

## TERRESTRIAL MAMMALS OF THE NAVAL SUPPORT ACTIVITY (NSA CRANE) IN MARTIN COUNTY, AND OF THE CRANE DIVISION OF THE NAVAL SURFACE WARFARE CENTER (GLEDORA SITE) IN SULLIVAN COUNTY, INDIANA

**John O. Whitaker, Jr. and Brianne L. Walters:** Department of Ecology and Organismal Biology, Indiana State University, Terre Haute, Indiana 47809 USA

**Scott Johnson:** Indiana Department of Natural Resources, 553 East Miller Drive, Bloomington, Indiana 47401 USA

**ABSTRACT.** A total of 79 small mammals was trapped at Naval Support Activity Crane, Martin County, Indiana, including 23 short-tailed shrews (*Blarina brevicauda*), 21 least shrews (*Cryptotis parva*), 11 prairie voles (*Microtus ochrogaster*), 7 southeastern shrews (*Sorex longirostris*), 5 smoky shrews (*Sorex fumeus*), 4 meadow jumping mice (*Zapus hudsonius*), 3 white-footed mice (*Peromyscus leucopus*), 2 meadow voles (*Microtus pennsylvanicus*), 2 pygmy shrews (*Sorex hoyi*), and 1 bog lemming (*Synaptomys cooperi*). This assemblage constituted rather low abundance as related to the amount of trapping.

A total of 121 small mammals was trapped at the Crane Division, Naval Surface Warfare Center (NSWC Crane), Glendora Site, Sullivan County, Indiana, including 54 least shrews (*Cryptotis parva*), 38 prairie voles (*Microtus ochrogaster*), 11 prairie deer mice (*Peromyscus maniculatus bairdii*), 7 bog lemmings (*Synaptomys cooperi*), 6 meadow voles (*Microtus pennsylvanicus*), and 5 white-footed mice (*Peromyscus leucopus*). This assemblage constituted rather low biodiversity, probably because the area was small and of relatively uniform habitat. However, it was a very interesting assemblage as it might resemble that of drier portions of earlier prairie in this area, and it contained two species relatively uncommon in surveys, the least shrew and the bog lemming.

**Keywords:** Small mammals, Crane, Glendora, Martin County, Sullivan County, Indiana

Studies are conducted on many public properties to determine what species are present, to determine if endangered or threatened species are there, and to make management recommendations if appropriate (e.g., Whitaker 2004). Military bases may serve as natural history reserves because they are large, they are protected, and they often contain areas of natural habitat. Examples from Indiana are at Newport, Vermillion County (Veilleux et al. 1998; Vincent et al. 1998) and Camp Atterbury (mostly Bartholomew County, Whitaker et al. 2005). Some publications from bases from other states are by Brack et al. (in press, from Kansas) and by Brack & Duffy (2006, from Ohio).

Naval Support Activity Crane (NSA Crane) is large (approximately 25,900 ha) and is used for testing by the US Navy. It is in the unglaciated hill country of southern Indiana, and as such has numerous hills and ravines. Much of the area had been previously farmed and/or timbered, and most of it is currently forest.

Glendora is a much smaller property consisting mostly of a lake constructed by the Navy for various kinds of testing, and of surrounding fields (Fig. 1).

The purpose of the present studies was to accumulate information on the small mammals of NSA Crane and Glendora, and particularly to determine if endangered or threatened species were present. Species of small mammals that might reasonably be expected to occur at NSA Crane (Mumford & Whitaker 1982) are the smoky shrew (*Sorex fumeus*), pygmy shrew (*S. hoyi*), southeastern shrew (*S. longirostris*), short-tailed shrew (*Blarina brevicauda*), least shrew (*Cryptotis parva*), eastern mole (*Scalopus aquaticus*), white-footed mouse (*Peromyscus leucopus*), prairie deer mouse (*Peromyscus maniculatus bairdii*), meadow vole (*Microtus pennsylvanicus*), prairie vole (*M. ochrogaster*), woodland vole (*M. pinetorum*), bog lemming (*Synaptomys cooperi*), house mouse (*Mus musculus*), and meadow jumping mouse (*Zapus hudsonius*).

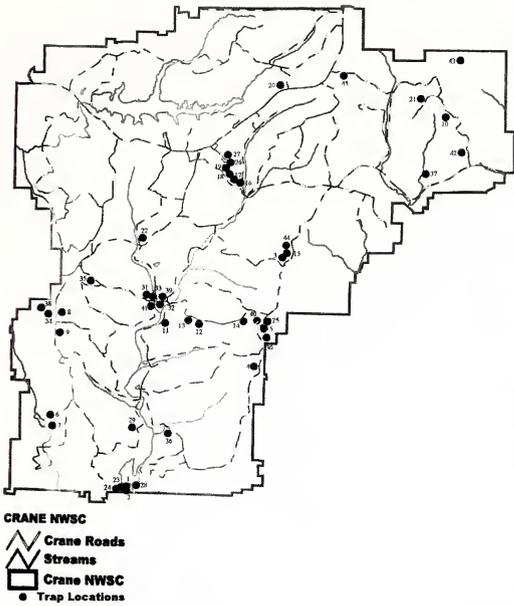


Figure 1.—Map of Crane Naval Surface Warfare Center, Martin County, Indiana. The area consists of 62,473 acres. The numbered dots are the sites of the trapping locations.

The same species would be expected at Glendora except for *Sorex hoyi* and *Sorex fumeus*, which occur only in the unglaciated hills of south central Indiana. In addition, the masked shrew would be expected at Glendora but not at Crane, as it occurs throughout the state except in the unglaciated hills.

NSA Crane includes a total of 25,900 ha in northern Martin County, Indiana (Fig. 1). NSA Crane provides a variety of weapons development, testing and manufacturing for the Navy, Army, Air Force and Marine Corps. It includes a large lake (Lake Greenwood) of about 324 ha, plus some smaller lakes (Lake Gallimore and Seed Tick Reservoir). Most of the terrestrial part of the study area is forested (7953 ha, 19,653 acres). There are a few dry grassy/weedy old fields, and isolated moist fields and a few marshy areas are also present.

The Crane Division, Naval Surface Warfare Center (NSWC Crane), Glendora Site includes a total of 187 ha, including a lake of about 36 ha, plus some smaller ponds, just northeast of Sullivan Lake, Sullivan County, Indiana (Fig. 2). It is used for testing various US Navy equipment and weapons. There is a small wooded area (about 4 ha) in the northwest corner of the property. Most of the terrestrial

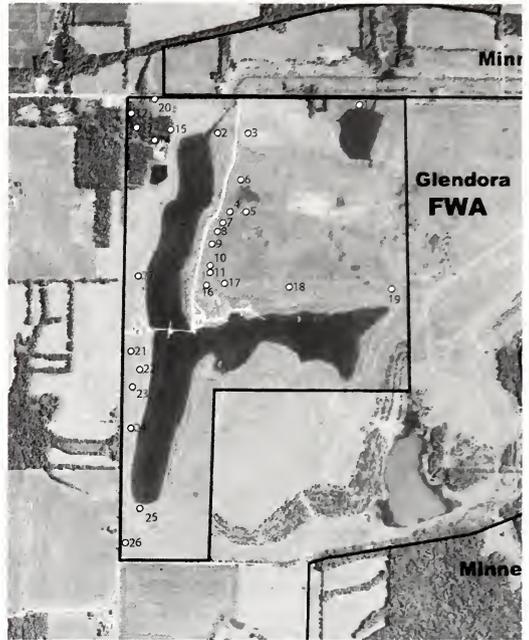


Figure 2.—Photo of the Crane Division, Naval Surface Warfare Center (NSWC Crane), Glendora Site, Sullivan County, Indiana. The area consists of 187 hectares. The numbered dots are the sites of the trapping locations.

part of the study area is composed of dry grassy/weedy old field, although isolated moist fields and marshy areas are also present. The areas, normally moist, were very dry at the time of the study.

METHODS

**Crane (Martin County).**—Small, snap-back mousetraps, rat traps, and pitfall traps (sunken cans) were used to sample the small mammals at NSA Crane. An attempt was made to sample the major habitats present, dry old field (grassy and/or weedy), moist old field, marshy areas, and wooded areas, and to trap for all of the species that might be present. Traps were set in 45 different lines (Fig. 1). The majority of the mousetrap lines contained 100 traps. Lines in the woods were directed at woodland voles, and, therefore, were set crosswise in underground burrows at the level of the floor of the burrow and covered with bark. These lines contained 45 or 50 traps. The pitfall lines contained 5, 10, or 15 sunken cans and the rat trap lines contained 12 or 13 traps per line. For comparison, data were summarized as number trapped per 100

Table 1.—Small mammals trapped at NSA Crane, Martin County, Indiana. TN = trap-nights.

	Dry field 27 lines 9200 TN	Moist field 5 lines 2000 TN	Woods 7 lines 785 TN	Pitfalls 6 lines 345 TN	Total 45 lines 12330 TN
<i>Blarina brevicauda</i>	7	3	3	10	23
<i>Cryptotis parva</i>	16	5	0	0	21
<i>Sorex longirostris</i>	0	0	0	7	7
<i>Sorex fumeus</i>	0	0	0	5	5
<i>Sorex hoyi</i>	0	0	0	2	2
<i>Peromyscus leucopus</i>	1	0	1	1	3
<i>Zapus hudsonius</i>	3	1	0	0	4
<i>Synaptomys cooperi</i>	1	0	0	0	1
<i>Microtus pennsylvanicus</i>	1	1	0	0	2
<i>Microtus ochrogaster</i>	9	2	0	0	11
Total (No/100TN)	38 (0.41)	12 (0.6)	4 (0.51)	25 (7.25)	79 (0.64)

trap-nights, a trap-night being one trap for one night.

**Glendora (Sullivan County).**—At Glendora, only snap-back mouse traps were used. Traps were set in 27 different lines in which an attempt was made to sample the major habitats present, dry old field (17 lines), moist field and marshy areas (6), and the wooded area (4). The first two lines included 191 and 155 traps, and the remainder contained 100 traps per line. Again, data were summarized as number trapped per 100 trap-nights. Observations were made of larger mammals or their sign while trapping occurred.

## RESULTS AND DISCUSSION

**NSA Crane (Martin County).**—A total of 79 small mammals of 10 species was collected at NSA Crane between 24 August and 28 October 2005 (Table 1). By order of decreasing abundance, they were *Blarina brevicauda* (23 individuals), *Cryptotis parva* (21), *Microtus ochrogaster* (11), *Sorex longirostris* (7), *Sorex fumeus* (5), *Zapus hudsonius* (4), *Peromyscus leucopus* (3), *M. pennsylvanicus* (2), *Sorex hoyi* (2), and *Synaptomys cooperi* (1).

Most of the lines (32 of 45) trapped during this work were in dry or moist open field (including marshy field). Seven lines were in woods, and six were pitfall lines in woods (Table 1).

The 27 lines in dry field yielded all of the species taken except for *Sorex fumeus*, *S. hoyi*, and *S. longirostris*. The major species in the dry old field were *Cryptotis parva* (16), *Mi-*

*crotus ochrogaster* (9), and *Blarina brevicauda* (7), *Zapus hudsonius* (3), and single individuals of *Peromyscus leucopus*, *Synaptomys cooperi*, and *M. pennsylvanicus*. The five lines in moist fields yielded *C. parva* (5 individuals), *B. brevicauda* (3), *M. ochrogaster* (2), *M. pennsylvanicus* (1), and *Z. hudsonius* (1).

The seven snap trap lines in woods yielded only one *P. leucopus* and three individuals of *B. brevicauda*. The six pitfall lines in the woods yielded five species of small mammals including *B. brevicauda* (10 individuals), *S. longirostris* (7), *S. fumeus* (5), *S. hoyi* (2), and *P. leucopus* (1).

In addition to the animals trapped, several other species were documented on the property. Eastern mole (*Scalopus aquaticus*) burrows were seen when trapping in the wooded areas. Cottontail rabbit (*Sylvilagus floridanus*) droppings were seen when trapping in the field sites. Chipmunks (*Tamias striatus*), fox squirrels (*Sciurus niger*), and gray squirrels (*Sciurus carolinensis*) were seen and heard on several occasions. A road-killed fox squirrel was collected on 21 October 2005. Coyotes (*Canis latrans*) and white-tailed deer (*Odocoileus virginianus*) were seen on many occasions. An opossum (*Didelphis virginiana*) was seen dead on the road at the north end of the property. Raccoon (*Procyon lotor*) tracks were seen on several occasions. In addition to this survey, one of the authors (SJ) supplied his data on mammals taken during radio-tracking work on bobcats (*Lynx rufus*) (Table 2).

Table 2.—Mammals trapped at NSA Crane (Martin County) by Scott Johnson between early December and early April, 1998–2005.

Species	Number trapped
<i>Didelphis virginiana</i> (Opossum)	629
<i>Procyon lotor</i> (Raccoon)	333
<i>Lynx rufus</i> (Bobcat)	62
<i>Mephitis mephitis</i> (Striped Skunk)	33
<i>Sylvilagus floridanus</i> (Eastern Cottontail)	20
<i>Canis latrans</i> (Coyote)	18
<i>Canis familiaris</i> (Domestic Dog)	2
<i>Felis catus</i> (Domestic Cat)	1
<i>Urocyon cinereoargenteus</i> (Gray Fox)	1
<i>Vulpes vulpes</i> (Red Fox)	1
<i>Sciurus carolinensis</i> (Grey Squirrel)	1
<i>Sciurus niger</i> (Fox Squirrel)	1

Many of the interesting small mammals are found in grassy fields, so the majority of our trapping occurred there. However, field habitats were rather scarce, were isolated from each other, and many were mowed. For these reasons, and probably because of the dryness, fewer mammals were trapped than expected. Also, there were no cultivated fields on the property, which is probably the reason we did not collect any prairie deer mice (*Peromyscus maniculatus bairdii*) or house mice (*Mus musculus*).

Another species that is very likely present at NSA Crane is the woodland vole (*Microtus pinetorum*). Although rather uncommon, it is usually found in soft moist soil in woods, but we found few areas of that sort on the property. Efforts to capture this species were not successful.

The number of small mammals trapped was small, possibly due to the area being rather uniformly forested. The species most commonly found in woods in southern Indiana is *P. leucopus*. We did not set traps specifically for this species, but were surprised that only three were captured, as this is probably the most common small mammal at NSA Crane. On the other hand, two species of shrews, *S. fumeus* and *S. hoyi*, first taken in Indiana in 1982 in unglaciated hill country of south central Indiana (Caldwell et al. 1983), are restricted in the state to that area (Cudmore & Whitaker 1984; Whitaker & Cudmore 1988). Crane is towards the northern edge of that area, and both species were documented during this study.

*Cryptotis parva* is seldom taken in large numbers, but surprisingly was the second most commonly taken species at NSA Crane. This was quite surprising since it is a species of the dry grasslands, and the property is mostly wooded. Likewise, *Synaptomys cooperi* is seldom taken, partly because it is not generally attracted to bait, and partly because, despite its name (bog lemming), it is usually found in dry grassy fields, especially of little bluestem. One *S. cooperi* was trapped in this survey. *Microtus ochrogaster* is the dominant vole species in dry grassy areas, and not surprisingly, was the third most abundant species at NSA Crane. On the other hand, *M. pennsylvanicus* is found in moist grassy vegetation; and only two were trapped during this study.

**Glendora (Sullivan County).**—A total of 121 small mammals of six species was collected in small mammal traps at Glendora between 23 May and 8 July. By order of de-

Table 3.—Small mammals trapped at Crane Division, Naval Surface Warfare Center (NSWC Crane), Glendora Site, Sullivan County, Indiana. TN = trap-nights.

	Old field 17 lines 5538 TN	Moist field 6 lines 1800 TN	Woods 4 lines 1200 TN	Total 27 lines 8538 TN	No/100 TN
<i>Cryptotis parva</i>	48	6	0	54	0.63
<i>Peromyscus maniculatus</i>	3	8	0	11	0.13
<i>Peromyscus leucopus</i>	0	2	3	5	0.06
<i>Synaptomys cooperi</i>	7	0	0	7	0.08
<i>Microtus pennsylvanicus</i>	0	6	0	6	0.07
<i>Microtus ochrogaster</i>	35	3	0	38	0.45
Total (No/100TN)	38 (0.69)	12 (0.67)	4 (0.33)	79 (0.93)	

creasing abundance, they were *Cryptotis parva* (54 individuals), *Microtus ochrogaster* (38), *Peromyscus maniculatus bairdii* (11), *Synaptomys cooperi* (7), *Microtus pennsylvanicus* (6), and *Peromyscus leucopus* (5).

Evidence of larger terrestrial mammal species was noted as follows. Two cottontail rabbits (*Sylvilagus floridanus*) as well as several piles of droppings were seen. Chipmunks (*Tamias striatus*) were seen on two occasions, one in the woods in the northwest portion of the area and another just outside that area across the road to the north. A coyote (*Canis latrans*) was seen in late morning on 24 May in a cornfield just west of the property. An opossum (*Didelphis virginiana*) was seen dead on the road just north of the property.

The number of species of mammals trapped was small probably due to the uniform habitat of the area, made up mostly of grassy fields with mixed forbs, and small areas of shrubby field. The only wooded portion was a few hectares in the northwest corner.

Most of the trap lines (total 21 of 27) were set in dry or moist open fields because this was by far the dominant habitat. Two lines were in marsh, and four were in woods (Table 1). The 21 lines in dry or moist fields yielded all of the species taken except for *M. pennsylvanicus* and *P. leucopus*. The major species in the dry old field were *C. parva*, *M. ochrogaster*, and *S. cooperi*, along with a few individuals of *P. maniculatus bairdii*. The two lines in a marshy field yielded all six individuals of *M. pennsylvanicus*, which is a marsh/moist field inhabitant.

The four lines in woods yielded only three *P. leucopus*. This is probably because the woods were so dry and also it was hard-packed soil. Other species that might be present but were not captured at Glendora are the meadow jumping mouse (*Zapus hudsonius*), the pine vole (*Microtus pinetorum*), the short-tailed shrew (*Blarina brevicauda*), the masked shrew (*Sorex cinereus*), and the southeastern shrew (*S. longirostris*). We were surprised not to find *Blarina brevicauda*, *S. cinereus*, *S. longirostris*, and *Z. hudsonius* in the moist areas, but this may have been because of the reduced amount and relatively isolated nature of these areas, plus the fact that even the moist habitats tended to be very dry during the study period. *Blarina brevicauda* is usually rather abundant in woods, but even the woods were very dry.

*Microtus pinetorum* is rather uncommon and is usually found in soft moist soil in woods, but we did not find soil of that sort in the study area.

*Cryptotis parva* is seldom taken in numbers, but was the most commonly taken species at Glendora. This was not altogether surprising since it is a species of the dry grasslands. Likewise, *S. cooperi* is seldom taken, partly because it is not generally attracted to bait, and partly because, despite its name, it is usually found in dry grassy fields, and often in little bluestem. *Microtus ochrogaster* is a dominant species in dry grassy areas and was the second most abundant species at Glendora. *Microtus pennsylvanicus*, on the other hand, is found in moist grassy vegetation, thus the reduced numbers. *Peromyscus maniculatus bairdii* occurs most commonly today in areas with little ground cover, primarily in cultivated fields. We have often wondered where this species occurred in the days of prairies with great amounts of vegetation. We think this species occurred sparingly because, although there was much vegetative ground cover, there were some areas with reduced vegetation.

Indiana originally contained much grassy old field habitat (prairie), and operations at Glendora have restored habitat resembling original prairie. This property may give a picture of the small mammal community of the prairies that used to be common in west central Indiana. *Microtus ochrogaster* would probably have been the dominant small mammal in the prairie environment. This species is cyclic, forming higher populations every three or four years, and we expect it was on the lower end of the cycle at the time of our study. It would be very interesting to study this community over several years to see how the various species inter-relate. *Microtus ochrogaster* and *S. cooperi* may have been the principal pure herbivores in this community, with *C. parva* being the principal carnivore. Since there is relatively little habitat of this type in Indiana, and since we think the small mammal community resembles that of drier parts of the original prairie, we recommend that the grassy nature of the area be maintained by mowing and/or fire. During this process it would also be beneficial to attempt to reduce the amount of fescue, and to increase the native grasses.

Results from the two studies can be compared. Trapping at Glendora resulted in 121 small mammals trapped in 8538 trap nights (TN), or 1.42 per 100 TN, as compared to 79 small mammals in 12,330 TN, for a total of only 0.64 per 100 TN. This difference was significant ( $\chi^2 = 31.44$ , 2 *df*).

#### ACKNOWLEDGMENTS

Our thanks go to Steven Andrews of Naval Support Activity Crane and Cloyce Hedge of the Indiana Department of Natural Resources, for support and for authorizing and arranging the projects. We also thank Tom Laughlin and Ed Nicol for help while working at Glendora, and Amy Fairbairn who assisted there with field collection.

#### LITERATURE CITED

- Brack, V., Jr. & J.A. Duffy. 2006. Bats of Ravenna Training and Logistics Site, Portage and Trumbull Counties, Ohio. *Ohio Journal of Science* 106:186–190.
- Brack, V., Jr., L.W. Robbins & C.R. Davis. In press. Bats of Fort Leavenworth Military Reservation and nearby areas of eastern Kansas and western Missouri. *Transactions of the Kansas Academy of Sciences* 00:000–000.
- Caldwell, R.S., C.K. Smith & J.O. Whitaker, Jr. 1983. First records of the smoky shrew, *Sorex fumeus*, and pygmy shrew, *Microsorex hoyi*, from Indiana. *Proceedings of the Indiana Academy of Science* 91:606–608.
- Cudmore, W.W. & J.O. Whitaker, Jr. 1984. The distribution of the smoky shrew, *Sorex fumeus*, and the pygmy shrew, *Microsorex hoyi*, in Indiana, with notes on the distribution of other shrews. *Proceedings of the Indiana Academy of Science* 93:469–474.
- Mumford, R.E. & J.O. Whitaker, Jr. 1982. *Mammals of Indiana*. Indiana University Press. 537 pp.
- Veilleux, J.P., J.O. Whitaker, Jr. & E.A. Vincent. 1998. Mammals of the Newport Chemical Depot, Vermillion County, Indiana. *Proceedings of the Indiana Academy of Science* 107:91–104.
- Vincent, E.A., J.O. Whitaker, Jr. & J.P. Veilleux. 1998. Reptiles and amphibians of the Newport Chemical Depot, Vermillion County, Indiana. *Proceedings of the Indiana Academy of Science* 107:105–113.
- Whitaker, J.O., Jr. 2004. *Mammals of Willow Slough Fish and Wildlife Area, Newton County, Indiana*. *Proceedings of the Indiana Academy of Science* 113:87–93.
- Whitaker, J.O., Jr. & W.W. Cudmore. 1988. Food and ectoparasites of shrews of south central Indiana, with emphasis on *Sorex fumeus* and *Sorex hoyi*. *Proceedings of the Indiana Academy of Science* 96:543–552.
- Whitaker, J.O., Jr., C.L. Gummer, A. Howard, W.A. Ulrey & V. Brack, Jr. 2005. Bats of Camp Atterbury in south central Indiana. *Proceedings of the Indiana Academy of Science* 114:216–223.

*Manuscript received 18 March 2006, revised 27 February 2007.*