setae. Anal opening transverse; anal papillae absent. Posterior spiracular plate (Fig. 5) at apex of posterior respiratory siphon circular with 2 spherical spiracular openings and 8 lateral interspiracular processes.

Cephalopharyngeal skeleton (Fig. 6, 7); length [illegible] mm; width [illegible] times longer than wide. Pharyngeal sclerite with dorsally projecting dorsal cornuae (DC) connected anteriorly to form dorsal bridge (DB); mandibular sclerite (M) small, lying ventral to dorsal cornuae; floor of pharyngeal sclerite with cibarial filter (CF) with 9 ridges converging posteriorly. Mandibular lobe absent.

Puparium (N=10).—Length (exclusive of posterior respiratory siphon) 4.2—5.2, 4.8 mm; width 1.8—2.7, 2.3 mm; 1.9—2.5, 2.1 times longer than wide. Total length of posterior respiratory siphon 2.2—3.5, 2.9 mm; width at base 1.0—1.7, 1.3 mm, 1.6—2.8, 2.2 times longer than wide. Body length 1.4—2.3, 1.7 times length of posterior respiratory siphon. Respiratory horn length 1.5—2.0, 1.9 mm; width 0.2 mm; 7.5—10.0, 9.1 times longer than wide; distance between respiratory horns at base 0.3 mm, 1.5—2.0, 1.7 times basal width of respiratory horn.

Puparium inflated, oval in dorsal and lateral views (Fig. 8); ventral surface flat. Transverse plicae faint. Setae fleshy, pale brown, reduced, scattered, becoming more abundant posteriorly. Frontal plate subtriangular (Fig. 9) with 4 transverse bands of spines. Dorsal plate oval (Fig. 10) with 2 respiratory horns and a ventral and dorsal band of spines which become contiguous along latera margin. Respiratory horn (Fig. 10) (RH) elongate, apical half with distinct tubercles.

The larva of *Orthonevra flukei* differs from that of *O. nitida* (Lavallee, and Wallace, J. Georgia Entomol. Soc. 9:8-15, 1974) in being shorter in length, having an additional primary sensilla ventrolaterally, and having 5 fleshy protuberances posterolaterally on the body. The puparium of *O. flukei* differs from that of *O. nitida* (Lavallee, and Wallace, J. Georgia Entomol. Soc. 9:8-15, 1974, Fig. 14, 15) in the shape of the frontal and dorsal plates and the arrangement of spines on the frontal and dorsal plates; it differs from that of *O. pulchella* (Johannsen, Mem. Cornell Univ. Agr. Exp. Stn. 177:1-62, 1935, Plate V, Fig. 58) in the shape of the dorsal plate and the arrangement of spines on the dorsal plate.

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MICROHABITAT RELATIONSHIPS OF KANGAROO RATS (*DIPODOMYS COMPACTUS* AND *D. ORDII*) IN SOUTHERN TEXAS.—Two closely related species of kangaroo rat (*Dipodomys compactus* and *D. ordii*) occur on the mainland of southern Texas. Both species are confined to the Rio Grande Plain, with *D. compactus* occurring on the eastern two-thirds of the region and *D. ordii* on the western two-thirds. Their ranges overlap in central southern Texas, and three sites of sympatry were recorded (see Baumgardner and Schmidly, Occas. Papers Mus., Texas Tech Univ., 73:1-27, 1981).

Trapping results derived from a study (conducted from November 1974 to March 1976) of the distributional and systematic relationships of these two species (Baumgardner and Schmidly, 1981) afforded an opportunity to assess their general habitat preferences across southern Texas. Preferences suggested by this survey were further investigated by intensive trapping at a sympatric locality in northwestern Jim Hogg County (13.4 mi SSE Mirando City, Webb Co., Texas; see Table 1 for sampling details). Specimens from the overall survey were captured using primarily Sherman live traps. Both trapping and hunting with .22 bird-shot were employed at the sympatric locality. No attempt was made to quantitatively determine animal densities. Habitat parameters (including vegetation type, height, spacing; soil composition, texture) were qualitatively assessed at time of capture.

Habitat at capture localities segregated into two microhabitat types. One type, referred to as disturbed, was characterized by low, sparse vegetation with friable soil. Such sites were typically root-plowed pastureland and cultivated or fallow fields. The other microhabitat type, referred to as undisturbed, had thick, bushy growth with compacted soil.

The trapping survey revealed that in eastern south Texas, where *Dipodomys compactus* was allopatric from *D. ordii*, the former occurred in both disturbed and undisturbed situations. To the west, where these species occurred in close proximity and sympatry, *D. compactus* was

TABLE 1.—*Trap regime and capture results from a locality at which* D. compactus *and* D. ordii *were sympatric. See text for exact locality.*

Trap Regime		Capture Results	
Site & Schedule	Number Trapnights	*Dipodomys compactus*	*Dipodomys ordii*
Disturbed Area			
16-17 March 1975	109	15	
16-18 July 1975	15	1	
12 October 1975	30		
3-6 November 1975	160	10	1
15-21 March 1976	264	19	2
Total	578	45	3
Undisturbed Area			
8-11 December 1975	160		5
15-21 March 1976	412		10
Total	572	0	15

consistently taken on or adjacent to disturbed sites, whereas *D. ordii* was captured on or adjacent to undisturbed rangeland and was occasionally associated with disturbed areas. Further west, where *D. ordii* was allopatric from *D. compactus*, the former occupied both microhabitats. Thus, where allopatric, these species utilize available suitable habitat; however, in regions of close proximity and sympatry, microhabitat segregation was suggested.

This apparent microhabitat discrimination was exemplified by the trapping records from the sympatric locality (Table 1). This locality included both microhabitat types. The disturbed area had previously been root-plowed, followed by burning of reinvading pricklypear cactus (*Opuntia* sp.). Compared to the undisturbed portion, the soil of the disturbed site was softer and contained several mounds of dirt. Vegetation on this site, which was low and open, consisted primarily of Christmas cactus (*Opuntia leptocaulis*), pricklypear (*Opuntia* sp.), mesquite (*Prosopis* sp.), blackbrush (*Acacia rigidula*), and scattered weeds and grasses. Brush averaged less than one meter in height and was spaced at about three to four meter intervals. The vegetation on the undisturbed portion, while similar to the previous site, was more mature and closely spaced. Average brush height was about two meters with only one to two meters separating plants.

Number of trapnights in both microhabitats was approximately 570; however, there was greater collecting effort, in the form of hunting with .22 bird-shot, on the root-plowed field. Collecting produced 45 *Dipodomys compactus* in the root-plowed field and none in the undisturbed area. Fifteen *D. ordii* were captured in the undisturbed portion and three were taken in the disturbed portion; however, the latter were captured within 10 meters of the undisturbed area in situations where both microhabitats interdigitated. The higher number of kangaroo rats in the disturbed area, relative to the undisturbed site, may be a reflection of the greater collecting effort in the former area rather than of a greater population density.

The major differences between microhabitats were in the less compacted surface soil and lower, sparser vegetation of the disturbed site. This openness might render the disturbed portion drier due to increased air flow near ground surface and possibly more accessible to predators. Beatley (J. Mamm. 57:67-93, 1976) noted these possibilities as reasons for habitat segregation of *Dipodomys merriami* and *D. microps* in southern Nevada, and she postulated that for these two species the open area was the more marginal situation.

Dipodomys compactus is in the same body size range as *D. ordii*, although it has some slightly smaller extremity and cranial measurements (Schmidly and Hendricks, Bull. Southern California Acad. Sci. 75:225-237, 1976). These smaller dimensions may be a reflection of its adaptation to the more marginal microhabitat. Kennedy and Schnell (J. Mamm. 59:45-59, 1978) observed that smaller size, relative to closely related forms, is one possible adaptation for some species of *Dipodomys* to reduced suitable habitat.

Southern Texas, where the ranges of *D. compactus* and *D. ordii* abut, could be regarded as marginal habitat for both species. Johnson and Selander (Syst. Zool. 20:377-405, 1971) postulated that in areas of range overlap of kangaroo rat species the more versatile one (defined by them as the one with the higher genic variability) inhabits the more marginal situation. Based upon the heterozygosity values given by these authors for the two species in question, the observed habitat occupancy fits the predications of their hypothesis. However, no heterozygosity values exist for the populations in the present study; thus, these results do not directly support the hypothesis of Johnson and Selander (1971).

That either species can survive in both microhabitats is evidenced by their use of these situations where they are allopatric. Evidence of microhabitat segregation where their ranges contact suggests that some form of competitive interaction is occurring. Whatever the mechanism of this interaction, it appears that *Dipodomys compactus* either selects for, or is relegated to, the disturbed situations. By doing so, further competitive interactions with *D. ordii* might be reduced, thereby allowing two similar-sized closely related kangaroo rats to inhabit the same geographic region.

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PRIOR TRAP EXPERIENCE MIGHT BIAS COYOTE RESPONSES TO SCENT STATIONS.—Scent-station lines have been used since 1972 to determine the relative abundance of coyotes (*Canis latrans*) throughout the western United States (Linhart and Knowlton, Wildl. Soc. Bull. 3:119-124, 1975; Bean and Roughton, U.S.D.I. Fish and Wildl. Serv., Pocatello Supply Depot, Pocatello, ID, 123 pp., 1980). Linhart and Knowlton (1975:119) noted that scent station "indices (like most direct counting methods) were subject to such variables as the characteristic non-random distribution of wild canids, varying seasonal or regional movements and behavior patterns, and other factors including age, sex, weather, food supply, and the influence of habitat." In addition, we hypothesized that response rates among coyotes previously trapped and released might be negatively biased because coyotes were seldom retrapped during capture-recapture experiments. This paper describes a test of our hypothesis.

The study area included the Welder Wildlife Refuge (WWR) and adjacent ranches located approximately 50 km north of Corpus Christi, Texas. The area was characterized by mixed mesquite, live oak-shrubland interspersed with areas of climax coastal prairie grassland. We operated scent-station lines, following two years of intensive study of coyote social organization, on the 32 km^2 WWR and on two ranches adjacent to and on opposite sides of the WWR. The vegetation, and livestock management, and relative lack of coyote exploitation on the adjacent ranches was similar to that on the WWR. Coyotes occupied almost all areas of the WWR and appeared to be evenly distributed (Andelt, unpubl. Ph.D. dissert., Colorado State Univ., Fort Collins, 1982). Based upon the even distribution of coyotes on the WWR, and similarities in vegetation and management between the WWR and adjacent ranches we believed that coyote densities were similar.

Nineteen coyotes that were trapped, radio instrumented, and released primarily on the western half of the WWR represented approximately 50% of the intensively trapped population during this study. We believe that no more than one or two coyotes with previous trap experience, as determined by radio telemetry, were present on the adjacent ranches. On 10-14 November 1979, after an elapsed time of 73 to 686 days ($x = 402$, $SD = 234$) since the most recent capture of individual coyotes, seven scent-station lines with 10 stations each were set on the WWR, and 6.5 lines were set on the two ranches. The scent stations were placed at 0.5 km-intervals and were operated for four consecutive nights.

We obtained a significantly lower visitation rate ($P < 0.025$) on the WWR than on the adjacent areas (Table 1). In addition, a comparison of visitation rates on the western and eastern portions of WWR suggested a lower, but non-significant, response rate where 16 coyotes (approximately 80% of the population) had previous trap experience than where only three coyotes (approximately 20% of the population) had prior trap experience (Table 1). Since coyote scat deposition rates were similar on eastern and western portions of WWR from November 1978 to May 1979 (278 and 253 scats collected from equal lengths of road on eastern and western portions, respectively), we surmise coyote densities were similar.

Our data suggest that unpleasant experiences, such as being trapped, reduce scent station visitations by coyotes. These results will not surprise individuals who have attempted capture-recapture experiments with coyotes. Our efforts have consistently produced low recapture rates.

TABLE 1.—*Indices of coyote abundance in relation to the relative number present with prior trap experience.*

	Estimated % Coyotes Trapped	N Scent Station Lines	N Operative Scent Station Nights	N Coyote Visits	Index	P[a]
ON WWR						
Western	80	3	117	16	137	
Eastern	20	3	115	28	243	>0.10
Central[b]	—	1	38	14	368	
Total	50	7	270	58	215	
ADJACENT AREAS	5	6.5	259	106	409	<0.025

[a] Probability determined with the Wilcoxon two-sample test (Sokal and Rohlf, W. H. Freeman and Co., San Francisco, 1969) with 10-station lines as samples.

[b] This 10-station line was marginal to intensively trapped and moderately trapped portions of the WWR.

We have no specific data on the persistence of the effects of negative reinforcement from trapping, but an affect exceeding one year is implied. This does not seem unrealistic since Gustavson et al. (Science 184:581-583, 1974) and Olsen (unpubl. M.S. thesis, Colorado State Univ., Fort Collins, 1975) reported lithium chloride produced aversions in coyotes lasting two to seven months and Linhart et al. (Proc. 7th Vert. Pest Conf. 7:302-306, 1976) claimed electric shock induced aversions in coyotes lasting three to nine months. In one isolated experience, a radio-instrumented coyote defaced a new trap site on six consecutive nights, without getting caught, eight months after initial capture.

In most instances, trapped coyotes are removed and pose few interpretive problems for scent station indices. In instances where individual animals are trapped and released, for example when relating scent station indices to known densities of coyotes, we suggest the scent-station indices be obtained before the animals are trapped, especially if density estimates are to be obtained by some trap, release, and "recapture" technique.

Another use of scent-station surveys might be to relate coyote densities to coyote management practices. Beasom (J. Wildl., Mgmt. 38:854-859, 1974) showed that coyotes infiltrate areas of intensive predator control from adjacent areas. Following years of persistent trapping, the percentage of coyotes that avoid traps might increase. If the coyotes that avoid traps also avoid scent stations, stations placed in areas of persistent predator trapping activities might provide lower visitation rates than otherwise expected.

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SUMMER USE OF ABANDONED MINES BY THE CADDO MOUNTAIN SALAMANDER, *PLETHODON CADDOENSIS* (PLETHODONTIDAE), IN ARKANSAS.—The Caddo Mountain salamander, *Plethodon caddoensis*, is endemic to the Novaculite Uplift area of the Ouachita Mountains in Polk and Montgomery counties, Arkansas. The species is generally restricted to north-facing slopes which are cooler and wetter and support more mesic vegetation than south slopes (Palmer, J. Arnold Arboretum, 5:108-134, 1924; Pope and Pope, Bull. Chicago Acad. Sci. 9:129-152, 1951). Spotila (Ecol. Monogr. 42:95-125, 1972) found that this species has a relatively high rate of dehydration and survives hot dry summers by burrowing deep beneath the surface of talus-covered slopes. During the course of continuing investigations of abandoned mines in the Ouachita Mountains, we discovered large aggregations of Caddo Mountain salamanders in two mines during the months of June through September, 1983. These mines (Sugarstick Mine—T4S, R29W, S6 and Twin Mine—T3S, R30W, S27) are both located in Polk County, Arkansas.