TEMPERATURE TESTS FOR DIURNAL LIVE TRAPPING SHADE CONFIGURATIONS

HOWARD O. CLARK, JR.,[1] H. T. Harvey & Associates, 7815 North Palm Avenue, Suite 310, Fresno, CA 93711-5511, USA.

DARREN P. NEWMAN, H. T. Harvey & Associates, 7815 North Palm Avenue, Suite 310, Fresno, CA 93711-5511, USA.

CHARLES J. RANDEL, III, Sapphos Environmental, Inc., 430 North Halstead Street, Pasadena, CA 91107, USA.

MARC D. MEYER, H. T. Harvey & Associates, 7815 North Palm Avenue, Suite 310, Fresno, CA 93711-5511, USA.

ABSTRACT: Diurnal live trapping in desert environments requires thermal protection from high temperature extremes. However, internal trap temperatures under cardboard shades have not been reported in the literature. We tested 3 shade designs commonly used by biologists during diurnal trapping: two A-frame designs with different cardboard colors, brown and white, and a cardboard box tube. Trap shade treatments were tested from 21 April to 7 July 2007 with temperatures (°C) recorded hourly with a datalogger. There was no difference in internal trap temperatures between the shade configurations when ambient air temperatures reached approximately 30°C, but as the trapping season progressed, residual heat stored in the desert landscape led to higher internal live trap temperatures.

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Diurnal trapping for rodent species in desert ecosystems typically involves the use of Sherman live traps (7.5 x 9.5 x 30.5 cm; H.B. Sherman Traps, Tallahassee, FL) placed in grids or linear transects and covered with a cardboard A-frame shelter or equivalent non-metal structure to provide shade. The covers are especially critical during the summer months when daytime temperatures can be extremely high. Hourly temperature monitoring at each grid site during trapping is usually required by the California Department of Fish and Game (2003).

There are no published reports of the microclimate temperatures within traps under cardboard shelters, as described in some diurnal live trapping protocols (e.g., California Department of Fish and Game 2003). Critical attention must be given to ambient air temperature during diurnal live trapping of desert rodents to prevent heat stress and heat-related mortality of captured individuals. Once daytime temperatures reach a critical point, diurnal mammal activity patterns adjust in order to compensate, but for animals sequestered inside a trap, temperature coping behaviors are limited (Drabek 1973, Schwanz 2006, Vispo and Bakken 1993). Here we present our results of microclimate temperatures within 3 different shade treatments.

METHODS AND MATERIALS

We established a transect with 3 traps under different shade treatments in a Mojave creosote scrub community (Holland 1986), 10 km northwest of Hesperia, San Bernardino County, California (34° 29' 30" N, 117° 25' 45" W, NAD83/WGS84; 990 m). We placed shade treatments in areas of comparable vegetative cover and shade regimes. Two shade treatments were A-frame cardboard shelters, one white and the other brown, made from standard corrugated cardboard measuring 60 x 90 cm. We folded the cardboard pieces in half to form an isosceles triangle and secured the edges by folding the outside 10 cm of cardboard upward and placing sand and rocks on the upper surface to hold the shades in place. The third shade treatment was a 60 x 90 cm brown cardboard piece folded into a rectangular, open-ended box that surrounded the trap's four sides. We secured the box shelter by driving wooden lath stakes along 2 sides.

We centered each trap within the shelters in a north-south orientation of the long axis using a standard military grade lensatic compass (Stocker and Yale, Inc., Beverly, MA) with the declination compensated 13.5° west with the entrance of each trap closed and facing north. We positioned a Hobo® datalogger (Onset Computer Corp.,

[1] hclark@harveyecology.com

Bourne, MA) within each trap. We programmed the dataloggers to record an hourly temperature until the end of the trapping season. We placed a fourth datalogger as a control within a goldenhead shrub (*Acamptopappus* spp.) to collect the ambient air temperature within a shade microhabitat.

We used a one-way, model I ANOVA to test the null hypothesis that internal trap temperature was similar among trap shade treatments when ambient temperature was between 30 and 34°C; 32°C is the ambient temperature at which traps must be closed according to some protocols (e.g., California Department of Fish and Game 2003) to avoid heat-related injury to desert rodents. Data for this analysis were evaluated for normality with the Kolmogorov-Smirnov test and for homoscedasticity with Levene's test (Zar 1999).

We used a linear regression to evaluate the relationships between spring calendar date (21 April to 7 July 2007) and internal trap temperature. We conducted this test to examine whether variation in internal trap temperature increased as the trapping season progressed from mid-spring to early summer. We evaluated regression variables for normality, homoscedasticity, and independence of residuals. For all analyses, we used only a single internal trap temperature value for each trapping date (selecting the value that was closest to 32°C) in order to maintain independence among samples. All analyses were conducted with Statistica 6.0 (StatSoft Inc., Tulsa, OK) using an α level of 0.05.

RESULTS

Each datalogger collected 1,534 temperatures from 21 April to 7 July 2007 (76 consecutive days). There was no difference in internal trap temperature among the three shade treatments ($F_{2,191}$ = 0.091, P = 0.913). There was a weak positive relationship between calendar date and internal trap temperature (β= 0.040 ± 0.067 [SE], $F_{1,62}$ = 5.752, R^2_{adj} = 0.070, P < 0.001). Figure 1 is an X-Y scatter of diurnal ambient control temperature in °C versus shade treatment temperature. Ambient temperature and internal trap temperature under the cardboard shade were similar during temperatures between 5°C and 20°C. However, when the diurnal ambient temperature was higher than 30°C, the temperature within the cardboard-covered trap varied +/- 10°C. Points above the regression line were typically recorded during the latter part of the season, and points below the regression line were recorded during the early part of the season.

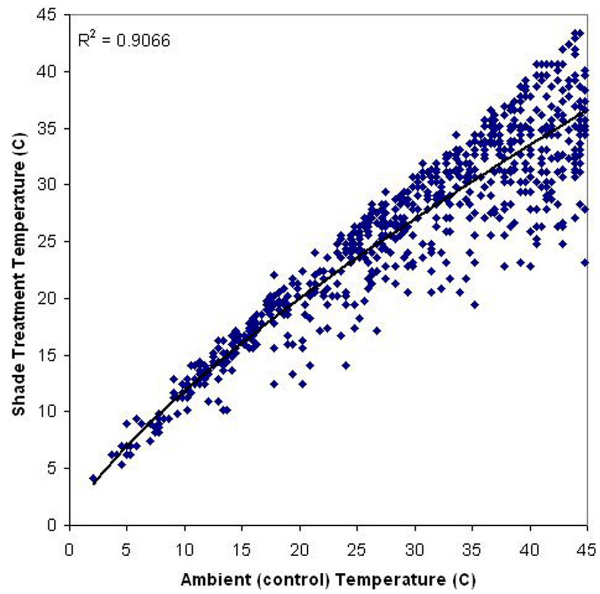

Figure 1. X-Y scatter of ambient control temperature versus shade treatment temperature. Nighttime temperatures were excluded; times included range from 0600 to 1800.

DISCUSSION

We found no significant difference in microclimate temperature between the configurations: white and brown A-frame cardboard shades, and a brown cardboard box tube. Our analysis of the microclimate temperatures within traps under cardboard shades suggests these shelters are fairly effective in reducing internal trap temperatures during late season, hot midday periods; however, internal trap temperature variation increased as the season progressed. During April and May, the internal microclimate had a low average of 28.5°C, and during June and July, the microclimate had a high average of 31.5°C. Higher trap temperatures observed throughout the season suggest accumulative residual heat stored in the substrate and released throughout the night, in which the shades had little influence. Daytime heating of the trap occurred much faster under these conditions and potentially provides more risk of heat stress to captured individuals.

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