Scavenging along an ecological interface: utilization of amphibian and reptile carcasses around isolated wetlands

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Abstract. Scavenging is an influential ecosystem process, providing many weak, but stabilizing food web links. Amphibians and reptiles (i.e., herpetofauna) utilize land/water interfaces and can have large biomasses concentrated here, making them important vectors of nutrients between aquatic and terrestrial systems and a valuable resource to scavengers. There are limited data on the fate of herpetofauna carrion, and thus, it is unknown how such carcasses are incorporated into food webs or how habitat and carcass characteristics influence which scavengers acquire these resources. We used camera traps to determine the proportion of experimental amphibian and reptile carcasses (lizards, salamanders, frogs, and toads) scavenged by vertebrates and invertebrates in two different habitats (wetland and upland) during the spring in the southeastern USA. Vertebrates removed 19.8% of all herpetofauna carcasses in both habitats, with the remaining carcasses removed by invertebrates (80.2%). We used log-linear models to evaluate the impact of habitat and carcass type on scavenging. We determined that habitat, but not carcass type, was influential in determining whether a vertebrate or invertebrate scavenged a carcass, with vertebrates able to scavenge more carcasses in wetland than in upland areas. In less than two days, 86.2% of all carcasses in both habitat types were completely scavenged, and carcasses in wetlands were removed more quickly, suggesting intense competition between vertebrates and invertebrates. Additionally, we observed low vertebrate scavenger richness, which we attribute to high invertebrate activity in the spring and the small size of the herpetofauna carcasses (<100 g). We identified the scavenging pathways along which herpetofauna are incorporated into the food web and the factors that influence those pathways, suggesting the large extent and spatial scale of this resource’s influence on food web connections and consequently food web and ecosystem stability.

Key words: ants; beetle; carrion; frog; herpetofauna; invertebrate; lizard; opossum; raccoon; salamander; scavenger; toad.

INTRODUCTION

Carcasses located along ecological interfaces (e.g., riparian areas and beaches) have been recognized as important sources of nutrients within those ecosystems (Cederholm et al. 1999, Huijbers et al. 2013, 2016, Schlacher et al. 2013, Brown et al. 2015). This research accompanies growing recognition for the amount of necromass processed by scavengers and the prevalence of facultative scavenging across vertebrate species (Putnam 1983, DeVault et al. 2003, Wilmers et al. 2003, Wilson and Wolkovich 2011, Mateo-Tomàs et al. 2015). Incorporating scavenging into food webs...
establishes a number of links that connect predators to the detrital pool, which in theory contribute to the overall stability of food webs (DeAngelis et al. 1989, McCann et al. 1998, Wilson and Wolkovich 2011, Moleón et al. 2014). Carcass characteristics, particularly size, and abiotic factors, such as habitat and season, are known to influence spatial and temporal engagement in scavenging behaviors and contribute to the diversity of scavenger communities (DeVault et al. 2004, Selva et al. 2005, Sharanowski et al. 2008, Parmente and MacMahon 2009, Ruzicka and Conover 2012, Moleón et al. 2015, Turner et al. 2017).

While studies have examined the importance of fish carcasses to terrestrial ecosystems, how carcasses of other species at this land/water interface structure scavenger dynamics is unknown. Many amphibians and some reptiles have high densities and large biomasses concentrated at this interface, which makes them influential in ecosystem processes, such as nutrient cycling, in both terrestrial and aquatic ecosystems (Arnold and Wassersug 1978, Deutschman and Peterka 1988, Pertanka and Murray 2001, Russell et al. 2002, Davic and Welsh 2004, Regester et al. 2006, Whiles et al. 2006, Beard et al. 2009). Salamanders in Hubbard Brook Experimental Forest, for example, can reach densities of 2950 individuals/ha, approximately equal to the biomass of mammals and twice that of avian species (Burton and Likens 1975). While there has been research on how herpetofauna (i.e., amphibians and reptiles) influence energy flow as consumers of resources (Stewart and Woolbright 1996, Kupferberg 1997, Beard et al. 2003), their contributions as carcass resources to other organisms are rarely studied. Previous research examining scavenging of herpetofauna focused on road-associated mortality (Antworth et al. 2005, Beckmann and Shine 2011, DeGregorio et al. 2011, Santos et al. 2011), which likely overestimates scavenging rates due to the high visibility of the carcasses and habituation of vertebrate scavengers to road-kill. But do herpetofauna expire in the land/water interfaces that they use throughout their life cycles? Two studies at the US Department of Energy’s Savannah River Site (SRS) found low percentages of adults returned to wetlands to breed. Scott et al. (2007) found 1.1%–45.2% (average 21.1%) of salamander metamorphs (*Ambystoma opacum*) returned to breed over 13 cohorts, and Semlitsch et al. (1996) found only 5% of the metamorph cohort returned as breeding females for a range of amphibian species (N = 13) over 16 yr. Considering the low percentage of adults that return to breed, other sources of mortality (e.g., starvation, exposure, accidents, and disease) undoubtedly occur, producing carcasses at this ecological interface. Thus, adult herpetofauna present an abundant and potentially widespread carrion resource that could contribute substantially to food web connections and stability (Wilson and Wolkovich 2011).

Quantifying how amphibian and reptile carcasses are partitioned between vertebrate vs. invertebrate scavengers and within scavenger groups is critical for understanding the influence of herpetofauna carcasses on food web dynamics. Carcass size has been shown to influence these scavenger dynamics, but studies on carcass size of many herpetofauna (<100 g) are lacking (Moleón et al. 2015, Turner et al. 2017). Given current global herpetofauna declines (Gibbons et al. 2000, Houlahan et al. 2000), it is important to understand the extent to which vertebrate scavengers utilize these carcass resources. Quantifying vertebrate scavenging on small herpetofauna species (<100 g) within their native ranges where they reach high densities and biomass, such as in the southeastern USA, is critical to understanding the potential influence of these carcasses on ecosystem processes. Furthermore, these data can help predict how changing population sizes, considering both global declines (decrease in populations) and invasions (increase), may influence ecosystem stability.

Our overall objective was to evaluate consumption of herpetofauna (lizard, salamander, frog, and toad) carcass in a temperate ecosystem. Specifically, we had the following two objectives: (1) to quantify the percentage of herpetofauna carcasses scavenged by invertebrates vs. vertebrates and (2) to determine whether habitat and/or carcass type influences the proportion of carcasses removed and the elapsed time to removal by vertebrates vs. invertebrates and among species within these scavenger communities. We predicted that the majority of herpetofauna carcasses would be incorporated into the lower levels of food webs by invertebrate scavengers (DeVault et al. 2004, Abernethy et al. 2016). We also expected habitat to influence scavenger dynamics and time to removal, with vertebrates scavenging more carcasses in wetland...
habitats and swifter removal times by all scavengers in wetlands. We based this prediction on evidence that suggests mesocarnivores, which are highly efficient facultative scavengers (DeVault et al. 2011, Olson et al. 2012), focus foraging activity around wetland habitats during spring when herpetofauna are emerging and migrating from wetlands (Beasley et al. 2007, Beasley and Rhodes 2010). We anticipated time to removal to be swifter in wetlands, as a result of increased competition between vertebrates and invertebrates driven by the focused foraging of mesocarnivores. Furthermore, we predicted that carcass type would influence the partitioning of carcass resources, specifically that vertebrates would scavenge toads less frequently than other carcass types, as toads possess a bufotoxin that makes them distasteful to some mammalian predators but not invertebrates (Abernethy et al. 2016). We also predicted that salamanders and frogs with thin, poorly keratinized mucous skin would have a faster removal time than toads and lizards, that possess thicker, and in the case of toads, tuberculated skin (Cornaby 1974, Cooper 2012).

**METHODS**

**Study system**

We conducted this research on the Department of Energy’s SRS in South Carolina, USA. Eighty-four percent of the ~800-km² SRS was forested (57% pine forest, 21% hardwood forest, 6% mixed forest, and 16% other, e.g., buildings) and managed by the USDA Forest Service, representing ecosystems and management practices prevalent throughout the southeastern USA. Camera traps were deployed around Carolina bays (Fig. 1), which are small, isolated wetlands found along the US Atlantic Coastal Plain that provide critical habitat for both amphibians and reptiles (Semlitsch and Bodie 1998, 2003). We characterized two habitat types around Carolina bays (i.e., wetland and upland), with wetland habitat occurring within 1–10 m of the water’s edge and upland habitat being dry, forested areas located >100 m from the water’s edge (101–2000 m).

We chose the following native herpetofauna common to the SRS as experimental carcasses: lizards (green anoles, *Anolis carolinensis*; 1–3 g),

![Fig. 1. Study area map showing the locations of Carolina bays around which scavenging trials were conducted on the Savannah River Site in Aiken, South Carolina. Inset image shows exact camera trap locations in wetland and upland habitats (Appendix S1 contains maps for each bay).](image)

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salamanders (mole salamanders, *Ambystoma talpoideum*; and marbled salamanders, *Ambystoma opacum*; 2–3 g), frogs (bullfrogs, *Rana catesbeiana*; and southern leopard frogs, *Rana sphenocephala*; 4–100 g), and toads (southern toads, *Anaxyrus terrestris*; 3–46 g). These species are abundant throughout the southeastern United States, and the amphibians, as well as the green anoles, depend heavily on isolated wetlands and the nearby upland habitat (Russell et al. 2002). We chose to perform the study in the summer to correspond with late emergences of herpetofauna metamorphs from Carolina bays and adult presence in nearby upland habitats. We obtained live animals either from a commercial supplier or collected them under SC (04-2014) and GA (29-WJH-14-93) collection permits. Animals were handled and euthanized following an Institutional Animal Care and Use Committee protocol approved through the University of Georgia (A2014 04-018-Y1-A0). We also used carcasses from previous experiments at the Savannah River Ecology Lab that had been frozen immediately following euthanasia or death. All carcasses were in a predominantly intact state, and no chemicals were used during euthanasia.

**Experimental design**

We chose eight Carolina bays of similar size and hydrology and paired each of these with nearby upland sites. Camera traps were located along pre-determined transects in wetland habitats, 1–10 m from water’s edge, and upland habitats, 101–2000 m from water’s edge, that were ≥50 m from major roads. Along transects, camera traps were located ≥200 m from all other active trials (Michaud et al. 2012). Camera trap trials, which consisted of one carcass placed in front of a camera (Reconyx HyperFire PC900; Reconyx, Holmen, Wisconsin, USA), were deployed from June to July 2014, each recording photographs for 7 d. Camera trap trials were started at different times from dawn to dusk each week, so as not to introduce systematic bias based on time of carcass placement (although all trials were started during daylight hours). We ran 24 camera trap trials with each carcass type (i.e., lizards, salamanders, frogs, and toads) in each habitat type (i.e., wetland and upland; *N* = 192). During a trial, a single carcass was placed on a pressure-sensitive, external triggering device located approximately 0.3–1 m in front of a camera that was attached to a tree a few centimeters to 0.5 m above the ground (DeVault and Rhodes 2002, Abernethy et al. 2016). Cameras were programmed to record three photographs when triggered by motion or by the pressure-sensitive, external trigger, and an additional time-lapse photograph was taken every 15 min. After 7 d, any remaining carcass material was removed, and camera traps were relocated 50–100 m away along transects and reset with fresh carcasses. (Appendix S1 shows camera locations for each Carolina bay and paired upland habitat.)

To confirm the independence of our carcasses, we conducted post hoc spatial clustering analyses using Moran’s *I* statistic in R version 3.2.4 for all carcasses located within 2 km of each other (Moran 1950, R Development Core Team 2015). While we observed significant clustering of scavengers at two of the eight Carolina bays, further examination of the data showed that these results were driven by a few temporally isolated events rather than systematic, repetitive scavenging by a single vertebrate species, and thus, individual carcasses were considered independent throughout analyses.

**Data analysis**

For each carcass, we identified the primary scavenger to species or lowest possible taxonomic level and the time at which scavenging occurred. Since vertebrates quickly scavenged entire carcasses, they were assigned a single removal time (i.e., elapsed time from carcass deployment to removal); however, for invertebrates, we recorded time to removal, as well as detection and handling time. Detection time was measured from carcass deployment to when a carcass was initially detected by the invertebrate group that would be its ultimate scavenger, and handling time was the amount of time that invertebrate group needed to scavenge (time between detection and removal of a carcass). The one scavenger (or one group of scavengers, in the case of ants [Family: Formicidae] and beetles [Order: Coleoptera]) that consumed the majority of the flesh or removed the carcass from the field of view of the camera was considered the primary scavenger of that carcass for our analysis. While invertebrates consumed a portion of carcasses before vertebrates, we were unable to
quantify this amount from the photographs. To be consistent, we chose to assign each carcass to the scavenger that clearly removed the majority of the resource. To better taxonomically describe the invertebrate scavenging community, we collected voucher specimens from additional herpetofauna carcasses over two days and nights in October 2014. These carcasses were not used in trials presented herein, and invertebrate specimens were identified and archived at the Georgia Museum of Natural History (Appendix S2).

To quantify the percentage of carcasses scavenged by vertebrates vs. invertebrates, objective 1, we calculated the percentage of each carcass type that was scavenged (i.e., removed from field of view or the majority of flesh was consumed) by vertebrates vs. invertebrates in each habitat. To evaluate factors influencing how carcasses were partitioned between vertebrates vs. invertebrates and within these two scavenger groups, objective 2, we used log-linear models to compare the number of carcasses (dependent variable) of each type (lizards, salamanders, frogs, and toads) scavenged by vertebrates and invertebrates in the two habitats (wetland and upland). Initially, we evaluated the three-way interaction between habitat, carcass type, and scavenger (independent variables); if non-significant, we further evaluated each of the pertinent two-way interactions.

We then constructed a log-linear model to compare the number of carcasses scavenged (dependent variable) by dominant members within the invertebrate scavenging community (ants and beetles) with habitat, carcass type, and scavenger as the independent variables. We evaluated three- and two-way interactions as appropriate. We constructed log-linear models using CATMOD procedure in SAS, version 9.3 (SAS Institute, Cary, North Carolina, USA). Due to low scavenging rates of individual vertebrate species, we could not conduct this analysis, nor the analysis described below for time to removal, within the vertebrate community.

To evaluate time to removal for herpetofauna carcasses, we used a three-way ANOVA to evaluate the time (dependent variable) from carcass deployment to when a carcass was scavenged (i.e., removal time) with habitat, carcass type, and scavenger as independent variables. Additionally, we conducted three-one-way ANOVAs to compare removal, detection, and handling time between dominant invertebrate scavengers.

**RESULTS**

**Proportion of carcasses removed by vertebrate vs. invertebrate scavengers**

At the end of all experimental trials, the majority of carcasses were completely consumed or removed. Of the carcasses that remained, no flesh persisted, with only dry skin stretched over the skeleton ($N = 6$) or bones ($N = 18$); thus, all of the carcasses were considered scavenged. Invertebrates scavenged the majority of carcasses (80.2%), with vertebrates (seven species) removing 19.8% of total carcasses in all habitats (see Appendix S2 for taxa list and Appendices S3, S4 for raw data). Raccoon and opossum were the dominant vertebrate scavengers, together removing 14.6% of all carcasses (Fig. 2). Some species (bobcat, Lynx rufus; wild pig, Sus scrofa; and gray squirrel, Sciurus carolinensis) were observed at carcasses ($N = 5$) but did not scavenge, and a few (skunk, Mephitis mephitis; coyote, Canis latrans; wild pig; and gray squirrel) were recorded at the site of carcass placement after carcasses ($N = 22$) had already been removed. The following species are not widely considered scavengers but were observed scavenging carcasses entirely or in part: great-crested fly catcher (Myiarchus crinitus), Carolina wren (Thryothorus ludovicianus), and barred owl (Strix varia). With respect to invertebrates, ants scavenged 41.1% of total carcasses and beetles 22.9%. For the remaining 16.1% of carcasses ($N = 28$), it was unclear what type of invertebrate (ant, beetle, or other invertebrate) had scavenged the majority of the carcass. We categorized these carcasses as unknown invertebrates (Appendices S3, S4). For analyses that treated invertebrates as a collective group, these 28 trials were included, but excluded for analyses of the dominant invertebrate scavengers (ants and beetles).

**Factors influencing proportions of carcasses removed**

In our log-linear analysis to determine whether habitat or carcass type influenced the proportion of carcasses scavenged by vertebrates and invertebrates, the three-way interaction between scavenger, habitat, and carcass type was not significant, but the two-way interaction between scavenger and habitat was significant (scavenger $\times$ habitat; df = 1; $\chi^2 = 8.30; P = 0.0040$;
Table 1. These results support our predictions concerning habitat that invertebrates would take more carcasses than vertebrates and that the strength of this relationship would vary by habitat (Fig. 3). In wetlands, invertebrates removed 71.9% of all carcasses, whereas vertebrates removed 28.1%. In upland habitats, invertebrates removed 88.5% of carcasses, whereas vertebrates removed 11.5%. Thus, vertebrate scavengers in wetland habitats consumed 2.5 times more carcasses than vertebrates in upland habitats. No evidence was found that carcass type influenced this dynamic.

For the dominant invertebrate groups, we found that the proportion of scavenged carcasses was influenced by an interaction between scavenger (i.e., ant and beetle) and carcass (scavenger × carcass; df = 3; \(\chi^2 = 19.39\); \(P = \) 0.0002; Table 1). These results support our predictions concerning habitat that invertebrates would take more carcasses than vertebrates and that the strength of this relationship would vary by habitat (Fig. 3). In wetlands, invertebrates removed 71.9% of all carcasses, whereas vertebrates removed 28.1%. In upland habitats, invertebrates removed 88.5% of carcasses, whereas vertebrates removed 11.5%. Thus, vertebrate scavengers in wetland habitats consumed 2.5 times more carcasses than vertebrates in upland habitats. No evidence was found that carcass type influenced this dynamic.

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Table 1. Results of log-linear models used to analyze herpetofauna data.

| Scavenger                  | Model                        | df | \(\chi^2\) | \(P\)   |
|----------------------------|------------------------------|----|------------|---------|
| Vertebrates vs. invertebrates | Scavenger/carcass/habitat   | 3  | 2.52       | 0.4725  |
|                            | Scavenger/carcass            | 3  | 2.20       | 0.5326  |
|                            | Scavenger/habitat            | 1  | 8.30       | 0.0040* |
| Ant vs. beetle             | Scavenger/carcass/habitat   | 3  | 0.43       | 0.9349  |
|                            | Scavenger/carcass            | 3  | 19.39      | 0.0002* |
|                            | Scavenger/habitat            | 1  | 0.27       | 0.6059  |

Notes: Two-way interactions were analyzed if three-way interactions were non-significant. Interactions and main effects of scavenger, carcass, and habitat that significantly influenced the scavenging efficiency of vertebrates compared to invertebrates and within the invertebrate community (ant and beetles) are shown.

* Indicates significance (\(P < 0.05\)).
Factors influencing scavenging time

Only 186 of the 192 trials were used in analyses of time to removal, with six trials censored due to difficulty in determining exactly when carcasses were scavenged. The mean time to carcass removal was 26.65 h. Furthermore, 87.63% of the 186 carcasses were scavenged in <48 h, with vertebrates removing 94.74% and invertebrates 85.81% of the carcasses that each group would ultimately scavenge within each trial.

There was no statistically significant difference between mean vertebrate and invertebrate removal times of carcasses based on the two- or three-way interactions between scavenger, carcass type, or habitat or the main effects of scavenger or carcass type as determined by ANOVA. In alignment with our predictions, habitat did influence removal times, with faster rates observed in wetland habitats (ANOVA, $F_{1,170} = 3.715$, $P = 0.0556$; Fig. 4). Vertebrates and invertebrates removed carcasses in wetland habitats after an average of 23.16 h (range = 1.11–106.41), whereas in upland habitats it took on average 30.29 h (range = 1.55–130.19). No evidence was found that carcass type influenced this attribute of carcass removal.

For carcasses removed by dominant invertebrate scavengers, the total time from carcass placement to removal was not significantly different between the two groups (ants and beetles). However, one-way ANOVAs revealed significant differences between invertebrate groups relating to the time it took invertebrate scavengers to detect (ANOVA, $F_{1,120} = 99.78$, $P < 0.0001$) and fully remove carcasses, that is, handling time (ANOVA, $F_{1,120} = 30.31$, $P < 0.0001$). Ants took significantly less time to detect carcasses than beetles (2.81 h on average, compared to 19.69), but beetles handled carcasses for shorter amounts of time than ants (6.40 h on average, compared to 28.75 h).

Discussion

Invertebrate scavengers removed the majority of herpetofauna carcasses (80.2%), and most carcasses were removed in <2 d during this study. We found that habitat significantly influenced
the percentage of carcasses removed and the time to removal between vertebrates and invertebrates. Vertebrates removed more than twice as many carcasses in wetland (28.1%) than in upland habitats (11.5%), and carcasses were removed faster in wetland habitats, regardless of scavenger. Carcass type did not influence the proportion of carcasses scavenged or removal time of a carcass when comparing vertebrates vs. invertebrates, but it did influence the proportion of carcasses removed by individual invertebrate groups (i.e., ants vs. beetles).

While there are many abiotic and biotic factors known to influence scavenger dynamics, our study provides additional evidence for the importance of habitat, especially those occurring at the ecological interfaces, and carcass type on scavenging ecology. Habitat influenced both the percentage of carcasses scavenged by vertebrates (more around wetlands) and the overall speed at which carcasses were removed (faster around wetlands). The higher percentage of carcasses scavenged by vertebrates around wetlands was driven by raccoons and opossums, both of which are known to focus foraging efforts in these areas (Greenwood 1982, Hofmann 1991, Beasley et al. 2007, Beasley and Rhodes 2010). Other vertebrate scavengers (e.g., rodents, birds, and reptiles) scavenged an equal number of carcasses between wetland and upland habitats. While top scavengers (raccoons and opossums) observed in this research are also top scavengers in other scavenging studies conducted within our study area, overall scavenger species richness for herpetofauna carcasses was relatively low due to the summer season in which our study was conducted. We observed seven vertebrate species scavenging, whereas DeVault et al. (2004) and Turner et al. (2017) observed 17 and 12 species, respectively, scavenging rodent carcasses throughout the year. During the winter season, these two studies saw an increase in vertebrate scavenger species richness, likely because carcasses were available to be scavenged for a longer period of time due to decreased invertebrate activity.

Fig. 4. The proportion of carcasses removed by all scavengers is shown as a function of time, with each line representing the two different habitats (wetland and upland). The elapsed time to carcass removal was unknown for six carcasses, which were deleted from this analysis.
While the only effect of carcass type we observed was on invertebrate community dynamics, it is likely that the small size (<100 g) of many herpetofauna carcasses influences which vertebrate scavengers will utilize these resources. Small mesocarnivores may find it energetically cost-effective and less risky to scavenge small carcasses, where they are less likely to be excluded and/or predated upon by large carnivores than at large carcasses (McKillup and McKillup 1994, Moleon et al. 2015, Turner et al. 2017). In South Carolina, small mesocarnivores (raccoons and opossums) are more likely than larger mesocarnivores (coyotes and bobcats) or obligate scavengers (vultures, *Coragyps atratus*, *Cathartes aura*) to utilize small carcasses (Turner et al. 2017). While small carcasses may be valuable to scavenge, mesocarnivores can experience enhanced competition with invertebrates when utilizing small carcasses. In our study, the percentage of carcasses consumed by invertebrates (80.2%) was high compared to other studies conducted in warm weather with small-sized mammal and avian carcasses (31% average, range = 6–75%, DeVault et al. 2003). The carcasses used in these studies were larger than our herpetofauna; thus, the size of our carcasses could have contributed to the success of invertebrate scavengers. Our study contributes to evidence suggesting intense competition between vertebrates and invertebrates for carcass resources in the summer, which could be mediated by carcass size, temperature, local abundance and/or foraging behavior of scavengers, and the predictability of the resource in the environment.

Our results also indicate that intense competition occurs within the invertebrate community, with ants scavenging significantly more carcasses than beetles, and that this dynamic is influenced by carcass type. The influence of carcass type on the proportion of carcasses scavenged by different invertebrate groups may have depended on size differences of a few 10s of grams and integument thickness. When considering the analysis on scavenging efficiency and time, we wish to point out the following aspects of our experimental design that influence this analysis. Carcasses were placed in the field during the day, which favors diurnal scavengers, and time to removal for beetle-scavenged carcasses occurred when a carcass was buried, rather than fully consumed as was the case for ants. Considering that the data are applicable to carcasses that expired during the day and that beetles are making carcasses less accessible to vertebrates and other invertebrates by burying them, we believe that analyzing these data is informative. It took ants significantly less time to detect a carcass of which they would be the primary scavengers, compared to beetles (3 h vs. 20 h). The average detection time for scavenging beetles, which are generally nocturnal, can be considered an average of the first two nights, since the majority of carcasses were scavenged in <2 d. Contributing to this competitive dynamic, beetles were able to remove carcasses on average only 6 h after initially detecting them, whereas ants required much longer (30 h) to fully consume the flesh from carcasses. Thus, beetles may be more efficient than recognized in this study, since some herpetofauna surely die at night.

As community dynamics and environmental factors mediate competition for carcass resources between and within vertebrate and invertebrate scavengers, the number and strength of those trophic links involving carcass resources influences ecosystem function and stability. This study suggests that herpetofauna carcasses in the southeastern USA are an important resource in food webs, particularly for invertebrates at lower trophic levels. With high local densities and biomass, herpetofauna carcasses likely influence ecosystem function and stability on a global scale to an extent that is greater than currently appreciated. How global declines in herpetofauna populations will affect the strength of these trophic connections is unknown but deserves further investigation.

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