Patterns and drivers of secondary production in white shrimp (Litopenaeus setiferus)

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Background
White shrimp (Litopenaeus setiferus) fishery one of the most valuable in South Carolina (SC). Secondary production as shrimp health indicator integrates changes in population biomass through time. Biotic & abiotic factors can influence secondary production. Shrimp black gill is a defense response causing pigmented gills correlated with black gill ciliate (sBG ciliate) (Figure 1). Black gill decreases physical endurance of shrimp. Decreased shrimp landings may be related to black gill or decreased shrimp health. Temperature & salinity can affect secondary production. Parasites of shrimp can also affect secondary production. Important to examine abiotic & biotic factors potentially influencing secondary production.

Secondary Production
- How does the secondary production of L. setiferus vary spatially among tidal creeks in the Charleston Harbor watershed?
- Which factors (i.e., salinity, temperature, watershed area) explain the spatial variation in secondary production?

Parasites
- How do parasite communities within L. setiferus vary spatially in the Charleston Harbor watershed?
- How does parasite infection vary ontogenetically in L. setiferus?
- Does visible black gill correlate with parasite load and/or intensity?

Secondary Production, Shrimp Condition, and Parasites
- Does visible black gill or parasite load affect L. setiferus body condition?
- How does visible black gill or parasite load affect secondary production of L. setiferus?

Methods

Condition & Secondary Production
- Shrimp condition: compare the logarithmic relationship between shrimp length & mass of clean and parasite-infected shrimp
- Secondary production: instantaneous growth or the size-frequency method, depending on cohort visibility
- Cohort visibility: length frequency histograms for each sampling event visually assessed.
- Growth rates: average shrimp mass of a cohort (or whole sample) changes over time

Post-larval Collection
- Nighttime flood tides from May to Sept. 2018
- Two 0.75m zooplankton nets
- Floating docks at Sunrise Park or Charleston Harbor Resort & Marina
- Specimens preserved in ~95% ethanol

Juvenile to Adult Collections
- Estuarine tributaries of Ashley and Wando Rivers (15 shrimp/site) (Fig 2)
- Charleston Harbor (23 shrimp/site) (Fig 2)
- May 2018-May 2019
- Enumerated, measured, and examined for black gill using a color standard (Figure 1A)
- Transported back to the lab on ice

Post-larval Examination
- Post-larvae separated from zooplankton
- IDed to Peneaidea morphologically
- Measured and sent to Skidaway Institute of Oceanography (SIO)
- Molecular assay at SIO to determine sBG ciliate presence

Juvenile to Adult Examination
- Cephalothorax, nerve cord, and gut dissected for parasites
- Parasites identified, extracted, dried, and weighed
- Remaining shrimp bodies dried and weighed
- Intensity of sBG ciliate infection: examine four gill filaments/shrimp under 20X magnification

Results
- Visible black gill: 14% prevalence (n=749)
- Parasite prevalence: 69% (n=263)
- Of parasites found, 95% are either trematode larvae (digeneans) or cestode larvae (trypanorhynchs) (Figs 3 & 4)
- sBG ciliate prevalence: 53% (n=32)

Discussion
- Impacts of parasite infections on shrimp condition will be important for understanding fluctuations in shrimp abundance and secondary production.
- These data show that trematodes and cestodes are the most prevalent parasites in shrimp in the Charleston Harbor watershed. Further analysis will show how their presence could be affecting shrimp populations.

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