A Comparison of Two Lower Trophic Models for the California Current System

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Introduction

- Interest in zooplankton production as fish food (CCCC goals)
- Focus on California Current System
  - Salmon primary species of concern
  - Focus on links between physics and ecological processes
- Previous work presented at PICES
  - C.A. Brown et al. (2001): NPZ model embedded in 2D physics model
Issues

- Is an NPZ model adequate?
- Do we need a more complex model? Balance conflicting goals:
  - Predictive ability: model that adequately captures production dynamics
  - Analytic ease: model that can be used for estimation, sensitivity analysis, scenario analysis
  - Confidence: measurable parameters, reasonable behavior within range of parameter uncertainty
Issues

- Compare two models
  - NPZ: simple (3-component) N-based model
  - NEMURO: complex (11-component) N + Si model
- Look at ecological summary variables:
  - Biomass variables:
    - Total Dissolved N (Nitr)
    - Total Phytoplankton N (Phyt)
    - Total Zooplankton N (Zoop)
    - Total Detrital N (Detr)
  - Productivity variables:
    - Phytoplankton P/B (PBPhy)
    - Zooplankton P/B (PBZoo)
    - Ecotrophic Efficiency (EE)
NPZ Model

- Several applications to California Current
- Well-known behavior
  - Newberger et al. 2003 (J. Geophys. Res. 108(C3))
NemPort Model

- “NEMURO Ported to Newport Line”
- Based on Kishi et al. 2001 (J. Ocean. 57:499-507) + PICES reports
- Simplifications
  - No temperature dependence
  - Simplified light response
  - Grouped parameters
Parameter Values

- Common parameters based on Wroblewski, Spitz et al. 2003 (J. Geophys. Res. 108(C3))
- Other NEMURO parameters taken from 2002 workshop report
- NemPort grouped parameters:
  - Density dependent mortality rate ($M_0$)
  - Maximum grazing rate ($G_{\text{max}}$)
  - Ivlev constant ($\lambda$)
  - Other phytoplankton & zooplankton parameters
Two Physics Models

- **Closed Box**
  - Unrealistic
  - Used for equilibrium, sensitivity analysis

- **Conveyor Belt**
  - Not quite entirely unrealistic
  - Allows comparison with field data
Results

- Closed Box
  - Equilibria
  - Sensitivities

- Conveyor-Belt
  - Cross-shelf patterns
  - Data comparisons
Equilibria: NPZ
Equilibria: NPZ
Equilibria: NemPort
Equilibria: NemPort
Sensitivities

NPZ

NemPort
Cross-shelf patterns

Dissolved N

Phytoplankton N

Zooplankton N

Detritus N
Cross-shelf patterns
Cross-shelf patterns

Dissolved N

Phytoplankton N

Zooplankton N

Detritus N
Data Comparison

Station NH5, 2000

Dissolved N

Phytoplankton

Zooplankton

(Data courtesy of Bill Peterson)
Previous results

C.A. Brown et al. (in prep.)
Future Work

- **Parameter fitting**
  - Focus on the 4 most sensitive parameters
  - Compare with full Newport Line data
  - Repeat for other years

- **Applications**
  - Tie into juvenile salmon growth/survival model
  - Consider herring or anchovy modelling
  - Develop zooplankton production index
Acknowledgments

- Cheryl Brown for problem definition, previous modeling, and teaching me physics
- Bill Peterson, Julie Keister, and Leah Feinberg for data and discussions
- Yvette Spitz for discussions
- U.S. GLOBEC program for funding