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SIZE-DEPENDENT PREDATION ON RATS (*RATTUS NORVEGICUS*)
BY HOUSE CATS (*FELIS CATUS*)
IN AN URBAN SETTING

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Although a considerable amount has been published concerning the feeding habits of rural house cats (*Felis catus*) (Coman and Brunner, 1972; Errington, 1936; Hubbs, 1951; Liberg, 1984; Llewellyn and Uhler, 1953; McMurray and Sperry, 1941; Van Aarde, 1980), there is little documentation regarding predation of Norway rats (*Rattus norvegicus*) by cats. Elton (1953) inferred cat predation on rats by examining the reinvasion by rats, following near extermination by poisoning, of farms with or without cats. Jackson (1951) estimated the impact of urban cats on rat populations of Baltimore, based on the presence of rat remains in feces, and concluded that individual cats remove approximately 28 rats per year. Feral cats are known to feed extensively on black rats (*R. rattus*) in New Zealand (Fitzgerald and Karl, 1979), and to a lesser extent in Australia (Jones and Coman, 1981).

Direct observation of cat predation on rats is rarely reported and evidence of predation is generally obtained by indirect means such as examining stomach contents or by the methods already described. Panaman (1981) reported direct observations of cat predation of small rodents, but rats were not included in the diet. Here I report observed and indirect evidence for size-dependent predation by urban cats on rats.

Data on interactions between rats and cats were gathered in three alleys located in residential areas of high human population density in Baltimore, Maryland, from September 1980 through May 1982. Approximately 912 h of observation were made from automobiles parked in alleys during bi-weekly visits to study sites. Observation periods were initiated within 1 h after dark and continued for 3-4 h, during which time Norway rats were concomitantly collected in alleys by use of Tomahawk live traps. Alleys were dimly illuminated by street lights and detailed observations of cat and rat interactions were limited to approximately 15 m.

Rats killed by cats were collected by three methods. First, after I witnessed predation, cats were pursued and captured rats were collected from fleeing cats. Second, home owners with pet cats were asked to save rat carcasses brought home by their free-ranging pets. Third, litters of stray kittens were located, and these den sites were visited once or twice a week to collect dead rats brought to the young by attending female cat(s).

All rat carcasses were weighed, and the amount and type of tissue ingested by cats were noted. In cases where rats were partially eaten, estimates of total body weight were made based on the percentage of parts missing. Rats captured in live traps were anesthetized with ether prior to being sacrificed and processed as with the rat carcasses.

Twenty-seven rat carcasses were collected and examined over the study period; three following observed cat predation (five predation events on rats witnessed, three successful recoveries), seven from household cats, and 17 recovered from three den sites occupied by litters of kittens belonging to stray cats. Of the 27 rat carcasses, 22 (81.5%) were sufficiently intact to be weighed (Fig. 1). These 22 animals were juvenile or young adults weighing less than 200 g. The distribution of weights of cat-killed rats differed from the distribution of weights of live-trapped rats ($t_1 = 7.06$, $P < 0.001$, Wilcoxon two sample test). In the trapped sample only 10 of 109 (9.2%) rats weighed less than 200 g; mean (\pm SD) weight of trapped rats was 392.9 \pm 124.9 g (range 55.4-610.0 g).

Of the 24 rat carcasses that were obtained without interruption of observed predation, 11 (45.8%) were not eaten, 8 (33.3%) were partially eaten, and 5 (20.8%) were totally consumed with the exception of head, skin, tail, and feet. The most commonly consumed tissues of partially eaten rats were brain (6/8), muscles of neck and back (4/8), and entrails (2/8).

Studies that have examined the diet of stray or free-ranging cats by analysis of stomach or fecal contents in urban or residential environments have stressed that refuse, rather than prey items, constituted the bulk

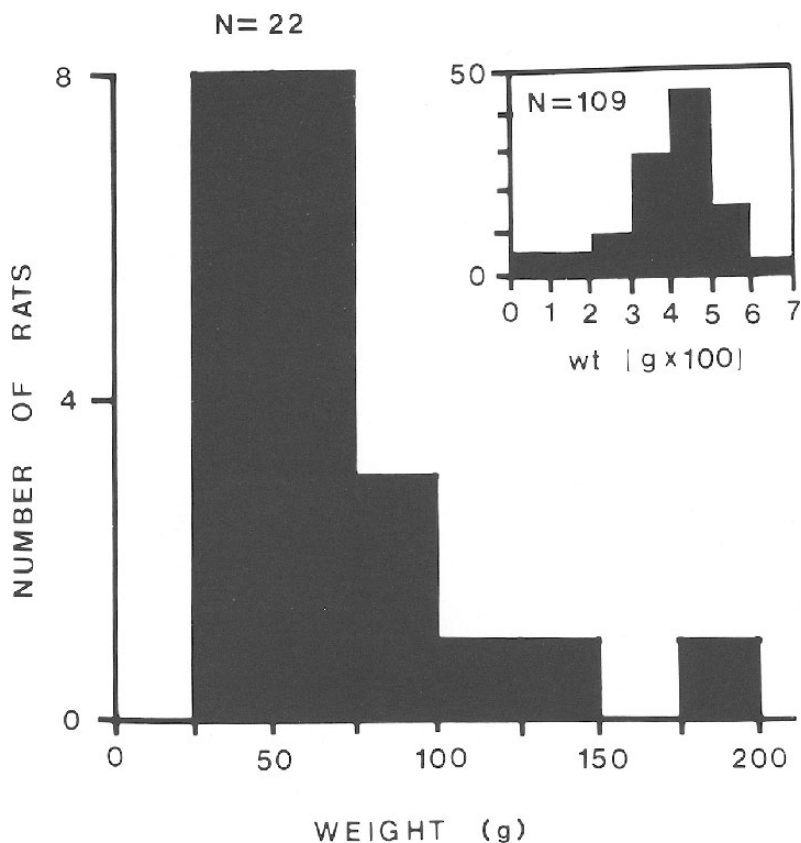


FIG. 1.—Histogram of weights, in 25-g classes, of rats killed by, or collected from house cats. Inset shows histogram of weights, in 100-g classes, of rats trapped in alleys of Baltimore.

of food items (Dards, 1981; Jackson, 1951; McMurray and Sperry, 1941). Observations from Baltimore support this conclusion, although quantitative data on time spent scavenging or pursuing and eating prey have not been gathered (Childs, 1982; Oppenheimer, 1979). Stray cats also receive handouts from home owners, and approximately 16% of the residents in households adjoining the study alleys actively supported free-ranging cats in this manner (Childs, 1982).

In this study, cats invariably preyed upon rats that can be considered juvenile or subadult, as was suggested by the difference between the distributions of rat weight based on trapping results and the collection of cat prey. The basis for this size selection is not certain, but several points may be considered. Although adult cats and large rats were frequently observed in close proximity (Fig. 2), no aggressive behavior was directed by rats towards cats, and generally these species coexist peacefully in alleys. I witnessed adult cats pursuing large rats on only five occasions and pursuits always terminated prior to physical contact. It is possible that cats had learned previously not to consummate attacks on adult rats, but still occasionally pursued these animals. Cats apparently show some size or age discrimination by selecting young rabbits (*Oryctolagus cuniculus*) as prey in Sweden (Liberg, 1984). However, cats preyed on voles (*Microtus pennsylvanicus*) independently of age or sex in Michigan (Christian, 1975), suggesting that absolute body size, not age, may determine prey selection.

Kuo (1930) showed that rat-killing in cats is a trait that may depend on early experience and learning and it is possible that in urban environments, where food resources are plentiful, few cats rely on rat predation. A large percentage of free-ranging cats are known to have been owned at one time (Childs, 1982), and therefore may have had no early experience with rat-killing.

Although trap sensitivity and seasonal variation may influence the relative proportion of each size class

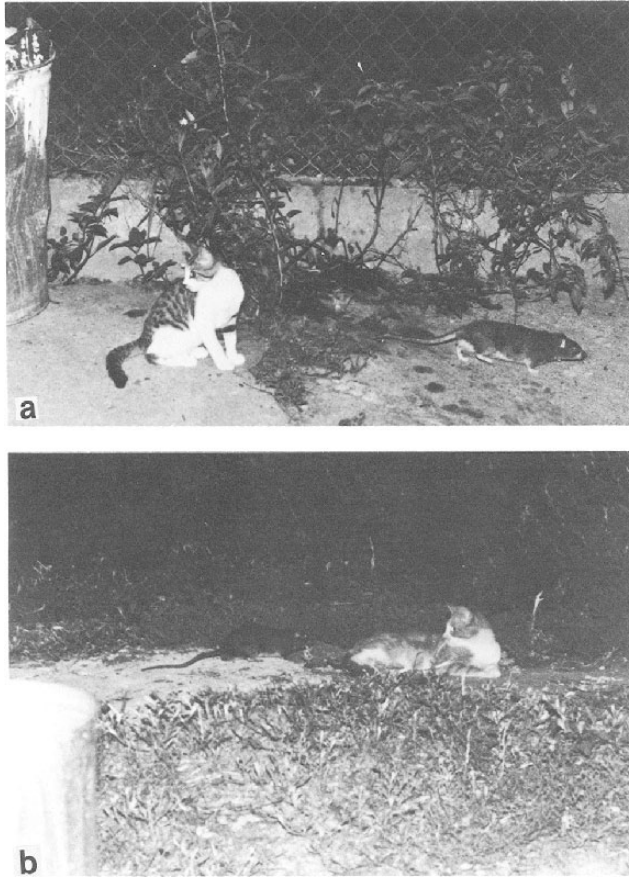


FIG. 2.—Photographs of typical interactions between cats and rats observed at night in Baltimore. a) Juvenile kitten ignores large adult rat; b) adult cat and adult rat inspect each other at close range.

of rat appearing in my sample, I doubt either factor would alter the findings of this study. Davis (1951) reported that 28–31% of rats trapped from urban Baltimore were animals under 200 g of weight, while Farhang-Azad and Southwick (1979) reported 53% of the rats trapped at the Baltimore Zoo (a more rural environment) weighed less than 200 g. Although both these studies report higher percentages of juvenile animals than I found, the complete absence of large rats in the cat-killed sample, coupled with the availability of this segment of the population, strongly suggests size-dependent selection of rats by cats.

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HOME RANGES OF FERAL CATS ON DASSEN ISLAND

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Feral cats (*Felis catus*) occupy habitats ranging from sub-Antarctic islands to temperate farmland and urban areas where the resources they exploit include human food refuse, small mammals, invertebrates and carrion. Feral cat population densities vary from 2.4 to 200 cats/km² and their group sizes vary from one to over 50 animals. They may occupy territories or home ranges which vary in size from 0.03 ha to 990 ha (Dards, 1978; Izawa et al., 1982; Jones, 1977; Jones and Coman, 1982; Liberg, 1980; Rees, 1981; Van Aarde, 1978).

As a comparison to these studies the ecology and behavior of feral cats on Dassen Island, South Africa were studied between March 1979 and June 1980 (Apps, 1981), when the number of cats increased from 20-25 to 37-50 and their diet consisted mainly of European rabbits (*Oryctolagus cuniculus*) and scavenged bird carcasses (Apps, 1983). The results of an investigation of the cats' ranging behavior are presented here.

Dassen Island (33°25'S, 18°06'E) lies 8 km off the west coast of South Africa, 65 km NNW of Cape Town. It is 224 ha in area, flat, and low-lying with sandy soil and areas of exposed rock and tumbled boulders. Except in parts covered by low bushes the vegetation is sparse in summer (Nov.-Mar.) and dense, though low growing (<1 m) in winter. The whole of the island is accessible to cats. The island's climate is Mediterranean. House mice (*Mus musculus*), European rabbits (1,000-2,000 in number) and domestic cats have been introduced by man and the island serves as a roosting and nesting site for some 140,000 seabirds. During the study period 12 people were living there.

Cats were caught in cage traps using fresh rabbit as bait, they were immobilized with 10 mg/kg of ketamine hydrochloride (Ketalor, Parke Davis) or a mixture of 10 mg/kg of ketamine hydrochloride and 5 mg/kg of xylazine (Rompun, Bayer Pharmaceutical) injected intramuscularly. Eight cats (four adult males, one juvenile male and three adult females) were fitted with VHF transmitter collars. Signals were received and animals located using a hand-held loop antenna. Wherever possible, radio-tagged cats were located systematically once daily. Fifteen cats and kittens (five adult males, three adult females, five juvenile males and two juvenile females) were fitted with identity collars carrying tags of reflective plastic. Two other cats