Field studies and the IACUC: protocol review, oversight, and occupational health and safety considerations

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Field studies involving animals, like other institutional research endeavors, are regulated and evaluated by an IACUC to insure that the protocols employed in those studies are consistent with the most humane care and use of animals. Unlike many other on-site research projects, however, field studies present unique logistical and other challenges to IACUC evaluation. The authors explore many of these challenges, including the special protocol considerations and idiosyncratic occupational health and safety concerns characteristic of field-study reviews.

The Institutional Animal Care and Use Committee (IACUC) is charged by both the Public Health Service *Policy on Humane Care and Use of Laboratory Animals* (PHS Policy)¹ and the *Guide for the Care and Use of Laboratory Animals* (Guide)² with the oversight of the animal care and use program, including worker occupational health and safety (OHS). Although IACUCs should be guided by uniform principles that are independent of study design and applicable to all animal studies—from those involving transgenic mice maintained in the laboratory to those focused on field mice living in the wild—there are some fundamental differences between field biology research and basic biomedical research that the Committee must recognize so as to correctly apply the principles of the *Guide* and PHS *Policy* to these different types of study.

The types and aspects of field studies that an IACUC may be called on to review include studies that:

- Assess animal population changes in the wild;
- Evaluate animals' behavior in their natural habitat;
- Gauge and manage naturally-occurring disease among wildlife populations;
- Measure the impact of environmental alterations on animal populations;
- Involve collecting animals for exhibition (as in a museum);

- Assess the teratogenic and mutagenic effects of a polluted area on select aquatic species;
- Trap, mark, and release animals as part of a graduate student research project; and
- Collect scat, tissue, or other samples from wildlife for analysis at the laboratory bench.

Such field studies fall under the legal purview of an IACUC when:

- The study is funded by the PHS or National Science Foundation, or if any other specific funding agency requires review;
- Per the Animal Welfare Act and Regulations^{3,4}, the animals are warm-blooded and the study has the potential to cause harm or alter the behavior of the animals under study;
- State regulations or the respective permitting agency requires IACUC review; or
- The institution chooses to extend to wildlife the same due consideration given to the animals on studies conducted in-house.

The number of field studies reviewed annually by an IACUC generally represents a very small percentage of the overall research effort. The Committee members' combined expertise may not be sufficient to critically review species-specific field research. The multiple thousands of species of fish, birds, amphibians, reptiles, and mammals that could be the subject of a field

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research study will challenge even the most diversely educated IACUC members. Therefore, the Committee may, as a first step in its review, consult with experts (such as ecologists, zoologists, wildlife biologists, etc.) on the proposed means of capture, study design, and husbandry requirements of the animal species involved in the research.

PROTOCOL REVIEW CONSIDERATIONS

Although a study's design can simply entail observation of the animal at a distance, some studies may require capture or capture and manipulation of the animals. These methods can induce stress in both the animal of interest as well as non-target species and neighboring animal populations. An IACUC must therefore raise and evaluate questions specific to wildlife studies, which may pertain to specific line items presented in the animal care and use protocol or be included as part of an internal checklist of questions used by the Committee during review and deliberations.

Pertinent questions

The six principles paraphrased below from the *U.S. Government Principles for Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training*⁵ serve as valuable starting points for IACUCs reviewing wildlife studies⁶⁻⁸.

1. The transportation, care, and use of animals should be in accordance with applicable local and federal guidelines. Some questions raised by this principle include the following:

- How will researchers capture the animals? How will researchers minimize the potential harm caused to the animal of interest by the traps? Are the traps designed to prevent capture of non-targeted animals? Who will perform the capture and has that individual been appropriately trained?
- If required, how will the researchers transport animals to a study area? Is the transport method humane? Will transport occur in a personal vehicle, open truck bed, or in an enclosed van with environmental controls? Will the animal need temperature-controlled air (or water, in the case of aquatic species)? Do safety concerns or parameters of the study require that during transport personnel are not exposed to the animal or that the animal is not exposed to the environment? Will the animals be exposed to other animals or biological variables that could endanger them or others? If the species itself presents a hazard, what special measures are in place to prevent escape?
- During transport, how will food and water be supplied? What time of day will the animals be transported? Oftentimes, overnight ground transportation is best. How and how often will the animals be checked? Transport may require scheduled stops.

Investigators and their staff often require training on capturing and handling wild animals. If the Principal Investigator (PI) has not previously dealt with the species under study, the training may have to come from experts who have published on the species. Biologists of the professional societies linked to mammals, birds, amphibians, reptiles, and fish have published guidelines addressing basic animal needs, as well as field techniques inclusive of capture⁹⁻¹³. Alternatively, some groups, such as Safe-Capture International, Inc. (Mt. Horeb, WI), offer specialty training and certification for research personnel.

2. Pain, discomfort, and distress must be minimized when consistent with the science of the study. Painful procedures should be performed with appropriate sedation, analgesia, or anesthesia. Unless proven to the contrary, something that causes pain in humans should be assumed to cause pain in the animal being studied. Some questions raised by this principle include the following:

- How often and at what time will the live-animal traps be checked? Will the animal be appropriately sheltered and protected from predators?
- How will the animals be managed and handled once captured? Simple restraint can be extremely stressful to a wild-caught animal; what steps will be taken to minimize the stress of handling? Does handling have the potential to cause rejection by conspecifics if released?
- How will the researchers conduct tissue sampling? Will it cause pain and/or distress?
- If the animal will be sedated for procedures, what, if any, are the drugs of choice, given a potentially novel use? At what dosages and via what routes?
- If pain is expected, and analgesics or sedatives are administered, will the animal then be put at risk by predators or rejected by conspecifics?
- If the animals will be marked and tracked, does the marker impede movements, make the animal a target for predators, cause pain in the marking process, or affect the animal's behavior? Will the markers be removed at the end of the study, thereby requiring another capture and release?

Unfortunately, there is scant scientific documentation regarding pain perception in the myriad species potentially studied in the wild. An IACUC may have to address these questions in an information vacuum, ever-conscious of taxonomic differences. Clearly, professional society guidelines (the American Societies of Mammalogists, Herpetologists, Ichthyologists) are useful tools for protocol directors and IACUC members to reference current approaches to field study practices. However, such guidelines may deviate from current regulatory policies and require written justification on the part of the protocol director.

In addition to capturing and handling animals in a way that minimizes distress, the staff must recognize,

prevent, and treat immobilization-related medical emergencies, such as respiratory arrest, shock, hyperthermia or hypothermia, bloat, physical injury, seizures, and the potential mortality of untended young. Ideally, the institution's veterinary staff can help to train investigators in surgical techniques that may be part of the wildlife protocol by using in-house animals of similar body conformation and physiology.

3. If an animal experiences significant pain or distress that cannot be relieved, the animals should be painlessly killed. Some questions raised by this principle include the following:

- What happens if an animal is injured in the course of manipulations (for example, broken wing, cardiac arrest, etc.)?
- Is euthanasia part of the protocol? Is the procedure humane and can the principles of the American Veterinary Medical Association (AVMA) Panel on Euthanasia¹⁴ be applied?
- How will researchers dispose of carcasses? Does carcass disposal have the potential to negatively impact the surrounding wildlife, as in the case of a carcass tainted with chemicals, for instance?

IACUCs commonly require animals to be rendered unconscious by chemical administration prior to euthanasia by physical means. This approach may be perceived as cumbersome or impractical by study personnel and may require the use of additional permits to carry controlled substances in the field, a potential legal concern if not adequately addressed.

4. The living conditions of the animals should be appropriate for the species and contribute to their health and comfort. Direction must be provided by individuals trained and experienced in the care and use of the animals being studied. Veterinary care must also be provided. Some questions raised by this principle include the following:

- Will live animals or their tissues be brought into the institution's animal facility? If so, what is the pathogen status of the animal living in the wild? Because this information may be difficult if not impossible to obtain, are there appropriate quarantine and barrier-housing conditions under which the animal can be maintained? Are the typical housing parameters described for an unusual species available, including special diet, ventilation, or water chemistry criteria? Does the caging system support the biological needs of the animal? Are the people who will be handling the animal adequately trained?
- Are the appropriate collection and wildlife permits current and in place?

Each state has its own requirements for collecting, housing, sampling, displaying, and generally using wildlife. In addition, when animals or their tissues are moved between states, each state's fish and game agency

(or department of natural resources), including wildlife preserves and refuges, should be consulted for compliance with specific policies and regulations. When animals or animal tissues are imported from another country, several agencies should be contacted to ensure that necessary permits and precautions are taken.

Common regulatory agencies that oversee the collection and handling of wildlife include the United States Fish and Wildlife Service, the Department of the Interior (specifically in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora¹⁵ for the international impact on endangered and threatened species), the United States Department of Agriculture Animal and Plant Health Inspection Service (for protection against importing animal pathogens⁴), and the Centers for Disease Control and Prevention (CDC) (for protection against importing human pathogens).

Other relevant federal legislation includes: the Lacey Act¹⁶, which pertains to movement of wild mammals or parts thereof to non-designated ports of entry and anything related to injurious wildlife that could cause environmental or agricultural damage; the Marine Mammal Protection Act¹⁷, which regulates the harassment and handling of all marine mammal species; the Migratory Bird Act, which regulates the handling and banding of migratory bird species; and the Endangered Species Act of 1972.

5. The animals used should be appropriate to the studies proposed. Efforts should be made to minimize the number of animals used. IACUC members may find themselves challenged when approving animal numbers related to a field study proposal. In studies ranging from population abundance assessment to satellite tracking of elusive species, there is often little information or guidance as to the number of animals the researchers will handle. Moreover, the species of study may not be well-characterized, the experimental approaches may be as unique as the species used, and the numbers of animals may be justifiably large (perhaps an entire population in some studies). There may even be cases in which the number of animals to be used is unknown as it depends on collection opportunities. Therefore, IACUC members may decide to request citations for the numbers of animals used previously in similar activities or may take input from a second source, such as a qualified statistician.

6. As quoted from the Guide, "The IACUC must be satisfied there is an effective occupational health and safety program which ensures that the risks associated with the experimental use of animals are reduced to acceptable levels and that personnel are adequately trained." Questions specific to wildlife studies should be raised and evaluated by the IACUC. They may be specific items in the written study protocol or be included as part of an internal checklist used by the

Committee during review and deliberations. Examples of these questions include the following⁶⁻⁸:

- Does the animal that is to be captured or handled pose a risk to human health (such as by toxin exposure or physical trauma)? Are ectoparasites a concern? Are there zoonoses known in the local population, either associated with the subject species or other animals in the vicinity? If so, what are the handling precautions?

Coda

Although an IACUC should address the PHS *Policy* principles in the same format for field research studies as protocols designed to support biomedical research, many of the questions that an IACUC should consider and evaluate for field studies are either not asked or not relevant to conventional biomedical research. This presents a quandary for the diligent, but unknowing, IACUC. For additional assistance, a sample outline that addresses issues specific to field studies can be found at the University of South Florida website (<http://www.research.usf.edu/cm/applications.htm>); Safe-Capture International also offers assistance in this area as part of its training program.

OVERSIGHT

An IACUC must review all study areas and facilities where animals are used or maintained. This is clearly a difficult charge for the Committee to execute when the study may literally be a field or a water system, often in an extremely remote area or even in another country. Yet an IACUC is legally bound to ensure protocol compliance in concert with humane animal care and use. Committee members must be given the opportunity to visit the sites, though it may not be economically feasible for the institution to fund semi-annual trips to the Serengeti of Africa, for instance.

An institution may address this aspect of an IACUC's oversight responsibility in the following ways:

- Sign a memorandum of understanding with an affiliated institution's IACUC that is in a better position to execute oversight; and
- Provide the investigator conducting the study with a video or web camera, thereby allowing the Committee to observe the protocol.

If the location and design of the study precludes a reasoned approach to IACUC oversight, then the institution may opt to attempt negotiations with the USDA APHIS Office of Animal Care and/or the National Institutes of Health Office of Laboratory Animal Welfare for a waiver of this responsibility.

OCCUPATIONAL HEALTH AND SAFETY PROGRAM

An OHS program is a required and critical component of any laboratory animal care and use program. Its implementation and effectiveness depend on

accurate information exchange between and among the PI and staff who use the animals, the veterinary staff responsible for programmatic direction, the IACUC responsible for programmatic oversight, and the occupational health professionals who administer the program. The design and implementation of these programs vary greatly between institutions based on known and controlled components, such as facility design, caging systems, and the zoonotic potential of the types of animal housed. Many institutions have successfully grappled with meeting the standards for their laboratory animal resource programs as defined in *The Occupational Health and Safety in the Care and Use of Research Animals*¹⁸ and have established effective models throughout the country.

Developing an OHS program that supports wildlife research, however, is more challenging because the variables that impact the program cannot be readily controlled. Some challenges might include the fact that the 'facility' consists of the natural environment, that the animal's ability to pose a zoonotic risk may be undefined, or that there is typically no caging system involved in the study. The following provides some practical guidance for designing an OHS program with regard to issues specific to wildlife research¹⁹.

Hazard identification and risk assessment

'Hazards' are simply those things that have the potential to cause harm; 'risk assessment' is the means by which the likelihood of the hazard to exact harm is established. Assessing risk involves analysis of (1) the hazard; (2) the hazard in combination with the health profile of the individual; and (3) the likelihood of coming into contact with the hazard. Hazard identification is a complex process for field-based studies. In a typical institution-based study, the environment is generally well-controlled, and the hazards intrinsic to the environment (such as the slip hazard caused by wet floors) are easily identifiable and oftentimes can be proactively addressed.

When working in a natural environment—be it the woods, a field, or the water—the environment itself presents unique risks. For instance, the possibilities for adverse weather conditions or transportation failures must be considered. The experiment itself may require the use of potentially hazardous infectious agents or chemicals. There are even physical hazards such as animal bites, kicks, or scratches; cuts or punctures from fins; capture equipment injuries caused by tools like dart guns or traps; ergonomic injuries caused by moving equipment in the field; restraint-device injuries; and hypodermic needle sticks. Because of the natural field-study environment, there is also potential for accidental exposure to anesthetic or immobilizing medications.

The animals themselves present risk for zoonotic infections and may harbor disease vectors such as

ectoparasites (fleas and ticks). Moreover, it may be the unidentified hazards that result in the most serious health issues, such as an unexpected encounter with a rabid animal or a run-in with a venomous snake. Other obscure risks to personnel could arise from rappelling, electrofishing, SCUBA equipment, or fires resulting from rocket-distributed capture nets.

It is important that the investigators writing study protocols clearly identify the hazards that they anticipate as well as give thought to the subtle dangers. Risk management is not solely the responsibility of the IACUC; risk assessment and intervention for ongoing projects should also be the shared responsibility of the institution and the respective department supporting the work.

Once the hazards have been identified (Table 1), the IACUC, with the help of the investigator, must identify those individuals who will be at risk. Part of this approach should include evaluation of the intensity, duration, and frequency of exposure; that is, are the field workers coming physically near the animals or are they able to assess them from a safe distance?

Facilities, procedures, and policies

In a typical laboratory environment, the safety equipment and physical features of the facility, in combination with established workplace practices that have been reviewed and approved by trained safety professionals, provide the first line of protection for the worker, student, or investigator. Although not as finely tuned, the same concepts can be applied to a field environment. The equipment used to transport the investigators to the work site should be regularly maintained,

as should the capture and/or restraint equipment. The workstations set up in the field should be designed to prevent ergonomic injuries. When possible, environmental extremes stressful to humans should be avoided or minimized through the use of appropriate apparel, including protection against the sun, wind, cold, and noise.

It may be appropriate for an IACUC to ask the research team to write a disaster or contingency plan as an exercise compelling them to consider the potential for injury during a wildlife study. Work practices or standard operating procedures should be described, such that practices that reduce exposure to potential hazards are employed whenever possible. These practices and procedures can then be reviewed by a trained safety professional or by IACUC members. In general, procedures should be selected that minimize the amount of handling time. If an animal is suspected of carrying a zoonotic disease, these practices should minimize exposure by inhalation, ingestion, contact, or needle stick. Consideration must be given not only to how contact with animal waste will be managed, but also how cages that may be used for temporary restraint are cleaned of waste. If needles will be used, their transport away from the site and disposal must be considered. Additional detailed information on how the animal is to be handled, restrained, and, if necessary, transported aids in preventing the worker from being bitten, scratched, or cut. Teams should consist of at least two individuals trained in the restraint of the animal and emergency procedures; work should never be done alone. Work practices and standard operating procedures, however well-written and designed, will

TABLE 1 | POTENTIAL HAZARDS IN FIELD STUDIES^a

Risks due to the location	Risks related to the work
PHYSICAL	PHYSICAL
Weather, terrain, remoteness	Needle sticks
Transportation failure	Restraint and capture injuries (dart gun, trap)
Communication failure	Animal kicks, bites, scratches
Provisions failure (food, fuel, shelter)	Ergonomic injuries related to support equipment
BIOLOGICAL	BIOLOGICAL
Unknown exposure to zoonotic disease	Zoonotic disease from animals studied
Poisonous plants	Poisonous animals in study
Poisonous animals	
Insect injuries	
Human health failure (heart attack, stroke)	
CHEMICAL	CHEMICAL
Pesticides	Radionucleotides
Agro-chemicals	Disinfecting chemicals
	Accidental anesthetic/analgesic self-administration
GENERAL	
Distance from health care provider	
Access to a health care provider who is knowledgeable about a specific zoonosis or poison	

^a Based on <http://www.dundee.ac.uk/safety/Fieldwork.htm> and http://www.usyd.edu.au/ohs/ohs_manual/fieldwork/safety_officers.shtml.

only be effective if the individuals conducting the study are thoroughly educated and trained in safe practices. This is especially important in the wild, when researchers are working far from easily accessible emergency-response resources.

Personal protective equipment, personal hygiene, and other needed equipment

The purpose of personal protective equipment (PPE) is to help create a physical barrier between the hazard and the worker. The recommended PPE depends on the environment, how the individual interfaces with that environment, and the types of hazards that have been identified with the research project. The PPE required for a field study can range from nonexistent (such as, for a study of the migratory patterns of egrets, for instance) to comprehensive (for example, for a project evaluating the presence of Ebola virus in cave-dwelling bats). Some examples of PPE are listed below:

- **Gloves.** In the laboratory animal facility, latex gloves may be suitable for most chores, but are inappropriate for pulling large fish from the water or removing rodents from their nest. Thick neoprene or leather gloves may be a better choice.
- **Face shields, netting, and goggles.** Among other things, these items can protect against pervasive on-site insects, splashed polluted water, animals that 'spray' noxious or irritating chemicals, or birds that peck the face.
- **Face masks and respirators.** Observational studies in forests or grasslands may expose personnel to allergenic pollen, excursions into caves may require special filters for gases or even oxygen, and face masks may be necessary to prevent the inhalation of hantavirus-laden particles.
- **Clothing.** Besides protection from infectious agents, appropriate clothing should be designed to prevent contact with contaminated water, protect the researcher from the sun or extreme cold temperatures, and prevent puncture wounds from snakebites or plant spines and needles.

Consideration should also be given to the disposal and potential for safe recycling of the PPE used in the field. For instance, it may be prodigal to throw away specially-designed gloves used for restraint, so care must be taken to disinfect them.

In addition to PPE, other items as basic as first aid kits, flashlights, insect repellent, cell or satellite phones, global positioning systems, and other essentials are required for field study work. These items are described on the University of Wollongong's Occupational Health and Safety web site, Appendix 5 (<http://staff.uow.edu.au/ohs/workingsafely/fieldwork/index.html>). It may be prudent to duplicate emergency gear (packed separately in case of loss) and changes of clothing.

Personal hygiene, a critical component of infection control, is often creatively maintained during field studies. The ability to wash-up in 'clean' water may only be available if the transport vehicle has a stored water source. Hand-cleaning compounds frequently used in medical clinics are ideal for use under field conditions, but have limited use for showering. It is wise to have policies in place that limit animal contact congruent with drinking or eating; these activities should be conducted with clean hands in a dedicated area apart from the work with animals.

Medical evaluation and preventative medicine

The *Guide* states, "The IACUC must be satisfied there is an effective OHS program which ensures that the risks associated with the experimental use of animals are reduced to acceptable levels and that personnel are adequately trained." The preventative medicine and medical evaluation component can be the most complex area of an OHS program designed to meet the needs of field-based research. The primary goals of the program are to:

- Prevent illness by recognizing the impact that the hazards may have on an individual's unique health profile and by providing preventative medications, such vaccines (rabies, tetanus, etc.) or prophylactic malarial treatment. Hazards may increase or decrease in severity when balanced against a worker's health status. For example, an immune-suppressed individual may be at heightened risk for infectious disease transmission. The CDC website contains information about infectious health risks specific to a geographical area.
- Recognize, treat, and manage the illnesses and injuries that result from a work-related incident. Depending on the distance to health facilities, implementation of this component can be challenging in the field. The staff on the excursion should have protocols in place regarding equipment safety (inclusive of firearms), as well as emergency medical kits that include general items like antiseptic, bandaging materials, topical antibiotics, tourniquets, fluids, IV sets, and possibly more specific items like anti-venom. Bites, kicks, and even scratches from larger animals can cause extensive, potentially life-threatening trauma. The field team should have an evacuation plan, as well as the contact numbers for trained medical professionals. At least one member of the field team should have basic training in first aid techniques. To aid the health care professionals, the team should also record information about any incidents, such as species involved, time of event, circumstances of event, and the team's response.

This component of the program will only be successful if it is designed with educated input from various expert sources—trained human-health professionals, the investigators (who are often expert in the species of study), and veterinarians who can help identify animal-specific health risks. Both healthcare providers and investigators need to be aware of infectious agents in the field study area²⁰. Lyme disease or malaria are especial concerns, as is the diagnosis of infection with Herpes B, which may be obfuscated by an absence of direct contact with nonhuman primates in the individual's medical history. Zoonotic intestinal parasites, such as *Giardia* and *Cryptosporidia* species, may also be missed by a physician not knowledgeable about zoonotic diseases. Additionally, bite wounds, which can inoculate organisms like *Bartonella henselae* or *Capnocytophaga canimorsus*, are easily mismanaged, resulting in prolonged infection or undue tissue trauma²¹.

If the study location precludes contact with knowledgeable physicians, it is incumbent upon the investigator and staff to be able to relay the pertinent information to the physician. The workers should detail the possible exposure to the known zoonotic agents carried by the animal species they were working with, retain maps of the geographic region(s) where the field study was preformed, keep package inserts of drugs used, and establish that anti-venom is available at the local medical clinic. A camera to assist in the identification of plants and snakes can be helpful, too.

CONCLUSIONS

Although the fundamental principles of proper animal care and use in research are shared between institution- and field-based researchers, the application of those principles by an IACUC in the areas of protocol review, animal care and use, and occupational health and safety oversight can be markedly different. The challenge to IACUCs evaluating field-based research is that such evaluation can be, by definition, contrary to traditional experimental design. Field studies use a wide range of species whose behaviors and physiology may not be well-understood in an environment that is uncontrollable, thereby forcing investigators to prepare for unforeseen hazards and experimental variables. Becoming educated on both the animal and the environment will aid the IACUC in ensuring that the experimental design is conducive to the mutual interests of human safety and humane animal care and use.

COMPETING INTERESTS STATEMENT

The authors declare that they have no competing financial interests.

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1. Public Health Service. *Policy on Humane Care and Use of Laboratory Animals* (US Department of Health and Human Services, Washington, DC, 1986; reprinted 2002).
2. Institute of Laboratory Animal Research, National Research Council. *Guide for the Care and Use of Laboratory Animals* (National Academy Press, Washington, DC, 1996).
3. Animal Welfare Act as Amended (7 USC 2131–2156)
4. 9 CFR, Chapter 1, Subchapter A–Animal Welfare
5. Interagency Research Animal Committee. U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training (Office of Science and Technology Policy, Washington, DC, 1985).
6. Orlans, F.B. *Field Research Guidelines: Impact on Animal Care and Use Committees* (Scientist's Center for Animal Welfare, Greenbelt, MD, 1988).
7. Williams, B. Wildlife research and the IACUC. *AWIC Bull.* **10(1–2)**, (1999). <http://www.nal.usda.gov/awic/newsletters/v10n1/10n1will.htm>.
8. Lindzey, J.K. *et al.* A unique application for studies of wild animals in or from natural settings. *Contemp. Top. Lab. Anim. Sci.* **41(6)**, 33–36 (2002).
9. American Society of Mammalogists Animal Care and Use Committee. Guidelines for the capture, handling and care of mammals as approved by the American Society of Mammalogists. *J. Mammal.* **68(4)**, 1–18 (1987).
10. Gaunt, A.S. & Oring, L.W. (eds.) *Guidelines to the Use of Wild Birds in Research* 2nd edn (1997). <http://www.nmnh.si.edu/BIRDNET/GuideToUse/index.html>.
11. Herpetological Animal Care and Use Committee of the American Society of Ichthyologists and Herpetologists. *Guidelines for the Use of Live Amphibians and Reptiles in Field and Laboratory Research* (2004). <http://www.clemson.edu/research/orcSite/ARCFORMS/doc/AmphibiansReptilesGuidelines.pdf>.
12. Use of Fishes in Research Committee, American Fisheries Society. *Guidelines for the Use of Fishes in Research* (2004). <http://www.fisheries.org/html/guidelines.html>.
13. Schaeffer, D., Kleinow, K. & Krulish, L. (eds.) *The Care and Use of Amphibians, Reptiles and Fish in Research* (Scientist's Center for Animal Welfare, Greenbelt, MD, 1992).
14. Beaver, B.V. *et al.* 2000 Report of the AVMA Panel on Euthanasia. *J. Am. Vet. Med. Assoc.* **218(5)**, 669–696 (2001).
15. Convention on International Trade in Endangered Species of Wild Fauna and Flora. <http://www.cites.org/>.
16. 16 USC 701. The Lacey Act. <http://ipl.unm.edu/cwl/fedbook/laceyact.html>.
17. Marine Mammal Protection Act of 1972. <http://www.nmfs.noaa.gov/pr/laws/mmpa.htm>.
18. National Research Council. *Occupational Health and Safety in the Care and Use of Research Animals* (National Academy Press, Washington, DC, 1997).
19. Laber, K. & Bayne, K. Designing and implementing an occupational health and safety program. *Contemp. Top. Lab. Anim. Sci.* **43(1)**, 79–80 (2004).
20. Kruse, H., Kirkemo, A.-M. & Handeland, K. Wildlife as source of zoonotic infections. *Emerg. Infect. Dis.* <http://www.cdc.gov/ncidod/EID/vol10no12/04-0707.htm>.
21. Stewart, C. in *Beyond the Road, Environmental Emergencies for Emergency Services Providers* (Charles Stewart and Associates, 1998).