

## **Annual Changes in Flea Populations on Three Domestic Pets, 1978-1984**

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### **Introduction**

There are about 1900 species and subspecies of fleas worldwide (4). In Indiana, Whitaker (6) has listed 31 species from wild mammals; in addition, two other species have been collected, one from barn swallows and another from man and domestic animals. Few among the many species of fleas are of direct concern to humans. Those that bother humans in modern societies are species that live on or in association with domestic animals or pets. Of direct concern to owners of the latter are the fleas that infest dogs and cats, especially if these pets share the living quarters of their owners. Because fleas may not always have contact with their normal hosts, in heavy infestations humans may serve as temporary sources for blood upon which adult fleas feed exclusively. Fleas on pets that live outdoors are not as likely to become a serious threat to either pets or owners.

This report is an outgrowth of efforts to control fleas on two neutered pet dogs and subsequently those infesting a neutered male cat. It was thought that if fleas were removed from the pets regularly in order to prevent large population build-ups, insecticides would not be needed. The purpose of control was to prevent development of large populations of fleas, rather than attempt to eliminate all fleas.

### **Methods and Materials**

Although the practice of regular weekly grooming and collecting fleas began earlier, in 1978 recording of data started and continued through part of August 1984, covering a period of six years and eight months. At the onset of flea infestations, particular attention was given to combing as part of grooming. Also, since the pets not only differed in size but in kind of pelage, different techniques were used in removing fleas. The part retriever female dog weighs about thirty pounds (13.6 kg), has straight, black hair which is dense over most of her body. The miniature male poodle, weighs about eleven pounds (4.95 kg), has tightly curled, tan hair through which a comb cannot be drawn. The grey tiger male cat has long, fine hair which forms a dense coat over most of his body.

On the retriever and cat, collecting was begun with a regular comb (7 teeth/cm). Some fleas were taken from hair mats removed with the comb. To remove fleas from the mats, forceps were used to transfer them to 70% ethanol. (Experience proved that it was important to keep the fleas in the mat and not allow them footing on any unbroken surface. While in the mat they seldom jumped, but from the comb's surface or finger they quickly sprung aloft). In addition, fine-toothed combs (12 teeth/cm) were used and were the most efficient collecting tool. Besides becoming entangled in hair mats, fleas were often wedged between the combs' teeth. They were then forced out with a thin blade into the alcohol. With the retriever, an alcohol wash-bottle was also used. In dense black hair, dark brown fleas can easily escape detection, but when seen they were doused with the alcohol. Besides being entangled they were mildly anesthetized making removal with blunt forceps easy. Forceps and alcohol wash-bottle were used to remove fleas from the poodle. Apparently, flea behavior includes positive thigmotropism. By pressing the hair upon the skin, a flea nearby would wedge itself

into the hair mesh so formed, and was easy to collect with the forceps. Fleas were readily removed from the poodle with forceps, especially on ventral posterior areas where the skin was mostly hairless.

Combing time varied on the pets, continuing on each until no fleas were seen. Combing began anteriorly, proceeding posteriorly on the dorsal surfaces and the process repeated on the ventral areas with the animals lying on their sides. By means of a stereo microscope (30X), collected fleas were sexed and numbers of each sex recorded by the week. During periods of population build-ups, collecting was done on a daily basis. Specimens for each year were stored in vials with 70% alcohol. When several successive checks for fleas revealed their absence, collecting stopped. Collecting resumed when any of the pets were observed scratching themselves, or if during the weekly grooming, blood clots appeared in the hair mats. The appearance of clots on their sleeping pads also prompted the resumption of collecting. The presence of adult fleas was a certain indication that collecting should resume.

As indicated in the Introduction, use of insecticides was not anticipated in controlling fleas. However, it was deemed necessary to apply an insecticide twenty-one different times during the six-year period, 1978 to 1984. Sevin<sup>TM</sup> as powder or spray and Durakyl<sup>TM</sup> were applied to one or all three of the pets and/or to their sleeping quarters on the following dates:

1978 August and September	1982 July, August (3)*, September and October
1979 August and September	1983 June, July (2), August and September
1980 None	1984 June, July (2), and August (2)
1981 December	*Number of applications per month

Using methods described above, it was possible to maintain a flea-host relationship among the pets that did not involve humans as temporary hosts. Additional steps taken to maintain this relationship included regular shaking and sweeping of sleeping pads and cleaning of sleeping quarters. Also, all debris combed from the pets was caught on the grooming pad and removed from the house.

### Results

Most of the fleas were collected during the second halves of the years (Figures 1 and 2). In the spring of 1983, however, more fleas were taken from the cat than from the dogs (Figure 2). A total of 4,549 fleas were collected and sex determinations made. Of the total, 2,937 were females and 1,612 were males resulting in a sex ratio of about 1.8:1.0. The species of flea collected in this study was *Ctenocephalides felis felis* (Bouché) as determined by Whitaker and Benton (personal communication). Among specimens submitted for examination by these investigators, the genal spines were not consistently subequal, nor was the distal end of the manubrium of the male clasper typically that of *C. f. felis*. With some fleas, Whitaker noted that the manubrium was expanded, somewhat similar to the condition found in *C. canis*/(Curtis), the dog flea. Another characteristic that aided in the determination was head length. That of *C. f. felis* is relatively longer than *C. canis*. Geary (3) collected *C. f. felis* from three times as many sources as *C. canis* which attests to its more widespread distribution than the latter species.

In his study of ectoparasitic insects, Marshall (3) found that females usually predominate in natural populations. Although he determined that the sex ratio of the majority of ectoparasitic insects is parity at emergence, fleas represent an exception.

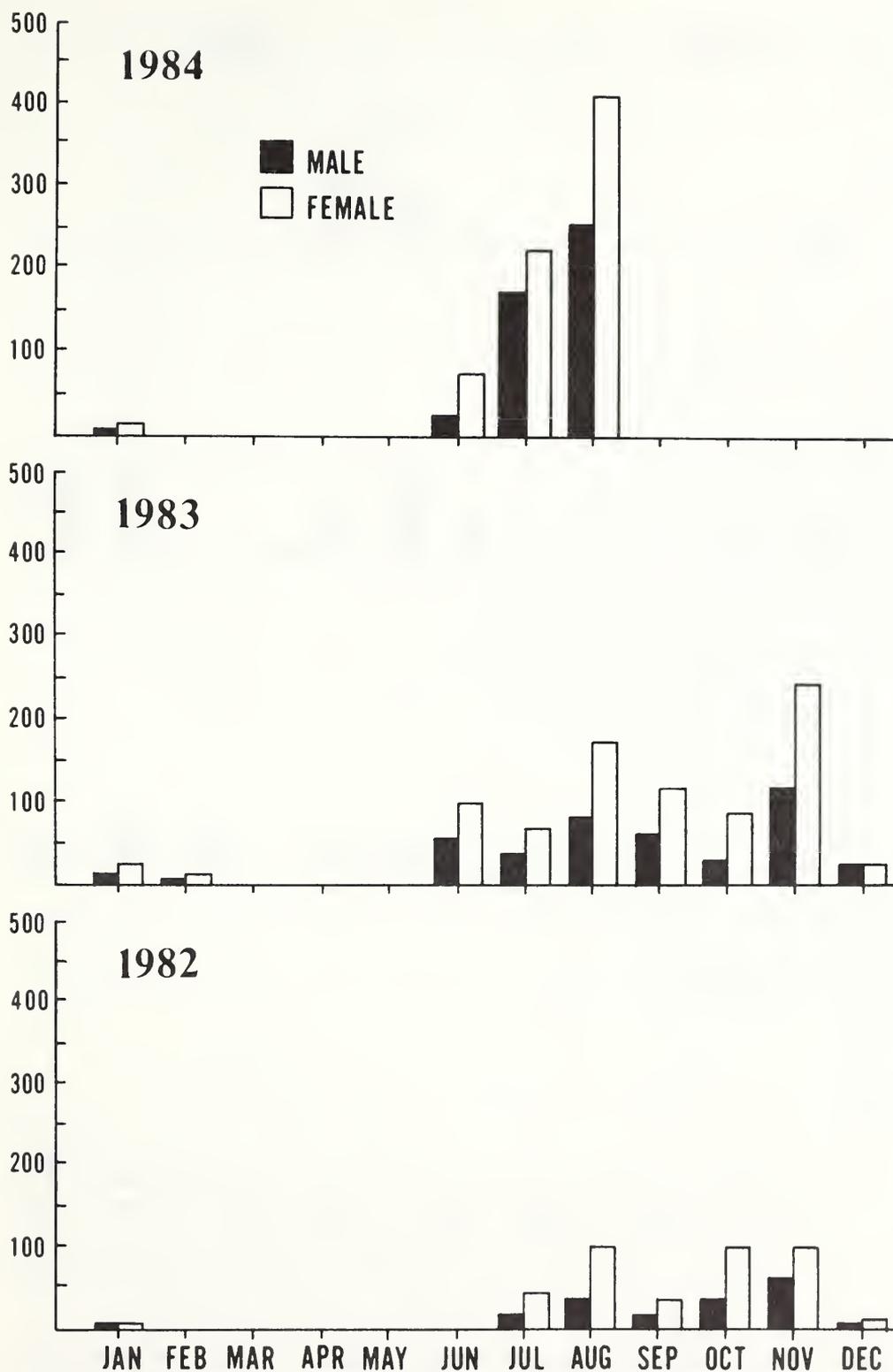


FIGURE 1. Number of fleas collected monthly from two domestic dogs, 1978-1984.

One factor offered to account for this is that male fleas, being more active and smaller than females, tend to separate more readily from the host. Also, he believes that males

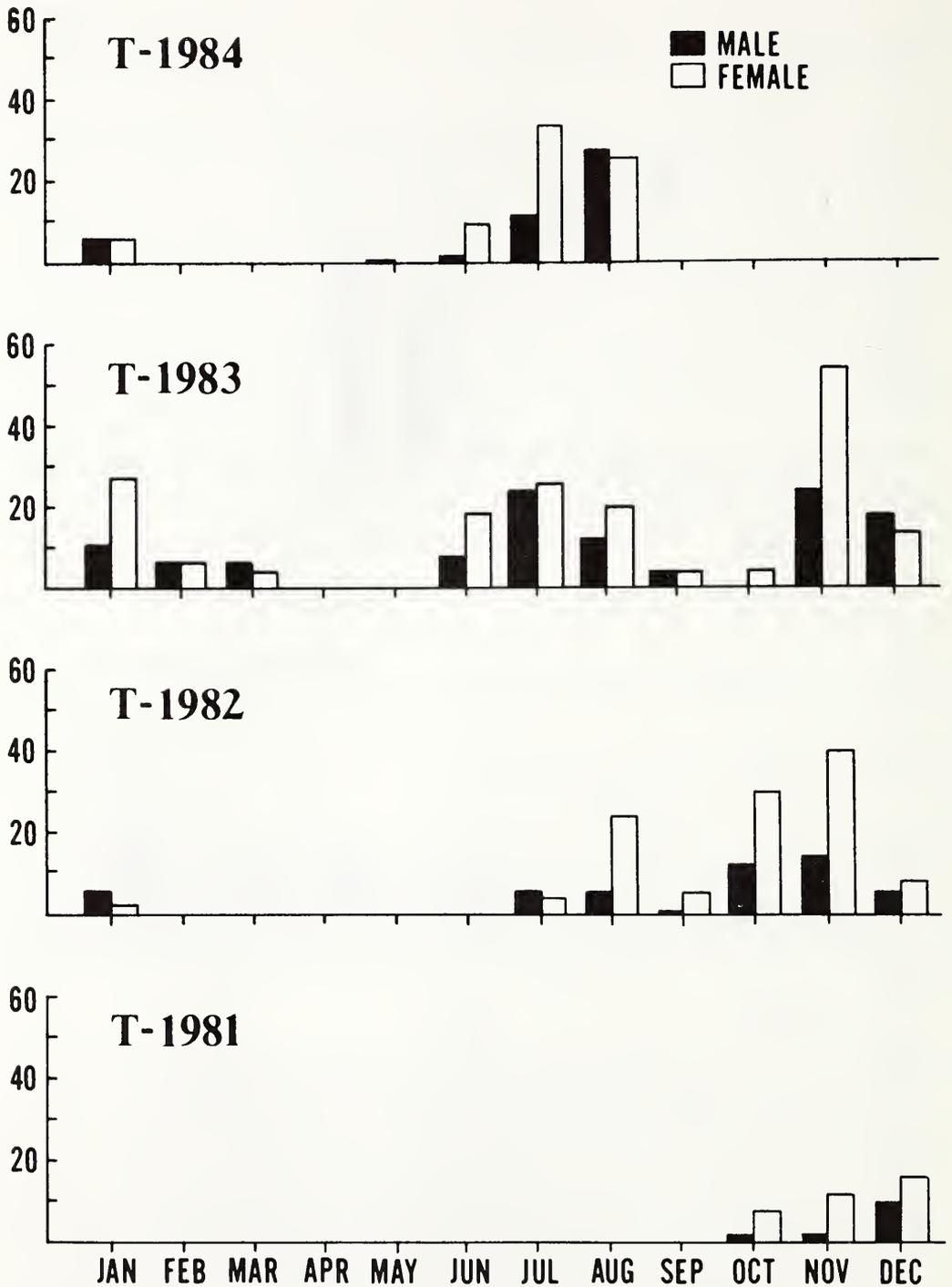


FIGURE 2. Number of fleas collected monthly from a domestic cat (T), 1981-1984.

are less able to withstand adverse conditions of nutrition and climate. He further noted that fleas are seasonal breeders. Another factor is that a sampling bias may exist that is caused by one sex spending more time on the host or in the home than the other. Finally, he noted that the sex ratio may vary with the season.

In the present study, female fleas outnumbered males 1.8:1.0. Although collections for some years show one and sometimes two months where the number of males

exceeds that of females, the preponderance of females over males is clear (Figures 1 and 2). This suggests that there is a certain amount of stability in the sex ratio.

Chumakova and Kozlov (1) tested the stability of sex ratios in three species of fleas. They found the ratio stable in flea progeny as a function of the age of female fleas, when the progeny fed on different host species, and when progeny fed on different generative states of the host.

An attempt was made to correlate area meteorological data with numbers of fleas collected on a monthly basis for each of the six years and eight months. No significant correlation was observed when numbers of fleas were compared with monthly means of temperature, rainfall, and relative humidity. The highest correlation was found with temperature ( $r = 0.3$ ). It was thought that significant correlation with one or more of these weather parameters would aid in explaining the changes in seasonal abundance as well as annual fluctuations in numbers of fleas shown in Figures 1 and 2.

Cole (2) studied the effects of temperature on the sex ratio in *Xenopsylla cheopis* (Rothschild), the rat flea. He found no significant correlation between percentage of females, collected weekly for forty-five weeks, and rainfall, relative humidity, or saturation deficiency. However, there was high correlation ( $r = 0.8$ ) with the sex ratio and weekly temperatures.

Throughout the flea control period represented in this report, a serious effort was made to avoid using insecticides. When used most often, 1982-1984, population increases were more pronounced than during previous years. In order to provide relief to the pets and to keep the host-flea relationship at tolerable levels for them, insecticides were applied as indicated. While numbers of fleas were reduced, distribution patterns from year to year appear to be less affected by these applications (Figures 1 and 2). Insecticides were used when needed rather than according to schedule.

### Conclusions

Fleas of dogs and cats that live in the home can become a serious nuisance to human occupants if not actively controlled. In this study, from January 1978 through August 1984, the attempt was to prevent fleas from building up large, uncontrollable populations on the pets without using insecticides. The intent was to maintain a manageable population of fleas by removing them from the pets regularly, mostly on a weekly basis. During the period indicated, on twenty-one occasions, however, it became necessary to use insecticides in addition to mechanical removal and sanitary control of fleas.

Results of tallies of fleas over the years suggest a seasonal basis for observed changes in their populations. However, no significant correlation between numbers of fleas and mean monthly temperatures, rainfall, or relative humidity was found. With few exceptions, however, the sex ratio in which females outnumbered male fleas was consistent from year to year. Overall, females outnumbered males about 1.8:1.0.

In this study during which fleas and their hosts were largely protected from the influence of the changes in weather and in the seasons, it appears that annual changes in the flea populations are intrinsically controlled on a cyclical basis which is independent of climatological influences. This explanation could account for the presence of fleas during the latter half of the year and their low numbers or absence in late winter and spring.

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