

Bering Sea Integrated Ecosystem Research Project: Format for Semiannual Progress Reports

Project #: B70

Title: Forage/euphuasiid abundance in space and time

Principal Investigator(s) and Recipient Organization(s):

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Contract Period and Amount of Funding:

April 1, 2008 to September 30, 2011.
\$506,716

Report Period:

April 1, 2008 to September 30, 2008.

Report Date:

September 29, 2008

Lead Author of Report:

Kerim Aydin

Proposed timeline and milestones within report period:

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| i) Review and report links between hypotheses and models | March 08 |
| ii) FEAST initial programming integration | July 08 |
| iii) Mini-workshop (vertically integrated models) | July 08 |
| iv) Incorporation of available retrospective data | July-Dec 08 |

Project Summary: We will implement a spatially-explicit forage fish/Pollock 3-D model based within ROMS, which communicates directly with the NPZ model (M.5) and allows for behaviors such as aggregation at fronts. This approach allows for depletion of primary and secondary production by all higher trophic levels, hence a simultaneous treatment of both top-down and bottom-up effects in the ensemble runs with euphausiids and pollock as the key interface between controlling mechanisms. The scale for the grid is 10km and covers the Bering Sea shelf. The FEAST model will have several sub-components, developed separately and finally integrated. The components include: Forage species (spatial distribution of prey fields), Cod/ATF/Salmon (pollock predators modeled within FEAST), Bird/mammal (forage fields and forage success) and Economic (spatial fishing choice model).

Progress Summary:

- i) Links between hypothesis and models: This was provided in part during two review meetings with the Ecosystem Modeling Committee (EMC, March 08 and July 08) and will be reported in-depth/finalized during the working sections of the upcoming PI meeting (October 08).
- ii) FEAST initial programming integration: The original intent was to have a pilot spatial version of FEAST with pollock, cod, arrowtooth flounder, and zooplankton species. The goal was later modified at the July meeting to have a non spatial (one cell) simplified version of FEAST implemented in C++, coupled on a daily time step with ROMS and NPZ that can be used on multiple test sites. We now have a working version of ROMS-NPZ that has two way feedback with FEAST set on a daily time step. The physical parameters driving the NPZ model come from analytical curves instead of five specific sites. This allows us to test the behavior of the model under a wide range of physical conditions. The version of

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FEAST working at present uses time-location specific data and has three species only: walleye pollock, Pacific cod and arrowtooth flounder. This simplified version is better suited for model exploration and testing. The rest of the species will be added in the next couple of months to have an all-species non spatial version of FEAST available for testing before moving to the spatial version.

iii) Mini-workshop (vertically integrated models): The mini-workshop was attended by almost all PIs in July of 2008. The addition of tidal currents to ROMS caused a local instability around Bristol Bay that is currently being worked on but prompted a change in modeling goals. The main outcome of this workshop was the modified goal of a non-spatial version of linked ROMS-NPZ-FEAST. We are currently awaiting meeting minutes/report from the EMC.

iv)) Incorporation of available retrospective data. Analysis of retrospective data has been used to establish growth curve parameters, length-weight relationships for pollock, cod and arrowtooth flounder, and amount of non modeled prey consumed. Likewise, retrospective data is being used to set year-location specific initial conditions for biomass and length distribution of walleye pollock, Pacific cod and arrowtooth flounder. Data sources include all databases related to the bottom trawls surveys, summer acoustic/midtrawl surveys for pollock and BASIS surveys conducted by AFSC/NOAA, and fish food habits data from AFSC retrospective sources as well as from project B.61.

Lessons learned and project adjustments:

As we became more familiar with very specific details of both ROMS and NPZ models, we also realized that as ROMS-NPZ is still very much in development mode, we should ensure modularity through the development of FEAST in a separate C++ module that “communicates” with ROMS-NPZ rather than as a piece of code directly integrated into ROMS-NPZ. This will allow the driving of FEAST with any NPZ output (from other data or models outside the ROMS-NPZ work funded by BEST) with fairly minimal effort. This also allows the grid for each model to be independent. Note that this modularity is implemented in the 1-D version and the computer-time expense of implementing this modularity in 3-D may be unacceptably high.

The purchase of a major computer (parallel cluster) for FEAST runs was expected to be completed by July 2008, but delays in the money being spendable at NOAA and subsequent delays in the NOAA procurement process and IT issues (included upgrading the UPS in our major server room) have led to an expected “switch-on” date of November 2008. This has not led to delays in model development as this computer was primarily intended for running the 3-D model.

We learned to keep meeting minutes independent of the EMC, at recent meetings it was unclear to what extent “suggestions” made by us were decisions versus suggestions made to the EMC for their consideration and recommendations in their reports, this led to some confusions on assigned tasks which led to some minor delays later. We (all vertically integrated modeling groups) have decided to clarify our own role by keeping “formal” circulated minutes and revised tasks at the end of each meeting even if run by the EMC.

We had previously understood that the NPZ non-spatial (1-D) model was running with ROMS input, but it is driven with a time series of reconstructed data, hence the difficulty of producing files for multiple sites on short notice. Locations with enough data to construct such time series are very limited. Also, the physical parameters predicted by ROMS does not fit the reconstructed data time series very well for site M2 (the one on which the NPZ is working). We opted to use an analytical curve to feed physical parameters for the time being and in the future we may also use time-location specific outputs from ROMS once data-model fitting issues have been resolved.

Integration activity: We distributed the first draft of FEAST equations during the EMC meeting in July 2008. We have also been working very closely with Al Hermann and holding weekly/biweekly meetings, both to program the linked ROMS-NPZ-FEAST pilot and understand ROMS and NPZ details. Close

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consultation about for ROMS and physical parameters has also been carried with Nick Bond. Group e-mails discussing modeling issues, instabilities and related issues are conducted mostly via e-mails. As the lead PI (Kerim Aydin) is a member of the Science Advisory Board, they have remained apprised of progress.

Education and Outreach:

A mini-workshop on the equations of the FEAST model was held for graduate students at the University of Washington, Seattle and provided valuable feedback for the modelers. Kerim Aydin attended a meeting of the LTK Regional Advisory Board to start the process of making model results relevant to communities dependent on the Bering Sea ecosystem.

Next year's Work plan (not part of the 5 page target length):

BSIERP Project number, Project Title, Contact name, e-mail and phone number

2009-2012 Tasks, Assignments, Timeline

<i>What</i>	<i>Who</i>	<i>Start (2009)</i>	<i>Other key dates</i>
Review and report links between hypotheses and models	Aydin	March 2008	
FEAST initial programming integration	Aydin, Ortiz, Hermann	July 2008	
Mini-workshop (vertically integrated models)	Aydin, Ortiz, Punt, BEST	July 2008	
Incorporation of available retrospective data	Ortiz	July-Dec 2008	
Coupled model first transect/low res runs	Aydin, Ortiz, Hermann	Jan 2009	
Initial NPZ/FEAST sensitivity analysis showing sensitive parameters for field research	Aydin, Ortiz, Hermann, BEST	Jan 2009	
Presentation/workshop with field researchers	Aydin, Ortiz, Hermann, BEST	Oct 08, Jan 09	
Incorporation of 2008 field data	Ortiz	Jan-July 2009	
Mini-workshop (vertically integrated models)	Aydin, Ortiz, Hermann, BEST	July 2009	
High resolution ensemble runs	Aydin, Ortiz, Hermann, BEST	July 09–July 10	
Ongoing incorporation of field data	Ortiz	July 09–July 10	
Low-resolution/restrospective runs for Management strategy evaluation	Aydin, Punt, Ortiz	July 09–July 10	
Results of field work incorporation,	Aydin, Ortiz	Jan 2010	

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presentation of “new hypotheses” for testing in 2010 field season			
MODEL WORKSHOP I, initial integration of multiple models (“parallel” models), driven by management analyses of needs	Aydin, Ortiz, Punt, Hermann, BEST	July 2010	
Scenario examination using ensemble runs, focusing on future scenarios, including for humans, birds and marine mammals, final evaluations of “uncertainty” in projections, comparisons with parallel models	Ortiz, Aydin, Punt, Hermann, BEST	July 2010-July 2011:	
Hypothesis evaluation workshop (evaluation of primary field “hypotheses” from the results of the models, and final field season (hypothesis testing season) begin “final publication” on combined model and data syntheses of “Bering Sea Structure and Function”)	Aydin, Ortiz, Hermann, BEST	January 2011	
MODEL WORKSHOP II on results of management strategy evaluation, recommendation of a “prediction strategy” for future use of these models and field work, especially within an ongoing NPFMC management context.	Punt, Ortiz, Aydin	July 2011	
Completion of publications, final reports	Aydin, Ortiz, Punt, Hermann, BEST	Sept. 2011	

Publications:

We expect the vertically-integrated sequence to include two “publication sets” (July 2010, July 2011 submission). These “publication sets” are envisioned as special volumes of peer-reviewed journals, along with accompanying “glossy and web versions” (developed with NPRB/BSIERP outreach assistance) for public access to results. The first publication set will focus on the models themselves (technical details) while the second will focus on management uses of the models.

A third publication set, integrating “our understanding and predictions for the Bering Sea ecosystem” may be lead from either the modeling or the field side, and will focus on the evaluation of the “core hypotheses” for Bering Sea structure and function (results of Jan 2011 workshop?). Additional publications are expected as individual results are completed, but are not explicitly scheduled.

Results are expected to be presented to the NPFMC Council (Plan Teams, SSC, and public) beginning in Fall 2009, thereafter following an annual presentation schedule (Aydin, lead) deemed appropriate by the Council.