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Article

Institutional Animal Care and Use Committee Considerations for the Use of Wildlife in Research and Education

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Abstract

Ethical and effective oversight of the use of wildlife species in research and education requires consideration of issues and methods not relevant to work with traditional laboratory or domesticated animals, just as the effective oversight of biomedical research requires consideration of issues and methods not germane to wildlife research. Institutional Animal Care and Use Committees or other institutional review committees can meet their responsibilities in these disparate types of animal activities only by using resources tailored to the animals and situations encountered. Here we review the issues and the resources that facilitate effective oversight of such activities in the wildlife research arena available to researchers, institutional review committees, regulatory bodies, and accrediting bodies. Issues covered include an understanding of the fundamental differences between wildlife research and biomedical research; the profound differences between wildlife species and traditional laboratory subjects, most of which are domesticated animals; and the unique issues presented when the research subjects are members of wild populations and communities. We review the resources available for effective oversight of wildlife projects and emphasize that competent oversight of wildlife research demands the use of appropriate resources. These resources include guidelines designed for the use of wild species (taxon-specific guidelines) and protocol forms tailored for the species and situations encountered.

Key words: animal care committee; animal experimentation; animal welfare; ecology; Institutional Animal Care and Use Committee (IACUC); One Health; wild animals; wildlife

Introduction

The use of living animals in research and education carries with it the ethical expectations of humane and appropriate treatment of subjects. These ethical expectations are supported by regulations in most countries to provide research subjects some degree of protection. Countries might differ in terms of which taxa are covered and how regulations are applied across the covered taxa, but regardless of country, species, or research focus, oversight bodies and personnel at all levels frequently struggle when evaluating activities involving wildlife species within the ethical and legal framework of animal research. The main source of difficulty is that the ethical and regulatory framework for oversight of animals in research is usually geared toward the use of traditional laboratory or domesticated animals in biomedical settings rather than wildlife. These regulations, which are designed

around a limited number of species maintained in homogenous environments and with human-provided food, care, and shelter, are a difficult fit for the more than 60,000 species of vertebrate animals that occupy diverse natural environments worldwide, survive on diets ranging from plankton to primates without human intervention, and thrive where human presence is not well tolerated and where it usually alters normal behaviors. The terms "wildlife" and "wildlife species or taxa," as used herein, refer to those animals existing free-range in their natural environments but might apply equally well to populations of a few domesticated species that have reverted to a wild existence and now thrive without human intervention. Feral horses, swine, and cats are examples of the latter. The terms wildlife or wild animals are not intended to apply to nonhuman primates or other species maintained in captivity over successive generations and that, through such a process, become habituated to human presence.

In the United States, an Institutional Animal Care and Use Committee's (IACUC's) responsibilities are delineated in the Animal Welfare Act and its implementing regulations (collectively AWAR [USDA 2013]) and in Public Health Services (PHS) policy (NIH-OLAW 2015). The AWA was passed in 1966 after public outcry over the mistreatment of dogs destined for biomedical research (Cowan 2010). PHS policy was promulgated in 1986 after passage of the Health Research Extension Act, which effectively extended coverage to all vertebrate animals for projects funded by PHS entities. PHS policy specifies compliance with the Institute for Laboratory Animal Research (ILAR) *Guide for the Care and Use of Laboratory Animals* (NRC 2011; hereafter *Guide*) and with the *Guidelines for the Euthanasia of Animals* produced by the American Veterinary Medical Association (AVMA 2013). Such policy makes these latter documents quasiregulatory for PHS-funded activities and for those entities requiring PHS assurance (note, as of October 1, 2015, this includes the US National Science Foundation (NSF) through a Memorandum of Understanding between the NSF and the National Institutes of Health Office of Laboratory Animal Welfare [NIH-OLAW]). The focus of these regulations, policies, and guidelines with respect to animal research is primarily the use of traditional laboratory and domesticated animals in biomedical settings (Sikes and Paul 2013; Sikes et al. 2012).

Investigators and oversight personnel are free to consult resources other than the *Guide*, and the *Guide* acknowledges that it "does not purport to be a compendium of all information regarding field biology and methods used in wildlife investigations, but the basic principles of humane care and use apply to animals living under natural conditions" (NRC 2011, 32). Despite these statements, IACUCs or other institutional review committees are often hesitant to deviate from the aforementioned mandated guidance documents. Unfortunately, but not surprisingly, guidance documents and regulatory requirements developed for traditional laboratory animals in laboratory settings provide little direction for institutional review committees and investigators when the research animal subjects are wild and the research is wildlife oriented. Judging from questions fielded by the authors over many years, this poor regulatory fit can result in awkward or ineffective oversight of wildlife research, uncertainty by oversight bodies, and frustration by investigators responding to forms and questions often not relevant to their research activities. If IACUCs and regulatory personnel are to provide ethical and appropriate oversight of wildlife used in research, they must be prepared to (1) appreciate fundamental differences between biomedical and wildlife research, (2) understand the different approaches required for work with wild animals compared with domesticated animals, and (3) use resources tailored to the taxa and research settings of wildlife research. Wildlife research demands, by its inherently disparate and unique nature, a commensurate and relevant set of standards that reflects the realities and nuances of such work.

Biomedical versus Wildlife Research

Difference in Focus and Goals

Biomedical research focuses on improving human health and well-being. Nonhuman animals are often used as models in these activities and as surrogates for humans who are the ultimate beneficiaries. To be sure, discoveries made in the course of biomedical research often benefit nonhuman animal health as well, but such research favors advances aimed at humans rather than other animals. Moreover, to ensure utility as test subjects, the animals used must possess sufficient physiological similarity to humans for processes and insights to translate to human biology. As biomedical studies move from general observations to mechanistic explanations, statistical power of the experimental procedures becomes increasingly important, as does control of within-sample variance. These needs favor animal models that can be selectively bred and easily and uniformly housed, especially mice and rats (Trull and Rich 1999). Wildlife research has important and contrasting needs and concerns. With few exceptions (usually stemming from historical genetic bottlenecks), wildlife species are far more genetically diverse than traditional laboratory animals or domesticates, and it is this genetic diversity that contributes to individual differences in response to environmental perturbations, which in turn ensures long-term persistence of a given species. Such diversity is the very foundation of natural selection, and the diversity of individual responses possible within a population or species is often of prime interest to wildlife researchers. Although wildlife researchers might indeed study individuals, they usually are more interested in the population or species characteristics than in individuals per se. Because the wild animals studied by field researchers exist as part of a natural population and a community, there is a potential for impacts beyond the individual on these higher-level entities. Populations and communities have no correlates in biomedical animal use with domesticated strains or races, so it is often difficult for oversight personnel to extend ethical considerations to these entities rather than ensuring humane and ethical treatment only of individuals. Such difficult assessments require experience and a well-heeled ability to keep these extended considerations in mind during project review. In practice, these considerations can often be seen in the implementation of euthanasia protocols. For example, chemical methods of euthanasia in the field should be weighed against residual impacts on secondary scavenging and environmental contamination should a researcher propose to leave a carcass in the field. Even the removal of a euthanized animal is an insult to the ecological community by removal of resources valuable for other species. However difficult, such a shift in thinking is imperative in the institutional review because the integrity of the natural population is of paramount importance in wildlife research. In this sense, ethical oversight of wildlife research is geared as much toward protection of natural populations and habitats as it is toward ethical handling of individual animals.

Ethical oversight of animal activities requires us to weigh benefits against costs. In biomedical research, the benefit accrues to humans, whereas costs are imposed on our animal subjects. Because these animals are bred and maintained by humans, the potential impact on higher-level entities such as populations and communities is not relevant, so costs are borne only by individuals and

tallied, at least in part, by the number of animals used. Deliberations focus on individual animals as subjects. In wildlife research, the animals themselves, or more specifically, the populations or species, are most generally the ultimate beneficiaries. Wild species are studied to gain a deeper understanding of some aspect of their biology because these insights inform our management decisions and our understanding of the natural world and our place in it. These insights that ultimately inform wildlife (and in a broader sense, ecological) management decisions are critically important as human populations grow, especially as we steadily encroach on the habitats of wild creatures and leave our indelible mark on the natural environment. It is believed by many investigators that we are now in the midst of a sixth great extinction that is due to the impact of humans on the environment (Ceballos et al. 2015), so the need for immediate action to conserve the Earth's biodiversity places an enormous premium on knowledge of natural systems. The challenge for oversight bodies becomes how to weigh potential benefits for populations and species of wild animals against costs to individual study animals.

Differences in Number and Diversity of Species

Whereas most biomedical research is conducted on only a handful of traditional laboratory animals and domesticated strains or races, by most estimates there are more than 60,000 species of wild vertebrates that investigators might choose as study taxa. By their very nature, species differ appreciably from other species of the same genus such that species and even subpopulations within a single species can be on different evolutionary trajectories. Moreover, many species exhibit fluctuations and changes in behavior, diet, disease susceptibility, morphology, sexual dimorphism, and reproduction in response to season, geography, age, and a host of other intrinsic and environmental factors. Study designs for wildlife research will be commensurately varied, complex, and adaptable. The ability to design and implement a research project that can safely and effectively achieve its goals in the throes of such a dynamic system is essential to wildlife research. It follows that pinpointing accurate, scientifically valid, and humane effects on research subjects in wildlife activities requires managing an even deeper overall complexity than is found in most biomedical research. These differences are precisely what create challenges for oversight, and as previously stated, there is no proportionate, comprehensive guidance or language in either the *Guide* or the AWAR with the clarity and purpose to meet these needs. Critical review of animal activities requires expertise and experience with the target animals, but ensuring expertise and experience when the focus is on wildlife is a formidable task for any committee because of the diversity among species even within seemingly closely related taxa. Even at the taxonomic level of order (order Rodentia, for example), differences between species, much less genus or family, can be so broad as to make extrapolation from one taxon to another inappropriate. Among a few of the groups of subterranean rodents, for example, African naked mole rats (*Heterocephalus glaber*) are eusocial, such that a single breeding female produces all offspring in a colony like a queen in a hive of honey bees; some tuco-tucos (*Ctenomys spp.*) in South America are social and some are not; and North American pocket gophers (family Geomyidae) are colonial but nonsocial. Also in sharp contrast to the familiar laboratory rodents, each of these subterranean rodents lives without access to free water for drinking.

The *Guide* states that "veterinarians providing clinical and/or Program oversight and support must have the experience, training, and expertise necessary to appropriately evaluate the health and wellbeing of the species used in the context of the animal use at the institution" (NRC 2011, 15). This is simply not possible at most institutions conducting wildlife research where subject animals can range from salamanders to turtles to mammals, not to mention the far larger number of nontarget animals that might be taken when conducting fieldwork. It is important to remember that the *Guide* emphasizes laboratory environments where the species diversity is far more restricted. For specific expertise with wild taxa, oversight personnel will have to use additional resources. Principal investigators (PIs) are often experts on the taxa they work with and should be considered valuable resources. Other resources include the professional taxon societies, taxon-specific guidelines (Beaupre et al. 2004; Fair et al. 2010; Sikes et al. 2011; Use of Fishes in Research Committee 2014), and investigators around the world who have worked with the same or closely related species. Use of such resources is required by the NSF (NSF 2013, section 3.b.i) and encouraged by the *Guide* (NRC 2011, 32). However, institutional review committees may not be aware of these resources or that their use is crucial for effective review and oversight of wildlife activities.

Procurement of Animals and Responsibility for Animal Care and Use

Animals used in traditional biomedical research are most often bred in dedicated animal facilities, either by the institution conducting the research or by a vendor. In the United States, these animals are owned by the institution producing or purchasing the animals unless their ownership is transferred during the course of the project. Following financial expenditures for animals and thus ownership of animals is one way that regulatory and funding agencies might determine institutional responsibility for research animals. The animal subjects of wildlife research, on the other hand, usually are captured from the wild. In the United States, management and oversight of wildlife populations usually fall to the individual states in which a population exists; however, federal exceptions to this precedent include the National Park Service (NPS), which is granted privileges of wildlife management and oversight within its boundaries, and the United States Fish and Wildlife Service, which administers the Endangered Species Act regardless of location within the country and its territories. In this context, the proprietary body of wildlife populations is the public, so there is no way to "follow the money" for institutional ownership in the context of responsibility for animal activities.

Permit Requirements for Wildlife Research

Because wild animals in the United States fall under governmental control, virtually all work with wildlife species will require permits of one form or another. The requirement for permits to work with the subject animals has no equivalent in biomedical research. Permits are issued to the individual investigator, and it is their responsibility to ensure that all necessary permits are obtained for lawful conduct of proposed activities. Because permits are the responsibility of the PIs, and because application, renewal dates, and reporting requirements do not correlate with those for animal use protocols, most institutions the authors have consulted review and approve protocols without first confirming that appropriate permits have been obtained, but make clear to the PI, usually in writing, that the approved activities cannot be conducted until all necessary permits are acquired.

Permit requirements may also vary with taxa and with location. Some species are regulated at the state level, others at the

national level, and still others, especially migratory and marine species, are regulated both nationally and internationally. Activities occurring in national parks in the United States will require permit and approval by the NPS IACUC. The current practice of the NPS IACUC is to review approved protocols from any organization seeking to conduct activities with covered species within NPS holdings. The NPS IACUC will require completion of the NPS protocol form if there are concerns about the quality of an institutional review from a wildlife perspective. The NPS IACUC review could also serve as a surrogate for IACUC review by the performing organization if suitable written understandings are in place that ensure required oversight. A review of the permitting requirements for wild vertebrates by Paul and Sikes (2013) provides a useful reference. Methods of euthanasia approved by the institutional review committee for use in the field may include the use of either chemicals or firearms, both of which may require distinct permits subject to municipal, county, state, or federal law, such that secondary and perhaps even tertiary levels of permits are required for specific activities or locations.

Domesticated versus Wild Animals

Domesticated animals differ fundamentally from their wild counterparts in virtually every way imaginable. Among all species of wild vertebrates, only a tiny handful have been domesticated, all of which have six traits in common (Diamond 2002). These traits are a "follow the leader" dominance structure, a diet easily supplied by humans, an amenable disposition, willingness to breed in captivity, reasonably short birth intervals and rapid growth rates, and a lack of panic when faced with predators or an enclosure. Most species of vertebrates lack one or more of these characteristics and are thus unsuitable candidates for domestication or even for keeping in captivity. From the small subset of vertebrates suitable for domestication, the process of domestication itself selects for additional desirable traits to produce a subset, strain, or breed of a given species that differs behaviorally, physiologically, and morphologically from its wild counterparts. Diamond (2002, p. 700) defined domesticates as "species bred in captivity and thereby modified from its wild ancestors in ways making it more useful to humans who control its reproduction and (in the case of animals) its food supply."

Rather than fearing humans as potential predators, competitors, or some other form of threat, domesticates look to us for food, shelter, and often companionship. Wild animals, on the other hand, typically fear humans and hide, flee, or fight when flight is not possible. Fear, flight, and fighting are usually undesirable traits in domesticated animals. Individuals exhibiting these behaviors may refuse to breed or deliberately are not bred and are thereby selected against. Over the course of generations, the result of this conscious and unconscious selection is a subpopulation with less inherent fear of humans. It is particularly important to keep in mind that the fear of humans necessarily is selected against early in the domestication process such that even regular human contact with wild individuals can alter behaviors that would be normal and adaptive in the animals' natural environment. Among other differences between wild and domesticated animals, Diamond (2002) points out that most domesticated strains have smaller brains and less keen senses than their wild ancestral species. Domesticates also respond differently to acute stressors than do wild strains.

The presence of a predator or competitor is a stressor for wild animals with both immediate acute and long-term effects. The acute effects are easily observed as the prey animal responds to a predation attempt or even to the presence of a threat as perceived from olfactory or auditory cues by fleeing or fighting. Although an animal's responses to predators are usually obvious and direct, even the risks of predation or competition can also exert long-term effects by altering behavior patterns, foraging choices, and life history parameters of the prey species (Boonstra 2013; Clinchy et al. 2013; Hawlena and Schmitz 2010). At some point, the cumulative effects of continued acute stress can lead to distress (the inability for coping mechanisms to maintain homeostasis), but the demarcation between these states is far from clear even in domesticates, much less wild taxa where visible signs of stress or distress would be particularly disadvantageous when observed by predators or competitors. Similar responses are absent or muted in domesticates, particularly in laboratory environments where stressors do not include such threats. Most important, the responses of domesticates to human presence are far less extreme than are the response of most wild individuals. The fact that humans are perceived as potential predators or competitors where the work concerns wild animals, on the other hand, should be considered in protocol review if we are to minimize stress to our research subjects and ensure the highest quality research.

Such considerations are particularly important during capture or initial handling of wild animals. Activities with wildlife that fall under the IACUC purview generally will include capture of the research subjects. Most capture methods for research animals are designed to hold them alive and unharmed or to kill the animal as humanely as possible without damage to specimens. Although live capture devices impose restraint, which can be a stressor for wild animals in some situations, panic responses in captured animals usually are not triggered until there are additional acute stressors, such as a predator. Because humans are perceived as threats by most wild animals, they are just such a stressor. Lapointe and colleagues (2015) showed that capture and recapture of free-ranging degus (*Octodon degus*) induced a spike in plasma cortisol levels and, importantly, this response was not diminished in animals recaptured as many as four times over the course of study. In other words, there was no habituation to human presence and handling. Hämäläinen and colleagues (2014) similarly reported no habituation to repeated capture as measured by fecal glucocorticoid metabolites in gray mouse lemurs (*Microcebus murinus*).

Newly captured or cornered wild animals usually will either attempt to flee or fight. The ensuing struggle jeopardizes human and animal safety, so practices to minimize risks to personnel and animals are warranted. It is for this reason that wild animals are often sedated upon capture rather than because the capture or handling itself causes pain or distress (capture usually causes stress but not necessarily pain or distress). Institutional review committees should take care to distinguish between activities where anesthetics or analgesics are used to relieve pain or distress versus those where chemical immobilizations are used to facilitate safe handling or to prevent injury to animals and personnel. In brief, it is incumbent on reviewers to effectively and accurately distinguish between the use of pharmaceuticals as a primary method of capture and restraint (chemical immobilization), versus the application of chemicals as a means to reduce or diminish pain and distress. In the first case the animals would be included under the US Department of Agriculture (USDA) category C for pain or distress, whereas in the latter, USDA category D is appropriate.

Because human presence is a stressor, reviewers and investigators should consider ways to minimize this stress. Care and use guidelines designed for wild animals invariably encourage minimal handling of individuals. This includes limiting personnel to

the number required to safely accomplish the tasks and efficient ordering of activities to minimize required manipulations. In general the shortest, safest, most efficient capture, handling, and processing interval is the ideal. To these guidelines, we add minimizing human scent and extraneous sounds to the extent possible. Mammals, in particular, live in a world dominated by olfactory input, so the scent of predators or competitors can be a powerful and aversive stimulus. Scent transfer is minimized by limiting the handling time of animals to the minimum required for study objectives.

Based on our own professional experience (and that of many of our colleagues) working with multiple species in the field, we have found that stress caused by human presence can have unintended consequences when animals are chemically immobilized and then released, regardless of whether the immobilization was to facilitate handling or for relief of pain or distress. The *Guide* (NRC 2011, 119) states that animals should be monitored until fully recovered from anesthesia. Such monitoring might not be possible or desirable in field settings. Animals might attempt to flee the presence of humans while only partially recovered and hence at increased risk of predation, injury, or death. In such cases, it is common practice among field researchers to position the sedated animal in a protected location away from water or obvious hazards and leave them to recover alone. Where applicable, implanted or attached telemetry devices can be used to confirm successful recovery. Such protocols of minimal human intervention regarding subject recovery in the field are commonplace in wildlife studies, and oversight bodies (e.g., IACUCs) dealing in wildlife are well attuned to this design. Moreover, oversight support for such practices is often predicated on the investigator's ability to demonstrate (historically) high levels of recovery success and low mortality rates. In cases of novice investigators, such activities may warrant closer, day-to-day oversight and progress reports from the field. The prioritization and application of such metrics and adaptability are seminal aspects of project review and are not often in play in biomedical research.

Resources for IACUCs and Oversight Personnel

Taxon Guidelines

As noted herein, the *Guide* does not include details on wild animals, and users are instead directed to other resources, some of which are referenced in the *Guide* as supplemental materials rather than as essential information for review of protocols involving wild animals. As a result, these resources are often not consulted, so essential issues of wildlife projects are not critically evaluated.

Taxon-specific guidelines prepared by professional taxon societies are the primary written resources for such projects (Beaupre et al. 2004; Fair et al. 2010; Sikes et al. 2011; Use of Fishes in Research Committee 2014). These documents are prepared by committees composed of individuals who are experts on the biology of the wild taxon they cover. Each of the guidance documents by these professional societies is peer reviewed and endorsed by its respective society. Further, as of this writing, the professional guidelines for birds (Fair et al. 2010) and for mammals (Sikes et al. 2011) have also been reviewed and adopted as reference documents by AAALAC International. Although the AWAR (USDA 2013) does not reference specific guidelines, PHS policy (NIH-OLAW 2015) specifies that animal activities assured by the PHS must be conducted in accordance with the *Guide* (NRC 2011) and with the AVMA *Guidelines for the Euthanasia of Animals* (AVMA 2013). Because of this language, institutional review committees can be reluctant to refer to guidelines other than those specified. An understanding of how and why taxon-specific guidelines came into existence should reassure the reviewers and underscore the necessity for their use.

The history of the development of taxon-specific guidelines was reviewed by Sikes et al. (2012) and especially Orlans (1988) and is summarized below. Orlans points out that, prior to passage of the Health Research Extension Act of 1985 and the modification of PHS policy in 1986 to reflect the legislative changes, PHS policy dealt primarily with care and maintenance of laboratory animal subjects rather than experimental procedures. Changes in 1986 added coverage for experimental procedures as well as methods of anesthesia and euthanasia. Because most wildlife research did not (and still does not) include care and maintenance of captive animals, they were not a focus of IACUC considerations until the 1986 revision included coverage of experimental procedures. However, because the *Guide* (NRC 2011) and PHS policy (NIH-OLAW 2015) included little information specific to wild vertebrates, and because no other guidelines were available, IACUCs in the United States were left to determine how best to apply the existing guidance to activities with wildlife. This situation was of concern to the NSF, which funded the bulk of such activities at the federal level. To fill the void in relevant guidance, the NSF approached each of the scientific vertebrate taxon societies of the United States and urged them to develop guidelines specific to the taxa for which they were the recognized experts. With encouragement and funding from the NSF, the first edition of guidelines appeared for mammals, birds, reptiles and amphibians, and fishes in 1987 and 1988. The NSF had required a PHS assurance for funded projects involving animal use even before passage of the Health Research Extension Act, but relevant guidance was lacking. Taxon-specific guidelines filled this void. Recognition of these guidelines as appropriate for use by institutional review committees overseeing wildlife research was strengthened by the NSF in 2013 when their Award and Administration Guide was modified to state specifically that "[t]he organization will follow recommendations specified in the *Guide* for details involving laboratory animals, and taxon-specific guidelines approved by the American Society of Ichthyologists and Herpetologists, the American Society of Mammalogists, and the Ornithological Council, as is appropriate for the taxon to be studied" (NSF 2013, section 3.b.i).

Wildlife Protocol Forms

Although guidance relevant to the taxa to be studied is essential, the review process for proposed animal activities also must elicit appropriate detail if oversight is to be meaningful. Given the many and varied differences between wildlife and traditional laboratory or domesticated animals, particularly in the context of research, and that working with wildlife requires unique considerations, it is logical that the review process be sensitive to these differences if it is to produce an effective review. Just as cage-washer operating manuals are not appropriate for operation of autoclaves (and vice versa), so too must the review materials and resources be appropriate for the taxa and conditions under study.

The animal use protocol form (sometimes called the project submission form) is the instrument by which the details of proposed activities are extracted for review. This form should be suited to the species and situations encountered. Unless they are modified extensively and based on the concerns relevant to wildlife, protocol forms designed for laboratory research do not address many of the issues of critical importance when the

proposed activities involve wildlife. Responsible review of wildlife protocols absolutely must, at some level, include such wildlife-specific issues as permits, method of capture of study specimens (including issues such as season, sex, terrain, and age), consideration of nontarget animals, how to estimate numbers of animals likely to be impacted when using various capture techniques, and the potential impact of proposed activities on wild populations. These topics, irrelevant to biomedical research, are seldom addressed in protocol forms designed for traditional laboratory animals and domesticates. A sample protocol form designed specifically for wildlife studies was developed as a starting point by the American Society of Mammalogists and the Ornithological Council. This form was the topic of a webinar hosted by NIH-OLAW in March of 2014 and is available in the OLAW Education Archives (http://grants.nih.gov/grants/olaw/educational_resources.htm#a_03202014), on the websites of the American Society of Mammalogists and the Ornithological Council, and as an appendix in Paul and colleagues (2015) in this volume to facilitate adaptation and use by institutions.

Personnel

Consultation with investigators is common in protocol review, and wildlife investigators are often a valuable resource for understanding the biology of the taxa involved. Because wildlife research is aimed at a better understanding of the species, investigators tend to have extensive experience with the species they study. They also usually have experience with the types of field activities proposed and justification for their proposed activities. This knowledge is especially valuable when the institutional review committee is unfamiliar with the activities or species. Review committees that frequently review wildlife protocols benefit from having one or more members with field experience. Although these individuals might not have detailed knowledge of specific activities proposed or the species to be studied, they can help guide deliberations on general wildlife issues and serve to sensitize the committee to the diversity of issues that warrant consideration for a responsible review. Moreover, given the general variety and levels of complexity from one wildlife research activity to the next, it is not uncommon for experienced reviewers to reject overarching, one-size-fits-all approaches to review. Professional wildlife experience is one of the most useful translational tools for committees reviewing wildlife research protocols.

A second obvious resource for taxon-specific questions are investigators who have published on the same or closely related species or on activities similar to those proposed. Identifying such individuals might be a challenge when the committee is unfamiliar with the wildlife literature, so a contact point at the appropriate professional taxon society is often a first stop. The chair and membership of the committee charged with revising and maintaining each of the taxon society's guidelines are usually posted on society websites. Although these individuals might not have the expertise or detailed information for a given species, they are usually able to identify appropriate individuals from within their respective society. These committee chairs regularly and willingly serve as resources for review committees, PIs, and oversight and accreditation agencies. It is important for reviewers to remember that consultation with outside experts is encouraged by the *Guide*, the AWAR, and regulatory and oversight agencies.

Conclusions

Research involving wildlife has become a significant factor in our pursuit of greater ecological understanding, natural resource management acumen, and predictive ability in the context of rapidly changing environments and One Health awareness. As with research protocols involving traditional laboratory animals and domesticated species, those involving wildlife deserve the oversight and protection of the most comprehensive, sophisticated, and appropriate guidance available. Historical, established guidelines and policies based on the use of traditional laboratory animals and domesticated species do not, on their own, provide appropriate, informed guidance for oversight of wildlife research efforts. We have described herein several examples of the differences between biomedical and wildlife research and detailed why the oversight needs of each should be met with equal vigor and intent. Also provided are key resources and references, including protocol forms that pose essential critical questions, suggestions for reviewer qualifications that enhance and facilitate review of wildlife activities, and taxon-specific guidelines to form the foundation of project review. These are provided as an initiation of sorts—an introduction to the realities of wildlife research, its significance, and the tools needed to bring its oversight deservedly on par with that of biomedical research.

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