Impact of spawning time and depth on larval transport by the Gulf Stream

Samikshya Poudel (poudel4samikshya@gmail.com), J.C. Garwood, Rutgers University New Brunswick

INTRODUCTION:

Larval dispersal in the ocean is one of the factors affecting marine biodiversity and population sustainability. Due to alongshore ocean currents, snail larvae originating on the New Jersey shelf are transported south. To investigate whether the Gulf Stream and warm core rings can return larvae to their original habitat, we model the transport of *Tritia trivittata*, one of the snail species found on the New Jersey shelf, in the Mid-Atlantic Bight. The influence of two different factors was investigated:

a. Spawning time (determined by temperature)

b. Spawning depth

METHODS:

To test if the Gulf Stream and warm core rings may return larvae to the New Jersey shelf, virtual snail larvae with swimming behavior resembling that of *Tritia trivatta* were released into a 3D regional ocean model (ROMS). Using ROMS Path, virtual larvae were released at Cape Hatteras at different depths (21, 29, 46 m) and different temperatures (6, 8, 10 °C) from 2010 - 2015 (Fig. 1). A total of 19,200 larvae were released for each condition. After 60 days, the larvae that ended at or near the shelf (here defined as water depth < 800 m) were considered successful.

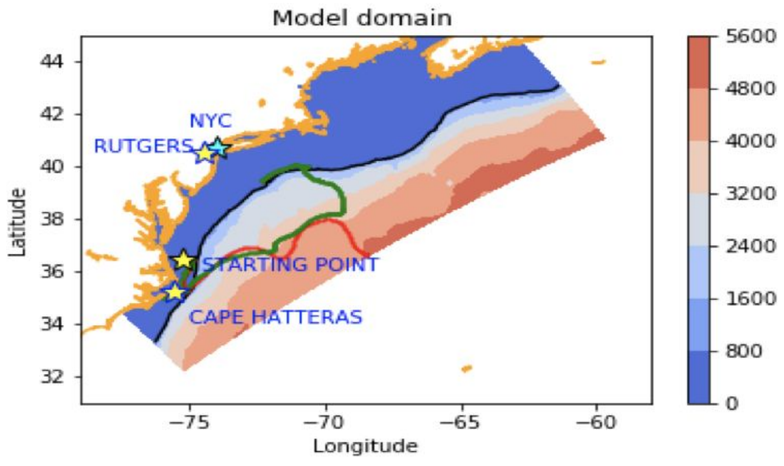

Fig 1. Model domain. The colorbar shows water depth. The green and red solid lines show example of successful and unsuccessful larval paths, respectively, from Cape Hatteras to the New Jersey Shelf due to Gulf Stream and warm-core rings in model.

FUTURE STEPS:

1. While exploring the data, I noticed a period of time when larvae could not stay at the surface. I would like to investigate the factors behind this sinking.
2. Compare more variables to have an in-depth understanding of successful vs. unsuccessful larval dispersal.
3. Compare the variation of larval success in different months.
4. Model more years to see if the observed trends are consistent.

RESULTS:

- Spawning at **intermediate depths (29 m)** seems most reliable for larvae to make it back to the shelf (Fig. 2).
- Larvae are seeming to be successful later in the years when ocean **gets warmer (Fig. 3).**
- **Overall, 2013 seems to be better year for the larvae.**

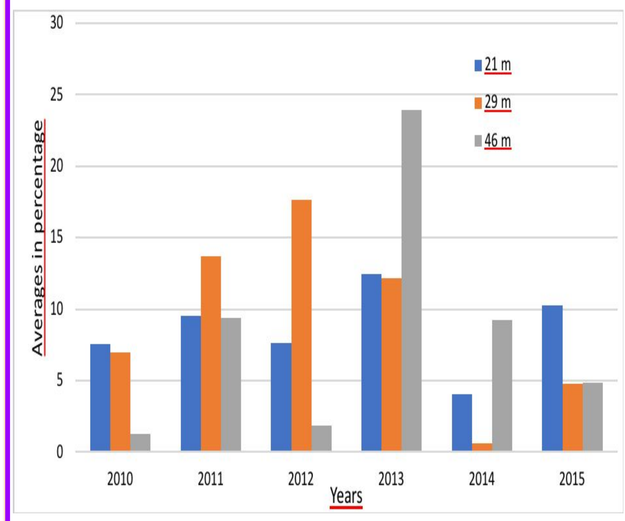

Fig. 2 Successful larvae (%) as a function of year, grouped by spawning depth.

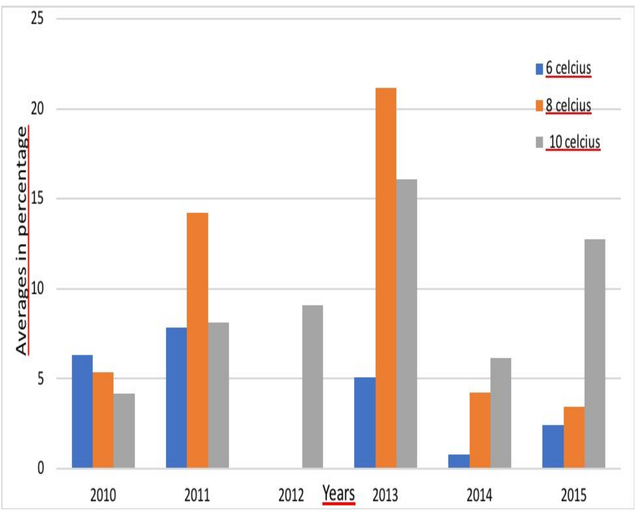

Fig. 3 Successful larvae (%) as a function of year, grouped by spawning temperature.

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