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EDITORIAL

Establishing general principles from little truths: lessons from marine mammal research

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Much of the work that we do as zoologists and publish in *Journal of Zoology* relates to the search for pattern in form and function (Bennett, 2008; Boyd, 2007). This quest, in many ways, tracks the relative maturity of our various disciplines. The Journal is calling for papers that cut across boundaries that traditionally separate the field of zoology from more specialized disciplines. This call for synthesis, rather than purely descriptive studies of narrow taxonomic and geographic focus, represents an exciting development in the Journal's history and provides a vital reminder that fundamental information about how animals function is essential to our efforts to conserve species.

What is less clear, however, is how we as zoologists – and how the *Journal of Zoology* itself – can better anticipate and meet the needs of policy-makers and conservation practitioners. In this editorial, I will focus on this question from the perspective of marine mammal research, but the central issues are relevant to both the current state of play in zoological research and the broader application of our knowledge to the conservation of species in increasingly human-dominated environments.

Ken Norris, one of the pioneers of marine mammal science, once wrote that marine mammalogists were tasked with compiling 'little truths on which future understandings . . . may be anchored' (Pryor & Norris, 1991). This modest set of expectations reflects the fact that marine mammals are difficult to study because of their lifestyle; our studies are often based on infrequent glimpses of animals at the surface. In 1970, Ehrenfeld outlined traits that make species inherently vulnerable to extinction, *inter alia* large body size, long gestation period, small litter size or lengthy maternal care, formation of large breeding aggregations, high commercial value for body parts and (or) an unregulated hunt, highly restricted distribution or distribution in international waters and trans-boundary migration. This description, in whole or in part, describes most endangered marine mammal populations. Marine mammals are particularly interesting study species for zoologists because they reach anatomical and physiological extremes, some species and populations are in dire straits, the status of many others is poorly known and our ability to conserve all of them depends on receiving the best possible advice from the zoologists who know their study animals the best.

Zoologists play a vital role in efforts to understand how anthropogenic activities affect wildlife, populations and ecosystems. Interpreting what is normal or abnormal cannot be done without knowing the timing of major life-history events, energy requirements, movement or migration patterns and behaviour. In setting conservation priorities, we need to know what it is about the biology of individual species that makes some of them more vulnerable to extinction than others, and how this knowledge can and should inform recovery plans.

For example, marine mammals have evolved exquisite systems for underwater hearing. As our oceans become increasingly noisy places, it is crucial to understand how these top predators will respond. Even modest disturbances in the acoustic environment can disrupt whales' foraging activities. But why do some species appear to be more tolerant of anthropogenic noise than others, even among species thought to have nearly identical hearing? Killer whales have evolved a suite of highly derived and specialized foraging tactics in sympatric and parapatric fish-eating and mammal-eating populations. Some populations capture prey using techniques such as intentional stranding, carousel feeding and tipping ice floes. Despite similar anatomical foundations within the species, will some killer whale populations be better able to adapt than others to urbanization and habitat degradation? Marine mammal science, both past and present, abounds with these sorts of conservation questions, whose answers are found in a solid understanding of the study animal's form and function. From bycatch in gillnet fisheries to the effects of a warming planet upon migratory habits (e.g. Williams, Noren & Glenn, 2010), cetacean researchers know that the best-laid plans for conservation and management are doomed to fail if they are not based on a good understanding of the biology of target species.

Natural resource management practices that ignore basic biology are obviously not confined to the marine environment. There is a parallel between historical exploitation of Southern Ocean baleen whales and American grazing practices. In the case of Antarctic whaling, the Blue Whale Unit was a bookkeeping measurement in which catch quotas for oil production were set by number of units rather than species-specific quotas that could be sustained by different populations (Hammond, 2006). A catch of one blue whale was treated as the equivalent of two fin whales, 2.5 humpback whales or six sei whales. Unsurprisingly, the system contributed to the rapid depletion of large whale stocks and was abolished in 1972. On the American grasslands, Sheep Units were used as a similar book-keeping tool to apportion access to grazing habitat (Chamberlin, 2006). This approach created an economic incentive to reduce livestock such as 'worthless' horses, which graze wild on the grasslands and eat on average as much grass as five sheep. These accounting shortcuts, obviously, are not the correct way to establish the big-picture narrative to which we should aspire. Zoologists know that it is foolish to manage guilds of seemingly similar animals simply because they play numerically similar roles in their environments. But it is often the case that decisions must be made in the absence of good, species-specific and context-specific information. Comparative approaches are one way of interpolating across species to predict vulnerabilities generally: these comparative approaches could be as ambitious as drawing parallels between the social structure of elephants and sperm whales. The better we understand the basic patterns of form and function in zoology, then more powerful and predictive this comparative approach becomes.

Fundamental information is needed about key animal species that can be gleaned from direct study or through comparative approaches to help us address conservation questions now and in the future. We need to establish general principles in zoology that can allow us to tackle issues as quickly as they arise. If we need to study every problem as if it were a new issue from first principles, then we will always be behind the curve and never be much use at giving advice to managers, sociologists, economists, planners and politicians.

As zoologists, our work is highly relevant to societal needs. The *Journal of Zoology* is encouraging more interdisciplinary dialogue in order to provide those responsible for developing conservation, management and population recovery plans with access to the specialized knowledge that only zoologists possess about their study animals. Today, papers that focus on a single species and do not elucidate general trends are likely to be sent to a taxon-specific journal. Papers that are primarily about conserving a particular population or managing a specific problem are more likely to be sent to specialized conservation or management journals. This traditional separation of disciplines muddies the interface between zoology and conservation and prevents us from exploring the wider implications of basic zoological research. An integrative approach to zoological studies that tell us how we think things generally work for a variety of species – from otters to seals to blue whales – will improve our ability to face new situations in which relatively little basic information is available. This interim advice, along with an honest appraisal of the resulting uncertainty in our predictions, will allow us to proactively design conservation and management measures that make some scientific sense. Indeed, this is exactly what the Journal aims to address by promoting the synthesis of specialized disciplines and welcoming papers that encompass a wide range of topics and that are truly integrative.

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