

**Shell-GIS – a new GIS tool for oyster
farm site selection, oyster growth
prediction and production carrying
capacity.**

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Funding by NRAC (2010-2012)

Assessment of Environmental Impacts of Oyster Aquaculture in New England Waters

Follow on funding by NRAC (2012-2014)

Shellfish STEM-GIS (ShellGIS) Development for Improved Siting and Farm Management

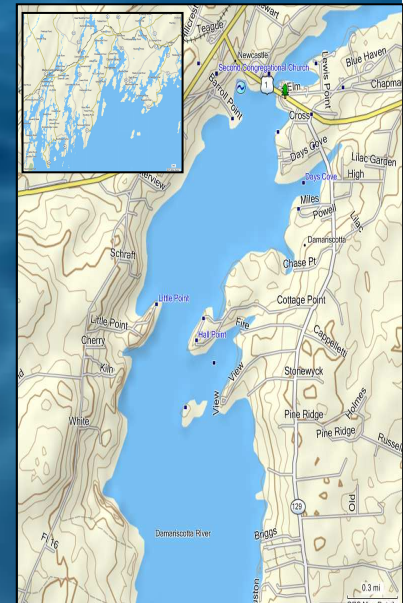
Project Objectives: 2010 and 2011

- Develop Hydrodynamic Flow Model for oyster aquaculture (Damariscotta, Maine) using Mike 21
- Develop a Seston Depletion Flow Model (Maine)
- Assess Benthic infaunal, epifauna and meiofaunal impacts (Maine)
- Create an oyster growth model using ShellSIM (Maine, Connecticut)
- Develop a STEM-GIS-based interactive tool incorporating all of the above data that a user-friendly for oyster farmers, managers and regulators (Maine)
- GIS can be used to estimate growth of oysters as a function of location within the estuary, and as a function of seeding density (patch modeling)



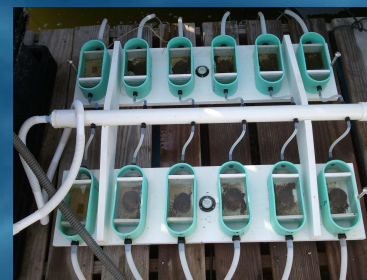
Year 1 (2010) upper Damariscotta River, Maine

- Develop 50 m grid flow model for estuary, calibrate with current meter measurements. High resolution bathymetry in area of lease sites.
- Deploy oysters for growth study at surface and bottom waters, where water samples are taken..
- Collect forcing functions for SHELLSIM American Oyster Growth Model: temp, sal, TPM, PIM, POM, POC, PON, Chl a
- Perform *in-situ* biodeposition studies of oysters from May – November in flow-through chambers over 24 hour periods
- Develop GIS system
- Do benthic infaunal sampling at oyster farm and control sites
- Do mobile epibenthic sampling of bottom and surface culture sites

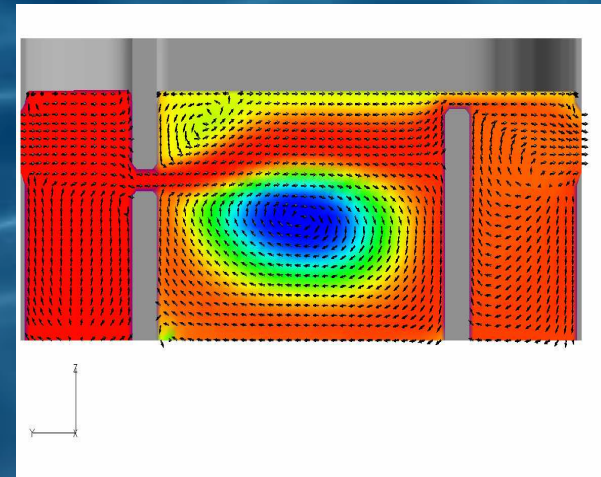


Year 2: Maine and Connecticut 2011

- Do growth trials, biodeposition and forcing functions for American Oysters at second location in New England to calibrate oyster growth model
- Collect more data in Maine for oyster growth and forcing functions, including biodeposition in May and September
- Refine GIS system, get user feedback
- Create new, simplified user interface for growers which answers FAQ's
- Release final product to user groups (2012)



Biodeposition studies repeated monthly from May – Nov Maine 2010, Ct. 2011. Did flow model of chambers to ensure sufficient flow rates to prevent recirculation

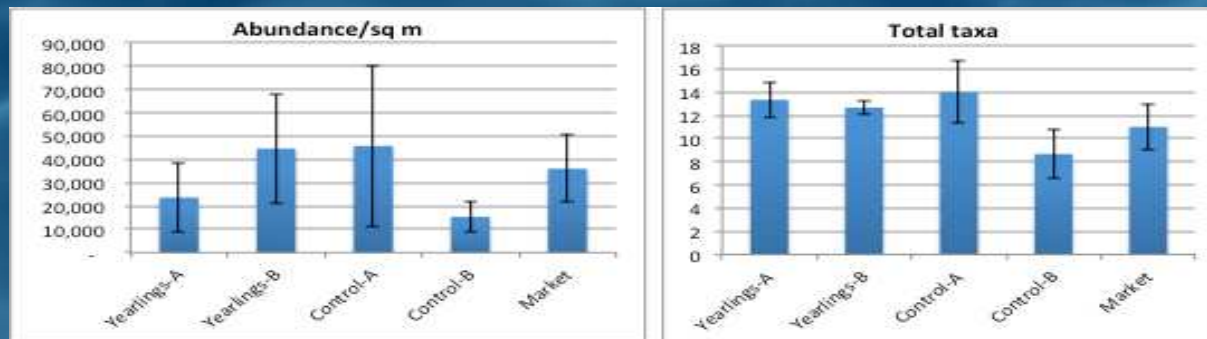


Benthic grab samples sieved to 1 mm



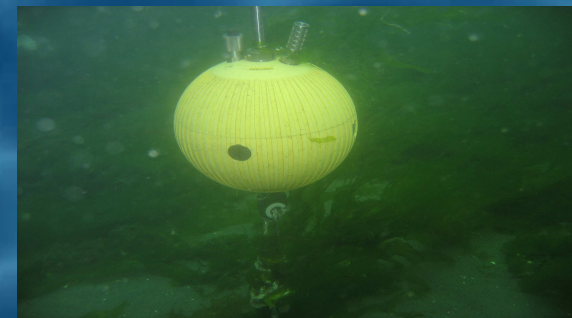
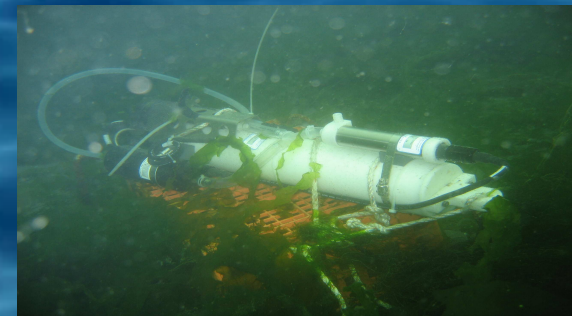
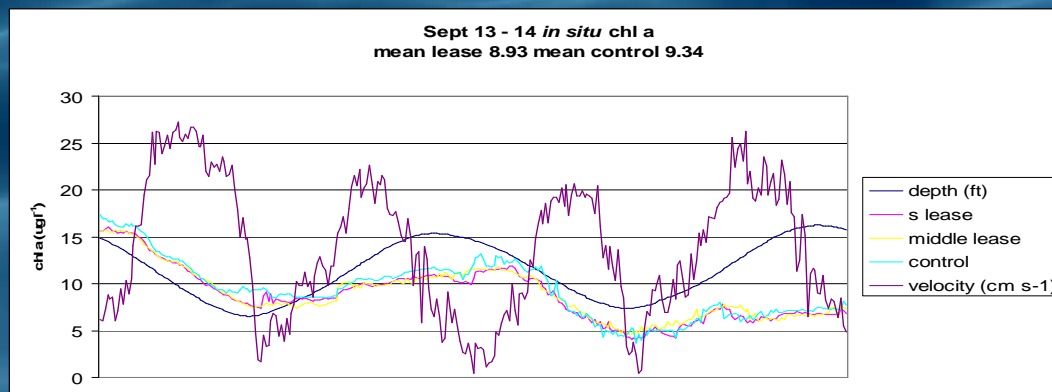
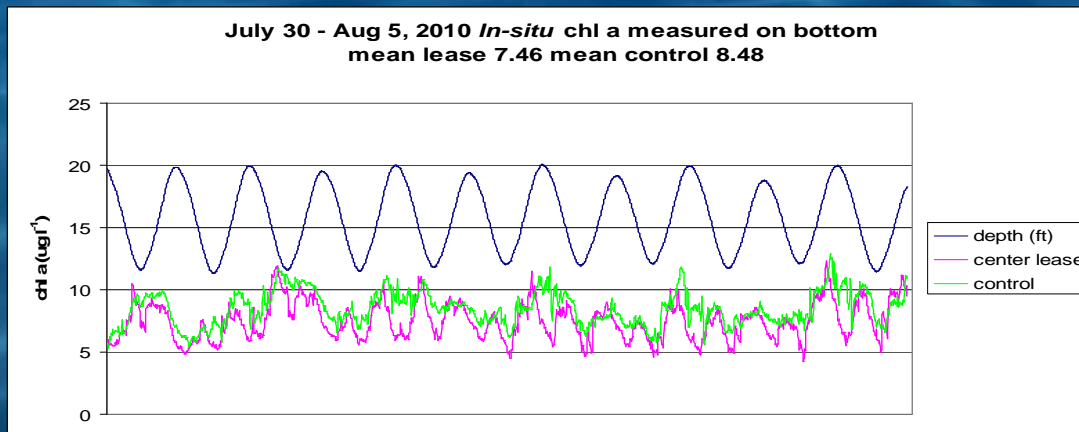
Benthic infauna and epibenthic sampling

- Oyster farms establish an abundant and diverse benthic infauna, enhanced relative to control sites
- Mobile epibenthic species are also abundant and diverse, and provide a food source for local fish stocks



Seston depletion studies used in model formulation for patch modeling

Seston depletion is a function of oyster biomass and water velocity



RESULTS TO DATE

- American oysters perform similar to other species modelled using SHELLSIM
- The quality of the organic matter is key to oyster growth, water sampling is necessary to estimate detritus quality in order to predict oyster growth
- The GIS system provides a pragmatic tool for determining production carrying capacity
- This same approach can be used for management of aquaculture of other species such as hard clams or scallops
- In our next project, we are focusing on more cost effective methods to collect growth driver data for SHELLSIM (buoys, etc.), better user interfaces, and developing more layers in the system for its use as a coastal management tool.
- In another project with Roger Newell and Larry Sanford of Maryland, we are incorporating biodeposition dynamics using DEPOMOD to refine the prediction of benthic impacts from suspension culture, and are applying to NSG to incorporate into Shell-GIS, and demonstrate its use in 3 other estuaries with 6 other species on the east and west coasts of the U.S.

- **NOW, THE GIS SYSTEM!**