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Impact of the parasitic nematode *Anguillicoloides crassus* on Chesapeake Bay American eels (*Anguilla rostrata*)

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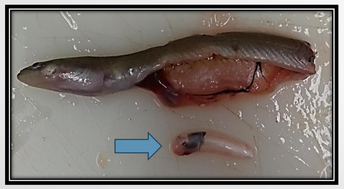
Introduction

- *A. crassus* (Dracunculidae) is an introduced nematode parasitizing the swimbladder of American eels.
- Causes severe deterioration and necrosis of the swimbladder.[1]
- First found in the U.S. in 1995 in TX and SC. Currently infects eels from Nova Scotia to Gulf of Mexico.[2,3]
- Prevalences of greater than 80% in some areas.[4]
- Eels become infected by eating infected zooplankton, fish, and snails.[5]
- The 2012 stock assessment by ASMFC declared the American eel population depleted and infection by *A. crassus* is a possible contributor to their decline.[6]
- Infection rates in glass and elver eels from Chesapeake Bay are currently unknown.



The swimbladder is the organ fish use to regulate their buoyancy. The black area is *A. crassus.*

Methods

- For the duration of the glass eel migration (usually March to June), collected up to 50 glass and 35 elver eels weekly from 6 sites in Chesapeake Bay tributaries.
- Brought eels back to lab and anesthetize with clove oil.
- Measured total length and wet weight for all eels, and pigment stage for glass eels.
- Dissect out swimbladder, cut open, extract *A. crassus*, and enumerate.
- Determine health of the swimbladder using the swimbladder degenerative index (SDI) developed by Lefebvre et al. (2011).
- Remove otoliths from elvers for age analysis.

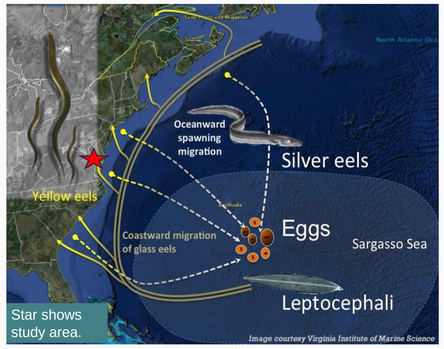


Figure 1. Life cycle of American eels. Infection from *A. crassus* first occur when eels enter coastal waters. Source: vims.edu.

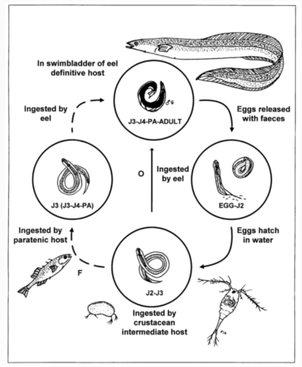


Figure 2. Life cycle of *A. crassus*. Source: Kirk 2003.

Prelimary results of elvers

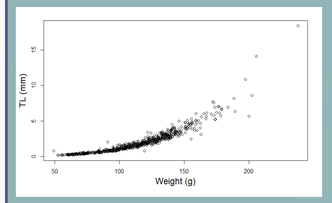


Figure 3. Length-weight distribution of elvers (n=806). The average weight was 2.01 g and the average length was 113.7 mm

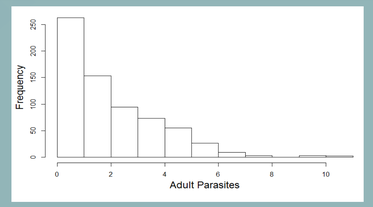


Figure 4. Range of intensity of infection with *A. crassus* adults. (n=681)

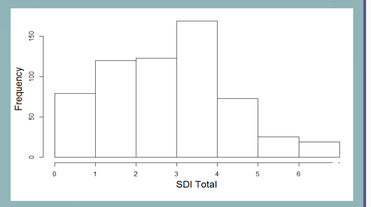


Figure 5. Swimbladder dengerative index (SDI) totals, with a range of 0 being the healthy/normal state and 6 being severely damaged. (n=608)

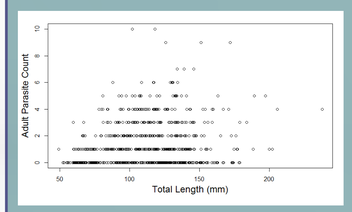


Figure 6. Total length of elvers compared to the amount of adult parasites. (n=608)

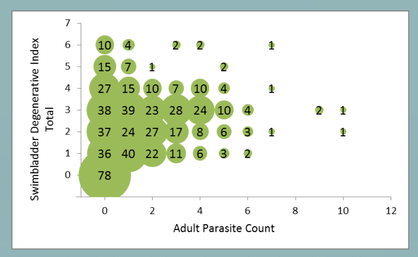


Figure 6. Number of elvers (size of circle indicated by number within) with a specific parasite load and SDI score (i.e. we recorded 10 elvers with 0 parasites that had an SDI of 6). (n=608)

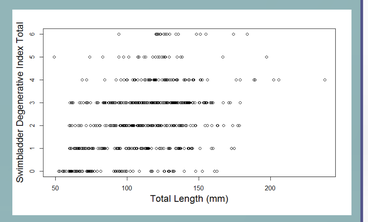
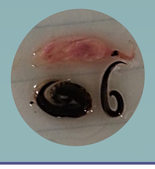


Figure 6. Total length of elvers compared to the SDI total. (n=608)

Prevalence	61.4%
Abundance	1.52 nematodes per elver
Mean Intensity	2.47 nematodes per infected elver
Prevalence of swimbladder damage	87.2%



Discussion

- Large majority of young eels aged 1-3 are infected and some already have destroyed swimbladders.
- Prevalence may not illustrate the whole effect of the parasite because eels with none or very few nematodes can have a high SDI.
- Nematode eggs, pre-adults, adults, and degrading adults were all found, but only adults were used to calculate prevalence.
- Dissection of more eels (including glass and yellow eels) over a longer time period will illustrate trends in prevalence, abundance, and intensity among sites and sizes of eels.

Future Work

- Identify intermediate hosts of *A. crassus* in the Chesapeake Bay. This is currently unknown, yet would help us understand transmission and develop risk assessments.
- Develop an epidemiology (force-of-infection) model using infection data from glass, elver, and yellow phase American eels to investigate population level impacts of *A. crassus.*
- Translate findings into management implications and improvements through collaboration with fisheries management organizations such as the Atlantic States Marine Fisheries Commission (ASMFC).

References

[1]Lefebvre, F., Fazio, G., Palstra, A. P., Székely, C., & Crivelli, A. J. (2011). An evaluation of indices of gross pathology associated with the nematode Anguillicoloides crassus in eels. *Journal of fish diseases*, *34*(1), 31-45. 2Fries, L. T., Williams, D. J., & Johnson, S. K. (1996). Notes: Occurrence of Anguillicola crassus, an Exotic Parasitic Swim Bladder Nematode of Eels, in the Southeastern United States. *Transactions of the American Fisheries Society*, *125*(5), 794-797.[3]Aieta, A. E., & Oliveira, K. (2009). Distribution, prevalence, and intensity of the swim bladder parasite Anguillicola crassus in New England and eastern Canada. *Diseases of aquatic organisms*, *84*(3), 229-235. [4]T. Tuckey, personal communicaiton. [5]Thomas, K., & Ollevier, F. (1992). Paratenic hosts of the swimbladder nematode Anguillicola crassus. *Dis Aquat Org*, *13*, 165-174. [6]ASMFC (Atlantic States Marine Fisheries Commission) (2012) American eel benchmark stock assessment. Stock Assessment Report 12-01. ASMFC, Washington, DC. Barse, A. M., & Secor, D. H. (1999). An exotic nematode parasite of the American eel. *Fisheries*, *24*(2), 6-10.

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