Upstream vs. downstream seining in suburban streams

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Abstract

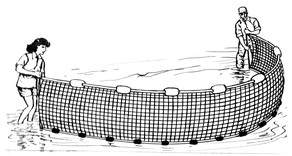
Seining is a common fish sampling practice in shallow water habitats. Tradition suggests upstream seining is most effective. We hypothesize downstream seining is actually more effective. This has important implications for research and management alike because data sets may be considerably improved should downstream sampling prove to be more effective. Our results show that downstream seining results in significantly more species detected as well as higher catch rates. We recommend researchers implement downstream seining instead of upstream sampling. Downstream sampling is clearly more effective as well as less physically demanding.

Introduction

Fisheries research and management requires the use of both passive and active capture gears (NOAA, 2011). Beach seines are a commonly used active capture gear in littoral habitats (FAOUN, 2011). Historical convention suggests upstream seining is the preferred and recommended method, especially in slow currents (Ott et al., 1998). However, previous research by Unmack (2003) suggests a study is needed to effectively document the effectiveness of upstream versus downstream sampling. Previous field experience lead us to believe the more common upstream sampling method is less effective than sampling downstream. We designed an experiment to compare the two methods and selected suburban streams in Payne County, OK as our field sites. We hypothesized that downstream seining would result in a greater number of detected species, higher catch rates, and larger captured individuals.

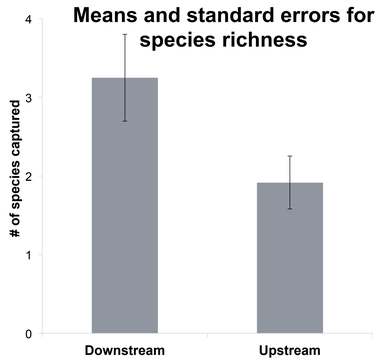
Methods

- We sampled three streams in the Stillwater area: Couch Creek, Perkins Creek, and Babcock Creek. Four upstream hauls and four downstream hauls were made at each site; each haul involved 10m of travel distance using a 2.44m seine with 3.2mm square mesh.
- We counted the number of each species and measured the total length of each captured individual for each haul.
- A generalized linear mixed model (GLMM) was used to test how seining direction influences the detected species richness, overall catch rates, and sizes of individuals captured; random effects were our sample sites; fixed effects were seining direction, species, and number of individuals captured.
- A linear mixed model (LMM) was used to test how seining direction determines the sizes of individuals captured; random effects were our sample sites; fixed effects were seining direction and sizes of individuals captured.

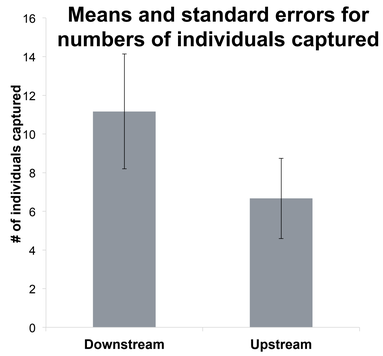


Results

- Seining downstream resulted in a greater number of detected species (Z-value = 4.276, p = 0.0334) with a mean species richness of 3.250 (SE ± .552). Upstream produced a mean species richness of 1.917 (SE ± .336).



- Seining downstream produced higher catch rates (Z-value = 6.389, p = 0.000126) with a mean catch rate of 11.1 (SE ± 2.96). Upstream produced a mean catch rate of 6.66 (SE± 2.07).



- Seining direction has no effect on the sizes of captured fish (t-value = 7.617, p = 0.087).

Discussion and Conclusions

Some researchers implement downstream sampling into their field practices, but many researchers use upstream seining for sampling protocol (Yant et al., 1984). Some agencies even standardize upstream seining for all research applications (USEPA, 2003). Our data, supported by Henricks et al., suggest fisheries professionals should adopt downstream sampling for research and management practices (1980). Perhaps, downstream seining is more successful because seiners can move more quickly with the current than against the current. Also, less disturbance is caused in the water column, and the disturbance that is created going downstream is more efficiently masked by flowing water than going upstream. As a result, canal neuromasts in fish lateral lines are less stimulated by shifts in the hydrodynamics of the system, making fish less perceptive to an approaching seine (Engelmann et al., 2000). This allows researchers to capture more fish going downstream with the current. In addition, seining downstream is less physically demanding. This means less resting time is needed between hauls, and more samples can be collected in the same amount of time as compared to sampling upstream.

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