Population size and diurnal travel distance of stray cats (Felis silvestris catus) in urban residential and other areas of Yokohama, Japan

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Abstract

To obtain basic data on the population size and diurnal travel distance of free-roaming stray cats ( Felis silvestris catus) in urban residential areas, a field investigation using a route censusing was conducted in Yokohama, Japan. A daytime walking censusing in each area (eight districts including four residential and four other areas) was carried out three times a day in March, July and November in 2010 through 2013. When the observers found a cat on the route, they marked the spot on a map. The mean density of cat population estimated in four residential areas (8.7 ± 3.9 cats/10,000 m²) was significantly (P < 0.05) larger than that in other four category areas (3.6 ± 2.2 cats/10,000 m²). Whereas the diurnal travel distance of intact males tended (P = 0.06) to be longer (62.9 ± 44.2 m) than that of castrated males (34.0 ± 24.7 m), it did not differ between intact females (30.0 ± 20.0 m) and sterilized females (33.1 ± 17.4 m).

Key Words: free-roaming cats, population size, stray cats, TNR, travel distance

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Introduction

Although the number of cats euthanized has markedly decreased in the last 15 years, more than 150,000 relinquished and stray cats ( Felis silvestris catus) are still euthanized annually in Japan (Nature Conservation Bureau of the Ministry of the Environment, Government of Japan, 2012). To reduce the number of these deaths, the Ministry of the Environment, Government of Japan (2010) advocates a “Chiiki-neko” program, which is “trap-neuter-return (TNR) program.” TNR programs are currently conducted around the world (e.g. Guttilla and Stapp 2010; Jones and Downs 2011). The “Chiiki-neko” program is considered by local residents as one effective administrative measure to help reduce stray cat populations and to placate disapproving neighbors (Uetake et al. 2013).

Our previous questionnaire investigation confirmed that the “bad smell of feces and urine” is the biggest complaint against stray cats by urban residents in Japan (Uetake et al. 2013). There is also ecological concern over the harmful impact outdoor free-roaming cats on other wildlife populations (Bonnaud et al. 2011; Loss et al. 2013). In addition, they can be a vector of several zoonotic diseases including rabies, toxoplasmosis, and cutaneous larva migrans (Gerhold and Jessup 2012). The diffusion risk of these problems is related to a population and movement distance of stray cats.

Thus to assess the effects of the “Chiiki-neko” or TNR program on managing stray cat populations, it is important to gather scientific data on the population size and travel range of the cats. However, there are few scientific reports focusing on these aspects especially in urban areas in Japan (Yamane et al. 2011). Therefore, we conducted a field investigation concerning the population size and travel distance of free-roaming stray cats in several residential and other areas of Yokohama, Japan.

Materials and Methods

A field investigation of population size and travel distance of stray cats was conducted for three years (from 2010 to 2013) in eight districts of Yokohama, Japan. Yokohama is the second largest city in Japan, and has variety of administrative districts categorized as residential, commercial, industrial, and agricultural areas. The eight districts were composed of four
residential, one commercial, one agricultural, and two multi-use (commercial/residential, commercial/industrial) areas. Areas of the districts ranged from 0.082 to 3.081 km² (mean ± SD: 0.499 ± 0.976 km²). These administrative information were provided from the staffs of the Environmental Sanitation Section, Health Sanitation Division, Kanagawa Ward, City of Yokohama, Japan. Before starting the investigation, censusing routes that covered at least one side of the all town blocks of each district were fixed. Distances of the censusing routes ranged 1,998 to 4,884 m (3,036.1 ± 853.2 m).

The investigation was carried out every four months in March, July and November. Two observers walked slowly along a censusing route three times a day. Start time of the walk (9:30, 13:30, 14:00 or 14:30, and 15:30, 16:30 or 17:30) changed along with the sunset times in each investigation month. When the observers found a cat, they recorded its features (sex, juvenile or adult, hair color, presence or absence of a cut on the tip of the ear that signify TNR) and marked the spot on a map. They also took photographs of the cat with a digital camera (COOLPIX S8000; Nikon Corp., Tokyo, Japan). It took one hour and half to cover one district, and approximately one hour for the other seven districts.

The cat population of each district was estimated as:

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\text{Number of recorded cats} = \text{Distance of a census route} \times \text{rate of discovery of a cat} \times \text{all road distances in a district}
\]

where the discovery rate of cats was 0.39 in the preliminary observation. Recorded cats were individually discriminated and considered not to overlap on the same day. The diurnal travel distance of a cat was calculated based on the spots marked on a map. Here the diurnal travel distance was defined as the biggest distance in a straight line between two map spots marked on the observation day. The analysis object was a total of 125 cats (castrated male 32, intact male 9, sterilized female 38, intact female 15, sex unidentified 31).

The cat population of each district was converted to that of 10,000 m² area to compare two district categories (residential and other areas). A repeated measures ANOVA using the between-subject factor of the district category and the within-subject factor of replication for each investigation month was performed. Mean travel distances of male and female cats during daytime hours were compared between individuals with and without castration or sterilization using the Student t test. The effect of season (investigation month) on the travel distance of intact male cats was analyzed using a χ² test. In this analysis, the travel distance was divided into two categories (distance of ≤ 20 m and distance of > 20 m). Here we supposed that a cat would stay at a radius of less than 10 meters if she or he settled in a house as a core living place.

Results and Discussion

During the investigation period, there was a significant effect of the district category (F₁,₆ = 10.371, P < 0.05). The mean density of cat population in the four residential areas (8.7 ± 3.9 cats/10,000 m²) was larger than that in the other four categories (3.6 ± 2.2 cats/10,000 m²). In particular, the cat density was the smallest (0.6 ± 0.1 cats/10,000 m²) in the agricultural area. The effects of the investigation month factor (F₁,₆ = 1.418, P = 0.204) and the interaction between district category and investigation month factors (F₁,₆ = 1.069, P = 0.401) were not significant (Figure 1).

![Graph](Figure 1. Change in estimated population size of stray cats in urban residential and other areas in Yokohama, Japan. NS: Not significant (P > 0.05).)
Figure 2 Comparison of diurnal travel distance between intact and castrated or sterilized cats.

The diurnal travel distance of intact males (62.9 ± 44.2 m, n = 7) tended (t20 = -1.979, P = 0.06) to be longer than that of castrated males (34.0 ± 24.7 m, n = 15). On the other hand, there was no difference (t27 = 0.450, P = 0.656) between intact females (30.0 ± 20.0 m, n = 13) and sterilized females (33.1 ± 17.4 m, n = 16) (Figure 2). The effect of season on the travel distance of intact male cats was not significant (χ²1 = 3.031, P = 0.082).

Doi (1997) summarized the previous research data on the relationship between life resources and cat population size. The size of cat populations is highly dependent on the amount of life resources for females such as food and safe places to hide and give birth. In an urban residential area, cats can easily find these two crucial resources, and their population density might reach more than 3,000 cats per 1 square kilometer (30 cats/10,000 m² in this study unit). In addition, the presence of cat-lovers who take care of stray cats helps them reproduce abundantly (Tennant and Downs 2008; Uetake et al. 2013). However, the number of cats estimated in this study has not reached such a high density yet. This might reflect the effect of voluntary castration or sterilization of stray cats in the residential areas of Yokohama. Incidentally, castration or sterilization rates in the residential areas investigated this time were estimated at around 50% in November 2013. Jones and Downs (2011) calculated that a stable cat population would be achieved at a 57%-sterilization rate with average fecundity, survival, and immigration rates.

We previously reported that the pregnancy rate of stray cats in Yokohama peaks in April and decreases to zero from October to December (Uetake et al. 2014). Similar seasonal fluctuations in cat reproduction are reported in other regions (Yamane et al. 1994; Wallace and Levy 2006). It would be inevitable that male cats expand their traveling ranges during the females' estrous season (Yamane et al. 1994) to meet with reproductive success (Say and Pontier 2004). However, the effect of season (investigation month) on the travel distance of male cats was not observed in this study. It is thought that this is related to the diurnal observation in our investigation. Cats are nocturnal or crepuscular so that male cats might locomote actively outside our diurnal observation time (Izawa et al. 1982; Barratt 1997; Horn et al. 2011). As for female cats, no seasonal difference between travel ranges in their estrous and non-estrous periods was found in the previous study (Yamane et al. 1994).

Even with diurnal observation, the travel distance of cats in this study was quite short compared to that demonstrated in a previous study (Guttilla and Stapp 2010). Travel distances around eight kilometers were recorded for feral cats of a wildland-urban interface region in California, USA. Neutering of stray cats (Barratt 1997) and, as one possibility, the presence of cat-lovers who take care of them especially in the residential areas of Yokohama (Uetake et al. 2014) might reduce the need of cats to cover a lot of territory for mating partner and life resources (Doi 1997; Tennent and Downs 2008).

The results obtained in this study suggest that a "Chiki-neko" program is high in the need in residential areas with many cat populations, and that sterilization has an effect on reducing the travel distance of stray cats.

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References


横浜市の住居地域とその他の地域におけるノラネコの個体数と日中の移動距離

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要約

都市部住居地域等におけるノラネコの個体数および日中の移動距離に関する基礎的データを得るため、横浜市においてルートセンサス法による野外調査を実施した。各調査地域（住居専用4地域とその他の用地区分4地域の計8地域）において、1日3回の徒歩によるルートセンサスを2010年から2013年のそれぞれ3月、7月、11月に実施した。ルート上にネコを発見することに、その地点を地図上にプロットした。住居専用4地域における平均個体数（8.7 ± 3.9頭/10,000 m²）は、その他の用地区分4地域（3.6 ± 2.2頭/10,000 m²）よりも有意に（P < 0.05）多かった。未去勢雄の日中の移動距離（62.9 ± 44.2 m）は、去勢雄（34.0 ± 24.7 m）よりも長い傾向（P = 0.06）にあった一方で、未避妊雌（30.0 ± 20.0 m）と避妊雌（33.1 ± 17.4 m）の移動距離に有意差は認められなかった。

キーワード：ノラネコ、個体数、移動距離、避妊去勢、TNR