Gustatory system data from an anatomical analysis of the development of the olfactory and gustatory system in the gobies, E. lori and E. colini conducted betwen 2011 and 2016

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Project
» Collaborative Research: The Role of Larval Orientation Behavior in Determining Population Connectivity (Elacatinus Dispersal II)

Contributors	Affiliation	Role
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Coverage

Temporal Extent: 2011 - 2016

Dataset Description

Gustatory system data from an anatomical analysis of the development of the olfactory system (nose) and gustatory system (taste buds) in the gobies Elacatinus lori and Elacatinus colini. Collections and experiements took place between 2011 and 2016. Gobies were collected from reef habitats at the South Water Caye Marine Reserve and Carrie Bow Caye, Belize and reared at Boston University.

These data are published in Hu et al. (2018) as Figure 7, Figure 9 and Figure 10.

Related datasets:
* Goby Histological Inventory: https://www.bco-dmo.org/dataset/779950
* Goby nose data: https://www.bco-dmo.org/dataset/780017

Methods & Sampling

Methodology:

Fish Collection and Rearing (for all histological and SEM analyses) - Mated pairs of E. lori and of E. colini were collected from reef habitats near Carrie Bow Caye, Belize and housed in 75-l aquaria in a flow-through seawater lab at the International Zoological Expeditions (IZE) field station on South Water Caye, Belize, or in a recirculating seawater system at Boston University, USA. Ontogenetic series of E. lori and E. colini larvae were reared in 76-l cylindrical black bins and fed a variety of cultured and wild-caught zooplankton (Figure 1). A detailed description of brood stock maintenance and larval rearing methods can be found in Majoris et al. (2018). Additional post-settlement E. lori and E. colini (settlers) were collected from reef habitats within the South Water Caye Marine Reserve. Field research in Belize and the export of samples from Belize was carried out with the approval of the Belize Fisheries Department. Fish were immersed in cold seawater (2-4 degrees C) for two minutes and then fixed in cold (2-4 degrees C) 10% formalin in seawater (or in phosphate-buffered saline, PBS) for at least two minutes for anatomical study, which is consistent with AVMA Guidelines on Euthanasia of small warm-water fish. Care was taken to ensure that fish did not contact ice directly. Chemical anaesthetic was not used for several reasons, in particular because fixation must occur prior to death to avoid post-mortem changes at the cellular level, and ensure quality of the histological data and specimens prepared for SEM.

Taste Bud Analysis - Individual taste buds (~15-20 m in diameter) were present in multiple sections, so other landmarks (e.g. eye, skeletal features) were used to distinguish between individual taste buds to ensure accurate counts. Taste buds were counted in four regions: 1) oral jaws, lips, and buccal valves, 2) roof of the buccal cavity, 3) floor of the buccal cavity, including the basihyal and basibranchial (the tongue), and 4) gill arches, including taste buds located between pharyngeal teeth. In order to assess rostro-caudal distribution of taste buds within the buccal cavity, the head of each individual was divided into ten equal bins along the rostro-caudal axis, extending from the lips to the anterior end of the esophagus (beyond which taste buds were not found) and the total number of taste buds was calculated for each bin.

Note: for olfactory size, measurements were taken on histological sections at 25 (position 1), 50 (position 2) and 75% (position 3) along the rostro-caudal length of the olfactory epithelium.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.

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Related Publications

Hu, Y., Majoris, J. E., Buston, P. M., & Webb, J. F. (2018). Potential roles of smell and taste in the orientation behaviour of coral-reef fish larvae: insights from morphology. Journal of Fish Biology, 95(1), 311–323. doi:10.1111/jfb.13793
Results

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: The Role of Larval Orientation Behavior in Determining Population

Connectivity (Elacatinus Dispersal II)

Coverage: Belizean Barrier Reef System

Description from NSF award abstract:
Understanding how far young fish move away from their parents is a major goal of marine ecology because this dispersal can make connections between distinct populations and thus influence population size and dynamics. Understanding the drivers of population dynamics is, in turn, essential for effective fisheries management. Marine ecologists have used two different approaches to understand how fish populations are connected: genetic methods that measure connectivity and oceanographic models that predict connectivity. There is, however, a mismatch between the predictions of oceanographic models and the observations of genetic methods. It is thought that this mismatch is caused by the behavior of the young, or larval, fish. The objective of this research is to study the orientation capabilities of larval fish in the wild throughout development and under a variety of environmental conditions to see if the gap between observations and predictions of population connectivity can be resolved. The project will have broader impacts in three key areas: integration of research and teaching by training young scientists at multiple levels; broadening participation of undergraduates from underrepresented groups; and wide dissemination of results through development of a website with information and resources in English and Spanish.

The overall objective of the research is to investigate the role of larval orientation behavior throughout ontogeny in determining population connectivity. This will be done using the neon goby, Elacatinus lori, as a model system in Belize. The choice of study system is motivated by the fact that direct genetic methods have already been used to describe the complete dispersal kernel for this species, and these observations indicate that dispersal is less extensive than predicted by a high-resolution biophysical model; E. lori can be reared in the lab from hatching to settlement providing a reliable source of larvae of all ages for proposed experiments; and a new, proven behavioral observation platform, the Drifting In Situ Chamber (DISC), allows measurements of larval orientation behavior in open water. The project has three specific objectives: to understand ontogenetic changes in larval orientation capabilities by correlating larval orientation behavior with developmental sensory anatomy; to analyze variation in the precision of larval orientation in different environmental contexts through ontogeny; and to test alternative hypotheses for the goal of larval orientation behavior, i.e., to determine where larvae are heading as they develop.

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Funding

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NSF Division of Ocean Sciences (NSF OCE)	OCE-1459546
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