

Social System of Feral Cats (*Felis catus*) Inhabiting a Small Area with Many Feeding Sites

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Abstract The social system of feral cats (*Felis catus*) feeding at several garbage collection sites (feeding sites hereafter) concentrated in a small range was investigated. Cats visited several feeding sites, and females intensively utilized one feeding site more frequently than males did. In interaction behaviour among cats at feeding sites, tolerance behaviour was observed more frequently than aggressive behaviour. I also observed the waiting behaviour at feeding sites (one cat waited outside of the feeding site until another cat finished eating). Feral cats in the present study area seem to share feeding sites using waiting behaviour, and this social system may be tolerance.

Key words Feral cat, Social system, Feeding sites, Interaction behaviour

Introduction

Many field studies have been conducted on feral cats (*Felis catus*) living in a variety of habitats, and some aspects of their social system have been discussed (Liberg 1980; Jones & Coman 1982; Izawa *et al.* 1982; Izawa & Doi 1994; Natoli 1985; Macdonald *et al.* 2000). The social system of feral cats is very flexible, ranging from solitary to living in a kind of group (Turner & Bateson 2000). Some studies have shown that the social system varies principally with the abundance and distribution of the food resource (Macdonald 1983; Macdonald *et al.* 2000). Feral cats living in an urban area are heavily dependent upon human beings for their food, either directly by obtaining food provided by cat lovers, or indirectly by obtaining food by scavenging garbage (Izawa & Doi 1994). The food resource at a garbage site is stable, patchily distributed, and is enough to sustain large numbers of cats (Yamane *et al.* 1994). Previous studies on the social system of feral cats inhabiting urban area mainly focused on quantity of food resource in one feeding point (Liberg 1980; Izawa *et al.* 1982; Natoli 1985; Yamane *et al.* 1994). To fully understand the social system of feral cat, it is necessary to understand the social system in a case of distribution pattern of food resource that little feeding sites are studded with small range. The aim of the present study is to clarify the social system of cats inhabiting an area with such feeding sites. I focused on the interaction behaviour between cats at feeding sites,

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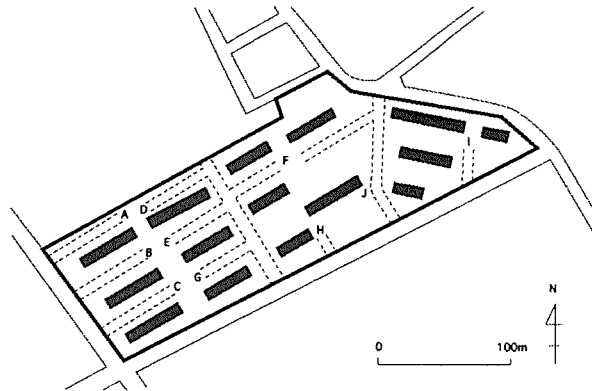


Fig. 1. Map of the study area. Bold line shows the outline of study area. The letters (A-J) indicate each garbage collection site. Black squares show houses, and dotted lines show the road.

which is hardly known (Izawa *et al.* 1982; Yamane *et al.* 1997), and because social interaction is considered to be an important component of the social system.

Materials and Methods

Present study was conducted at a housing complex (27,360 m²), Chatan-cho, Okinawa Prefecture, Japan (26° 20' N, 127° 45' E). There are 10 garbage collection sites in this area, situated 12.6m to 100m apart (Fig. 1). They were made of wire-mesh frame frame (2.2 m × 3.2 m × 2.1 m high). Cats could get in and out the site through the opening and exclusively obtained their food from these garbage sites (Haramura personal observation). Thus, these garbage sites are referred to as feeding sites hereafter.

A field study was carried out from September 1998 to October 1999. A direct observation was made from 18:00 h to 24:00 h because feral cats are generally more active at night (Izawa 1983; Jones & Coman 1982). Observations were conducted eight or nine nights each month, for a total of 105 nights. Cats coming to feeding sites were observed from the inside of a car, which allowed me to observe detailed behaviour without disturbance. Each cat was identified by pelage pattern, sex, and body size. Recording of interaction behaviours among cats at feeding sites was started when cats approached the feeding sites. The duration of each observation at each feeding site was at least 30 minutes. When cats had been foraging for feeding sites and encountered other cats, I observed them until they finished the interaction behaviour. To record the interaction behaviour among cats at feeding sites, I divided it into four categories. 1: eating together at a feeding site, 2: one cat was waiting out of the feeding site until another cat finished eating (waiting behaviour: see Yamane *et al.* 1997), 3: fighting, 4: one cat left the feeding site when another cat was eating. In a case of encountering several cats at the same time (three cats present), I recorded the interaction behaviour between two cats at a time. Interaction behaviour between a mother and her kittens was not included in this study.

Data were analyzed using StatView version 5.0 (SAS Institute Inc.), a statistical analysis software. I used Mann-Whitney U-test to compare the number of utilized feeding sites between sexes, and also to compare the utility ratio of one feeding site between sexes. Utility ratio was the maximum number of visits at one feeding site (which is the most frequency utilized feeding site among some feeding sites)/ total number of visits in all feeding sites by one cat. Because the sample size of each interaction behaviour among cats was small, I analyzed behavior 1 and 2 as tolerant behaviour and 3 and 4 as aggressive behaviour. Interaction behaviour between sexes was analyzed by using Fisher's exact test. The level of statistical significance was set at $P = 0.05$.

Results

Twenty-seven adult feral cats (15 males, 12 females) were individually identified in this study, and 23 of them (85.2 %; 13 males, 10 females) utilized more than one feeding site for feeding. The mean number of utilized feeding sites of the males and females was 4.3 ± 2.7 ($\pm$ SD; range 1 to 9) and 3.3 ± 1.8 (range 1 to 6), respectively. There were no significant differences with sex in the number of utilized feeding sites (Mann-Whitney U-test, $U=73.0$, $P>0.05$).

The utility ratio of one feeding site was analyzed for the 23 cats that visited several feeding sites. Feral cats that utilized only one feeding site (utility rate was 100%) were excluded. Females utilized one feeding site more frequently than males did (male: 55.15% vs. female: 73.25%, Mann-Whitney U-test, $U=34.0$, $P<0.05$).

At feeding sites, thirty-four interactions were observed in the present study. Interaction behaviour between females was not observed. Tolerant interaction behaviour was more frequently observed. However, interaction behaviours were not significantly different (Fisher's exact test, $p>0.05$, Table 1).

Discussion

Several interesting findings were obtained on the social system of feral cats. One was that most feral cats inhabiting this area utilized several feeding sites, and the utility ratio

Table 1. Interaction behaviour of feral cats at feeding sites. Interaction behaviour was divided into tolerant behaviour and aggressive behaviour. Interaction behaviour between females was not observed. Fisher's exact test $P<0.05$.

	Tolerance behaviour	Aggressive behaviour
Male vs male	5	4
Male vs female	21	4

of one feeding site showed a sexual difference. Cats inhabiting an urban environment obtain the food resource from humans, such as a garbage site or feeding site provided by cat lovers. There are several studies about social system of feral cats inhabiting an urban environment (Izawa *et al.* 1982; Dards 1983; Natoli 1985; Calhoun & Haspel 1989). For example, in Ainosshima Island where feral cats formed a feeding group (Izawa *et al.* 1982), males utilize several feeding sites but females generally utilized one feeding site (Izawa *et al.* 1982; Yamane *et al.* 1994). Yamane *et al.* (1994) concluded that males utilized some feeding sites to visit females in other feeding site groups, but females defended one feeding site. Similar results were reported in carnivores and feral cats inhabiting other habitats (Sandell 1989; Tumer & Bateson 2000). In the present study area, female cats utilized some feeding sites similar to those utilized by males. This means that one feeding site did not contain sufficient amounts of food resources though feeding sites provided stable food resources. Females of polygynous or promiscuous mammal species including feral cats apply strategy to maintain breeding resources (food and breeding site; Davies 1991). Female cats in the present study area also would utilize more frequently one feeding site to maintain stable breeding resources.

Another interesting subject is that the interaction behaviour among cats in the present study area was tolerance, and that waiting behaviour was observed at the feeding sites. There are few studies on the interaction behaviour among cats at feeding sites. Izawa *et al.* (1982) reported that feral cats formed groups inhabiting a fishing village and fed together with other cats. The feeding site in a fishing village is open and large with an abundant food resource to support many cats (Izawa *et al.* 1982; Yamane *et al.* 1994). In the present study area, the feeding site was small and closed in wire nets. Therefore, it seems to be difficult to feed together with other cats at the same time. Yamane *et al.* (1997) have reported a similar situation at feeding sties in a field experiment. They investigated the feeding order of group-living feral cats using a plastic container with food, which prevented more than one cat from feeding at the same time. In their experiment, they observed that cats are waiting until the first cat became satiated and left the container when the first cat was eating (Yamane *et al.* 1997). Whether or not there was a feeding order for the feral cats in the present study area was unknown. I concluded that the cats in the present study area shared the food resource exhibiting waiting behaviour at feeding sites.

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