

Availability and Toxicity of Copper and Zinc in the Florida Keys: Implications for Queen Conch Larval Recruitment



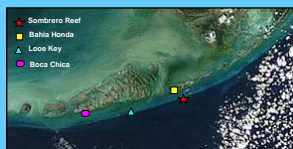
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Background

- Despite the Florida Keys being designated as an "Outstanding Florida Waters" area, only a few sites have been tested for heavy metal contamination in surface water, sediments, or primary producers.
- Queen conch populations in the Florida Keys have had a slow recovery despite a 25 year fishery closure.
- Adult queen conch in nearshore waters are incapable of reproduction, yet recover when transplanted to offshore reef habitats.
- Population surveys have noted a decline in nearshore populations of queen conch, and large juvenile aggregations have not been recorded nearshore.
- A recent study showed a higher level of Cu and Zn in conch found nearshore in comparison to their offshore counterparts.
- Understanding the impacts of heavy metal contamination on all life stages of the queen conch will help to conserve the species and to predict the effects on other molluscs in the ecosystem.

Methods: Objective 1

- Two site pairs were selected in the middle and lower Keys where conch larval transportation between sites is known to occur: Sombrero Reef-Bahia Honda and Looe Key-Boca Chica.



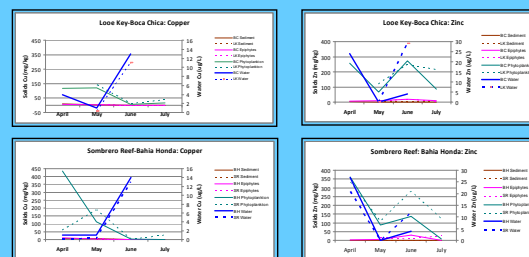
- Water, sediment, epiphytes, and phytoplankton samples were collected each month during the queen conch spawning season April – October 2010 (*in progress*). A 0.5m² grid was tossed within the seagrass beds six times, and GPS was used to verify the same starting point during each collection.



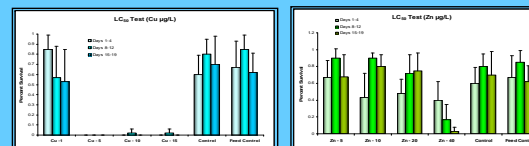
- Solid samples were acid digested (HNO₃ and H₂O₂) and all were analyzed on an ICP-OES at Harbor Branch.

Results (to date)

- Cu and Zn levels as analyzed to date (*in progress*). Figures show Cu (left) and Zn (right) levels for solids (sediment, epiphytes), and phytoplankton in mg/kg and water levels in µg/L on the secondary axis for both site-pairs.



- LC₅₀ survival and larval growth rates. Figures show survival and growth rates of each larval age group during the 96 hr period. Calculated LC₅₀ values from a Probit analysis are shown in the tables.

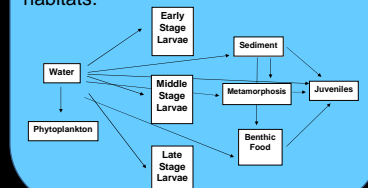


Cu LC ₅₀ (µg/L)	24 hrs	48 hrs	72 hrs
Days 1-4	8.36	3.29	n/a
Days 8-12	8.59	4.34	2.26
Days 15-19	8.30	2.43	n/a

Zn LC ₅₀ (µg/L)	24 hrs	48 hrs	72 hrs
Days 1-4	0.18	144.41	n/a
Days 8-12	52.93	75.56	75.60
Days 15-19	No morths	11 x 10 ⁶	n/a

Anticipated Impacts

- Increase the amount of information for Cu and Zn occurrences in the Florida Keys.
- Understand the toxic effects of Cu and Zn on early life stages of queen conch
- Identify critical pathways of Cu and Zn accumulation and assess the impacts on population recruitment in nearshore habitats.



Relevant References

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Objectives

- To quantify the amount of Cu and Zn present in the water, sediment, phytoplankton, and epiphytes in selected nearshore and offshore sites important to conch larval recruitment.
- To determine a) LC₅₀ levels for early life stages of queen conch, and b) the EbC₅₀ levels for microalgae exposed to Cu and Zn (*in progress*).
- To determine the cumulative effects of chronic Cu and Zn exposure and to establish bioaccumulation pathways (*in progress*).

Methods: Objective 2a

- Pieces of egg masses were collected from Looe Key and Sombrero Reef
- Four age groups of larvae (weeks 1, 2, 3, and at metamorphosis) were exposed to Cu (1, 5, 10, 15 µg/L) and Zn (5, 10, 20, 40 µg/L) for 24, 48, 72, and 96 hrs.
- LC₅₀ levels were calculated at 24 and 48 hrs due to >10% mortality in the controls at 72 and 96 hrs.



Preliminary Summary

- Levels of Cu in the water seen in the field during particular months have been higher at all sites than the calculated LC₅₀ values. This has not been the case for Zn.
- Activity (swimming) and physical development (lobes) are impaired by levels of Cu (5-15 µg/L) and Zn (40 µg/L).
- Survival for larvae was near zero for Cu levels greater than 1 µg/L.
- Competent larvae appear to be more tolerant of higher Cu and Zn levels, and have slightly better metamorphic success when exposed to epiphytes versus sediment (*data not presented here*).