Feeding-induced variations in ichthyocarbonate production and composition by the Gulf toadfish

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Ichthyocarbonates are magnesium-rich calcium carbonate precipitates formed as part of the osmoregulation strategy of marine bony fish that allows them to remain hydrated by drinking seawater. Ichthyocarbonates are precipitated in the intestine, held together by organic mucus coatings, and excreted into the ocean continuously. Fish metabolic rate is thought to be an important control on ichthyocarbonate formation, however, the impact of feeding on ichthyocarbonate production rate and composition is poorly understood. Previous studies have shown that fasting does not prevent ichthyocarbonate production but have not examined how feeding state impacts production rate and composition—crucial factors expected to determine the role of ichthyocarbonates in oceanic carbon cycling. Here, we investigate how the feeding state of the Gulf toadfish (*Opsanus beta)* affects ichthyocarbonate production rate and size, crystallite morphology, mol%$MgCO_3$, and phosphorus concentration under current ambient oceanic conditions. We collected ichthyocarbonates from fed and unfed Gulf toadfish, noting time elapsed since last meal. Samples obtained from the tank bottom daily and sampled directly from the intestinal lumen at the conclusion of the study. Wet weight and size of ichthyocarbonate were measured to evaluate changes in production rate or morphology with changes in feeding state. Preliminary wet weight results (milligrams of ichthyocarbonate/grams of total fish mass/day) indicate similar ichthyocarbonate production rate between fed (n = 18, M = 0.163 mg/g/day, ±SEM = 0.019 mg/g/day) and unfed (n = 18, M = 0.130 mg/g/day, ±SEM = 0.033 mg/g/day, p = 0.386) Gulf toadfish. Ongoing work includes Scanning Electron Microscopy to assess crystallite morphology and elemental analysis on an ICP-QQQ to determine concentrations of magnesium, calcium, and phosphorus to support comparisons between tank and intestinal samples. Results are anticipated to enhance understanding of controls on ichthyocarbonate composition, contributing to knowledge on their role in the global carbon cycle. This research highlights the underestimated significance of fish in the exchange of oceanic carbon, addressing critical knowledge gaps in ichthyocarbonate production rates.