



New England Fishery Management Council

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To: Paul J. Howard, Executive Director
From: Steve Cadrin, Chairman, Scientific and Statistical Committee
Date: September 20, 2010

Subject: Technical Review of the Analyses to Support Essential Fish Habitat (EFH) Omnibus Amendment 2

The Scientific and Statistical Committee (SSC) was asked to:

- 1) Evaluate the appropriateness of the Local Indicators of Spatial Association (LISA) analysis methods for defining clusters of habitats that are vulnerable to fishing effort ('Z_∞').
- 2) Evaluate the appropriateness of analyses for comparing practicability among management alternatives (the 'Z Net Stock Model').

The Council is currently developing Essential Fish Habitat (EFH) Omnibus Amendment 2. Phase 1 of the Amendment described and identified EFH for each managed species, reviewed the prey species consumed by each managed species, and reviewed non-fishing impacts to EFH. Phase 2 is being developed and includes alternatives to minimize, to the extent practicable, the alteration of habitat from fishing effort.

In order to better inform the alternatives development process and more objectively and analytically compare between alternatives, the Council's Habitat Plan Development Team (PDT) created the Swept Area Seabed Impact (SASI) model. The SSC reviewed the structure and data inputs of the SASI model at two meetings on 18 March 2009 and 9 December 2009 and concluded that "*the Swept Area Seabed Impact model is a technically sound basis for evaluating relative effects of alternative management decisions on habitat impact. However, the data used by the model does not currently have adequate resolution for the model to detect subtle differences in habitat impact among different types of fishing gear... Given the SSC's involvement in providing the Council with recommendations on ecosystem-approaches to fishery management, it would be appropriate for the SSC to review applications of the SASI model for management decisions.*"

On August 25, 2010 the SSC reviewed information and associated presentations developed by the Habitat Plan Development Team (PDT):

- 1) Terms of Reference memo
- 2) SASI Model document Part 1
- 3) SASI Model document Part 2
- 4) Sensitivity analyses
- 5) Spatial analyses Local Indicators of Spatial Associations (LISA) statistics
- 6) Z Net Stock Opportunity Cost Analysis

Two types of spatial analyses have been developed to 1) evaluate status quo management areas and 2) determine which grid cells within the model domain have significantly higher than average Z_{∞} scores (an estimate of the habitat alteration that would result from a uniform application of area swept fishing effort data across the model domain) using Local Indicators of Spatial Association (LISA) analysis. A variation of the model was developed to assess the practicability of spatial management measures. This tool, called the Z Net Stock model, incorporates economic value data in addition to area swept data and vulnerability estimates.

The Habitat PDT's analyses may be the most technically advanced attempt to evaluate fishing impacts on habitat, and could be the basis for a broader research and monitoring program. As the SSC recommended in 2009, *"The next stage of development for the SASI model is to ground truth some of the model assumptions. For example, susceptibility of different habitats to different fishing gears should be field tested. Similarly, recovery rates of different energy environments should also be ground truthed. The model is flexible enough to allow for revised susceptibility and recovery information."* The SSC reviewed the PDT's methods and results at several stages, and no major technical flaws were identified. However, the process would benefit from a more formal peer review of the methodology. Alternative methods, perhaps simpler methods, might perform better for meeting the Council's objectives. Performance of alternative models could be evaluated using simulation.

The alteration of habitat from fishing can be reduced by effort reduction or area closures to protect particularly vulnerable habitats. The PDT's analyses of major fishing gears indicate that effort reductions in the northeast U.S. since 1996 reduced habitat impact by 60%. Under the current management system, regional fishing effort will be constrained by annual catch limits. The alteration of habitat from fishing could be further reduced via time-area management.

The PDT's analyses are useful for identifying areas of habitat that are vulnerable to alteration from fishing and for evaluating area closures. The SASI model identifies locations with habitats that are altered by fishing effort, and the LISA analysis evaluates contiguous areas of these habitats. The SSC concludes that the PDT's methods are valid, and the reported results are realistic. For example, most of the current habitat closures had relatively high Z_{∞} . The analysis can be expanded to evaluate the ecological value and role of different habitats in ecosystem and fishery production, but the SSC agrees that the PDT's current analysis is the most appropriate approach for the data that is available at this time. Although alternative spatial methods could be considered, the PDT's analyses appear to be appropriate for the spatial properties of information that is available. The SSC recognizes that habitat data are limited, and data availability varies geographically. Therefore, the PDT's existing measures of data support should be routine diagnostics for determining the information content of spatial results.

The PDT's comparisons of practicability among management alternatives are promising, but can be improved in several areas. The economics of multispecies tradeoffs and utilities are complicated, and anticipating changes in fishing behavior is difficult. Alternative approaches to modeling the effects of closed areas on redistribution of fishing effort for area closure scenarios should be explored. The PDT's methods may help to inform some specific management decisions but are not adequately developed for general application.

SSC recommendations:

- 1. The PDT's methods are the most appropriate measure of habitat alteration for the information available to support fishery management decisions.**
- 2. Evaluation of data support should continue to be routinely considered for interpreting results of spatial analyses.**
- 3. Economic analysis for comparing practicability among management alternatives needs more extensive consideration of redistribution of fishing effort.**