

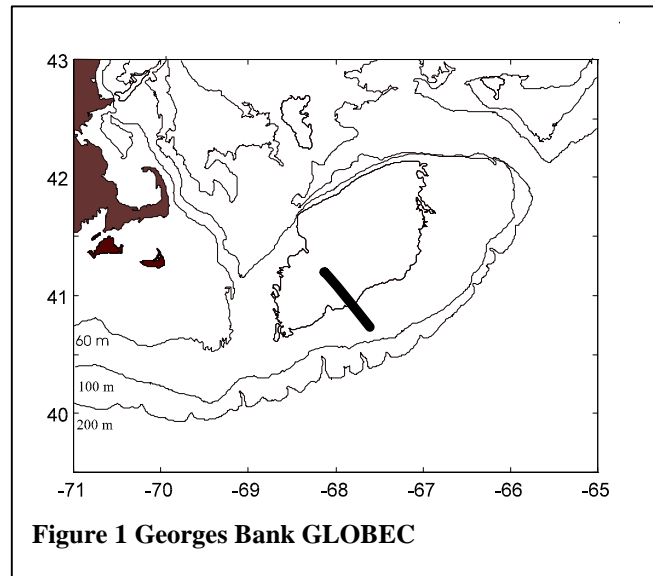
# FleetLink Field Demonstration

## Transects of the tidal mixing front on the southern flank of Georges Bank

### July 2001

#### Biological and physical significance of the tidal-mixing front on Georges Bank

The pilot phase of the U.S.GLOBEC Georges Bank Study examined the tidal-mixing front on the southern flank of Georges Bank in 1995 (see, e.g., Mountain and Taylor, 1996). This persistent and predictable feature is typically located at about the 60 m isobath on Georges Bank (Garrett et al., 1978). The tidal-mixing region defines a boundary between physical (the shallow, well-mixed waters of the Bank crest vs. the deeper seasonally-stratified waters of the flank; Garrett et al., 1978) and biological regimes (Fig. 1). Within the well mixed area, chlorophyll levels and rates of primary production are higher than in surrounding stratified waters (O'Reilly et al., 1987); the phytoplankton assemblage is dominated by diatoms in well-mixed regions vs. dinoflagellates in stratified waters (Cura, 1987). There are characteristic differences in the species composition of the zooplankton assemblage: *Centropages hamatus* and *Pseudocalanus moultoni* frequently dominate the Bank-crest, while *Calanus finmarchicus* is concentrated on the flanks of the Bank (Casas et al., 1995 1).



The exchange of physical and biological properties across these fronts can influence the supply of nutrients for primary production, the retention (loss) of the target species and their prey on (from) the Bank, and interactions between the target species, their prey, and their predators. Cross-frontal exchange is influenced by physical processes which determine the location, deformation, and movement of the front including tides, winds, seasonal heating/cooling, and offshore forcing, and by biological characteristics and behavior which may enhance or minimize exchange. Fronts often are regions of aggregation for marine plankton, both because of physical processes such as divergence or convergence and biological responses such as enhanced production or behavior (i.e., depth-keeping swimming). Such aggregations of plankton provide an enhanced food source for predators including larval cod and haddock. Fine-scale description of the physical and biological fields comprising fronts may reveal aggregations of phytoplankton and zooplankton associated with specific physical structures (e.g., density, temperature, and micro-structure) which provide for enhanced predator-prey contact rates and ultimately elevated production of the target species.

Preliminary examination by R. Beardsely and S. Gallager (WHOI, personal communication) has yielded a schematic of physical dynamics in the tidal-mixing frontal region on the southern flank of

Georges Bank (Fig. 2), which they have used to propose hypotheses regarding cross-frontal transport of several target species, including fish larvae and copepods. According to their hypothesis, *Pseudocalanus* spp. will be found predominantly in the well-mixed area and not be transported across the front into stratified water.

**Temperature profiling as part of the FleetLink project**

During Summer 2001, one of the FleetLink vessels will conduct a high resolution sampling of the sea surface and water column temperature in the tidal mixing front region on the southern flank of Georges Bank. The goal will be to complete 6 to 8 transects across the tidal mixing front between 40 m and 100 m depth. During each transect, underway sea surface temperature will be measured, and vertical temperature profiles will be taken at 5 km intervals along the transect.

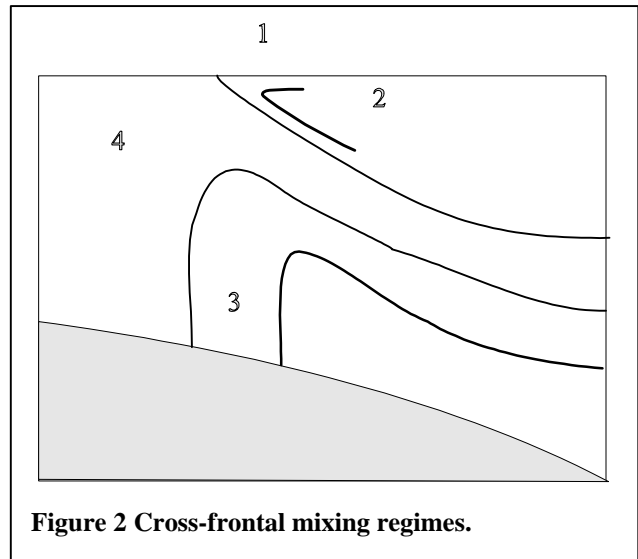


Figure 2 Cross-frontal mixing regimes.

The sea surface temperature data will be telemetered to the FleetLink data server at WHOI and will appear on the project web site. The surface temperature data will be used to locate the tidal mixing front, and ensure adequate sampling on either side of it.

**Logistical details for cruise planning**

**Gear set-up:** 20 pound chain on polypropylene line; VemCo and NetSensor on same line; both sensors 2 meters above weight

**Cruise plan**

The general plan includes replicate cross-isobath transects on and off the Bank in a parallel series moving east to west (Fig. 3). Transects are 20 miles long (with 5 miles separating each transect) with profiles to be taken every 2 and ½ miles along the transects. Estimated timing of each transect is 3 hours steaming and 3 hours at the stations (i.e., 9 profiles at 20 minutes each). The timing of each transect should be done so that at the mid-point of each transect, the tidal flow is either maximum onbank or maximum onbank in the tidal ellipse (Fig. 4). One suggestion would be begin the first transect 3 hours before

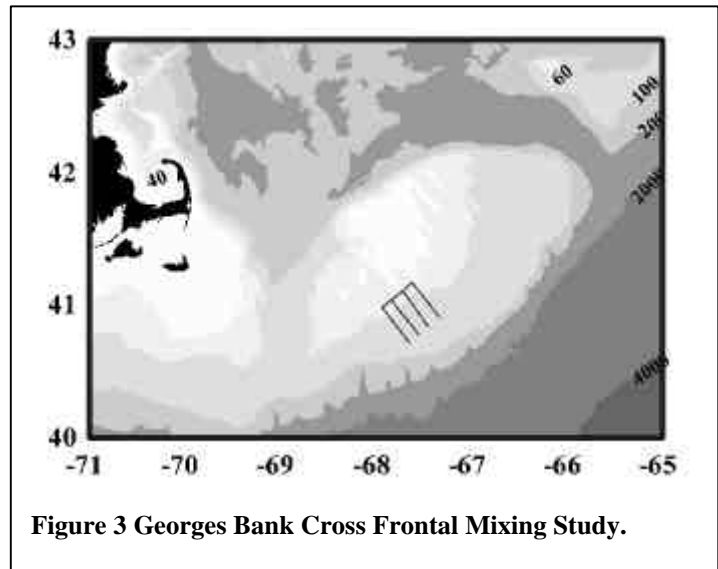


Figure 3 Georges Bank Cross Frontal Mixing Study.

tidal maximum, and complete both transects in Leg I during that tidal cycle. Work on Leg II could begin after the transit to the next Leg and after a rest. Also, IJim Bisagni for AVHRR print-out and any other satellite imagery.

Cruise track: endpoints for the cruise, with estimated timing:

**Transit:** Fairhaven to first point (175 miles; 22 hours)

**Test drop:** Great South Channel in about 80 m of water and test the gear and data collection

**Leg I** (12 hours)

Onbank endpoint 41° 10'; 67° 37'

Offbank endpoint 40° 54'; 67° 20'

**Leg II** (12 hours)

Onbank endpoint 41° 06'; 67° 43'

Offbank endpoint 40° 50'; 67° 27'

**Leg III** (12 hours)

On bank endpoint 41° 2'; 67° 50'

Offbank endpoint 40° 46'; 67° 33'

**Leg IV** (12 hours)

Onbank endpoint 40° 59'; 67° 56'

Offbank endpoint 40° 43'; 67° 39'

**Transit:** Endpoint to Fairhaven (175 miles; 22 hours)

