More Training in Animal Ethics Needed for European Biologists

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Research on basic animal biology and ecology is essential for increasing our knowledge and for improving species conservation. However, it often involves the suffering or killing of a certain number of animals, and such matters are rarely debated. Moreover, in providing education in ethics, biology seems to lag behind other disciplines of life sciences. Here, I first review several situations in biological research and species management in which animal ethics issues arise. Second, in order to determine the current status of the ethics education of undergraduate students in biological sciences in Europe, I report the results of the evaluation of curricula at 150 universities offering such programs. Surprisingly, merely 9% of the programs offered ethics as a mandatory and stand-alone course. I consider this a significant gap in biological education and advocate that biologists should receive proper training in animal ethics.

Keywords: animal ethics, biology, conservation, education

With advances in science and a drive for more knowledge, our society faces increasingly significant legal, social, political, economic, and ethical challenges. The ethical considerations are particularly crucial for the formulation of scientific research practice (Shammo and Resnik 2009). One area of potential ethical issues in science is research on animals. The discussion on this topic usually revolves around the use of animals in pharmaceutical and medical experiments (e.g., Gross and Tolba 2015, Joffe et al. 2016), but the suffering and killing of animals are also a frequent part of research in basic biology and species management, and this is very rarely discussed (Crozier and Schulte-Hostedde 2015). Biologists often need to consider the ethical aspects of their practice, and this is only possible if they are encouraged and given the tools to do so. This should start with the education of biology students. In the following, I provide a brief summary of ethical issues involving animals in biological research and species conservation, and I assess to what extent European universities include ethics in the curricula of study programs in biological sciences.

The invasiveness of biological research

Research in ecology and biology remains crucial for increasing our knowledge and improving the management and conservation of species in the midst of the current biodiversity crisis (Butchart et al. 2010, Pereira et al. 2010), but this usually means invasive sampling of a certain number of animals. Marking and sampling practices include taking blood samples, toe-clipping amphibians and reptiles, hot-branding marine mammals, and using implants or subcutaneous dyes (Sutherland et al. 2004, Schmidt and Schwarzkopf 2010, Walker et al. 2012). The latest research shows that it is not only vertebrates that can experience pain (Elwood 2011, Sneddon et al. 2014, Elwood and Adams 2015), but marking techniques that might affect animals' welfare but not their survival are still considered acceptable (Cattet 2013). Even research not requiring invasive methods, such as behavioral studies, could potentially involve animal suffering (Buchanan et al. 2015). The viability of a population is thus often prioritized over the interests and rights of individual animals (Farmer 2013).

Dilemmas in species conservation

Because concerns for species preservation often arise from ethical or moral values, ethics is an inherent part of biological conservation (Cohen 2014). Nonetheless, animal ethics and welfare may not always be explicitly considered (Harrington et al. 2013). Whereas conservation managers seem to have goals similar to those of people favoring animal rights, wildlife management often includes culling in order to reduce the population size and protect other species or habitat (Ehrenfeld 1991, Woodroffe and Redpath 2015). For instance, approximately three million kangaroos are killed each year to lower their impact on agricultural production in Australia (Boom et al. 2012). Culling is also sometimes used to manage the high population density of African elephants, which causes significant harm to the ecosystem (Marris 2007).

Sometimes, animals need to be relocated or reintroduced, with the aim to recover a species population of conservation

BioScience 67: 301–305.
doi:10.1093/biosci/biw177 Advance Access publication 1 February 2017

concern. However, animal welfare is not always considered under these circumstances either, even though significant challenges such as mortality, disease, or human–animal conflict often occur (Harrington et al. 2013). Specifically, there have been several accounts of unintentional disease transmission from captive to wild populations (Woodford and Rossiter 1994), and stress and maladaptation to the new environment can result in high death rates of the reintroduced animals (Teixeira et al. 2007, Harrington et al. 2013). Given that reintroduction programs are associated with significant financial costs and a failure rate of up to 50% (Fischer and Lindenmayer 2000), when is it acceptable to conduct such projects? There is surprisingly little discussion of ethics in the literature on reintroductions (Harrington et al. 2013).

Another controversial topic is the eradication of *invasive species*, which are species introduced to a location where they spread and reproduce rapidly, causing severe problems to native organisms (Pysek et al. 2004). Even just one invasive species can substantially change the whole ecosystem, as was the case with the introduction of the Nile perch (*Lates niloticus*) into the African lakes (Kaufman 1992). The preferred approach to dealing with invaders is to prevent their arrival and establishment, but when the species is already present, the default action is removal, which is often lethal to the individuals (Genovesi 2005). Still, invasive and pest animals do not have a smaller capacity to experience pain than other species, but the tools for their control that are considered best for animal welfare may not be very effective (Littin 2010).

Stress on researchers' self-regulation

The examples listed above illustrate that biologists and conservation practitioners frequently face complex ethical challenges in their work and need to weigh the potential gain in knowledge and benefit to the population or ecosystem against the negative impacts on individual animals or species (Minteer and Collins 2005, 2008). One would therefore hope that the scientific community enforces ethical considerations—for example, as a part of the peer review of manuscripts submitted to scientific journals.

Whereas journal publishers increasingly require researchers to consider animal welfare, not all journals provide strict ethical guidelines to which authors need to conform, and as long as a study adheres to legal regulations, editors may not examine its ethical dimensions (Marsh and Eros 1999, Vucetich and Nelson 2007). This is particularly the case with studies that involve invertebrates, which have limited legal protection (Andrews 2011). In these situations, codes of practice and policies are important, but they may not be very useful when a researcher needs to decide between different ethical principles that may be in conflict (Shrader-Frechette and McCoy 1999).

Therefore, the assessment of whether certain practices are justified often depends entirely on the judgment of the scientist (e.g., Farnsworth and Rosovsky 1993, McCoy and Berry 2008). But the question remains: Are biologists actually trained to assess the ethical dimensions of their practice that involves animals?

Lack of training in ethics at European universities

To answer this question, I assessed the extent of courses in biological fields (i.e., biology, ecology, and life sciences) in undergraduate (bachelor's degree) programs in Europe. The undergraduate stage is the time when students start to learn what it means and entails to be a scientist, and any education in ethics should be incorporated as early as possible (Eisen and Berry 2002). Using a sample of 150 universities in 36 European countries (figure 1, supplemental table S1), I searched for evidence of courses in ethics by reviewing documents describing the program curricula, which were available on university websites. I found that only 14 programs (9%) provided ethics as a stand-alone and compulsory course (figure 1). These programs were offered at universities in Austria, Belgium, Finland, Germany, Italy, Poland, Switzerland, and the Netherlands. However, this still does not mean that ethical issues pertaining to animal research are being discussed. In terms of a specific content of the teaching, ethical issues about genetically modified organisms, the role of science in society, or gene therapy were among the most often listed topics. Twenty-nine universities (19%) offered ethics only as an optional course or as a part of another course. But the majority, 107 (72%) out of the 150 surveyed programs, did not offer any ethics training to the students (figure 1). This situation does not seem to be specific to Europe. For instance, Zaikowski and Garrett (2004) reported more than 10 years ago that most undergraduate programs in the United States did not require an ethics course to receive a degree in the biosciences. The status apparently has not significantly changed since then (Smith 2014).

The reason for the observed lack of training in ethics might be that this type of education has historically not been considered to be of much importance in the life sciences (Douglas 2009). Through verification and the elimination of bias, science has strived to distinguish itself from the humanities (Reiser and Heitman 1993). And in the case of animal use and lethal management, compassion for the organism may be thought to interfere with scientific objectivity (Nelson et al. 2016).

Necessity of training in ethics

If morality was common sense, we would not hear of so many controversies. It is unfortunate that often, only revealing the circumstances of serious breaches of professional and ethical guidelines leads to a call for more ethics among scientists (e.g., Vucetich and Nelson 2007, Mitcham and Snieder 2014). The basic ethical principles are usually shown to us by our parents and schoolteachers, but the professional ethics of students and early researchers are often modeled by the behavior of the principal investigator in the lab (Eisen and Berry 2002). However, given that the majority of

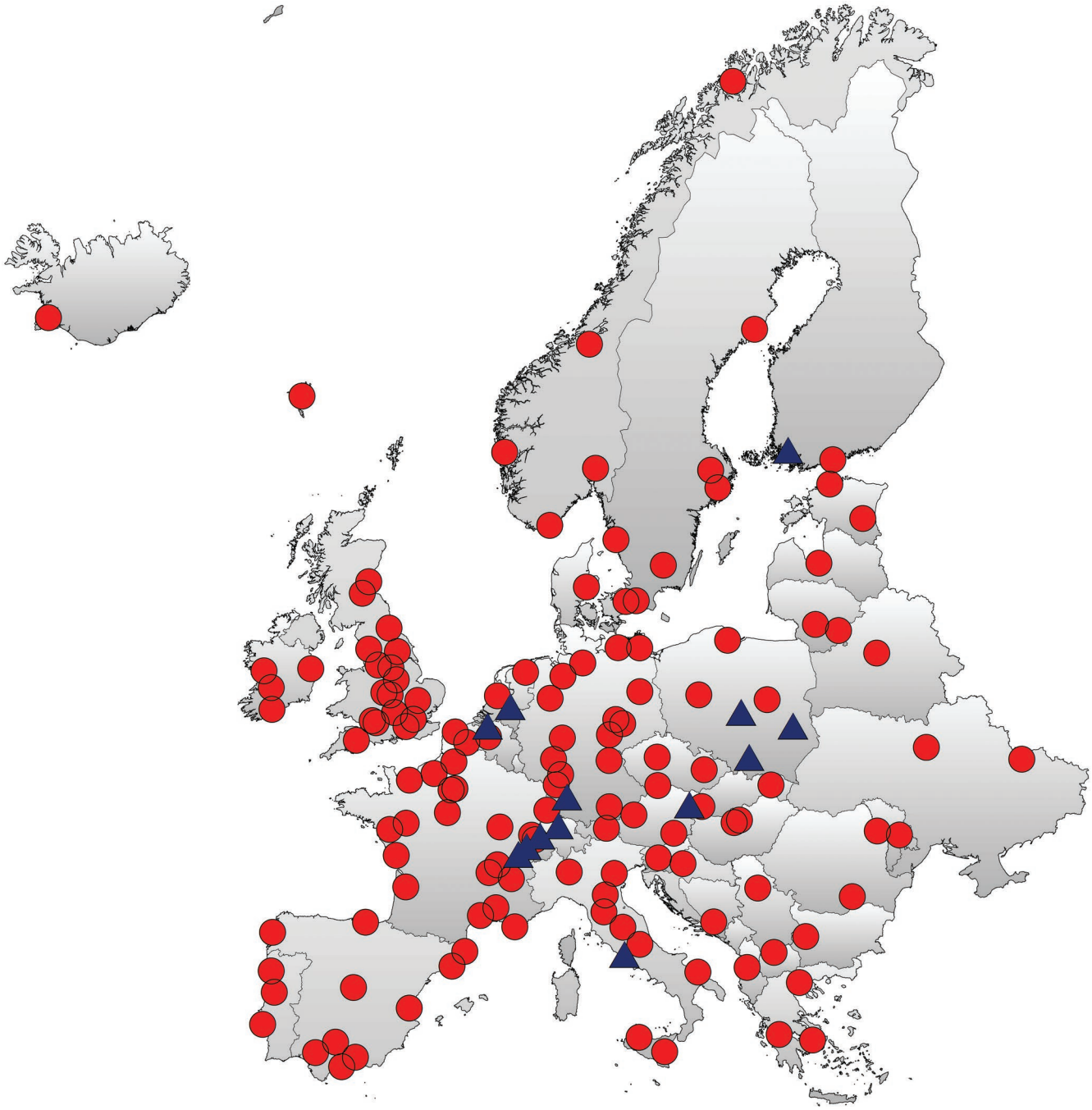

Figure 1. Lack of training in ethics at the European universities. The map shows 150 surveyed undergraduate programs in the biological sciences that include ethics as a stand-alone and compulsory course in their curricula (n = 14; triangles), and programs in which ethics is included only as a part of another course, as an optional course, or not offered (n = 136; circles). See supplemental table S1 for more details.

researchers did not obtain explicit training in ethics, how can we expect them to provide an example for and educate the next generation of biologists?

The contentious issues of research and management of animals that were discussed above could be approached from several different angles, and an ethics education can offer formal tools and concepts for building arguments and rationalizing decisions (Jamieson 2008, Minteer and Collins 2008). Courses in ethics would provide students with the key skills of reasoning, critical thinking, and argumentation and enable researchers to identify and analyze the ethical aspects of animal use and conservation, as well as use these skills beyond their undergraduate studies (Nelson and Vucetich 2012, Crozier and Schulte-Hostedde 2015). How

this incorporation of ethics into the curriculum could be implemented has been discussed elsewhere (e.g., Zaikowski and Garrett 2004, Herreid 2014, Smith 2014). The most effective approach might be to provide specific examples of case studies combined with discussion of the emerging practical guidelines that are specific to the research and management of wildlife animals (Curzer et al. 2013, Lindsjo et al. 2016).

Biological research and species conservation are valuable and needed, but we should reflect upon and acknowledge ethical problems when they emerge. Research on animals remains a controversial topic in both scientific and public debates (van Zutphen 2002, Mervis 2015), and scientists must be able to justify and communicate their research clearly.

Conclusions

There are several possible circumstances in animal research and conservation in which ethical issues arise, and ethically conducted research and management are possible only if scientists are properly trained. The results presented here should provide a useful overview of the lack of training in ethics in European biological education. Hopefully, awareness is the first step on the way to improvement.

Acknowledgments

I thank Elisa Aaltola and Gieri Bolliger for encouragement and Gerald Heckel for support. This manuscript was greatly improved by comments from John Vucetich and the two anonymous reviewers.

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