Applying the Heat to Research Techniques for Species Conservation

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There is no question that good data yield better conservation recommendations and actions, but it is becoming increasingly difficult to collect good data as ethical scrutiny of research involving wildlife intensifies. Recently, Dalton (2005) reviewed the current debate on how best to conserve the endangered Steller sea lion (*Eumetopias jubatus*) and, in particular, how wildlife researchers are facing escalating criticism and lawsuits over their use of "invasive" procedures to collect ecological data required for population management. Dalton's article is not unique in the world of conservation politics insomuch as there are many well-documented instances of conservation research being questioned and, indeed, even halted due to local politics and animal welfare concerns (Jabour Green & Bradshaw 2004). Thus, for effective and ethically sound conservation research, conservation scientists need to be more proactive in investigating the potential effects of their chosen methods and communicating the results to conservation practitioners and management authorities (Wilson & McMahon 2006).

Most would agree that it is healthy and morally responsible to question the assumptions on which the ethical principles of conservation biology are founded (Barry & Oelschlaeger 1996), and the legal power of animal ethics committees in public and private institutions has increased over the last few decades to reflect the public's rising interest in and concern about conservation issues (Jabour Green & Bradshaw 2004; Dawkins 2006). What seems to be missing in many cases of the priority debate between animal ethics and conservation is the administrative, legal, and ethical frameworks necessary to prioritize research techniques relative to the severity of the conservation crisis at hand. Indeed, it would be prudent to view biodiversity conservation as a decision process operating along a continuum, including both predicted research benefits and risks. Otherwise, in cases when research done to improve the conservation status of endangered or declining animal populations is halted on emotional grounds, the use of reason to provide effective conservation outcomes is seriously handicapped (Jabour Green & Bradshaw 2004).

Doing effective and meaningful research is imposed on conservation biologists by the global biodiversity crisis, so the hard reality is that sometimes "invasive" techniques are necessary to provide high-quality demographic data that will ideally lead to improved survival prospects for the species being studied (McMahon et al. 2006*a*). The precipitous decreases and potential extinction of the Wandering Albatross (*Diomedea exulans*) could not have been discovered and prevented if ethical restrictions preventing the marking of individuals had been imposed before it was learned that long-lining was seriously reducing adult survival (Weimerskirch & Jouventin 1987). It is also plausible that the world would be without species such as the enigmatic Kakapo (*Strigops habroptilus*) and Whooping Crane (*Grus americana*) had it not been for some potentially contentious scientific approaches, such as marking all individuals in the remaining population (Nedelman et al. 1987) and reducing supplementary feeding to manipulate offspring sex ratios (Sutherland 2002), to provide data essential for long-term conservation management.

Nevertheless, good demographic data necessary for conservation management and planning are often not easy to collect. Central to understanding the population dynamics of animals is the need to mark individuals so

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Figure 1. A 23-year-old female southern elephant seal that was branded as a pup alongside her own pup (photo by Mark A. Hindell).

that they can be subsequently identified. Durable, long-term marks are the most fundamental component of this necessity because they provide estimates of age structure, survival, longevity, dispersal, fecundity and abundance in wild, and domesticated animal populations. The choice of marking method depends on many different factors, not least of which is the desire to minimize the mark's impact on the animal's behavior and performance. For example, branding of southern elephant seals (*Mirounga leonina*) has no long-term effects on survival (McMahon 2006b): individuals branded as pups grow to maturity and return annually to breed (Fig. 1).

A range of painted marks, external tags, and, more recently, implanted passive integrated transponder (PIT) tags are used for conservation research purposes. Unfortunately many of these marks require the individual to be captured repeatedly over its lifetime for identification and reapplication of tags. In addition, some external marks (e.g., penguin flipper bands) affect survival adversely; hence, their use has been curtailed (Gauthier-Clerc et al. 2004). The application of permanent marks such as brands that can be identified from afar usually raises some ethical and emotional concerns (Jabour Green & Bradshaw 2004). On the one hand, a permanent mark removes the need to reapply temporary tags, thus resulting in a reduction in the cumulative disturbance experienced by the marked individual over time. The countervailing argument is that permanent marks such as brands require some initial damage to the animal's tissues and are therefore sometimes considered ethically unjustified as was the case in a long-term demographic study of elephant seals that we discuss below (Jabour Green & Bradshaw 2004).

Despite the recent emotive calls to ban branding as a conservation tool, recent work suggests that branding has no discernable long-term impact on seal survival or condition (van den Hoff et al. 2004; McMahon et al. 2006*b*). Moreover, a particular long-term branding program for southern elephant seals reveals some important discoveries that help explain the processes involved in recent population declines: (1) juvenile survival is the key demographic parameter driving variation in population growth (McMahon et al. 2005), (2) climatic conditions encountered by naïve pups affect survival (McMahon & Burton 2005), (3) mothers produce pups for the duration of their lives (Hindell & Little 1988), and (4) a mother's age and breeding experience are important determinants of pup survival (McMahon & Bradshaw 2004).

Nevertheless, and despite these valuable life-history insights, the branding of southern elephant seals on Macquarie Island became so emotively charged and controversial, receiving both national and international media coverage and condemnation (Animal Welfare Institute 2000; McGilvray 2000; Widolf 2002; ABC 2004), that the program was suspended indefinitely (Jabour Green & Bradshaw 2004). Similar political intervention catalyzed by adverse media coverage (New Zealand Herald Online 2000) occurred in New Zealand with conservation research that involved permanent marking methods in a long-term study of the demographic status of the endangered Hookers sea lion (*Phocarctos hookeri*). Most recently, in the United States, research methods are being criticized and there are calls for the conservation program of a threatened species to be suspended pending an independent review, with the possible prosecution of individual scientists pending (Dalton 2005; Young 2005). Such interference on the basis of animal welfare issues is difficult to justify considering that in the United States approximately 36,480,000 of the 96,000,000 beef cattle (38%) in that country are either hot- or cryo-branded each year (U.S. Department of Agriculture 1993).

The inability of conservation science to justify real and perceived intrusion into the collection of essential information must be overcome to prevent conservation science from becoming "functionally sterile" (Barry & Oelschlaeger 1996). Perhaps one method to circumvent such outcomes is to design more preliminary studies to ascertain the effectiveness and long-term implications of the proposed methodology prior to implementation of a full-scale marking program. After demonstrating the effectiveness (e.g., van den Hoff et al. 2004) and lack of negative impacts (e.g., McMahon et al. 2006*b*) of a particular method, the procedure is much more likely to gain support from regulating authorities and the public in general (Wilson & McMahon 2006). The choice of an appropriate marking technique that imposes little overt harm to the species of interest is an essential element of conservation science. The alternative means management decisions would be based on inferior information (in terms of larger errors associated with parameter estimates).

Nevertheless, discovering that a research technique has no measurable effect should not be seen as a carte blanche to use a technique indiscriminately. For example, some conservation projects targeting endangered marine turtle

populations place particular importance on tagging individuals even though tagging often fails to provide any reliable biological data on which recovery plans can be based (Mrosovsky 1983). These sorts of nonfunctional animal manipulations, providing no guaranteed or obvious conservation outcome other than satisfying the apparently inherent belief that doing something is better than doing nothing at all, highlight the importance of identifying the information most likely to provide useful conservation outcomes (e.g., vital rates) (McMahon et al. 2005 and references therein).

Scientists have a responsibility to convince conservation authorities to invoke reason when making decisions about the value of a research technique by being proactive in our assessments of the possible effects of a particular methodology and by highlighting the urgency for prompt conservation action based on sound biological information. Scientists may also wish to challenge the prevailing philosophy espoused by many conservation and research authorities (e.g., government agencies and animal ethics committees) that the scientist's onus of demonstrating the absence of negative effects takes priority over the authority's responsibility to reveal any deleterious consequences of the proposed work. When human intervention is required to safeguard species of high conservation concern, this guilty-until-proven-innocent stance should yield to the more important aim of minimizing the probability of extinction. The conservation clock is running out, and in some cases attempts to appease all the ethical sensitivities that surround the study of wild animals threatened with extinction may have to be forgone. The challenge then is to bring the biological, ethical, and legal components of biodiversity conservation into some form of jurisdictional harmony prior to the initiation of research projects attempting to address species decline.

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Literature Cited

ABC (Australian Broadcasting Corporation). 2004. Seal branding for science finally stops. 4 April, 7.30 report, Sydney. ABC, Sydney. Available from http://www.abc.net.au/7.30/stories/s116022.htm (accessed October 2005).

Animal Welfare Institute. 2000. Elephant seals hot iron branded. Animal Welfare Institute Quarterly **43**. Available from http://www.awionline.org/pubs/Quarterly/Summer2000/hotiron.htm (accessed October 2005).

Barry, D., and M. Oelschlaeger. 1996. A science for survival—values and conservation biology. Conservation Biology **10:**905–911.

Dalton, R. 2005. Animal-rights group sues over 'disturbing' work on sea lions. Nature **436:**315.

Dawkins, M. S. 2006. A user's guide to animal welfare science. Trends in Ecology & Evolution **21:**77–82.

Gauthier-Clerc, M., J. P. Gendner, C. A. Ribic, W. R. Fraser, E. J. Woehler, S. Descamps, C. Gilly, C. Le Bohec, and Y. Le Maho. 2004. Long-term effects of flipper bands on penguins. Proceedings of the Royal Society of London, Series B: Biological Sciences **271:**S423–S426.

Hindell, M. A., and G. J. Little. 1988. Longevity, fertility and philopatry of two female southern elephant seals (*Mirounga leonina*) at Macquarie Island. Marine Mammal Science **4:**168–171.

Jabour Green, J., and C. J. A. Bradshaw. 2004. The "capacity to reason" in conservation biology and policy: the southern elephant seal branding controversy. Journal for Nature Conservation **12:**25–39.

McGilvray, G. 2000. Seal uproar: big questions arise. Australian Veterinary Journal **78:**299.

McMahon, C. R., and C. J. A. Bradshaw. 2004. Harem choice and breeding experience of female southern elephant seals influence offspring survival. Behavioral Ecology and Sociobiology **55:**349–362.

McMahon, C. R., and H. R. Burton. 2005. Climate change and seal survival: evidence for environmentally mediated changes in elephant seal, *Mirounga leonina*, pup survival. Proceedings of the Royal Society of London, Series B: Biological Sciences **272:**923–928.

McMahon, C. R., M. A. Hindell, H. R. Burton, and M. N. Bester. 2005. Comparison of southern elephant seal populations, and observations of a population on a demographic knife-edge. Marine Ecology Progress Series **283:**273–283.

McMahon, C. R., C. J. A. Bradshaw, and G. C. Hays. 2006*a*. Branding can be justified in vital conservation research. Nature **439:**392.

McMahon, C. R., H. R. Burton, J. van den Hoff, R. Woods, and C. J. A. Bradshaw. 2006*b*. Assessing hot-iron and cryo-branding for permanently marking southern elephant seals. Journal of Wildlife Management. In press.

Mrosovsky, N. 1983. Conserving sea turtles. The British Herpetological Society, Essex, United Kingdom.

Nedelman, J., J. A. Thompson, and R. J. Taylor. 1987. The statistical demography of whooping cranes. Ecology **68:**1401–1411.

New Zealand Herald Online. 2000. Vet defends branding of sea lions. Auckland, 1 December. New Zealand Herald, Auckland. Available from http://www.nzherald.co.nz/search/story.cfm?storyid=ED587C94-39D9-11DA-8E1B-A5B353C55561 (accessed October 2005).

Sutherland, W. J. 2002. Conservation biology—science, sex and the kakapo. Nature **419:**265–266.

U.S. Department of Agriculture (USDA). 1993. Branded beef cow/calf herd management practices in the United States. Cow/Calf Health and Productivity Audit 27, Boulder, Colorado. USDA, Washington, D.C. Available from http://www.aphis.usda.gov/vs/ceah/ncahs/nahms/beefcowcalf/index.htm#chapa93 (accessed October 2005).

van den Hoff, J., M. D. Sumner, I. C. Field, C. J. A. Bradshaw, H. R. Burton, and C. R. McMahon. 2004. Temporal changes in the quality of hot-iron brands on elephant seal (*Mirounga leonina* L.) pups. Wildlife Research **31:**619–629.

Weimerskirch, H., and P. Jouventin. 1987. Population dynamics of the wandering albatross, *Diomedea exulans*, of the Crozet Islands: causes and consequences of the population decline. Oikos **49:**315–322.

Widolf, H. E. 2002. Animal rights and the Antarctic Treaty system. Human Ecology Review **9:**59–67.

Wilson, R. P., and C. R. McMahon. 2006. Devices on wild animals: what constitutes acceptable practice? Frontiers in Ecology and the Environment **3:**147–154.

Young, S. 2005. Weird science: HSUS lawsuit seeks to halt invasive research on threatened Steller sea lions. The Humane Society of the United States, Washington, D.C. Available from http://www.hsus.org/marine_mammals/marine_mammals_news/weird_science.html (accessed October 2005).