Small Mammals of Reclaimed Mine waste in Northern Minnesota

David Olfelt
Department of Zoology
University of Wisconsin
Madison, WI 53706

The study of small mammals utilizing reclaimed minelands is important for several reasons: 1) small mammals, at high densities at least, have potential impact on vegetation (Banfield 1977) 2) small mammal diversity and abundance may be used as a measure of reclamation success 3) small mammals are important food for a wide variety of predatory species.

This study investigates small mammal abundance and species composition of communities inhabiting two sorts of reclaimed mine waste areas: taconite tailing basins and waste rock stockpiles. Two taconite tailing basins were studied, one owned by the National Steel Pellet Company and located just south of Keewatin; the other owned by Butler Taconite and located near Nashwauk. The vegetation is composed primarily of grasses and forbs; sweet clover and reed canary, intermediate wheatgrass and red top grasses are among the dominant species (Dewar 1983). Cover ranges from nearly 100% to very sparse. In some areas hybrid poplars have been planted and relatively little grassy cover remains. The reclaimed portion of National Steel's tailing basin exceeds 6 km^2 and Butler Taconite's reclaimed area was more than 550 ha in 1983.

Three waste rock stockpiles were studied. All are owned by National Steel and are located west of Keewatin. They range in size from 17 ha to 25 ha. The vegetation on these stockpiles is all volunteer, the stockpiles having been established before reclamation legislation took effect. The amount of vegetation varies with the length of time since dumping last occurred. Woody species included birch and aspen, and sweet clover was the most abundant non-woody plant.

Small mammals were captured with hardware store variety mousetraps, baited with a mixture of peanut butter, oatmeal and anise oil. Traps were placed in lines at 10 meter (1983) or 15 meter (1984) intervals and set out for four nights. In 1983 trapping was conducted only at National Steel's tailing basin (June 24-27, August 11-14) for a total of 2800 trap nights (1 TN = one trap set out for 24 hrs). Trapping was conducted from July 9 - August 14 in 1984 at five different locations. Control traplines were established adjacent to each mined area. Woody controls were located in moist woods dominated by aspen with some maple and birch. Grassy controls were located along highway or power-line rights of way (Table 1).

Trapping results are presented in Table 2. A one way analysis of variance and protected significant difference test (Snedecor and Cochran 1980) were performed on the 1984 data to test which stands had similar trapping success (Table 2 and Figure 1).

Table 1 1984 TRAPPING SITES

National Tailing Basin (NTB) and Butler Tailing Basin (BTB) - sweet clover, alfalfa, grasses --- cover often sparse, some shrubs, hybrid poplar

National Stockpile I (NSP I) - bare rock, small birch and aspen

National Stockpile II (NSP II) - less bare rock, sweet clover, larger birch, aspen

National Stockpile III (NSP III) - thick grass in places, tree-sized birch, aspen, leaf litter

Woody controls (Woody) - moist aspen forest, dense underbrush

Grassy controls (Grassy) - dense grasses, sedges, ferns --- along roads, power lines

A total of ten species were caught. Woodland deer mice and meadow voles were the most common animals on the mine wastes. Deer mice were significantly more abundant on waste rock stockpiles than on either of the tailing basins or in control stands. Meadow voles were also most abundant on one of the rock dumps, one that had good grassy cover on top, and in the grassy controls. Masked shrews were the most common mammal off the waste areas. In terms of total captures, the tailing basins had statistically similar and low capture rates, the control stands had statistically similar and high capture rates (compared to other northern forest studies e.g. Richens 1974, Batten 1980), while the two older rock stockpiles had the highest capture rates.

If one groups species by their feeding habits (grazers, omnivore-granivores, insectivores) some interesting patterns appear (Figure 2). The control stands have a high proportion of insect eating mammals and a relatively low proportion of grazers, even in grassy controls where one would expect grazers. The two stockpiles with the sparsest vegetation have a preponderance of omnivore-granivores.

High populations of deer mice have been noted by a number of researchers on recently disturbed lands (e.g. Kirkland 1976). Deer mice are thought to have generalist lifestyles (Krebs and Wingate 1976) and so may be best able to exploit a pioneering situation such as a tailing basin or rock stockpile. The greater abundance of deer mice on the stockpiles may be due, in part, to the large number of hiding places afforded by the broken rock. The lack of deer mice in the controls is interesting. Batten (1980) working near Ely, found deer mice associated with dry woody areas with ground litter. Timm (1975) working in Cook county found deer mice most common in aspen-birch woods, rocky outcrops and disturbed areas. The fact that control stands in the present study tended to be moist may have prevented deer mice from becoming abundant there.

Meadow voles require grassy cover, both for food and for building runways, and prefer moister habitats (Timm 1975, Getz 1961a). The highest numbers of meadow voles were captured on sites with those characteristics.

Southern red-backed voles, jumping mice and the shrews also tend to be found in moister situations (Getz 1961b, 1961c, Timm 1975, Miller and Getz 1971).

Table 2 CAPTURES PER 100 TRAP NIGHTS

	NTB 1983	NTB 1984	BTB	NSP I	NSP II	NSP III	WOODY CONTROL	GRASSY CONTROL	ANOVA F
Masked shrew (Sorex cinereus)	.1				.3	3.8	13.3	6.7	44.8*
Artic shrew (Sorex arcticus)	.07						.9	4.9	13.32*
Short-tailed shrew (Blarina brevicauda)		.1					1.8	1.5	3.67*
Eastern Chipmunk + (Tamias striatus)							.3		1.14
Least Chipmunk + (Eutamias minimus)				.3	.3				0.96
Thirteen-lined ground squirrel + (Spermophilus tridecemlineatus)	.1	.4	1.3		.3				2.21
Woodland deer mouse (Peromyscus maniculatus gracilis)	.9	1.0	3.4	11.4	24.7	16.8	1.2	.4	37.37*
Southern red-backed vole (Clethrionomys gapperi)				.6	2.2	6.7	3.9		14.34*
Meadow vole (Microtus pennsylvanicus)	2.0	3.1	2.8	.8	4.2	11.5	.3	6.7	5.35*
Meadow jumping mouse (Zapus hudsonius)	.2	.1	.3		1.3	1.0	2.4	1.1	3.91*
TRAP NIGHTS	2800	800	320	360	312	208	332	268	31.18*
TOTAL/100 TRAP NIGHTS	3.30	4.75	7.81	14.17	33.33	39.90	24.10	20.15	
TOTAL CAPTURES	93	38	25	47	104	83	80	57	

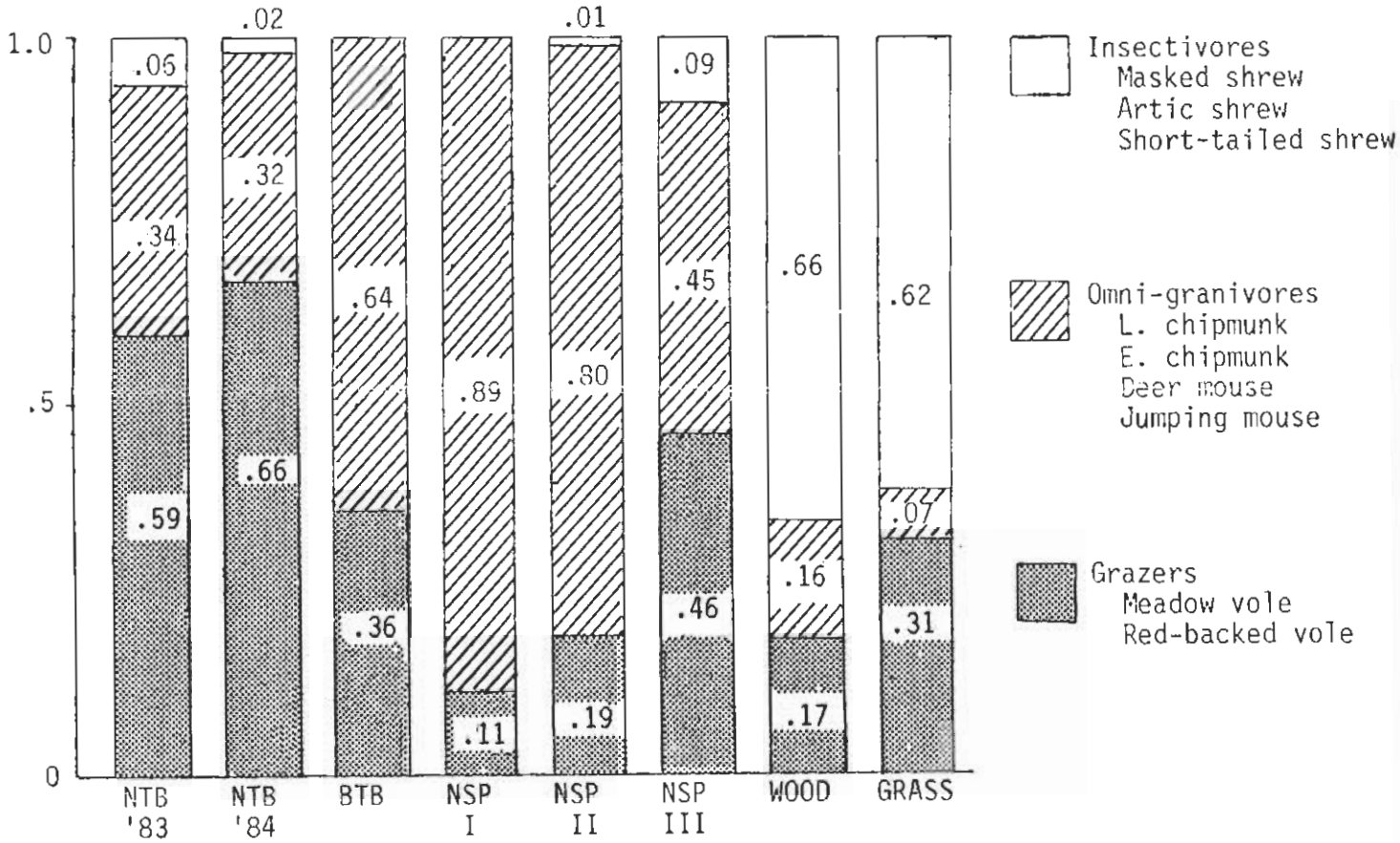
\+ Animals too large to be sampled accurately with traps used.
* Significant at 1% level.

Figure 1 RANKED CAPTURE RATES

Stands underlined are statistically similar $\alpha = .01$

Masked shrew	NTB	BTB	NSP I	NSP II	NSP III	GRASSY	WOODY
Arctic shrew	NTB	BTB	NSP I	NSP II	NSP III	WOODY	GRASSY
Short-tailed shrew	BTB	NSP I	NSP II	NSP III	NTB	GRASSY	WOODY
13-lined ground squirrel	NSP I	NSP III	WOODY	GRASSY	NSP II	NTB	BTB
Woodland deer mouse	GRASSY	NTB	WOODY	BTB	NSP I	NSP III	NSP II
Southern red-backed vole	NTB	BTB	GRASSY	NSP I	NSP II	WOODY	NSP III
Meadow vole	WOODY	NSP I	BTB	NTB	NSP II	GRASSY	NSP III
Meadow jumping mouse	NSP I	NTB	BTB	NSP III	GRASSY	NSP II	WOODY
TOTAL	NTB	BTB	NSP I	GRASSY	WOODY	NSP II	NSP III

Figure 2 TROPHIC LEVEL COMPARISONS



Proportion of insectivores, omnivore-granivores, grazers in each stand. Groupings based on Hazard (1980).

Red-backed voles were caught in situations where deep, leafy litter was present, such as under trees on the oldest of the dumps. Masked shrews were ubiquitous in the control stands but on the waste areas, were present only on the oldest stockpile. Jumping mice were caught in grassy or grassy-shrubby areas as were arctic and short-tailed shrews.

In general, deer mice have been most successful at colonizing these mine wastes, managing to live in areas with scarcely any vegetation. Meadow voles are living in areas planted to grasses and sweet clover (or similar volunteer vegetation). Their numbers can be expected to increase as grassy cover improves. Red-backed voles and masked shrews appear as forest-like stands of trees develop and provide sufficient leaf litter to meet their moisture requirements. Such vegetation is developing well on the stockpiles but is lacking on the tailing basins, despite planting efforts. Jumping mice, arctic shrews and short-tailed shrews will probably become more common as grassy and shrubby vegetation becomes more abundant and is able to provide more stable moisture regimes.

Rock stockpiles seem capable of supporting large and, with time, relatively diverse small mammal communities, even without reclamation efforts. The tailing basins studied on the other hand, need more, and perhaps more diverse vegetation before they can provide adequate small mammal habitat.

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