# Ph.D. Dissertation Defense


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### On the success of the hadal snailfish

The influence of trophic ecology, life history, and pressure adaptation on depth zonation in the planet's deepest-living fishes


Abstract: The snailfishes, family Liparidae (Scorpaeniformes), have found notable success in the hadal zone from ~6,000 - 8,200 m, comprising the dominant ichthyofauna in at least five trenches worldwide. The hadal fish community is distinct from the surrounding abyss where solitary, scavenging fishes such as rattails (Macrouridae), cutthroat eels (Synaphobranchidae), eelpouts (Zoarcidae), and cusk eels (Ophidiidae) are most common. Little is known about the biology of these deepest-living fishes, nor the factors that drive their success at hadal depths. Using recent collections from the Mariana Trench, Kermadec Trench, and neighboring abyssal plains, this dissertation investigates the role of trophic ecology, pressure adaptation, and life history in structuring fish communities at the abyssal-hadal boundary. Stomach content and amino acid isotope analyses suggest that suction-feeding predatory fishes like hadal liparids may find an advantage to descending into the trench – where amphipods are abundant. More generalist feeders and scavengers relying on carrion, such as macrourids, might not benefit from this nutritional advantage at hadal depths. Hadal fishes also show specialized adaptation to hydrostatic pressure, as seen in metabolic enzyme activities. Maximum reaction rate of lactate dehydrogenases from hadal liparids increased activity under *in situ* pressures of 600 bar, while in shallow-living fishes, this enzyme was pressure-inhibited. These types of pressure adaptation would be a necessary condition for fishes to thrive at hadal depths. Intraspecific activities of tricarboxylic acid cycle enzymes, considered proxies of metabolic rate and nutritional condition, increased with depth of capture in hadal snailfishes, further suggesting an advantage to snailfishes living deeper in the trench where food availability would be higher. Analysis of otolith growth zones support an additional hypothesis, that snailfishes may be adapted to a seismically active, high-disturbance hadal environment by having relatively short life-spans compared to other deep-sea fishes, on the order of fifteen years. Additional aspects of hadal snailfish biology, including thermal histories, reproduction, swimming kinematics, and buoyancy strategies are discussed. The taxonomic description of a newly-discovered hadal liparid from the Mariana Trench is also included. This study provides insight into the ecology and physiology of deep-dwelling fishes and informs new understanding of life in the trenches.


**Thursday April 6th, 2017 3:00 pm MSB 114**