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STUDIES OF POPULATIONS OF ADULTS AND IMMATURE INSECTS AND MITES FROM TWO TREATMENTS AT COTTONWOOD, SOUTH DAKOTA

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ABSTRACT

Arthropod samples collected periodically during the months of May through August 1970 yielded information on the population trends of various groups of invertebrates. Six orders of insects make up the greater density of the invertebrates in both treatments studied. The large number of Hymenoptera is due to the presence of ants. During the month of May, a total of 32,995 individuals were collected and distributed among 13 orders of the class Insecta, the Acarina, Araneae, Diplopoda, and Chiliopoda. A total of 12,297 of these were collected from the grazed treatment and 20,698 from the ungrazed treatment. In June only 7,963 individuals were obtained among 14 orders of Insecta, the Arachnida, and Diplopoda. The grazed treatment contained 4,514 individuals, while 3,449 specimens were obtained from the ungrazed treatment. The month of July is evaluated on the basis of one sample date with a total of 9,185 specimens collected. The grazed treatment contributed 5,914 individuals and the ungrazed treatment only 3,271 specimens. These were distributed in 12 orders of the Insecta, the Arachnida, Diplopoda, and the Chilopoda. The month of August contributed a total of 21,028 individuals in 10 orders of the Insecta, and the Arachnida. The grazed treatment had 13,183 individuals while the ungrazed treatment contained 7,845 specimens.

INTRODUCTION

Although some progress has been made in dealing with the complexity of structure and interaction at the community level (Elton and Miller 1954 and Elton 1966), studies of a single community and its invertebrate fauna are still largely in the natural history stage of development. This paper is derived from an investigation of a grassland ecosystem located at the Cottonwood Site of the U.S. IBP Grassland Biome Comprehensive Network.

The site of these studies is the Cottonwood Range Field Station comprising 2,640 acres owned by the South Dakota Agricultural Experiment Station. The cultural history of the fields and its climatic regine, physiography, soils, and vegetation have been described elsewhere (Lewis et al. 1971); only a brief summary will be presented here.

THE STUDY AREA

The fields utilized are on a large Pierre-Promise (Pierre, 50%; Promise, 15%; Lismas, 22%). The fields are of well to excessively drained grayish-brown clays which are undulating to steep. The area is sometimes called the "gumbo region" of South Dakota because of the plastic clay which weathers from the shale. The strata of the Pierre shale are soft and easily eroded (Westin, Puhr, and Buntley 1959). A continental climate exists with extremes of summer heat, winter cold, and rapid fluctuations of temperature. Detailed data as to temperature ranges, precipitation, dates for killing frost, etc., are given by Lewis et al. (1971).

The season of plant growth and insect activity is extensive, since the fall shoots and basal leaves of the perennial grasses and herbs remain green throughout some of the winter months. These regions

resume active growth with the increased photoperiod in late March or early April; and soon thereafter, the early spring insects become evident.

The surface of the study area is gently undulating and predominantly clay in texture, with frequent occurrence of gilgai microrelief on the slopes. Two treatments have been established: one long unused for either crops or pastures and referred to as the permanent exclosure ungrazed treatment; and one temporarily excluded from a heavily grazed pasture and referred to as the heavily grazed treatment. In all probability, browsing by deer and rabbit has occurred, although by widely scattered individuals. The ungrazed treatment was fenced from the back portion of the lightly grazed pastures in 1963. This area is dominated by *Agropyron smithii*, with conspicuous amounts of *Stipa viridula* and with an understory of the shortgrasses, *Bouteloua gracilis* and *Buchloe dactyloides*. *Bromus japonicus* may be abundant in certain years, depending on climate conditions. The grazed treatment area is in low range condition, dominated by *Buchloe dactyloides*. *Bouteloua gracilis*, *Carex eleocharis*, and *Bromus japonicus* are also important parts of the flora on this treatment (Lewis et al. 1971). This location is close to a small lake and stream supporting cottonwood, ash, and an occasional willow, which are important factors in explaining the presence of certain members of the insect fauna reported in this study.

METHODS

The data in this paper are derived from records of occurrence, based on D-vac suction samples of invertebrates encountered on the two treatments from May to August 1970. The principal tools were quick-traps, produced at the U.S. IBP Grassland Biome Pantex Site and completely modified at Cottonwood, the D-vac suction apparatus,

and a dry extractor Berlese funnel. The extracted material was sorted, using two stereomicroscopes with 10x widefield eye-pieces and overall magnifications of 6, 12, 25, and 50 x. Extractions from the Berlese funnels were sorted in Petri dishes, 150 x 20 mm, and placed in small screw-cap viles for storage. The quick-trap determined the plot and sample size and was located on the herbage dynamics study plots. Sampling was at two-week intervals during a period of rapid growth of the flora, this established to be approximately between May 15 and August 15. During the months of September, October, and March and April, samples were taken once monthly in the same manner as those taken during the rapid growth period. Since no flying insects were encountered during the winter months, samples taken in November, December, January, and February were taken without the use of the quick-traps. However, overwintering forms in the crowns, mulch, and topsoil were obtained during these months.

This study included both the Apterygota, immatures and mites, as well as adult insects. Excluded were the Mallophaga, Anoplura, and Siphonaptera, all external parasites of birds and mammals. Some of the representatives included are species which are fossorial, aquatic, or subterranean which, in one or more of their life stages, appear aboveground for a portion of their lives.

Portions of the material contained in this report were submitted to professional systematists for identification. However, as the samples were worked and familiarity with the fauna increased, it was possible to make identification on a comparison basis.

For a few species of scale insects, I have records of nymphal occurrence and information on both adult and larval feeding habits,

but in the main, such specific information is lacking. For an analysis of trophic structure, reliance on published data about species, genera, or families has been utilized. Caution has been used, however, and only general trophic habits are suggested for large groups of individuals within genera and families.

Trophic analyses have been based on the following food habit classification, modified after Evans and Cain (1952), Evans and Dahl (1955), and Evans and Murdoch (1968):

(i) Entomophagous predators, feeding largely or exclusively on other insects.

(ii) Entomophagous parasites, the parasitic feeding being confined to the larval stage.

(iii) Omnivores, feeding on both plant and animal tissue.

(iv) Leaf-and-stem feeders, including suckers of internal plant juices, as well as seed, flower, nectar, and pollen feeders.

(v) Scavengers, feeding on dead and decomposing matter.

Throughout this paper, the term "herbivore" is synonymous with category (iv) above.

RESULTS

The total number of individuals obtained by use of the D-vac suction apparatus for May was 32,995. Six orders of insects and the mites make up most of the invertebrates on both the grazed and ungrazed areas (Table 1).

The large number of Hymenoptera is due to the ants which were found in nearly equal numbers on both the grazed and ungrazed areas. A total of 3,067 individuals was collected which belong to the family Formicidae, commonly called field ants, of the genus *Lasius*, and 124 belong to other families within the order Hymenoptera (Table 2).

Table 1. The total number of different groups of animals taken in two grassland areas with a D-vac suction apparatus for the month of May, 1970.

Group	Grazed	Ungrazed	Total
Chilopoda	4	3	7
Diplopoda	0	4	4
Araneae	27	23	50
Acarina	8,520	8,627	17,147
Collembola	372	7,146	7,518
Orthoptera	1	12	13
Psocoptera	5	0	5
Dermoptera	0	1	1
Hemiptera	352	223	575
Homoptera	626	533	1,159
Thysanoptera	181	442	623
Neuroptera	0	1	1
Coleoptera	258	421	679
Diptera	7	15	22
Hymenoptera	1,656	1,411	3,069
Lepidoptera	1	1	2
Trichoptera	2	3	5
Larvae Unidentified	285	1,832	2,117
TOTAL	12,297	20,698	32,995

Table 2. The total number of members of the order Hymenoptera by family for the month of May 1970.

Family	Grazed	Ungrazed	Total
Formicidae	1659	1204	2863
Braconidae	8	25	33
Unidentified	19	72	91
TOTAL	1686	1301	2987

The total number of individuals collected in the grazed treatment was 12,297, and for the ungrazed treatment, it was 20,698 (Table 1). That certain plots (quadrats) would contain a large number of individuals (373 in a single grazed plot) and that other plots would contain only a few ants (only a single ant was obtained in several plots in both the grazed and ungrazed) is due to the fact that colonies of ants are not uniformly distributed over their whole range, but are encountered only in particular stations or habitats. This indicates that ants, like plants and many other animals, depend very intimately for their welfare on precise physical and organic environments, such as the nature of the soil and vegetation, the amount of moisture, and the exposure to sunlight.

Members of the ant genus *Lasius*, which includes the cosmopolitan field ant, prefer to nest in grassy pastures, in situations exposed to the full warmth and light of the sun. However, some species of the genus *Lasius* are so adaptable that they occur in nearly all types of habitats within a restricted range. Members of this genus feed on the excretions of plants, such as the sweet liquids exuding from the leaves and especially from the floral and extrafloral nectaries, the sap escaping from wounded stems, and the honeydew excreted by plant lice (aphids), mealybugs (coccids), and leafhoppers (membracids). These liquids are plant juices that have undergone certain changes in the alimentary tract or glands of the insects. Other food materials are the seeds of plants, (especially of grasses, berries, drupes, and fruits of all kinds),that have been injured by birds or other insects, or that have fallen to the ground. Ants are unable to gnaw through the tense

skins or rinds of certain fruits. Some hypogaeic species also feed on bulbs or tubers, the tender bark of grass roots, or the cotyledons of germinating seeds (Wheeler and Wheeler 1944).

The ants play another role in the overall energy flow within the Grassland Biome. They have developed a symbiotic relationship with the phytosuccivorous Homoptera the plant lice (Aphidoidea), and the scale insects or mealybugs (Pseudococcidae).

The consociation of ants with aphids has enabled them to obtain a large amount of food without losing time and energy in ranging throughout an area in search of food. The genus *Lasius* is known to not only utilize the honeydew of aphids, but has been observed in the autumn of the year collecting and storing aphid eggs in the chambers of their nests. They care for these eggs through the winter and in the spring place the newly hatched nymphs on the crowns and roots of various grasses. It has been shown by Forbes (1891), Weed (1891), and Webster (1888, 1899, 1907), that the common ant, *Lasius americanus*, is instrumental in rearing and disseminating a root aphid (*Aphis maidiradicis*) throughout a pasture. This same species of aphid is of economic importance in its feeding and association with ants on corn.

Nearly all plants are subjected to attack by aphids and all parts of the plant may be utilized as a feeding area. Certain species prefer the leaves, others the twigs, and still others the roots and subterranean stems. The sedentary and gregarious habits of the aphids and scale insects expose them to a host of enemies, among which the Coccinellidae beetles and their larvae, the larvae of certain Diptera (Syrphidae) and Neuroptera (*Chrysopa hemerobius*), and a host of parasitic Hymenoptera (Pteromalidae, Baconidae, Crabronidae) are the most formidable. It is

because of the presence of the aphids and scales that the different types of insect predators are found in the Grassland Biome.

The amount of food or energy extracted from plants by these phytosuccivorous insects can be seen in the amount of honeydew extracted by each individual. Busgen (1891) studied the amount of honeydew excreted by a single aphid and found a single linden aphid to excrete 19 drops in 24 hours and the maple aphid up to 48 drops during the same period. Enough honeydew is extracted by aphids that members of the genus *Acanthomyops*, the yellow subterranean ant, can live exclusively on the excrement of root aphid and scale insects.

If, as has been pointed out, ants found on the Cottonwood plots belong to the genera *Lasius* and *Acanthomyops*, which require excrement produced by aphids for a source of food, the question arises as to why only a small number of aphids was obtained during the month of May while a very large number of ants was collected. This can be explained in regard to the feeding habits of aphids and their complete dependence on the ant as a means of transportation. They are helpless without their benefactor, the ant; and in a Berlese trap, aphids will not move away from heat, but rather tend to move upward, or toward the heat.

Much of what has been said of the aphids will also apply to the scale insects (mealybugs) of the family Pseudococcidae. The adult members of the family Pseudococcidae are even more sedentary than the aphids and are found on both the roots and aerial surfaces of grasses. Like the aphids, they excrete honeydew often in considerable quantities, from ducts of the dorsal surface of the body or, in some species, the anal orifice. Unlike the aphid, the mealybugs avoid heat and light and move down when placed in a Berlese trap. Also, the mealybug is

able to migrate in its nymphal stage for long distances from one area to another without the aid of ants.

The cuticle in the nymphal stage and adult mealybugs is preformed before feeding commences, and the body is immediately capable of passive distension. When fully fed, the bodies of nymphs and adults are much distended. Progressive changes between feedings affect the shape, color, elevation of folds, depths of grooves, and appearance of the wax ducts. These alterations frequently make the diagnosis of species difficult. Changes from the rotund to the flattened condition do not greatly affect the length and the breadth of the specimen, but the grooves on the body become well defined (McDaniel, unpublished).

The amount of plant juice ingested by mealybugs from the grass roots or stems during one period of feeding is about 150 times its original body weight in some species to only four to five times original body weight in other species (McDaniel, unpublished).

In Table 3, it can be seen that the grazed treatment contained the largest number of individual mealybugs: 581 individuals were obtained from the grazed treatment, and 299 individuals were obtained from the ungrazed treatment.

The Hemiptera-Heteroptera complex include families like the Tingidae or "lace bugs," Miridae or "leaf bugs," and Lygaeidae, Coreidae, and Neididae, the members of which feed upon plant tissues (Table 3). The Homoptera all suck the juices from leaves, stems, tubers, and roots. Thus, the members of the family Cicadellidae which feed upon the leaves are called "leafhoppers," and the Membracidae which feed upon the stems and twigs are called "treehoppers," The Fulgoridae are stem or leaf feeders and are called "lantern flies." The Cercopidae, known as

Table 3. The total number of members of the order Hemiptera-Homoptera by family for the month of May 1970.

Family	Grazed	Ungrazed	Total
Lygaeidae	374	57	431
Tingidae	0	99	99
Phymatidae	0	2	2
Pseudococcidae	581	299	880
Aphididae	2	0	2
Unidentified	74	329	403
TOTAL	1031	786	1817

"froghoppers" or spittlebugs, make a frothy mass on the stems of grasses. They suck the juice from their host. The Psyllidae, or jumping plant lice, occur on the stems and leaves of woody plants, seldom attacking grass species. The Aphidoidea or "plant lice" have been referred to in association with ants; however, there are many species that are not attended to by ants (this superfamily is very abundant as to the number of species). The Aleyrodidae, or whiteflies, also obtain their food from plants, but seldom attack members of the grass family found in South Dakota. However, in the tropic regions, such plants as bamboo have members of the Aleyrodidae utilizing it as a host plant. The Coccoidea or "scale insects" occur on the bark, leaves, stem, crown, tubers, and roots of plants. Many species are host specific and feed only on grasses. Like the aphids, the superfamily is an economically important group of plant parasitic forms.

Within the Hemiptera, such families as the Reduviidae ("assassin bugs"), Phymatidae ("ambush bugs"), and Nabidae ("damsel bugs"), are predatory on insects and other small animals. Other families such as the Pentatomidae ("stinkbugs") contain certain species which are plant feeders, while others are predatory in habit.

The number of individuals in both of these orders is greatly reduced, and it could be said to be held in check by parasites and natural enemies, such as predacious species. The Hymenopterous, Dipterous, and even Lepidopterous species are known to parasitize the Hemiptera and Homoptera. The larvae of Coleoptera, especially Coccinellidae or lady beetles, devour vast quantities of aphids and scale insects. The larvae of certain Dipterous flies (Syrphid flies) and lacewing flies (Neuroptera) also feed on soft body species of these orders.

There is approximately 20 to 30 thousand Hemiptera-Homoptera species described from the whole world, and about 9 to 12 thousand species occur in North America. In the number of species, these two orders are exceeded only by the Coleoptera (beetles), Lepidoptera (butterflies and moths), and Hymenoptera (ants, bees and wasps), and possibly by the Diptera (flies) in South Dakota.

The family Lygaeidae is of interest in this discussion, as only the nymphal instars were collected during this period. The single species collected of this family was the well known pest of grain crops, the chinch bug, *Blissus leucopterus* (Say). A total of 389 individuals was obtained; 333 of these were taken from plots of both replicates of the grazed treatment, while only 56 specimens were collected from the two replicates of the ungrazed treatment (Table 4). The immature nymphs of this species, especially the third and fourth instars, are easily recognized by the red spots on the abdominal segments.

Adult chinch bugs hibernate during winter in native clump-forming grasses in pastures and meadows in South Dakota. Emergence from hibernation occurs early in the spring in the western part of South Dakota. At Cottonwood the emergence is sometimes between early March to late April, or possibly late February, depending on the snow cover for a given year. Some adults will, upon emergence, mate; and the females may deposit eggs at the base of native grass plants. Depending on the time of emergence, they may mate and migrate to grain crops, feed for several weeks, then deposit eggs at the base of these plants. In this case, the nymphs feed on small grain crops until almost full grown and either move back to native grass pastures, or to corn fields where they reach maturity. In corn fields these new adults deposit eggs

Table 4. The total number of 4th instar nymphs of *Blissus leucopterus* (Say) (Lygaeidae: Hemiptera) by treatment for the month of May 1970.

Species	Grazed	Ungrazed	Total
Blissus leucopterus (4th Nymphal instar)	333	56	389

behind leaf sheaths of corn plants, and another brood develops before fall. The fact that only the nymphal instars were obtained during May can be explained by the above life cycle. It is clear that what was collected were the nymphs from eggs of overwintering adults, and they were utilizing the native grasses rather than small grain crops to reach maturity.

The family Tingidae is also of interest, as only the ungrazed treatment supplied all 99 individuals of this family during the month of May (Table 3). The family is easily distinguished by the wing being filled with areoles, giving it a lace-like appearance. The species of this family feed exclusively on plants, generally congregating on the underside of the leaves. They hibernate in the adult stage. The species taken at the Cottonwood Site belong to the genus *Corythucha*. Members of this genus have been recorded from sunflowers, goldenrod, and various weeds in the eastern part of South Dakota. The species *C. marmorata* (Uhl.), the chrysanthemum lace bug, and *C. ciliata* (Say) have been recorded from eastern South Dakota (Severin 1924) feeding on goldenrod. Britton (1923) regarded the subspecies *C. marmorata informis* as a northern form. It is this subspecies that was collected by Parshley (1919) from goldenrod in South Dakota. Members of this genus are also harmful to plants because of their habit of laying their eggs within the host tissue. The sycamore lace bug, *C. ciliata*, is distributed throughout North America, where its host is found. *Gargaphia solani* Heidemann feeds on various salanums and on cotton; it can be a serious pest in the southern United States (Essig 1942).

The Phymatidae are predacious, occurring in the flowers of plants where they feed on bees and other insects. In South Dakota the

goldenrod and other yellow-colored flowers are common habitat for members of this family. The species *Phytma fasciata* var. *georgiensis* Melin is recorded from South Dakota. It hides in the flowers of the common goldenrod. Members of this family are known for their ability to destroy honeybees and other beneficial as well as destructive species of insects. Only a single specimen was collected from the ungrazed treatment during the month of May (Table 3).

At the present time, 119 specimens are still unidentified, all belonging to the order Hemiptera (Table 3).

The scale insects of the superfamily Coccoidea have been discussed in association with ants. However, many species are not dependent on ants for their existence. During May, a total of 880 individuals were collected (Table 3). No attempt was made to separate the immatures and the adults, as both have the same method of feeding. All the material collected belongs to the family Pseudococcidae, commonly called mealybugs.

Members of this family feed on the phloem of their hosts. They occur in masses on the upper and lower surfaces of leaves of grasses, at the base of leaf stems, and at the bases of clump grasses. Individuals of all age groups may be found on a plant at the same time. They remove the sap from their hosts and excrete a form of honeydew Also present on the Cottonwood Site is the ground mealybug, *Rhizoecus terrestris* (Newstead). This is a minute species which infest the roots of grasses in large numbers. These were collected outside of the study areas, and their numbers are not included in the D-vac samples. A single root system may contain up to 500 individuals (McDaniel, unpublished).

During May 581 individuals were obtained from the grazed treatment and 299 individuals from the ungrazed treatment (Table 3). It is expected that in the months of July, August, and September, members of the family Dactylopiidae will be encountered. The species *Dactylopius coccus* Costa feeds on *Opuntia cacti*, and it has been observed on *Opuntia* outside both the grazed and ungrazed treatments. The first nymphal stage of this species will migrate through an area in search of its host. It is, therefore, believed that they will be picked up as the eggs hatch during the late summer months.

The superfamily Aphidoidea has been discussed earlier in connection with its close association with ants. Only 11 specimens were obtained during the month of May (Table 3). This low number was explained by their habit of moving toward a heat source and their probable death in the Berlese traps.

In the order Psocoptera, sometimes called psocids, book lice, bark lice, or dust lice, only five specimens were collected in May (Table 5). They appear to belong to the family Liposcelidae; however, a positive determination is not yet established. Members of this family are commonly found associated with grain in the midwest (Chapman 1930). Members of this family contain species with onmivorous feeding habits, and are well known for their capacity for the production of large numbers of eggs.

The order Thysanoptera, commonly known as thrips, form a homogeneous group readily distinguished by their peculiar fringed wings. This order is divided into two well-defined suborders. In the suborder Terebrantia the females have saw-like ovipositors, while in the suborder Tubulifera the saw-like ovipositors are absent. Within the

Table 5. The total number of minor orders by family for the month of May 1970.

Order - Family	Grazed	Ungrazed
Psocoptera - Liposcelidae	4	0
Trichoptera - Unidentified	2	3
Diptera		
Phoridae	1	1
Cecilomyiidae	0	2
Unidentified	6	10
Lepidoptera - Unidentified	1	1
Dermaptera - Unidentified	0	1
Neuroptera - Unidentified	0	1

suborder Tubulifera, according to Stannard (1957), only a single family is recognized, and the term Tubulifera and the family name Phlaeothripidae has been used interchangeably. In the work by Cott (1956) two families are utilized, Phlaeothripidae and Urothripidae. The family Phlaeothripidae, according to Stannard (1957), has evolved in an ecological zone called the saprophytic fungus habitat. Members of this family are commonly found in association with decaying grasses. The trophic level of this group is variable. Individuals of some species suck juices from mosses and leaves of grasses or other higher plants, while others ingest juices from bulbs. Some species are predacious. However, the majority of the species feed on fungal spores. Feeding habits, according to Cott (1956), have become fairly well stabilized within generic limits. He maintains that the feeding habits of individuals may be predicated with a high degree of accuracy from data on the feeding habits of other members of the genus. This fact emphasizes the importance of identification of members of this suborder. For example, members of the genus *Goniothrips* are found in the inflorescences of grasses. Members of the genus *Leptothrips* and *Karnyothrips* would be expected to be predacious, while members of the genus *Liothrips* usually feed on leaf tissue and young shoots, primarily of angiosperms.

The suborder Terebrantia, according to Bailey (1957), did not consider knowledge of host plants important for the identification of this suborder. The major part of this suborder deals with species that are of economic importance due to their feeding habit of utilizing important food plants for a source of food. However, the genus *Aeolothrips* is predacious and feeds on spider mites, nymphs of scale insects,

and other thrips. Members of the Gramininae are commonly utilized as a food source for this group of insects.

Seasonal abundance occurs in both suborders within the Thysamoptera, some species being numerous in the spring and others during the warm, dry season (Bailey 1957). He also observed that heavy rains readily destroy thrips.

At Cottonwood during May, a total of 623 individuals were obtained, with 442 members from the ungrazed treatment and 181 collected from the grazed treatment (Table 1). This ratio would be in keeping with the knowledge that members of this order are found in association with the ecological zone that is composed of leaf litter.

The Collembola, like the members of the order Thysanoptera, inhabit the mulch region and are considered as soil insects by many workers. However, members of this order are abundantly found upon the surface of water during certain periods of their life. A number of species are found in the intertidal areas along seashores where they may be completely submerged for a considerable portion of the time (Bacon 1912 and 1913). The Collembola utilize decaying vegetable matter, fungi, and lichens as a source of food. Some species will feed on spores, germinating seeds, and living plants. Those species living on the surface of water feed extensively upon diatoms, dismids, or algae. Snow fleas will feed on pollen grains, as do other species that live on plants. Certain maritime species also feed on carrion. A very few are predacious and cannibalistic. Several species have become beneficial because of their breeding in the filter beds of sewage disposal plants where they act as scavengers. A complete discussion of the food of Collembola is given by Macnamara (1924).

It has been pointed out by Maynard (1951) that an important factor determining the occurrence of members of this order is moisture. Without moisture most species will perish in a very short time.

Major changes in the vegetation of an area, such as are caused by fire or by human interference or by the normal succession of the flora will have obvious important effects on the abundance of springtails. Two families are included in the grassland ecosystem at Cottonwood, Entomobryidae and Sminthuridae. A third family, Poduridae, is present in the area, but is confined to the small lake located near the grazed treatment. The Collembola is divided into two major groups or suborders, the Arthropleona and the Symphypleona. These two suborders are easily separated by the shape of the body. Members of the Arthropleona have an elongated body, whereas the species of Symphypleona has a globular body. The family Entomobryidae belongs to the suborder Arthropleona and the family Sminthuridae to the Symphypleona.

A total of 7,518 individuals was collected from both the grazed and ungrazed treatments during the month of May (Table 6). The family Entomobryidae contained the larger number of specimens, having a total of 7,126. The ungrazed treatment contained 6,800 individuals compared to 326 specimens from the grazed treatment. For the family Sminthuridae, 85 individuals were collected, 51 from the ungrazed and 34 from the grazed treatments. A total of 307 specimens are still unidentified as to their family rank. However, 295 of these unidentified individuals were collected from the ungrazed treatment compared with only 12 specimens from the grazed (Table 6).

The family Entomobryidae is the dominant family of the order Collembola and is rich in genera as well as species. They are commonly found in association with grass fields, underbark, groundcover, etc.

Table 6. The total number of members of the order Collembola by family for the month of May 1970.

Family	Grazed	Ungrazed	Total
Sminthuridae	34	51	85
Entomobryidae	326	6800	7126
Unidentified	12	295	307
TOTAL	372	7146	7518

Many species are quite specific in their habitat preference. Mills (1934) refers to *Isotoma walkeri* Packard as a part of the cortical fauna of fallen trees, especially cottonwood. The genus *Entomobrya* is widely distributed and difficult to identify because of their similarity of structural details. Color patterns are relied upon for the determining of species, and in certain instances, the body color varies greatly between individuals of a single population. This genus is present on the two treatments at Cottonwood.

The members of the suborder Symphypleona, found by suctioning at Cottonwood, all belong to the family Sminthuridae. This family, unlike the Entomobryidae, has departed from the original habit of feeding on rotting or decayed vegetable material and has adopted the trophic level of utilizing the delicate tissues of living plants. In their natural surroundings, owing to their small size and to the delicacy of their mouthparts, the damage which they do is generally (though not by any means always) too slight to be considered of economic importance. However, man has provided two means by which the springtails have become ecomonic pests: (i) by introducing richer pastures, so that native species tend to transfer their activities from native flora to introduced crops; (ii) by the accidental introduction of species into new environments, where more suitable climatic conditions and the void of predators, disease, etc., enable them to become formidable pests.

The example of a pest among members of the family Sminthuridae is the well known "lucerne flea" or "clover springtail". In South Dakota the alfalfa springtail, *Sminthurus medialis* Mills, is commonly found associated with alfalfa in the western portion of the state.

This species was also taken from both the grazed and ungrazed treatments at Cottonwood. It should be noted that a field of alfalfa was in close proximity of both the treatments, and it is probable that it is not a natural inhabitant of the grass ecosystem at Cottonwood. A total of 85 specimens was obtained during May, 34 from the grazed and 51 from the ungrazed treatments.

The species *S. medialis* is considered to be closely related to the "lucerne flea," a very important pest of clover in other parts of the world.

At the present time, a total of 307 individuals has not been placed according to family rank, 295 from the ungrazed and 12 from the grazed. These specimens are considered to be in the immature stages and do not lend themselves to the keys available for the identification of Collembola (Table 6).

The order Orthoptera contains the very familiar grasshopper. This insect has, in the past, been the target insect in ecological studies to evaluate how much energy is removed from the faunal ecosystem by insects. Because of its habit of chewing plant material and its grazing manner of feeding, it has been likened to the grazing of domestic cattle. This is familiar to the ecologist whose training is gained from a study of large mammals or involvement with range management programs. Few entomologists consider the grasshopper as an indicator of energy flow due to the sporadic fluctuation in numbers in a given area.

A look at the grasshoppers collected by suctioning at Cottonwood shows the low numbers that were present during the month of May (Table 7). A total of seven individuals, all belonging to the family Acrididae,

Table 7. The total number of members of the order Orthoptera by family for the month of May 1970.

Family	Grazed	Ungrazed	Total
Acrididae	1	7	8
Gryllidae	0	2	2
Mantidae	0	3	3
TOTAL	1	12	13

was collected. The family Gryllidae, or crickets, was also of little importance, if individual numbers are an indication of the role they play in the removal of energy from the grassland ecosystems. Only three specimens were collected in May. Also collected were two members of the family Mantidae, which is predacious and does not take its food materials directly from the plants (Table 7). Members of the family Acrididae are the short-horned grasshoppers which utilize plant tissues for their sole source of food. However, members of the family Gryllidae are both herbivorous and carnivorous, and if conditions exist, will become cannibalistic. The species obtained at Cottonwood was the common black-field cricket, *Gryllus assimilis* (Fabricius). The three specimens of *G. assimilis* were taken from the ungrazed treatment. Seven of the individuals belonging to the family Acrididae were also taken from the ungrazed treatment, with a single individual of this family collected from the grazed treatment.

The order Dermoptera is commonly called "earwigs." Only two specimens were collected during the month of May, both from the ungrazed treatment (Table 5). The species of this order are found in moist, shady regions of the habitat, under stones, bark of trees, piles of refuse, manure, hollow grass stems, etc. They are generally omnivorous feeders. In Cottonwood it would be expected that the two members of this order are herbivorous, as most of the northern species of this order feed on dead or decaying vegetable matter and living plant material (Herbard 1917).

The Coleoptera, known as "beetles," are the predominant order of the insect world. In most species of this large order, the thin forward pair of wings have been transformed into what is called an elytra

which makes them poor fliers, but has provided them a protection that has brought prosperity to their kind. The order consists of about 350,000 known species which are grouped in upwards of 110 families (Arnett 1968). A total of 674 adult individuals was collected during the month of May, 416 specimens from the ungrazed treatment and 258 from the grazed treatment (Table 8). Within these totals, 11 families are represented, the largest number of individuals totaling 117 and the smallest being 1. There are 84 specimens that presently are unidentified, and none of the larva have been separated into orders.

The family Carabidae is called ground beetles, with the majority being predacious in their food habit. Forbes (1883) examined 175 adult individuals belonging to 38 species and 20 genera to determine the contents of their stomachs. Of the 175 specimens, 56% of the food was of animal origin with 36% being composed of the remains of insects. The other 21% was made up of mollusks, earthworms, myropods, and arachnids. The vegetable matter eaten was composed of the remains of cryptogamic plants, pollen of grasses, and some tissue of some plants. The larvae, like the adults, are also predacious and live beneath the surface of the ground, feeding upon the soft bodied larvae and other soil arthropods. According to Ball (1959) some species have larvae that are parasitic. During May, 94 individuals of this family were collected, with 51 taken from the ungrazed treatment and 43 from the grazed treatment (Table 8). Because of their predatory habits, members of this family are considered highly beneficial. However, a number of genera take an energy source directly from the flora by their habit of feeding on berries, seeds, tender shoots, pollen and, in some cases, the foliage of plants. Among the seed, plant, and berry destroyers

Table 8. The total number of members of the order Coleoptera by family for the month of May 1970.

Family	Grazed	Ungrazed	Total
Staphylinidae	23	38	61
Carabidae	43	51	94
Scarabaeidae	136	22	158
Lathridiidae	12	83	95
Coccinellidae	8	2	10
Curculionidae	3	24	27
Mordellidae	1	117	118
Chrysomelidae	2	15	17
Elateridae	0	2	2
Tenebrionidae	1	0	1
Pselaphidae	2	11	13
Unidentified	27	51	78
TOTAL	258	416	674

are *Amara*, *Anisodactylus*, *Calathus*, *Clivinia*, *Harpalus*, *Omophron*, *Pterostichus*, and *Zabrus* (Arnett 1968).

The family Staphylinidae, the "rove beetles," is easily separated by the elytra truncate, which is very short and always leaves some of the abdominal segments exposed. They are usually small insects and feed upon decaying animal and vegetable material. However, certain members of the Aleocharinae are parasitic on fly puparia. Other members of this subfamily have larva that are predacious, feeding on maggots, other insects, and arachnids. The family as a whole occurs in almost every type of habit. A total of 61 individuals was obtained during the month of May at Cottonwood. No difference is seen between the grazed and ungrazed treatment in the number of individuals present, with 38 collected from the ungrazed and 23 from the grazed treatments (Table 8).

It is significant that Blackwelder (1952) and Arnett (1968) both concur that members of the subfamily Aleocharinae are, at the present time, the least known group of the Coleoptera. Most of the specimens collected at Cottonwood belong to the subfamily Aleocharinae.

The family Pselaphidae, the "short-winged mold beetles," resembles the Staphylinidae, but can be distinguished by being more compact, robust, and heavily chitinized. Park (1942) states that the majority of the members are associated with mold. They also feed at times on plant material such as pollen, spores, and cryptogamic plants. A small number of individuals were obtained at Cottonwood during May, 11 collected from the ungrazed and two specimens from the grazed treatment (Table 8).

The large family Scarabaeidae has as its most distinctive feature the lamellate segments of the antennae. The Japanese beetle belongs to the large family and is well known for its destruction of plants. The feeding habits of members varies even within species in the same genus. Arnett (1968) gives nine examples regarding food and habital associations within this family: dung, humus, and fungus feeders, living plant material, and carrion feeders are some habits listed. The larvae are associated many times with vertebrate nests, or live in association with other insects. It is the larval stage that is a pest of lawns and golf greens. The adults are popularly separated into two well-marked groups, the dung or scavenger beetles and the leaf chafers. The former live upon putrefying or decomposing matter, such as the dung of animals, decaying fungi, and carrion. The leaf-chafers feed either upon the leaves of trees or the pollen and petals of flowers.

A total of 158 individuals was collected from both treatments at Cottonwood, 136 from the grazed and 22 from the ungrazed treatments (Table 8).

The Lathridiidae are very small beetles ranging from 1 to 3 mm in length. They occur for the most part in decaying vegetable matter. A total of 95 individuals was collected during may at Cottonwood, 12 from the grazed and 83 from the ungrazed treatments (Table 8).

The Mordellidae, or the tumbling flower beetles, are small wedge-shaped beetles. They are phytophagous, feeding especially on unbelliferous flowers. According to Boving and Craighead (1931) the larvae are carnivorous, and one species is parasitic on a wasp. The carnivorous larvae feed on the larvae of Lepidoptera and Diptera, which they find in the plant stems. The adults occur on the flowers, as their common name implies.

These beetles were, except for one specimen, collected from the ungrazed treatment. A total of 118 individuals was taken at Cottonwood, 117 of these from the ungrazed treatment (Table 8).

The small numbers of members of the families Chrysomlidae and and Curculionidae reflect the early period upon which this report is based. A total of 27 individuals from the family Curculionidae was collected, three from the grazed and 24 from the ungrazed treatments. Of the Chrysomelidae, only two were taken from the grazed while 15 were collected from the ungrazed treatment (Table 8).

The predacious lady beetles of the family Coccinellidae were represented by a total of 10 individuals, eight from the grazed and two from the ungrazed treatments (Table 8).

The presence of members of the family Pselaphidae is to be expected since they, like the aphids, are associated with ants. They live for the most part in the grass mulch and feed on mites and other small arthropods. A total of 13 individuals was collected at Cottonwood, two from the grazed and 11 from the ungrazed treatments (Table 8).

The families Elateridae and Tenebrionidae were represented by only one specimen for each family. The Elateridae was taken from the ungrazed, the Tenebrionidae from the grazed treatments at Cottonwood (Table 8). A total of 84 specimens are presently unidentified.

The order Hymenoptera includes the family Formicidae or ants and was discussed in detail at the beginning of this paper. However, 91 individuals of this order are as yet unidentified (Table 2).

The flies or Diptera were represented by two families, Phoridae and Cecilomyiidae, each having only a single adult collected from the ungrazed treatment. However, 16 unidentified adults were collected, 10 from the ungrazed and 6 from the grazed treatments (Table 5).
A total of seven individuals was collected from the orders Trichoptera

and Lepidoptera; five of these were from the Trichoptera and two were from Lepidoptera (Table 5). A factor influencing the low collection numbers of these orders was the presence of a blacklight collecting trap at the field station more than one mile away.

The order Neuroptera contained only a single individual from the ungrazed treatment (Table 5).

Two noninsect arthropod groups were obtained: Diplopodae, with four individuals collected from the ungrazed treatment; and the Chilopoda, with a total of seven individuals collected, four from the grazed and three from the ungrazed treatments (Table 1).

During the month of June a total of 7,963 individuals was collected at the Cottonwood Range Field Station (Table 9). This, when compared with 32,995 individuals, is a large reduction in the overall number of insect specimens. This can be accounted for by the use of a new type of Berlese extractor funnel in which the heat source was too extreme, and many individuals were killed within the Berlese funnel. Also, during the month of June the Cottonwood Site was under a severe drought condition. However, a look at ratios in data reflects a somewhat steady state. An example of this is seen by a comparison of such orders as Homoptera, Hemiptera, Hymenoptera (Formicidae), Arachnida, Thysanoptera, and Collembola (Tables 9, 10, 11, and 12).

The orders of insects remain almost identical with those collected in May, except for those listed as minor orders. The addition of new families for June are as follows: Coleoptera -- Cleridae, Anthicidae and Silvanidae; Hymenoptera -- Ichneumonidae, Eurytomidae; Hemiptera -- Homoptera -- Miridae, Corimelaenidae, Piesmidae, Coreidae, Neididae, Anthrocoridae, Cercopidae, Cicadellidae, Fulgoridae; Orthoptera -- Mantidae, Tettigoniidae; Lepidoptera -- Gelechiidae.

Table 9. The total number of different groups of animals taken in two grassland areas with a D-vac suction apparatus for the month of June 1970.

Group	Grazed	Ungrazed	Total
Diplopoda	0	2	2
Collembola	841	122	963
Orthoptera	4	16	20
Psocoptera	1	10	11
Dermoptera	0	1	1
Hemiptera	252	122	374
Homoptera	366	279	645
Thysanoptera	82	243	325
Neuroptera	0	1	1
Coleoptera	50	58	108
Diptera	43	34	77
Hymenoptera	1768	1167	2935
Lepidoptera	2	2	4
Trichoptera	3	0	3
Plecoptera	0	2	2
Arachnida	1059	1118	2177
Unidentified Larvae	39	211	250
Unidentified Pupa	4	61	65
TOTAL	4514	3449	7963

Table 10. The total number of members of the orders Hemiptera - Homoptera by family for the month of June 1970.

Family	Grazed	Ungrazed	Total
Lygaeidae	60	17	77
Tingidae	2	32	34
Miridae	20	0	20
Corimelaenidae	2	0	2
Piesmidae	1	1	2
Coreidae	2	0	2
Neididae	0	1	1
Anthrocoridae	0	1	1
Cercopidae	0	3	3
Unidentified (Hemiptera)	165	68	233
Pseudococcidae	254	181	435
Cicadellidae	4	23	27
Fulgoridae	1	4	5
Unidentified (Homoptera)	107	70	170
TOTAL	618	401	1012

Table 11. The total number of members of the order Hymenoptera by family for the month of June 1970.

Family	Grazed	Ungrazed	Total
Formicidae	1668	1067	2735
Braconidae	27	14	41
Ichneumonidae	2	2	4
Eurytomidae	0	1	1
TOTAL	1697	1083	2780

Table 12. The total number of members of the order Collembola by family for the month of June 1970.

Family	Grazed	Ungrazed	Total
Sminthuridae	734	122	856
Entomobryidae	107	0	107
TOTAL	841	122	963

The family Cleridae are called the checkered beetles and are found associated with flowers. They are predacious in both the larval and adult stages. Members of the genus *Necrobia* are found associated with carrion and feed on the Dipterous larvae. According to Arnett (1968) the subfamily Clerinae feeds on pollen. At Cottonwood a single species men was collected in June from the ungrazed treatment (Table 13).

The family Anthicidae is the ant-like flower beetles; they are found on flowers and foliage. The larva of one species *Notoxus monodon* (Fabricius) is predacious according to Arnett (1968). At Cottonwood two specimens were collected, one from the ungrazed and one from the grazed treatment (Table 13).

The family Silvanidae or Cucujidae, according to Arnett (1968), are called the flat-bark beetles. One specimen was collected during June at Cottonwood from the grazed treatment (Table 13). It was the common pest of stored products, *Oryzaephilus surinamensis*. This species has been recorded as associated with dung in South Dakota by McDaniel and Balsbaugh (1969).

The two families of the order Hymenoptera, Eurytomidae and Ichneumonidae, represent two extremes as to habit; the latter are slender parasitic wasps, and the former are both parasitic and phytophagous. Members of the family Ichneumonidae, because of their extensive parasitism, are among the most important checks to many serious enemies of native grasses. The single species of the family Eurytomidae, found at Cottonwood from the ungrazed treatment, belongs to the genus *Harmolita* which contains the well-known wheat straw worm and the wheat joint worm (Table 11). Members of this genus feed on the stems of grasses and cereals.

Table 13. The total number of members of the order Coleoptera by family for the month of June 1970.

Family	Grazed	Ungrazed	Total
Staphylinidae	0	13	13
Carabidae	24	25	49
Lathridiidae	1	47	48
Coccinelidae	3	2	5
Curculionidae	0	11	11
Mordellidae	2	33	35
Chrysomelidae	6	2	8
Pselaphidae	0	5	5
Cleridae	0	1	1
Anthricidae	1	1	2
Cucujidae (Silvanidae)	1	0	1
Unidentified	12	18	30
TOTAL	50	158	208

The new records of families belonging to the Hemiptera-Homoptera for the month of June show the increase in both the predacious and phytophagous forms.

The family Neididae contains aquatic species. They are found in recently dried steam beds. They fly by night and are attracted to light. A single specimen was collected on the ungrazed treatment at Cottonwood (Table 10).

Members of the families Coreidae, Corimelaenidae, and Miridae (certain species) are herbivorous. The family Miridae, or plant bugs as they are commonly called, is usually limited to a single host in its feeding habit. Within the family there are members that are predacious and this predacious habit is only partially developed in certain species, and thus insect blood serves merely to supplement the sap obtained from particular food plants. At Cottonwood 20 specimens were obtained from the grazed treatment during June (Table 10). The family Coreidae is largely a plant feeder. The best known species of this family is the common squash bug, *Anasa tristis* (DeGeer), which is destructive to curcurbitaceous plants. At Cottonwood a specimen was collected from the grazed treatment (Table 10). Two individuals were obtained belonging to the family Corimelacidae, both from the grazed treatments (Table 10). Members of this family are commonly found on grasses, seeds, berries, and flowers.

The members of the families Piesmidae and Anthrocoridae are predacious on other small insects. Members of the family Anthrocoridae feed on mites, thrips, aphids, and leafhoppers, and on eggs and newly hatched caterpillars of the corn earworm. Only a single individual was collected of this family from the ungrazed treatment. Two specimens of the family Piesonidae were obtained, one each from the grazed and ungrazed treatments (Table 10).

The families Cicadellidae, Cercopidae, and Fulgoridae are all plant feeders belonging to the order Homoptera. The Cicadellidae are the well-known leafhoppers; they feed principally on the leaves of their food plants. A total of 27 specimens was collected, four from the grazed and 23 from the ungrazed treatments at Cottonwood (Table 10). The family Fulgoridae, the plant hopper, has feeding habits that range from trees and shrubs to weeds and grasses. At Cottonwood five individuals were obtained, one from the grazed and four from the ungrazed treatments (Table 10). The family Cercopidae, known as froghopper or spittlebug, feeds on many different species of plants including certain grasses. A total of four individuals was collected from the ungrazed treatment (Table 10).

In the order Orthoptera the new families collected during June were the Tettigoniidae and Mantidae. The latter family is the well-known praying mantid which is predacious. A single individual was collected from the ungrazed treatment (Table 14). Members of the family Tettigoniidae are the long-horned grasshoppers. Most of the species are plant feeders, but a few prey on other insects. At Cottonwood three individuals were collected from the grazed treatment (Table 14).

A new family recorded within the order Lepidoptera during June was the Gelichiidae. This family contains the well-known angoumois grain moth, *Sitotroga cerealella* (Oliver), and the pink bollworm, *Pectinophora gossypiella* (Saunders). The specimens collected at Cottonwood belong to the genus *Gnorimoschema* that form galls in the stems of goldenrods. A total of two individuals was obtained from the ungrazed treatment at Cottonwood (Table 15).

Table 14. The total number of members of the order Orthoptera by family for the month of June 1970.

Family	Grazed	Ungrazed	Total
Acrididae	1	7	8
Gryllidae	0	8	8
Mantidae	0	1	1
Tettigoniidae	3	0	3
TOTAL	4	16	20

Table 15. The total number of minor orders by family for the month of June 1970.

Order - Family	Grazed	Ungrazed
Psocoptera - Liposcelidae	1	10
Trichoptera - Unidentified	3	0
Diptera		
Phoridae	9	9
Unidentified	34	25
Lepidoptera		
Gellechridae	0	2
Unidentified	2	0
Dermaptera - Unidentified	0	1
Plecoptera - Unidentified	0	2
Neuroptera - Unidentified	0	1

The month of July must be evaluated on the basis of one sample date. However, there was not a change of either order or family composition (Tables 16-22). No new families were added, and it is clear on the basis of comparison, that the number of individuals have increased from the June sample dates and are approaching that of May. An assessment of the individual family ratios must await computerized data processing.

The month of August, like July, did not change as far as new orders or family composition are concerned (Tables 23-28). The total number reflects the overall stability when compared with the month of May (Table 23). However, the order Homoptera and the Arachnida make up the bulk of the total. There was an overall reduction in the number of families in the Hemiptera-Homoptera complex, there being only five families recorded (Table 24). Also, in the order Coleoptera only seven families were recorded (Table 25). In the family Formicidae (ants) only 91 individuals were collected in contrast to the family Pseudococcidae (scale insects), in which 13,799 individuals were collected (Tables 24, 26). An assessment of the individual family ratios must await computerized data. Data for the month of November are given in Tables 29-34).

Table 16. The total number of different groups of animals taken in two grassland areas with a D-vac suction apparatus for the month of July 1970*.

Group	Grazed	Ungrazed	Total
Chilopoda	3	0	3
Diplopoda	0	58	58
Arachnida	3103	1345	4448
Collembola	672	115	787
Orthoptera	2	3	5
Psocoptera	16	4	20
Ephemeroptera	0	1	1
Hemiptera	195	68	263
Homoptera	454	185	639
Thysanoptera	244	266	510
Coleoptera	175	237	412
Diptera	14	10	24
Hymenoptera	995	742	1737
Lepidoptera	0	1	1
Trichoptera	3	2	5
Unidentified Larvae	32	116	148
Unidentified Pupa	6	118	124
TOTAL	5914	3271	9185

*Based on only one sample date.

Table 17. The total number of members of the order Coleoptera by family for the month of July 1970*.

Family	Grazed	Ungrazed	Total
Staphylinidae	3	3	6
Carabidae	53	60	113
Scarabaeidae	78	5	83
Lathridiidae	3	102	105
Coccinellidae	4	1	5
Curculionidae	4	3	7
Mordellidae	0	8	8
Elateridae	0	1	1
Tenebrionidae	0	3	3
Pselaphidae	3	3	6
Unidentified	27	51	78
TOTAL	175	240	415

*Based on only one sample date.

Table 18. The total number of members of the order Hymenoptera by family for the month of July 1970.

Family	Grazed	Ungrazed	Total
Formicidae	957	657	1614
Braconidae	0	5	5
Unidentified	38	80	118
TOTAL	995	742	1737

Table 19. The total number of members of the order Hemiptera - Homoptera by family for the month of July 1970.

Family	Grazed	Ungrazed	Total
Lygaeidae	156	19	175
Tingidae	3	7	10
Unidentified (Hemiptera)	28	38	66
Pseudococcidae	360	112	472
Fulgoridae	1	2	3
Cercopidae	4	1	5
Meridae	1	0	1
Cicadellidae	83	72	155
Unidentified (Homoptera)	11	1	12
TOTAL	647	252	899

Table 20. The total number of members of the order Orthoptera by family for the month of July 1970.

Family	Grazed	Ungrazed	Total
Acrididae	4	3	7
Gryllidae	3	0	3
TOTAL	7	3	10

Table 21. The total number of minor orders by family for the month of July 1970.

Order - Family	Grazed	Ungrazed
Psocoptera - Liposcelidae	16	4
Trichoptera - Unidentified	3	2
Diptera		
Phoridae	1	0
Unidentified	14	10
Lepidoptera		
Gilechidae	0	1
Unidentified	5	0
Ephemeroptera - Unidentified	0	1

Table 22. The total number of the order Collembola by family for the month of July 1970.

Family	Grazed	Ungrazed	Total
Sminthuridae	155	96	251
Entomolobryidae	517	19	536
TOTAL	672	115	787

Table 23. The total number of different groups of animals taken in two grassland areas with a D-vac suction apparatus for the month of August 1970.

Group	Grazed	Ungrazed	Total
Collembola	54	38	92
Orthoptera	0	1	1
Psocoptera	11	15	26
Hemiptera	121	116	237
Homoptera	10,446	3,385	13,831
Thysamoptera	129	640	769
Coleoptera	24	363	387
Diptera	6	18	24
Hymenoptera	60	96	156
Trichoptera	0	2	2
Arachnida	2,218	3,016	5,234
Unidentified larvae	114	152	266
Unidentified pupa	0	3	3
TOTAL	13,183	7,845	21,028

Table 24. The total number of members of the orders Hemiptera - Homoptera by family for the month of August 1970.

Family	Grazed	Ungrazed	Total
Lygaeidae	115	96	211
Piesmidae	1	0	1
Pseudococcidae	10,438	3,361	13,799
Cicadellidae	0	15	15
Fulgoridae	0	7	7
Unidentified (Hemiptera)	5	20	25
Unidentified (Homoptera)	8	2	10
TOTAL	10,567	3,501	14,068

Table 25. The total number of members of the order Coleoptera by family for the month of August 1970.

Family	Grazed	Ungrazed	Total
Staphylinidae	0	3	3
Carabidae	17	62	79
Lathridiidae	0	90	90
Coccinelidae	3	0	3
Curculionidae	1	3	4
Pselaphidae	1	2	3
Tenebrionidae	0	1	1
Unidentified	2	202	204
TOTAL	24	363	387

Table 26. The total number of members of the order Hymenoptera by family for the month of August 1970.

Family	Grazed	Ungrazed	Total
Formicidae	29	62	91
Unidentified	31	34	65
TOTAL	60	96	156

Table 27. The total number of members of the order Collembola by family for the month of August 1970.

Family	Grazed	Ungrazed	Total
Sminthuridae	28	17	45
Entomobryidae	26	21	47
TOTAL	54	38	92

Table 28. The total number of minor orders by family for the month of August 1970.

Order - Family	Grazed	Ungrazed
Psocoptera - Liposcelidae	2	15
Trichoptera - Unidentified	0	2
Diptera - Unidentified	6	18
Orthoptera - Acrididae	0	1

Table 29. The total number of different groups of animals taken in two grassland areas with a D-vac suction apparatus for the month of November 1970.

	Grazed	Ungrazed	Total
Chilopoda	0	1	1
Arachnida	1248	1676	2924
Collembola	59	322	381
Orthoptera	1	0	1
Psocoptera	4	14	18
Hemiptera	8	12	20
Homoptera	1611	423	2034
Hymenoptera	1	2	3
Thysanoptera	17	115	132
Coleoptera	4	20	24
Diptera	0	23	23
Larvae unidentified	19	64	83
Unidentified	0	1	1
TOTAL	2972	2673	5645

Table 30. The total number of members of the order Hemiptera - Homoptera by family for the month of November 1970.

Family	Grazed	Ungrazed	Total
Lygaeidae	0	6	6
Cicadellidae	1	0	1
Pseudococcidae	1610	421	2031
Unidentified	8	8	16
TOTAL	1619	435	2054

Table 31. The total number of members of the order Collembola by family for the month of November 1970.

Family	Grazed	Ungrazed	Total
Sminthuridae	3	37	40
Entomobryidae	56	285	341
TOTAL	59	322	381

Table 32. The total number of members of the order Thysanoptera by family for the month of November 1970.

Family	Grazed	Ungrazed	Total
Thripidae	0	40	40
Phloeothripidae	5	8	13
Unidentified	12	67	79
TOTAL	17	115	132

Table 33. The total number of members of the order Coleoptera by family for the month of November 1970.

Family	Grazed	Ungrazed	Total
Staphylinidae	0	1	1
Pselaphidae	0	1	1
Carabidae	0	1	1
Coccinellidae	1	0	1
Lathridiidae	1	0	1
Anthicidae	1	0	1
Unidentified	1	17	18
TOTAL	4	20	24

Table 34. The total number of minor orders by family for the month of November 1970.

Order - Family	Grazed	Ungrazed
Psocoptera - Liposcelidae	4	14
Diptera - Cecidomyiidae		
Larvae	0	23
Orthoptera - Acrididae	1	0
Hymenoptera		
Braconidae	1	0
Unidentified	0	2

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APPENDIX I

FIGURES

FIGURE TITLES

Fig. 1. Numbers of individuals of the family Formicidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 2. Numbers of individuals of the family Pseudococcidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 3. Numbers of individuals of the family Lygaeidae, species *Blissus leucopterus* in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 4. Numbers of individuals of the family Scarabaeidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 5. Numbers of individuals of the family Carabidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 6. Numbers of individuals of the family Nitidulidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 7. Numbers of individuals of the family Lathridiidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 8. Numbers of individuals of the family Sminthuridae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

Fig. 9. Numbers of individuals of the family Entomobryidae in the permanent exclosure, high range condition ☐ and the temporary exclosure, low range condition ▨ by sample dates.

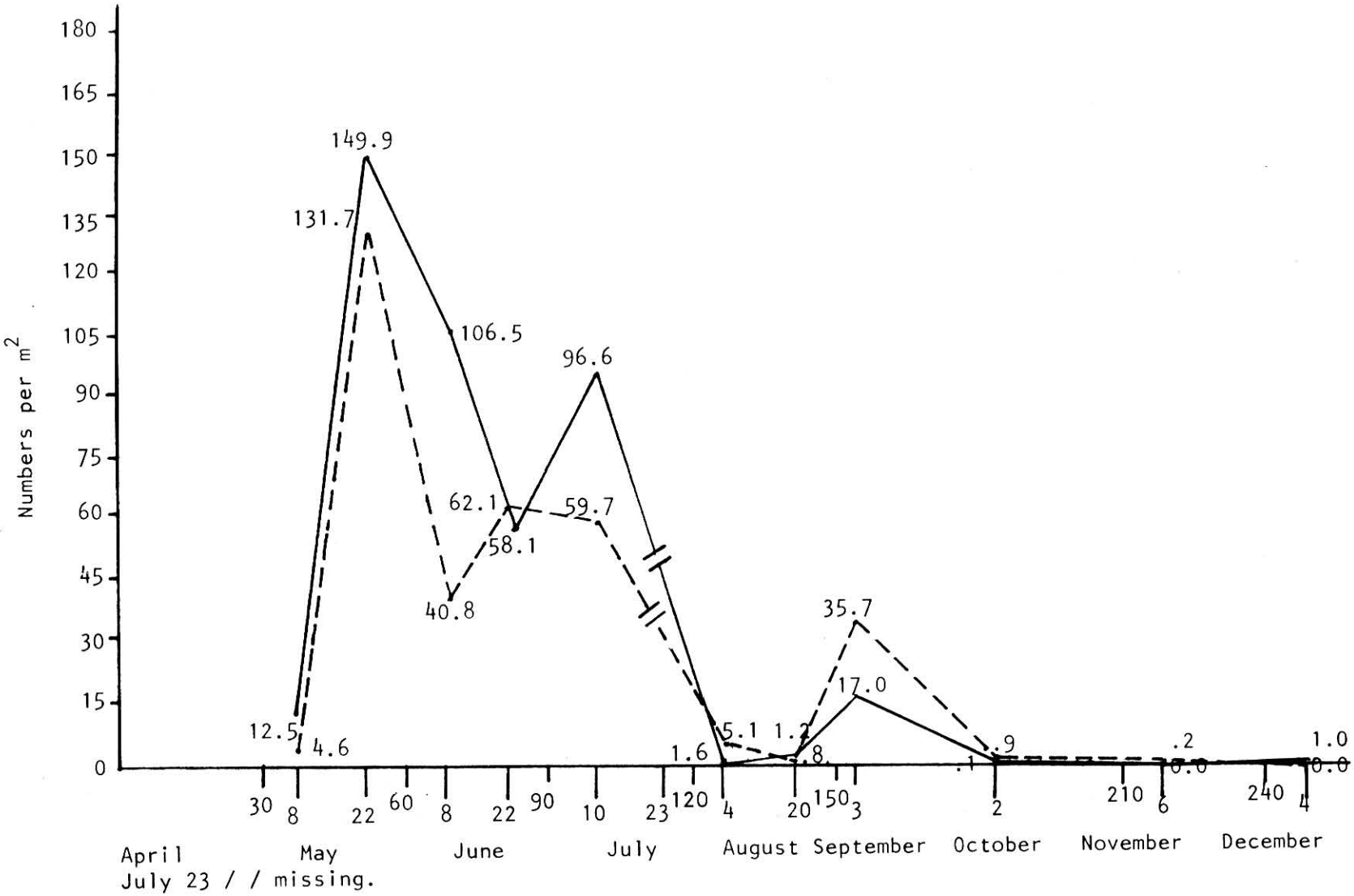

Fig. 1. Numbers of individuals of the family Formicidae in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

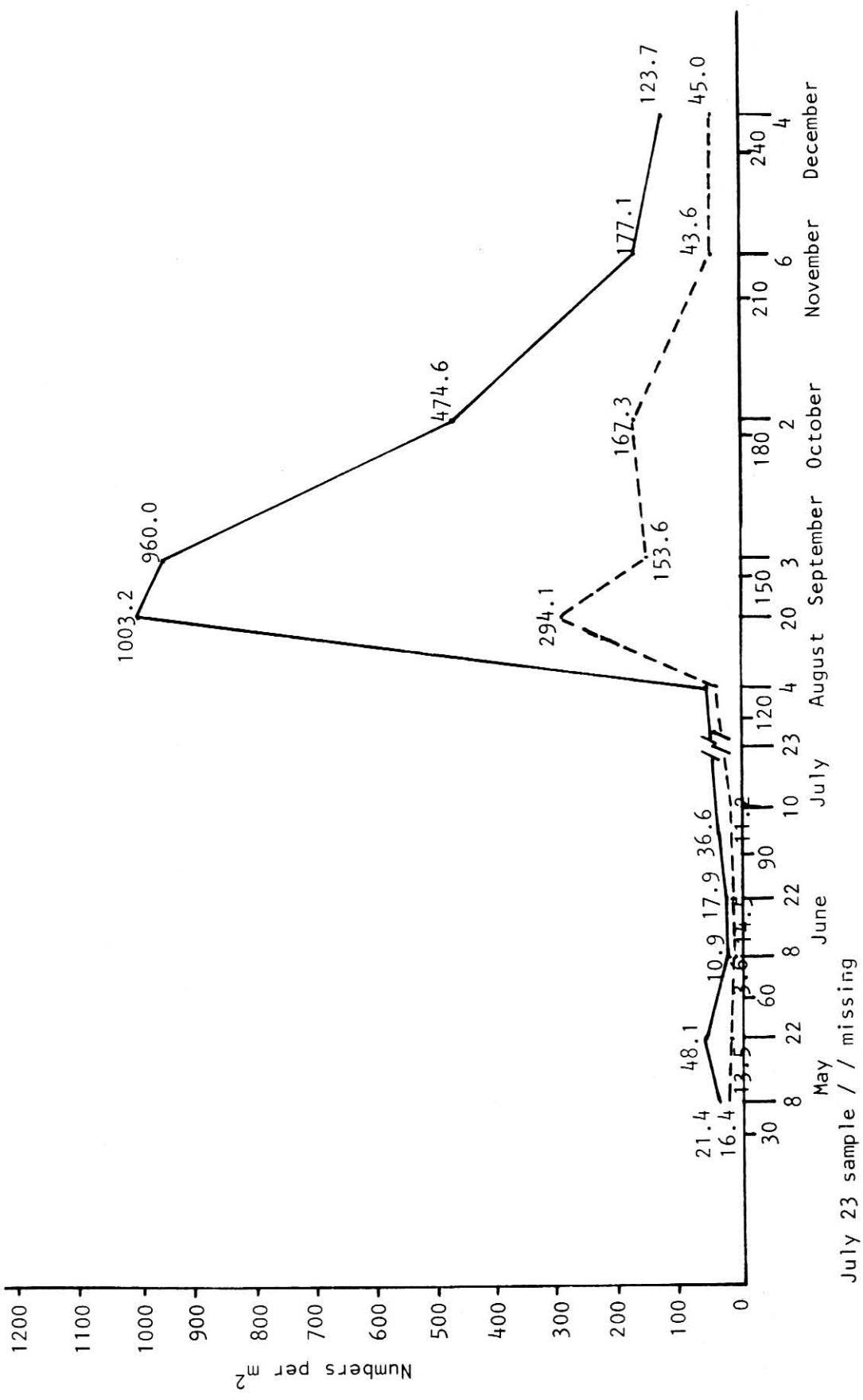

Fig. 2. Numbers of individuals of the family Pseudococcidae in the permanent exclosure, high range condition (_ _ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

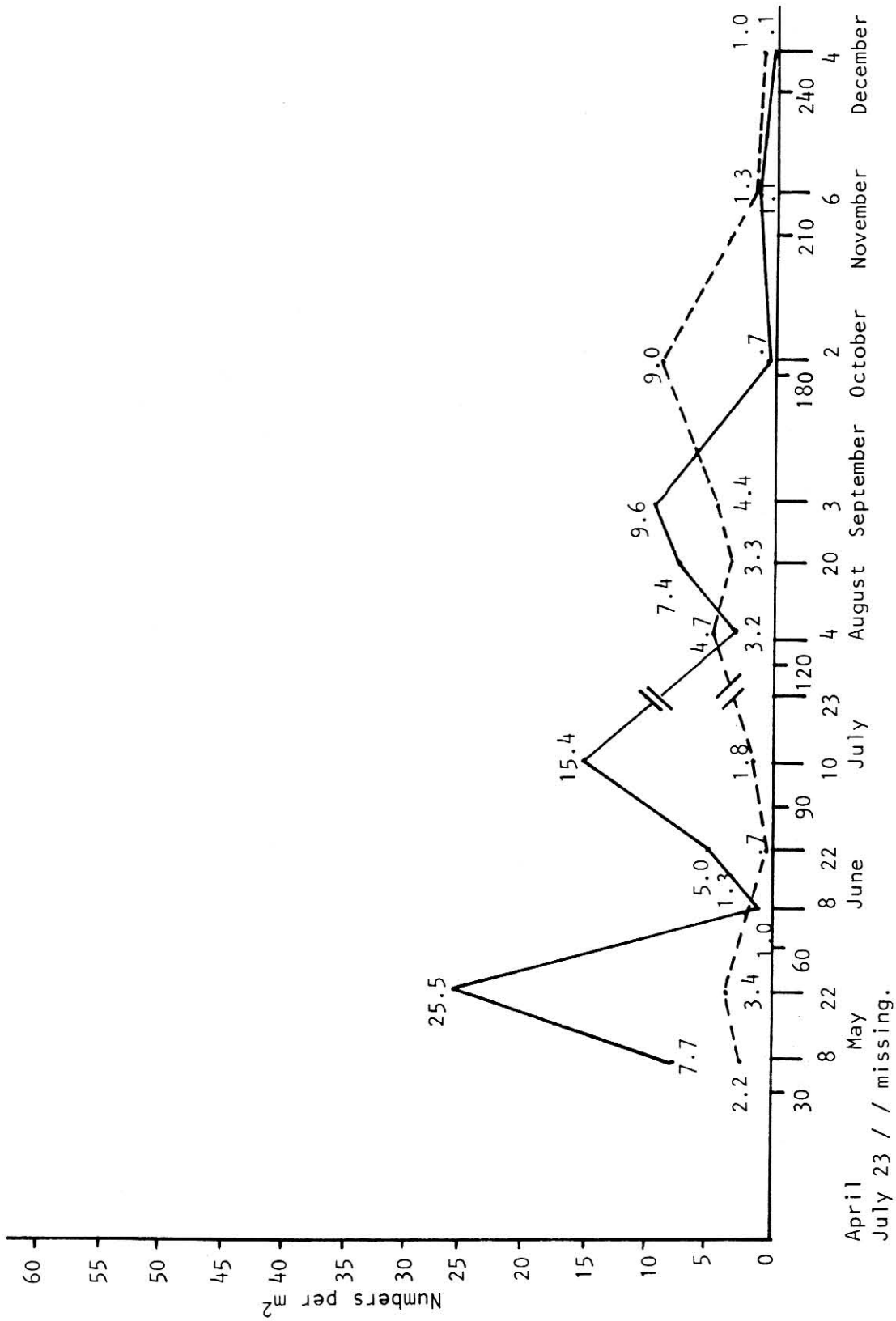

Fig. 3. Numbers of individuals of the family Lygaeidae, species *Blissus leucopterus* in the permanent exclosure, high range condition (_ _ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

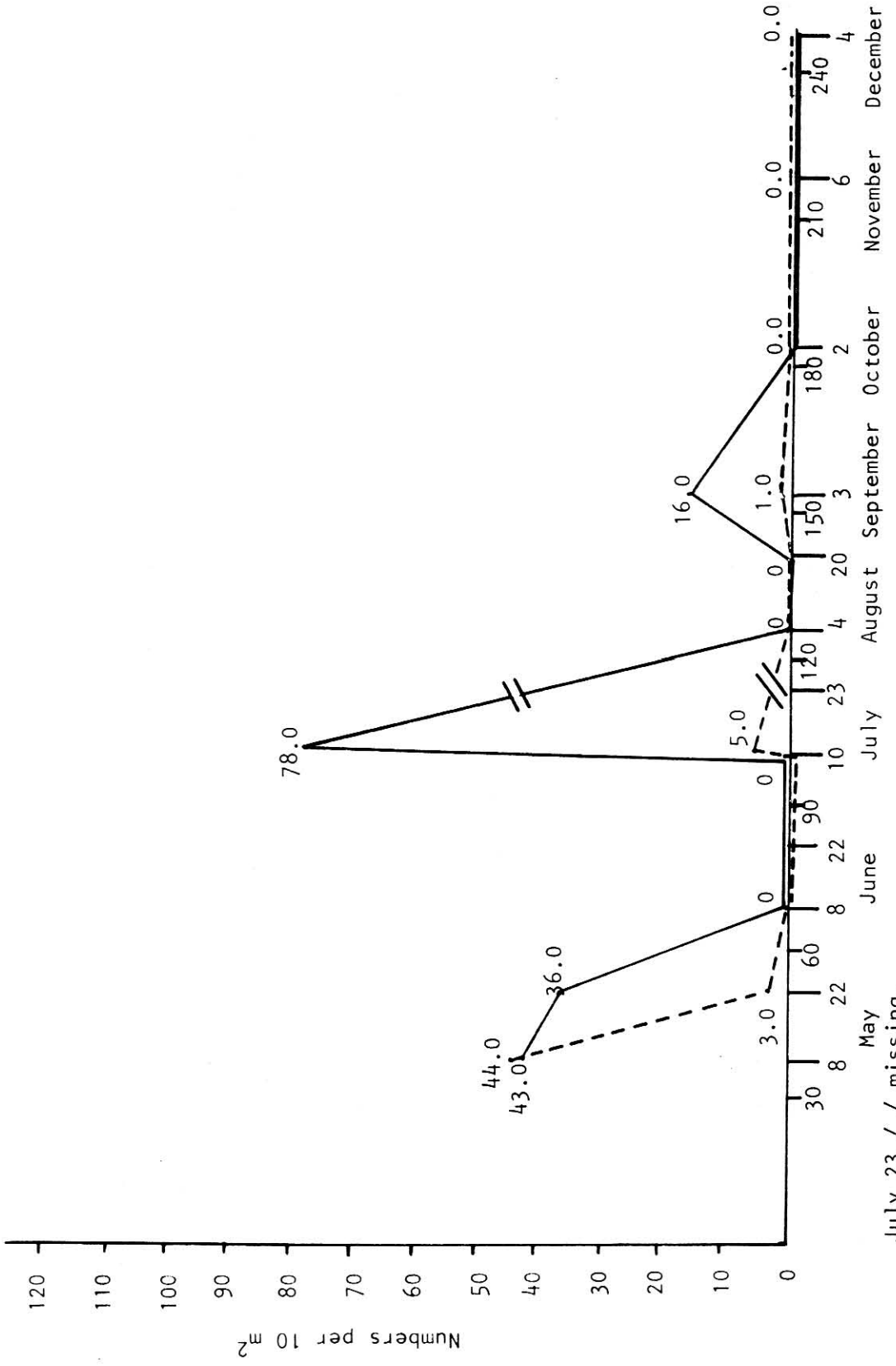

Fig. 4. Numbers of individuals of the family Scarabaeidae in the permanent exclosure, high range condition (_ _ _ _ _) and the temporary exclosure, low range condition (_____) by sample dates.

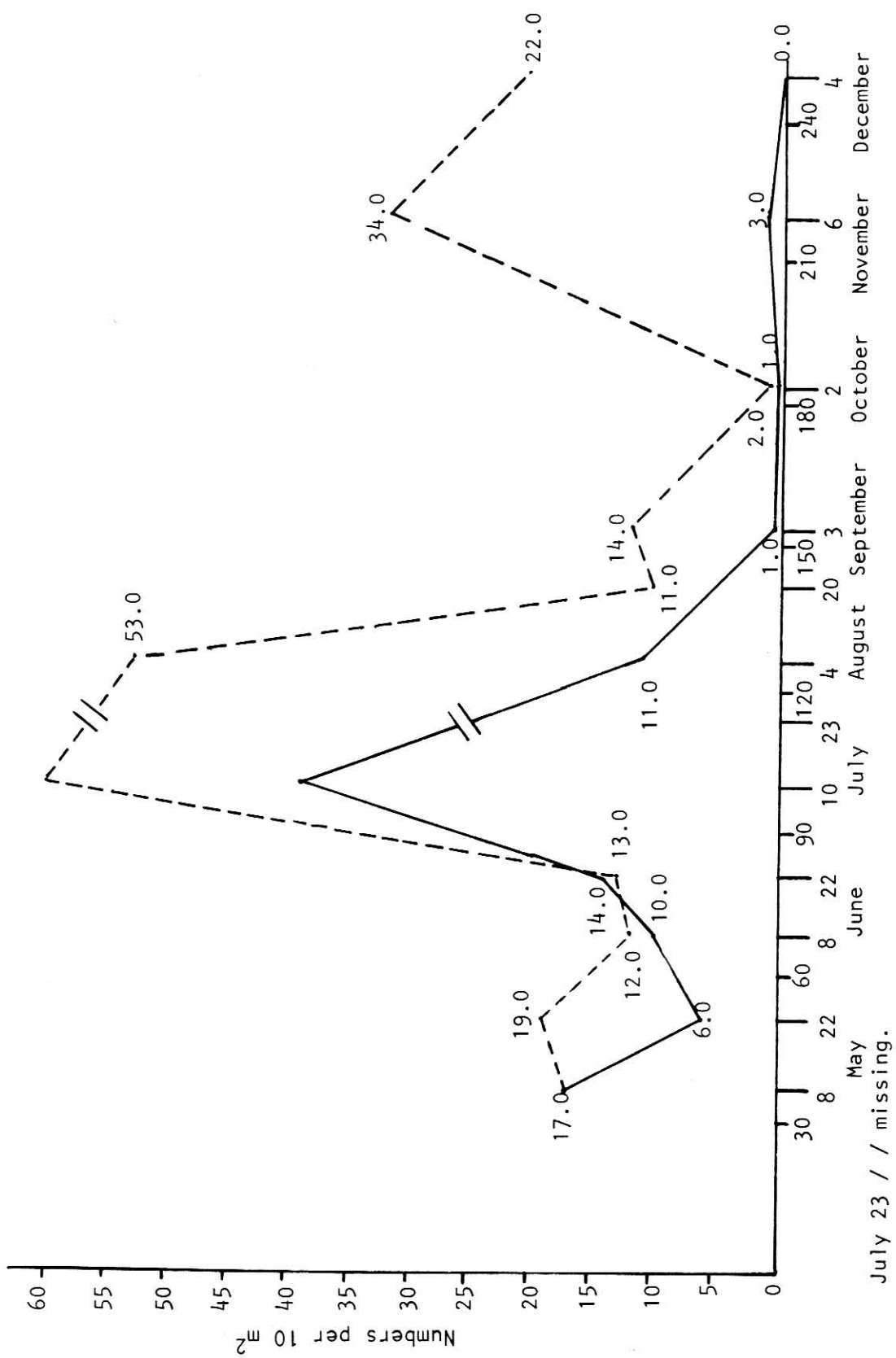

Fig. 5. Numbers of individuals of the family Carabidae in the permanent exclosure, high range condition (– – – – –) and the temporary exclosure, low range condition (————) by sample dates.

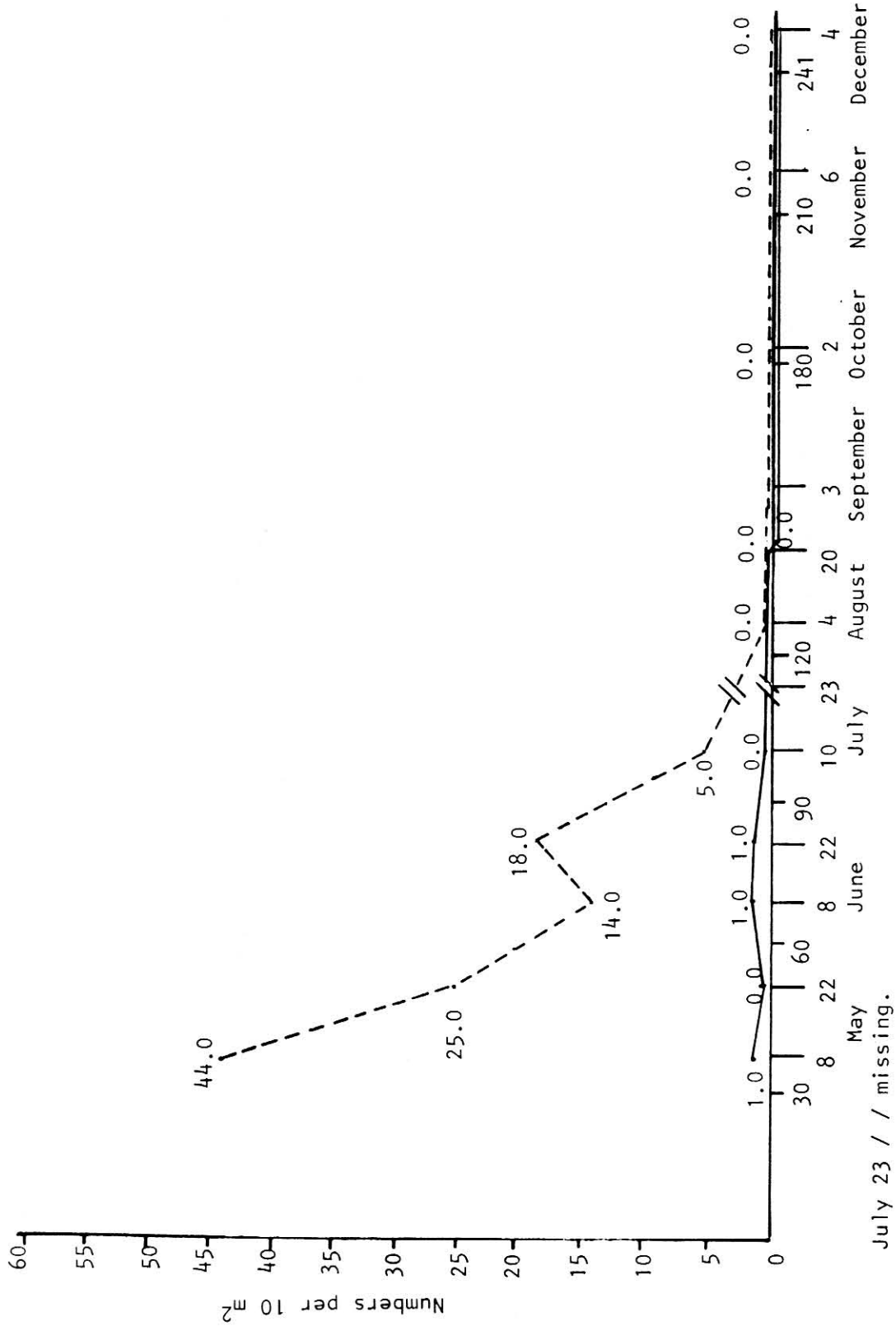

Fig. 6. Numbers of individuals of the family Nitidulidae in the permanent exclosure, high range condition (— — — — —) and the temporary exclosure, low range condition (————) by sample dates.

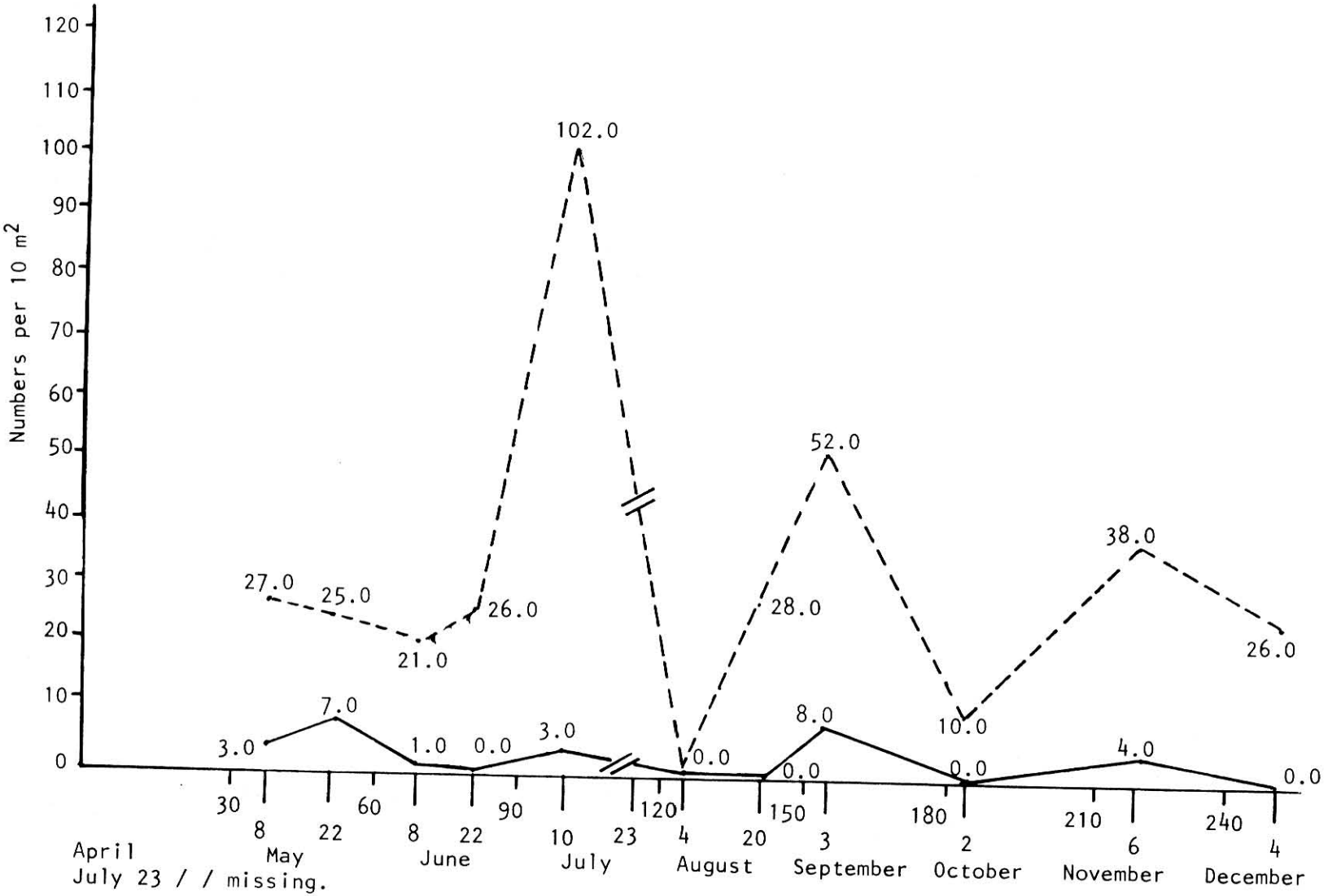

Fig. 7. Numbers of individuals of the family Lathridiidae in the permanent exclosure, high range condition (– – – – – –) and the temporary exclosure, low range condition (————) by sample dates.

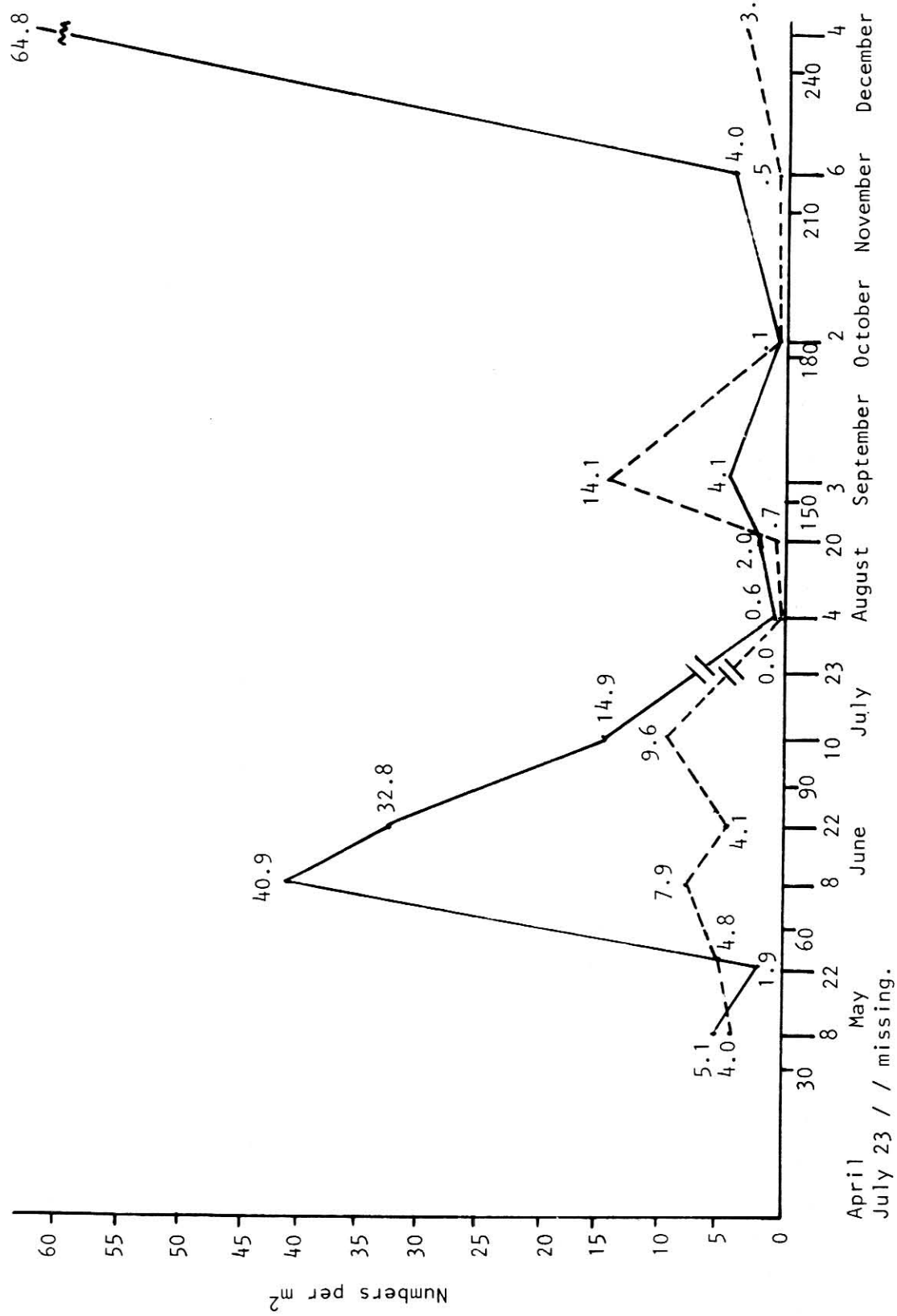

Fig. 8. Numbers of individuals of the family Sminthuridae in the permanent exclosure, high range condition (– – – – – –) and the temporary exclosure, low range condition (————) by sample dates.

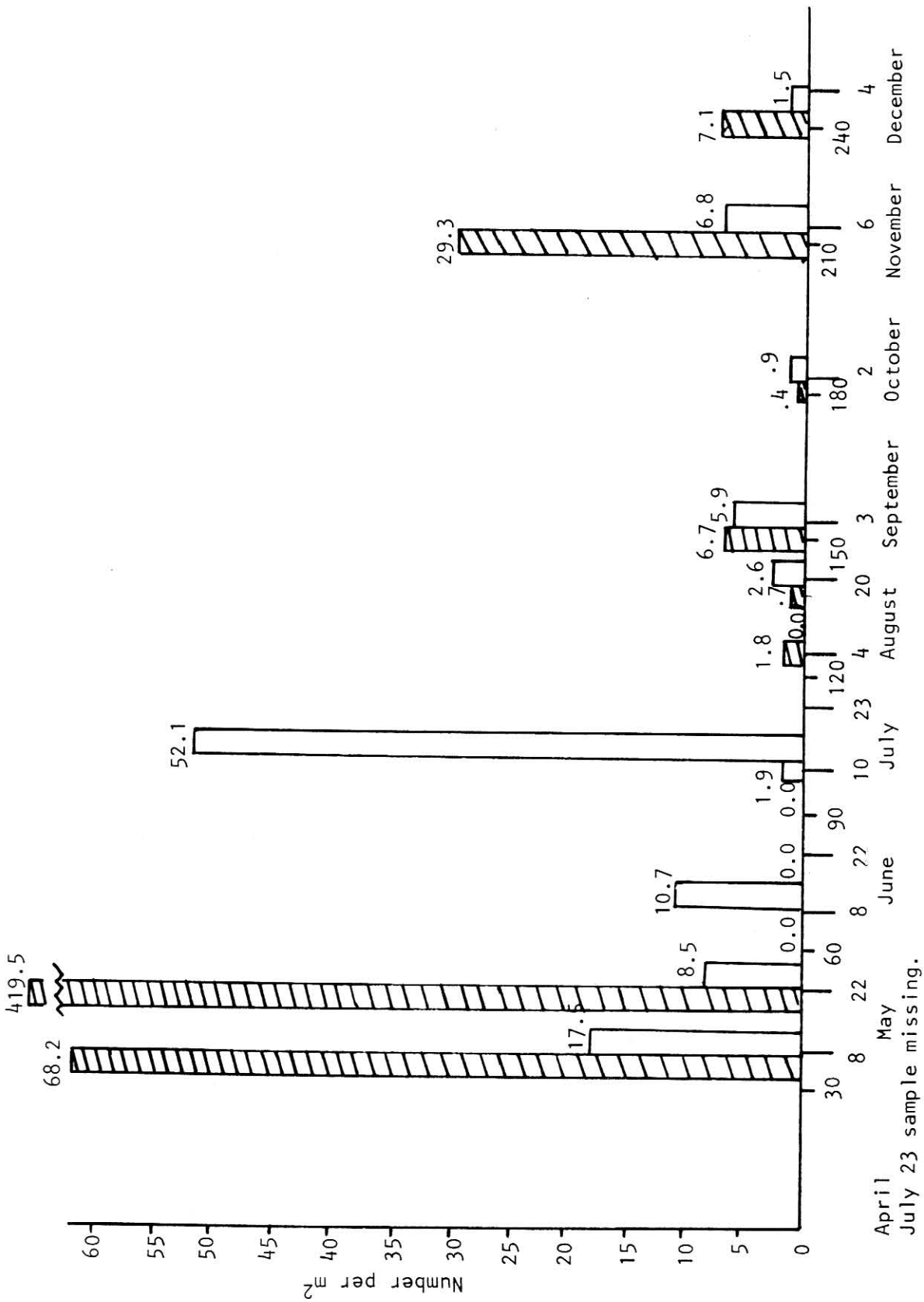

Fig. 9. Numbers of individuals of the family Entomobryidae in the permanent exclosure, high range condition ☐ and the temporary exclosure, low range condition ▨ by sample dates.

APPENDIX II

FIELD DATA

Invertebrate Data

Invertebrate data collected in 1970 on the Cottonwood Site is Grassland Biome data set A2U3004. Data were collected on form NREL-30. A sample data form and a sample of the data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - INVERTEBRATE

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	TROPHIC	HOST	ORDER	FAMILY	GENUS	SPECIES	SUBSPECIES	LIFE STAGE	TOTAL NO.	DRY WT.	NO. WEIGH
			Day	Mo	Yr															
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	20-21	23	25-29	31-33	35-37	39-40	42-43	45	47-48	50-55	57-62	64-6

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
[illegible] Microbiology - Biomass
43 Microbiology - Root Decomposition
44 Microbiology - Respiration

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

TROPHIC
0 Unknown
1 Plant feeding (tissue)
2 Plant feeding (sap)
3 Plant feeding (pollen and nectar)
4 Plant feeding (seed)
5 Predator
6 Parasitoid
7 Parasite
8 Scavenger
9 Non-feeding stage

LIFE STAGE
00 Undetermined
10 Adult
20 Pupae
30 Egg
40 Nymph or Larva
41 Nymph or Larva, early
42 Nymph or Larva, middle
43 Nymph or Larva, late
50 Instar
51 Instar, 1st
52 Instar, 2nd
53 Instar, 3rd

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5         6
1234567890123456789012345678901234567890123456789012345678901234567890

3004BMD080570110.7102 2      HEMIPHYM            42       1
                      02 0   COLESTAR            10       2
                      02 1   THYATHRI            10       6
                      02 5   COLECARA            10       1
                      02 8   COLELATH            10       4
                      02 5   COLEPSEL            10       1
                      02 0   COLESEAR            10       1
                      02 1   COLLENTO            10      12
                      02 0   COLL                10       2
                      02 2   HEMILYGARLISLEUC    41       1
                      02 2   HOMOPSEU            00      11
                      02 5   HYMEFORM            10       1
                      02 2   HOMO                40       1
                      02 2   HEMILYGARLISLEUC    41       1
                      02 0   HYME                40       4
                      02 0   ARAC                00      23
                      02 0   UNDE                20      22
                      01 2   HOMOPSEU            00      24
                      01 5   HYMEFORM            10       7
                      01 2   HEMITING            10       3
                      01 0   COLESCAR            10       1
                      01 8   COLELATH            10       3
                      01 9   TRIC                10       2
                      01 2   HEMILYGARLISLEUC    40       4
                      01 2   HOMO                40       1
                      01 5   COLECARA            10       2
                      01 3   COLEMORD            10       2
                      01 5   COLECHRY            10       2
                      01 0   THYA                10       6
                      01 2   HOMO                40       6
                      01 0   ARAC                00     114
                      01 1   COLLENTO            00      19
                      01 5   COLEPSEL            10       1
                      01 0   DIPT                10       1
                      01 0   UNDE                20      21
                      01 0   UNDE                40       1
                      03 6   HYMEBRAC            40       1
                      03 8   COLELATH            10       2
                      03 1   THYATHRI            10       2
                      03 2   HOMOPSEU            00       2
                      03 5   COLECARA            10       1
                      03 0   ARAC                00      33
                      03 1   COLLENTO            10       2
                      03 2   HEMILYGARLISLEUC    42       1
                      03 3   COLEMORD            10       8
                      03 0   UNDE                20      42
                      03 0   UNDE                40       1
```

04	2	HOMOPSEU	00	28
04	3	COLEMORD	10	10
04	0	THYA	10	5
05	1	THYATHRI	10	1
04	0	ARAC	00	49
04	5	COLEPSEL	10	2
04	2	HOMO	40	1
04	2	HEMILYGARLISLEUC	42	1
04	6	HYMEBRAC	40	3
04	2	HOMO	40	1
04	0	UNDE	40	98
05	5	HYMEBRAC	10	2
05	2	HOMO	40	1
05	0	ARAC	00	136
05	2	HOMOPSEU	00	5
05	2	HEMILYGARLISLEUC	42	1
05	2	HEMITING	10	1
05	1	COLLENTO	10	1
05	0	DIPT	40	1
05	2	HOMO	40	2
05	3	COLEMORD	10	1
05	0	HYME	00	1
05	0	UNDE	20	36
05	0	UNDE	40	2
07	0	THYA	00	7
07	3	COLEMORD	10	1
07	5	HYMEFORM	10	7
07	2	HOMOPSEU	00	9
07	8	COLELATH	10	2
07	1	COLLENTO	10	18
07	5	COLEPSEL	10	1
07	5	COLECARA	10	2
07	5	COLECHRY	10	1
07	2	HEMI	40	1
07	0	ARAD		79
07	2	HOMO	40	3
07	0	COLESTAP	10	1
07	5	NEAR	10	1
07	0	UNDE	20	13
07	0	UNDE	40	2
08	0	DIPT	10	1
08	5	HYMEFORM	10	18
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08	0	THYA	10	3
08	2	HOMOPSEU	00	5
08	3	COLEMORD	10	1
08	0	ARAC	00	157
08	2	HOMO	40	2
08	5	COLECHRY	10	1
08	0	HYME	00	1
08	0	UNDE	20	10
08	0	UNDE	40	1

	09 3	COLEMORD	10	18
	09 0	COLESCAR	10	12
	09 0	THYA	10	13
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	09 1	COLLENTO	00	14
	09 2	HEMITING	10	2
	09 2	HOMOPSEU	00	8
	09 0	ARAC	00	159
	09 2	HOMO	40	2
	09 1	COLECURC	10	1
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	09 2	HOMO	40	1
	09 0	UNDE	20	14
	09 0	UNDE	40	2
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	10 5	HYMEFORM	10	3
	10 5	COLEPSEU	10	2
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	10 2	HEMITING	10	2
	10 3	COLEMORD	10	4
	10 0	COLESTAP	10	2
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	10 0	THYA	10	4
	10 5	COLECOCC	10	1
	10 2	HEMI	40	12
	10 2	HOMO	40	5
	10 6	HYMEBRAC	40	5
	10 0	COLE	00	1
	10 0	ARAC	00	383
	10 2	HOMOPSEU	00	23
	10 0	UNDE	20	50
	10 0	UNDE	40	2
3004BMD090570120.7101	0	ARAC	00	9
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	01 5	HYMEFORM	10	1
	01 6	HYMEBRAC	10	1
	01 0	HYME	00	2
	01 0	UNDE	20	12
	02 0	THYA	00	8
	02 8	COLELATH	10	1
	02 0	COLESTAP	10	1
	02 1	COLLENTO	00	12
	02 5	HYMEFORM	10	2
	02 2	HOMOPSEU	10	10
	02 2	HOMO	40	2
	02 3	COLEMORD	10	1
	02 0	HYME	10	1
	02 0	ARAC	00	30
	02 0	UNDE	20	14
	02 0	UNDE	40	3

03 0	COLESTAP	10	2
03 2	HEMITING	10	1
03 5	HYMEFORM	10	2
03 0	THYA	10	3
03 2	HEMI	40	2
03 2	HOMOPSEU	00	5
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03 0	ARAC	00	91
03 1	COLLENTO	10	3
03 0	UNDE	20	3
03 0	UNDE	40	1
04 2	HEMILYGABLISLEUC	42	2
04 0	COLESTAP	10	1
04 2	HOMOPSEU	00	6
04 5	COLECARA	10	2
04 8	COLELATH	10	2
04 5	COLEPSEL	10	2
04 5	HYMEFORM	10	1
04 0	THYA	10	2
04 0	COLE	10	1
04 1	COLLENTO	10	3
04 0	ARAC	00	72
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04 2	HOMO	40	1
04 2	HEMI	40	1
04 0	UNDE	20	7
05 1	ORTHGRYL	10	1
05 2	HEMITING	10	2
05 0	COLESTAP	10	1
05 5	COLECOCC	10	1
05 2	HEMILYGABLISLEUC	42	3
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05 1	THYATHRI	10	1
05 1	COLLENTO	00	544
05 2	HOMOPSEU	10	3
05 2	HOMO	40	4
05 8	COLELATH	10	2
05 0	DIPT	10	1
05 0	ARAC	00	96
05 0	COLE	10	2
05 6	HYMEBRAC	40	1
05 0	UNDE	20	8
05 0	UNDE	40	1
06 2	HOMOPSEU	00	14
06 0	THAY	00	9
06 0	COLESTAP	10	1
06 8	COLELATH	10	1
06 3	COLEMORD	10	1
06 5	COLEPSEL	10	1
06 5	COLECARA	10	1
06 0	DIPT	10	1
06 2	HEMITING	10	2
06 2	HOMO	40	3
06 2	HEMILYGABLISLEUC	42	1
06 2	HEMI	40	1

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	06	0	ARAC	00	197
	06	0	UNDE	20	29
	06	0	UNDE	40	4
	07	0	HYME	10	2
	07	5	COLECARA	10	2
	07	8	COLELATH	10	2
	07	2	HOMO	40	2
	07	2	HOMOPSEU	10	1
	07	0	THYA	10	2
	07	0	ARAC	00	48
	07	0	UNDE	20	24
	07	0	UNDE	40	3
	08	8	COLELATH	10	2
	08	2	HOMOPSEU	10	4
	08	1	THYATHRI	10	1
	08	2	HEMILYGABLISLEUC	42	3
	08	5	COLECARA	10	1
	08	0	ARAC	00	50
	08	0	UNDE	20	11
	08	0	UNDE	40	1
	09	1	ORTHACRI	10	1
	09	5	COLECARA	10	3
	09	8	COLELATH	10	3
	09	2	HOMOPSEU	43	3
	09	2	HEMILYGABLISLEUC	42	1
	09	0	THYA	10	2
	09	0	COLE	10	1
	09	1	COLLENTO	00	5
	09	0	ARAC	00	92
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	09	0	HYME	43	1
	09	0	UNDE	20	13
3004RMD080570510.7	10	1 5	HYMEFORM	10	2
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	01	0	COLE	10	1
	01	2	HEMI	40	1
	01	0	UNDE	20	3
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	02	0	ARAC	00	123
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	02	0	COLESCAR	10	1
	02	2	HOMO	40	1
	02	1	HEMILYGABLISLEUC	42	2
	02	5	COLECOCC	10	1
	02	0	UNDE	40	3

03	2	HOMOPSEU	00	7
03	2	HEMILYGABLISLEUC	42	7
03	0	COLESCAR	10	1
03	0	ARAC	00	47
03	5	HYMEFORM	10	2
03	1	THYA	10	1
03	1	HOMO	42	1
03	0	UNDE	40	1
03	0	UNDE	20	5
04	5	HYMEFORM	10	17
04	2	HOMOPSEU	00	6
04	0	ARAC	00	15
04	5	COLECOCC	10	1
04	2	HEMI	42	1
05	2	HOMOPSEU	00	7
05	2	HEMILYGABLISLEUC	40	11
05	5	HYMEFORM	10	5
05	0	COLESCAR	10	2
05	0	COLLENTO	00	9
05	5	COLECOCC	10	1
05	0	ARAC	00	293
05	2	THYA	10	2
05	0	COLE	10	2
05	0	DIPT	10	1
05	0	UNDE	20	3
06	2	COLLENTO	00	40
06	5	HYMEFORM	10	8
06	2	HOMOPSEU	00	7
06	0	COLESCAR	10	2
06	2	HEMILYGABLISLEUC	42	1
06	1	THYA	10	2
06	0	ARAC	00	274
06	0	UNDE	40	1
07	2	HOMOPSEU	00	20
07	5	HYMEFORM	10	6
07	1	COLLENTO	10	3
07	2	HEMILYGABLISLEUC	42	5
07	0	COLESCAR	10	1
07	0	ARAC	00	224
07	2	HOMO	41	1
07	9	TRIC	10	1
07	0	DIPT	10	1
07	0	UNDE	20	4
07	0	UNDE	40	2
08	5	HYMEFORM	10	12
08	2	HEMILYGABLISLEUC	42	1
08	1	THYATHRI	10	4
08	1	COLLENTO	10	2
08	2	HOMOPSEU	10	1
08	0	ARAC	00	176
08	8	COLELATH	10	1
08	0	DIPT	40	1
08	0	UNDE	20	1

	09	2	HEMILYGABLISLEUC	42	5
	09	5	HYMEFORM	10	6
	09	2	HOMOPSEU	00	10
	09	0	COLESCAR	10	1
	09	0	ARAC	00	114
	09	1	COLLENTO	10	3
	09	1	THYATHRI	10	2
	09	0	UNDE	20	1
	10	5	CHIL	10	1
	10	0	COLESCAR	10	7
	10	5	COLECARA	10	7
	10	5	HYMEFORM	10	7
	10	1	COLECURC	10	1
	10	1	THYATHRI	10	1
	10	0	COLLENTO	00	129
	10	2	HOMOPSEU	00	6
	10	2	HEMILYGABLISLEUC	42	2
	10	0	COLESTAP	10	1
	10	2	HOMO	40	1
	10	0	ARAC	00	68
	10	0	UNDE	20	13
3004RMD090570520.7101		2	HEMILYGABLISLEUC	42	3
	01	5	HYMEFORM	00	7
	01	5	COLECARA	10	2
	01	2	HOMO	40	1
	01	2	HOMOPSEU	00	3
	01	0	COLESCAR	10	1
	01	1	COLLENTO	00	11
	01	0	ARAC	00	78
	01	0	THYA	00	2
	01	0	HYMF	00	1
	01	0	DIPT	00	1
	01	0	UNDE	20	2
	01	0	UNDE	40	1
	02	0	COLESCAR	10	1
	02	0	ARAC	00	10
	02	2	HOMOPSEU	10	1
	02	5	HYMEFORM	10	1
	02	0	THYA	10	1
	02	2	HOMO	40	1
	02		HYMF	40	1
	03	0	ARAC	00	121
	03	2	HOMOPSEU	00	18
	03	2	HEMILYGABLISLEUC	42	11
	03	5	HYMEFORM	00	14
	03	5	COLECOCC	10	1
	03	0	THYA	10	3
	03	2	HEMI	40	1
	03	1	COLLENTO	10	1
	03	0	UNDE	20	5
	03	0	UNDE	40	3

04	0	COLESCAR	10	11
04	2	HEMILYGABLISLEUC	42	9
04	5	HYMEFORM	10	14
04	0	THYA	10	10
04	2	HOMOPSEU	00	10
04	1	COLLENTO	10	2
04	0	ARAC	00	210
04	0	UNDE	40	1
05	1	ORTHACRI	10	1
05	8	COLFLATH	10	2
05	2	HEMILYGABLISLEUC	42	8
05	1	COLLENTO	00	28
05	5	HYMEFORM	00	3
05	2	HOMOPSEU	00	47
05	0	THYA	00	8
05	5	COLECARA	10	2
05	5	COLEPSEL	10	1
05	0	ARAC	00	173
05	0	UNDE	20	4
05	0	UNDE	40	3
06	0	COLESCAR	10	5
06	5	HYMEFORM	10	9
06	2	HEMILYGABLISLEUC	42	2
06	0	THYA	10	4
06	5	COLECARA	10	2
06	2	HOMOPSEU	10	3
06	2	HOMO	41	1
06	0	ARAC	00	34
06	0	UNDE	40	1
07	0	COLESCAR	10	1
07	5	HYMEFORM	10	1
07	2	HOMOPSEU	10	2
07	0	ARAC	00	15
07	0	UNDE	40	1
08	5	HYMEFORM	10	2
08	0	HYME	40	1
08	5	CHIL	10	1
08	5	COLECARA	10	4
08	2	HEMILYGABLISLEUC	42	3
08	0	COLESCAR	10	1
08	3	COLEMORD	10	1
08	2	HOMOPSEU	00	9
08	1	THYATHRI	10	1
08	1	COLLENTO	00	8
08	0	ARAC	00	160
08	0	UNDE	20	13
08	0	UNDE	40	2
09	0	THYA	10	4
09	2	HOMOPSEU	00	5
09	0	ARAC	00	75
09	0	UNDE	40	3

10	0	ARAC	00	105
10	0	COLESCAR	10	8
10	5	COLECOCC	10	1
10	2	HEMILYGABLISLEUC	42	6
10	2	HOMOPSEU	00	22
10	5	HYMEFORM	10	3
10	0	THYA	10	7
10	0	HYMF	10	2
10	2	HEMI	42	1
10	0	UNDE	40	4