

**QUANTIFYING PREDATION BY FERAL CATS AND  
DOGS ON THREATENED NATIVE MAMMALS ON  
AMAMI ISLAND, JAPAN\***

CHIIHIRO OKUBO

SATOSHI HIRAO

MISATO ISHIKAWA

*Osaka Prefectural Toyonaka High School, 2-5-12, Ueno-Nishi  
Toyonaka City, Osaka 560-0011, Japan  
Email: z-toyonaka@sbox.osaka-c.ed.jp*

Amami Island, part of the Ryukyu Archipelago in Japan, is known for high levels of diversity and endemism. However, many species are now globally threatened with extinction, especially due to predation by feral animals. We surveyed prey species based on analysis of fecal samples of feral cats and dogs and present evidence that 74.3% of endemic species are being preyed upon. We investigated eating habits of feral cats and dogs in Amami Island by directly analyzing their droppings. Identification of prey animals was based on fur and bone fragments in droppings confirmed that many threatened species are consumed not only by feral dogs but also cats. Our study shows that the introduced animals are likely to adversely affect Amami's terrestrial ecosystems.

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## 1. INTRODUCTION

### 1.1. Amami Island

Amami Island is located south-west of the main islands of Japan and like many islands of the Ryukyu Archipelago, has a subtropical climate. It has own ecosystems with very rich primeval forests, mountains and mangroves. The island does not support any large carnivores like bears and foxes, instead most of the mammals are small-sized including rats, bats and rabbits. There are many unique animals in primeval forests. As a result, Amami Island is expected to be the World Natural Heritage (WNH) in Japan. As Amami is the quasi-national park, Kagoshima prefecture, which Amami belongs to, urged the project to be on the national park so that Amami can become a WNH. The Japanese people are now very active in efforts to preserve the environment.

There are a lot of species of rare animals and plants in Amami and many of them are in fact endangered.

**Table 1.** This is a summary of the species in Amami Island on the ICUN red lists.

Taxonomic group	CR (Critically Endangered)	EN (Endangered)	VU (Vulnerable Species)	Total
Mammals	0	4	1	5
Birds	1	0	3	4
Reptiles	0	0	1	1
Amphibians	0	6	0	6
Total	1	10	5	16

**Table 2.** This shows the typical species in Amami Island.

Class	Species	CS
M	Amami spiny rat ( <i>Tokudaia osimensis</i> )	EN
M	Ryukyu long-furred rat ( <i>Diplothrix legata</i> )	EN
M	Amami rabbit ( <i>Pentalagus furnessi</i> )	EN
M	Amami shrew ( <i>Crocidura orii</i> )	EN
M	Ryukyu wild boar ( <i>S. scrofa riukiuanus</i> )	VU
B	Amami jay ( <i>Garrulus lidthi</i> )	VU
B	Amami woodcock ( <i>Scolopax mira</i> )	VU
B	Amami thrush ( <i>Zoothera dauma major</i> )	CR
R	Anderson's crocodile newt ( <i>Echinotriton andersoni</i> )	EN
A	Ishikawa's frog ( <i>Rana ishikawae</i> )	EN
A	Otton frog ( <i>Rana subaspera</i> )	EN

Table 2 shows bird and mammal species included in the IUCN Red List (International Union for Conservation of Nature and Natural Resources).<sup>1</sup> In this island there are 44 endemic species.

There are some reasons why they are endangered in this island. For example, the deforestation for road improvement destroys their habitat. As we will describe in the next subsection, the presence of the introduced animals also affect them greatly.

## 1.2. Alien animals vs native animals in Amami

Many mammals like mongooses, feral cats and dogs were historically introduced to the Ryukyu Islands by man for pets or for hunting animals which are harmful to human.

For example, it is said that mongooses were introduced by humans to eliminate poisonous snakes on the islands, (e.g. *Ovophis okinavensis*). However, this introduction did not work well. Mongooses began to prey on native animals on Amami Island instead of the snakes and spread widely in the habitats on the island, resulting in a rapid decline of the Amami rabbits.

To solve this problem, a group called ‘Mongoose Busters’ invented a trap to capture mongoose and started extensive trapping across the island. Thanks to this effort, almost all of the mongooses were captured, so the number of many rare animals began to recover.

However, another problem came up: feral dogs and cats. It was known that the feral dogs there ate Amami rabbit from their bite marks and a study on their droppings.<sup>2</sup> Surprisingly, a sensor-camera which was set in the forest showed that the feral cats also ate Amami rabbits. It was thought that the cats are too small to eat rabbits. It is a very shocking fact for the researchers as well as for us.



From this new observation, it is suggested that not only the feral dogs but also the feral cats might influence the ecosystem greatly on Amami Island. It is a serious problem for preserving the environment, especially the rare animals on Amami Island. For the recent research on Amami rabbit, see the papers.<sup>3-6</sup>

Our study aims to investigate the dietary composition of feral dogs and cats to understand how frequently native mammals are preyed upon. Then, we began to research their eating habits. We directly analyzed the droppings of the dogs and cats. Our study will be important to understanding the impact of feral mammals on native species on Amami Island.

## 2. METHODS AND MATERIALS

### 2.1. Method for analysis of the droppings

We used the droppings which were randomly collected in closed-canopy forests around the Amami Wildlife Conservation Center.

We obtained 35 droppings from Amami and froze them so they would not disintegrate. We used droppings both from the edge and the interior.

We first measured the diameter and the length of the droppings collected, and checked out whether they belonged to the dogs or cats. We can obtain this information by the size of the droppings, and this is the only way to do so. If it is larger than 22mm, it is considered to be that of a dog. If it is smaller than 22mm, we considered it a cat droppings. This identification of the droppings is based on the reference.<sup>7</sup>

We added water in order to make it soft, and washed them on a net with fine mesh. In order to analyze easily, we spread it on the newspaper, and waited for two days for it to dry out. We did these processes for both dogs' and cats' droppings.

Finally we checked what was in them. We identified digested animals from the characteristics of fur and bone in the droppings by using identification we will show below.

## 2.2. Identification of the prey mammals

Four species of native mammals were identified based on our analysis of the droppings:

- (a) Amami rabbit
- (b) Amami spiny rat
- (c) Ryukyu long-furred rat
- (d) Pinkfoot rat

(a) Amami rabbit (42-51cm):

It is larger than the other rats but smaller than a hare. The fur is quite short and black.

(b) Amami spiny rat (6-13cm):

Its fur is brown. It has flat, and spiny white thorn edged black. It has no long furs but we could see lots of white fur from the droppings. Its teeth are flat.

(c) Ryukyu long-furred rat (22-33cm):

Its fur is long, which is 40~60mm and light brown. It has thorn like Amami spiny rat's.

(d) Pinkfoot rat (15--23cm):

It is similar to Amami spiny rat, but its teeth are rough. The color of its fur is dark brown to red brown and the size is 10-30mm.



Fig 1 Amami rabbit



Fig 2 Amami spiny rat



Fig 3 Ryukyu long-furred rat



Fig 4 Pinkfoot rat

It was difficult to distinguish Amami spiny rat from Ryukyu long-furred rat because these two rats have similar thorns. But it was easy to distinguish Pinkfoot rat from other two rats by checking their teeth. Amami spiny rat's teeth and Ryukyu long-furred rat's teeth are flat, but those of Pinkfoot rat are rough. It is because Amami spiny rat and Ryukyu long-furred rat are herbivores, and Pinkfoot rat is omnivorous.

It is true that there were some objects difficult for us to identify. But with the help of specialists for identification of animals, we were able to finish obtaining the information about all of the samples.

## 3. RESULTS

Based on the 35 samples of droppings we analyzed, we were able to identify the remains of shellfish, insects or bones and fur of mammals. If the feral dogs and cats ate pet foods, then shellfish insects or bones and fur of mammals would not be contained. Therefore it is confirmed that they had eaten the wild animals.

The following is the numbers of the rare animals which remains were found in the droppings.

**Table 3.** This shows the composition of various endemic animal remains identified from the droppings samples of feral dogs and cats. There were some droppings that contained several species.

	From dogs	From cats
All samples	17	18
(a) Amami rabbit	1	3
(b) Amami spiny rat	13	8
(c) Ryukyu long-furred rat	10	6
(d) Pinkfoot rat	6	12
Samples including (a), (b) (c) or (d)	15	11

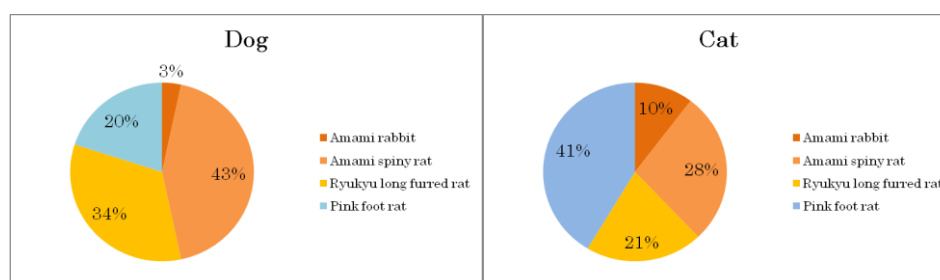
We obtained almost the same numbers of dropping samples from cats as those of dogs. We found out that not only one species but also multiple mammal species could occur within one dropping sample. At least one of the four mammal species identified were found from the 61.1% droppings of the cats, and the 88.2% of the dogs. Taken as a proportion of all dropping samples collected, 74.3% of cat and dog droppings contained at least one species of native mammal. We represented it as the proportion of all collected dropping samples as identification of the droppings are lacking in reliability (the size alone was used to tell if the droppings were the dogs' or cats').

From these results, it was confirmed that even the feral cats, which are smaller –sized than the dogs, prey on a considerable proportion of native mammals.

#### 4. DISCUSSION

A natural enemy of native animals in Amami is Habu (*Ovophis okinavensis*). Animals on Amami, especially rats have evolved to avoid predation. On the other hand, it is thought that they have no tolerance to large-bodied predators like feral dogs and cats.<sup>8</sup>

Since it is known that few rats have been observed by man, we had expected that their remains would not be obtained from the droppings. However, they were found from the 24 samples.



Conversely, since Amami rabbit is slower, louder and less adopted to escape predation by large carnivores, in comparison to the two species of rats mentioned above, we thought it would be easy prey. However, they were found in fewer samples than the rats. It is considered that the habitats of Amami rabbits and those of the dogs and cats do not overlap. It is a quite intriguing and significant problem for the future work to discover the relationship between their habitats.

Another question is the size of the predators and the prey. Compared to cats, dogs in general tend to eat animals that are as big as themselves. For example, see the reference for the size of the predators and the prey.<sup>9</sup> However, in our results, the cats favoured Pinkfoot rats more consistently

than Amami spiny rats, which is the smallest. On the contrary the dogs' favorite seems to be Amami spiny rats.

## 5. CONCLUSION

Our new investigation confirmed that feral dogs and cats prey on many species of native mammals, in particular, the endangered Amami rabbit, Amami spiny rat and Ryukyu long-furred rat.

The population of the native species is not so much. It is also impossible for them to colonize new areas because the land is limited. So, feral animals which were deliberately introduced by human can seriously affect island ecosystems. Although owners must firmly take care of their dogs and cats under law and local regulations, these are not strictly enforced. Many owners let their pets run loose, and some of them prey on rare animals during night without the care of the owners. It is essential to preserve this environment as a World Natural Heritage Site.

From now, we will continue to analyze the droppings and increase the number of samples to make the data more reliable. We also want to study how greatly the feral animals influence the population of native species. The research of the impact of feral cats has just opened, so we need more data.

Humans have destroyed the precious environment on Amami by introducing animals from elsewhere. At the same time, humans are also the only ones who can change this situation. One way that Japanese could do is to remove all of the feral animals. This is quite a simple way to get rid of the issue. But some of them are kept by residents so we can't kill them easily. Another way is to return the cats to their families, to improve the environment of the island to a place in which feral dogs, cats and native species could spend more comfortably. In fact, we are trying hard to look for the possible parents for cats and dogs, as an activity to contribute to preserve the endangered species and the ecosystems on Amami Island.

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