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Small Mammal Populations near the Trojan Nuclear Power Station, Oregon¹

Abstract

A small mammal live trap-mark-recapture survey was made in Douglas-fir forest and grassy meadow habitats at the Trojan nuclear power station, Oregon, during 1972 and 1973. Seven species were caught; the deer mouse, *Peromyscus maniculatus*, was most abundant. More small mammals were captured in the forest than in the meadow habitat. Jumping mice, *Zapus trinotatus*, and Townsend voles, *Microtus townsendii*, were caught only in the meadow habitat. Townsend chipmunks, *Eutamias townsendii*, were caught only in the forest habitat.

On the average, male deer mice weighed more than females. Females were reproductively active at all seasons. Bot fly infestations were more pronounced in the forest animals than in meadow animals. One male deer mouse lived on the study plot for 21 months.

Introduction

Small mammals are widely distributed and often abundant in terrestrial ecosystems in North America, and they provide an important food base for mammalian, reptilian, and avian predators (Hall and Kelson, 1959). At times, small mammals are regarded as pests. In forested regions, deer mice, *Peromyscus maniculatus*, eat the seeds of Douglas-fir trees (Gashwiler, 1971). Individually, deer mice under confined conditions can consume more than 200 Douglas-fir seeds in a single night, a problem that is particularly acute when artificial seeding is used as a reforestation practice (National Academy of Science, 1970).

Usually small mammals are more amenable for population studies than are medium or large mammals, partly because small mammals are abundant and have small territory requirements; some may spend their entire lives confined to a few acres of suitable habitat. Some small mammals are readily captured in live traps and individual animals can be recaptured again and again offering opportunity to examine individuals in hand for weighing and observations of general health.

This paper presents the results of a 21-month mark-recapture study of small mammal populations near the Trojan nuclear power station and contributes to the state of knowledge of forest and meadow habitats of western Oregon. The study was initiated to establish baseline data to monitor the effects, if any exist, of nuclear power plant operation on small mammals.

The Site

The Trojan nuclear power station is located adjacent to the west bank of the Columbia River near the village of Prescott, Columbia County, Oregon. The site consists mostly of

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second growth forest, meadow, and marshlands. Uplands with well-drained soil support coniferous forest stands dominated by Douglas-fir, *Pseudotsuga menziesii*. Wet soils support stands of Oregon ash, *Fraxinus latifolia*, and black cottonwood, *Populus trichocarpa*. Marshlands contain mostly reed canary grass, *Phalaris arundinacea*, and shrub willows, *Salix* spp. Meadows of perennial grasses are mowed annually.

The site has undergone more than a century of land use. One railroad and a highway cross the site. The existing forests are second growth stands crisscrossed with abandoned logging roads. A few aged fruit trees mark the location of abandoned farmsteads. About 40 acres of land are presently devoted to buildings, parking lots, outdoor storage space, and surfaced roadways designed to service the nuclear power station. Landscaping consists of the development of a reflection pool and the planting of lawn grasses and ornamental trees. However, the major part of the 80 acre property is undeveloped and provides habitat for wildlife.

Methods

Twenty-five Sherman live traps were distributed at approximately 15-meter intervals along each of two different trails. One trail was in a Douglas-fir forest and the other along a meadow edge. Traps were opened in the afternoon and visited in the early morning for two consecutive trap nights. Sixteen sessions, mostly at monthly intervals, were conducted between April 1972 and December 1973.

Trapped animals were individually marked using toe amputations. Animals were weighed using a delicate spring balance, identified to species, examined for sex, approximate age, reproductive condition, and the occurrence of bot fly larvae or their scars. All animals were released near points of capture.

Traps were supplied with mixed seeds and grain to help sustain animals during their stay inside the traps. A wad of soft Dacron material was also supplied to act as thermal insulation to help maintain body heat. A small quantity of an oatmeal-peanut butter mixture was placed on the door for bait when the traps were set.

Trapping Results and Discussion

Seven species of small mammals were taken from the two trap lines (Table 1). The deer mouse was the most often trapped small mammal. Townsend chipmunks were also more frequently trapped than the remaining five species, although they did not occur in the meadow. Jumping mice and Townsend voles did not occur in the forest community. Only the deer mouse was captured often enough to yield information concerning sex ratios, longevity, seasonal changes in body weights, and trapability.

Deer mouse captures in the forest were highest in the early spring of 1972. Catches steadily declined with the lowest success in the spring of 1973. The catch increased in the fall of 1973. Too few captures were made in the meadow habitat to identify trends.

More male than female deer mice were captured, which probably reflects the greater mobility of males. The recaptures of 25 deer mice marked in April 1972 were followed through December 1973 and are illustrated in Table 2. One male deer mouse remained on the trap line after 21 months. The longest persistence time on the trap line for females was only eight months. On the average, male deer mice weighed more than females. Weights of females and males fluctuated according to reproductive condition as well as age.

Date	Deer Mouse <i>Peromyscus maniculatus</i>	Townsend Chipmunk <i>Eutamias townsendi</i>	Oregon Vole <i>Microtus oregoni</i>	Vagrant Shrew <i>Sorex vagrans</i>	Shrew Mole <i>Neurotrichus gibbsi</i>	Jumping Mouse <i>Zapus trinotatus</i>	Townsend Vole <i>Microtus townsendi</i>
Forest Plot							
1972							
Apr	25	2	0	0	0	0	0
May	27	8	1	0	0	0	0
Jul	16	4	0	0	0	0	0
Aug	15	11	0	0	0	0	0
Sep	17	13	2	1	0	0	0
Nov	15	2	1	0	0	0	0
1973							
Jan	5	0	0	0	0	0	0
Mar	2	0	1	0	0	0	0
Apr	3	6	0	0	0	0	0
May	5	5	0	0	0	0	0
Jun	6	5	1	0	0	0	0
Jul	5	1	0	0	1	0	0
Aug	2	0	1	0	2	0	0
Sep	6	0	2	0	2	0	0
Oct	12	0	0	0	0	0	0
Dec	9	0	0	0	0	0	0
Total	170	57	9	1	5	0	0
Meadow Plot							
1972							
-----Not Trapped-----							
Apr							
May	11	0	0	1	0	4	1
Jul	5	0	0	0	0	0	1
Aug	9	0	0	1	0	0	0
Sep	2	0	0	0	0	0	0
Nov	4	0	0	0	0	0	2
1973							
Jan	7	0	0	0	0	0	0
Mar	4	0	3	0	0	0	0
Apr	5	0	1	1	0	0	0
May	4	0	2	0	0	2	0
Jun	2	0	2	1	0	1	0
Jul	0	0	0	0	0	1	1
Aug	3	0	0	0	0	0	0
Sep	1	0	0	0	0	0	0
Oct	1	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0
Total	58	0	8	4	0	8	5

TABLE 1. Monthly trap catch of small mammals on forest and meadow trap lines at the Trojan nuclear power station, Oregon, 1972-73.

Infestation by Bot Fly Larvae

During routine trapping, infestations of small mammals by the larvae of *Cuterebra* sp. were observed. The larvae were first noted in August 1972. Four of the 24 deer mice and three of the 11 chipmunks captured showed evidence of cuterebrid infestations. In September only one of 19 deer mice and one of 13 chipmunks were infested. Cuterebrid larvae were not found again until August 1973, when one of five deer mice captured contained larvae. Late summer to early fall is considered to be the bot fly season (Hunter *et al.*, 1972). Blair (1942) observed that in Michigan there was a correlation between a forested environment and the presence of *Cuterebra* sp.

There were too few recaptures to make any determination of detrimental effects of bot fly infestations on either individuals or the population. Conflicting results have been reported from studies on longevity of infested mice (Wecker, 1962; Hunter *et al.*, 1972).

Reproductive Activity of Deer Mice

The deer mice on the Trojan station exhibited no significant seasonal reproductive behavior. Female *P. maniculatus* which were noted as being reproductively active were

I. D.	APR	MAY	JUL	AUG	SEP	NOV	JAN	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DEC
MALES																
0001	X		X	X	X	X										
0003	X	X														
0004	X	X	X	X	X											
0005	X	X				X										
0011	X	X	X													
0012	X	X		X	X	X										
0013	X	X		X												
0015	X	X	X	X	X	X										
0021	X	X	X	X	X	X										
0123	X					X	X		X	X	X	X	X	X	X	X
0024	X	X														
0030	X			X												
0031	X	X														
0040	X	X			X	X	X		X	X	X					
0041	X															
TOTAL	15	11	6	6	7	6	2	0	2	2	2	1	1	1	0	1
FEMALES																
0002	X	X	X													
0010	X	X	X													
0014	X	X														
0020	X	X			X											
0022	X	X														
0025	X	X														
0032	X	X		X	X											
0033	X	X	X	X												
0034	X	X												X		
0035	X															
TOTAL	10	9	3	3	1	1	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL	25	20	9	9	8	7	2	0	2	2	2	1	1	1	0	1

TABLE 2. Persistence of deer mice caught in the forest trap line over a 21-month period, April 1972 to December 1973.

captured during all seasons of the year. Kritzman (1970) reported that breeding of *P. maniculatus* in the desert steppe of south-central Washington appeared to cease during times of environmental extremes. The environmental stresses imposed upon small mammals living in a coastal forest ecosystem are probably less severe *i.e.*, in terms of heat, cold, and snow cover.

Indices used for classification as breeding or nonbreeding condition can be somewhat arbitrary. A study in southwestern British Columbia and western Washington describes a lack of reproductive activity in early winter by *P. maniculatus* (Sheppe, 1963). However, Sheppe did not consider some animals in early pregnancy or in estrus to be in breeding condition. In this study, all females showing signs of estrus, pregnancy, or post partum were considered reproductively active.

Relationship to Other Vertebrates

Avian predators were scarce at the Trojan site. The most important bird that can kill

and feed upon small mammals is the great blue heron, *Ardea herodias*. Herons are important in meadow and marsh-pond habitats but not in forests. Garter snakes, *Thamnophis sirtalis* and *T. ordinoides*, were abundant in meadow habitats and these could be important predators on small mammals, especially in warmer seasons that are favorable to increased metabolic activities of these cold-blooded vertebrates. Mammalian predators include the least weasel, *Mustela rixosa*, and red fox *Vulpes fulva*. The latter could well be an important predator on small mammals at the Trojan site since it ranges through many terrestrial habitats.

Relationships to Plant Growth and Reproduction

Deer mice can consume large quantities of Douglas-fir seeds, and these could cause serious losses to artificially disseminated seeds. However, most of the acres that can sustain Douglas-fir trees are already well stocked by natural reproduction.

Meadow mice have high reproductive potential and can reach population densities great enough to harvest substantial amounts of plant production. Economic losses can be attributed to decreased yields of grass or alfalfa. Although meadows at the Trojan site are cut for hay, maximum forage production is not a goal of management, and rodent control is not practiced.

Relationship to Power Station Operation

The data obtained in this investigation identify the species of small mammals living at the Trojan site and yield some indication of their relative abundance. The density of small mammals fluctuates with births, deaths, immigration, and emigration.

The most apparent terrestrial environmental impact of the operation of the nuclear power station will probably be the water vapor plume emanating from the cooling tower and the associated drift which consists of small droplets discharged into the surrounding air. These droplets will be deposited over adjacent landscapes throughout the 30-40 year operational life of the power station. Drift contains dissolved minerals associated with the coolant water as it is drawn from the Columbia River.

This study is expected to detect gross changes in small mammal populations attributable to the accumulation of minerals dissolved in coolant water or changes caused by logging and wildfire should these occur on the established study area. Laboratory studies utilizing conventional biological assay techniques using wild, small mammal stock would be useful in identifying more subtle long-term effects of cooling tower effluents on general health and reproductive capability of small mammals.

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