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Evaluation of the rate of artificial coverboard use by the salamander, Plethodon cinereus, in the vicinity of natural cover objects

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Evaluation of the rate of artificial coverboard use by the salamander, *Plethodon cinereus*, in the vicinity of natural cover objects

Artificial cover objects (ACOs) can be effective tools for assessing the relative abundance of salamanders, and for monitoring salamander populations (Davis 1997; Fellers and Drost 1994; Houze and Chandler 2002), particularly Red-backed Salamanders, *Plethodon cinereus* (Carfioli et al. 2000; Grover 2006). In several studies, the number of salamanders, including Red-backed Salamanders, or amphibians has been shown to increase with increases in natural cover objects (NCOs) such as coarse woody debris (CWD) (e.g., Grover 1998; Hicks and Pearson 2003; Morneault et al. 2004; Young and Yahner 2003), although this relationship can vary depending on the quality of the CWD (e.g., McKenny et al. 2006). In addition, ACOs have been shown to allow *P. cinereus* to exist in areas, such as meadows and pastures, that lack NCOs (Riedel et al. 2008). In some populations, relatively few NCOs are occupied by Red-backed Salamanders (Richmond and Trombulak 2009). Thus one might expect that the efficacy of ACOs may be influenced by the proximity of ACOs to NCOs. We investigated if the number of Red-backed Salamanders found under an ACO is influenced by the number of natural cover objects (NCOs) located near the ACO. In addition, we examined whether the size of salamanders differs between ACOs and NCOs.

This study was conducted in the Denison University Biological Reserve in Granville, Licking County, Ohio on three sampling dates in late March and early April 2008. We used coverboards (ACOs) measuring 61 by 30 cm by 5 cm located in a deciduous woods. Coverboards had been in place for six years prior to this study. We measured the dimensions of the three closest natural cover objects (NCOs), including both logs and rocks, and measured their distance from each respective coverboard. We counted and then measured the SVL (to nearest mm) of all salamanders found under both ACOs and NCOs. For analyses we used the mean number or SVL of salamanders found under each cover object across all three sampling dates. For some analyses, we also corrected for the size of the cover objects by dividing the number of salamanders found under a cover object by the area of the cover object. We used paired t-tests to compare numbers of salamanders and SVL between ACOs and NCOs. We also used linear regression to examine the relationships between the number of salamanders under ACOs and the mean distance to the nearest NCOs, between the mean number of salamanders beneath ACOs and NCOs, and between the mean size of salamanders under ACOs and NCOs. Pairs of NCOs and ACOs with no salamanders were not included in the analyses.

Significantly more salamanders were found beneath ACOs (0.66 ± 0.096) than NCOs (0.29 ± 0.096) ($t_{30} = 3.80$, $P = 0.0007$). When the number of salamanders found per cover object was corrected for the area of the cover objects, there was no significant difference in the number of salamanders under each cover object type (ACO: 0.0004 ± 0.0002; NCO: 0.0006 ± 0.0002; $t_{30} = 1.57$, $P = 0.13$). Salamander size did not differ between ACOs (3.30 ± 0.26 cm) and NCOs (3.17 ± 0.26 cm) ($t_{10} = 0.49$, $P = 0.63$).

The number of salamanders per coverboard was positively related to the distance to the nearest NCOs (mean number of salamanders under ACO = 0.28 + 0.005mean distance to NCOs; $N = 37$, $r^2 = 0.15$, $P = 0.017$). The number of salamanders under ACOs was positively related to the number of salamanders under nearby NCOs (mean number of salamanders under ACOs = 0.44 + 0.42mean number of salamanders under NCOs; $N = 38$, $r^2 = 0.13$, $P = 0.026$). There was no relationship between the mean size of salamanders under an ACO and the mean distance to the

nearest NCOs ($N = 26$, $r^2 < 0.001$, $P = 0.99$). There was no relationship between the mean size of the salamanders under ACOs and the mean size of the salamanders under nearby NCOs ($N = 11$, $r^2 = 0.08$, $P = 0.39$).

Taken together, our results suggest that ACOs are effective at sampling Red-backed Salamanders, with more salamanders tending to be found under ACOs than NCOs, although this is in large part due to the larger area of the ACOs than the NCOs. Moore (2005) also found that the number of Red-backed Salamanders was related to the area of the cover object. In addition, we found that ACOs were used by more salamanders when the distance to the nearest NCO was greater, suggesting that ACOs may be more useful at detecting salamander presence or absence in areas with fewer or less dense NCOs. However, we also found a significant relationship between the number of salamanders under ACOs and nearby NCOs, suggesting that estimates of the relative abundance of the salamanders based on ACO and NCO surveys are likely to provide qualitatively similar results.

We also found that the size of *P. cinereus* found under ACOs and NCOs did not differ. This is similar to the results of previous studies (Houze and Chandler 2002; Marsh and Goicochea 2003; Monti et al. 2001; Richmond and Trombulak 2009). However, there may be concerns when juveniles are considered (e.g., Marsh and Goicochea 2003). These results suggest that ACOs likely provide a reasonable estimate of population size structure, at least for adult salamanders.

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