SMALL MAMMAL CENSUS

Introduction--The major purpose for this census of small mammals (mice, voles, shrews and squirrels) was to obtain population, specie diversity and biomass estimates for different forest habitats commonly found on the Minesite area. Small mammals are generally censused by using either snap traps or live traps. After considering the time requirements necessary for the two trapping metholds, the distances involved in travelling to the various sites, and the available manpower and resources, the decision was made to census with snap traps. Snap traps were used in a grid arrangement. This arrangement provided data which can yield population estimates by using regression analysis techniques.

Another purpose for the census is to provide a way of ranking plant communities by comparing the richness of small mammal species and total numbers of individuals among the different forest types. In addition, some small mammals will be analyzed for levels of heavy metal body burdens.

Methods

Trapping was conducted during three principal periods (Period A, June 22-28; Period B, July 27-August 2; and Period C, August 31 - September 6) and one intermediate period (August 5-11, 1976). Twelve sites, representing six different forest types, were trapped during each peirod. The trapping was equally distributed between deciduous (two trembling aspen, two paper birch and two mixed trembling aspen-paper birch) and coniferous types (two red pine, two jack pine and two black spruce). In most cases, based on the availability of suitable habitat, one grid was located

north and the other south of the Laurentian Divide.

During the one intermediate trapping period, four different forest types were trapped (one tamarack, one 1-2 m tall tamarack, one mixed tamarack-black spruce, and one white cedar). A total of 40 different grids were trapped during the 1976 field season at 13 different sites.

Materials and Methods

Grids--When sites were large enought, a square gird of 8 x 8 stations (64 traps) was established. On smaller sites, as many traps as possible were fit into the site allowing at least a 15 m buffer zone between outermost trap lines and other cover types or roads. Most trapping grids included 50 or more traps.

The interval between each station in the rows and columns was 15 m. Each station was located using a compass line for direction and split-image range finder for distance. A gauge, 50 cm long steel stake was used to mark each station. The stake also held traps securely in place and was looped at one end to hole a numbered plastic marking flag. The numbered plastic flag indicated the row and column position of each trapping station.

Trapping--Each grid station contained a single Museum Special snap trap. Traps were baited with peanut butter and rolled oats. Prebaiting (traps unset) was conducted for two days. Traps were then set and checked once a day for five consecutive days thereafter.

Each mammal was placed in a plastic whirl-top bag at the trap station, with a piece of high rag paper containing the trap number, date, species name (if known), site number, and researcher's initials. Specimens were kept on ice the remainder of the day and frozen upon return to the laboratory. Over 1000 small mammals were trapped during the 1976 summer.

Laboratory Studies--A number of factors are being looked at in the laboratory. These include: 1) aging all specimens; 2) sexing and determing reproductive condition; 3) positive taxonomic identification; 4) fresh frozen ~~weither~~ WEIGHT of ~~all~~ EACH speciments; 5) ~~saving~~ hair samples ARE BEING SAVED to store in the biological archives; 6) ~~puting up~~ museum ~~skings~~ SKINS WERE MADE of uncommon speices; 7) ~~saving~~ stomach contents ARE PRESERVED in alcohol from all species. This work is currently being conducted by Dr. Elmer Birney, Bettsy Batten, and Dr. Birney's laboratory technician. Dr. Birney is the Curator of Mammals at the Bell Museum of Natural History, University of Minnesota, Minneapolis Campus and is under contract to conduct these ~~measurements~~ DETERMINATIONS. The total contract is $1000.00 and could include as many as 2000 speciments for both 1976 and 1977. This work could not be done as accurately, or in the same time frame, by members of the terrestrial staff, thus ~~a contract was let.~~

Stomach contents are being saved with the hope that we can find an interested person to identify these materials for a food studies paper, ESPECIALLY FOR SHREWS. The hair samples being collected will be saved in the biological archives for possible future analysis for heavy metals. Elemental content of hair has been shown to vary considerably during different season of the year ~~for moose~~ (Franzmann et.a., 1976). Other studies have recognized that hair analysis from various animals is a way of determining dietary deficiency or surpluses ~~of for~~ trace metals (Anke, 1965; Bradfield, 1968; Hammer et.al. 1971; Sims, 1968).

Results and Discussion

Trapping Period A, C and Intermediate Period--Data from these three periods are not yet available. ~~Small mammals~~ Specimens must still be examined in the laboratory by Dr. Elmer Birney and his staff. These results should

be available by mid-winter (1976-77).

Trapping Period B--most of the data from trapping period B is presently available. A few individuals of Sorex sps. must still be positively identified. A number of individuals of other species must be reexamined and there may be minor changes in specie numbers in future reports from those presented here. Gunderson and Beer (1953) state that Soxex cinereos, the most common species during trapping period B, cannot be separated from the pigmy shrews (Microsorex) on the basis of external characteristics. However, they can be distinguished by dental characters. We have tentatively identified, as they suggest, all of the small, long-tailed shrews of nearly uniform brownish color as Soxex cinerious until laboratory test are completed.

The numbers and percentages of each species trapped in period B are given in Table SM-1, both. The scientific and common names for each species are given in Table SM-2. For trapping period B, a total of 492 small mammals were collected. Sorex cinereus (Cinereous shrew) and Clethrionomys gapperi (Red-backed vole) accounted for 60.8 percent of the total animals collected. These two species, along with Peronyscus maniculatus (white-footed mouse) and Blarina brevicauda (short-tailed shrew), accounted for 85.4 percent of the total. Figure SM-1 graphically shows that these four species are much more abundant than the others on our forested plots on the Minesite area.

As shown in Table SM-1, a total of 12 known species (excluding 1 juvenile snowshoe hare) were collected. Site 27B (paper birch) contained the highest number of species (9), while site 2B (jack pine) contained the lowest number (3). An average of just under six species (5.75) were trapped per site. The largest number of individuals collected on a single grid was at site 29B (trembling aspen), with 72. The lowest number was at site 3B (red pine), with 17. The average number of individuals collected/site was 41.

Since the number of traps varied for each site, the grid areas were not constatn. Because of this, it is not accurate to compare actual numbers for the sites. It is better to express the numbers as densities (individuals/ hectare) thus compensating for differences in grid areas.

Grid areas included the area inside the grid arrangement plus the area of a 7.5 m wide fringe around the grid. Traps in the grid were arranged 15 m apart, each trap was assumed to have an effective trapping area of a square, 15 m on a side. ~~Since the trap was in the center of this trapping square, the edge of the square is 7.5 m from the trap.~~ Thus, to have equal trapping areas for each trap, a 7.5 m wide fringe area was added to the traps on the edge of the grid arrangement.

The number of traps in each site ranged from 46 to 64 traps, with an average of 58 traps per site. From these variables gird arrangements, the area of the grids ranged from 1.04 to 1.44 hectares, with an average of 1.30 hectares per site.

With the numbers shown in Table SM-1 and the grid areas calculated for each site, densities of herbivores and insectivores for each site were calculated and shown in Figure SM-3. Insectivores were defined as the shrew species (Sorex and Blaria), and herbivores included the rest of the speices. Only in sites 13B (pole trembling aspen), 28B (black spruce), and 6B (mature black spruce) did the densities of insectivores exceed the densities of herbivores. No insectivores were collected in site 3B (mature red pine). ~~When comparing different forest types, the paper birch sites had the highest densitities of herbivores and the trembling aspen sites had the highest densities of insectivores. The trembling aspen sites had the highest densities of insectivores. The trembling aspen sites also had the highest densities of small mammals.~~

Biomass per area for herbivores and insectivores is shown in Figure SM-6. Biomass was calculated by adding the weights for each individual TRAPPED. Only on site 13B (pole trembling aspen) did the biomass per area of insectivores exceed the biomass per area of herbivores. It is important to remember the pronounced weight differences of individuals of different species. For example, Sorex cinereus averages less than 5 g. each, the smaller herbivores average about 20 gs, with chipmunks and flying squirrels averaging more than 75 grams. Even though Sorex cineus was the most common species collected (155 individuals caught), its relatively low weight reduced its influence on biomass estimates. In turn, the relatively high weights of chipmunks and flying squirrels (37 individuals only total collected) strongly influenced biomass estimates.

As stated previously, one major reason for the census of small mammals was to obtain population estimates for different forest habitats. The analysis method used on the data was the least squares regression as described in Zippin (1956) and Grodrzinski et.al. (1966). An example of linear regression analysis is shown in Figure SM-8. Y values are the number of small mammals trapped per day and x values are the cumulative number of small mammals previously caught. Grodzinski et.al. (1966) states that the resulting graph yields the number of rodents caught after removal of a definite number of animals from the population. By calculating the equation of linear regression, $y = -ax + b$, it is possible to calculate the intersection point of the straight line $y = -ax + b$ with the axis

of abscissal. This intersection point equals the estimated population size for the study area. As shown in Figure SM-5, the estimated population size for site 10B was 48. With a grid area of 1.44 ha, the estimated population density for site 10B was 33 individuals per hectare.

The estimated densities for the 12 sites are shown in Figure SM-6. Figure SM-7 (densities of actual individuals caught) is presented to show how estimated densities from linear regression compare to the actual numbers of individuals collected. As shown in Figure SM-8 the trembling aspen sites (29B and 13B) had estimated populations much higher than other forest types. Also, the mixed aspen-birch sites (9B & 10B) had much lower estimated populations than either the birch or the aspen sites, along. The average population densities (using regression) for all the deciduous types was 81 individuals per hectare, while the average for all coniferous types was only 35 individuals per hectare (Figure SM-7). The average number of individuals collected during the five day period was 39 per hectare for the deciduous types and 26 per hectare (Figure SM-6) for the coniferous types. From these data, it appears that the deciduous forest types on the study area contain considerably higher densities of small mammals than the coniferous types studied.

Grodzinski et.al. (1966) states that the reliability of the estimates by regression depends on the correctness of the following premises: 1) all the individuals in the population have a uniform change of being caught, 2) there is either no, or very little, immigration and emigration of individuals during the capture period, 3) variations in numbers due to mortality or reporduction are slight during the caputre period, and 4) capture conditions are similar throughout the whole of the capture period. One method to determine reliability of the estimates is by calculating confidence limits for the population estimates at each site. At this time there are questions concerning the proper method needed to assess these confidence limits. More work is

needed before these limits can be calculated and reported.

Conclusion

Since the results of this report are based on limited data from just one trapping period, the trends observed must be assumed to be preliminary. Much additional information concerning small mammals in the Minesite area will be reported as soon as the data are available and analyzed.

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Table SM-1.

Numbers and percentages of small mammal species caught by site and cover types.
(Trapping period B July 29 - August 2, 1976

	Cover Type and Site Number																		Totals	
	(27B) Paper Birch		(8B) Paper Birch		(9B) Mid-aged Aspen-Birch		(10B) Mid-aged Aspen-Birch		(29B) Trembling Aspen		(13B) Pole Aspen		(28B) Black Spruce		(6B) Black Spruce		(26B) Red Pine		(3B) Red Pine		(2B) Jack Pine		(1B) Jack Pine			
Species	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sorex cinereus	3	8.1	14	23.7	3	9.7	11	26.8	11	15.3	38	70.4	33	53.2	18	81.8	3	10.2			15	32.6	6	27.3	155	31.5
Clethrionomys gapperi	11	29.7	28	47.5	4	12.9	18	43.9	12	16.7	3	5.6	17	27.4	1	4.5	7	24.1	6	35.3	30	65.2	7	31.8	144	29.3
Peromyscus maniculatus	6	16.2	10	16.9	12	38.7	6	14.6	28	38.9					1	4.5	16	55.2	3	17.6			1	4.5	83	16.9
Blarina brevicauda	2	5.4	5	8.5	5	16.1	4	9.8	15	20.8	3	5.6	2	3.2			1	3.4					1	4.5	38	7.7
Eutamias minimus	3	8.1							3	4.2			1	1.6					4	23.5			5	22.7	16	3.3
Tamias striatus	4	10.8			4	12.9	1	2.4	2	2.8									1	5.9					12	2.4
Microtus pennsylvanicus											3	5.6	5	8.1	2	9.1									10	2.0
Glaucomys sabrinus	2	5.4					1	2.4					2	3.2			1	3.4	2	11.8			1	4.5	9	1.8
Zapus hudsonicus			2	3.4							2	3.7					1	3.4	1	5.9	1	2.2			7	1.4
Napeozapus insignis	4	10.8			3	9.7																			7	1.4
Unknown	1	2.7							1	1.4			2	3.2									1	4.5	5	1.0
Sorex arcticus (?)											4	7.5													4	0.8
Sorex sps. (?)											1	1.9													1	0.2
Lepus americanus	1	2.7																							1	0.2
Totals	37	99.9	59	100.0	31	100.0	40	99.9	72	100.1	54	100.2	62	99.9	22	99.9	29	99.8	17	100.0	46	100.0	22	99.8	492	99.9

Table SM-2.

Scientific and common names* of small mammal species trapped in period B (July 29 - August 2, 1976).

Scientific Name	Common Name
Sorex cinereous	Cinereous shrew
Clethrionomys gapperi	Red-backed vole
Peromyscus maniculatus	Deer or white-footed mouse
Blarina brevicanda	Short-tailed shrew, mole shrew
Entamias minimus	Least chipmunk
Tamias striatus	Eastern chipmunk
Microtus pennsylvanicus	Common meadow mouse, Pennsylvania meadow mouse
Glaucomys sabrinus	Northern flying squirrel
Zapus hudsonicus	Meadow jumping mouse
Napeozapus insignis	Woodland jumping mouse
Sorex arcticus	Saddle-backed shrew, Richardson shrew
Lepus americanus	Varying hare, Snowshoe rabbit

* Gunderson, H.L. and J.R. Beer (1953).

Figure SM-1 Sites on which small mammals were trapped during 1976 (trapping period A,B,C and intermediate)

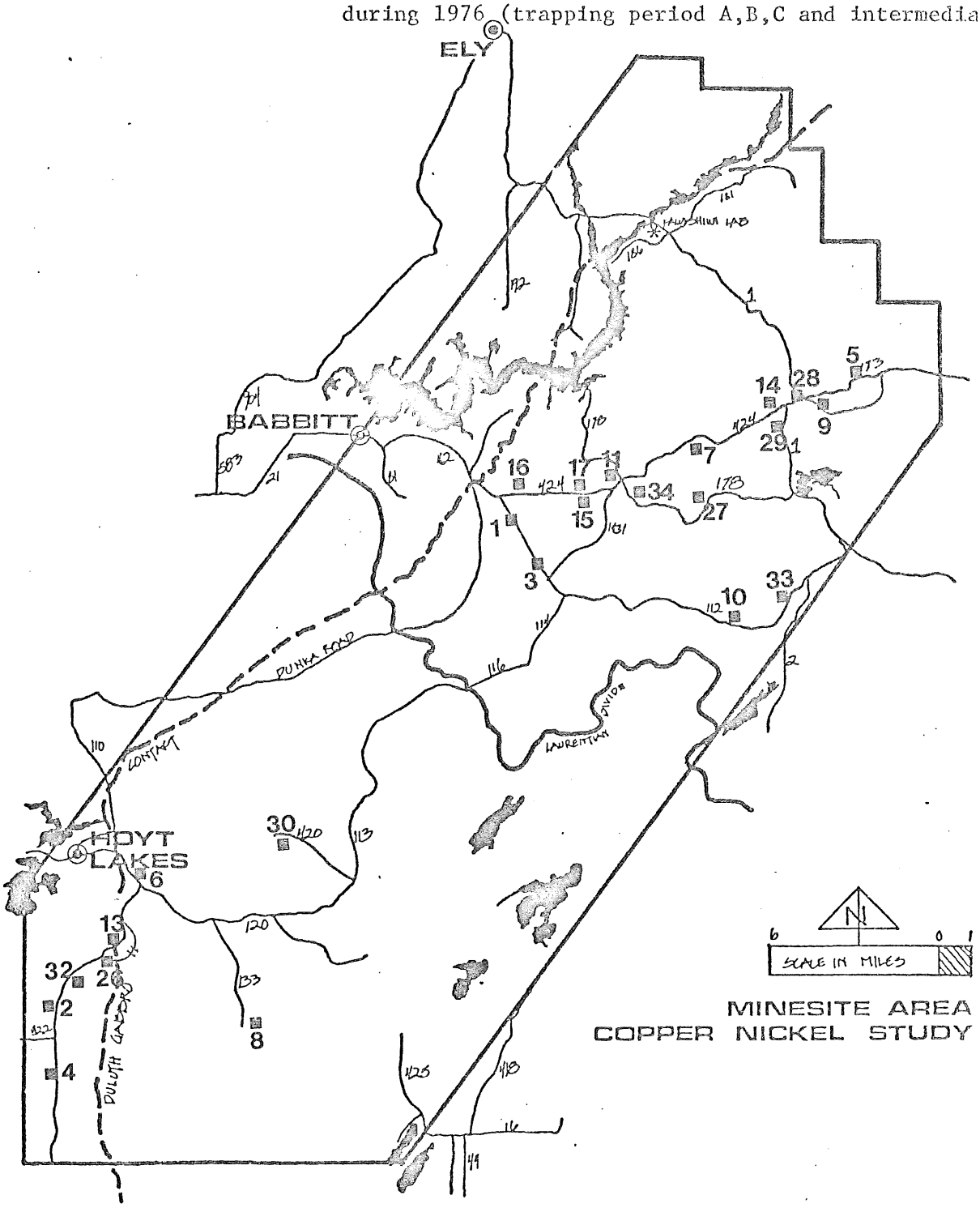


Figure SM-1

Total numbers of small mammals of each species trapped on 12 sites during trapping period B (July 29 - August 2, 1976).

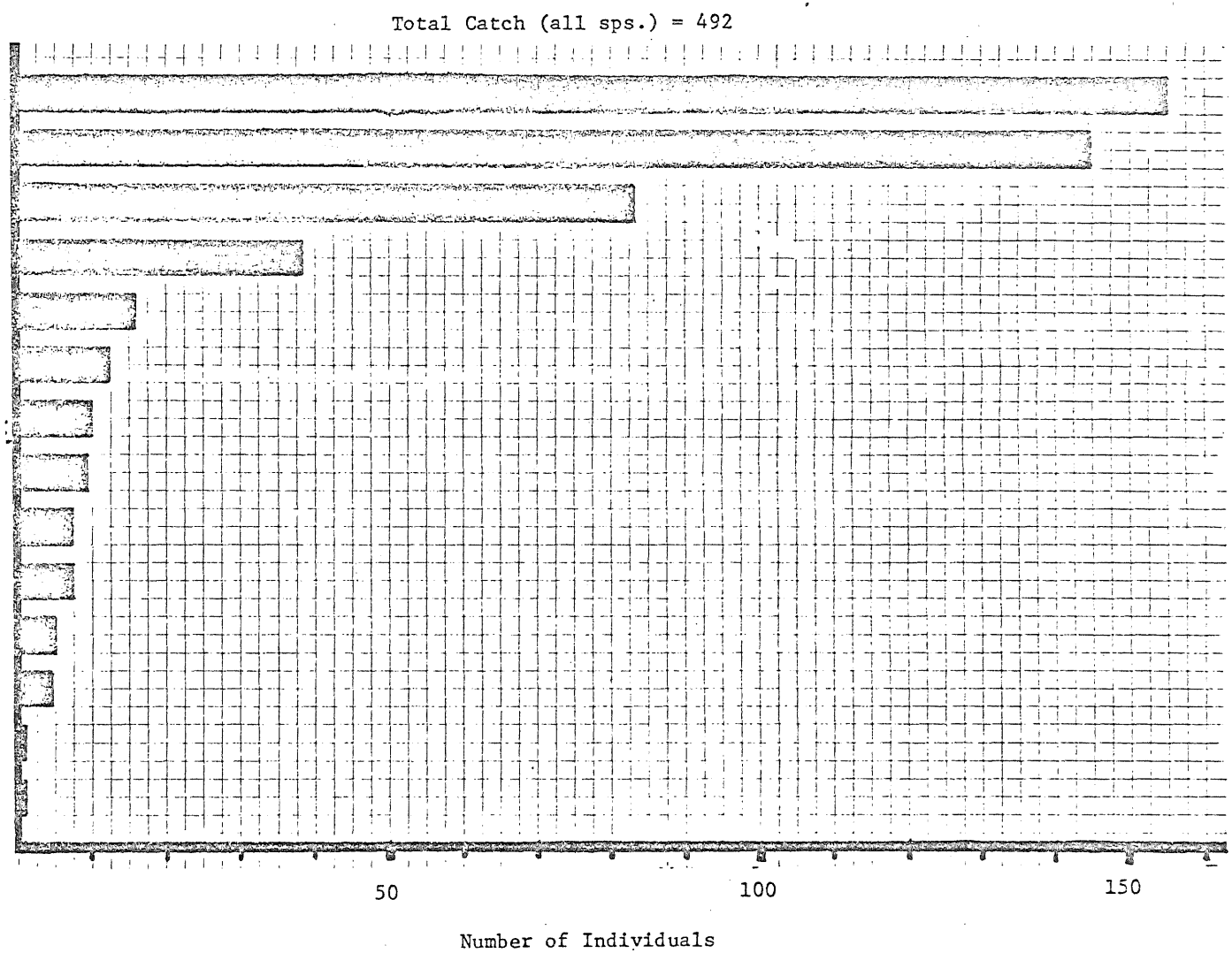


Figure SM-3.
Densities of herbivores and insectivores
by site and cover type.
(Trapping period B, July 29 - August 2, 1976)

Cover Type	Site No.
Paper Birch	(27B)
Mature Paper Birch	(8B)
Mid-aged Aspen-Birch	(9B)
Mid-aged Aspen-Birch	(10B)
Trembling Aspen	(29B)
Pole Trembling Aspen	(13B)
Black Spruce	(28B)
Mature Black Spruce	(6B)
Red Pine	(26B)
Mature Red Pine	(3B)
Mature Jack Pine	(2B)
Mature Jack Pine	(1B)

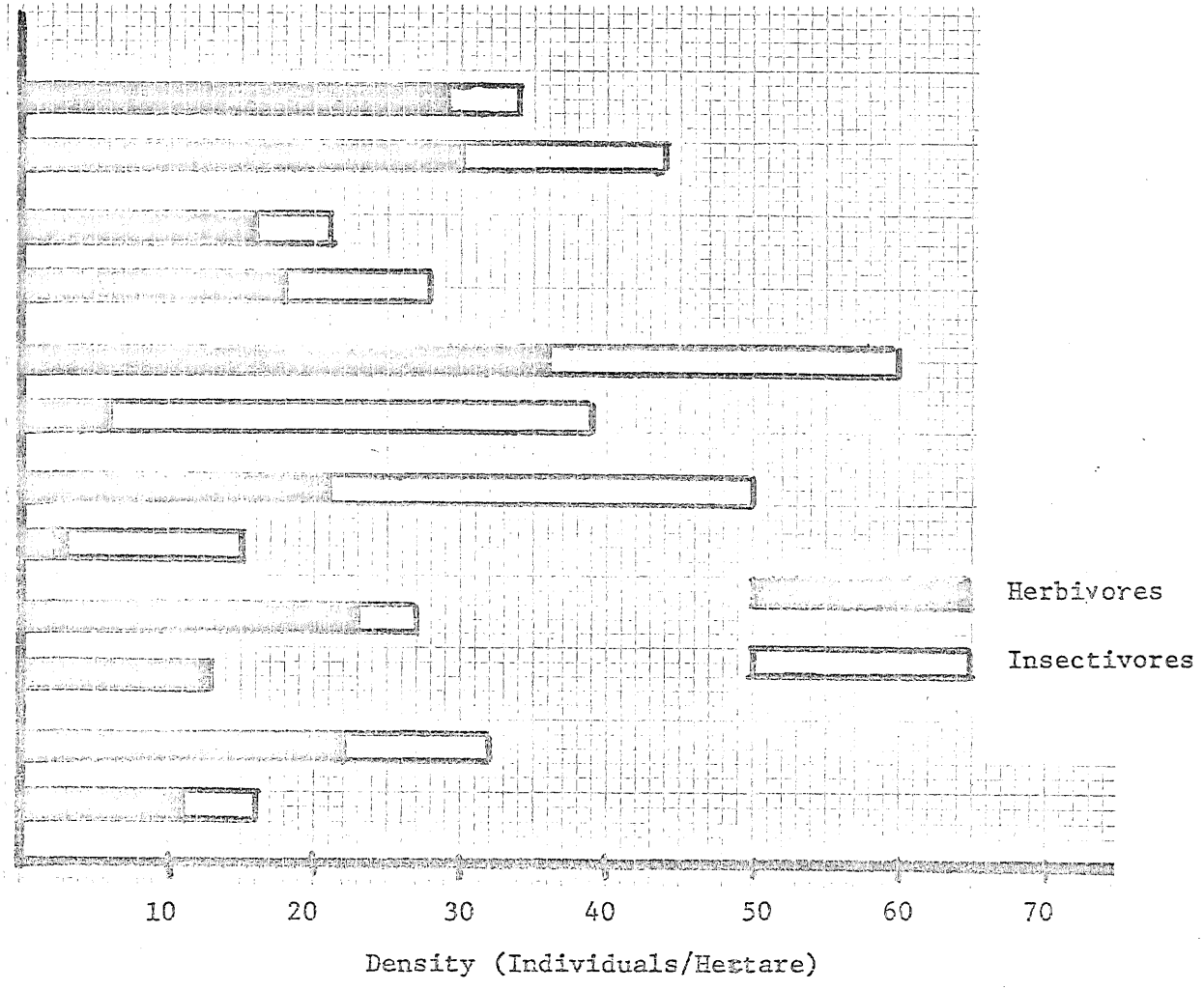


Figure SM-4.
Biomass/area for herbivores and Insectivores for each site and cover type.
(Trapping period B July 29 - August 2, 1976)

Cover Type	Site No.
Paper Birch	(27B)
Mature Paper Birch	(8B)
Mid-aged Aspen-Birch	(9B)
Mid-aged Aspen-Birch	(10B)
Trembling Aspen	(29B)
Pole Trembling Aspen	(13B)
Black Spruce	(28B)
Mature Black Spruce	(6B)
Red Pine	(26B)
Mature Red Pine	(3B)
Mature Jack Pine	(2B)
Mature Jack Pine	(1B)

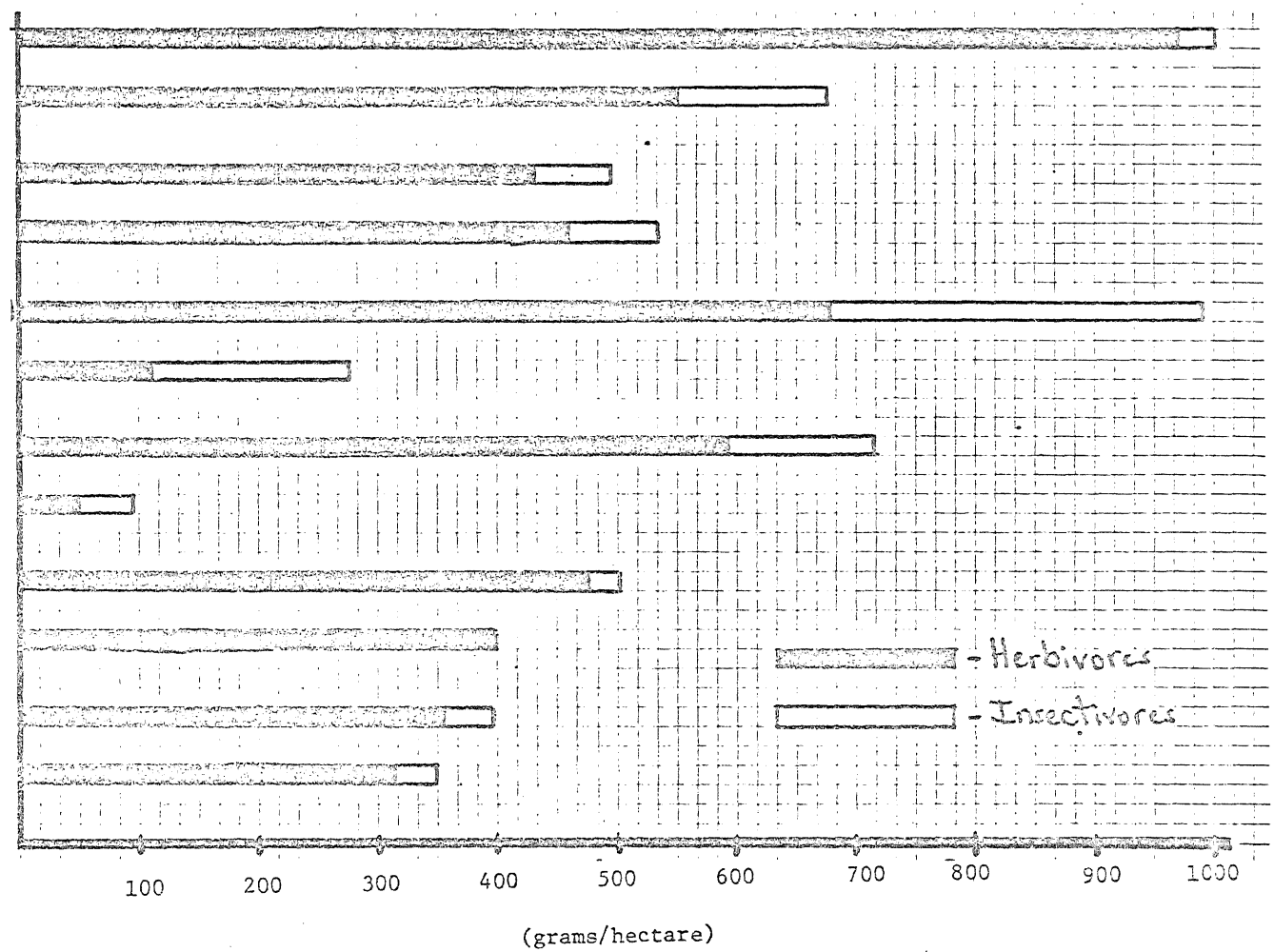


Figure SM-4.
Example of method used in determining estimated populations using linear regression.
(Trapping period B, July 29 - August 2, 1976)

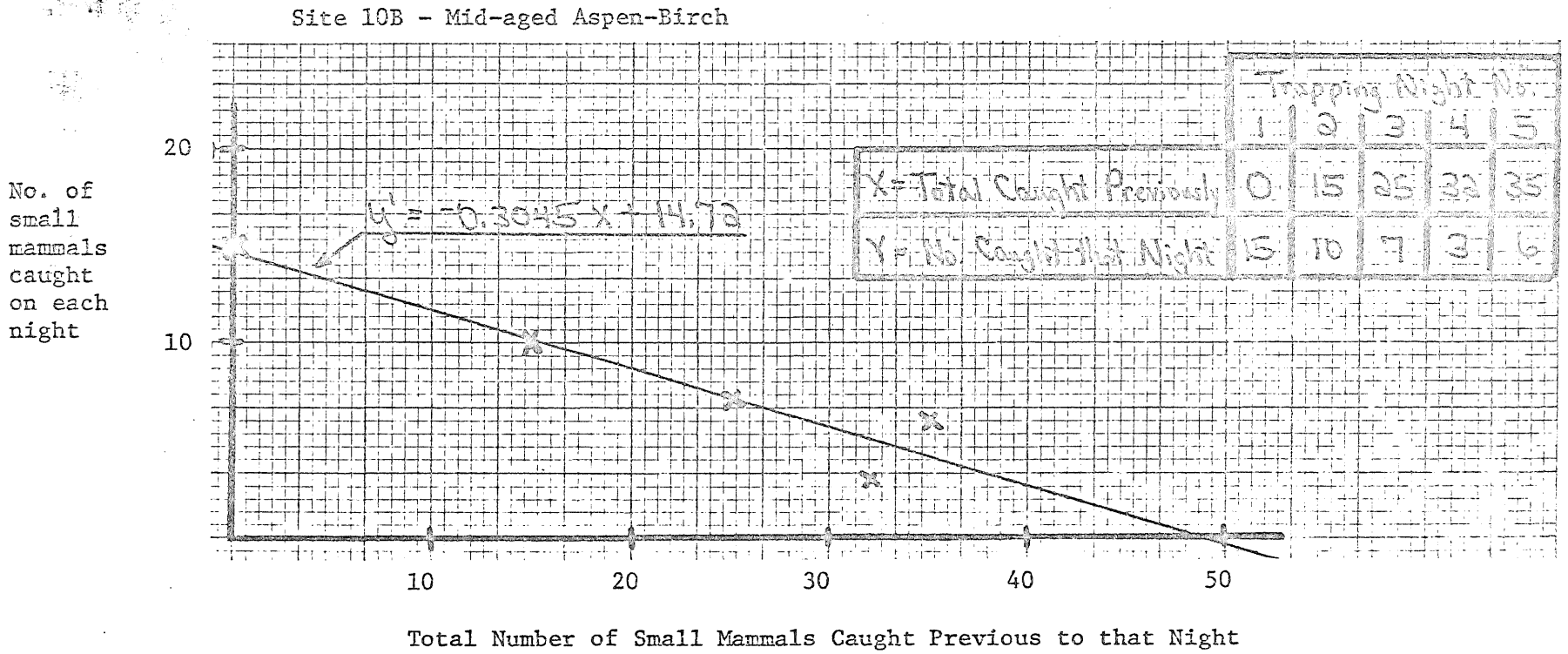


Figure SM-6.
Estimated total populations (all species) as calculated from linear regression by site number and cover type. (Trapping period B, July 29 - August 2, 1976)

Cover Type	Site No.
Paper Birch	(27B)
Mature Paper Birch	(8B)
Mid-aged Aspen-Birch	(9B)
Mid-aged Aspen-Birch	(10B)
Trembling Aspen	(29B)
Pole Trembling Aspen	(13B)
Black Spruce	(28B)
Mature Black Spruce	(6B)
Red Pine	(26B)
Mature Red Pine	(3B)
Mature Jack Pine	(2B)
Mature Jack Pine	(1B)

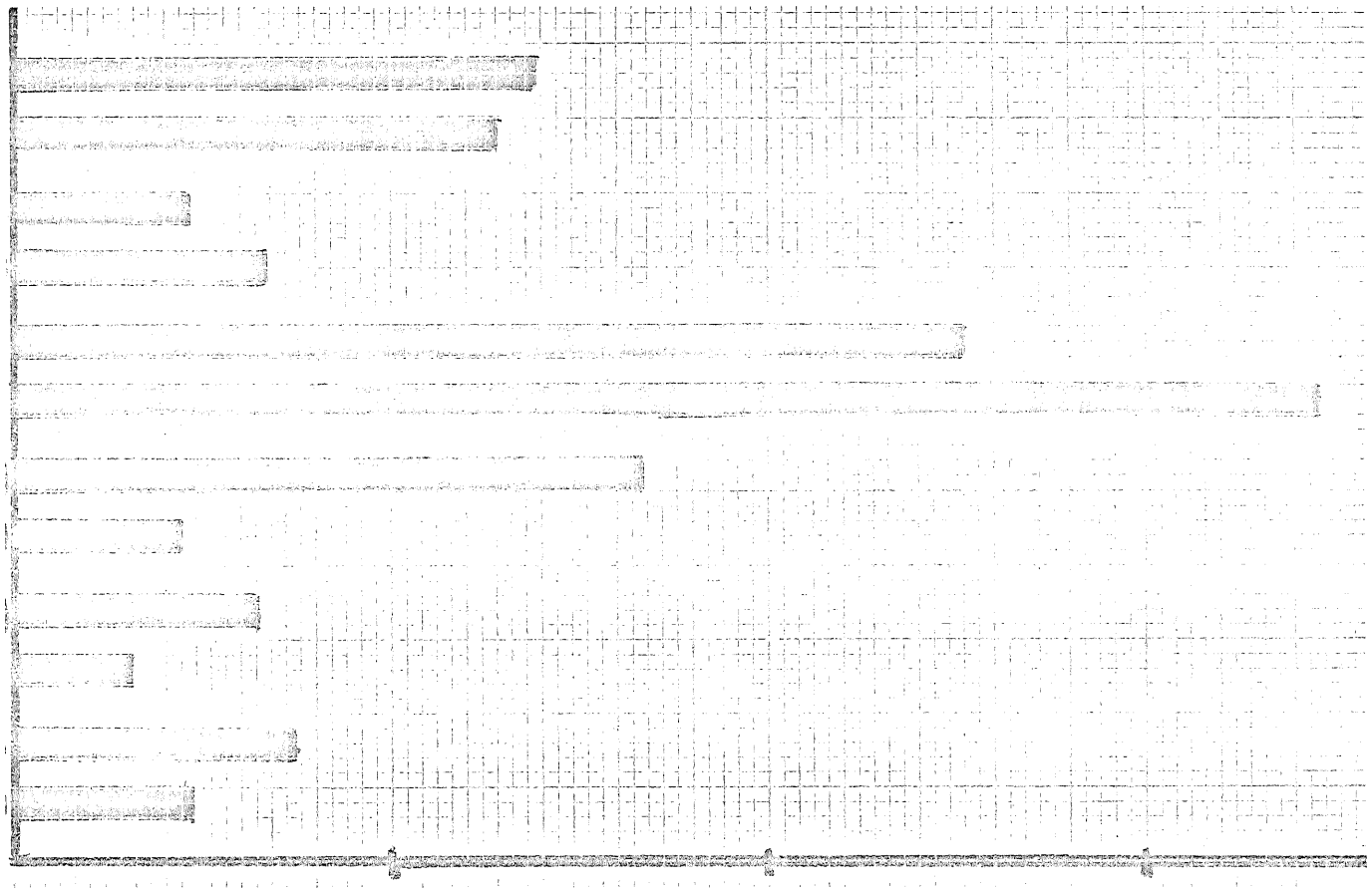
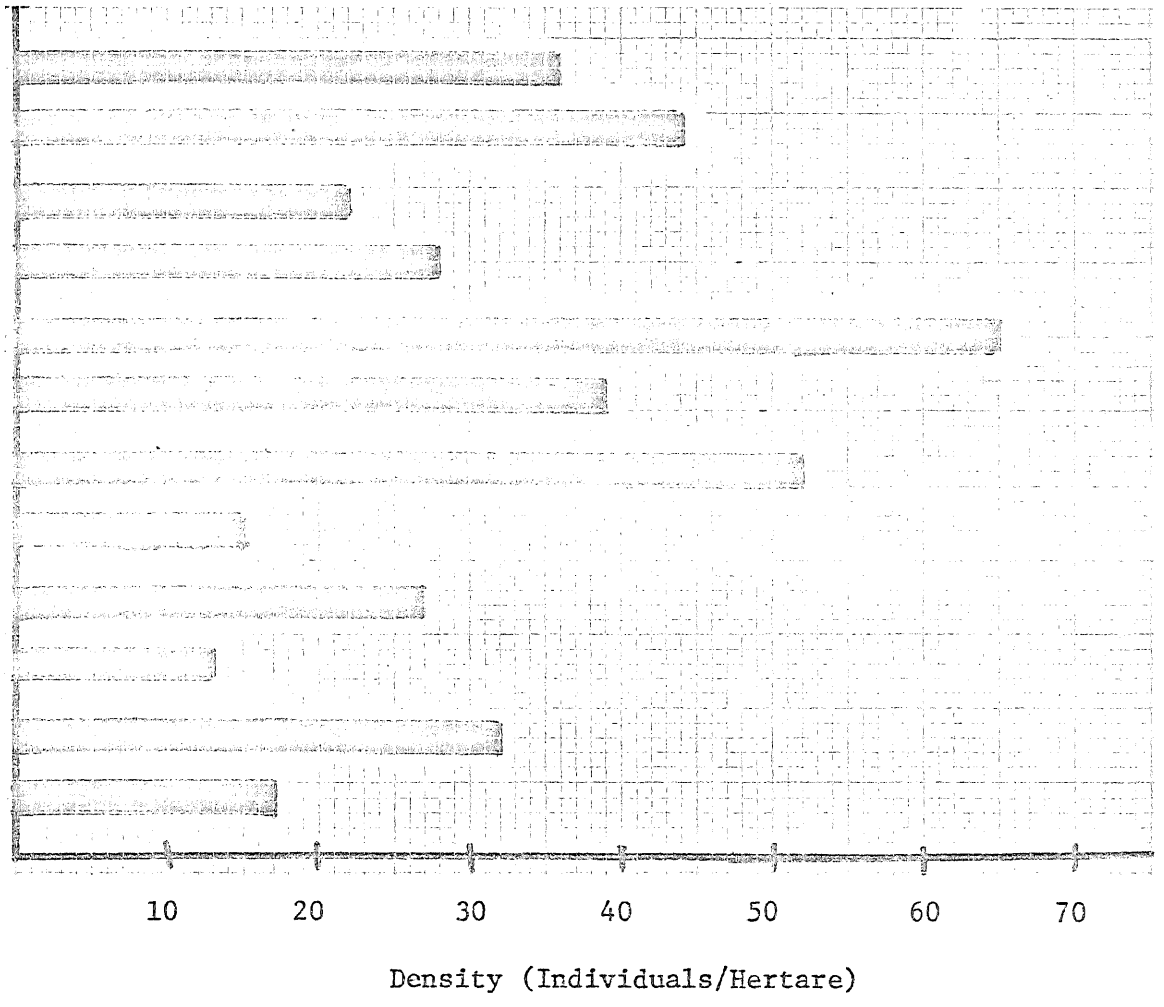
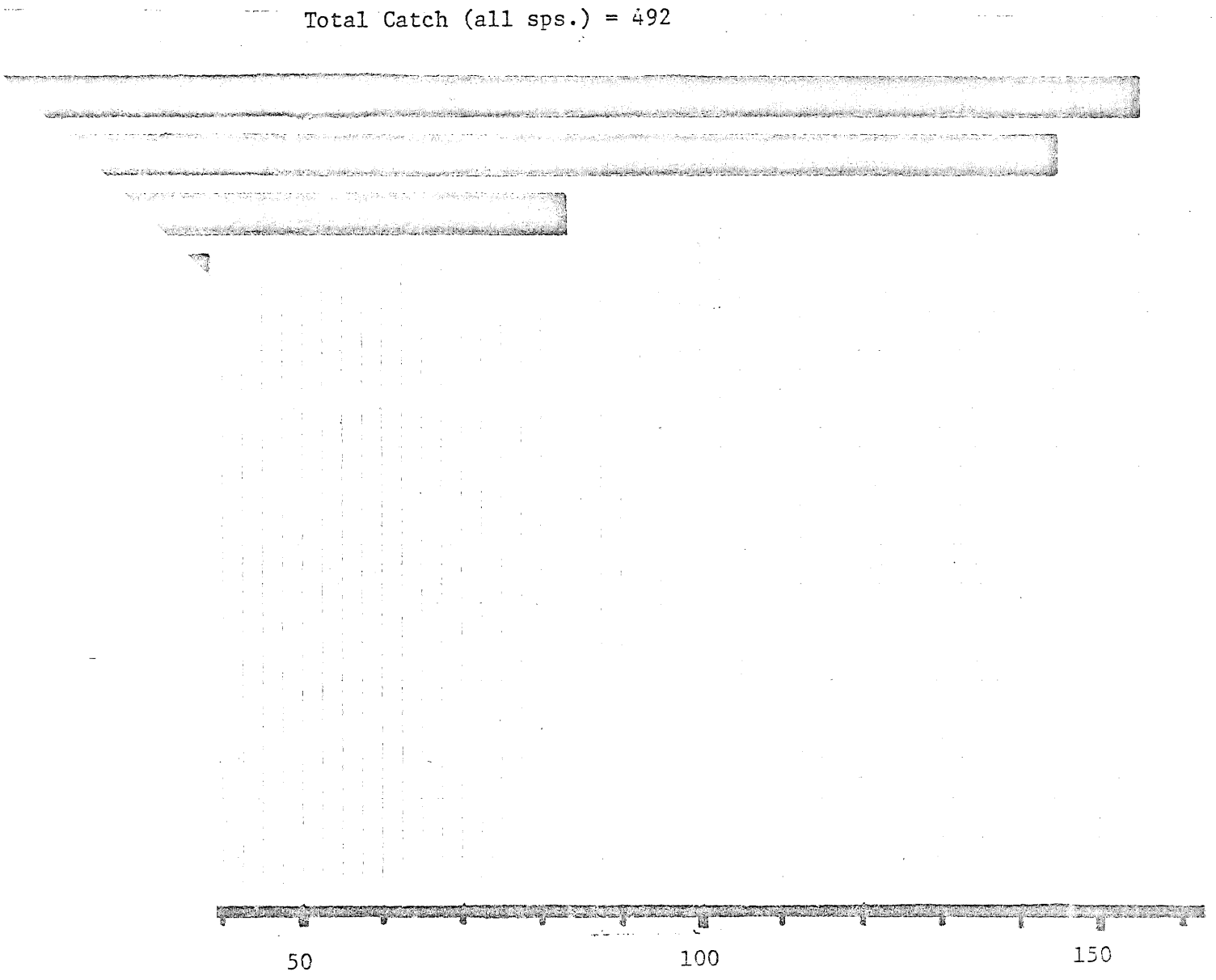


Figure SM-6.
Densities of total individuals
caught per site.
(Trapping period B July 29 - August 2, 1976)

Cover Type	Site No.
Paper Birch	(27B)
Mature Paper Birch	(8B)
Mid-aged Aspen-Birch	(9B)
Mid-aged Aspen-Birch	(10B)
Trembling Aspen	(29B)
Pole Trembling Aspen	(13B)
Black Spruce	(28B)
Mature Black Spruce	(6B)
Red Pine	(26B)
Mature Red Pine	(3B)
Mature Jack Pine	(2B)
Mature Jack Pine	(1B)



`f each species trapped on
(July 29 - August 2, 1976).



nal species

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(10B) -aged n-	(29B) Trembling Aspen No.	(29B) Trembling Aspen %	(13B) Pole Aspen No.	(13B) Pole Aspen %	(28B) Black Spruce No.	(28B) Black Spruce %	(6B) Black Spruce No.	(6B) Black Spruce %	(26B) Red Pine No.	(26B) Red Pine %	(3B) Red Pine No.	(3B) Red Pine %	(2B) Jack Pine No.	(2B) Jack Pine %	(1B) Jack Pine No.	(1B) Jack Pine %	Totals No.	Totals %
		15.3	38	70.4	33	53.2	18	81.8	3	10.2			15	32.6	6	27.3	155	31.5
		6.7	3	5.6	17	27.4	1	4.5	7	24.1	6	35.3	30	65.2	7	31.8	144	29.3
		8.9					1	4.5	16	55.2	3	17.6			1	4.5	83	16.9
		0.8	3	5.6	2	3.2			1	3.4					1	4.5	38	7.7
		4.2			1	1.6					4	23.5			5	22.7	16	3.3
		2.8									1	5.9					12	2.4
			3	5.6	5	8.1	2	9.1									10	2.0
					2	3.2			1	3.4	2	11.8			1	4.5	9	1.8
			2	3.7					1	3.4	1	5.9	1	2.2			7	1.4
																	7	1.4
		1.4			2	3.2									1	4.5	5	1.0
			4	7.5													4	0.8
			1	1.9													1	0.2
																	1	0.2
		0.1	54	100.2	62	99.9	22	99.9	29	99.8	17	100.0	46	100.0	22	99.8	492	99.9

nsectivores

1976)