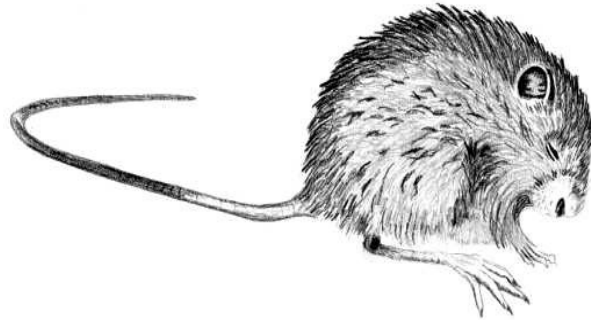


**SURVEY FOR PREBLE'S MEADOW JUMPING MICE
(*Zapus hudsonius preblei*) ON F.E. WARREN AIR FORCE
BASE, WYOMING:**



2008 PROJECT REPORT

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INTRODUCTION

*This report details the results of a small mammal survey targeting Preble's meadow jumping mouse (*Zapus hudsonius preblei*; hereafter *Preble's*) and performed between 11 August and 19 August 2008, along Crow Creek on F.E. Warren Air Force Base (hereafter FEWAFB) near Cheyenne, Wyoming. This is the eleventh such survey performed by the Wyoming Natural Diversity Database (WYNDD; University of Wyoming) at this site (see Garber 1995, Beauvais 1998, Keinath 2001, Dark-Smiley and Keinath 2002, Beauvais 2003a, Beauvais and Gruver 2004, Beauvais and Smith 2005a and 2005b, Beauvais and Keinath 2007, Beauvais and Griscom 2008). These reports, in addition to Elliot (1996), Schuerman and Pague (1997), Travsky (1997), and Young et al. (2000) represent thirteen consecutive years of Preble's survey and research on FEWAFB.*

*As in previous reports, we acknowledge the ongoing taxonomic uncertainty of the Preble's subspecies in Wyoming by referring to individuals of *Zapus* documented on FEWAFB as "suspected" Preble's.*

Preble's meadow jumping mouse is a relict subspecies isolated to riparian environments on the Front Range of the Rocky Mountains in southern Wyoming and northern Colorado, and has experienced population and range declines over the past 20 years (Beauvais 2001, Beauvais 2003b, U.S. Fish and Wildlife Service 2002a, 2008). Preble's was listed as Threatened under the U.S. Endangered Species Act in May 1998 (U.S. Fish and Wildlife Service 1998), with subsequent actions by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2001a, 2001b, 2002a, 2002b, 2008) modifying details of the taxon's status and management.

Over the past 15 years there has been substantial controversy over the taxonomic validity of the subspecies, which has greatly complicated management and policy-making. One genetic study (Ramey et al. 2005) suggested that the taxon was not unique enough to retain subspecific status and recommended synonymy with other, more widespread subspecies of *Z. hudsonius*. However, a more recent genetic study (that included a re-evaluation and critique of Ramey et al. 2005) concluded that the taxon is unique and should retain subspecific identity (King et al. 2006). The latter study is generally given precedence over the former by mammalogists and

regional ecologists, and the U.S. Fish and Wildlife Service appears to be proceeding based on its findings.

Although these recent investigations clarify some of the taxonomic confusion regarding Preble's as a whole, there remains some uncertainty over the taxon in the northern portion of its range. Presumed Preble's in the North Platte River basin appear to overlap more in morphology, genetics, and range with western jumping mice (*Z. princeps*) than do presumed Preble's to the south (Long 1965, Clark and Stromberg 1987, Riggs et al. 1997, Conner and Shenk 2003), raising the possibility of species-level hybridization in the north (see Hafner 1997, Pague and Grunau 2000, Schorr 2001, Beauvais 2003b).

The latest action by the U.S. Fish and Wildlife Service relevant to Preble's is the de-listing of the subspecies in the Wyoming portion of its range, but retention of Threatened status in Colorado (U.S. Fish and Wildlife Service 2007, 2008). The main reason for the Wyoming de-listing was an assumed lower prevalence and severity of threats to the taxon in Wyoming relative to Colorado.

The purpose of this study was to continue an annual small mammal trapping program that began on FEWAFB in 1995, with the specific intent of documenting the occurrence of suspected Preble's and noting their general habitat selection in this environment.

METHODS

Study area - Our work was conducted along Crow Creek on FEWAFB near the town of Cheyenne, Wyoming (Figure 1). Crow Creek is the only perennial stream on FEWAFB, and as such supports the primary corridor of habitat suitable for Preble's. Several studies have detailed the composition and structure of vegetation in this area (Marriott and Jones 1988, Young et al. 2000). Briefly, the Crow Creek corridor supports stands of willow (typically *Salix exigua*) with scattered cottonwoods (typically *Populus deltoides*), marshy areas dominated primarily by *Typha latifolia* and *Scirpus validus*, and herbaceous communities characterized by sedges (*Carex* spp.), Baltic rush (*Juncus balticus*), and several grasses. Adjacent uplands support true grasslands. Invasive weeds, most notably Canada thistle (*Cirsium arvense*), leafy spurge (*Euphorbia esula*), houndstongue (*Cynoglossum officinale*), and crested wheatgrass (*Agropyron cristatum*), are abundant and widespread throughout FEWAFB in general and the Crow Creek corridor in particular.

Small mammal surveys - The study was designed primarily to determine the presence or absence of *Zapus* sp. on FEWAFB. As in previous years we began by concentrating trapping efforts on Crow Creek above the Family Campground where suspected Preble's have been most reliably captured in the past.

Trapping surveys were conducted on 9 transects placed along Crow Creek between 11 August and 19 August 2008 (Figure 2). Trapping methods generally conformed to the guidelines established by the U.S. Fish and Wildlife Service (1999). Briefly, each transect consisted of two parallel lines of 25 Sherman live traps (one line on either side of the stream); traps were placed 5m apart and were less than 10m from a stream channel. All traps contained polyester bedding material, were baited with 3-way livestock feed, and were set in the evening and checked early the following morning. Captured animals were identified in the field and released at the capture site; no tissue samples were collected, nor were any animals deliberately sacrificed for specimen examination purposes. Animals that died in the traps were retained and later identified to species in the laboratory.

Disturbance of traps by raccoons (*Procyon lotor*) and striped skunks (*Mephitis mephitis*) has been a problem during past small mammal surveys on FEWAFB, and baited Tomahawk live traps have been employed to minimize such disturbance. Our general strategy has been to deploy Tomahawk traps only after substantial trap disturbance is recorded, to avoid unwittingly attracting predators to the trap lines.

RESULTS AND DISCUSSION

Small mammal trapping - Trapping was conducted over 6 nights for a total of 2650 raw trap-nights. After accounting for traps damaged or moved by large animals (n=19), undisturbed traps that were closed but empty (n=41), and traps that captured animals (n=415), we estimated a corrected sampling effort of 2412.5 net trap-nights (using the technique of Beauvais and Buskirk [1999]; Table 1).

Trap disturbance was rather low in 2008, echoing the low disturbance noted in 2007. We deployed no Tomahawk traps, and captured no raccoons, skunks, or other medium-sized predators in either year.

The 2008 capture rate of 4.97 suspected Preble's/ 1000 net trap-nights is second only to the 2005 capture rate of 9.56 suspected Preble's/ 1000 net trap-nights, considering all annual surveys performed on FEWAFB since 1996 (Figure 3). Total animal captures per 100 net trap nights (17.20; 17.16 when corrected for non-target species captures; Table 1) was relatively high for the same survey period.

Four-hundred-fourteen individual small mammals were caught, representing 5 taxonomic groups: deer mice (*Peromyscus maniculatus*), jumping mice (*Zapus* sp.), western harvest mice (*Reithrodontomys megalotis*), voles (*Microtus* spp.), and shrews (*Sorex* spp.; Table 1). Voles were more abundant than deer mice in 2008, reversing the pattern recorded in 2005, 2006, and 2007. The 2008 trapping data do not suggest a regular annual cycling in small mammal numbers in general, or deer mice and vole numbers in particular; such cycling was hinted at in the pre-2006 trace of FEWAFB capture rates (Figure 3). Most notably, vole numbers have remained relatively low since 2004.

Across 13 years of consecutive survey on FEWAFB the annual abundances of voles and deer mice were significantly correlated (Pearson correlation coefficient 0.57, $P=0.042$); neither was correlated with abundance of suspected Preble's (*Zapus* X *Microtus* Pearson correlation coefficient -0.25, $P=0.417$; *Zapus* X *Peromyscus* Pearson correlation coefficient -0.029, $P=0.9241$), nor was the combined abundance of voles and deer mice correlated with abundance of suspected Preble's (Pearson correlation coefficient -0.18, $P=0.556$). As noted by Dark-Smiley and Keinath (2002), this lack of correlation generally supports Whitaker's (1972) contention that other species of small mammals do not limit jumping mice.

Beauvais (2003a) suggested that the abundances of these 3 taxa may be related via a threshold effect such that abundances of all 3 vary in concert with general environmental conditions and do not substantially influence one another during most years, but during some years the numbers of voles and deer mice increase greatly and suppress numbers of Preble's. The first part of this hypothesis - numbers of the 3 taxa vary in concert during most years - is not strongly supported by the data. Although numbers of deer mice and voles are positively correlated, neither correlate with abundance of suspected Preble's, even when years of unusually high deer mice and vole numbers (2000 and 2003) are removed from the dataset. The second part of the hypothesis - in some years numbers of voles and deer mice increase greatly and suppress numbers of Preble's - is supported by trapping data from 2000 and 2003, although more

years of such numbers will be needed before the pattern can be established with confidence. It remains apparent that *Zapus* sp. populations on FEWAFB are not limited by the same factors which limit vole and deer mouse populations.

The 2008 captures support the general habitat preferences outlined in more detail in previous years' reports. Jumping mice were found in dense and tall vegetation with some woody overstory, and apparently did not strongly avoid stands of exotic weeds. No effort was made in 2008 to more intensively analyze habitat selection by *Zapus* on FEWAFB.

RECOMMENDATIONS

The recent decision to de-list Preble's in the Wyoming portion of its range (U.S. Fish and Wildlife Service 2008) raises some question over the need to continue monitoring the presence of the taxon on FEWAFB. As with most listing/ de-listing decisions, however, this one may be challenged in court, and Preble's may be re-instated to Threatened status in Wyoming. Future declines in Wyoming populations, or increases in threats in Wyoming, may also result in re-instatement. These are only a few of the many scenarios and information streams that managers must integrate in deciding on future monitoring efforts. It is not the intent of this report to advocate for either continuation or discontinuation of monitoring.

In the event that field surveys for suspected Preble's continue on FEWAFB, we recommend that they proceed in a standardized fashion utilizing the techniques outlined by the U.S. Fish and Wildlife Service (1999) and the transect system illustrated in Figure 2. As time and budget permit we recommend splitting trapping efforts between areas where Preble's have been reliably captured in the past (transects 1-3, 7, 12 and 16; Figure 2) to document continued presence on FEWAFB, and areas without previous captures to document local range expansion. We recognize that FEWAFB personnel may be pursuing specific projects that can be informed by trapping efforts, and that such projects may dictate where trapping takes place in any given year. Ideally, trapping should be conducted at about the same time every year, and efforts to minimize disturbance to traps should be employed. Results should be reported in the same manner every year, with special attention to reporting trapping effort as the number of net trap-nights (e.g. Beauvais and Buskirk 1999).

Pre-2006 trapping efforts were substantially affected by trap disturbance from raccoons, striped-skunks, and possibly feral cats, suggesting that depredation from such predators may

significantly limit the distribution and abundance of several mammals and birds in the riparian habitats of FEWAFB. Predator disturbance during post-2006 has remained low, and consultations with FEWAFB staff may reveal whether this was a result of active predator control or other factors. It may be prudent to continue, or initiate, such control in the future.

As one of the largest areas of occupied habitat under a single management regime within the range of Preble's mouse, FEWAFB should provide a unique opportunity to study population dynamics and habitat selection. However, the chronically low numbers of suspected Preble's captured here (Figure 3) suggests that a rather large amount of trapping effort would be needed to acquire the amount of data necessary for statistical analyses.

A more appropriate commitment of resources may be to continue monitoring *Zapus* while simultaneously attempting to improve habitat for and widen the distribution of the taxon on FEWAFB. This is the general approach forwarded by the FEWAFB management plan for Preble's meadow jumping mouse and Colorado butterfly plant (*Gaura neomexicana* var. *coloradensis*) (Grunau et al. 2004).

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TABLES

Table 1. Summary of small mammal captures along Crow Creek on F.E. Warren Air Force Base, Wyoming, August 2008. Numbers in parentheses are captures per 100 net trap-nights.

Species	Transect									Total	
	1	2	3	4	6	7	9	10	16		
Jumping mouse (<i>Zapus</i> sp.) ^a	0	10	1	0	0	1	0	0	0	12	(0.50)
Vole (<i>Microtus</i> spp.)	5	21	15	10	13	12	20	5	2	103	(4.27)
Deer mouse (<i>Peromyscus maniculatus</i>)	21	17	32	22	22	35	36	40	65	290	(12.02)
W. harvest mouse (<i>Reithrodontomys megalotis</i>)	0	0	0	0	1	0	0	0	0	1	(0.04)
Shrews (<i>Sorex</i> spp.) ^b	1	1	2	1	1	1	0	0	1	8	(0.33)
Nontarget species ^c	1	0	0	0	0	0	0	0	0	1	
Total captures	28	49	50	33	37	49	56	45	68	415	(17.2)
Raw trap-nights	300	300	300	300	300	300	300	300	250	2650	
Net trap-nights [raw -(0.5 * sprung traps)]	285.5	275	274	279	279.5	273	272	275.5	199	2412.5	

a) *Zapus* sp. here are assumed to be Preble's meadow jumping mice (*Z. hudsonius preblei*), based primarily on geographic location. Individual *Zapus* from transects 3 and 7 were unique (i.e., not recaptures of the same animal); 7 unique *Zapus* were captured on transect 2, with 3 of them re-captured once each.

b) *Sorex* spp. were identified only to genus in the field, but all trap mortalities were later keyed to dusky shrew (*Sorex monticolus*).

c) Includes only one capture of a weasel (*Mustela* spp.)

FIGURES

Figure 1. F. E. Warren Air Force Base, Wyoming. Major riparian corridors are noted. (— = base boundary).

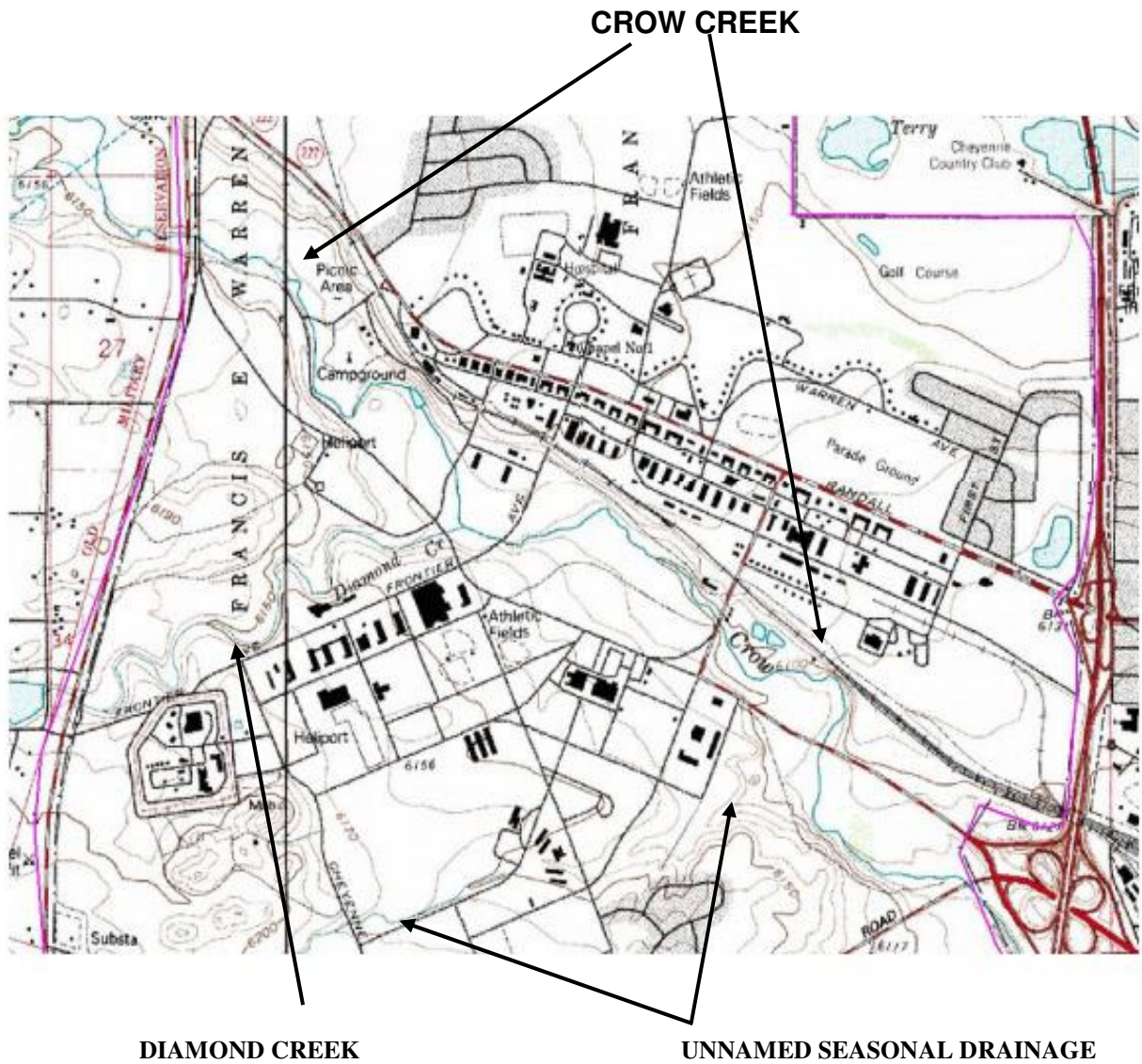
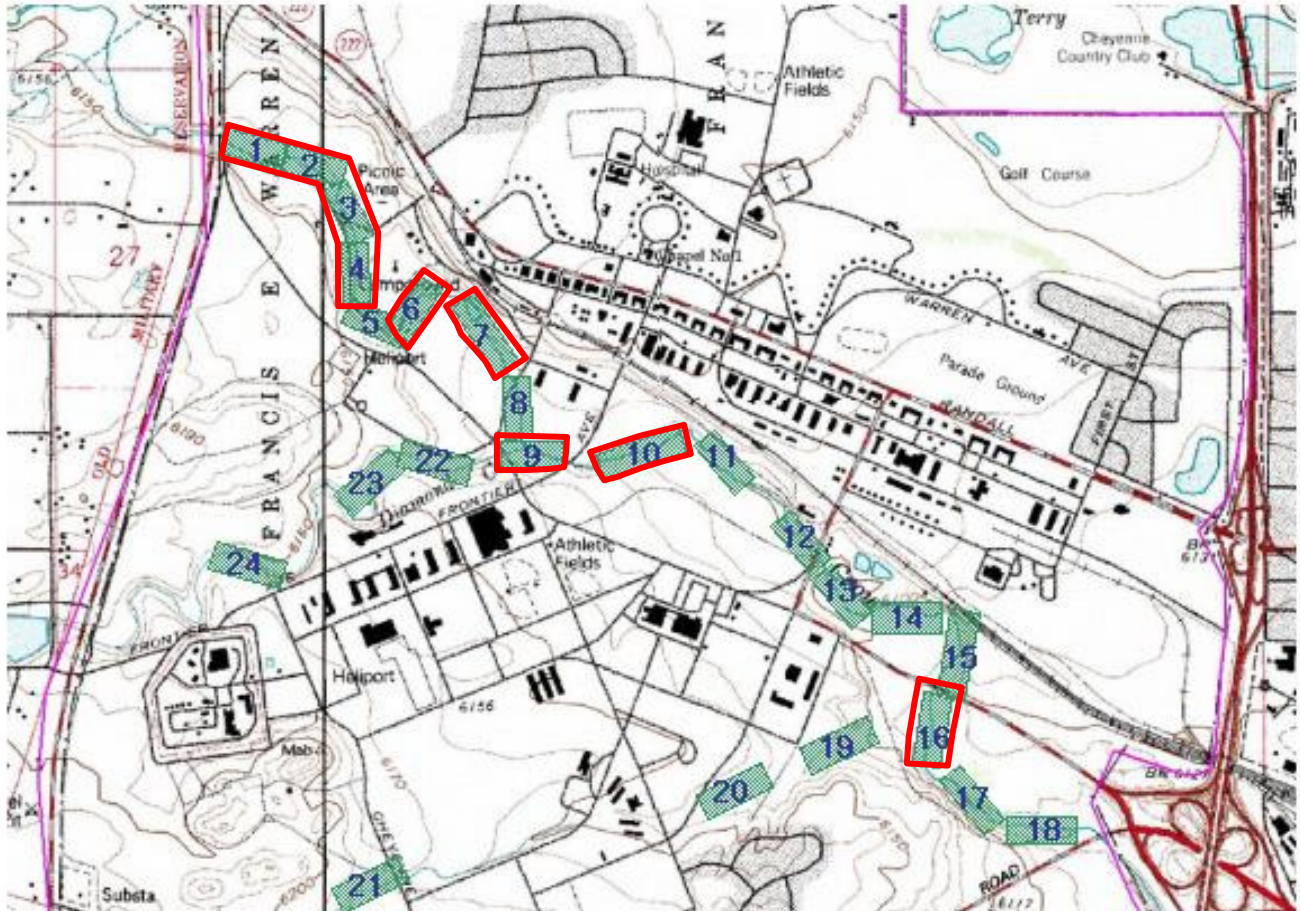


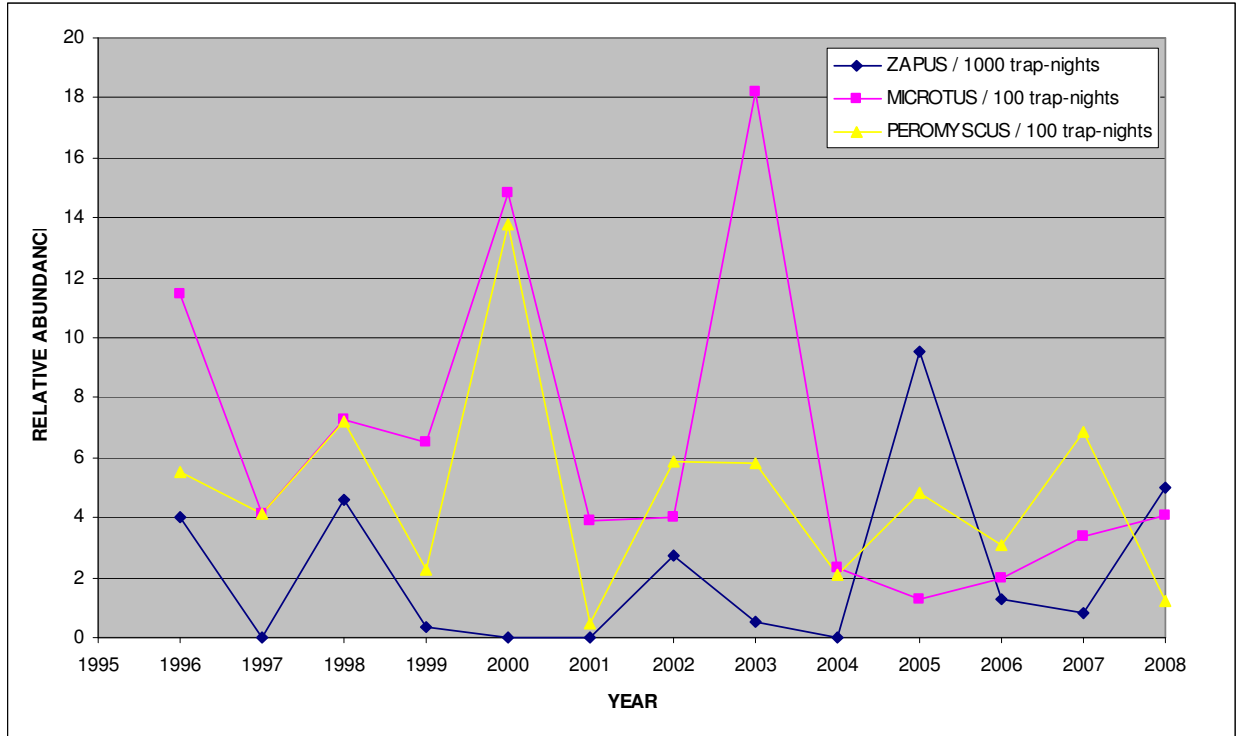
Figure 2. Distribution of survey effort and captures of suspected Preble’s mice (*Zapus hudsonius preblei*) on F. E. Warren Air Force Base, Wyoming. All numbered stream segments have been trapped in at least one year since 1995. Segments outlined in red were trapped in summer 2008. The chart below the map indicates segments where suspected *Z. h. preblei* have been captured.



Stream segment number

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1995																X									
1996	X	X																							
1997																									
1998	X	X	X				X					X													
1999							X																		
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2002	X		X																						
2003			X																						
2004																									
2005	X	X	X																						
2006	X																								
2007		X					X																		
2008		X	X				X																		

Figure 3. Trend in annual small mammal capture rates on F.E. Warren Air Force Base, Wyoming.^a



^a) Includes all years for which complete survey data are available (Schuerman and Pague 1997, Travsky 1997, Beauvais 1998, Young et al. 2000, Keinath 2001, Dark-Smiley and Keinath 2002, Beauvais 2003a, Beauvais and Gruver 2004, Beauvais and Smith 2005a and 2005b, Beauvais and Keinath 2007, Beauvais and Griscom 2008, this report). Studies of jumping mice in southeast Wyoming took place from 1993 to 1995, sometimes including F.E. Warren Air Force Base, but no *Zapus* were found here during this period and capture rates for other taxa were not reported (e.g., Compton and Hugie 1993, Garber 1995).