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Wildlife Radio Telemetry: Use, Effect and Ethical Consideration with Emphasis on Birds and Mammals

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Abstract

Wildlife researchers have been using radio-telemetry to track wild animal movement and behavior for long time. To use this method, wild animals are captured, manipulated and carry the transmitter over an extended period of time. Hence, it is impossible to exclude short or long term negative effects of radio collars. If such effects exist, it would bring up some ethical and scientific problems; such as, the animal could suffer, if the transmitter affects the behavior of the animal, the animal would no longer be a representative sample of the non-collared population. According to Tom Regan, who specializes in animal rights, the fundamental wrong assumption about animals is the system that allows us to view animals as our resources. It is generally assumed that, as long as the ethical guidelines are applied, the effect of radio-collars animals is insignificant. The purpose of this review paper is to raise some points for understanding of radio telemetry use and impact in scientific research. I tried to see the history of radio telemetry, its effect on wildlife, its contribution in wildlife conservation, guidelines, and Ethical consideration. Different current articles were reviewed to compare the ideas. From this background I tried to answer: Is the use of wildlife telemetry morally legitimate, if Regan's theory about animal rights is correct? And finally I summarized the ethical issues raised by different scholars and gave my assumption.

Keywords: wildlife telemetry; radio transmitter; collar; scientific ethics**.**

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1. Introduction

Radio-tracking is the system of determining information about an animal through the use of radio signals from or to a device carried by the animal. Radio-telemetry technology and tracking methods for studying the behavior and ecology of wild animals have advanced significantly since it was first used in the 1960s [1]. Currently, wildlife researchers are using radio telemetry in both developed and developing countries. For instance, in Ethiopia radio telemetry has been used to study the behavioral ecology of Ethiopian wolves (*Canis simensis*) [2, 3] and Golden Jackal (*Canis aureus*) [4]. Radio-tracking is used universally in studies of wild animals with a fundamental assumption being that tagged animal do not significantly differed behaviorally from untagged animals. Radio-telemetry has improved the ability of wildlife ecologists to locate animals, increasing the chances to examine detailed ecological and management questions related to movement [5] animal behavior [6], habitat use and activity [7]. However, radio-tracking can be considered intrusive since it requires live-capturing animals and attaching a collar to them [8].

There are three types of radio tracking in use today: very high frequency (VHF) radio tracking, satellite tracking, Global positioning system (GPS) tracking. Three of them have strong and weak sides. However, animal freedom movement, which was begun by Singer's book, argues that it is ethically wrong to use animals in such a way that we cause them suffering, either by the deficiency of essential components of a happy existence, or by causing them pain.

2. Methods

I tried to search for relevant articles from different sources such as web of science and Google scholar, using terms like radio telemetry, Animal right and wildlife collaring. Using the articles identified by these searches, I then evaluated the journals with emphasis on journal published after 2005. Examples were taken from the positive and negative impact of collars on mammals and birds, for understanding of radio telemetry use. For comparison impact of radio telemetry on wildlife, articles on ethical consideration were reviewed.

3. Result

3.1 Advantage of wildlife radio telemetry

Studding the behavior of wild animal has supplied important information to wildlife management and conservation [2]. For many years, the only way researchers were using to track wildlife was to simply follow and observe the movement and habits of an animal. Today, scientists have new tools to help them to determine the home range, how animals move and how they use their environment [1]. A lot of valuable information about animal migration can be obtained from wildlife radio telemetry. By using data generated from wildlife radio telemetry, researchers can determine migratory routes, critical stopover sites, and anthropogenic barriers to the migration from remote areas. For instance, the study by [9] identified critical stopover sites for the Northern pintails, which is the most important sites for conservation. And the authors use this information to urge for protection of these sites to ensure the continuation of pintail migration. In addition, use of wildlife radio telemetry can be of great use when studying the migration of land mammals. Reference [10] outfitted rocky

mountain elk (*Cervus elaphus nelson)* with GPS collars and monitored elk ability to cross roads, as the direct and indirect impacts of highways. Highways are among the most common forces altering ecosystems in the United States, killing an estimated 500,000–700,000 deer on U.S. highways annually. The study showed that using GPS telemetry can provide solutions to physical barriers to elk migration, as data generated were used to develop fencing and re-routing strategies to promote barrier permeability and reduce fatal collisions with vehicles [10].

3.2 Effect of radio-telemetry on wild animals

Regardless of which telemetry system is selected, potential effects on an animal's normal behavior must be considered whenever an animal is handled or instrumented. It is to the researcher's advantage to minimize these effects since the goal of radio-tracking is to obtain data most closely reflecting the animals' natural behaviors. Adverse effects from capturing and radio-tagging an animal can range from short to long-term and from apparently tolerable to severe or death [11]. Experiments designed to detect adverse effects from radio-tagging have focused mainly on birds and mammals. Hence, in this essay only effect on birds and mammal will be discussed. According to different studies [12, 13] bird and mammalian species have shown that markings can cause pain and distress, interfere with natural behavior, and reduce survival and reproduction.

3.2.1 Birds

Reference [14] explained that Radio telemetry can be used for determining bird movements over areas ranging in size from the restricted breeding territories of resident bird species to the movement patterns of international migratory species. It has important applications in the investigation of infectious diseases of migratory species. Despite its positive impact, since most birds are relatively light and depend upon flying for survival, it is possible to expect that negative effects from the transmitter's weight and attachment packages would be easier to detect on a bird than on a large mammal [14]. Therefore, the effects of radio-tagging on birds have been primarily concerned with the transmitter-to-body weight ratio [15]. To achieve a broader understanding of effect of radio collars on birds, Reference [16] used a meta-analysis of 84 studies to ask: Do devices have an overall effect on birds? Which aspects of avian behavior and ecology are affected? What attributes of birds influence transmitter effects? What attributes of devices influence their effects? Are effects partially a consequence of capture and restraint? And they found a negative effect of devices, both overall and for 8 of the 12 specific aspects analyzed. The most substantial effects were that birds with devices had markedly increased expenditure and were much less likely to nest. However, Reference [17] study detected no difference in weight loss or dispersal behavior between goshawks fitted with transmitters and those fitted with leg bands. He also found comparable hourly feeding rates for sparrow hawks before being fitted with a transmitter and afterward.

3.2. 2 Mammals

Between taxonomic groups, mammals were less likely than birds or fish to have the impact of their tags tested. Reference [15] encouraged researchers to investigate the impact of radio collars on wild mammals. Many studies show that Radio telemetry can affect small mammals as well as large mammals. Although the majority

of radio-tagged mammals are large predators or ungulates, most studies on the impacts of radio-tagging on mammals have concerned smaller mammals such as black-tailed jack rabbits, meadow voles, and lemmings. This might be because of the weight of radio telemetry [15] which can affect the movement of small mammals more. Instrumented small mammals have shown impaired movements, decreased digging ability, and decreased survival [15].

There are a limited number of studies on the impact of radio tagging on a larger mammal. The studies involving the impacts of radio-tagging on white-tailed deer noted adverse effects. Reference [18] conducted a mortality study with white-tailed deer fitted with collars taped with yellow. They learned that the bright collars also allowed hunters to more easily see the deer and, therefore, the mortality data were biased with respect to hunting pressures. Reference [19] found a significant effect of collar weight and fit on the rate of travel of plains zebra (*Equus burchelli antiquorum*) females in the Makgadikgadi, Botswana. Although both types of collar were well within accepted norms of collar weight, the slightly heavier collars (0.6% of total body mass reduced rate of travel by >50% when foraging compared with the collar that was 0.4% of total body mass..

3.3 Ethical Considerations

The concept of rights for animals raises the disturbing, and controversial, issue of their legal status. It is often argued that our legal tradition classifies everything as either “human” or “non-human”, and animals are in the category “other” than human. One of the results of this classification for animals, it is pointed out, like inanimate, they are classified as “things”. Therefore, animals can be owned and are subject to the property rights of their owners with concern to a moral perspective on animal suffering [20], different positions have been occurred for human conduct towards animals.

According to [21], the ability to experience suffering is what gives an animal equal interests to those of humans, and moral judgments should be based on interests rather than race, genus, or species. Singer's ethical philosophy follows Utilitarian principles [22]. According to these principles, the best solution to a moral problem is the one with the best likely consequences for the majority concerned. Hence, it is morally justified if you cause relatively little harm to a few being to minimize a greater harm to more beings [23]. Singer’s philosophy also allows to experiment on some animals to save the lives of many more humans or animals; but it would be wrong to kill or cause severe pain to the many to save a few.

The most systematic philosophical argument for animal rights has been set out by Tom Regan. He begins by challenging the assumption that humans are superior beings who are entitled to use animals for any purpose. According to Regan the fundamental wrong assumption about animals is the system that allows us to view animals as *our resources*, here for *us* – to be eaten, or surgically manipulated, or exploited for sport or money. Moreover Regan explain his feeling as follows:

‘’My position, roughly speaking, may be summarized as follows. Some nonhuman animals resemble normal humans in morally relevant ways. In particular, they bring the mystery of a unified psychological presence to the world. Like us, they possess a variety of sensory, cognitive, conative, and volitional capacities. They see and

hear, believe and desire, remember and anticipate, plan and intend. Moreover, what happens to them matters to them. Physical pleasure and pain—these they share with us (http://onthehuman.org/2011/05/regan-preface/#sthash.T3hnLQtx.dpuf)''.

Regan, like the utilitarian, which relies on the ability of an animal to suffer, as it was used by Bentham and continues to be used by Singer. However, Regan argues that the ability to suffer does not provide grounds to respect an animal's life in and of itself. According to this theory, killing the animal can be justified if it promotes the general welfare and is done humanely. Animal rights theory, therefore, needs to establish that animals have a moral status derived, not from their ability to suffer, but from some quality that is intrinsic to them. This quality could be the *reason* if it can be shown that animals are rational beings. Whereas Singer is primarily concerned with improving the treatment of animals and accepts that, in some hypothetical scenarios, individual animals might be used legitimately to further human or nonhuman ends, Regan believes we ought to treat nonhuman animals as we would humans. He applies the strict Kantian ideal (which Kant himself applied only to humans) that they ought never to be sacrificed as a means to an end, and must be treated as ends in themselves.

3.4 Animal research Guidelines

Currently, guidelines have been developed by an expert in different countries on use of wildlife radio telemetry. The Guidelines mainly outline strategies to approach particular issues such as trapping, collection of specimens and studies involving wild animals. Some major points in the guidelines are: it is strongly recommended that all studies involving radio telemetry of wildlife undergo peer and veterinary review prior to start, it should include examination of inventory objectives and methods, evaluation of expected ecological impacts, permits from concerned organizations, experienced researchers should provide valuable guidance regarding transmitter weight, attachment method and capture protocol, helping to avoid problems which have already been solved by other professionals, researchers planning a radio-telemetry study should strive to ensure that study animals are affected as little as possible by the transmitter and are handled humanely and effectively during capture and transmitter attachment procedures, Capture techniques should be designed to minimize stress to the animal at all times, and their selection should be based upon an understanding of the behavioral and physical characteristics of the species.

4. Discussion and conclusion

Wildlife Radio telemetry is currently playing a great role in collecting data from a remote areas, where it is difficult to cover physically, and contribute for conservation of biodiversity. However, several authors have identified different negative sides of wildlife radio telemetry on animals; such as, weight loss, change in feeding rate, exposure to predator and reproduction.

Regan disagrees with Singer's utilitarian program for animal liberation. According to Singer, animal research is morally acceptable if the benefits to humans or animals used clearly outweigh the harm to the animals used in the research. Singer usually concludes that the cost to the animals outweighs the benefit to others. Regan

allocates intrinsic value to animals and humans. This value describes the animals', or human's right to life and concern for them. Regan feels that the Singer's (utilitarian) view lacks this intrinsic value. Regan differs on this argument because he holds that the individuals of a species, not the species as a whole, are what are important for determining moral value. Throughout his explanation, Regan describes in details how certain experiments affect one particular animal, often using the words "he", "she", "his, and "her" to describe what is happening to the individual animal, rather than using the words "they" and "their". This is the main point which makes him different from utilitarian view. Therefore, is collaring of wildlife possible, if we consider the view of Regan? However, when we see the detail explanation of Regan, he doesn't believe that the experimentation of animals is wrong in itself, but he focused more on how each individual animal of the species being tested is treated.

To minimize the effect of radio collars, guidelines have been developed by scholars. According to the guidelines reviewed, among the major aspects that should be considered to use radio-telemetry on animals are: type of trap, use of immobilization medicine, method of handling and manipulation, weight and form of the transmitter in relation to the weight of the animal, and tightness of the collar around the neck. Therefore in the study of wildlife ecology using telemetry, to minimize the effect on each individual, using alternative methods is the best option. However, if it is the only possibility to get the necessary data, it is better to use within a careful ethical framework discussed above.

Generally, I support to use the wildlife telemetry where there are no other potential alternative methods. My main arguments are: 1) Using telemetry is important to conserve wildlife population including the tagged individual, 2) the purpose of wildlife telemetry is for conservation, and 3) the impact of telemetry can be reduced following the ethical principles developed, carefully. This conclusion doesn't oppose the idea of Regan, when it is ended ethically. Therefore, all researchers planning a radio-telemetry study should struggle to ensure that study animals are affected as little as possible by the transmitter, and are handled humanely and effectively during capture and transmitter attachment procedures. Wildlife capture techniques should be designed to minimize stress to the animal at all times, and their selection should be based upon an understanding of the behavioral and physical characteristics of the species to be studied.

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