lation structure, including age structure and habitat usage, we recommend a combined approach using extensive summer rock turning, bank searches focused on appropriate cobble piles adjacent to large rock areas, and limited trapping in areas of deeper water, or where unliftable substrate renders other search methods impossible.

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Relative Efficacy of Three Different Baits for Trapping Pond-dwelling Turtles in East-central Kansas

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The diverse array of collection methods used to sample freshwater turtles (e.g., Gibbons 1990; Glorioso and Niemiller 2006; Plummer 1979; Vogt 1980) do not necessarily provide equivocal results in ecological studies of freshwater turtles. Using different methods may significantly influence estimates of abundance, sex ratio, and population/community structure (Frazer et al. 1990; Gamble 2006; Ream and Ream 1966; Thomas et al. 1999). Frazer et al. (1990) argued that studies designed to compare different methods of capturing turtles were needed to ensure that the results of ecological studies accurately reflect reality.

Baited funnel traps of various designs are commonly used to sample freshwater turtle populations/communities, using a variety of baits (see Gibbons 1990; Kennett 1992; Plummer 1979). We are aware of three published studies that attempt to quantitatively compare the effectiveness of different baits on the capture rate of freshwater turtles (Ernst 1965; Jensen 1998; Voorhees et al. 1991). We experimentally examined the effectiveness of three types of bait in funnel traps to capture *Trachemys scripta elegans* and *Chrysemys picta bellii*. The baits selected were canned creamed corn (*Zea mays*), canned Jack Mackerel (*Trachurus symmetricus*), and frozen fish (*Pomoxis annularis* or *Lepomis cyanellus*); these baits were selected because they were commonly used in previous studies.

Methods.—Rectangular frame nets (65 × 90 cm frame covered with 3.8 cm treated nylon mesh; Nichols Net & Twine Inc.) were used to capture Red-eared Sliders (*T. s. elegans*) and Western Painted Turtles (*C. p. bellii*) in a complex of eight manmade ponds (pond sizes ranged from 0.2–9.6 ha) located on or within 2.5 km of Emporia State University's Ross Natural History Reservation (RNHR; Spencer 1988) near Americus, Kansas, USA (38.49491°N, 96.33540°W; NADS 1983). Three frame nets were set in each of the eight ponds (total = 24 frame nets). Baits were placed in perforated PVC tubes so that turtles could detect but not consume baits. The three frame nets within each of the eight study ponds were baited either with canned creamed corn, canned jack mackerel, or frozen fish (i.e., each of the three frame nets within a single pond were baited with a different bait). The initial assignment of bait type to the three frame nets within a pond was random. Thereafter, frame nets were checked daily and the position of the PVC tubes containing the different baits systematically rotated daily among the three frame nets. The purpose of systematically rotating the baits among the three traps within each pond was to equally distribute the possible influence of differences in capture rates between specific trap locations within a given pond. Baits were removed from the perforated PVC tubes and replenished with fresh bait every other day.

Frame nets were set in 1–3 ponds/day over the 5 d period that began 14 May 2007. We reversed this staggered schedule for removal of frame nets at the end of the 13 d study period to maintain an approximately equal number of trap hours in all ponds. Thus, all ponds were sampled continuously for a total of 13 d with substantial temporal overlap of the trapping schedules (i.e., all trapping conducted from mid- to late May). There were 3 traps/pond for 13 d in eight ponds (overall, 7488 trap hours summed across all three baits, 2496 trap hours/ bait, 936 trap hours/pond, and 312 trap hours/pond/bait).

All *C. p. bellii* and *T. s. elegans* captured were uniquely marked using the system described by Cagle (1939). We considered all captures (original captures and recaptures) as independent in statistical analyses.

Trap success may have been influenced by inherent site-specific variation among the eight ponds and/or the temporal variation that may have resulted from slight differences in the precise trapping schedules among sites. Because of possible site-specific variation, we used Analysis of Variance (ANOVA) within a randomized block design to compare the mean number of turtles (of each species) captured with each of the baits during the 13 d study period. Blocking designs are desirable in such situations because they increase the precision of the model by removing one source of known (or suspected) variation (e.g., inherent site-specific variation in capture rates among ponds) from experimental error (Peterson 1985; Sokal and Rohlf 1995). The eight study ponds were considered as blocks, the different baits were the treatments, and mean number of turtles (i.e., either *C. p. bellii* or *T. s. elegans*) captured/pond with each of the three baits served as the response variable. Separation of means was accomplished using Fisher's Protected Least Significant Difference (LSD; Peterson 1985) and alpha was set at 0.05 in all statistical tests.

Results.—We captured 93 (69 original captures + 24 recaptures) *C. p. bellii* and 81 (50 original captures + 31 recaptures) *T. s. elegans* during the 13 d study period. We captured *C. p. bellii* in all ponds and caught *T. s. elegans* with one or more of the baits in all but one pond. Therefore, we excluded this pond from the analyses for *T. s. elegans*. We observed a significant bait effect for both species (*T. s. elegans*: F = 5.25; d.f. = 2, 12; P = 0.023; $R^2 = 0.69$; *C. p. bellii*: F = 4.73; d.f. = 2, 14; P = 0.027; $R^2 = 0.75$). We captured significantly more *T. s. elegans* in frame nets baited with frozen fish than with creamed corn, but observed no significant difference between frozen fish and canned mackerel or between canned mackerel and creamed corn (Fig. 1A). Mean separation procedures for *C. p. bellii* revealed that both canned mackerel and frozen fish were significantly more effective than creamed corn but canned mackerel and frozen fish were not significantly different from each other (Fig. 1B).

Discussion.—We concluded that both canned mackerel and frozen fish were significantly "better" than creamed corn for attracting these two species to frame nets. First, we discuss several potentially confounding factors that are known to influence capture rates. For example, captured females may serve as an additional enticement for males to enter nets (Frazer et al. 1990; Jensen 1998; Thomas et al. 1999). However, we did not observe unusually large numbers of males within traps containing females (see Jensen 1998), and we see no reason to expect that the particular food bait within a trap would alter the attractiveness of a female within that trap. Therefore, the influence of this factor should have been equal across all three baits. Likewise, individual turtles sometimes exhibit so-called "trap-happy" or "trap-shy" behaviors (Deforce et al. 2004; Koper and Brooks 1998). But, we do not think that the observed differences were an artifact of such behaviors. First, because of the short duration of our study period many individuals were never recaptured (i.e., captured only once) and most of those that were recaptured were recaptured only once. Second, turtles were not rewarded for entering a trap (i.e., not allowed to consume the baits) and the bait tubes were systematically rotated every day among the three traps within each pond. Therefore, we have no reason to expect the propensity for "trap-happiness" or "trap-shyness" to have differed among the three baits. Therefore, the influence of such behaviors (if any) should have been equal across all three baits.

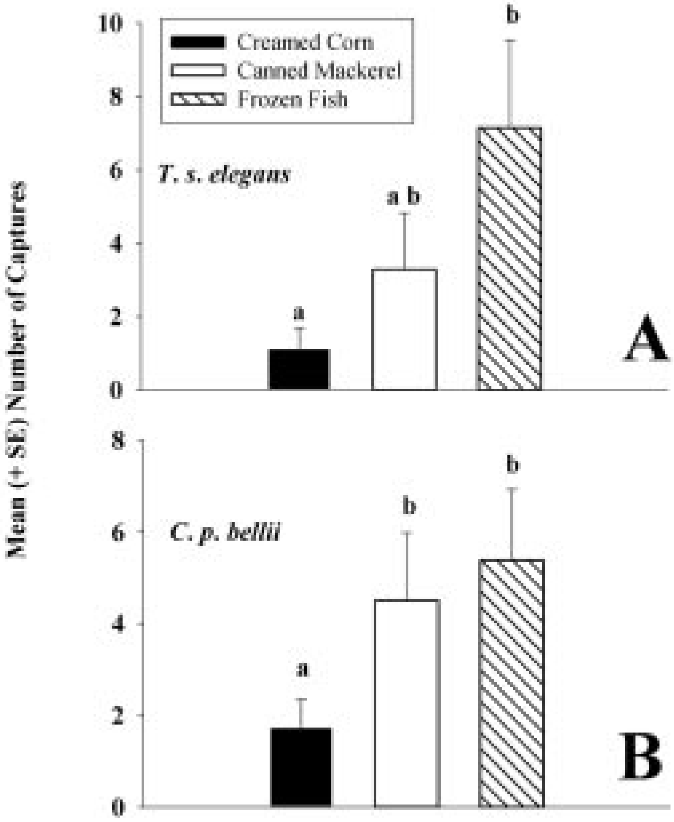

FIG. 1. Mean (+ SE) number of turtles captured/pond during 13 days of trapping (A = *Trachemys scripta elegans*; N = 7 ponds; B = *Chrysemys picta bellii*; N = 8 ponds) with canned creamed corn, canned mackerel, and frozen fish. Means sharing the same lower case letter were not significantly different (Fisher's Protected LSD; $\alpha = 0.05$).

Consistent with previous studies, we found that using different baits sometimes resulted in differences in capture rates. But various factors limit our ability to directly compare our results with those of previous studies. For example, the three published studies (Ernst 1965; Jensen 1998; Voorhees et al. 1991) were conducted in different geographic locations and/or habitats, sometimes used different baits, and/or involved different species. Our study was conducted in manmade ponds located within a small portion of east-central Kansas and we cannot necessarily assume that our results are applicable across the relatively large geographic distributions of these species. We examined three commonly used baits but there are a large number of baits that have been used as bait in funnel traps. Currently, nothing is known with respect to the relative effectiveness of most of these baits. Likewise, the potential for seasonal, sexual, and ontogenetic variation in the effectiveness of particular baits deserves further consideration.

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A Simple Pitfall Trap for Sampling Nesting Diamondback Terrapins

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The Diamondback Terrapin *(Malaclemys terrapin)* is an estuarine turtle inhabiting coastal salt marshes from Massachusetts to Texas (Ernst et. al. 1994). Previous data on nesting Terrapins have primarily been collected via visual searches during peak nesting activity (Feinberg and Burke 2003; Roosenberg 1996; Roosenberg and Dunham 1997). Although effective, this method is time consuming, requires a reasonably large population, and sometimes requires numerous volunteers. Many of these studies occurred along the Atlantic Coast where nesting beaches are located on the mainland. This has allowed researches to easily access nesting beaches to conduct visual searches for terrapins. Nesting beaches in the Northern Gulf of Mexico, however, are located almost exclusively on islands (D. H. Nelson, pers. comm.), making nesting beaches accessible only by boat. Boat travel results in increased travel time and thus decreased searching time for nesting Terrapins. To complicate matters, nesting beaches in the northern Gulf Coast are usually small and widely distributed, making typical nesting surveys almost impossible to conduct (Nelson et. al. 2005). Unlike Atlantic coast nesting beaches, beaches in Alabama are largely composed of oyster shells, which prevents locating turtles and their nests via female crawls (a method used in Feinberg and Burke 2003). Given these atypical nesting conditions, we decided that a passive trapping method would be more appropriate for capturing Terrapins on local nesting beaches.

Initial efforts with pitfall traps constructed from Christiansen and Vandewalle (2000) fell short of our expectations. These traps did not hold up to the demands of the estuarine environment (e.g., saltwater, winds). Specifically, the wooden lid and metal rod degraded quickly, rendering the trap non-functional. Furthermore, 5-gallon buckets did not seem to provide suitable space for trapped terrapins to maneuver. We used the Christiansen and Vandewalle (2000) design as a starting point and began experimenting with various modifications of their design. Herein, we describe the