

## Transport Pathways in the North Atlantic: Searching for Throughput

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The objective of this program is to clarify the transport pathways in the North Atlantic, with implications for physical, chemical or biological tracers.

### Recent results

At the end of their life cycle, American eel (*Anguilla rostrata*) migrate to the Sargasso Sea from freshwater habitats along the east coast of North America in order to spawn planktonic eggs. The eggs develop into larvae that then have to reach estuarine and freshwater nursery habitats along the North American coast within approximately their first year of life. A coupled biological–physical model was used to study how potential behavioral adaptations influence the ability of American eel larvae to reach near-coastal waters. Specifically, several larval swimming behaviors were investigated, including passive drift, random walk swimming, and directional navigation with and without a preferred swimming direction. Directional swimming with a randomly chosen direction improved the success rates of larvae reaching the continental shelf by more than two orders of magnitude compared to passive drift, and swimming primarily to the northwest further tripled these success rates. Success rates also substantially increased for larvae with swimming abilities even slightly above an estimated average. Notably, directional swimming resulted in a reasonable distribution of larvae along the North American shelf break, whereas other swimming scenarios left distinct gaps where no simulated larvae reached the shelf, including near the Gulf of Maine where juvenile eels are abundant. Additionally, directional swimming yielded transit times of about one year, in agreement with observations. Finally, the model supported the southwestern Sargasso Sea as the probable spawning area for American eel. A manuscript describing these results has been published (Rypina et al. 2014)

The American Eel population has been declining over the last two decades. Part of this decline is due to overfishing. However, the oceanic variability on inter-annual scales also has a direct influence on the number of larvae that are reaching the coast each year. We have been investigating the connection between the North Atlantic circulation and the success rates of American eel larvae using a coupled physical-biological model.

### Bibliography

Rypina, I. I., L. J. Pratt, J. Llopiz, and S. Lozier, 2014: Dispersal pathways of American eel larvae from the Sargasso Sea. *Limnol. Oceanogr.*, **59**, 1704-1714, doi:10.4319/lo.2014.59.5.1704.