REServ Project:

Status and Challenges for Economic and Ecological Modeling Components Completion (as of March 1, 2013)

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## Introduction

The motivation for this document is to describe the status of the economic and related ecological modeling components of the REServ project, challenges we are facing, and how we will move forward given the lack of data available from growers in Long Island Sound.

In our original project plan we proposed inclusion of economic analysis for Long Island Sound (LIS) and Great Bay/Piscataqua (GBP) to determine provision of goods (e.g. oysters and clams for consumption) and services (e.g. reduction of nutrients and particulates in the water column) provided by shellfish aquaculture in these two locations. The analyses were to include; the potential of bioextraction to reduce water treatment costs on land and to improve water quality via filtration by shellfish, and an estimate of the added value of the product (i.e. shellfish for consumption) that would provide incentive for growers to consider becoming involved, when possible, in a nutrient credit trading program. Scenario analysis for potential increased removal with expanded aquaculture activity was also planned. The success of the economic analysis is dependent on results provided from local and system scale ecological models.

## Status, Challenges, Roadblocks

The status, challenges and roadblock to completion of our planned analyses are described below:

1. *Valuation of Ecosystem Services* related to shellfish aquaculture through analysis of economic value of services linked to reduction of eutrophication through natural filtration and removal of phytoplankton and detritus by shellfish. Assessment of shellfish aquaculture's contribution to the economic value of water quality and habitat improvements will be based on outcomes of system scale ecological models, the system scale Assessment of Estuarine Trophic Status, and the local scale FARM models as well as a standard avoided cost analysis. Relevant monetary values for both LIS and GBP at present and in aquaculture expansion scenarios will be estimated from analysis of nitrogen removal through shellfish filtration.

The local scale Farm Aquaculture Resource Management (FARM) model output among other results, provides estimated harvest biomass, the value of the harvest, and the amount of nitrogen removed through filtration during the harvest cycle. The estimated value of the nitrogen removed is also calculated by the model based on an estimate of the local cost for removal of nitrogen through traditional management measures. The amount of nitrogen removed will be used for additional comparative avoided cost analysis described below.

Avoided cost will also be calculated based on costs of N removal via Point Source Controls (annualized capital and O&M costs of load reduction), Agriculture Best Management Practices (nutrient management and cover crops per-acre implementation costs), Urban Best Management Practices (wet pond and submerged gravel wetlands (average per acre-drained construction costs). Data on substitute or avoided costs have been obtained for LIS and will be used also in Great Bays. This analysis is dependent on the nitrogen removed which is being estimated at the local farm scale by the FARM model for both LIS and GBP, and at the system scale by the EcoWin2000 model for LIS only.

Status: The avoided cost analysis and FARM model analysis are in progress for LIS and GBP.

*LIS*: First estimates of nutrient removal by shellfish filtration have been made for a single farm in CT via the local scale FARM model for which a single grower has provided needed data. Further application/validation of the local scale model with the successfully added Eastern oyster component (from individual growth experiments) is ongoing.

System scale EcoWin2000 modeling for present shellfish related removal and for potential removal under an expansion scenario is ongoing; the SWEM model high resolution grid has been merged into an appropriate scale grid, and is in process of providing water quality results needed for the EcoWin2000 modeling. The EcoWin2000 results for nitrogen removal will provide the basis for the avoided cost analysis. However, the data required for model application (e.g. acres of lease area, cultivation area, harvest) has been exceedingly difficult to acquire. NOTE: The ecosystem model cannot be applied without this data and without those results the economic analysis is also compromised (see Challenges below).

*GBP:* A less robust analysis is being made for GBP due to the lack of a system scale circulation model but expansion scenarios have been formulated. The FARM model will be applied and nutrient removal amounts provided for estimation of the ecosystem service values and the avoided cost analysis. The FARM model will be applied to GBP using culture practice that has been provided. An expansion scenario has been conducted from which a coarse estimate can be made of potential increases in the value of removal of nitrogen and avoided cost.

Challenges:

*LIS*: Culture practices for clam and oyster in CT have been extremely difficult to characterize, actual lease areas that are under cultivation are unknown NOTE: the lease areas under cultivation are needed to run the system wide model, and those results are needed for the economic analysis. NOTE: For NY there is very little information and as a result we cannot estimate N removal for NY oyster and clam industry and thus not for the whole of Long Island Sound.

*GBP*: The less robust analysis, due to absence of system wide model, will proceed after a check to see that all environmental, culture practice and farm layout data needs are known (Suz).

1. *Economic Impact Assessment of Shellfish Aquaculture, Long Island Sound only*. The economic impacts of the shellfish aquaculture industry will be quantified using input-output analysis. NEI with Shellfish Environmental Services and the CT SeaGrant Extension designed and implemented a survey of growers in CT and RI (the RI data meant to serve as proxy data for Great Bays as those data are not available) to assess the economic impacts of shellfish aquaculture in LIS.

The objective of the survey was to collect information on industry spending (and some culture practices) in LIS, including number of jobs, revenue, harvest, etc. This information was to be used in an input-output model for LIS. The IMPLAN software was to be used with this recently collected data to quantify the direct, indirect, and induced economic impacts of the industry on LIS with economic impacts measured in terms of employment and income.

Status: The Survey of Growers in the CT side of LIS was conducted and delivered February 2013.

Challenges: Results were disappointing. NOTE: employment and income data are not adequate for application of IMPLAN and thus the analysis of economic impact of shellfish aquaculture in LIS is not feasible. There are no data for the NY side of LIS and this necessarily indicates inability to conduct a full LIS analysis.

## Way Forward: Action Items

Given the data constraints outlined above, we will proceed in the following way to use the data and information we do have to the best possible outcome. Please note that there are still some analyses that will not be completed unless we are able to get missing data immediately:

*Avoided costs evaluation* (task 1.):

*LIS:* We will complete the FARM and EcoWin2000 analyses in LIS to provide N removal through farmscale and system scale shellfish filtration, use LIS trading/exchange program values and avoided costs (e.g. local Point Source Control, Agriculture and Urban Best Management Practice values) for calculation of comparative benefits value from the 2 approaches for the present.

We will use SWEM data results in EcoWin2000 for one expansion scenario to estimate potential increase in value with increase in shellfish aquaculture and also for estimation of changes in system eutrophication status. NOTE: this cannot be performed if we cannot get values for the lease areas under cultivation. Also, this will necessarily be an underestimate because we are lacking data in NY.

*GBP*: We will proceed as appropriate with avoided cost calculation using the present conditions and growout scenarios. (Suz, Trina, Phil, Joao)

*Economic impact analysis in LIS* (task 2.): NOTE: This analysis cannot be done without additional data for revenues, expenditures and acres in production. Also, data for NY is inadequate, the lease acreage is not available, and so it will not be representative of total LIS, only for CT.

We will attempt to use an alternative/work around for EcoWin2000: determine currently operated lease areas on a ratio basis from total declared production data to estimated potential total based on overall lease areas, then we will know how much of the lease area is unused – on that basis, we can examine scenarios based on the unused (and therefore) expandable CT lease areas. NOTE: if successful this still will be for CT only since for NY, we have very little data at all (Trina, Joao, Suz).

## Other questions, concerns

Can we get anything for lease acreage and aquaculture activity in NY from the growers? Can Bob do in person interviews? Is there a NY Bureau of Aquaculture that Bob can visit? We have some data/information for production and value in NY, but we need acreage of leases to go forward with modeling, both ecological and economic. Can we use the NY lease areas as the ‘expanded aquaculture’ if we are unable to get data to make any analyses in NY? (MDN - Bob, Trina, Joao, Suz)

Assessment of eutrophication status for expansion scenario, i.e. at the system scale how will eutrophication status change with expansion of aquaculture activity, is dependent on the successful completion of the ecological system scale modeling.

related links:

<http://longislandsoundstudy.net/wp-content/uploads/2010/02/section3.1_2008.pdf>

<http://longislandsoundstudy.net/2010/06/approved-shellfish-acreage/>

<http://longislandsoundstudy.net/2010/06/oyster-harvest/>

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