Stable Isotope Analysis of an Invasive Crab Species, *Charybdis hellerii*, in the Indian River Lagoon

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Background

Charybdis hellerii invaded the southern IRL approximately 25 years ago[3]. Sebastian Inlet was believed to be the northern limit to its range, but that may be changing. Individual sightings have occurred in recent years as far north as North Carolina[1]. Little is known about the feeding habits of *C. hellerii* and the threat it may pose to native swimming crab species. Blue crab (*Callinectes sapidus*) is one of the most economically important shellfish in the IRL. To address this knowledge gap, we are using stable isotope analysis of muscle tissue and whole crabs. Stable isotopes work on the principle that the ratio of $^{15}N/^{14}N$ and $^{13}C/^{12}C$ in consumer tissue reflect diet, allowing for the estimation of the contribution of feeding resources to the crabs. Carbon tells dietary source, while nitrogen shows the trophic level occupied by the crabs[4].

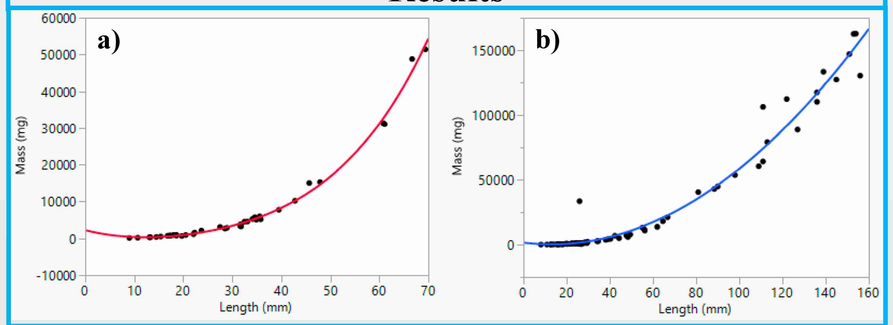
Objective

To assess the dietary overlap between an invasive swimming crab species and its economically viable counterpart

Study Site & Methods

The Indian River Lagoon spans from Cape Canaveral to Ponce Inlet. The crabs caught by the UCF MEC Lab in this study were captured in the northern Mosquito Lagoon – the source of all but two *C. hellerii*. A minority of crabs used in this study were caught by the Florida Fish & Wildlife Conservation Commission slightly further south in the lagoon. Muscle tissue was pulled from large enough crabs, dried, ground to a fine powder, and sent to the UC Davis Stable Isotope Facility. Small crabs were dried whole, treated with 1 M HCl, dried again, ground to a homogenous powder and sent to UC Davis to be analyzed.

Results



Sizes of *C. hellerii* (Fig. 1a; n=42) and *C. sapidus* (Fig. 1b; n=86) used in this study

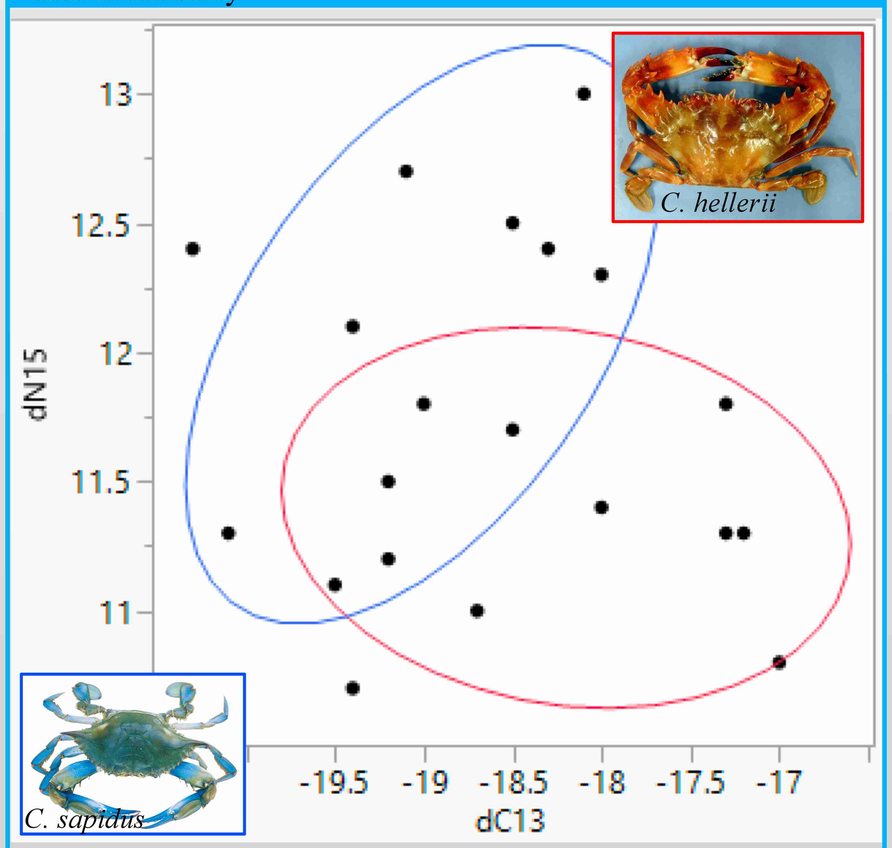


Figure 2. Possible ellipses generated by hypothetical values estimated using data from Gelpi et al. (2013)

Research During the Pandemic

Lab restrictions due to COVID-19 and the UC Davis SIF shutting down operations delayed this project by an entire semester. Samples are currently at UC Davis and results are expected back by March 1.

Discussion

There is a dense overlap of crabs smaller than 40mm in carapace length in this study. There is more variability above 40mm and only *C. sapidus* above 70mm. There are dietary shifts in blue crabs at 31mm and 60mm. This suggests a reasonable likelihood to detect dietary overlap between the species either below 31mm carapace length, between 31mm and 60mm, or both. Small crabs processed whole in this study are relatively few in quantity (28; 5 *C. hellerii*, 23 *C. sapidus*) but can provide support for overlap found in muscle tissue samples (100; 37 *C. hellerii*, 63 *C. sapidus*).

Implications

Results generated from this study can identify an overlap of dietary resources between the recreationally and commercially important blue crab and the invasive *C. hellerii*. Any overlap found could represent competition between the two species and a threat to blue crab fisheries along the East Coast. With this knowledge, we can recommend population management steps be taken to limit further spread of invasive populations or address existing overlapping ranges of the two crab species.

References

1. Fofonoff, P.W. et al. 2018. National exotic marine and estuarine exotic species information system. https://invasions.si.edu/nemesis/browsed/SpeciesSummary.jsp?TSN=-79 **2.** Gelpi Jr., C.G. et al. 2013. Using $\delta^{13}C$ and $\delta^{15}N$ to determine the migratory history of offshore Louisianna blue crab spawning stocks. Marine Ecology Progress Series 494:205-218. **3.** Lemaitre, R. 1995. *Charybdis hellerii* (Milne-Edwards, 1867), a nonindigenous portunid crab (Crustacea: Decapoda: Brachyura) discovered in the Indian River Lagoon system of Florida. Proceedings of the Biological Society of Washington 108:643-648. **4.** Post, D.M. 2002. Using stable isotopes to estimate trophic position: Models, methods, and assumptions. Ecology 83:703-718.

Acknowledgements

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