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THE WILD ANIMAL AS A RESEARCH ANIMAL

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ABSTRACT. Most discussions on animal experimentation refer to domesticated animals and regulations are tailored to this class of animals. However, wild animals are also used for research, e.g., in biological field research that is often directed to fundamental ecological-evolutionary questions or to conservation goals. There are several differences between domesticated and wild animals that are relevant for evaluation of the acceptability of animal experiments. Biological features of wild animals are often more critical as compared with domesticated animals because of their survival effects. An important issue is what is called here "natural suffering": the suffering from natural circumstances. Should this type of suffering be taken into account when suffering from experimentation is evaluated? As an answer, it is suggested that "natural functioning" should be considered as an additional standard in the evaluation of wild animal experimentation. Finally, two topics related to the ecological context are considered. Firstly, the often inevitable involvement of non-research animals in wild animal experimentation, and secondly, the eco-centric approach to nature conservation. According to the latter position, animals are subordinated to ecosystems. All these aspects make the evaluation of wild animal experiments much more complex than experiments with domesticated animals. Preliminary scores are proposed to deal with these aspects. It is argued that this should not lead to a more complex governmental regulation, since an effective maintenance and control are hard to realize and one may loose the cooperation of researchers themselves. In addition, non-governmental professional organizations such as research societies and funding organizations play a pivotal role.

KEY WORDS: animal experimentation, animal welfare, domesticated animals, field biological research, natural functioning, natural suffering, wild animals

INTRODUCTION

Peter Singer's *Animal Liberation* (Singer, 1973) and accordingly many others publications (e.g., Regan, 1983; VandeVeer, 1979; Singer, 1989) led to a wide public awareness of and debate on the use of animals for scientific research and the debate on this topic is still going on. As a result, many countries have now implemented legislation on the use of animals in scientific research. For example, in the Netherlands, so-called Animal Experimentation Committees (*Dierexperimenten Commissies*, abbreviated to "DECs") evaluate research protocols on the balance between the expected level of animal suffering or discomfort and the interest of the experiment. This interest should be related to biomedical,

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diagnostic, veterinary, or scientific ends. Moreover, research animals must be obtained from accepted breeding institutes and strong rules apply for housing conditions of the animals (Boon, 1999).

In the public debate, most attention is usually paid to laboratory animals. The caged rat with a tube implanted on its head and connected to high-tech equipment in the laboratory functions as an icon of animal experimentation. However, animal experiments are not restricted to the caged animal; experiments are also performed with free ranging wild animals under field conditions. Research questions of these so-called "field biological experiments" are often related to ecological or evolutionary themes such as dispersion of organisms, ecological relationships, and reproductions strategies of animals. Besides pure observational studies, more or less drastic invading techniques are applied in this type of research, for example ringing, tagging, attachment of radio transmitters, blood sampling, drug administration, and surgery (Rijssen, 2002). No doubt, these field biological experiments are animal experiments, but there are several reasons to consider field biological differently from laboratory animal experiments.

In this paper, differences between bred laboratory animals and free ranging wild animals are discussed in relation to animal experimentation. Attention is paid to (1) biological differences between bred and wild animals in relation to research, (2) experimental and natural animal suffering, and (3) the ecological context of wild animal experimentation. Finally, some policy consequences are discussed.

DIFFERENCES BETWEEN DOMESTICATED AND WILD ANIMALS

One of the main objects of regulation on animal experimentation is to minimize animal suffering. The refinement, reduction, and replacement of animal experimentation were proposed many years ago as guiding principles (Russell and Burch, 1959) and are now widely accepted. The possibility to realize this so-called "triple-R" concept depends of course on the research question that is put and on the availability of the alternatives. However, also the expected or wanted level of statistical significance of the experimental results, biological features, origin of the animals, and the body of knowledge we have of the animals play an important role. As we shall see, these aspects are important with respect to wild animal experiments as compared to experiments with domesticated animals.

Biological Features

Much biological research with animals is done with domesticated animals that are bred and housed under controlled conditions. The difference between domesticated and wild animals is not very sharp; e.g., zoo and wild park animals may be considered as in between. For clarity, we will limit our selves in this paper to free ranging wild animal in nature reserves or wild areas on the one hand and bred laboratory animals on the other hand. To a certain extent, these latter animals are adapted and accustomed to the circumstances of laboratory life. During a long breeding history, morphological, physiological, and behavioral traits have often been changed. Size, fur, bones, teeth, and aggressiveness may, for example, differ. Domesticated animals may even be genetically tailored to specific experiments by breeding or genetic modification and function as so-called animal models for human diseases; e.g., mice breeding lines in case of some cancers and diabetes. Most domesticated animals have lost a number of their former essential traits and cannot or can hardly survive under field conditions.

As compared to domesticated animals, wild animals' traits are stronger related to natural conditions. Morphological, physiological, and behavioral features are often essential for their survival (RIC, 1998; Anonymous, 2003). For example, tagging animals with dyes or labels in the laboratory will often not hurt the animal but may lead to animal suffering or malfunctioning under natural conditions because it may affect the fur or disturb animal communication. In general, one may conclude, that manipulation of biological features of wild animals is more critical as compared with domesticated animals. However, specific guidelines on the treatment of wild research animals cannot easily be given because the level of suffering and malfunctioning of wild animals is also dependent on additional factors as the species, the natural environment, the season, age of the animals, and so on. This makes the task of evaluating wild animal experimentation regarding suffering or malfunctioning a difficult task.

Sample Size

One of the elements of the triple-R concept is the reduction of numbers of required research animals. We may ask how this aim relates to wild animal experiments. From literature it is much more difficult to derive the required number of animals in wild animal experiments as compared to laboratory experiments. This is because laboratory and field experiments often have very different research questions. Moreover, it appears that within field experiments, the numbers of animals vary considerably (Still, 1982; McConway, 1992). There are a number of reasons for a

larger required sample size in case of wild animal experimentation. Firstly, wild animals often have higher levels of genetic variation, because they are usually less inbred than domesticated animals. They may, therefore, respond more heterogeneously, which leads to a larger sample size. This is illustrated by my own experience, as a member of the Animal Experimentation Committee (DEC) of my university. It appears that laboratory experiments with so-called wild-type rats (rats with a high level of genetic variation) require up to 25 animals for one data point instead of often 4 to 6 animals when an inbred line is used. Secondly, and in addition to the first reason, field conditions like temperature, food supply, social relations, and individual history also contribute to the level of experimental variation and this also leads to a larger sample size. Thirdly, under natural conditions the number of animals that will die or will become unusable, due to unforeseen events (storm, floods, predation, and so on) is expected to be higher than under laboratory conditions.

So, we may expect that field biological experiments, assuming for the sake of the argument *a conditio ceteris paribus*, require more animals as compared with laboratory experiments. Experimentation with domesticated animals is, from this perspective, preferred above wild animals and wild animals should only be taken if the research question cannot be answered otherwise.

Suffering and Control

Experiments with wild animals may require manipulation like tagging, drug administration, surgery, or captivity (Anonymous, 2003). Capturing is often necessary. However, most animals avoid humans and capturing is usually accompanied by stress, sometimes followed by death. Even human presence at a distance may lead to high levels of stress. Captivity may cause additional stress or suffering if animals are taken away from their familiar environment and congeners. If animals are set free after the experiments, it is not always possible for them to resettle. Other animals may occupy their ecological place and additional stress or suffering may occur by reoccupation efforts. If it is not successful the animal may end in a marginal subsistence.

If the animals are not held in captivity but range freely within the framework of the experiment, they may get at places that are hard to access for the researcher. This is, for example, the case with migration research on a continental scale with animals that are equipped with, e.g., radio transmitters or loggers; the latter are devices that continually register data, e.g., body temperature, blood pressure, etc. Care taking for their health

and welfare is then much more difficult as compared to captive animals. Intervention to prevent or to lower suffering is often not possible.

Choice of Species

In laboratories, often a limited number of species are used for animal experimentation. A number of rodents and a few other species dominate. In the Netherlands, more than 70% of the research animals in 1998 were rats or mice (Ministry VWS, 2000). There are some reasons for this. Firstly, because laboratory research is often done in a biomedical setting, it is not the interest for the animal itself but medical progress that drives the choice of species. Biological and pathological similarity with the human body is important. Therefore, mammals and especially rodents dominate medical animal experimentation that is usually done with domesticated animals. Secondly, species that are rather easy to breed, to house, and to manipulate are preferred in laboratory experiments and this is certainly true for domesticated rats and mice, and many other rodents. Thirdly, medical researchers strive for joining with the current body of biomedical knowledge because this makes it possible to relate insights from different research programs to each other, e.g., to relate research on brain anatomical structures to drug distribution research. Most researchers will thus conservatively choose for already well known and widely used species. As a result a limited number of standard species dominate.

In biological field research, a different situation exists. Firstly, this type of research is often meant to gain knowledge of ecosystem functioning. Ecosystems consist of many interacting species, so multi-species research is often required. Moreover, within ecology different paradigms may flourish with respect to the role of species, processes, or structures in a ecosystem, leading to different visions of nature (Swart et al., 2001) and as a consequence to different species of choice. Secondly, since wild animals are primarily recruited from and kept in the wild, features that determine breeding and housing success are often not so important in field biological research and will not limit species choice. Thirdly, because biological research often aims for new fundamental, biological knowledge, species that are not known very well are probably more attractive for researchers than widely known species. So we may expect that the range of species is much wider in field biological research and it may also include rather unfamiliar species.

Because of the wider range of species in wild animal research, knowledge of research animals is expected to be more heterogeneous. At the same time, it may be expected that the number of field biological field

researchers is much lower as compared to the number of biomedical researchers. This is probably also true for the available body of knowledge research animals, such as the survival value of traits, the animal origin, sensitivity of the animal for manipulation, the individual history, the expected effects of loggers, etc. We may, therefore, expect that accurate assessment of suffering and discomfort and the application of the triple-R concept are much more difficult to realize in biological field experiments.

In spite of these differences, most legislation and regulation on animal experimentation is often tailored to laboratory animals in a biomedical context and much less to wild animals.

The special effects on wild animal are often not recognized in regulation. For example, Dutch regulation does not mention suffering caused by capturing, captivity, or reintroduction in the so-called "scale of discomfort," a scale from 1 up to 6 expressing the seriousness of discomfort or suffering due to experimentation. Also, officially allowed reasons for animal research ignore the special case of wild animal research. In Dutch legislation, pathological, diagnostics, toxicological, medical, pharmaceutical, and veterinary purposes are notably mentioned as acceptable reasons for animal experimentation. Other purposes are permitted, but only under specific circumstances. Thus, animal experiments solely for nature conservation ends are, if we take such legislation literally, probably not permitted. Another problem is that current rules on housing and feeding can often not be applied under field conditions when animals range freely. As a consequence, the animal researchers and commissions that evaluate experiments must operate in a kind of decision vacuum. A recent survey among a number of field researchers made clear that current legislation is considered to be weak for field research in other European countries as well (Rijssen, 2002).

These discussed differences matter but it does not, however, lead to a fundamental different type of deliberation for field biological research. In current practices of deliberation on animal research, suffering has to be in balance with scientific and societal benefits.

A more fundamental problem is if and how far we have to strive for a reduction of suffering in wild animal experimentation. Current regulations actually says "as low as possible," but in the case of wild animals one must realize that natural conditions may also lead to discomfort and suffering. How must we deal with this "natural suffering" as compared to experimental suffering? Another issue is the natural context itself. Wild animals are members of a bio-community or components of an ecosystem, which themselves are worth to be protected. How do we deal with this,

especially when ecosystem or population perspectives conflict to animal welfare? These two issues will be discussed below.

NATURAL AND EXPERIMENTAL SUFFERING

The main reason in most societies to consider animals as moral subjects is that they can experience pain or are able to suffer (Singer, 1973). Beside this, it is recognized that animals – as living entities – have an intrinsic value, i.e., they have a good for themselves or they are seen as part of the natural order that must respected (Regan, 1983; Brom, 1997). In the Dutch Animal Experimentation Law, the intrinsic value is recognized as a basic principle (Boon, 1999). However, in practice, utilitarian considerations dominate, since a license for animal experimentation is usually obtained after a deliberation on animal suffering over societal and scientific interests. So in a practical context, suffering is a key factor in the applied animal experimentation ethics.

Suffering is an element of the wider concept of welfare that includes both pleasant and unpleasant experiences. Suffering is not only associated with pain and discomfort, but illness and stress are also related to it. Illness denotes feelings of malaise, tiredness, and nausea (Vorstenbosch et al., 1999). Stress is related to emotions such as fear, panic, and loss of control in an unpredictable environment. Fear, predation, and starving, which may be considered as serious forms of suffering, are, however, regular circumstances for many wild animals. We may say that suffering is a "fact of wildlife". Suffering as a result of an experiment may even be negligible as compared to natural suffering. For example, suffering by sampling small amounts of blood is probably much smaller as compared to suffering from fights between competing males where animals can seriously be hurt. Experimental conditions created by researchers may also be more favorable as compared to natural conditions, as is probably the case when food is provided to animals. On the other hand, experimentation may also lead to very high levels of discomfort or suffering due to experimental protocol, e.g., experiments with unnatural high levels of predation (Huntingford, 1984).

The fact that under natural conditions animals may suffer is used by some authors as a moral reference. Howard (1993) states rather provocatively that "the killing of wild and laboratory animals can be justified morally and considered as a sacred act." He applies a kind of what I would call a naturalistic ethics: "Nature death ethics, the survival of the fittest, is what the balance of nature is all about." And, according to him, research animals are often better off than wild animals: "In contrast to the

brutality of natural predation, people must operate under regulations to protect animals and their populations."

However, justifying animal research by a reference to cruelty of nature is an illogical way of reasoning. Firstly, nature cannot be seen as a moral agent with its own ethical framework as Howard suggests in the quote above. This is because a moral agent is "any being who is capable of thinking, deciding, and acting in accordance with moral standards and rules" (Taylor, 1975, p. 6), and this is certainly not true for animals or for nature. Howard's statement fits into an animistic culture, but in our contemporary age, it is an anachronistic position. Secondly, deriving normative statements from factual statements may be considered as a naturalistic fallacy. "Is" does not imply "ought," as it is often stated.

A Natural Functioning Approach of Welfare

According to most regulations animal suffering in scientific experiments must be prevented or should be as low as possible. So, non-suffering is a basic norm and deviation from it needs good arguments. On the other hand, knowing that wild animals sometimes suffer seriously by natural causes questions the reasonableness of the basic norm of non-suffering in biological field experiments. As an example, is it acceptable to perform predation research with, e.g., mice that are naturally preyed on by raptors? Is it allowable to do starvation research with wild animals that actually starve by natural causes? And, do we have to intervene when wild animals suffer by natural causes? Different answers are given by field biological researchers (Rijssen, 2002) and it suggests that another basic standard than the "no suffering" one is at least conceivable. However, from the paragraph above, we have at least two inaccurate arguments for considering natural suffering as a justification for experimental suffering: an animistic death ethics or a naturalistic fallacy.

Is there an escape from this way of reasoning, making natural suffering acceptable to a certain extent? To put it metaphorically, are we able to sail between the Scylla and Charybus of a naturalistic ethics and a naturalistic fallacy respectively, in the case of biological field research?

To answer this question, we need a closer look at suffering and stress in a natural context. Pain, stress, and suffering discomfort have a function under natural conditions and should not be seen as pure negative phenomena. Under natural conditions, experiences of stress and suffering are even necessary for animals because they need to learn and to become accustomed to less favorable circumstances in order to survive (Bateson, 1991). In biological literature, stress is related to the ability to cope with the challenges of the environment (Koolhaas et al., 1999). Nesse (1999)

uses the term "good stress" because stress may also contribute to alertness, which is important in dangerous situations. Experiences of stress are often necessary for wild animals and the ability to cope with it, is partly genetically anchored. Domesticated animals differ in this respect from wild animals due to their breeding history and the way they have been raised. Domestication leads, according to Price (1999), to a less adequate responsiveness to the changing environment. So, it is not impossible that wild animals are even better adapted to some discomfort or suffering conditions in experiments as compared to bred animals, since the latter have not had any preparing experience for such situations.

As a conclusion, discomfort, suffering, pain, etc. are not only a fact of wildlife but may also contribute to the animal's ability to survive in wild conditions. One may, however, question the use of terms like pain and suffering, since these terms imply the subjective experience of an animal, which is only knowable indirectly from an analogy with man (Brom, 1997). The connection to natural conditions makes another approach possible. When we accept that suffering, stress, etc. are elements of or can even contribute to the natural functioning of wild animals, we may consider natural functioning as an alternative standard besides suffering. This line of reasoning is taken by different authors (e.g., Stafleu et al., cited in Brom, 1997; Fraser et al., 1997; Heeger and Brom 2001; Musschenga, 2002). These authors distinguish besides the subjective view of welfare two other positions. The first is a functionalistic position in which welfare is considered as the well-functioning of animals in respect to their health, growth, and their physiological and behavioral systems. The second is a naturalistic position in which welfare is seen as a situation that enables animals to live their natural lives through the development and use of their natural adaptations and capabilities. The subjective and functionalistic approaches suit very well to domesticated animals, since these animals do not live under natural conditions. However, a naturalistic approach is probably also conceivable for these animals if we create housing and treatment conditions that imitate natural circumstances, e.g., artificial holes for burrowing animals. For wild animals under natural conditions, the functionalistic and naturalistic approach may merge, since both well- and malfunctioning have an adaptive and thus a "functional" role, as explained above. We may label this merged position as the "natural functioning" view of welfare. Welfare in this approach is seen as the circumstance in which a wild animal functions naturally and autonomously. Such a natural functioning approach can be translated into biological and empirical terms. For example, if survival of wild research animals after the experiment appears

not to be changed as compared to non-research wild animals, one may probably conclude that their natural functioning is not affected severely.

The natural functioning approach of welfare makes another reference position than solely the absence of suffering possible for wild animal research. Since the natural situation is not a stable but a fluctuating condition, one may even refer to a range of conditions that a researcher may initiate without infringing the standard of natural functioning. However, a pure natural functioning approach in wild animal experimentation may lead to total disinterestedness for the subjectively experienced suffering of wild animals. The subjectivity of the concept of suffering does not justify its denial. Ignoring probable suffering of animals due to, e.g., starving or predation experiments because starving and predation are natural phenomena is not defensible and must be considered as a naturalistic fallacy. On the other hand, it may be tenable to do observational studies on starvation and predation in the wild if they occur as natural phenomena. Otherwise, one should always take steps when ever suffering is observed and intervention is expected to reduce the aggregated level of suffering. This is not only absurd, it also ignores the fact that wildness is not per se a pleasant condition.

Because of these considerations, the natural functioning approach should not be applied instead of, but beside or in conjunction with the subjective approach. Some types of suffering or stressing can be accepted just because it is so close to the normal situation of the animal or because the natural functioning of the animal is hardly compromised. As an example, hibernating animals such as bats often awake a number of times. Too many awakenings by experimentation may reduce the bats physical condition and its functioning later on. So, arousing these animals because of experimental purposes can only be acceptable when it occurs in accordance with the normal frequency and intension range of natural awakening.

Natural functioning as a co-occurring standard may not always lead to a relaxation of the regime of experimentation; it may also lead to additional restrictions for researchers. For example, small cage housing of wild animals that normally need a large natural territory in order to find food should be avoided. Housing in big cages so that they can behave as naturally as possible in spite of sufficient amount of food, is preferred. In practice, it may be expected that both subjective and the natural functioning approach often converge. Artificial suffering and stress often reduce the scientific meaning of a wild animal experiment, since field biological researchers consider a natural context as a pre-condition

for their experiments. Disturbance, pain, and malfunctioning due to e.g. heavy radio transmitters, will therefore often be avoided.

As a conclusion, natural functioning may be seen as a normative reference in conjunction with subjectivist approaches of suffering. In general, artificial or experimental suffering and disturbance should not be higher than the natural levels without good reasons. This means that the character, the intensity, and the frequency of suffering, stress, or disturbance due to the experiments must fall within an acceptable range of the natural level, taking into account the species peculiarities.

THE ECOLOGICAL CONTEXT

Many biological field experiments with wild animals are done in natural reserve areas because of the natural conditions. Such experiments may have effects on the natural areas themselves. Since nature protection is partly based on ethical considerations, the debate on wild animal experimentation cannot ignore this contextual difference with laboratory experiments. We will discuss two of these contextual issues of biological field experiments: effects on indirectly involved animals and the expected effects on ecosystems or populations.

Indirectly Involved Animals

Domesticated animals are often housed in groups, but these groups are usually rather small and its members are often considered as exchangeable components. The consequences of animal experimentation for other animals are, except for sex-related relations such as male to male aggression, usually not taken into account in assessing animal suffering. However, under wild conditions, animals exist in a network of other animals. Biological field research may, therefore, affect other, non-research animals as well. For instance, juveniles may be affected because of research on parents (Bekoff, 1993; Elwood, 1991), and removing prey animals may influence the food availability for their predators. Moreover, catching and trapping techniques are often not very species specific and may lead to disturbance or by-catch and subsequently to stress and suffering of animals that are not meant to be involved (Rijssen, 2002).

Even field biological research that is not directed to animals may have big consequences for animals. For instance, inundating meadows and pastures in order to investigate flooding effects on vegetation may have catastrophic effects on animals that cannot escape, e.g., mice and moles. This latter experiment is usually not labeled as animal research because

the animals are not meant as research objects. However, if these fields were inundated, exactly in the same way, for animal population dynamics research, it would be considered as a wild animal experiment. Both experiments lead, however, to the same amount of animal suffering (or natural malfunctioning). Taking the consequences for these so-called secondary affected animals into account may thus lead to a larger numbers of involved animals in field biological research as compared to laboratory experiments.

Nature as a Moral Entity

Earlier, we described the natural functioning approach to animal experimentation. According to this way of reasoning, the natural functioning of animals should be considered as a morally relevant criterion. Natural functioning is not restricted to animals but also applies to non-sentient entities as plants, populations, and ecosystems. Malfunctioning of these entities reduces the value of nature. Many authors have discussed nature valuation and generally three main positions can be distinguished. The eco-centric position stresses the inherent or intrinsic value of nature and its constituents (species, communities, or ecosystems). The anthropocentric position stresses the value of nature if it contributes to human interests such as goods (food, medicines, fuel, etc.), services (recycling of garbage, homeostatic control), and immaterial goods (scientific information, pleasure). The third main position is stewardship, which is characterized by the obligation of care for environment and nature, often related to external "higher" entity as God, the Community or whatever (see e.g., Swart et al., 2001).

So, wild animal experimentation may not only offend the intrinsic value of animals but also that of nature, since non-sentient and collective entities such as the population or the ecosystem can be affected. On the other hand, wild animal experimentation may also contribute to nature, since it may deliver knowledge for protection, conservation, or restoration of nature it self or as a condition for the natural functioning of animals.

The involvement of nature conservation efforts in animal experimentation has led to a loud debate between proponents of animal rights and nature conservation on the priority of their perspectives (Klaver et al., 2002; Callicott, 1989). According to animal ethicists, which take a so-called zoo-centric stance, animals have an intrinsic value because they can suffer or because they have a good for themselves. On the other hand, eco-centric ethicists claim that collective entities such as populations or ecosystems have an intrinsic value as natural entities. Animals are elements of these systems and their welfare is, therefore, subordinate to the natural functioning of the ecosystem or the population. As a consequence,

animal rights ethicists and eco-centric ethicists may strongly disagree on the acceptability of wild animal experimentation, even if it is in the interest of the population or the ecosystem to which the wild animal belongs. On might argue that natural functioning of animals discussed above, is a similar consideration as the eco-centric argument. However, this is not true. The flourishing of ecosystems may be considered as a pre-condition for the natural functioning of animals, whereas eco-centrist see this relationship clearly the other way around.

All these different positions can be seen as societal positions, since stakeholder groups argue for them. In the consideration of wild animal experiments these issues are, therefore, worth being taken into account, although the weighing will become, again, much more complex as compared to laboratory experiments with domesticated animals.

CONCLUSIONS AND CONSEQUENCES

From the discussions above, it follows that additional concerns arise in case of wild animal research as compared to laboratory research with domesticated animals. Biological traits that do not matter for domesticated animals can be very important for wild animals under natural conditions. Secondly, the acquirement of animals by capturing from and reintroduction into the wild may be accompanied by additional suffering. A third difference is that the number of animals that is involved in biological field experiments may be much higher than in laboratory experiments with domesticated animals because of higher and not reducible animal and environmental variation and because these experiments may affect other, non-research animals. Fourth, the ability of the researcher to minimize suffering is less under field conditions because of limited possibilities for control. It is also suggested that the available body of knowledge on wild animals is less and more scattered among different researchers as compared to biomedical knowledge on domesticated animals. As said before, the triple-R concept may thus less easily be realized.

Another important issue is the so-called “natural suffering” of animals under wild life conditions. The suggestion in this paper is, in order to avoid illogical reasoning, to take the natural functioning interpretation of welfare as an additional normative principle. Finally, many people see the population and the ecosystem as moral entities and, as a consequence, eco-ethics enters the debate on animal experimentation if these entities are affected by wild animal research. Even if such experiments contribute to ecological goals, they may be questioned because animal ethics may be considered by some people to be more important than eco-ethical considerations.

How do we have to deal with these complex issues in practical situations? One way is to extend existing decision models that are suggested for laboratory animals (e.g., Bateson, 1986; Porter, 1992; Cock Buning and Theune, 1994). For example, Porter (1992) proposed a so-called tool-kit consisting of 2 research and 6 animal score categories for considering the ethical acceptability of animal experimentation. The first research category reflects the aim of the experiment (such as health or welfare, and scientific progress), the second one stresses the scientific potential to achieve objectives. The 6 animal categories are species of the animal, level of pain, duration of discomfort or distress, duration of the experiment, number of animals, and quality of animal care. In each category, 1 to 5 points can be scored. The unavoidable minimal score is therefore 8. This "reflects the tension between ideal and practice and is a reminder that every experiment on a sentient animal represents a departure, in at least some measure, from the ideal" (Porter, 1992, p. 102). The maximal score is 40 but according to Porter the cut-off score must be much lower, i.e., 15 for the animal categories and 7 for the two research categories.

A number of the consequences of wild animal experimentation discussed above, can be put in this system, e.g., suffering by stress from capturing. For natural malfunctioning and ecosystem disturbance we need to construct – assuming that comparable scientific information can not be produced with domesticated animals – additional scores. However, the concerns discussed here are not as scalable as the categories of Porter, such as severity of pain or numbers of involved animals. Animal malfunctioning, uncontrollability, uncertainty, and ecosystem effects are very heterogeneous and would require at least several categories. This would lead to a very complex system. As a practical compromise, a summarizing category reflecting several concerns at a more general level, is therefore worked out in Table I. If we follow the line of reasoning of Porter, this additional animal category increases the minimal score to 9, the maximal score to 35, and a cut-off to 17 or 18 points for the animal categories. Since wild animal experimentation may also contribute to nature conservation aims, one should also add a factor to the other side of the pair of scales by adding a nature protection term to the health and welfare terms in the research category "Aim of the experiment."

Of course, the expressions and scores in Table I are very preliminary and provisional and should be adjusted in practice. Moreover, they should be tailored to actual circumstances because the effects of wild animal experimentations are strongly species and environment dependent. In addition, assuming that effects on natural functioning appears from survival rates afterwards, post-experimental monitoring may be required. This latter element should, therefore, be added to Porter's animal category

TABLE I

An additional animal category in the score system of Porter (1992) that takes into account both natural malfunctioning of the animal and ecosystem effects

Level of natural malfunctioning/ecosystem effects	Examples
1. The experimental effects are comparable or close (in frequency, character, or numbers of affected animals) to experiences of vertebrate animals under natural conditions or the experiments have a negligible effect on post-experimental survival chance.	Blood sampling of small amounts of blood, assuming no severe effects from capturing.
2. In addition to (1), the experimental effects include a significant number of other vertebrate animals not belonging to the experiment. These so-called secondary affected animals are affected within or close to the range of their experiences under natural conditions and may have affected their survival chance.	Additionally captured non-research animals in case of e.g., birds research or by-catch in fishery research.
3. Wild vertebrate research animals are almost practically out of control and the possibility that they will suffer or disturbed in their natural functioning is significant. Knowledge about the vertebrate research animals is poor or not available such that effects are unknown or very uncertain.	Free ranging animals equipped with e.g., external radio emitters. Research on a – for the researcher – new species.
4. The experimental effects experienced by vertebrate research animals and secondary affected animals fall clearly (in frequency, character and affected numbers) outside the range under natural conditions and they will probably affect post-experimental survival change.	Capturing animals for a longer time, such that they cannot easily return to the wild.
5. In addition to the effects 1 to 4, the ecosystem (including non-vertebrate animals) is seriously affected, such that special measurements must be taken to restore the system. Research animals or secondary affected animals (vertebrate and non-vertebrate animals) are threatened with extinction (red list species).	Sampling, capturing or removing a total local population. Removing vegetation (e.g., by burning) in order to study effects on animals.

"Quality of animal care." Field biologists have themselves the best information and skills for such a tailoring. It is, therefore, also their task to propose alternative orderings and ways of implementing such a system.

Maintenance and control are often weak elements of governmental top-down regulation and it may discourage researchers in taking measures themselves. It is, therefore, important that regulation recognizes the specific aspects of wild animal experimentation and that it stimulates deliberation and taking measures by researchers themselves. The proposed system or possible comparable evaluation systems published elsewhere should, therefore, be seen as practical tools for conscientious research

that must be advocated by governments. They should not be used as a top down governmental instrument of regulation itself. In addition, non-governmental organizations such as nature conservation organizations (Tramper, 1999; Piek, 2000), research societies (see e.g., Anonymous, 2003), funding organizations, and scientific journals can have a pivotal role in reducing negative consequences of wild animal research, because researchers are probably rather sensitive to the public meaning, funding demands, and restrictions imposed by platforms of publication.

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