NExUS Ongoing Projects and Activities Fri Nov 16 02:30:26 EST 2018

Name	Tidal front mixing and exchange on Georges Bank: Controls on the production of phytoplankton, zooplankton and larval fishes

Description	From Project Description: Georges Bank supports a rich fishery because: (1) large portions of the bank are shallow enough that light-limitation of phytoplankton is usually not important; (2) deep waters rich in inorganic nutrients are available for mixing onto the bank; and (3) the Bank's clockwise circulation can retain the planktonic stages of important fish species. The tidally mixed front (TMF) is central to the productivity of Georges Bank through the processes of nutrient injection in the north and retention of larvae on the south flank. These two regions are connected by a circulation pathway along the front in which nutrients lead to phytoplankton and zooplankton growth, creating a donut-shaped region of high production surrounding the crest. We suggest that the productivity of this pathway is the result of northern edge nutrient injections and is susceptible to climatic influences on nutrient supply in that region. The overall objective of this proposal is to understand the processes within the TMF that sustain the biological productivity of Georges Bank and the success of the target species, cod and haddock. This requires that we understand how mixing and circulation within the TMF supply new nutrients, support primary production, and retain larvae. GLOBEC dye tracer experiments have for the first time measured directly the near-bottom Lagrangian circulation and mixing in the TMF. Results show that vertical mixing in the front, and the on-bank flow through the base of the TMF, are dynamically connected. Our study examines the 3-dimensional dynamics of the TMF based on these measurements. Models will help us assess how the strength of the across- and along-isobath circulation sets time and space scales compatible with the development of cod and haddock larvae. This project will consist of a mix of data analysis and modeling activities. First, dye dispersion data and simple shear dispersion models will be used to understand the link between cross-bank flow and vertical mixing. Second, a finite-volume coastal ocean model (FVCOM) will be used to calculate the temporal and spatial structure of nutrient flux into the TMF, contrasting northern and southern flank inputs. A coupled FVCOM-NPZ (nutrient-phytoplankton-zooplankton) model will be used to test the following hypotheses: (i) Nutrient injections in the north are advected around the crest of the bank and lead to a plume of elevated phytoplankton and zooplankton production. (ii) The plume enriches the area of larval entrainment on the south flank. If the above statements are true, then production in the plume, can be altered by the nutrient content of source waters in the Northeast Channel of the Gulf of Maine, and these changes will affect the feeding environment of larval cod and haddock. Finally, models incorporating the measured 3-D flow and turbulence fields will be used to examine spatial patterns of larval retention and define the kinds of environmental transitions that larvae experience during this process.
Category	- Climate-change Specific Projects - Research
Sector	- Managed Ecosystems - Natural Ecosystems
Focus Area	- Sustainability of Marine Ecosystems
Region	- Regional Or State -- New England

Status	- Ongoing
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