南太平洋海域調査研究報告　No.58（2017年3月）
OCCASIONAL PAPERS　No.58（March 2017）

Assessment of the Impact of Wildlife Tourism on Animals: A Case Study of Amami-Oshima Island

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Abstract

Wildlife tourism is a large and global industry. It contributes to wildlife conservation, while sometimes negatively impacting on animals. Numerous studies have reported the impact of wildlife tourism on animals. They have used several parameters, such as physiological response, behavioral modification and population dynamics, to evaluate the effects of such tourism on animals. In Amami-Oshima Island of Kagoshima Prefecture, Japan, the number of tourists has been increasing recently. One of the main wildlife tourism activities is a night tour for watching a nocturnal animal including Amami rabbit (*Pentalagus furnessi*), which is an endemic species inhabiting only Amami-Oshima and Tokunoshima islands. In order to evaluate the effects of wildlife tourism on Amami rabbits, we investigate their physiological and behavioral responses to the fluctuation of traffic volume on the road used for night tours. Such research will lead to the realization of stress-free tours on wildlife.
Keywords: Amami rabbit, human disturbance, stress, traffic, wildlife tourism

Wildlife Tourism for Animals

Wildlife tourism has recently become a large and global industry. In order to watch wild animals, people visit natural areas, such as rain forests and savannas, even if they are in distant countries. Because a tourist spends money not only on tour, but also on transport, accommodation, food and souvenirs, it is considered that wildlife tourism brings an economic profit to the habitat countries and/or regions. Moreover, the experience in nature gives an opportunity of environmental education to tourists. The economic and social value of wildlife tourism let people stop a destructive development and choose the sustainable use of a nature, which leads to the conservation of the target animals and their living environment (e.g.,

WEAVER 1999). However, several studies have reported negative impacts of tourism on animals (for example a review about birds: STEVEN *et al*. 2011).

How to Assess the Impact of Wildlife Tourism

Several ways are used to assess the impact of wildlife tourism on animals. Measuring physiological response has been a major technique for evaluating the impact on animals in the last decade. The plasma and/or feces glucocorticoid (GC) concentration (BUSCH and HAYWARD 2009, MILLSPAUGH and WASHBURN 2004), the heart rate (king penguins [*Aptenodytes patagonicus*]: VIBLANC *et al*. 2012) and hematological changes (southern stingrays [*Dasyatis americana*]: SEMENIUK *et al*. 2009) are used for measuring the phisiological response to the tourism. GCs have been used as an index of stress level though the primary role of GCs is to regulate the basic energy metabolism of the cells. When individuals encounter unexpected challenges, their GC concentrations rise beyond the threshold, sometimes posing a threat to their survival (in details: BUSCH and HAYWARD 2009). However, the interpretation of results can be complicated because many factors such as season, sex and age can affect GC levels (BUSCH and HAYWARD 2009). The modifications of animals' behavior after an encounter with tourists have also been surveyed as the effects of wildlife tourism. The self-scratching, aggressive behaviors, and change of habitat area were observed as the behavioral responses of animals to wildlife tourism (LUSSEAU 2005, MARÉCHAL *et al*. 2011, STAFFORD-BELL *et al*. 2012). Although mortality and reproductive success are the most important parameters of population dynamics and useful for evaluating the impact of tourism, it is difficult to investigate these parameters of animals with long life spans. While measuring the physiological responses provide us the quantitative data, animals can cope with human disturbances by changing their behavior and/or being habituated without physiological disorder. Therefore, it is considered better to perform a comprehensive evaluation by combining several parameters.

What of Tourism Affects Animals Negatively?

Several factors of tourism have been reported to negatively affect wildlife. Firstly, the heavy traffic can affect the behavior and physiology of animals. For example, bottlenose dolphins (*Tursiops* spp.) in New Zealand seem to avoid the fjord, which is a tourist spot, during the seasons of increasing boat traffic (LUSSEAU 2005). The hoatzin (*Opisthocomus hoazin*) chicks living in the tourist-exposed sites in Amazonian rainforest lakes also showed higher mortality and plasma GC levels, than those living in the undisturbed sites (MÜLLNER *et*

al. 2004). These indicate that the heavy traffic might cause noise disturbance and increase the risk of traffic accidents for the animals living there.

Even while observing the animals on foot, the tourists give some stress to the animals. In the Red Ape Encounters in the Malaysian state of Sabah, an ecotourism program which facilitates trekking for wild orangutans (*Pongo pygmaeus morio*), although the visitors are provided guidelines when observing animals, the stress hormone levels of the two habituated orangutans significantly elevated on the day after tourist visitation (MUEHLENBEIN *et al*. 2012). At Sandfly Bay in New Zealand, as the number of tourists increased dramatically, the yellow-eyed penguins (*Megadyptes antipodes*) showed higher stress hormone levels and reduced breeding success compared to those at the undisturbed breeding sites (ELLENBERG *et al*. 2007). In addition, close observation by tourists also might cause the disease transmission from humans to animals (WOODFORD *et al*. 2002).

Wildlife Tourism in Amami-Oshima Island

Amami-Oshima Island belongs to the Nansei Islands in the south of Japan, and is located at the northern limit of the subtropical climate zone. Approximately 80% of its land is covered by evergreen forests, most of which are secondary forests. The island is surrounded by the coral reefs, and is famous as a diving and fishing spot. The Nansei Islands, including Amami-Oshima Island, are one of the biodiversity hotspot areas in the world because they are inhabited by many endemic species such as Amami rabbit (*Pentalagus furnessi*), Habu (*Protobothrops flavoviridis*) and Otton frog (*Babina subaspera*).

Wildlife tourism in Amami-Oshima mainly involves a night-tour for watching Amami rabbits by automobile, and a whale-watching tour by boat. During whale watching, the tourists can see the humpback whales (*Megaptera novaeangliae*) and bottlenose dolphins (*Tursiops aduncus*). In the night tour, one can see not only the Amami rabbits but also other nocturnal animals including rats, frogs and snakes. The number of tourists in these wildlife tourism areas has been increasing recently. One of the reasons for this is the registration of the Amami and Ryukyu islands as the World Natural Heritage Sites by the UNESCO, and the annual total number of tourists has been increasing constantly in Amami-Oshima Island (KAGOSHIMA PREFECTURE 2016).

An increase in the number of tourists has led to an increase in the concern about the impact of tourism on animals. The Amami-Oshima Eco Tour Guide Association implements rules and conducts the training of guides for all tourism sites. The night-tours are carried out by using the forestry roads spread through the forests and old roads which were no longer used. These roads make it easy for the tourists to access the Amami rabbits' habitats and they sometime visit there without guides. This makes difficult to regulate all tours.

Monitoring Physiological and Behavioral Responses of Amami Rabbits in Amami-Oshima

In order to assess the impacts of such activities on the Amami rabbits, we have investigated their physiological and behavioral responses to the fluctuation of the traffic volume on the road used for a night-tour. The Amami rabbit is a nocturnal and burrowing animal, and is endemic to Amami-Oshima and Tokunoshima islands (YAMADA *et al*. 2000). It often uses open areas, including roads, for feeding on grasses and excreting during the night. We investigate the road use by Amami rabbit on the forestry road used for a night tour in Amami-Oshima Island. The fecal piles and the videos by camera trapping during a night were counted on 1.7 km of the road from July to December 2015. In addition, in order to measure the cortisol levels, fecal samples were collected. Each fecal sample has been individually identified by analyzing the DNA extracted from it and then the stress level of each individual has been investigated. Hormonal and DNA analyses are ongoing. We also obtained the data on the traffic volume of the target road using a counter machine which was installed by the Kagoshima Prefecture.

The traffic volumes during nights in August (mean: 3.5 cars per night, max: 9 cars) and September (mean: 3.4 cars, max: 11 cars) were greater than those during the other months (e.g., mean: 0.8 cars, max: 3 cars on December). The number of fecal piles and videos in August were lower than those in the other months (SUZUKI *et al*. 2016). These results suggest the negative impact of tourism on the behavior of Amami rabbits. We are going to analyze the relationship between the fluctuation of traffic and their stress levels.

We use the traffic volume as a parameter of the tourism pressure to animals because it has been often used and is the measureable even at night. However, it is difficult to observe the situation of each tour in detail. Other parameters, such as distance between animals and tourists, speed of a vehicle and tourist behaviors may be necessary to be analyzed. Furthermore, in order to assess the impact on the population of the Amami rabbit, we would like to focus on the effect of tourism in long-term. Such research will lead to the realization of stress-free tours on wildlife.

Acknowledgments

This study was supported by Special Budget of the Ministry of Education, Culture, Sports, Science and Technology, Japan, in 2015 (Establishment of Research and Education Network on Biodiversity and Its Conservation in the Satsunan Islands) and a grants-in-aid of the Inui Memorial Trust for Research on Animal Science, Japan. We thank Kagoshima Prefecture for permitting to use the traffic count data.

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