Animal Welfare Challenges in Research and Education on Wildlife, Non-Model Animal Species and Biodiversity

Presentation Abstracts

Session 1: Perspectives on Animal Welfare Considerations Between Lab Animal and Free-ranging Fish & Wildlife Field Research

Introduction to Challenges Involving Wildlife

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Regulations and guidance for the use of vertebrate animals in research, particularly in biomedical research, have developed primarily around the use of domesticated species in laboratory settings. As a consequence, when study animals shift to wild animals, especially if free-ranging, it poses challenges for investigators, oversight bodies (IACUCs), regulators, and accrediting bodies, each of which is faced with the task of interpreting species requirements and activities of wild animals within an oversight/regulatory system for which they are typically a poor fit. Challenges stem from the differences in behavior of wild *vs* domesticated animals, the necessity to capture these animals from the wild, the sheer diversity of species that are potential subject animals and their equally diverse habitats. The challenges mount further if wild-caught animals are to be maintained in captive settings. Even the nature of questions posed differs from biomedical research, where a better understanding of the wild animals themselves usually is the focus with wildlife research as compared to our use of domesticated and often inbred strains of animals as surrogates for humans in biomedical research. The goal of this workshop is to identify the challenges and stakeholders for research involving non-typical animal models as a necessary step toward resolving these difficulties.

Animal Welfare Perspectives on Wildlife Research: US National Science Foundation

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The US National Science Foundation (NSF) supports a quarter of the basic research conducted at US colleges and universities. A significant fraction of NSF-supported research involving vertebrate animals includes research on wildlife. Wildlife research is critical to recognizing and understanding the rules, principles, and mechanisms of life. NSF's portfolio of funded wildlife research is taxonomically diverse, includes lab and field research, and can include observations, manipulations, and/or terminal sampling. Studies range in topic from understanding factors leading to biodiversity and the evolution of species, to elucidate mechanisms that control behavior and environmental response, to discovering and investigating developmental and physiological processes. This diversity in wildlife research results in unique animal welfare challenges for investigators, and more guidance and resources are needed to insure the welfare of wildlife study organisms.

Research Conducted on Wild Animals and The Animal Welfare Act

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Research conducted on wild animals presents challenges for Institutional Animal Care and Use Committees (IACUCs) and research facilities in meeting the regulatory requirements under the Animal Welfare Act (AWA). The challenges IACUCs face are ensuring sufficient expertise to evaluate proposals to use wild animals, interpreting the AWA regulatory definition of a field study, determining covered activities, and meeting regulatory responsibilities. Research facilities face challenges in the provision of care to wild animals brought in-house for study, and the completion of the annual report submitted to the U.S. Department of Agriculture as required under the AWA regulations.

This presentation will discuss challenges, regulations, and the guidance available to assist IACUCs and research facilities in meeting the AWA regulatory requirements when using wild animals in research.

Research Involving Wild Animals from an OLAW Perspective: Challenges and Opportunities

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This presentation will introduce current OLAW guidance on research involving wild animals, discuss challenges unique to field research, and opportunities to address them.

AAALAC Perspective: *Wildlife Studies – Beyond the Three Primary Standards*

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Wildlife research and teaching protocols pose unique challenges to IACUCs and AAALAC requiring we seek guidance beyond AAALAC's "Three Primary Standards" – the ILAR *Guide*, the FASS *Ag Guide* and European Council of States *ETS 1,2,3*. AAALAC has formally reviewed and adopted four reference resources providing guidance for accredited units to use when developing a wildlife research program, for AAALAC site visitors to use when assessing an institution's compliance with standards and for AAALAC Council to use when deliberating to determine a unit's accreditation outcome. These four wildlife, taxon-specific reference resources, authored by subject matter experts, detail IACUC priorities and research methodologies promoting the welfare of free-ranging, wild amphibians, reptiles, fishes, birds, and mammals enrolled in field research and teaching protocols. The AAALAC perspective on appropriate use of these taxon-specific guidelines highlighting select caveats,

clarifications and unique applications will be reviewed. Peer reviewed publications and funding opportunities show an increasing trend in multi-disciplinary, "One Health" scientific studies of emerging zoonoses, the ecosystem health impact of biodiversity loss and the new human: wildlife interface created by climate change and environmental degradation. The increased need to enroll wildlife in these scientific studies provides a call to action for IACUCs and AAALAC to facilitate wildlife-based research by prioritizing relevant references beyond the "Three Primary Standards" when developing, overseeing, and assessing animal care and use programs.

Session 2 (Part 1): Review Laws, Regulations, and Permits Associated with Fish and Wildlife

Animal Welfare Challenges in Research and Education on Wildlife: A Natural History Museum Perspective

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Gantz Family Collection Center
Field Museum of Natural History

Natural history museums serve as conduits for research, public outreach, and action for all biodiversity, and as such present unique challenges when it comes to adhering to regulations pertaining to animal welfare. This talk will cover some of the many regulatory challenges facing natural history museums as they relate to research on non-model organisms. Particular emphasis will be placed on the unique position such institutions face in light of the need to lethally collect specimens to meet their organizational objectives. The suite of regulations, both domestic and international, facing scientists working at natural history museums certainly creates roadblocks and challenges that can hinder scientific advances, educational outreach, and conservation of biodiversity.

Challenges from the National Park Service Perspective

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National Park Service

With over 400 locations with the potential for wildlife research the National Park Service's IACUC has many challenges. This presentation will review the NPS IACUC's processes for the review of approximately 150 protocols per year. The NPS IACUC was established in 2010 and focuses on assuring that all vertebrate species are handled in a safe and humane manner. The NPS is tasked with assuring that all natural resources are maintained and preserved for generations to come. As such, research activities are reviewed with all factors in mind, including impacts on non-target species, human health and safety as well as potential impacts to the environment and ecosystems. The IACUC works closely with each park's biological and natural resource staff to assure compliance with regard to the Animal Welfare Act as well as permitting requirements. This presentation will also discuss the NPS IACUC approach to assessing projects as research, management or field studies.

Research on Tribal Lands - Unique Examples

Caleb R. Hickman, Ph.D.
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Office of Fisheries and Wildlife Management

Even though tribal citizens represent only 1% of the U.S. population, their lands hold higher biodiversity than neighboring public lands. Despite these prodigious resources and significant land-bases, there remains many inequalities and misunderstandings about tribes. Research on tribal lands is just as misunderstood. Most federal, state, and academic groups lack the understanding about how tribes function as partners or independent research units and the struggles tribes must overcome to appropriately manage resources. In this talk, I hope to provide a short review of some of these misconceptions and clarify how tribes work with natural resources, including those that require some form of animal care.

Session 2 (Part 2): Case Studies / Examples

Unique Challenges When Working with Free-Ranging Wildlife: Hummingbirds As A Case Study

Lisa A. Tell, D.V.M
Professor
University of California Davis

There are numerous and varied challenges when conducting research studies involving free-ranging wildlife compared to traditional laboratory animal species. The incredible diversity between and within avian, mammalian, and reptilian taxa becomes obvious when working in the field. For the purposes of this presentation, hummingbirds will be used as a representative species to highlight issues for researchers to consider when working with free-ranging wildlife. For example, animal welfare is a priority for any research activities and there are similarities but also nuanced differences for free-ranging wildlife versus traditional captive laboratory animals. In addition, unique challenges when working with free-ranging wildlife include euthanasia protocols, dealing with injured animals, obtaining IACUC approval and permits, and interpretation of permit conditions. Researchers are also required to fulfill labor intensive reporting requirements. Finally, similar to working with captive laboratory animals, the potential for zoonotic diseases exists with free-ranging wildlife, however ensuring the health and safety of the research team, students and the public can present different challenges when working in the field.

Conducting Biodiversity Surveys in the New Age of Wildlife Discovery

Lawrence R. Heaney, Ph.D.
Negaunee Curator of Mammals
Field Museum of Natural History

Many studies of wildlife in nature can be conducted in places where basic information on ecology and distribution is readily available for species likely to be present for a particular study. However, in many parts of the world, and for many groups of organisms, even this most basic baseline information is lacking. To meet this

need, much current research is focused on obtaining current data on the distribution, habitat associations, abundance, evolutionary relationships, and conservation status, including impacts of changes in land-use and climate. In many places, especially the tropics, such research is resulting in a new age of discovery of previously unknown species, even including hundreds of new species of mammals. For example, in the Philippines, 40 previously unknown species of mammals have been discovered and named since 2002, many from previously unknown areas of endemism, and the rate of discovery has accelerated as techniques for conducting surveys have improved. The resulting information has contributed greatly to the establishment of about 20 national parks and has provided most of the information for assessments of conservation needs for these threatened, highly distinctive, previously poorly known mammal fauna.

For these studies, obtaining IACUC approval and US and foreign permits is challenging because, *by definition*, it is not possible to list "target species" in advance, their relative abundance is unknown, and simply learning how to detect and capture the species is a primary objective. Such research includes the need to collaborate with foreign colleagues and help train their students, following local legal requirements and cultural priorities, and to collect and import the voucher specimens that are essential for formal description of new species. Further, much of the research is conducted in remote rural areas that are the homelands of indigenous people whose traditions and culture must be respected, and these may differ from US culture and traditions. Carrying out this crucially important work to discover and document the extent of biodiversity requires that emphasis be placed on procedures that allow flexibility within reasonable bounds.

Field Research Involving Reptiles and Amphibians, Remote Study Sites, and Undergraduate Students

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Field work in wildlife ecology includes the study of vertebrate species in ecosystems that often cross political boundaries, such as streams and rivers, and occur under unpredictable environmental conditions. Based on over 15 years of field research, a case study will be presented on the challenges, complexities, and importance of conducting research on reptiles and amphibians in aridland riparian systems of the American Southwest. This work has focused on applied research questions around the management of species and their habitats; however, data collection can involve extensive permitting, training undergraduate students, and managing the safety of animals and people in remote settings. The studies presented use live-trapping methods, where animals are measured and given unique marks, then released at point of capture. Many undergraduate students decide to move into STEM career paths, in part, because of an interest and curiosity about animals. Engaging with undergraduate students in field research requires careful proactive preparation, with added challenges of pandemic precautions. Involving students in animal research requires class IACUC review, student training on ethical handling of animals, and even, the use of social media. Ultimately, the benefits that students gain from animal research is critical thinking, science communication, and feelings of belonging in science.

Session 3: Wild Animal Population Concerns

Challenges of High-Risk Fieldwork and Working with Venomous and Hazardous Species for IACUCs

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Department of Forestry and Environmental Conservation
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Working with wildlife in the field and laboratory presents a multitude of challenges for both investigators and compliance bodies. Wildlife field research can take place in many different ecosystems, from an urban concrete jungle to the wilds of Africa or the Amazon. Each location brings specific hazards to investigators and the wildlife for which the necessary precautions need to be taken and assessed by IACUCs. Different risk assessment and mitigation levels are required when fieldwork is conducted in "high risk" countries or areas and when working directly with venomous or hazardous species. Additionally, increased levels of risk occur when investigators must bring and maintain venomous species in captivity to carry out their research. Most IACUC policies and guidelines are not designed for use with wildlife. When IACUCs are confronted with investigators that want to work with venomous species or work in the extreme field areas, they are unaware of the questions that must be asked and addressed to facilitate and ensure the safety of investigators and wildlife. The goal of my talk is to enable dialogue among IACUC, BioSafety, and EHS committees; helping both committee members and their investigators work jointly to reduce risk while moving forward with their research program.

Standards of Practice Facilitate Research and Management of White-Nose Syndrome In Bats

Jonathan Reichard, Ph.D.
Wildlife Biologist, National Assistant Coordinator for White-nose Syndrome
U.S. Fish and Wildlife Service

White-nose syndrome is a disease of free-ranging hibernating bats caused by a fungal pathogen recently introduced to North America. It was first discovered in 2007 in a handful of caves and mines in New York and has now caused widespread mortality in multiple bat species across the U.S. and Canada. Since its discovery, state, federal, and tribal management agencies have worked together with academic institutions and non-government organizations to investigate and manage this disease and the bats affected by it. This collaboration, coordinated by the U.S. Fish and Wildlife Service under the framework of the White-nose Syndrome National Plan since 2011, organizes a diverse group of experts to conduct critical research and implement actions in support of bat health. To facilitate the work, the white-nose syndrome response community has developed standards of practice around biosecurity and animal welfare by evaluating risks, mitigation measures, and outcomes for a variety of activities related to research and management of bats. The objectives of these protocols and resources are to reduce the potential for our activities to exacerbate the disease or to inadvertently harm bats or other taxa sharing their habitats. Over time, these practices have evolved to best reflect the current state of knowledge about this and other threats to bats. This presentation will focus on some tools developed by the white-nose syndrome response team, including decontamination protocols and risk mitigation recommendations for a variety of partners and stakeholders that interact with bats, and how these resources help ensure the welfare of animals and personnel urgently working to conserve them.

Animal Welfare Challenges in Research on Amphibian Disease Ecology: Impacts on Natural Systems, Biodiversity, and Biosafety (part 1)

Karen Lips, Ph.D.
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Research on infectious diseases of wildlife has increased with the emergence and global spread of several pathogens. Amphibian chytridiomycosis, caused by two species of invasive, pathogenic fungus, has decimated amphibian populations around the world in the last 50 years, caused dozens of extinctions, and triggered numerous cascading effects on other organisms and their ecosystems. Reductions in amphibian abundance have likely altered the conservation status of many species, which could warrant discussions regarding ethical choices of study species and numbers of individuals available for research. Biosecurity precautions implemented in the field included wearing gloves, bleaching footwear and sampling gear, and decontaminating vehicles between sites. These precautions are broadly used by herpetologists studying diseases in the field, but are rarely used by field researchers working on other organisms at these sites or by amphibian taxonomists or evolutionary biologists. There is a need to identify organizations and mechanisms to facilitate greater communication of risks associated with increased spread of wildlife diseases by field researchers and their impacts on biodiversity and species conservation.

Animal Welfare Challenges in Research on Amphibian Disease Ecology: Impacts on Natural Systems, Biodiversity, and Biosafety (part 2)

Vance T. Vrendenburg, Ph.D.
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The recent global declines in amphibians has been suggested as a sign of the sixth mass extinction on earth. This phenomenon has motivated research on remaining wild amphibian populations to determine the causes and mitigate them if possible. Research on infectious diseases of wildlife, in particular, has shown that the emergence and global spread of several pathogens is implicated. Two fungal pathogens, causing the disease chytridiomycosis, have caused epizootics (epidemics in wildlife) followed by mass die-offs and extinctions even in protected areas. Over 30% of all species of amphibians (there are over 8,400 known species) are now considered threatened, and this has motivated renewed interests in conservation research. New studies include interventions, reintroductions and experimental approaches in the wild and in laboratory settings. This, in turn, has sparked new biosecurity precautions since manipulations could lead to further pathogen spread by humans. Field herpetologists have long considered biosecurity as an integral part of their study plans, but as new collaborations are forged across different disciplines and as new lab approaches are considered (e.g. microbiome manipulations, synthetic biological approaches, etc.), a new awareness of biosecurity measures must be broadly discussed to limit the spread of wildlife diseases.

A Brief Summary of the Inherent Aspects of Risk Management in the Context of Wildlife Animal Use Activities

John A. Bryan, II, D.V.M., M.S.
Zachery Consulting, LLC

Wildlife fieldwork carries inherent, and often profound risk. Such is the nature of the endeavor, and an experienced, informed understanding of this reality is an inextricable prerequisite for wildlife biologists, researchers, veterinarians, and all others intent upon engaging free-range species in their natural habitat. However, such comprehension is not the exclusive domain/territory of those who venture into diverse natural environments. Animal welfare compliance and oversight bodies also share equal responsibility to measure any and all fundamental risk factors when reviewing wildlife use activities for approval, amendment, or appeal. And such considerations are complex, layered, dynamic, and potentially refractory to the standard metrics employed by more laboratory-focused animal welfare oversight bodies. Institutional Animal Care and Use Committees (IACUCs) are ***obliged*** to amass an appropriate level of competence concerning the review and oversight of wildlife use activities that fall under their jurisdiction. There are many reasons for this; however, a priority among them is risk mitigation; e.g., risk mitigation concerning humans, target animals under study, non-target animals under study, and impacts upon the environments/habitats in which these species live. From safety protocols involving tracking, hiking, capture, handling, sampling, zoonotic and reverse zoonotic disease transmission, toxicology, landscape and weather hazards, etc., etc., all must be considered. A few of these issues have been presented in this session; however, taken together they represent intrinsic parts that speak to the need to recognize a larger reality: That IACUCs have an obligation to be competent in appropriately evaluating the character of biosafety concerning wildlife use activities.

Session 4: Restraint and Handling of Animals in the Field, to Include Use of Compounds for Capture and Handling

Extra-Label Drug Use In Free-Ranging Wildlife: Rules, Regulations and Reality

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Professor
University of California Davis

Veterinarians and biologists play a pivotal role in ensuring that animal-derived food products are free of chemical residues to protect human health. Drug residue avoidance is a normal standard of practice in domestic food animal medicine and for commercially farmed non-domestic species. However, drug residue avoidance with free-ranging wildlife presents unique challenges to comply with best practices. Residues refer to the parent chemical or metabolites that can be present in any animal-derived edible food products that are destined to be consumed by humans. These residues can originate from medications, contaminants, or pesticides. Veterinary oversight is key for the prevention of residue violations. Free-ranging non-domestic wildlife are considered minor food-producing species and are subject to rules that have been established to keep the human food supply safe.

The Use of Pharmaceutical Agents in Carnivores, Bears and Ungulates Within a Wildlife Management Agency (Reality and Challenges)

Mark Drew, D.V.M, M.S., DACZM
Wildlife Health Services, LLC

Wildlife management agencies are focused on the sustainable management and harvest of wildlife in natural environments. To accomplish various management and research objectives, many wildlife species are captured and handled by agency personnel. Restraint and handling of wildlife in the field by veterinarians and wildlife biologists includes the use of antibiotics, anti-inflammatory agents, vaccines, anthelmintics and a variety of drugs used for chemical immobilization. For chemical immobilization or restraint, both controlled and non-controlled substances are used. Within wildlife management, multiple challenges exist for the use of pharmaceutical agents. There are a minimal number of pharmaceutical agents that are label approved for use in wildlife so many are used in an extra-label manner. Many chemical immobilization agents used within wildlife management agencies are compounded drugs made available by a very limited number of suppliers. While wildlife veterinarians are the primary drug conduit within wildlife management agencies, most drug administration is done by wildlife biologists, with minimal direct supervision by veterinarians. Most wildlife biologists work within a VCP relationship and under AMDUCA including the establishment of meat withdrawal times for those species that could be used for food since most animals that are handled by wildlife biologists will be released. Without access to pharmaceutical agents, the handling, welfare and treatment of free-ranging wildlife for management, health, and research would be severely compromised.

A Brief Introduction to the Complexities of Working with Multiple Agencies to Conduct Wildlife Animal Use Activities

John A. Bryan, II, D.V.M., M.S.
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The pursuit, capture, handling, sampling, recovery, release, and post-activity monitoring of free-range species for research and/or management purposes is (and ***must*** be) inherently governed by best practices; i.e., such activities must be conceived, designed, and implemented in a manner consistent with the highest applicable standards of veterinary medicine. And it is the duty of animal welfare compliance and oversight bodies; e.g., Institutional Animal Care and Use Committees (IACUCs), to review such activities by employing these standards. And in most cases, to a certain extent, such standards of review are generally applicable across a wide swath of territories and conditions; however, this formula has limitations. Complex differences in approaches to ensuring veterinary best practices exist between federal, state, academic, private, and international entities. This is especially so concerning the acquisition and use of pharmaceuticals. Generally accepted understandings and applications of high veterinary standards tend not to vary greatly from place to place, or agency to agency; however, disparate policies, protocols, laws, and cultures unique to such bodies exist, and translating these differences often proves to be a formidable barrier to the timely commencement of wildlife animal use activities. Navigating the law and policy interplay between and among academic, federal, international, private, and state agencies is an essential aspect of conducting wildlife animal use activities, regardless of locale, and must be considered by IACUCs and researchers alike.

Challenges in the Capture and Handling Wild Birds in Research

Jeanne M. Fair, Ph.D.
Biosecurity & Public Health
Los Alamos National Laboratory

Due to the diversity of wild bird species and research questions designed to better understand birds, there are many challenges for the capture, handling and sampling of wild and captive birds. One of the top challenges are some misconceptions that remain for the capture and handling of birds. Here, some of the top misconceptions for handling birds are discussed, as well as some of the realities for avian research. There are numerous resources available with specific guidance for avian research that are designed for both Institutional Animal Care and Use Committees (IACUCs) and researchers. An example of such a resources includes the Guidelines for the Care and Use of Wild Birds in Research. There are also biosafety and considerations for fieldwork with birds that protect both the birds and humans from injury and infectious diseases. While State and Federal permits for scientific work with wildlife may be similar, there are specific permitting requirements for wild birds. Lastly, humane euthanasia of individual birds in the field should be available and taught to all researchers, even if they are not collecting birds, as there may be injuries sustained and euthanasia may be required.

Capture and Handling of Free-living Wild Small Mammals for Research and Education

George James Kenagy, Ph.D.
Professor of Biology, Emeritus, Department of Biology
Curator of Mammals, Emeritus, Burke Museum of Natural History and Culture
University of Washington

Over a span of nearly 60 years I've experienced many changes in the challenges and obstacles of administrative and regulatory oversight to the study of natural history, ecology, behavior, physiology, and evolution of free-living animals in nature. Additional challenges have been raised to our ability to bring wild animals into the laboratory for study of behavior and physiology under controlled conditions. As an undergraduate zoology major I experienced the ease of capture and handling of wild small mammals, which inspired my career in biology. Most of the species I have worked with are small and can be easily captured and gently handled by researchers and students, allowing these species to be investigated in many ways without the need of restraint using drugs. Procedures such as injections, or collection of body fluids including blood, urine, or milk are carried out with relative ease. Many species of small mammals, particularly rodents, return readily and repeatedly to traps, with only a modest reward of bait, allowing large numbers of marked individuals to be studied over months and years. The variety of behaviors and ecologies represented by populations of small mammals of diverse orders and families warrant ongoing expansions of our research horizons and insights to share with undergraduate biology and wildlife students. The techniques by which various species can be captured and handled may be as numerous as their ecological diversity. Much of what is prescribed for care and handling of inbred strains of laboratory rodents may be inappropriate and even detrimental for non-domesticated species of small mammals. I believe that the broad phylogenetic, behavioral, and ecological biodiversity of small mammals is a theme that can be readily demonstrated through teaching of university field courses and public outreach activities at universities and museums. Providing students with opportunities to capture and handle these animals in the field will encourage the next generation of naturalists and educators responsible for enhancing our understanding of life on earth. Questions welcomed to: kenagy@uw.edu

Session 5: Role of Veterinary Medicine in Wildlife Research

The Wildlife Veterinarian's Role in Championing Animal Welfare Programs and Policies

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Veterinarians play important roles in promoting and protecting the health and welfare of wildlife used in research. In some cases, veterinarians may provide hands-on medical care and treatment to research animals, for example administering anesthesia and conducting surgery for sample collection or telemetry implantation. Perhaps more commonly, veterinarians provide consultation, training, and oversight to biologists and researchers so they can conduct investigations on free-living wildlife in the field. Frequently, for example, chemical immobilization in the field is conducted by researchers through a veterinary (wildlife veterinarian)-patient (individual in a wildlife population)-client (researcher in a public trust role) relationship. A contribution that may be less apparent, but equally important, is application of a veterinarian's knowledge of animal welfare regulations and guidelines, veterinary medicine practice acts, and DEA and state pharmacy board regulations to the development and implementation of policy. Knowledge of these laws, regulations, policies, and guidelines brings an ethical and legal obligation to uphold them. As such, the veterinarian often serves as a champion for internal policy development and in providing oversight to help ensure an agency or institution is in compliance and remains aware of evolution of animal welfare standards and laws. Although current guidance on the use of wildlife in research is limited and often unclear, models exist that can promote the welfare of wildlife and enhance reliability and availability of research results.

Understanding, Respecting, and Enhancing the Role of Veterinary Medicine in Wildlife Research: A Wildlife Biologist's Perspective

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For wildlife research, everything from state and federal permitting, to IACUC protocols, to access to controlled substances all fall under the purview of, require the approval of, and necessitate the provision of a licensed veterinarian. Since most wildlife biologists are not licensed veterinarians, wildlife biologists must gain the approval and support of one or multiple veterinarians for their projects whether their fieldwork is conducted with the presence of a veterinarian or not. Unfortunately, relationships between biologists and veterinarians can become strained or even antagonistic, and yet, some level of functionality in those relationships are a requisite to executing wildlife research. I suspect such struggles are at least, in part, a function of the forced and authoritative dynamic, and a failure to appreciate the perspectives that each hold. Nevertheless, as demonstrated by the talks in this session, there is a shared desire to better communicate, understand, and make progress towards making biologist-veterinarian-wildlife relationships more harmonious and productive.

Understanding, Accepting, & Enhancing the Role of Veterinary Medicine in Wildlife Research: A Wildlife Veterinarian's Perspective

Michael W. Miller, D.V.M., Ph.D.
Wildlife Veterinarian
Colorado Parks & Wildlife

The required role of veterinarians and veterinary medicine in traditional animal research settings is well established and generally accepted by investigators. By contrast, a role for veterinary medicine in wildlife research – especially in field studies – has been less consistently embraced and incorporated. Greater investment in cultivating veterinarian-biologist-wildlife subject relationships analogous to the more conventional "veterinarian-client-patient" would benefit research oversight as well as operational aspects of field studies involving wildlife species. Doing so will assure compliance with established laws, and likely will improve wildlife subject welfare and field research products as well. Understanding commonalities and differences in biologists' and veterinarians' perspectives seems a necessary first step toward progress. Consequently, two of the four talks in this session are devoted to sharing such perspectives. Numerous challenges are inherent in practicing wildlife medicine and in overseeing and conducting wildlife research. Nonetheless, examples of functional veterinarian-biologist-wildlife relationships in field research settings are available and can serve as a catalyst for progress elsewhere.

Surgeries in the Field

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Wildlife Veterinarian (Retired)
Journal Editor (Retired)

Surgery is second only to capture in its intrusiveness on wild animals. Surgeries are done as part of research projects on wild animals to obtain tissue samples, implant electronic devices, manipulate fertility, marking, and for other reasons. Because of the invasive nature of surgery, the procedures used must be of high quality, both out of concern for the well-being of the individual animal before, during and after surgery, and to assure that the data gathered from the animals is of the best quality possible. Drugs used in surgery on wildlife include capture drugs, anesthetics, sedatives, analgesics, reversal drugs, and antibiotics. Drug usage is increasingly tightly controlled, both by regulation and by policy.

Session 6. Pain and Distress, Euthanasia and Humane Killing, Lethal Take

AVMA Perspectives on Ending Lives of Wildlife Species

David S. Miller, D.V.M., CWB, Ph.D., DACZM, DACAW
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The American Veterinary Medical Association's (AVMA) *AVMA Guidelines for the Euthanasia of Animals: 2020 Edition* (https://www.avma.org/sites/default/files/2020-01/2020-Euthanasia-Final-1-17-20.pdf) represented a transition of the Panel on Euthanasia (POE) to the use of methods and species' Working Groups that addressed a wider range of topics than previously, and accordingly included a greater diversity of members with veterinary and nonveterinary expertise. This transition was prompted by the need to provide guidelines to U.S. veterinarians that are working in a wider range of settings, as well as an interest in providing a more comprehensive document for assisting with evaluation of the many variables that veterinarians must consider when euthanizing an animal. Concurrent with this transition was the explicit recognition that context is relevant to how an animal's life is taken by the creation of Panel on Humane Slaughter

(https://www.avma.org/sites/default/files/resources/Humane-Slaughter-Guidelines.pdf) and Panel on Animal Depopulation (https://www.avma.org/sites/default/files/resources/AVMA-Guidelines-for-the-Depopulation-of-Animals.pdf) guidelines. The 2020 POE also explicitly addressed the assumption that there is a justified need for taking an animal's life when considering the POE guidelines for a given circumstance, and that these justifications are varied.

Free-ranging wildlife are addressed in several sections of the 2020 POE report, and the guidance developed was based on input from veterinarians and biologists. These professionals considered euthanasia in a variety of settings for a variety of species, and developed recommendations that were intended to be flexible enough to account for the wide range of anticipated and unanticipated real-world scenarios that must be considered. The recommendations consider the impact of a euthanasia procedure on an animal and any post-mortem use of the animal; the ability of humans to reliably deliver a method of euthanasia and the potential impacts on those applying euthanasia methods; environmental impacts; and legal considerations for a method's availability and legality in different circumstances. For all species groups addressed by the 2020 POE, the need for appropriate animal handling (or absence of handling, in some instances), and effective, safe application of methods was explicitly addressed. While the *AVMA Guidelines for the Euthanasia of Animals* are written to be adaptable for a range of species, methods, and circumstances, this adaptability requires careful consideration for interpretation and application for a given set of circumstances. Therefore, this adaptability presents challenges for IACUCs, researchers, and members of the public that may have different understanding and interpretation of the POE guidelines, differing baseline perceptions based on differing value systems, and variable levels of understanding of the biology and practical concerns for a specific situation. Additional confusion occurs when standards of euthanasia cannot be appropriately applied to a given, justified basis for taking an animal's life, and alternate guidelines for humane slaughter, depopulation, humane killing, or other approaches should be used. Such confusion can be reduced by better communication and training of all individuals involved with evaluating or applying euthanasia methods; additional data on existing methods; creativity for developing novel euthanasia methods and strategies; acceptance of pragmatic realities and tradeoffs; and explicit strategies for addressing differing value systems that may be held by those considering and conducting euthanasia.

Challenges in Humane Killing of Wild Birds as Museum Vouchers Supporting Biodiversity Research

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Historic bird specimens are now used in ways that were undreamed of by those who collected them in the past. Likewise, birds collected in this era will be relevant for researchers 50 to 100 years from now. There is strong evidence that passing samples of biota forward to future researchers is one of the most effective ways to contribute to the accomplishments of future science and conservation biology. Modern studies have generated a renaissance in securing museum specimens. However, museum ornithologists who strive to collect face challenges particularly regulatory permitting and animal care when death is the endpoint. Specifically, challenges exist in two areas: 1) the education of field ornithologists and IACUC members in the process of collecting bird specimens; and 2) the challenges of humane killing of birds in a dynamic field setting. Methods for collecting birds range from mist netting and overdose of anesthetic inhalants, to the use of firearms, and collecting in remote conditions where these methods are not available.

The reality of field collecting frequently does not fit neatly into the standard IACUC training and authorization process. AVMA approved methods at times do not take into consideration the challenges faced by the museum collector, and can cause frustration in the IACUC review process. Facing conditions on remote research expeditions, where approved chemical euthanasia cannot be used, is among the biggest challenges for biodiversity exploration. Lethal chemicals are sometimes unobtainable, either because of the remote nature of the work and/or restrictions on importing and transporting chemicals. Under these special field conditions, a primary challenge remains to identify common ground for humane killing methods that meet the needs of the researcher and the goals of IACUC approval. Solutions to these challenges can be met through education of researchers and IACUC members, clearly defining the euthanasia method and need, and above all, training.

Context-Dependent Challenges and Decisions for Humane Killing of Wild Small Mammals

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The AVMA recognizes that there are challenges inherent in the study of free-ranging wildlife that can necessitate departures from the Guide. Researchers who conduct field surveys of wild small mammals (rodents and shrews) might find themselves in circumstances where AVMA preferred capture techniques or methods of euthanasia are not practical or may be a less than ideal choice. Circumstances can be limited by species, environmental conditions, or logistical constraints. This talk considers circumstances where use of kill traps might be a sound alternate method to use of live traps for small mammals. Under the AVMA guidelines, use of live traps is preferred, and followed by methods of euthanasia when collection or killing are appropriate or necessary. Although kill traps may not consistently meet the AVMA standards for euthanasia and may best be characterized as humane killing, they might still provide the best choice for lethal take and can be approved under some circumstances when scientifically justified. Researchers proposing use of kill traps must provide sound justification and should include citations and references both in their protocol and as educational resources for the IACUC. Similarly, IACUCs who review research protocols should seek guidance from relevant experts for methodologies or species for which the committee is not familiar.

Challenges in Following Euthanasia Guidelines in Marine Fisheries Sampling

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The *AVMA Guidelines for the Euthanasia of Animals: 2020 Edition* outlines acceptable forms of euthanasia in fish including immersion, injection, and physical approaches. Each approach requires handling of individual fish or small numbers of fish. The gear types used to sample marine fish populations are often the same or similar to that used in commercial fishing; these include bottom trawls, beach or purse seines, and gill nets. The number of individual fish caught at one time can be large and acceptable forms of euthanasia are not possible or impractical under these circumstances. The latest edition of the *AVMA Guidelines* provides language describing these situations and the reality that acceptable forms of euthanasia in these cases are unable to be met. IACUC committees should be aware of this language and understand that meeting acceptable forms of euthanasia are not possible under certain scenarios; additionally, PIs should clearly justify why sampling large numbers of individuals is required. Fisheries scientists should continue exploring and testing new technologies (e.g. sonar,

cameras) that can replace the need for or reduce the use of commercial sampling gear when possible. Commercial fishing gear is used to catch the fish that many of us eat and IACUC committees should place the requirements of euthanasia in marine fisheries sampling into this context.

Session 7: Transition of Wild Animals to Captive Settings and Housing Challenges

Establishing Captive Populations of Wild Animals: Communicating with your IACUC

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Establishing captive populations of wild animals is challenging for multiple reasons. While some of these challenges derive from the animals themselves, others arise due to mismatches between the needs of exotic species and existing animal welfare regulations. Communication between researchers and IACUCs is critical to resolving these challenges. For researchers, this often involves generating quantitative information regarding the efficacy of non-traditional husbandry practices, thereby placing an additional regulatory burden on investigators working with exotic species. Using examples drawn from my studies of a captive population of colonial tuco-tucos (*Ctenomys sociabilis*), I outline general strategies for working efficiently with IACUCs to develop protocols that recognize the distinctive needs of exotic species while ensuring that welfare standards are met.

Challenges to Wildlife Adjusting to Captivity – Negotiating with the IACUC

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The Guide to the Care and Use of Animals in Research focuses heavily, and nearly exclusively, on domesticated species. Housing wildlife often creates different challenges that are not relevant to domesticated species. Examples include different food requirements such as live prey, inability to habituate, unpredictable changes in body weights, and the general stress of being in captivity. There are also procedural challenges. For example, shaving fur is important to prepare for surgery, but can't be performed when a species doesn't have fur. In addition, there are often tensions between maintaining clean animal facilities and species-appropriate caging. For example, plastic is easy to clean, but can create foot problems when used as perches for wild birds. Finally, there can also be tensions between IACUC goals and wildlife research. As an example, one IACUC mandate is to reduce the number of animals used, yet many wildlife studies require trapping as many animals as possible rather than as few as possible (such as studying migratory routes of birds). Fortunately, taxa-specific guides can help researchers and IACUCs navigate the different concerns with wildlife research.

Compliance Challenges for Capturing, Transferring and Keeping Wild Bats in Captivity for Research and Teaching

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Live bats are a valuable resource for research and teaching. In the United States Protocols for establishing and maintaining captive colonies of wild-caught bats were largely developed by trial and error in the mid-twentieth century, well before the modern research compliance era. Since then, there has never been a systematic effort to improve husbandry or veterinary care protocols for bats. To meet compliance regulations and facilitate monitoring, institutions and investigators generally adapt bat husbandry and veterinary care protocols to resemble guidelines for model species, especially rodents and songbirds. Some species are amenable to this cookie-cutter approach, but most bats, especially insectivorous bats, have a plethora of special needs. Husbandry challenges include unusually long lifespans, reproductive constraints, a need to fly, plus eating, drinking and defecating upside down. Between species, diet, torpor, hibernation, migration, and sociality all vary in ways that influence housing and care. In this talk I will review what are currently the most common procedures for the procurement and transfer of bats to captivity and highlight where research compliance problems arise. I will discuss how researchers, institutions and agencies might benefit by tailoring more realistic species-specific expectations for captive bat colonies. I will conclude with some predictions about the future of bat research in the United States and where efforts for improvement might be focused.