization. Cranes, swans and birds of paradise have extremely complex, elongated tracheas for the same reason. Pelicans, gulls and hornbills have a crista ventralis, a cartilaginous projection at the glottis, whilst pelicans have a vestigial tongue (glottal mass). Emus and male ruddy ducks (*Oxyura jamaicensis*) have a tracheal sac-like diverticulum that may be mistaken for a ruptured trachea.

The avian respiratory system separates ventilatory and gas exchange compartments, making it highly efficient. More efficient gas exchange leads to rapid induction of gas anaesthesia and recovery from gas anaesthesia. The ventilatory compartment includes the major airways, the air sacs and the thoracic skeleton (pneumatic bones, which are hollow). Most species have nine air sacs: the paired cervical, cranial thoracic, caudal thoracic and abdominal, and the single intraclavicular. Some species have subcutaneous air sacs, such as pelicans, boobies, tropic birds and gannets. Pneumatic bones include the vertebral ribs, sternum, humerus, pelvis, femur and cervical, and some thoracic vertebrae. In pelicans and

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California condors (*Gymnogyps californianus*), the ulna is also a pneumatic bone.

Rigid lungs and lack of a diaphragm require external body wall movement (excursions) for breathing. The overall lung capacity in birds is much smaller than that of mammals, but the total respiratory volume (with air sacs) is two to four times that of dogs. This smaller functional reserve means that brief apnoea (lack of breathing) leads to marked hypoxia (lack of oxygen in the tissues). In some birds, dorsal recumbency (lying on the back) can cause the weight of the abdominal organs to compress the abdominal and caudal thoracic air sacs (Rupley 1997; Lierz & Korbel 2012; Raftery 2013; Ludders 2015; Heard 2016; Zehnder et al. 2017).

Intermittent positive pressure ventilation (IPPV) may be needed under anaesthesia to ensure adequate ventilation. Studies of red-tailed hawks (*Buteo jamaicensis*) under gas anaesthesia showed the greatest lung and air sac volumes in sternal (compared to lateral or dorsal) recumbency, with no changes in ventilatory rate as a function of position (Ludders 2015).

There is a dive response in many species of waterfowl. Episodes of apnoea and bradycardia (low heart rate) can occur during induction of anaesthesia. This is a stress response initiated by the stimulation of receptors in the beak and nares and can be triggered simply by placing a mask snugly over a bird's bill. When this occurs, turn off anaesthetic gas, remove the mask from the head and provide flow-by oxygen until the bird has recovered.

The avian renal (kidney) system represents another difference between birds and mammals. An arrangement of smooth muscle forms a valve within the external iliac vein, which can cause blood flow from the back half of the body to pass through the kidneys before reaching the front half of the body (and heart/brain). This is called the renal portal system. Though its true significance is still unknown, it is recommended that drugs that could potentially harm the kidneys, or drugs with high renal excretion, be administered in the front half of the body (Fowler 1995; Heard 2016; Zehnder et al. 2017; Scott 2021).

Pain and multimodal analgesia

Analgesia, or the relief of pain, is critical in the care of wildlife, not only ethically but also to prevent physiological changes, such as changes in blood pressure, altered endocrine function, tachycardia (high heart rate), dysrhythmias (abnormal heart rhythm), hyperglycaemia (excess glucose in the blood), decreased immunity and decreased wound healing. Wild animals typically hide pain as much as possible, as an injured or hurt animal is likely to become food for another animal. Therefore, close observation of patients is key to determining and evaluating pain.

Some things to look for to help recognize pain in birds include (Malik & Valentine 2018):

- Changes in posture and appearance, including a hunched appearance, drooping demeanour with fluffed up feathers, closing eyes, poor feather quality, tucked-up abdomen and standing on one leg;
- Changes in locomotion, including lameness, decreased weight bearing on a limb, slower speed, difficulty perching/climbing, falling, stumbling and decreased confidence in mobility;
- Changes in temperament/personality, including aggression/passivity depending on normal behaviour; lethargy; apathy; decreased interest in surroundings; anxiety, fear or restlessness; escape reactions; passive immobility and sleep deprivation;
- Guarding behaviour, including protecting/hiding the affected area;
- Changes in grooming behaviour, including destroying feathers, overgrooming and self-mutilation;
- Changes in normal eating, drinking or toileting, including inappetence or constipation;
- Changes in vocalization, including increased or decreased vocalization and vocalizing on physical manipulation of the affected area;
- Changes in physiological parameters, including tachypnea, tachycardia and hypertension (acute pain);
- Changes in weight, including weight loss or loss of muscle mass (chronic pain).

The pain pathway, from pain stimulus to the brain, goes through a number of stages. Transduction occurs when the pain receptors sense the pain stimulus and start the electrical signals that will travel through the nerves to the spinal cord. Transmission conducts the stimulus from that first nerve to the second nerve within the spinal cord. Modulation occurs via neurotransmitters or other substances either amplifying or suppressing that signal from the first nerve at the point of transmission. Perception is the actual signal detection by the brain (Tseng 2007). Multimodal analgesia uses multiple types of pain medications to work at different points along the pain pathway. For instance, transduction of pain stimuli can be decreased with non-steroidal anti-inflammatory drugs (NSAIDs), local anaesthetics and opioids. Transmission can be decreased by alpha-2 agonists. Modulation to decrease pain can occur through epidurals and *N*-methyl-d-aspirate (NMDA) antagonists. Pain perception may be decreased with opioids. Each of these types of drugs is discussed in further detail below.

Whenever possible, pre-emptive analgesia is important to prevent "wind-up", a response where once pain has already started, it is increasingly difficult to stop the pain due to increased numbers of nerves sensing the pain. Analgesic medications should be administered before the pain has started, for example, before a surgery, rather than waiting until after the event. Proper analgesia is key to maintenance of anaesthesia because, with appropriate analgesics used as pre-medications, the doses of anaesthetics can be decreased, which can, in turn, decrease the risks of anaesthesia. One key point to remember is that drug response is highly variable by species, so what works well in one species may have no effect on another species.

Types of analgesics

Opioids

Opioids are powerful analgesics that are controlled substances and can only be used under the direct supervision of a veterinarian. Different opioids work as agonists or antagonists at different types of receptors in the brain, called Mu, Kappa and Delta receptors. In birds, opioid receptors are detectable as early as 10 days in embryonic chicks. In mammals, the distribution of Mu, Kappa and Delta receptors is consistent across different parts of the brain, whilst in pigeons, 75% of the receptors in the fore- and mid-brain are Kappa (>Delta > Mu). In day-old chicks, there are more Mu receptors (>Kappa > Delta), and in adult peregrines, there are also more Mu receptors (>Detla > Kappa). Opioids are most commonly used in birds for moderate to severe pain such as from fractures, trauma or surgery.

There is a significant first-pass effect when opioids are given orally, which means that the concentration of drug is greatly decreased by absorption in the liver before it can reach the rest of the body. The most common opioids used in wildlife are buprenorphine and butorphanol.

Fentanyl is a Mu receptor agonist that has been used intramuscularly (IM), intravenously (IV) and in transdermal forms. It can cause apnoea, so the rehabilitator needs to be prepared to breathe for the bird if necessary whilst it is under anaesthesia. Common doses in rehabilitation start at a loading dose of 20 ug/kg IM then 0.15–0.5 ug/kg/min IV in a constant rate infusion (Hawkins et al. 2016; Barron & Hawkins 2017; Hawkins et al. 2018). Fentanyl can be very harmful to humans so use with caution and care.

Hydromorphone is another Mu receptor agonist used IV, IM or subcutaneously (SQ), with common doses of 0.1–0.6 mg/kg every 3–6 hr, studied in American kestrels (*Falco sparverius*). These same dosages had no effect on pain in cockatiels, using a thermal foot withdrawal test (Ceulemans et al. 2014; Hawkins et al. 2016; Barron & Hawkins 2017; Hawkins et al. 2018).

Buprenorphine is a partial Mu receptor agonist, as well as a Kappa receptor agonist and antagonist, commonly used at 0.1–0.6 mg/kg every 8 hr (Tseng 2007; Lierz & Korbel 2012; Ceulemans et al. 2014; Hawkins et al. 2016; Hawkins et al. 2018). When studied at 0.6, 1.2 and 1.8 mg/kg in cockatiels, it did not seem to provide analgesia (Guzman et al. 2018).

Butorphanol is a mixed agonist/antagonist that is often used at 1–4 mg/kg every 1–4 hr (Hawkins et al. 2016, Hawkins et al. 2018). It has poor oral availability, so IM injection is recommended, and it can cause sedation at higher doses.

Tramadol is a synthetic Mu opioid agonist that also inhibits reuptake of norepinephrine and serotonin and has NMDA antagonist effects. As in many of the drugs, the effects vary greatly by species, and in mammals, there is currently evidence that it is ineffective for osteoarthritis. In birds, doses range from 5 to 30 mg/kg PO every 6–12 hr (Souza et al. 2012, Hawkins et al. 2016, Hawkins et al. 2018), and it is recommended that it is not to be used as the sole analgesic. Larger birds require lower doses at decreased frequency compared to smaller birds. Tramadol is now a controlled substance and must be used under the direct supervision of a veterinarian.

Non-steroidal anti-inflammatory drugs

Cyclooxygenase enzymes COX-1 and COX-2 are widely distributed in birds and can be modulated with NSAIDs. NSAIDs work to decrease the production of prostaglandins, which promote inflammation, pain and fever. They also work locally to decrease nerve ending sensitization. COX-1 produces prostaglandins that protect the gastrointestinal (GI) system, so over the years, medicine has promoted the use of COX-2 specific drugs to prevent any adverse GI effects caused by inhibiting COX-1. NSAIDs should not be used if there is any sign of kidney disease, heart disease and GI disease (do not use after GI surgery). Adverse effects are often dose dependent and associated with chronic administration (Hawkins et al. 2016). Response is very species-specific, even amongst birds. For example, diclofenac has been used in some species but kills Old World vultures. Meloxicam is likely the most widely used NSAID in wildlife.

Flunixin meglumine (Banamine®; Merck Animal Health, Madison, New Jersey) is not COX-selective and causes muscle damage with IM injections. It has been shown to cause kidney lesions in quail, cranes and budgies, and administration is not recommended in birds (Paul-Murphy & Fialkowski 2001; Hawkins et al. 2016; Barron & Hawkins 2017).

Meloxicam (Metacam®; Boehringer Ingelheim Animal Health USA Inc., Duluth, Georgia) is COX-2 preferential (not COX-2 specific, as at higher doses, its COX-2 specificity is diminished) and has been used in a wide variety of species. It is available as an injectable and as an oral formulation. It has been used at 0.25–2.0 mg/kg PO (orally) every 12–24 hr; ensuring adequate hydration is essential (Hawkins et al. 2016; Barron & Hawkins 2017; Hawkins et al. 2018). In a study of African Grey Parrots, 1 mg/kg/day for 12 days was not associated with adverse effects (Montesinos et al. 2019).

Carprofen (Rimadyl®; Zoetis, Kalamazoo, Michigan) has been researched in some species, at 5–10 mg/kg (Lawtown & Howlett 2000). It showed no effect in Broiler chickens (25 mg/kg), only a short-term effect in Hispanolan Amazon parrots (*Amazona ventralis*) (3 mg/kg), and caused renal, hepatic and muscle damages in pigeons (Columbidae) (2, 5 and 10 mg/kg) (Barron & Hawkins 2017).

Ketoprofen (Ketofen®; Zoetis, Kalamazoo, Michigan) has been shown to have low bioavailability and a short half-life in quail, caused high mortality in eiders (2–5 mg/kg) and Cape Griffon vultures (*Gyps coprotheres)* (5 mg/kg), and renal tubular necrosis in budgies (2.5 mg/kg). Administration in birds is generally not recommended (Hawkins et al. 2016; Barron & Hawkins 2017).

Piroxicam (Feldene®; Pfizer Inc., New York, NY) is a COX-1 specific drug with good oral absorption and a long half-life, though in cats and dogs, it is used primarily for its antitumor activity. Used in cranes, there was mild to moderate improvement of chronic degenerative joint disease at 0.5–1 mg/kg. In chickens, there was no effects at 0.15 mg/kg and gut ulceration at 0.6 mg/kg (Hawkins et al. 2016; Barron & Hawkins 2017).

Aspirin is a COX-1 inhibitor that is broken down by the body to its active state as salicylic acid. It has been used at 150 mg/kg (Lawtown & Howlett 2000).

Local analgesics

Local analgesics work to block sodium ion channels, decreasing local nerve transmission. Anecdotally, the toxic doses are lower in birds than in mammals, but there is little research to back this claim. They can be used to provide “local blocks” via injection into the tissue surrounding the incision site, “regional blocks” through injection around the nerves leading to that area or for epidurals in some species (though use of epidurals is limited in birds due to fusion of the lumbosacral spine).

EMLA® (AstraZeneca, Wilmington, Delaware) cream has a 2.5% lidocaine and 2.5% percent prilocaine that is used topically. It can be useful for things like catheter placement; however, it requires 30–45 min of contact time to work, and toxicity can occur with uptake after prolonged occlusion. Depth of penetration of effect correlates directly with contact time (Tseng 2007).

Ophthalmic topicals such as tetracaine and proparacaine are widely used for eye procedures.

Long-acting drugs such as bupivacaine, levobupivacaine and ropivacaine can be very useful for brachial plexus blocks before wing fracture repair, though use of a nerve locator/stimulator is advised. Common dosages are 1–2 mg/kg (Tseng 2007; Hawkins 2016). Intra-articular bupivacaine was studied in chicks with artificially induced arthritis, and they were able to feed and stand like normal birds (Paul-Murphy 2006).

Lidocaine has been used in a variety of species but has often had no effect (mallards [*Anas platyrhynchos*] ineffective at 15 mg/kg, chickens at 20 mg/kg), and dosages often used are 1–4 mg/kg (Paul-Murphy & Fialkowski 2001; Hawkins et al. 2016). It is usually diluted 1:10 for use in birds (Tseng 2007).

Other

Gabapentin has analgesic effects and can prevent allodynia (sensation of pain resulting from a normally non-noxious stimulus) or hyperalgesia (exaggerated response to painful stimuli). It also has antiseizure activity. The mechanism of action is not fully understood, but it appears to bind to voltage-gated calcium channels to decrease calcium influx, which inhibits the release of excitatory neurotransmitters such as substance P, glutamate and norepinephrine. It appears to work synergistically with NSAIDs and/or opioids. Research in great horned owls (*Bubo virginianus*) started with 11 mg/kg dose, and common dosages start at 10 mg/kg and have gone up as high as 80 mg/kg (Yaw et al. 2015). Gabapentin is considered a controlled substance in some states and must be used under direct supervision of a veterinarian.

Acetaminophen is the generic name for Tylenol® (Johnson & Johnson, New Brunswick, New Jersey). The exact mechanism of action of acetaminophen is not completely understood. It produces analgesia and inhibits fever via a weak, reversible inhibition of COX-3 and COX-1. It is not anti-inflammatory. It has been used in broiler chickens with no nephrotoxicity but has low bioavailability. There are anecdotal reports that doses proven toxic in other species may be well tolerated in many parrots, but there is little research behind its use in many bird species.

Types of anaesthetics

Pre-anaesthetics

A veterinarian may recommend pre-anaesthetic medications, usually including a sedative, tranquilizer and/or an analgesic, to prevent the "wind-up" response. In many cases, it may also be beneficial to pre-oxygenate the patient by holding oxygen to the nares of the bird before it is completely sedated. Many of the drugs used as pre-anaesthetics are controlled substances that must be used under direct supervision of a veterinarian.

Anti-cholinergics such as atropine and glycopyrrolate are not commonly used in birds due to the already high resting heart rate.

Tranquilizers/sedatives

Benzodiazepines are tranquilizers. Diazepam and midazolam are commonly used and can be reversed with flumazenil. They provide muscle relaxation and sedation, have anticonvulsant properties and are mild analgesics.

Alpha-2 adrenergic agonists provide analgesia, decrease anxiety and cause sedation. These include xylazine, tiletamine, medetomidine and dexmedetomidine. They can be reversed with atipamazole (detomidine products) or yohimbine (xylazine). They commonly cause cardiac effects such as irregular and very slow heart rates, and respiratory depression.

Intranasal midazolam (3 mg/kg) and midazolam/butorphanol (3 mg/kg each) result in rapid onset of sedation in cockatiels (Doss et al. 2018).

Injectable anaesthetics

There are advantages and disadvantages to injectable anaesthetics. Advantages include the following:

- when surgery would be complicated by the presence of the endotracheal tube used for gas anaesthesia;
- for surgery of the coelomic cavity, allows a decrease of inhalant dose; and
- in the field when gas anaesthesia/oxygen is not present.

Disadvantages include:

- variability in effect between species;
- poor induction of anaesthesia;
- inadequate muscle relaxation;
- cardiopulmonary depression;
- prolonged/violent recoveries;
- route of delivery can affect efficacy and dosage;
- elimination depends on drug distribution, and liver and/or kidney metabolism; and
- some cannot be reversed and instead must be metabolized.

It is vital to have an accurate body weight when dosing injectable anaesthetics and to calculate emergency/supportive drugs in advance. Close cardiopulmonary monitoring is required, and endotracheal tubes and oxygen should be on hand in case of emergency. Many injectable anaesthetics are controlled substances that must be used under direct supervision of a veterinarian.

Ketamine is an NMDA antagonist that causes anaesthesia but does not provide adequate analgesia (Sinn 1994; Lierz & Korbel 2012); doses are usually 2.5–10 mg/kg IM or IV for induction (Paul-Murphy & Fialkowski 2001; Tully 2009). It has little cardiopulmonary depression but can cause violent recoveries, has no reversal agent and can cause seizures, excitation and salivation in Old World vultures. Dosing is by allometric scaling, meaning that smaller animals require larger relative doses.

Propofol is used at 1 mg/kg/min IV (Paul-Murphy & Fialkowski 2001). It causes smooth, rapid induction of anaesthesia, though apnoea is very common; rehabilitators should be prepared to intubate and ventilate immediately after induction. It causes profound respiratory depression, prolonged recovery and central nervous system signs when used in constant rate infusion, and there are fewer adverse events if given to effect. It is metabolized very quickly in birds, so is not used as a sole agent unless as a continuous rate infusion (Lawtown & Howlett 2000).

Alfaxalone is a neuroactive steroid that binds GABA-a receptors. There is no reversal agent; it is generally given at 5–10 mg/kg IV or IM (Lawtown & Howlett 2000; Heard 2016).

Inhalant anaesthetics – Isoflurane, Sevoflurane and Desflurane

The advantages of inhalant anaesthetics include rapid induction and recovery, the ability to rapidly change the depth of anaesthesia, no requirement of an accurate body weight, little metabolism and recovery is independent of kidney/liver function. Disadvantages include the pollution of the work environment, the expense of anaesthesia and equipment, oxygen is required for use, dose-dependent cardiopulmonary depression and hypotension (decreased blood pressure) is common.

- Isoflurane is considered safe but hypotension is common and can be severe in cranes (Sinn 1994). The respiratory and cardiovascular depressions are dose dependent (Sinn 1994);

- Sevoflurane has lower solubility, faster induction/recovery and is expensive; and
- Desflurane requires expensive, specialized vaporizer and has little data in birds.

Anaesthesia equipment

The veterinarian should be able to guide the rehabilitator in the use of the anaesthesia equipment. Use non-rebreathing circuits and uncuffed tubes inserted only far enough to prevent the tip from slipping easily out of the trachea. Creativity is necessary in providing appropriate tubes for each species. Intubation is usually not attempted for very short procedures, not at all in birds less than 150 g, and not in sharp-shinned hawks (*Accipiter striatus*). In tiny birds, the inside diameter of the tube that would fit in the trachea becomes too small and too prone to blockage by mucus. However, appropriately sized tubes should be available to provide a means for rapid intubation, and ventilation should the bird become apnoeic. Most birds will need an oxygen flow rate of 1–2 L of oxygen/min, and the percent of gas needed to maintain anaesthesia will depend on the pre-anaesthetic drugs used, in which gas anaesthetic is used. Pay special attention to accipiters; do not use injectables except as pre-anaesthetics. Start induction at low levels of isoflurane and increase gradually. They are prone to sudden cardiac arrest, especially during recovery. Careful monitoring of all birds is required during anaesthesia and recovery, especially the heart and respiratory rate and character (see below).

Supportive care during anaesthesia

Fluids are recommended, most often a SQ bolus of 5 ml/100 g body weight before anaesthesia. Larger birds may be catheterized and put on a constant fluid drip. Maintenance fluids in birds are generally 40–60 ml/kg/day. Sites for fluid administration IV include the jugular vein, medial metatarsal vein and, in the pelican, the pouch vein. Avoid the basilic vein in all birds. In some cases, an intraosseous catheter may be used in the distal ulna (not pelicans) or proximal tibiotarsus, avoiding the pneumatic bones.

Instead of using an endotracheal tube, the veterinarian may instead install an air sac cannula (Sinn 1994; Rupley 1997; Lawtown & Howlett 2000), especially if an endotracheal tube would be obstructive or if the surgery was involving the upper airways. The left abdominal caudothoracic air sac is commonly used. The cannula can remain in place for up to 3–5 days. Use a cuffed tube for this purpose.

Maintenance of body temperature (104–110°F/40–43°C) is important. Because of the high body-to-surface area ratio, birds generally radiate heat rapidly. Once anesthetized, the bird is immobile and relaxed, generating less heat from muscle contraction. The patient is also subject to evaporative loss from the respiratory tract (dry anaesthetic gases), skin surfaces (surgical prep solutions) and open-body cavities, conduction of heat via surface contact and convection of warm gases from around the bird. Anaesthesia redistributes blood flow and depresses thermoregulatory response, promoting heat loss.

Hypothermia can decrease anaesthetic requirement and metabolism and will prolong recovery. Monitoring core body temperature and providing thermal support are mandatory to reduce anaesthetic morbidity and mortality in the anaesthetized and recovering patient. Large species and northern owl species may become hyperthermic due to the insulating effects of the feathers, which can be prevented or reversed by placing ice packs along the body of the patient.

Intermittent positive pressure ventilation is essential during extended anaesthetic periods (>30 min), monitoring excursion of the sternum in dorsally recumbent birds or elevations of the base of the tail in ventrally recumbent birds. Anaesthetic agents depress ventilation to a greater extent in birds than in mammals; therefore, hypoventilation (not breathing enough) should be presumed in all anesthetized birds. IPPV in spontaneously breathing birds at two cycles per minute is sufficient to maintain blood gases in a suitable range. If apnoeic, the rate of ventilation should be 6–12 respirations per minute. The veterinarian should teach the rehabilitator how to properly provide breaths to anaesthetized patients using anaesthesia equipment.

Monitoring

Heart rate can be monitored using stethoscopes: regular, paediatric or oesophageal. Doppler can also be used. Heart rates in avian species vary greatly from 200 beats per minute (bpm) to 1000 bpm, depending on the species; a patient's heart rate should be ascertained prior to surgery as a baseline. Maintenance of an even, steady rate appropriate for the species is more important than an absolute number. Decreased heart rate should prompt a reduction in anaesthetic gas concentration, evaluation and treatment of hypotension and review of the patient's surgical situation (pain, tissue trauma and positioning). Unfortunately, cardiac arrest is typically not successfully reversed. Electrocardiogram can be used to diagnose arrhythmias and monitor the heart rate. In birds, an oesophageal probe is more accurate. Changes in heart rate should be communicated with the veterinarian, so they can determine the need for changing anaesthetic depth.

Changes in respiratory rate and character usually precede cardiac changes; therefore, respiration is often the single most important factor to monitor. If apnoea occurs, anaesthetic gases should be turned off, the delivery system purged, oxygen flow re-established and the patient manually ventilated. It is vital that any change in respiration be communicated with the veterinarian promptly.

Reflexes are vital to determination of anaesthetic plane. For most surgical procedures, a patient should still have a mild palpebral (eyelid) reflex, a slow but still present corneal reflex and no pedal (foot) withdrawal.

Indirect blood pressure can be monitored for trends. Direct blood pressure is difficult in most birds. Again, the exact number is less important than the overall trends.

Capnography is the measurement of end-tidal carbon dioxide ($ETCO_2$), the amount of carbon dioxide in exhaled air, which is a measure of ventilation. In African grey parrots (*Psittacus erithacus*), $ETCO_2$ consistently overestimates arterial CO_2 by approximately 5 mm Hg. $ETCO_2$ of 30–45 mm Hg indicated adequate ventilation (Edling 2006). Use a side stream capnograph and minimize dead air space.

Pulse oximetry is not useful in birds, and sufficient oxygenation does not necessarily mean that the bird is being adequately ventilated.

Maintaining perfusion of the tissues is vital. Perfusion can be monitored by checking the colour of the mucous membranes as well as the capillary refill time, or the refill time at the basilic vein in birds.

Common emergency treatments

- Doxapram can be used to stimulate breathing. It has a direct action on respiratory centres in the medulla of the brain.
- Isotonic crystalloid fluids can be used to treat or prevent hypotension by expanding blood volume and increasing tissue perfusion.
- Epinephrine hydrochloride can be used in cases of cardiac arrest to initiate heartbeats, as it increases the heart rate and cardiac output.
- Atropine may be used to correct slow heartrate or bradyarrhythmias (slow irregular heartrate) by stimulating supraventricular pacemakers in the heart.

Recovery

Recovery is a vital phase of anaesthesia, and monitoring should be continued through recovery. Recovery is often rapid once gas anaesthesia ceases. The rehabilitator should maintain the bird on oxygen during recovery and be prepared for mechanical ventilation in the event of apnoea. A brief excitatory stage may occur, which may be accompanied by regurgitation. The endotracheal tube should be removed when the bird starts to move its head.

Conclusion

Stress in captivity is considered the primary cause of death of wildlife in rehabilitation. Therefore, it is vital that wildlife rehabilitators work closely with veterinarians to decrease stress, especially for any procedures involving pain. Multimodal analgesia and anaesthesia are important tools to decrease stress, and wildlife rehabilitators familiar with these protocols will have patients that are more comfortable, less stressed and more likely to recover quickly from injuries and procedures with better outcomes.

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wrb WILDLIFE REHABILITATION BULLETIN

ARTICLE

Becoming a media ambassador

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Abstract

Speaking with the media is something that many wildlife rehabilitators and educators are faced with at some point in their career, but it makes many people uncomfortable—or maybe even downright terrified! The key to a good media interview is preparation and practice; the goal of this article is to give wildlife professionals some practical, attainable goals while practicing the skill of the interview.

BIO

Amanda Nicholson is the Senior vice president for Outreach and Education of Outreach at the Wildlife Center of Virginia. Amanda oversees the department responsible for public education and community involvement. Amanda supervises the Center's ever-changing website, manages the "Critter Cams" and moderated discussion, organizes the annual *Call of the Wild* conference and acts as the associate producer for the Center's television series, *Untamed*. She also serves as the program coordinator for the National Wildlife Rehabilitation Association's annual symposium.

Keywords

Media; interviews; reporters; press; outreach

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Introduction

Wildlife rehabilitators and educators have great stories to share; after all, the public loves hearing about wildlife. Given the appealing subject matter, reporters at a variety of media outlets are drawn to wildlife rehabilitators to help share stories. Common media stories include discussion about a current wildlife issue, seasonal observations of wildlife, a particular wildlife patient that has been rescued (typically with human-interest rescue story) or an upcoming event that a wildlife rehabilitator or facility is hosting. As technology allows reporters to be creative and create more stories over greater distances, a media interview may not look like it once did; while reporters still often travel to their interviewee's location, there are also a growing number of "distance interviews," utilizing Skype and shared video.

Technology and affordable equipment have also driven amateur media storytelling; more rehabilitation facilities are creating their own "in-house" videos for the public with the help of staff members, volunteers and/or students who have an interest and a knack for minor video filming and editing. These types of projects may feature the work of a wildlife rehabilitator, include staff interviews or perhaps highlight particular skills or techniques for training volunteers and students.

No matter who is on the other end of the camera, it is important that everyone gets the most out of their interview to best display the professional nature of the wildlife rehabilitation and medicine field. A rehabilitator's time on camera can be extremely valuable—though a terrifying prospect for some, it is an excellent way to represent an organization and/or profession and is a valuable tool to share critical wildlife information with the public. After all, it is a wildlife rehabilitator's duty to "encourage community support and involvement through … public education" [NWRA 2021].

Before the interview

The best way to avoid panic at the thought of an interview is to take time to prepare. Typically, a reporter will call and set up a time for an interview; many are operating on a tight timeline, but it is common to have at least an hour or two to prepare (if not more). Depending on the story angle, preparation includes re-reading a particular patient's record, reviewing the natural history of a particular species of wildlife or running through the logistics and timeline of an event. Pick the three most important points that the public should know about the subject matter—the three main takeaways from this information. Sometimes a quick discussion with a co-worker or colleague can be reassuring just to have another knowledgeable person offer feedback or additional thoughts on the topic.

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Before the reporter arrives, take a few minutes change into a clean, professional shirt for the interview. Appearance counts and will help shape the way the public views the story and subject.

Staging the interview

Reporters may be coming with an idea for a story, but they might not necessarily understand the greater context of what a wildlife rehabilitator or rehabilitation facility does. A quick tour will help provide the reporter with more context and may help frame the story. On the tour, the interviewee can point out one or two suggested spots for filming the interview. It is usually best to have one or two "pre-approved" places picked out to steer the reporter to a safe, comfortable location; given free choice, reporters may want to film inside a patient enclosure, for example, which would not be appropriate or safe.

Reporters often want their own footage of the animal or particular species in question, but it is important to remember permit conditions, which stipulate that patients may not be shown to the public. If a reporter is able to come and quietly film (without speaking) during a planned procedure, they may be able to get the footage they want for the packaged media story. Otherwise, it will be most helpful for wildlife rehabilitators to supply the reporter with a few short, horizontal video clips and/or photos of the animal or species in the story. It is important to be firm on this point—patient care may not be compromised for the sake of a story. While reporters may desire their own footage, it is not critical that it be their own to create a good story, and wildlife rehabilitators should remain advocates for their patients and profession. It is often helpful to set this expectation ahead of time, to pre-empt additional questions or discussion during the interview.

During the interview: speaking professionally

As the interview starts, reflect on the three most important points that viewers should come away with after seeing/hearing this story. Share those point in sound bites—short sentences of about 5–10 s in length. It is important to remember that to create a cohesive story, producers will break up an interview into short snippets; long awkward sentences typically make editing challenging and may be cut out altogether. Pausing briefly in between main points and sentences will allow for easier editing and will keep those important points in the story (Figure 1).

Seasoned reporters typically ask leading questions that will prompt the interviewee to make a full statement, but not all reporters are created equally and some will ask yes or no questions. Never answer "yes" or "no," this type of answer does not work from a storytelling perspective. Simply remember to repackage the answer with a part of their question to make a complete sentence (Figure 2).

Use bold action words if warranted, but exercise caution and do not overstate the point. Reporters may be drawn to more emotional, dramatic storytelling but always remember to provide professional messaging to the public. Avoid any "off the record" statements; expect that anything said to a reporter may end up in the story in some capacity, since reporters will sometimes use off-camera statements to help shape their story (Figure 3).

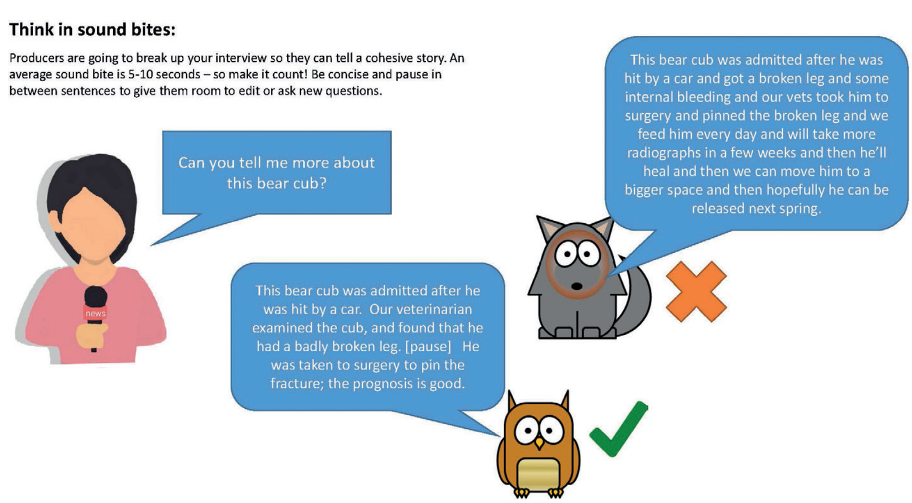

Fig. 1 Think in sound bites to provide short concise statements.

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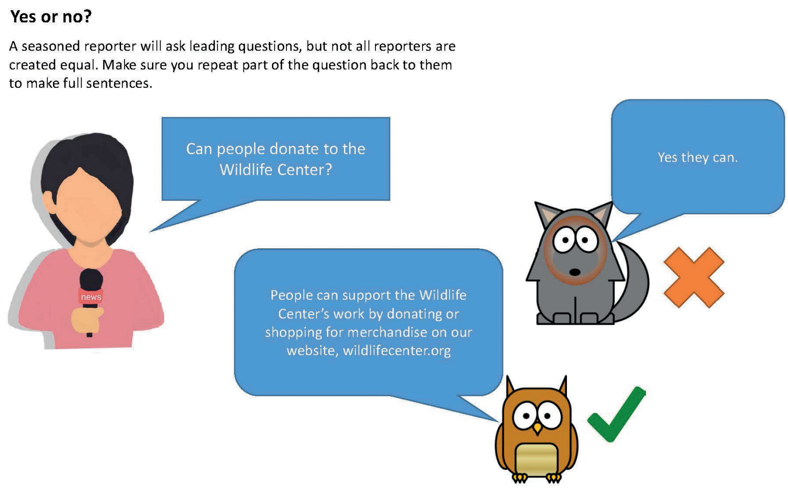

Fig. 2 Always answer in full, complete sentences – even if you are asked a yes or no question.

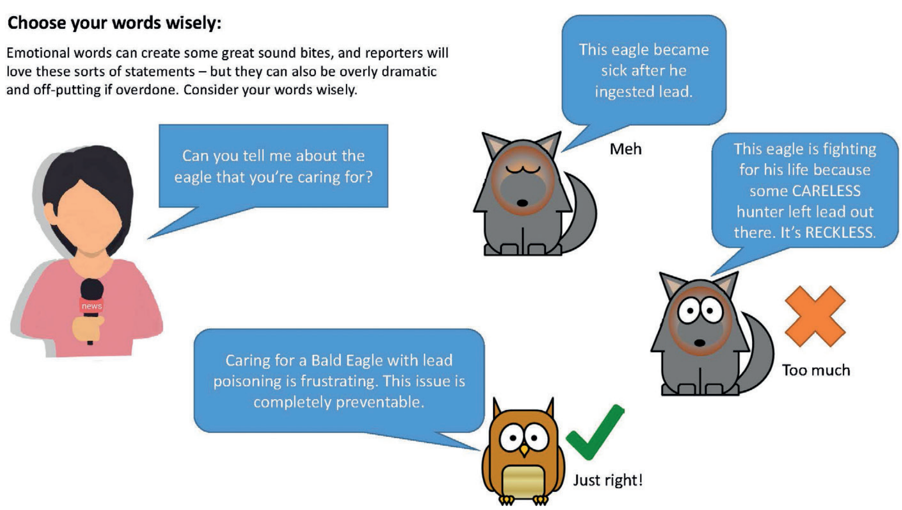

Fig. 3 Avoid overly dramatic and emotional statements – these may be taken out of context as sound bites!

Always tell the truth but be ready to "pivot" if needed. Sometimes reporters may ask questions about large-scale issues that are simply too complicated to cover in a 2-min news story; if the question seems as though it will lead to a difficult discussion, simply reframe the question slightly and give the sound bite that would be most appropriate for the story. Credibility is crucial, but always keep the interview on track and headed in the right direction (Figure 4).

Avoid using jargon; those in the wildlife rehabilitation and medicine field sometimes forget their audience and may use their own terms for species abbreviations (e.g., "EASOs" and "BADOs"), techniques (e.g., "QID feedings" and "auto-squirreling") and locations (e.g., "B-pens" and "Hold"), which does not make any sense to the general public (Figure 5).

Interviewees should also remember to be aware of personal mannerisms and habits while speaking during the interview. For the most part, those being interviewed can act natural but should avoid a lot of excessive, overt gesturing and nodding. Some mannerisms do not necessarily translate well on camera, but interviewees should also take care not to be completely wooden statues during the interview.

Nearly, all reporters will close the interview with a final question: "anything else?" While those who have not enjoyed the on-camera experience may be tempted to end the interview and be done, this is a

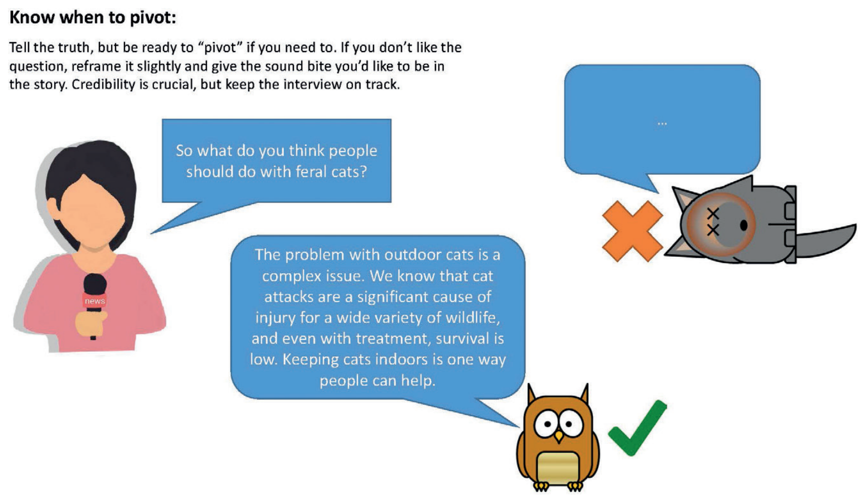

Fig. 4 If you don't want to answer the specific question you were asked, pause and re-frame the question.

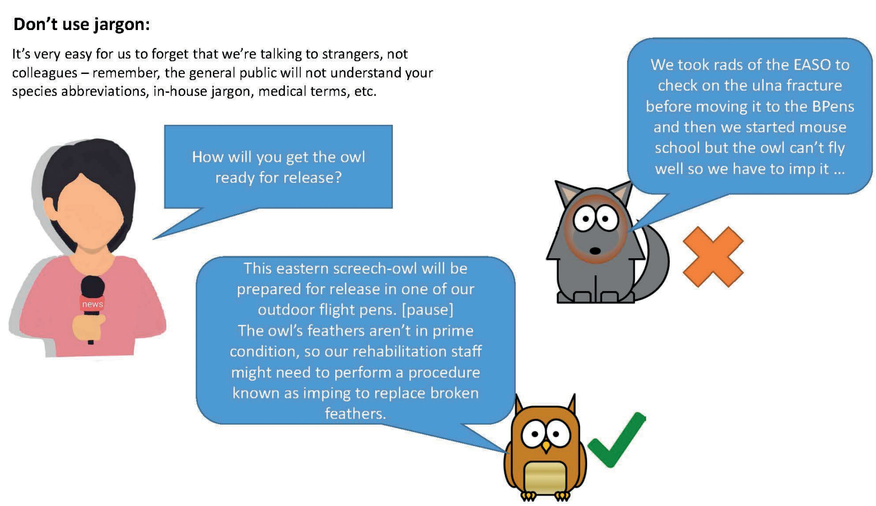

Fig. 5 Remember your audience and avoid using jargon and other "insider" language.

final opportunity to include any piece of information in the story that was not already asked. Even if the final answer is something along the lines of "For more information, visit [website]," this can be a good addition to the story (Figure 6).

After the interview

As the reporter is putting the camera away, ask when the story will air. Media stories are excellent ways to interact with a news outlet via social media and should be shared with supporters. Unless the reporter was truly terrible to work with, tell them how to get in touch about other story ideas; encourage them to follow the organization's social media presence and website if this is a good way to get ideas for future story.

While many people do not enjoy watching themselves on camera, reviewing the interview is extremely helpful. Interviewees will have a great example of how a media story is assembled and will better understand what sorts of statements work and which ones do not. When a friend or neighbour mentions seeing the story on television, ask what they remember about the interview and what they took away from it. This can be a useful way to gain insight into how the general message was perceived.

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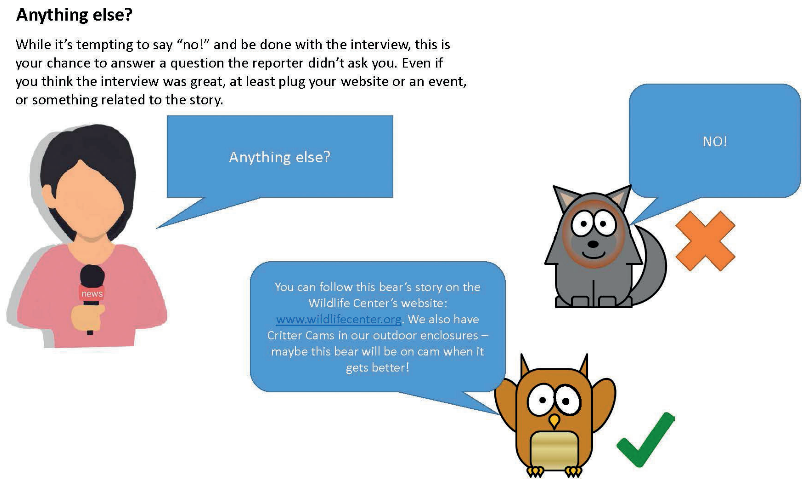

Fig. 6 Always leave the reporter with a brief summary or takeaway.

The role of B-roll

B-roll is known as the supplemental footage that helps add depth and context to the main interview footage. This footage is incredibly important—even if it is not the main interview, it makes stories much more interesting and captivating. For a wildlife rehabilitator or educator, b-roll may be as simple as quietly working in the background while a colleague is being interviewed or when a cameraperson requests to have a rehabilitator complete a simple task on camera.

Appearing in b-roll is simple; those on camera should just carry on with work as usual. Additional tips include not looking directly into the camera, and taking extra care to make sure appearance is professional.

Audio is not typically used in b-roll, but it is still advisable to curb all extraneous chatter that is not pertinent to the action that is taking place. Additionally, it is often a pet peeve of camera people when those being filmed ask, "Are you filming?" Anyone with a camera pointed at them can just safely assume they are being filmed!

Conclusion

Media stories are wonderful opportunities to share important and educational messages with the public and supporters. Taking time to prepare and present ideas and thoughts professionally can help share powerful and effective messages on behalf of wildlife.

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wrb WILDLIFE REHABILITATION BULLETIN

ARTICLE

Ethical considerations in wildlife medicine

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One Earth Conservation

Abstract

Component wildlife ethics includes two aspects: an understanding of ethical principles and skills in ethical deliberation. Ethical principles reviewed here include utilitarianism, deontological ethics, environmentalism or respect for nature, virtue ethics, relational ethics, care ethics and reverence for life ethics. Other processes and tools that take into account human sociology, behaviour and subconscious functioning in moral decision-making include conservation psychology, narrative ethics, socioscience, listening and communication skills, and needs-based ethics. We also take into account non-human functioning such as welfare science, conservation behaviour and cognitive ethology. Incorporating these tools and instituting ethical practices and programs within our wildlife and conservation management plans and organizations improve our ability to care for ourselves, other humans, wildlife and ecosystems.

BIO

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Keywords

Ethics; communication; veterinary ethics; wildlife medicine; nonviolent communication; conservation psychology; conservation behavior; animal welfare; utilitarianism

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Introduction

The stress veterinarians and rehabilitators experience over moral and ethical issues can be intense. This is in part because decisions on levels of care and whether the animal lives or dies may not conform to what is known to be in the best interest of the animal. Furthermore, society's understandings of animal's and human's relationships have changed dramatically in recent decades, with a plethora of differing viewpoints on animals' agency and value. In a given medical case, no one may agree on how much intervention is appropriate and how much financial resource to expend.

Those working with wildlife may experience even more challenges, given that funding, time and staff are often inadequate. The variety of species and their different needs make for complex treatment and care. Also, wild species often coexist in proximity to humans, which enhances the chance for human–wildlife conflict. The moral complexity of working with wildlife is staggering and not only leads to social conflict but can also cause personal burnout and stress. Finally, pressure on diminishing wildlife populations increases the stakes for a positive outcome, especially when dealing with rare and endangered species.

As a wildlife veterinarian specializing in wild bird medicine, and eventually moving to Guatemala to work with parrot conservation, the author directly experienced these challenges. Whilst working with parrots as well as other wild birds and animals that came into the clinic, what soon became clear was a lack of resources to adequately and humanely house and treat the wide variety of animals that came to the facility. Guatemala at this time was rife with poverty and guerilla warfare, and decisions made as a veterinarian also impacted the well-being of community members. For example, the author controlled the salary paid to workers, whether people worked in risky locales and situations, and how medical services could be provided. The demands were impossible to meet given the oppressive and violent conditions. As one professor in ethics once said, "Life is full of tragic choices. There is no correct ethical stance over another, only the presence of one another to support us as we engage to make difficult decisions in our life."

Although, in most situations, a veterinary clinic does not exist in such dire circumstances, many veterinarians experience the dilemma of how to address the often-competing claims of themselves, other staff members, clients and owners and their families, and the animals. This process of choosing between interests

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of self and interests of others, or between interests of others, is known as ethical deliberation. The more skilled we can become in ethical deliberation, the greater our ability to resolve conflicts that arise out of our passionate understanding of the best way to treat wildlife, whilst also caring for ourselves and the people with whom we work. Unfortunately, training in ethical deliberation has not been adequate to the task—people, organizations and animals may languish because of it. For instance, how people "got along with one another" was mentioned during the National Wildlife Rehabilitator Association's 2010 Symposium as a pressing concern amongst those working in wildlife rehabilitation. One recent study reported that up to 50% of conservation projects in Mexico fail due to interpersonal conflict and lack of social capital, and not due to funding restrictions or characteristics of the species or habitat (Rubio-Espinosa 2010). In another study, the most prevalent cause of conservation project failure was due to interpersonal relationships and conflict (Catalano et al. 2019).

A membership letter in January 2009 from the president of the American Veterinary Medical Association, Dr. James Cook, stated:

> … I am worried that differing perspectives on animal welfare have the potential to do what earthquakes and hurricanes couldn't do...divide us. The AVMA has plenty of science-based information to help legislators decide and veterinarians lead on these complex issues, but that isn't enough. I need for you to listen respectfully to your colleagues and engage in a respectful exchange of ideas. We all see things in different ways, but we can't get mired in those differences to the extent that we lose sight of our common goals and veterinary oath.

For the sake of our common goal of animal health, we need to find ways to engage in ethical issues, such as with respectful conversation. How we engage in ethical issues is as important as the ethical principles employed. Using the science of understanding humans and non-humans gives us tools that help us more skillfully and effectively handle ethical situations. This paper will review ethical principles as one framework for handling ethical issues and investigate other frameworks and tools to add to a wildlife medicine ethical toolbox.

Principal ethical approaches

Learning ethics happens best when situated in real-life situations, in which the participant is enmeshed. Think of a situation involving wildlife that caused some confusion, conflict or emotional reaction. These may be situations where decisions were made to offer more or less care, whether to cause more or less harm or where questions arose about whether a behaviour "is right" or if someone "should be" doing something different.

Examples of situations include the following: not having enough funding to pay for staff well or even take care of the animals; not having enough space to house the animal, which is an abundant species, and hence, must consider euthanasia; needing to release recovered individuals into subprime habitat or in less-than-optimal condition.

For the sake of clarity, I choose a common issue that often perplexes those who care for wildlife.

Imagine being presented with a young black-crowned night heron that was attacked by a cat. She is depressed and may have a broken wing. The reader has never treated this species before and is unfamiliar with how to diagnose, treat, house and release this particular species. In addition, there are no funds to cover costs, and money has been tight around the clinic recently. Finally, today is a very busy day, and there may not be much time to read, go online or call someone for information about caring for the bird. Should you or anyone else accept the bird into your care or, in general, treat wildlife?

Utilitarianism

Approaching the situation of the heron from the viewpoint of utilitarian ethics, the decisions is based on terms of better or worse—basically, a cost versus benefit analysis. One seeks to choose a strategy that maximizes good, which, in this case, considers the needs of the heron and the humans involved. Whatever decision is made can be justified because the final outcome causes less harm than if no action was taken. The end result justifies the means.

In this case, one must take a measure of where the suffering occurs. The heron is wild, and you know little of how to care for the bird. She will suffer in your clinic. Yet, the bird is suffering now. You and your staff will lose time and money to treat the bird. On the other hand, you will gain experience and positive public relations if you accept the bird. You also really like herons, and she is so beautiful. You would like to do the bird some good and learn more about herons by practicing on the bird. You figure that the bird will suffer more if you send it home with the kids who brought it in. You might call up the local rehabilitation clinic, but you know that they too do not have much experience in this species, are swamped with baby birds and do not have many staff or financial resources. All in all, you figure out that it is a greater harm to not accept the bird, so you do.

Disadvantages of the utilitarian approach include trying to determine what suffering is allowable under what conditions. What might be construed as minimal harm by one may be maximum to another. It also purports that individuals can be treated as objects and do not have intrinsic worth or value in and of themselves. In other words, you can do what you wish with animals and people if the final result is the least harm and the best for the most beings. This approach can lead to tough circumstances for individuals whose well-being is sacrificed for the benefit of others. Often, animal welfare approaches relating to animals fall under this principle.

Deontological ethics

This approach, on the other hand, elevates the worth and dignity of every individual as the ultimate good. One might know this as Kantian ethics, named for Immanuel Kant. Kant stated that humans have an intrinsic worth and dignity and should therefore be treated always as an end and never merely as a means. The same applies for non-humans—animals are not a means to an end.

In the case of the heron, one might say that under no circumstances should the heron be treated with less than 100% care. This means that considerations of publicity, learning, beauty, one's willingness to contribute or finances do not come into the picture. Knowing that adequate care cannot be provided for the bird, it is not accepted into the clinic. Alternatively, knowing this, the rest of the day's appointments are cancelled, and the bird is driven to a wildlife clinic that specializes in heron care. Alternatively, one might decide that there is not anyone who can care for the bird adequately, so she is euthanized.

The largest criticism to this approach is how hard it is to consistently adhere to absolute statements. For instance, one may say that herons should never suffer, yet as citizens allow the presence of a hog production farm nearby whose grounds flooded last year and killed a number of herons with the faecal pollution. One might also have competing rules at stake. For instance, one might say that herons should never suffer, and that humans do not have the right to end the life of another. These two rules can complicate actions if one does not have a way to end the suffering without euthanasia. The stance of animal rights organizations often falls under deontological ethics.

Environmentalist and respect for nature

Sometimes at odds with both deontological and utilitarian ethics is environmentalism or "Respect for Nature." In this approach, humans have duties to a species, not just to individual animals. Our moral concern is not whether a wild animal can live according to its evolved set of behaviours (deontological ethics says the individual animal has absolute integrity that cannot be violated) or what might cause the greatest harm to individuals or a group of individuals (utilitarianism). What is held as the ultimate value is the extinction of a species, which is deplorable.

In the case of the heron, one might consider what species of heron it is. Is it common, threatened or endangered? Is it not native to the area? Is it hurting other native wildlife? If the heron is not threatened, one might not be as concerned as if it were a rare species, or was suffering population decline or other environmental threat. One might also elect to not care for the bird because it is just an individual. Resources are directed towards the survival of the whole species, such as donations to conservation and environmental protection.

Criticism here lies in the fact that individuals might suffer as a result of actions that protect the species or the ecosystem as a whole, such as hunting deer or killing wolves. Who decides which individuals or which species merit less attention than other species or the ecosystem?

Virtue ethics

In virtue ethics, we relate to animals in ways that make us virtuous people. For instance, we say that a virtuous veterinarian cares for all animals. In the case of the heron, one would elect to treat the bird and do everything possible in to care for the bird, regardless of other commitments. Alternatively, one could say that a virtuous veterinarian is prudent; takes care of herself or himself, the staff and those she supports financially; and is the working and financial success of the clinic. In this case, one might not admit the bird or even spend time with the bird to see that cared was provided. Not only might there be competing virtues, but also with the previous two examples, the ethical choice is based on human perspective and not on the animal's.

Relational, care and reverence for life ethics

These are three approaches that are similar in some ways to virtue ethics, in that how an animal is cared for depends on how humans relate to the animal. In relational ethics, if we see our relationship to animals as stewards or as veterinarians, then we are inclined to take care of the heron. However, relational ethics does not tell us how to care for the bird and does not take into account the individual bird. It is our relationship to the bird that matters most. With care ethics, we draw on our empathy and say that if an animal suffers, we are obligated to do all we can to care for them. It is the author's belief that the care ethic is strong in wildlife rehabilitation. One possible disadvantage to relying on this as an ethic, however, is that it depends on humans understanding animal physiology and behavior, and correctly interpreting when an animal is suffering. What if our sense of empathy is misplaced or not even triggered? In these cases, we might care for the heron but not realize how the animal suffers due to our intervention techniques. Alternatively, we might not "connect" with the bird and not be able to properly care for the animal because we see it as "not suffering."

The term "Reverence for Life" comes from Albert Schweitzer, who said, "In this sense, reverence for life is an absolute ethic. It does not lay down specific rules for each possible situation. It simply tells us that we are responsible for the lives about us. It does not set either maximum or minimum limits to what we must do." Criticism here comes from there being no absolute guide for what we may do. For instance, one might consider the heron the most amazing wonder on Earth. We are responsible not only for this bird but also for all the other amazing species and individuals on the planet. How do we decide? Which animals "deserve" better care? Humans are inclined to offer greater reverence or compassion to those that look like us. We may wish to refrain from a speciesist stance in which we accord greater worth, respect or care to one species over another. Our subconscious, however, evolved to recognize faces and care for those closely related to us. For instance, the heron with her reserved stance and bird-like ways might be ignored more frequently or given less care or medication than an injured chimpanzee brought to the clinic. If asked, one might not admit to thinking that the heron has less worth than another species; however, the time, money and effort spent on one species say otherwise.

Similar to reverence, Tomas Regan writes of inherent worth. For Regan, every species has a distinctive value that is inherent in their existence. They are a "cup" that is precious in its own right, no matter how we might fill the cup with our definitions of "animal" or "species," or descriptions of their behaviour. No matter how we see the species or imagine their thinking, feeling, behaviour and capacity to suffer, all species are valuable and have inherent worth (Regan 2004). It is not our thinking, current philosophy or cultural constructs that determine our care, but the existence of the animal himself or herself.

Hybrid ethical views

In all likelihood, most of us would approach the heron with a mixture of ethical approaches, if not all of them! One set of principles alone does not seem satisfactory, and yet, a conglomeration of principles may be no less confusing and leave one straining to resolve the incompatible claims that each ethical approach demands.

> The opportunity to combine elements...does not, however, make it easier to formulate a plausible, logically consistent account of human duties to animal. (Sandhoe 2008)

No matter the approach, one is still faced with the fact that we treat species differently, and in a very real, pragmatic and tragic sense, we consistently compromise our values. In fact, the only consistent approach to ethics is that we are all inconsistent.

The author's rational approach to ethics encompasses the belief that there is no rational, consistent approach to ethics. Decisions are frequently made based on self-interest, past experiences and emotions that do not register in the cognitive realms. In one study of veterinary students at Cornell, those aspiring to work with food animals considered more procedures to be humane for all species than did students aspiring to work with small animals (Levine et al. 2005). Both sets of students experienced the same curricula; however, their careers impacted their interpretation of this knowledge.

In the case of the heron, the veterinarian or rehabilitator might be experiencing a difficult day due to an argument with a family member or friend. This results in fewer personal resources to give to a complex and time-consuming situation such as treating the heron. On that day, one might be more inclined to argue that the heron is not suffering, or that it is okay to spend less time on the case than one might otherwise. Consciously, if given time to think or research, one knows that biology, physiology and welfare science indicate that birds do feel stress and pain in therapeutic procedures. At a subconscious level, however, one might take shortcuts in treatment or alternatively compromise self-care. Either way, our subconscious is often the final decision maker in what we do. Hence, it behoves us to know all we can about how humans think and feel, so we can challenge our assumptions in order to deliver the best care to ourselves and others. In addition, learning all we can about non-human animals will impact our discernment of what we can do to positively impact their well-being.

Understanding humans

Though we seek to understand humans as irrational beings, we should not dismiss a rational ethical approach that conforms to ethical principles. Rationality can refine and improve our choices and perhaps ease our own confusion or discomfort. We are largely influenced, however, by the culture around us in ways of which we are not always aware. The greater our awareness of how we are influenced helps us understand both ourselves and others whose actions may be at odds with ours or seem inconsistent. Understanding promotes empathy for ourselves and others, which, in turn, promotes greater ability to discuss ethics. Empathy opens space to increase our understanding of cultural influences, feelings and thoughts, which, in turn, promotes greater empathy.

Humans as feeling animals

Understanding human's emotive functioning guides us in discerning how we reason and interact socially (Briscoe & Joyner 2008). From earlier ape ancestors, humans inherited complex emotional responses hardwired to help us form social attachments and engage in care giving. The need for social attachments helped us not only raise our young but to offset the biology of earlier apes that leans towards freedom, autonomy, individualism and ego (Turner 2000). Whilst the earlier ape biology was successively adaptive to living somewhat individually in a subarboreal niche in the forest, this way of living proved impractical as ape species radiated out in the Africa savannah. There, human ancestors needed to support one another in complex social relationships so as to maintain social cohesion and reciprocity to combat predation and secure food.

To grow in social complexity, the ability for complex emotions also grew. Since humans are hardwired for complex emotions, we are primed to form attachments in a large variety of forms, including those far from one's base family and community and extending out to other species. In tension with this desire to form attachments is the individualism and ego of ape evolution, which influences any care situation such that humans are also primed to seek benefits for themselves alone and to eschew community, including communities of mixed species. Along with self-interest, humans also evolved to rely upon each other, seek connection, and appreciate biodiversity. We have developed an "innate tendency to focus on life and life-like processes" (Wilson 1984) and can respond to non-human animals with a sense of kinship and awe. This appreciation of life and the living world are known as biophilia.

Cognition or rational thinking partners with emotions, the limbic system and subconscious thought-processing to impact our ethical codes and moral actions. In simple terms, a "low road" uses neural circuitry that runs through the amygdala and other similar automatic nodes without being conscious of it, and the "high road" sends messages to the prefrontal cortex where one can think about what is happening and intentionally impact our actions. The low road is always operating and, indeed, impacts all our decisions and actions. For this reason, a rational argument alone will not greatly impact human behaviour, and indeed, rationality does not exist outside of the emotions that underlie our thinking.

Unfortunately, research in the past has overlooked the role of affect and emotions in moral functioning (Zeidler et al. 2005). Recently, we have learned that care, empathy and other relational-based concerns impact learning and decision-making, as does having a sense of safety and comfort. For instance, in one study, girls more than boys gave greater attention to safety and comfort of themselves and others and less to that of decision-making (Zeidler et al. 2005).

Overlaying this evolved neural (limbic and cognitive) network to form attachments is the capacity for culture to guide human moral concerns. This is in part because humans have evolved to use rituals to mobilize emotional energy for the benefit of community. In other words, rituals found in community gatherings, such as those in religious traditions, guide behaviour for adhering to ethical codes and community taboos and strictures. Furthermore, the use of negative emotions such as guilt, shame and fear developed for social cohesion, as did the use of positive emotions such as pride, satisfaction and happiness (Goleman 2006).

Humans as learning animals

Knowing how emotions impact reasoning is but one factor to consider in social interactions. Intertwined with how we feel is how we learn. Understanding how these two dances together tempers our plan for intentionally growing our capacity for ethical engagement.

A recently discovered brain cell, the mirror neuron, senses both the physical moves another person is about to make and their feelings and prepares us to imitate that movement and feel with them. Mirror neurons exist throughout our lives, ever adapting to social cues around us and how we might care for others. When our body mimics the action of another person, we have a greater sense for what that person or non-human animal felt. We are able to do this not through conceptual reasoning (high road) but through direct simulation, by feeling, not by thinking (the low road; Goleman 2006).

Another recent understanding is how our brains have an incredible capacity to grow and to heal, even as we age and after terrible trauma (Bolte 2006). According to the theory of neuroplasticity, thinking, learning and acting actually change both the brain's physical structure and functional organization from top to bottom. This means that we heal after emotional and physical trauma to our brains, and the potential to grow the ability to communicate, empathize and think is always present. This is a paradigm shift in our understanding of the brain and brings hope as scientists get closer to designing protocols and strategies to grow and heal brains of all ages. In other words, we can always learn and grow in interpersonal and intrapersonal skills and understandings.

Humans in culture—speciesism

As mentioned earlier, we view species differently, often with a bias towards those animals most closely resembling humans. The result is that we treat different species differently, even though our values are to care for all species equally and accord them respect. The challenge to live according to our values is that we have subconscious and even conscious understandings of species that our culture constructs. For instance, herons and eagles may feel the same amount of pain, yet the author would guess that in most cases, eagles garner much more care and support than herons. This is known as speciesism, "a failure in attitude or practice to accord any nonhuman being equal consideration and respect" (Dunayer 2004).

Human dimensions of wildlife and conservation psychology

Besides speciesism, there are many other ways that cultures construct how we view animals, resulting in acting inconsistently. One aspect comes from the work in the social science of human dimensions in wildlife. Here, one sees how values, ideology and value orientations impact behaviour. Findings suggest that "values related to conformity, tradition, security, and self enhancement support utilitarian views toward wildlife, while values related to openness to change and self-transcendence support more protectionist, aesthetic, and mutualistic views toward wildlife" (Manfredo 2008). Depending on how these collections of values are emphasized, one might lean towards an utilitarian view (animals can be used as a means to an end) or mutualism (animals have worth in and of themselves and did not evolve to be manipulated by humans).

People also diverge on ideological perceptions of wildlife. In hunter and gatherer societies, many researchers posit that an egalitarian ideology was present. Wild species were fellow inhabitants of the same world. A domination ideology emerged with pastoral societies as hierarchies formed amongst people and between humans and non-humans. This domination ideology underlies how humans see themselves as separate from nature in modern times and facilitates the belief that humans' role is to exercise mastery over wildlife (Manfredo et al. 2009).

Value orientations impact behaviour as well. For instance, two different people might hold equally important the value of treating all living things humanely. Yet, this value might lead one person to euthanize the heron and the other to attempt to save her life. The difference is due to value orientation. Two value orientations direct a lot of thought about wildlife in North America (Manfredo et al. 2009). One value orientation is domination and the other is egalitarian or mutualism. "The stronger one's domination orientation, the more likely he or she will be to prioritize human well-being over wildlife, accept actions that result in death or other intrusive control of wildlife, and evaluate treatment of wildlife in utilitarian terms. A mutualism wildlife value orientation, in contrast, views wildlife as capable of living in relationships of trust with humans, as life-forms having rights like those of humans, as part of an extended family, and as deserving caring and compassion." In the United States, there is an increasing trend towards mutualism orientation and away from domination, though both are prominent within our society.

The field of conservation psychology takes what we know about the science of human behaviour and the interdependence between humans and nature and then seeks to promote a healthy and sustainable relationship (Clayton & Myers 2009). Currently, there are books, journals, conferences, websites, departments at universities and careers founded on how we understand humans in relation to other species and how we can use that understanding to impact behaviour. Conservation psychology persistently and deeply asks: what is the human place in nature and what is nature's place in the human being? These questions are asked, so that we can sustain care. To care about an issue or a species, people must be informed, people must feel and "people should act in ways that express both their knowledge and their emotions" (Clayton & Myers 2009). Conservation psychologists coach people to care by integrating cognition, emotions and behaviour. Behaviour change does not happen just at the individual level but involves whole communities. One must also seek to align our behaviour with our values in community settings in order to see if more of our energy, resources and time is spent defending our ideological stances than in taking concrete steps to improve care for others.

One conservation psychology tool that works at the community level is ethnoornithology. Ethnoornithology "explores how peoples of various times and places seek to understand the lives of the birds round them" (Hunn 2010). It studies the relationships between humans and birds. In the author's work, understanding is sought about how people working in the complex and often discouraging situation of conservation and wildlife medicine in Central America think of birds. Understanding what motivates them to do this work and how they make meaning of their work informs how we could support and improve our efforts. To gain this understanding, in 2009–2011, the author conducted ethnoornithological research targeting conservationists working in Central America.

Briefly summarizing hundreds of pages of notes, the author found that the major meaning-making activity was the work itself (collecting data and applying knowledge to improve the lives of birds) and the times when teamwork was most manifest. Meaning-making also happened frequently around meals when stories were told of the work and experiences. Meaning evolved during the collection and review of media, such as photographs and videos. Whilst watching media, they gathered to partake in both silent storytelling and spoken meaning-making as they talked about what they are seeing. Meanings that frequently surfaced regarding their efforts included love, conversion, calling, insiders/outsiders, interconnection, death, hope, end times (eschatology and apocalypse), sacrifice, service, suffering, compassion, worth and dignity, awe, wonder, social justice, prophetic voice, resistance and solidarity. Having time for meaning-making activities allowed the team to work together more effectively across differences of class, ethnicity, language, gender, religion, age, values and behaviour patterns.

Though it is not possible for everyone involved in wildlife to become proficient with the sociological aspects of human and wildlife relationships, there is much merit in forming multidisciplinary teams that include social scientists or facilitators to help us navigate the complexity of human thinking and behaviour.

Understanding non-humans

Cognitive ethology and conservation behaviour

Non-humans also experience complex thinking, emotions and behaviour. In recent decades, the field of cognitive ethology has emerged to help identify what an animal experiences. Cognitive ethology "emphasizes observing animals under more-or-less natural conditions, with the objective of understanding the evolution, adaptation (function), causation, and development of the species-specific behavioral repertoire" (Tinbergen 1963). In other words, as one studies the subjective lives of animals, one can better understand their levels of stress, suffering or discomfort. This informs how our actions (or inactions) impact the well-being of other species. By studying animal cognition, we develop tools to change attitude and perceptions of non-human animals in society, and hence improve treatment (Mendi & Paul 2004).

Conservation behaviour is the application of knowledge of animal behaviour to solve wildlife conservation problems (Blumstein 2010). By knowing a species' social, reproductive and antipredator (or predation) behaviours, one can help design conservation strategies that take into account non-human cognition and behaviour. Such strategies include rescue, rehabilitation, translocations and reintroductions, and hence wildlife medicine.

Welfare science

The scientific approach to animal welfare is one framework that society can use to resolve questions about the proper treatment of animals. It works in conjunction with other frameworks within the broad range of ethical approaches, such as the theories, philosophies and principles of ethics outlined in the beginning of this chapter. "The scientific study of animal welfare makes important and unique contributions to issues of animal ethics. It can be used to indicate and clarify problems, identify trade-offs, evaluate alternatives, develop solutions, and build up an understanding of how life is experienced by animals themselves" (Fraser 2008). Keeping abreast of recent research in welfare science guides humans in determining the validity of assumptions of animal well-being, whilst also minimizing the propensity to project one's own subjective experiences onto animals. The Five Domains Model is an excellent tool and includes five categories to assess welfare: nutrition, environment, health, behaviour and mental domain.

Compassion and communication tools for engaging ethical complexity

Determining what animals think, how they feel and how they suffer through philosophical arguments, cognitive ethology and welfare science must be part of our ethical decision-making process. Ultimately, however, one can never know what is "best" in the morass of ethical vagueness regarding non-human life. Instead, one can be compassionate in each moment by considering the needs of all species, which can only be done by having open and sustained discussions with our fellow humans. We might still make tragic choices, but less so. Every deliberation or application of wildlife medicine then becomes a practice ground for the skills of compassion and communication, which impacts our delivery of ethical care. The following are some tools for improving communication and compassion.

Narrative ethics

In narrative ethics, stories are told about ethical choices. Whilst speaking, the teller is able to clarify their own needs and values, as are the listeners. These stories take the form of case examples that cover more than the medical aspects of a situation. They also highlight moral guides to living the good life, not just in veterinary care, but in all aspects of one's life. These narratives of witness with their experiential truth and passion compel re-examination of accepted medical practices and ethical precepts, which, in turn, allows us, as a community, to develop our ethical abilities. Using narrative ethics that emphasizes communication does not preclude the use of principle ethics. Indeed, both contribute to understanding moral life and the process of ethical decision-making in healthcare situations (McCarthy 2003).

In the case of the heron, members of the care team might gather to hear the case report of how decisions were made to care for the heron. There is no "right" or "wrong" ethical philosophy or principle here to determine. Instead, the process brings together everyday humans struggling to make the best choice possible in the given situation. In the process of telling, an internal dynamic occurs within both the teller and listeners that stimulates emotions as well as conscious and subconscious thought of past experiences, values and cultural constructs. This dynamic helps us align our behaviour with our thoughts and emotions.

Socioscience

Mark Twain once said, "The physician who knows only medicine, knows not even medicine." Socioscience guides the veterinary team member in knowing more than medicine. It is similar to narrative ethics, in that those in science and medicine take time to examine the ethical implications of their work through intentional periods of presenting and discussing ethical case reports. During these case reports, socioscience stresses morality and ethics as well as the interdependence between science, medicine and society. It does this by considering the psychological and epistemological growth of child or adult individual, and the development of character or virtue (Zeidler et al. 2005). It focuses on growing the individual through relational challenges that focus on complex ethical situations that involve science and human communities. Relational skills and growth are paramount; habits of mind may suffice for decisions and actions initiated by an individual but do not suffice for real-life complex situations that animal caretakers encounter. A given medical case might entail desires for the flourishing of not just the non-human animals but also of self, family, staff, broader communities, global society and habitats full of other species.

Relational and communication skills are also important because often the best possible decision or action requires collective decision-making that can be both challenging and uncomfortable. In these decision-making processes, the group constructs meaning and understanding through the pedagogical power of discourse and reasoned argumentation. Humans together, rather than alone, have the power to integrate the emotive, developmental, culture or epistemological connections within the decisions and actions themselves.

Ethical deliberation draws on personal beliefs, individual emotive characteristics and individual identity within a community, such as gender and ethnicity. To engage in discourse that tugs at emotions, core beliefs and identities, mutual respect and tolerance of dissenting views must be supported for the development of more sophisticated learning. Under all levels of discourse, we must examine how power and authority are embedded in scientific and medical enterprises, such as privilege, class, gender and ethnicity. To truly engage in a socioscientific approach to wildlife medicine, it follows that "buttons must be pushed, lines must be crossed, and sensibilities must be challenged" (Zeidler & Sadler 2007).

Full listening helps us attune to others and their internal states. By stilling the cognitive loops and chatter that go on inside of us, we come to attentive recognition of what another is feeling and, hence, have a greater chance to understand them and offer empathy. When another person feels heard and receives empathy, they, in turn, are in a better place to listen, as well as recognize their own emotional state without it being overridden by concerns of threat from without.

Transformational reasoning occurs when one can clearly internalize and articulate the thoughts, arguments or position of another. This is because one's reasoning becomes integrated with that of another (Zeidler et al. 2005). In socioscience processes, one begins with the presentation of controversial science or medical case studies followed by participants taking turns arguing various viewpoints. It is important to repeat back what one has heard and to argue the case you do not agree with. In this process of "pretending" to take the other side, one actually gains in empathy for other positions and grows in sophistication with one's newly acquired and more integrated ethical approaches. Participants can also be urged to build consensus regarding the issue to further expand their abilities in discourse.

In practical terms, a group of rehabilitators could hold monthly meetings that discuss the ethical and moral implications of their work. By coming together in this way, the group grows their relational, listening and dialogical skills. This brings greater coherence between their values, subconscious processes and behaviour towards one another and the animals in their care. A trained facilitator can help guide the group in both narrative ethics and in socioscience case reports and encourage ever greater active listening and empathy.

Needs based ethics and compassionate communication

Compassionate Communication, based on Marshall Rosenberg's Nonviolent Communication theory, emphasizes honesty and empathy in interpersonal and intrapersonal relationships (Rosenberg 2003). Through practice, it leads to shifts in thinking and emotional responses. It is based on the understanding that human beings operate best in social groups when they receive empathy. Greater connection and rapport between individuals, so paramount in social discourse, occurs when communication (verbal, paraverbal, and body language) used arises naturally from the subconscious's emphasis on the idea of universal needs and not on judgment, blame or domination to get needs met. Instead, empathy through deep listening, authentic sharing of needs and feelings and clear requests suggest the best strategy for people to come up with creative solutions where everyone is heard and everyone, including non-human animals, has their needs considered. Turner develops this theory by developing concrete ways that people can transact through the medium of needs to produce positive emotions and commitment (Turner 2002).

In the case of the heron, we seek to empathize with the needs of everyone involved in the case:

- The heron
- Herons as a species
- Veterinarians
- Veterinary team members
- Rehabilitators
- People who found the heron or care for the cats who attacked the heron
- Family members of those working with the heron
- Habitat and other species that evolved in balance with the heron (as prey and predators)
- Individuals within local conservation and wildlife groups, such as preserves and the Audubon society
- Yourself (as reader)

By equally considering the needs of all involved, one can come up with creative, synergetic solutions that deliver the best care possible to the broadest constituency. This happens because keeping "all needs on the table" allows one to break free from ideological stances or cultural constructs that might normally restrain us, such as animal rights versus animal welfare, or domination versus mutualism. Instead, one comes into a spaciousness to hear one another and, indeed, listen to how life is coming through the very worthy lives of the species with which we share our communities. This does not ensure that hard choices will not still need to be made. Even if the ultimate choices one make are regretful, such as euthanasia or trapping the feral cats living in the preserve, one's work is sustained by connecting fully to the broad diversity of life around us.

Where do we go from here—next steps

Component ethical discourse cannot be achieved by reading this paper, or even the thousands of tomes dedicated to ethics. Ethical processes also differ between cultures, and this article only begins to touch the surface of how multicultural skills are an important part of moral reasoning. It takes practice, hard work and discomfort for our whole lives. We can always improve. We are neither static beings—nor are others, our communities or our science or medicine. Ethics cannot be achieved then by just one period of focus. One is not alone in this life-long effort because ethical discourse also cannot be done alone. It is a multidisciplinary effort that involves the community, in which our wildlife medicine is embedded. The question of what to do next is not "What will I or you do?" but "What will we do, together?"

For future herons and other wildlife, there is much we can do together. We can work together to develop protocols within our institutions or strengthen individual and community processes of support. We do this, so that our care will be dictated by our ultimate values and the inherent value of other species, and not by the vagaries of our cultural influences and daily events.

Possible actions

1. Organize a study group that reads and discusses relevant texts;
2. Organize an ethical practice group to develop skills and confidence in ethical deliberation (and to challenge unchecked assumptions);
3. If you belong to an organization, do numbers one and two above within your group;
4. If you are individual, seek companions who will join you, or alternatively find a partner with whom to learn and confide;
5. Present and discuss ethical case reports within your medical team;
6. Present ethical and human dimension lectures at meetings and provide opportunities to practice ethical deliberation at conferences and symposiums;
7. Form an ethical guidance committee to support these processes within the organization and to support members.

Conclusion

So, what about the heron? Are you any closer to knowing what you would do in this case, or future cases? Specifically, does this paper help improve your clarity of thought, process of decision-making or application of care? The author would like to know, as she believes that we employ ethics as a community of wildlife care practitioners and would like to support you in your work. In the nourishing of ourselves, we can give more to the flourishing of all life. Even if one cannot decide how to take care of the next wild animal, one comes across in a clinic, backyard, roadside or preserve, perhaps for the one after that and the many to come. This paper is just a beginning of a shared lifelong obligation as stated in the veterinary oath.

THE VETERINARIAN'S OATH

Being admitted to the profession of veterinary medicine, I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health and welfare, the prevention and relief of animal suffering, the conservation of animal resources, the promotion of public health and the advancement of medical knowledge.

I will practice my profession conscientiously, with dignity, and in keeping with the principles of veterinary medical ethics.

I accept as a lifelong obligation the continual improvement of my professional knowledge and competence.

Disclosure statement

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