

Nearshore larval transport: biological and physical processes

Final Report for MASTS/WHOI Academic Bridge - 10/05/2015 to 20/08/2016

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MASTS provided funding for a three-month placement in the Pineda Benthic Ecology and Nearshore Oceanography Lab within the Biology department at Woods Hole Oceanographic Institute. I made contributions to three research projects within the group with the overarching themes of larval transport and the role of behaviour and fine-scale physical processes in structuring ecological processes. Details of the work carried out for each project are given below.

Project 1: Quantifying the role of wave circulation/stokes drift in larval transport

As part of an on-going collaboration between the University of San Diego (USD) and the Pineda Lab, I assisted with a NSF-funded project that aimed to understand the role of surf zone hydrodynamics in the rate of delivery of barnacle cyprids to the intertidal zone. A visit to the field site at Bird Rock, La Jolla, California was undertaken and involved collecting and processing zooplankton samples. Plankton samples were obtained during internal wave conditions and non-wave conditions, and the number of cyprids and nauplii quantified. These samples will be combined with other annual samples taken by the group during the spring and winter to determine the extent of seasonal differences in the predominance of different forms of oceanographic circulation, and hence mechanisms of delivering larvae to the coastal zone.

The knowledge gained from this on-going project at WHOI and USD will allow for greater insights into fundamental processes in plankton ecology, and will be broadly applicable to global temperate coasts. Such an understanding can be used for managing the marine environment and predicting the impacts of increasing anthropogenic pressures on the oceans, which will inevitably affect larval processes.

Project 2: Understanding the role of behaviour and tidal forcing on the vertical distribution of bivalve larvae

Models of larvae dispersal typically assume that larvae disperse like passive particles, yet there is mounting evidence that bivalve larvae can influence their horizontal distribution by controlling their vertical position in the water column and thus affect transport and spatial distribution. Within the Pineda lab, research is being conducted to evaluate the vertical distribution of larvae after reproduction and quantify the extent to which the vertical distribution is dependent on tidal amplitude. I helped to develop methods for measuring the

initial dispersion of tagged larvae after a simulated reproductive event. I undertook toxicity assessments to define the level of stain that could be used to tag larvae prior to release. I contributed to the development of fluorescence microscopy methods for identifying recaptured larvae. The methods will be used to compare bivalve larval dispersal to the dispersal of tracer dye released at the same time, which can be used to represent the passive dispersal model.

Project 3:

The final project that I contributed to during the placement was on-going work by the Pineda lab to quantify *in-situ* patterns of zooplankton accumulation, sand lance, dogfish and humpback whale abundance in relation to non-linear internal waves and hydraulic jumps within Massachusetts Bay. I analysed echosounder recorder data, previously collected from Stellwagen Bank, to quantify the number of Spiny Dogfish (*Squalus acanthias*), and their position in the water column before, during and after the passage of internal waves. Fieldwork was undertaken on a NOAA vessel to collect preliminary data on zooplankton accumulation in hydraulic jumps in Stellwagaen area. This work fed into a successful funding proposal by the group to continue researching ecological responses to hydraulic jumps.

The academic bridge placement was highly successful and rewarding, and it is hoped that there will be continued collaboration with the group. In the final week, I was also offered the opportunity to join a one-week research cruise with NOAA to carry out the annual stock assessment of clam fisheries on the east coast of the USA. I would like to thank all those that I worked with at WHOI and Jesús Pineda for hosting me in his lab. I would also like to thank MASTS for funding this placement.