Outcomes of interactions between five species of medusae and their prey from experiments conducted between July and August of 2016.

Website: https://www.bco-dmo.org/dataset/743065
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Project
» RUI: Collaborative Research: What's their impact?: Quantification of medusan feeding mechanics as a tool for predicting medusan predation (Medusan Feeding Mechanics)

Contributors	Affiliation	Role
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Abstract
Raw data of outcomes of interactions between medusae (5 species) and their prey (artemia or copepods) was collected from experiments conducted between July and August of 2016.

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Coverage

Temporal Extent: 2016-07-01 - 2016-08-31

Dataset Description

These data have been submitted to BCO-DMO and are in the process of being served.

Methods & Sampling

To quantify prey capture and encounters with the feeding structures, we recorded the outcome of each stage of the feeding process. Since medusae are not visual predators and they use a feeding current to encounter their prey, we define an encounter as occurring when a prey item is clearly entrained (being transported) by the feeding current of the medusae. Consequently, we will use the term ‘entrainment’ throughout the rest of the manuscript to denote an encounter. The definition for feeding efficiency has been variously defined by previous authors, so for this study we defined different feeding efficiencies based on 3 sequential steps (see equations below): contact (Eq. 1), capture (Eq. 2), and retention (Eq. 3). For this experiment, we defined contact efficiency as the proportion of entrained prey particles that made contact with the feeding structures of the medusae. Capture efficiency was the proportion of contacted prey that were captured, i.e. stuck to the capture surface. Retention efficiency was the proportion of entrained prey that were ultimately ingested. We did not track prey into the guts and assumed if they remained captured for >30 s that they were eventually ingested.

Eq. 1: Contact efficiency = no. prey contacted/ no. prey entrained × 100

Eq. 2: Capture efficiency = no. prey captured/ no. prey contacted × 100
Eq. 3: Retention efficiency = no. prey captured/ no. prey entrained × 100

Capture maps were generated from the 3D videos. During video analysis, individual prey were tracked in relation to the medusae and the medusa's reflection to observe points of contact. Points of contact were recorded online maps generated by averaging the size ratios of the medusae using dimensions recorded in ImageJ (64 bit, Java 1.8.0_66).

Experiments were conducted at the Marine Biological Laboratory in Woods Hole during the summer (July-August) of 2016. The medusae were provided by the New England Aquarium. Artemia and copepod prey were cultured onsite at the MBL.

Data Processing Description

ImageJ (64 bit, Java 1.8.0_66)

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

RUI: Collaborative Research: What's their impact?: Quantification of medusan feeding mechanics as a tool for predicting medusan predation (Medusan Feeding Mechanics)

Coverage: Woods Hole, MA

In many areas around the world jellyfish population abundances are increasing and, at times, result in destructive blooms. Their rapid growth and high feeding rates make them important predators in marine ecosystems and their effects on ecosystems and human activities have increasingly raised concerns. Unfortunately, scientists do not currently understand the factors that determine which types of prey jellyfish eat and how much prey they eat. This presents a knowledge gap of increasing importance as jellyfish undergo inexplicable population fluctuations and invade new environments. In this project the investigators will develop a robust understanding of the factors that determine who and how much jellyfish consume based on their morphology, behavior and size. This fundamental understanding of their feeding process will enable researchers to use simple jellyfish characteristics to predict the ecological impact of different types of jellyfish. This project will include the studying of a greatly understudied group, rhizostome jellyfish, which represents many of the recorded bloom events and geographic expansions. Further, these techniques are sufficiently robust to have broader use in the study of physical-biological interactions for other jellyfish species and other pelagic organisms. The principal investigators participating in this collaboration are from primarily undergraduate institutions. Student participation in the project will involve several undergraduates during each year of the award. Through summer research at the Marine Biology Laboratory, undergraduate students will become exposed to a wide range of research and become immersed in a post-graduate environment that can strongly influence their perception of the scientific profession. The trophic impacts of scyphomedusae are subjects of broad international interest and results of our research will be exchanged with a wide range of colleagues, contributing to international scientific dialogue. In addition, we will use our contacts with media (e.g. PBS Shape of Life series, Fantastic Jellies exhibit at the New England Aquarium) involved in scientific education of the general public to communicate our new findings.

The goal of this project is to quantify the variables that control the post-encounter capture process in order to be able to predict the prey selection patterns and clearance rate potential of different rowing medusae based upon their morphological characteristics and size. To achieve this goal, the PIs will use laboratory and in situ videography and optics techniques to quantify the outcome of individual interactions with prey in the lab and in the field. Step-by-step quantification of the post-encounter capture process will enable them to quantify capture efficiencies of different prey types and determine which stages of the process were most influential in determining the outcome of the encounter. The investigators will use these quantitative observations to relate medusan morphology and nematocyst properties to capture efficiencies. This will allow them to predict prey selection patterns. These predictions will be combined with flow-based encounter models to predict clearance rate potential and prey selection of different medusan species under different prey conditions. Finally, the investigators will validate our predictions using laboratory bottle incubation studies to quantify prey selection and clearance rates of medusae fed different prey assemblages. When achieved, this study will provide marine ecologists with the critical "missing links" to be able to model and predict the ecological impact of medusae populations in a variety of environments.

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NSF Division of Ocean Sciences (NSF OCE)	OCE-1536688

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