
Effect of house cats, being fed in parks, on California birds and rodents

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Abstract

Increasingly, cat (*Felis catus*) advocates are establishing feeding stations or cat colonies in public parks and often claim that the well-fed cats pose little threat to wildlife populations. This claim was tested on East Bay Regional Park District land east of San Francisco, California during 1995 and 1996. Rodents were livetrapped on 100-trap grids for 8 nights at 9 sites (5 in 1995) in a no cat area and 9 sites (5 in 1995) in a cat area. Bird surveys, 6 in each area in 1995 and 8 in each area in 1996, were conducted along 2.2km transects. The number of cats seen in the 2 areas differed both years ($P < 0.0001$). In 1995, more harvest mice (*Reithrodontomys megalotis*) were trapped in the no cat area ($P = 0.022$) whereas the numbers of deer mice (*Peromyscus* sp.) ($P = 0.207$), house mice (*Mus musculus*) ($P = 0.257$), and California voles (*Microtus californicus*) ($P = 0.362$) trapped were not different in the cat and no cat areas. In 1996, more harvest mice ($P = 0.0003$) and deer mice ($P = 0.019$) were trapped in the no cat area, more house mice (*Mus musculus*) were trapped in the cat area ($P = 0.008$), and the numbers of California meadow voles ($P = 0.838$) trapped were not different between areas. More native rodents were trapped in the no cat area both years, 1995 ($P = 0.033$), 1996 ($P = 0.005$). Over 85% of the deer mice and the harvest mice trapped occurred in the no cat area and 79% of the house mice trapped were in the cat area. Birds that were resident year-round were seen more often in the no cat area ($P = 0.009$). California quail (*Callipepla californicus*) ($P < 0.0001$) and California thrashers (*Toxostoma redivivum*) ($P = 0.002$) were more likely to be seen on a survey in the no cat area than in the cat area.

INTRODUCTION

Groups of "feral" house cat (*Felis catus*) advocates are establishing and maintaining cat colonies in many cities around the world. These groups have varying goals which often include: finding homes for homeless cats, reducing the numbers of homeless cats by adoption, educating people about cat sterilization programs and overpopulation, feeding homeless cats, and the creation and maintenance of cat colonies. It is the feeding of homeless cats and cat colonies that cause problems for urban wildlife. Two claims that are often made about cat colonies are that the colonies are self limiting in size because the cats are strongly territorial and that they are no threat to wildlife because the cats are well fed (Tabor 1983, Anonymous 1993, Alley Cat Allies 1994). Neither of these claims is supported by the scientific literature. Indeed hunger and hunting have become delinked in cats; many will hunt even if they are well fed

(Adamec 1976). Two other claims, while valid, are irrelevant to the discussion of the impact of cats on wildlife: there are other causes for wildlife population declines, and that cats eat far more rodents than birds (Alley Cat Allies 1994).

In many areas cat advocates are promoting a Trap, Test, Vaccinate, Alter and Release (TTVAR) program as a solution to the homeless cat problem. The claim is made that these programs, with a feeding program, will control and reduce the homeless cat population and, for the previously mentioned reasons, pose no threat to wildlife. Churcher and Lawton (1987), Stallcup (1991), Roberto (1995), and Dickman (1996) found that house cats were having a significant impact on wildlife.

A semantic problem in the cat *versus* wildlife debate involves the use of the word "feral." Emotional appeals are made to the press and in meetings

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to help the feral cats. Munton (1982) defines an animal as being feral when 2 conditions are met: (1) the species has been domesticated; and, (2) the individual is now living free of human involvement. Dickman (1996) cites Moodie (1995) as making the distinction that urban strays, living independently but purposely fed by humans, often are referred to in the literature, confusingly, as feral cats. Moodie defines the stray cat as one that relies partly on humans for provision of its ecological requirements such as food or shelter, provided intentionally or otherwise.

In California, individuals and groups have taken it upon themselves to provide food for "homeless" cats on private and public lands (Jurek 1994). The Stanford Cat Coalition boasts of maintaining a core population of 300 cats since 1989 on the Stanford Campus, and the Santa Clara County Board of Supervisors recently passed an ordinance legalizing homeless domestic cat colonies in county parks (Davis 1996). Cat advocates are increasingly attempting to secure written agreements with local governments to allow cat colonies on public lands, most often in parks.

The cat in the wild has a unique ecological position in California: it is a semi-feral, exotic, and subsidized predator. Because of supplemental feeding, people are allowing artificially high densities of this predator to occur (Macdonald 1983; Soule et al. 1988; Coleman 1994) and these densities of cats are impacting wildlife populations.

The East Bay Regional Park District (EBRPD) has had people feeding cats in various parks for many years which is in conflict with EBRPD Master Plan's Wildlife Policy which states: "the District will conserve wildlife populations to foster native species and to protect or increase the populations of endangered species" (East Bay Regional Park District 1989). We examined the relative abundance of birds and small ground-dwelling native rodents at sites that have high-cat populations (receiving supplemental food) with sites that do not have high-cat populations in 2 EBRPD parks to test the hypothesis that cats were having no impact on wildlife.

STUDY SITE AND METHODS

This study was conducted at Lake Chabot and Anthony Chabot Regional Parks in Alameda County, California, on property belonging to the East Bay Municipal Utilities District (EBMUD) and administered by the East Bay Regional Park District. The area has a Mediterranean climate with a marine influence. Winters are cool and wet, summers mild and dry. The Jepson Manual of Higher Plants of California (Hickman 1993) describes the area as

being in the San Francisco Bay Area of the California Floristic Province. It consists of a mosaic including grasslands, chaparral, oak woodland, and planted eucalyptus (*Eucalyptus* sp.) groves. The study site was divided into an area where cats were being fed by individuals and an area where cats were not being fed.

Methods

Cats. Cat sightings on or within 100 m of rodent grids and on bird surveys were recorded. A *t*-test was used to test for differences between no-cat and cat treatments. Individuals were identified if possible. Track plates (Raphael and Marcot 1986) baited with commercial cat food were set out to estimate cat track densities. In 1996, cats were counted at feeding stations set up by persons feeding cats at Lake Chabot. Locations of feeding stations were recorded. In 1996, we placed sand boxes near cat feeding stations and on or near rodent study sites. Cat scat was collected for 300 days at 10 locations in the cat area and 260 days at 9 locations in the no-cat area to demonstrate that cats were eating birds and rodents. Scat also was collected by visual searches (Pearson 1966).

Rodents. Rodents were sampled on trapping grids by live trapping for 8 nights in a 10-day period at 9 sites (5 in 1995) in each treatment. These grids, each with 100 Sherman live traps at 10-m intervals, were located in grasslands and patches of grasslands. Rodents were ear tagged and released where they were captured. A General Linear Model was used to analyze the rodent data (Hawkins 1998).

Vegetation was sampled on each of the rodent trapping grids by a combined point-intercept and line-transect method (Bonham 1989). Species of the first plant hit at each point were recorded. Species also were classified by life form, as either grass, forbs, shrubs, or trees. Bare ground and thatch were grouped together and treated as a life form category. Life form data were plotted on ordination diagrams (axes) (Zavala-Hurtado et al. 1996; Pitkänen 1997), using Detrended Correspondence Analysis (Hill and Gauch 1980) to determine the degree of similarity among sites and treatments. Similarity of life forms also was tested by contingency table analysis.

On rodent grids, aspect and slope were measured to look for extremes that might indicate micro habitat differences. Distances from garbage sources (or dwellings) were also measured. A *Watson-Williams test with ties* (Zar 1996) was used to test aspect. Differences in slope and distances from rodent grids to garbage sources (or dwellings) were tested with a *t*-test.

Two methods were used to record human use of rodent grids. All people seen within a grid during trap set up, sampling and trap collection were

counted. Every other month at a random daylight time, people were counted on each site for 1 hour.

Birds. Bird surveys were conducted by walking a 2.2-km transect starting at first light, in the cat area or in the no-cat area. The transects followed established trails because steep terrain, thick chaparral and extensive patches of poison oak (*Toxicodendron diversilobum*) made cross country transects impractical. All birds that could be identified within 10 m of the trail were recorded. Six pairs of surveys were conducted in 1995 and 8 in 1996. Surveys were conducted April-September. Six additional pairs of surveys for California quail (*Callipepla californicus*) and California thrashers (*Toxostoma redivivum*) were conducted in April and May 1996. The data for the 2 years were combined for analysis. All birds closely associated with open water (Erlich et al. 1988; Peterson 1990) were eliminated to remove the influence of Lake Chabot. A General Linear Model was used to analyze the bird data (Hawkins 1998). A Chi-Square test was used to test for differences in California quail and the California thrasher.

RESULTS

The presence of homeless house cats that received supplemental food had a negative impact on native California rodents and birds (Figure 1). Native rodents and birds were less abundant and the exotic house mouse (*Mus musculus*) was found to more abundant in areas where cats were being fed.

Cats

Estimating a cat presence relative index based on track plates was not successful. Two hundred track-plate nights resulted in 1 cat track in the cat area and none in the no-cat area.

Feeding station counts were taken in 1996 and the number of identifiable cats seen in any 1-week period in the cat area was 26, 19 at 6 cat-feeding sites and 7 on rodent grids. One cat was seen in the no-cat area in May of 1995. Two people were seen regularly putting out cat food at a minimum of 6 locations in the cat area, 2-6 cats were seen at each feeding site. Birds, raccoons, opossums, and a fox also were seen eating this cat food.

In 560 days of exposure, no scat was found in any of the sand boxes. A search of both areas for scat resulted in 120 samples from within 30 m of cat feeding sites August-October 1996. Cat scats were analyzed, and 65% were found to contain rodent hair and 4% contain feathers. Visible parasites (*Ascaris* sp.) were found in 17% of the scat. There was a significant difference in the number of cats seen between treatments for both 1995 ($t = 9.037$, 10 df, $P < 0.0001$) and 1996 ($t = 7.246$, 20 df, $P = 0.0001$).

Rodents

Deermice (*Peromyscus* spp.) and the western harvest mouse (*Reithrodontomys megalotis*) were caught more often on no-cat sites than on cat sites. The California vole (*Microtus californicus*) did not exhibit any clear response to the presence or absence of cats. The exotic house mouse was caught more often on cat sites. Two species of deer mice were caught during the study. *P. maniculatus* was the more common, *P. truei* was only caught on 1 site. The deer mice species analyzed separately and combined yielded essentially the same conclusions, only the combined analysis is discussed. In 1995, there was a species x treatment interaction ($F = 3.51$, 1 df, $P = 0.068$). Further analysis revealed that there was a difference between treatments for the western harvest mouse ($P = 0.022$). In 1996 there was a species x treatment interaction ($F = 8.05$, 1 df, $P = 0.0001$). Further analysis revealed that there was a difference for the harvest mouse ($P = 0.0003$), the house mouse ($P = 0.008$), and deer mouse ($P = 0.019$).

Native rodents were more abundant in the no-cat area than the cat area, and the exotic mouse was more abundant in the cat area than the no-cat areas. There was a significant species x treatment interaction both years. Further analysis revealed differences between treatments for natives in 1995 ($P = 0.033$) and in 1996 for both natives ($P = 0.005$) and the exotic ($P = 0.028$).

At the treatment level distribution of vegetation samples among life forms is statistically ($X^2 = 119.5$, $P = 0.0001$) different. However, the treatments are similar as are the sites, basically providing a single habitat layer *in sensu* Short (1986). When the standard deviations of the Detrended Correspondence Analysis of the life form data are plotted on ordination axes, their ranges indicate that the sites are quite similar. On the first 2 ordination axes for 1995, the range is less than 0.9 standard deviations, and the range for 1996 is less than 1.2 standard deviations.

There was no significant difference in slope ($t = 0.685$, 16 df, $P = 0.503$) nor in aspect ($F = 0.178$, 1,16 df, $P > 0.25$) of rodent grids; however, grids in the cat area were significantly closer to garbage sources ($\bar{x} = 34\text{m}$) than those in the no-cat area ($\bar{x} > 180\text{m}$) ($t = -7.61$, 16df, $P < 0.0001$).

Human Use

The number of people seen on rodent grids during human use surveys and trapping sessions was 219. Two sites, both on major trails, accounted for 70% of the use, 53% on a cat site and 17% on a no-cat site. The human impact on the rodent sites was deemed to be insignificant because 95% of the usage was restricted to trails crossing those sites.

Birds

Birds associated with open water were removed from the analysis. Of the remaining birds, almost twice as many were seen on the no-cat transect as on the cat transect (Fig. 1). There was a significant difference in the number of resident birds ($F = 7.86$, 1 df, $P = 0.009$).

California quail ($X^2 = 37.727$, 1 df, $P < 0.0001$) and California thrashers ($X^2 = 10.000$, 1 df, $P = 0.002$) were more likely to be seen on a survey in a no-cat area than in a cat area.

DISCUSSION AND CONCLUSIONS

The distribution of rodents between the 2 treatments was very different: more than 85% of the deer mice and harvest mice occurred in the no-cat area and 79% of the house mice were in the cat area, whereas the voles showed no apparent preference. Over 70% of the native rodents (i.e. excluding house mice) were caught in the no-cat area. Since voles (DeLong 1966; Lidicker 1966; Shure 1970; Dueser and Porter 1986) and deer mice (Caldwell 1964; Whitaker 1967; Lund 1994) have been observed to out-compete house mice in field studies, it is unlikely that house mice were out-competing the native rodents in the cat area. Thus, it appears that cats have a negative impact on deer mice and harvest mice, but their effect on house mice is less obvious.

The house mouse and the house cat have co-evolved in close association with man for 4-6,000 years (Serpell 1986; Lund 1994). Deer mice and harvest mice in California have had neither the exposure nor the time to have responded to house cats in an evolutionary sense. It is possible that cat predation is selective with regard to harvest mice and deer mice, and that house mice have evolved behaviors that reduce the impacts of house cat predation.

Nearly twice as many birds were seen in the no-cat area as in the cat area. The difference in numbers of California quail for the no-cat treatment was striking; they were seen or heard almost daily in the no-cat area, whereas they were never seen or heard in the cat area. It is possible that in addition to predation, cats may also be excluding some species by interference with the birds' normal behavior. Leopold (1977) suggests that cats being fed by people may have a greater impact on quail than truly feral cats.

The differences observed in this study were the results of the cats' predatory behavior. This is consistent with the literature on cat predation and food habits. Most research has concentrated on food habits rather than population impacts of cats.

The presence of cats in this study area already

appears to have caused a shift in the composition of the rodent community; it is possible that a shift in the larger biotic community could follow. It is impossible to tell, in this study, whether the small but noticeable difference in the vegetation (in the shrubs) (Hawkins 1998) is a stochastic variation or perhaps the beginning of a rodent-mediated vegetation shift. A long-term research project on a desert rodent community has demonstrated the effects of changes in species composition within the rodent community on the larger community as a whole (Heske et al. 1994). Changes within the granivorous rodent community revealed a complexity of unexpected interactions both within that community and within the biotic community as a whole (Brown et al. 1986).

Soule et al. (1988) suggest that along urban boundaries mesopredator release can be a factor in wildlife declines. Specifically they discuss house cats as a subsidized predator that can continue to take prey long after the prey base has fallen below the level that could support a native predator. Fox and Brown (1993) suggest that interspecific competition drives the assembly of functional groups of desert rodents. If interspecific competition drives the formation of rodent communities, and a predator of rodents is introduced and maintained at an abnormally high density, that predator could cause changes in the rodent community, especially if it preyed preferentially on one or more species.

We suggest that cats being regularly fed on public lands, as was the case in this study, represent subsidized exotic predators possibly functioning as a keystone modifier (Mills et al. 1993) both by direct predation on native rodents and by indirect competitive release of the house mouse.

This project was a natural experiment (Diamond 1986), so there were factors, such as access to potential sources of supplemental food for rodents, levels of human disturbance on bird transects, and distances to prominent landscape features (Lake Chabot) that differed between treatments and therefore may have confounded the experimental design. The difference in distance to garbage sources (as a potential source of rodent food) between treatments probably was not an important factor in this study as it would not precipitate a decline in rodents and because park personnel emptied the garbage cans daily and kept the areas clean. Human disturbance (number of people walking the trails) along the bird survey transects was not measured, but the timing of the surveys, early in the morning when there were few people on the trails, minimized the impact of this usage (S. Laymon, Kern River Research Center, personal communication).

Conclusions

Cats in this study are having a significant impact on native rodents and birds. It is counter productive to manage for wildlife and allow cat feeding in the same area.

Public health concerns also should play a role since over half of the cat scat in this study was collected in the decomposed granite under and around picnic tables. Cat feces are known to transmit *Toxoplasma* which can remain viable for up to a year (Frenkel 1973). The California Veterinary Medical Association (1982) lists several diseases and parasites that can be transmitted to humans from cats.

The presence of cats at artificially high densities, sustained by supplemental feeding, reduces abundance of native rodent populations, changes the rodent species composition, and may facilitate the expansion of the house mouse into new areas. Bird numbers are lower where cats are being fed. Some species, such as California quail may be excluded completely from areas with high cat densities. Over a period of several years, cats at artificially high densities may function as a keystone modifier and lead to substantial long-term changes in the biotic community as a whole.

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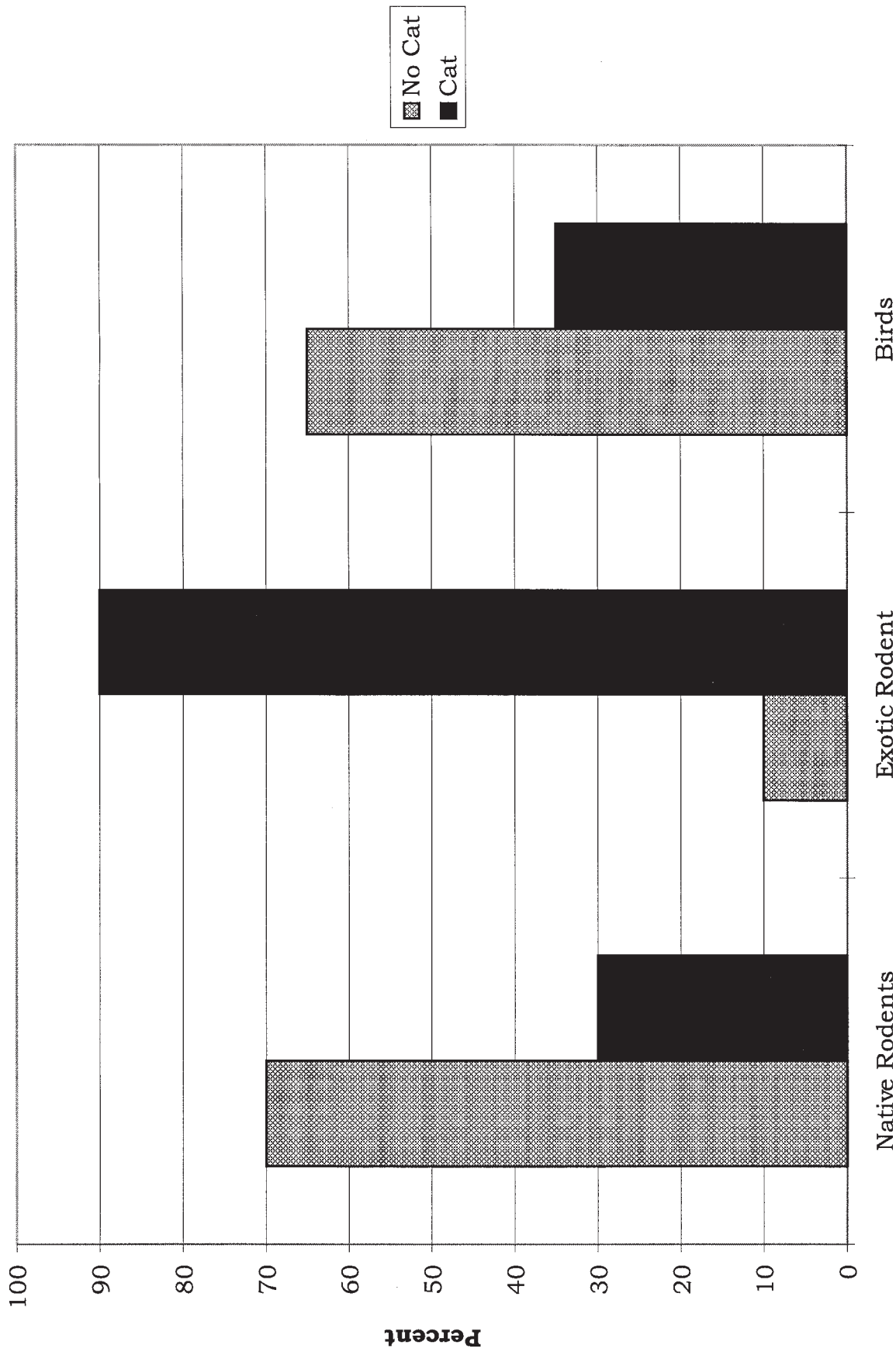


Figure 1. Percentages of native rodents, exotic rodents, and birds counted in cat and no cat treatments. Data from both years are combined in this figure.