EFFECT OF SUBSIDIZED HOUSE CATS ON CALIFORNIA BIRDS AND RODENTS

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ABSTRACT: Cat advocates are establishing feeding stations in public parks, often claiming that well-fed cats pose little threat to wildlife. This claim was tested east of San Francisco, California, in a cat area and a no-cat area. In 1995, more harvest mice were trapped in the no-cat area. In 1996, more harvest mice (*Reithrodontomys megalotis*) and deer mice (*Peromyscus* sp.) were trapped in the no-cat area, and more house mice were trapped in the cat area. The numbers of trapped California meadow voles (*Microtus californicus*) were not different between the areas in either year. More native rodents were trapped in the no-cat area in both years. Both resident and migrant birds were more abundant in the no-cat area. Birds present during the breeding season were seen more often in the no-cat area. California quail (*Callipepla californicus*) and California thrashers (*Toxostoma redivivum*) were present in the no-cat area and absent in the cat area. Cats at artificially high densities, sustained by supplemental feeding, reduced the abundance of native rodent and bird populations, changed the rodent species composition, and may have facilitated the expansion of the house mouse into new areas. Thus we recommend that the feeding of cats in parks should be strictly prohibited.

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INTRODUCTION

The house cat (*Felis catus*) is having a significant impact on wildlife populations (Churcher and Lawton 1987, Dickman 1996). However, individuals and groups in California 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 domestic cat colonies in county parks (Davis 1996). Many of the people feeding these animals claim that such cats, well fed, pose little threat to wildlife. However, hunger and hunting have become "de-linked" in cats, who will hunt even if they are well fed (Adamec 1976, May 1988).

The California Department of Fish and Game has become concerned with the impact of cat colonies on wildlife (Jurek 1993, Jurek 1994). For example Jurek and Drew (1994) compiled 341 selected references on feral and free-ranging domestic cats in relation to wildlife conservation.

The cat has a unique ecological position: it is a semi-domesticated, exotic, and subsidized predator. Because of supplemental feeding, people are allowing artificially high densities of this predator to occur (Macdonald 1983, Coleman 1994) and these densities have been shown to impact wildlife populations. Soule et al. (1988) for example, refer to the cat as a subsidized predator that has driven wildlife populations in some areas of California well below levels that can support native predators.

For many years people have been illegally feeding cats in various units of the East Bay Regional Park District (EBRPD). The goal of this study was to examine the impact of subsidized stray domestic cats on local native wildlife populations in 2 EBRPD parks. Herein we present results from our comparison of the relative abundance of birds and small ground-dwelling native rodents at sites with high-cat populations associated with subsidized feeding versus sites that did not have high-cat populations or subsidized feeding.

STUDY SITE

This study was conducted in Alemeda County, California, on property belonging to the East Bay Municipal Utilities District. Most of the sites were located in Anthony Chabot Regional Park (1826 ha) and Lake Chabot Regional Park (255 ha) and was administered by the EBRPD.

METHODS

The study site was divided into an area where cats were being fed, *ad lib*, twice a day, and an area where cats were not being fed.

Small mammal sampling

Small ground-dwelling native rodents were sampled on trapping grids in 1995 (January-May) and in 1996 (May, June, October). Rodents were live-trapped for 8 nights in a 10-day period at 9 pairs of no-cat vs cat area sites (5 in 1995). One grid with 100 Sherman live traps,

at a 10-m intervals, was located at each site. Each rodent captured was identified by species, weighed and tagged with a numbered ear tag. Rodents were released where they were captured. A General Linear Model was used to analyze the relative abundance of rodents (Hawkins 1998). Since pairwise comparisons were made, 1 for each species, the Bonferroni procedure required a reduction in the significance threshold from 0.10 to 0.025.

Bird sampling

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 either side of the trail and the vegetation type in which they were seen were recorded. The lengths of the transect segments passing through different vegetation types were measured. Each set of bird surveys was conducted in the cat and no-cat areas within a 10-day period. 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.

The bird data were summarized by survey and vegetation type in which they were seen. All birds closely associated with open water (Erhlich, et al. 1988, Peterson 1990) were eliminated to remove the influence of Lake Chabot, which is adjacent to the cat area and not the no-cat area. The remaining number of birds were then divided by the total length of the habitat in which they were seen. A General Linear Model was used to analyze the bird data (Hawkins 1998).

Cat observation data

Cats seen on or within 100 m of rodent grids, during trapping sessions, and on bird surveys, were counted, and a *t-test* was used to test for differences in the number of cats counted in the no-cat and cat areas. Track plates (Barrett 1983) baited with commercial cat food were set to estimate cat track densities. In 1996, cats were counted at feeding stations at Lake Chabot. In 1996, sand boxes were placed near cat feeding stations and on or near rodent study sites for 300 days at 10 locations in the cat area and 260 days at 9 locations in the no-cat area. Scat also was collected by visual searches (Pearson 1966).

Vegetation sampling

Vegetation was sampled on each of the 18, 1ha rodent trapping grids by a combined point-intercept and line-transect method (Bonham 1989). Five, 5-m transects were located randomly in each trapping grid and 50 point intercept samples were recorded at random points along each transect. Species also were classified by life form, as either grass, forbs, shrubs, or trees. Life form data were plotted on ordination axes (Pitkänen 1997), using Detrended Correspondence Analysis (Hill and Gauch 1980) to determine the degree of similarity among sites and between the cat and no-cat areas. The computer program CANOCO, Version 3.12 (Ter Braak 1991), was used for ordination. Similarity of life forms also was tested by contingency table analysis.

Site characteristics

On rodent grids we measured the aspect and slope to look for extremes that might indicate micro-habitat differences between the cat and no-cat areas, and we also measured distances from garbage sources or dwellings. A Watson-Williams test with ties (Zar 1996) was used to test for differences in aspect among grids. Differences in slope and distances from rodent grids to garbage sources or dwellings were tested with a *t-test.*

RESULTS

Based on small mammal trapping and bird surveying efforts we found that the presence of free-living cats that received supplemental food seemed to have a negative impact on native California rodents and birds (Fig. 1). Native rodents and birds were less abundant and the introduced house mouse (*Mus musculus*) was more abundant in areas where cats were being fed.

Small mammals

Deer mice (*Peromyscus* sp.) 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 differences between no-cat sites and cat sites; the exotic house mouse was caught more often on cat sites. In 1995, there was a species x treatment interaction, where there was a difference between the cat and no-cat areas for the western harvest mouse ($P = 0.022$). In 1996 there was again a species x treatment interaction, where further analysis revealed a difference for the harvest mouse ($P = 0.0003$), the house mouse ($P = 0.008$), and deer mouse ($P = 0.019$) between the cat and no-cat areas.

Native rodents were more abundant in the no-cat area than the cat area and the house mouse was more abundant in the cat area than the no-cat areas (Fig. 1). There

was again a significant species x treatment interaction both years, with differences between the cat and no-cat areas for natives in 1995 (P = 0.033) and in 1996 for both natives (P = 0.005) and the house mouse (P = 0.028).

Birds

Almost twice as many birds were seen on the no-cat transect as on the cat transect (Fig. 1). There was a significant difference in the number of birds that were resident year round (F = 7.86, 1 df, P = 0.009), in the numbers of birds present during any part of the year (resident and migrant) (F = 4.13, 1 df, P = 0.052), and in the number of birds present during the breeding season (F = 3.08, 1 df, P =0.096). There was no difference between the no-cat and cat areas for birds that were known to nest on or near the ground or in shrubs and vines less than 1.5 m in height (F = 2.03, 1 df, P = 0.166), however, no nest counts were made this does not apply to actual nesting. Finally, 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 have been seen on a survey in a no-cat area than in a cat area.

Cats

There was a significant difference in the number of cats counted within 100 m of rodent grids during trapping sessions, and on bird transects during surveys, between the cat and no-cat areas for both 1995 (t = 9.037, 10 df, P < 0.0001) and 1996 (t = 7.246, 20 df, P = 0.0001). Estimating a relative cat abundance based on track plates was not successful. Two hundred track plate nights resulted in only 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 a 1-week period in the cat area was 26. Two people were seen regularly putting out cat food at a minimum of 6 locations in the cat area, and 2-6 cats were seen at each feeding site. Birds, raccoons (*Procyon lotor*), and opossums (*Didelphis virginianus*), were also seen eating the cat food. In 560 days of exposure, no cat scat was found in any of the sand boxes, however, a search of both areas for scat resulted in 120 samples near cat feeding sites. Cat scat was analyzed and 65% were found to contain rodent hair and 4% feathers. Visible parasites (*Ascaris* sp.) were found in 17% of the scat.

Vegetation

In the cat and no-cat areas, the distribution of vegetation samples among life forms was statistically different (X^2 = 119.5 , P = 0.0001). However, Detrended Correspondence Analysis demonstrated a similarity be-

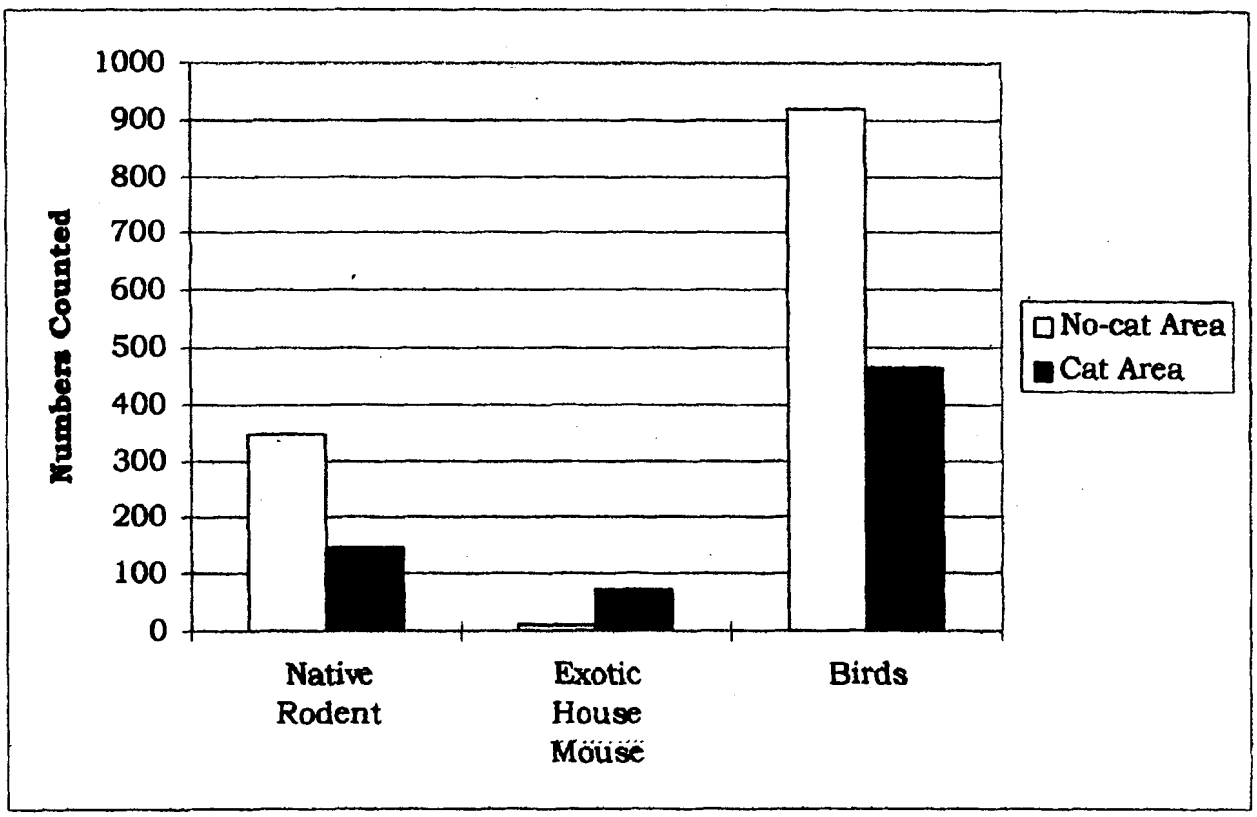

Figure 1. Numbers of native rodents, house mice, and birds counted in cat and no-cat areas. Data from 1995 and 1996, all grids, and all surveys are combined in this figure

tween the cat and no-cat areas and among sites, basically providing a single habitat layer *sensu* Short (1986). When the standard deviations of the Detrended Correspondence Analysis of the life form data were plotted on ordination axes, their ranges indicated that the sites were quite similar (on the first two axes the range was less than 0.9 standard deviations for 1995 and less than 1.2 standard deviations for 1996).

Sites

There was no significant difference in slope ($t = 0.685$, 16 df, $P = 0.503$) or in aspect ($F = 0.178$, 1,16 df, $P > 0.25$) among rodent grids. However, grids in the cat area were significantly closer to garbage sources ($x = 34$ m) than those in the no-cat area ($x > 180$ m) ($t = -7.61$, 16df, $P < 0.0001$).

DISCUSSION AND CONCLUSIONS

The presence of cats at artificially high densities, sustained by supplemental feeding seemed to reduce the abundance of native rodent populations, change rodent species composition, and may have facilitated the expansion of the house mouse. Bird numbers were also lower where cats were fed, and some species, such as California quail, may have been excluded completely from the areas with high cat densities.

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

There were almost twice as many birds seen in the no-cat area as in the cat area. The preference of ground feeding birds (Hawkins 1998) for the no-cat area was striking; for example, California quail were seen almost daily in the no-cat area, whereas they were never seen or heard in the cat area. There were more birds that were resident year round in the no-cat area. There were also more birds during the breeding season in the no-cat area. While there was no difference in the numbers of birds known to nest on or within 1.5 m of the ground, this was based on birds seen from transect surveys and not nest counts.

The differences observed in this study may have been due to the cats' predatory behavior. This is consistent with the literature on cat predation and food habits (Churcher and Lawton 1987, Stallcup 1991, Dickman 1996). Most research we have found has concentrated on food habits rather than population impacts of cats.

This project was a natural experiment (Diamond 1986), and 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 (i.e., Lake Chabot), that differed between the cat and no-cat areas and therefore may have confounded the experimental design. The difference in distance to garbage sources (as a potential source of rodent food) between the cat and no-cat areas, however, probably was not an important factor in this study. Human disturbance 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 factor (S. Laymon, Kern River Research Center, personal communication).

Cats in this study seemed to be associated with significant differences between native rodents and exotic house mice and birds. Therefore, based on our findings, we strongly recommend that cat feeding not be allowed in parks managed for native wildlife. The EBRPD does not and has not condoned or authorized the "feeding" of house cats in its parks (J. DiDonato, EBRPD, personal communication).

Public health concerns also play a role in this discussion of management implications since over half of the cat scat in this study was collected in the decomposed granite under and around picnic tables. Cat feces is 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.

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