Predatory Interrelations in Weber & Davis County Streams

Jackeline Bedoya-Wilkinson, Blake Hansen, Brennen Slagowski, Desiree Peck, Crystal Price, McKenna Merrill

Introduction

Predatory organisms adopt different behaviors around each other according to foraging habits, preferences, and prey. For example, water striders (Gerridae), suspended on top of slow-moving water and prey on benthic emerging aquatic insects or terrestrial prey items landing on the water surface (1). If fish are present, they may harass striders, causing them to avoid deeper water. Also, *Tetragnatha elongata* is a web-building spider exclusively associated with riparian habitats and does not build webs where the environment is unfavorable, such as if there is not open-water accessibility or if the insect availability is insufficient (2).

Our study objective was to investigate interactions among various aquatic predators along with the influence of habitat characteristics on their interactions. Researchers have only just begun to study subsidies that cross ecosystem boundaries and how predators within those ecosystems, and the ecotones in between them, can affect each other. One example of these interactions is trout eating benthic invertebrates which lead to a decline in emergent insects that riparian spiders can take advantage of later (3).

Methods

We studied 100 m reaches in seven first and second-order streams: Burch, Holbrook, Stone, North Fork Holmes, Holmes, Steed, and Strong's creeks, in the Wasatch Mountains, located in Weber and Davis Counties, Utah. Habitat measurements included stream wetted width, water depth, and pebble counts, measured every 0.2 m across 10 transects. Stem width of all submerged and aerial branches were measured.

Along each transect, we counted spider webs horizontally facing the stream, with the assumption that these were Tetragnathidae. We also counted water striders. We used kick nets to sample for perlid larvae and backpack electroshocking to collect trout (Bonneville Cutthroat trout *Oncorhynchus clarkii utah* or rainbow trout *Oncorhynchus mykiss*). Clove oil was used as a mild sedative for trout and all individuals were released after we measured their total length as an estimate of biomass.

The habitat volume of each site was calculated by multiplying median width, median depth, and length of the sample reach. Invertebrate densities were calculated by dividing the total number counted by aquatic-habitat volume. We used Pearson correlations to determine relationships of median depth, median wetted width, median substrate size, total submerged wood, total aerial branches, and total trout biomass versus densities of water striders, spider webs, and perlid larvae.

Tetragnathid Spider

Water Strider

Results

All correlations conducted with wetted width, substrate size, submerged branches, aerial branches, and trout were insignificant ($P > 0.02$, Table 1). We did, find that median depth had a moderate negative correlation with water-strider density ($P < 0.20$) (Table 1, Figure 1) and spider-web density ($P < 0.10$) (Table 1, Figure 2).

Table 1. Pearson correlations conducted

		R	P
Depth	**Water Striders**	**-0.5938**	**<0.20**
Depth	**Spider Webs**	**-0.7373**	**<0.10**
Depth	Perlids	-0.4596	>0.20
Depth	Trout	0.11454	>0.20
Width	Water Striders	-0.2898	>0.20
Width	Spider Webs	0.27083	>0.20
Width	Perlids	-0.1508	>0.20
Width	Trout	0.56424	>0.20
Substrate	Water Striders	0.02898	>0.20
Substrate	Spider Webs	-0.1665	>0.20
Substrate	Perlids	0.33768	>0.20
Substrate	Trout	-0.3356	>0.20
SubBran	Water Striders	-0.502	>0.20
SubBran	Spider Webs	-0.0057	>0.20
SubBran	Perlids	-0.3645	>0.20
SubBran	Trout	0.80806	>0.20
AerBran	Water Striders	0.111	>0.20
AerBran	Spider Webs	0.06004	>0.20
AerBran	Perlids	-0.1408	>0.20
AerBran	Trout	-0.6742	>0.20
Trout	Water Striders	-0.4665	>0.20
Trout	Spider Webs	-0.2716	>0.20
Trout	Perlids	-0.3643	>0.20

References

1. Marczak, L., Hoover, T., Richardson, J. (2007). Trophic interception: how a boundary-foraging organism influences cross-ecosystem fluxes. *Oikos* 116: 1651-1662.
2. Gillespie, R.G. 1987. The mechanism of habitat selection in the long-jawed orb-weaving spider *Tetragnatha elongata* (Araneae, Araneidae). *Journal of Arachnology* 15: 81-90.
3. Englund, G., Johansson, F., & Olsson, T. (1992). Asymmetric Competition between Distant Taxa: Poecilid Fishes and Water Striders. *Oecologia* 92: 498-502.
4. Cooper, D.S. (1984). The effects of trout on water striders in stream pools. *Oecologia* 63: 376-379.
5. Kato, C., Iwata, T., Nakano, S. and Kishi, D. (2003). Dynamics of aquatic insect flux affects distribution of riparian web-building spiders. *Oikos* 103:113-120.
6. Marczak, L.B., and Richardson, J.S. (2007). Spiders and subsidies: results from the riparian zone of a coastal temperate rainforest. *Journal of Animal Ecology* 76: 687-694.
7. Benjamin, J.R., Lepori, F., Baxter, C.V., and Fausch, K.D. (2013). Can replacement of native by non-native trout alter stream-riparian food webs? *Freshwater Biology* 58: 1694-1709.

Discussion

Median depth influenced two predatory invertebrates. As already mentioned, water striders avoid deeper habitats to avoid increased water velocity and harrasment by trout. For example, trout confine water striders to the shallow edges of pools (3). In fast-flowing streams or times of high discharge, striders are also restricted to pool margins regardless of whether they contain trout (4), consistent with our results.

In comparison, trout cannot directly influence spider webs. Thus, water depth must have indirect effects on spider abundance. Tetragnathid spider abundance is closely tied to abundance of emerging aquatic insects (5, 6). This suggests that deeper pools have fewer emerging insects. It is possible that deeper streams have more trout and that trout may reduce emerging insects (7). However, we did not find a relation between trout abundance and water depth in this study ($R = 0.115$, $P < 0.02$). This suggests there may be other reasons for a negative effect of depth on spider webs.

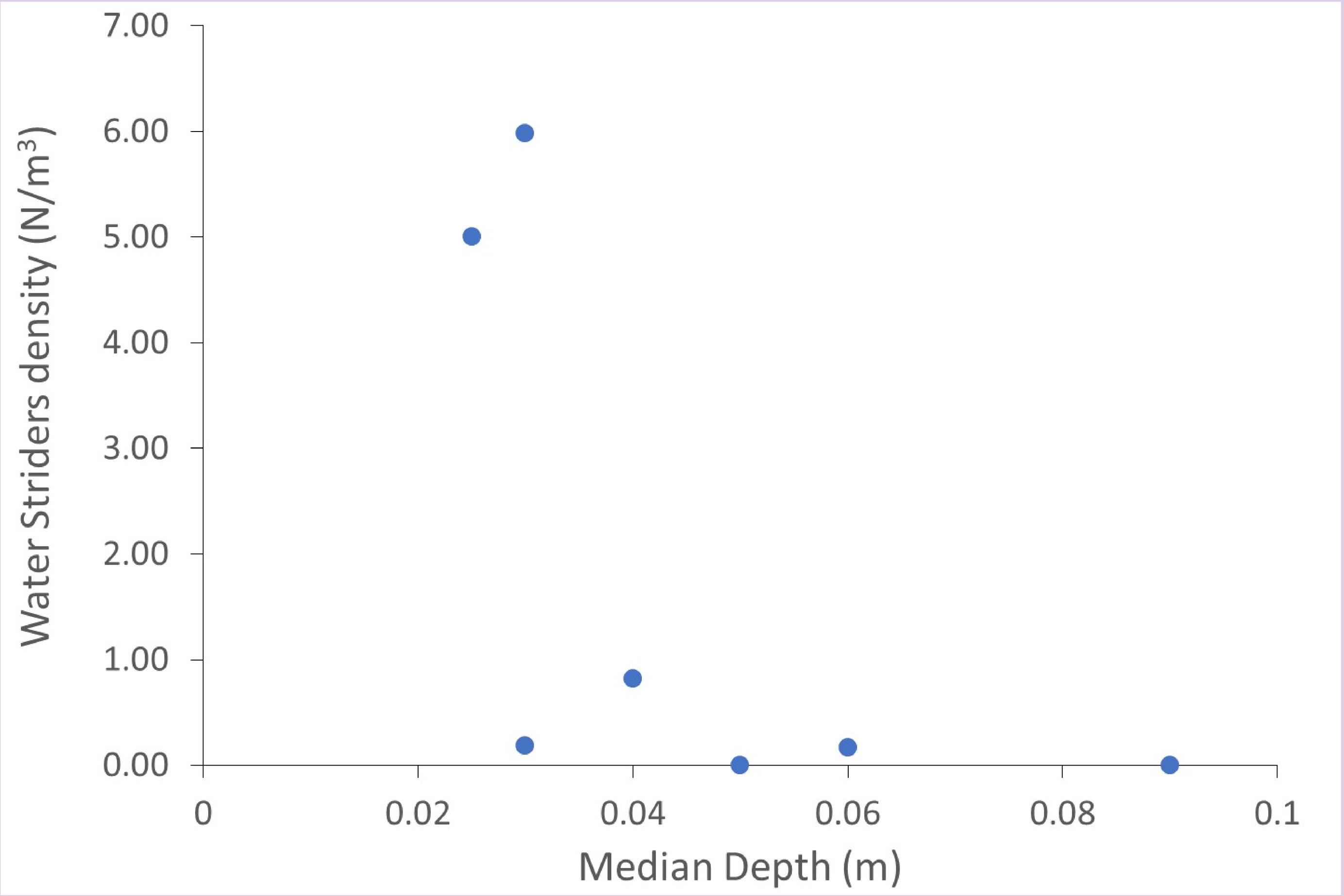

Figure 1. Relationship of the density of water striders versus median water depth for seven creeks along the northern Wasatch Front (Table 1).

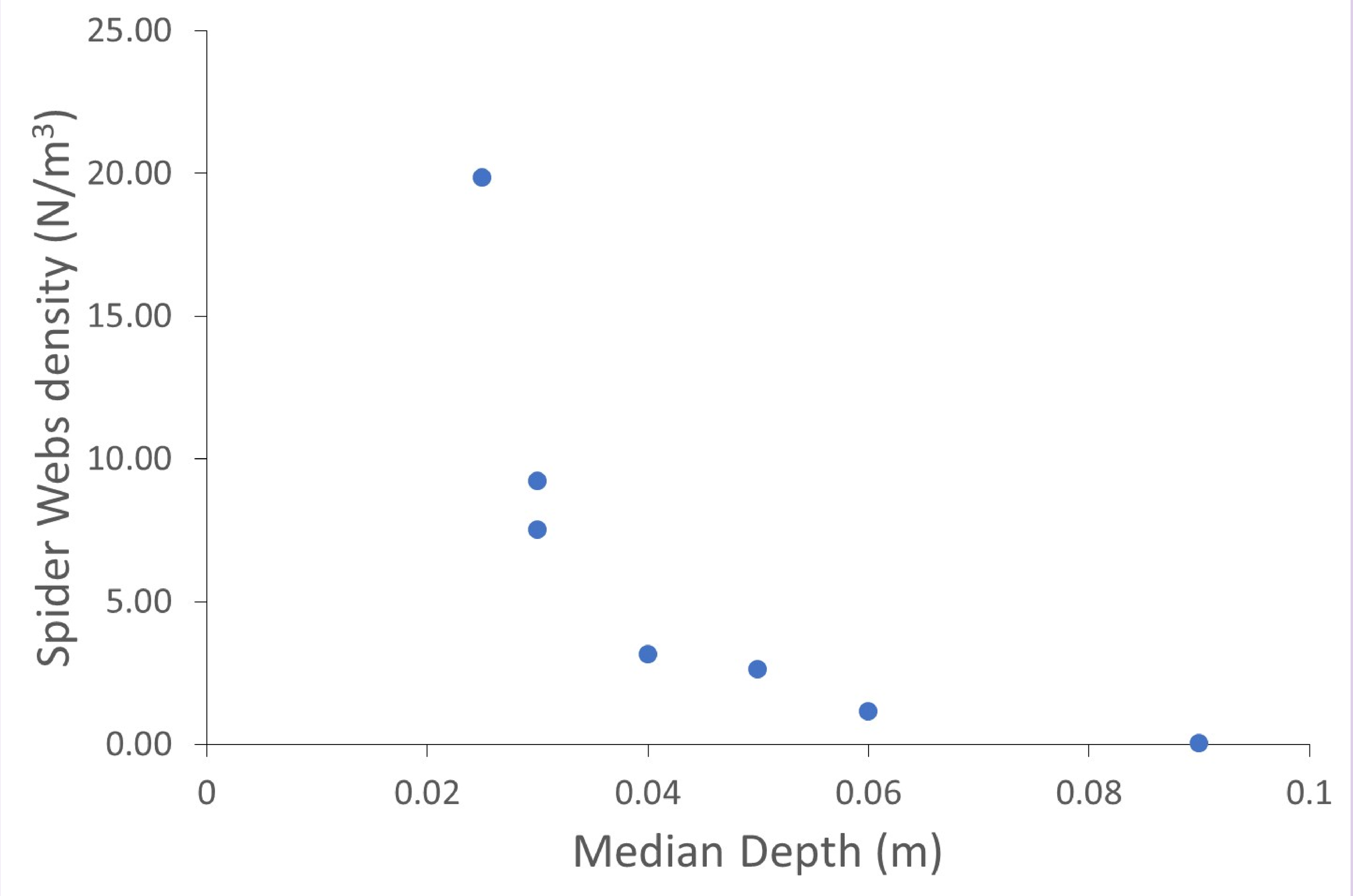

Figure 2. Relationship of spider web density to the median water depth in seven creeks along the northern Wasatch Front (Table 1).