Seasonal Dynamics of Plankton in the Northern California Current System: A Model-Data Comparison
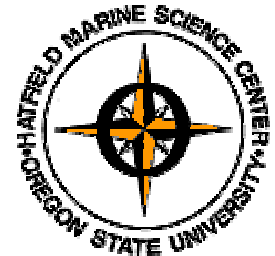
Thomas C. Wainwright
William T. Peterson
NOAA Fisheries
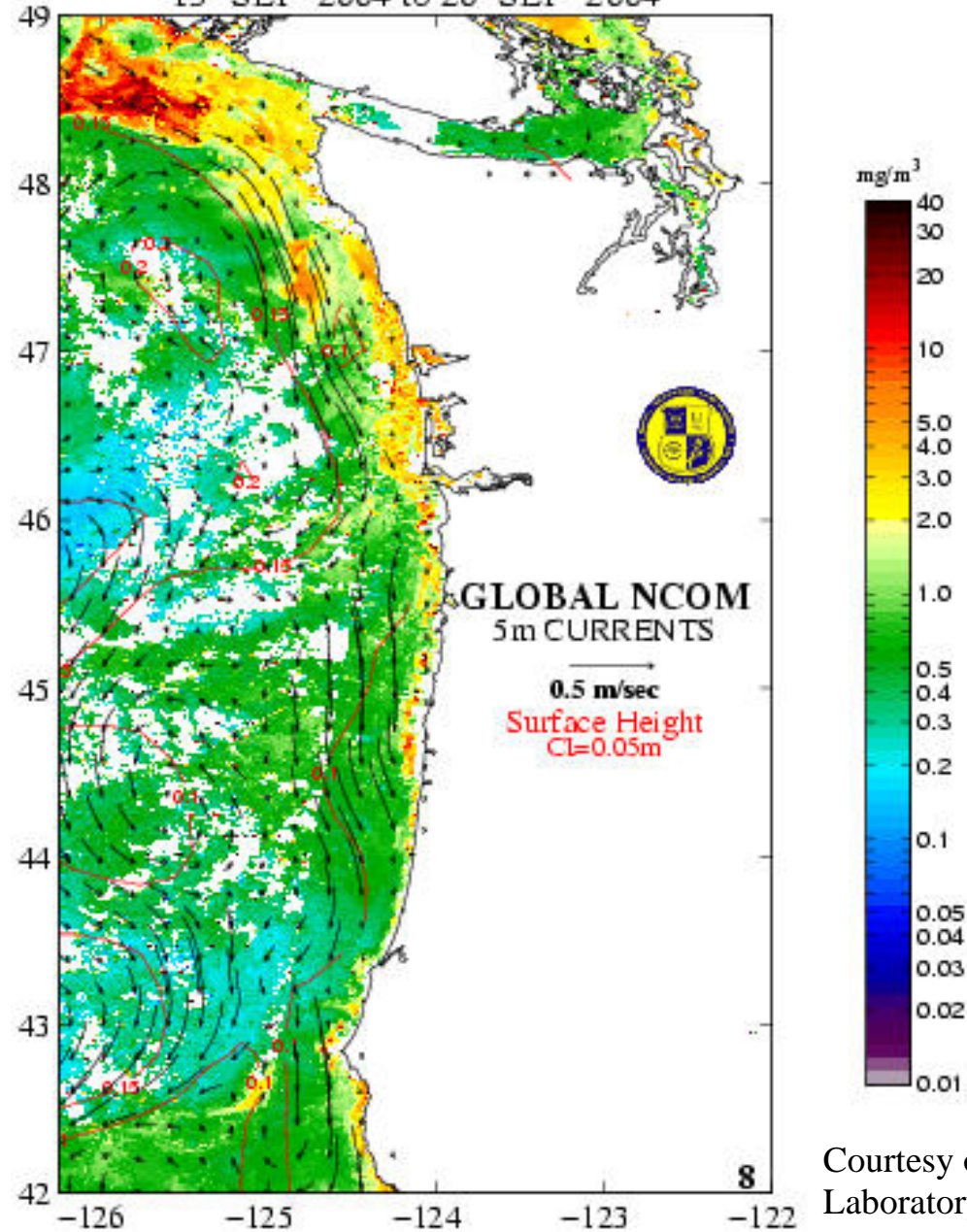Newport, Oregon, USA

Rian C. Hooff
Hatfield Marine Science Center
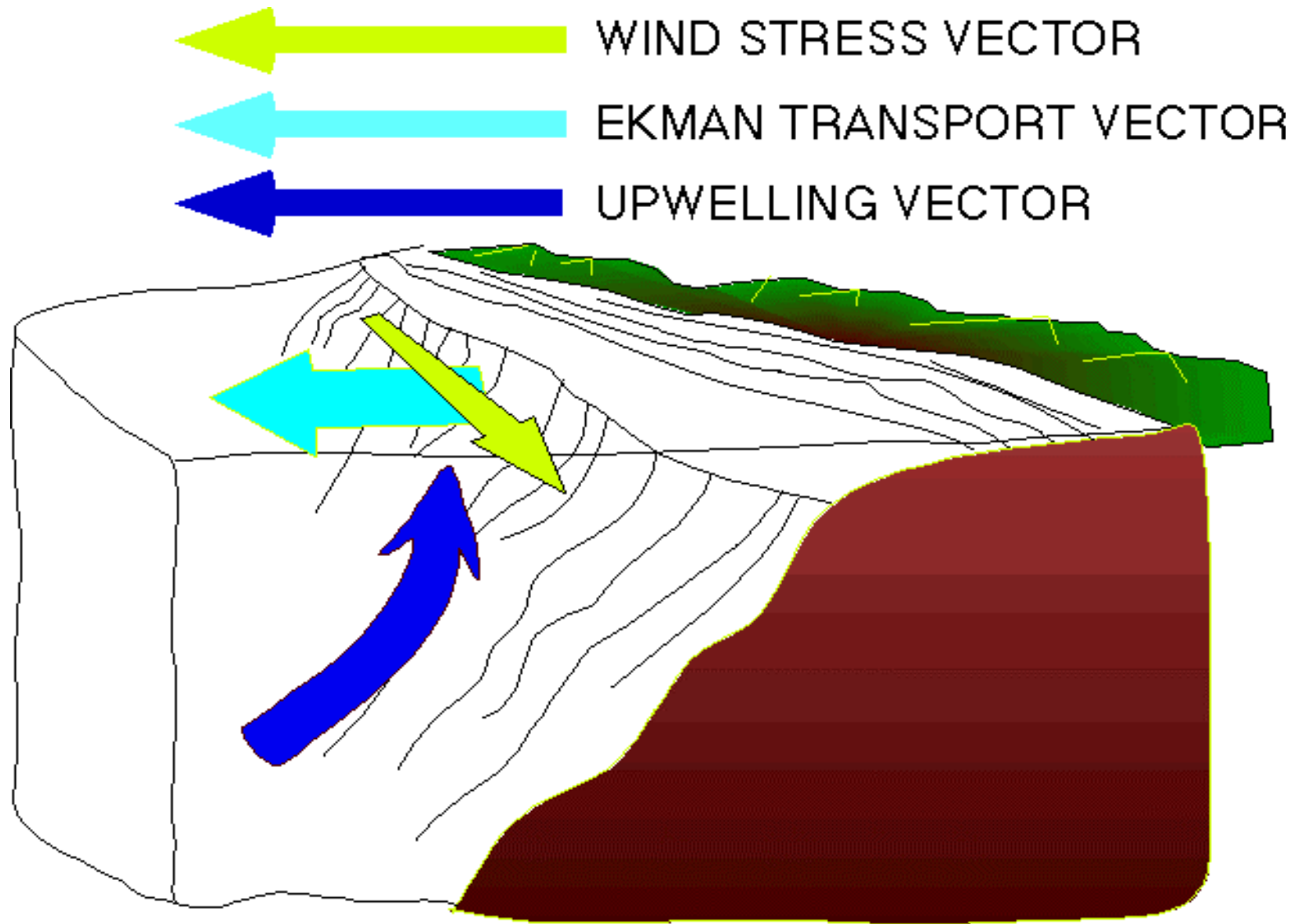Oregon State University
Newport, Oregon, USA

Northern California Current

NCOM + SeaWiFS Chlorophyll Concentration (OC4)
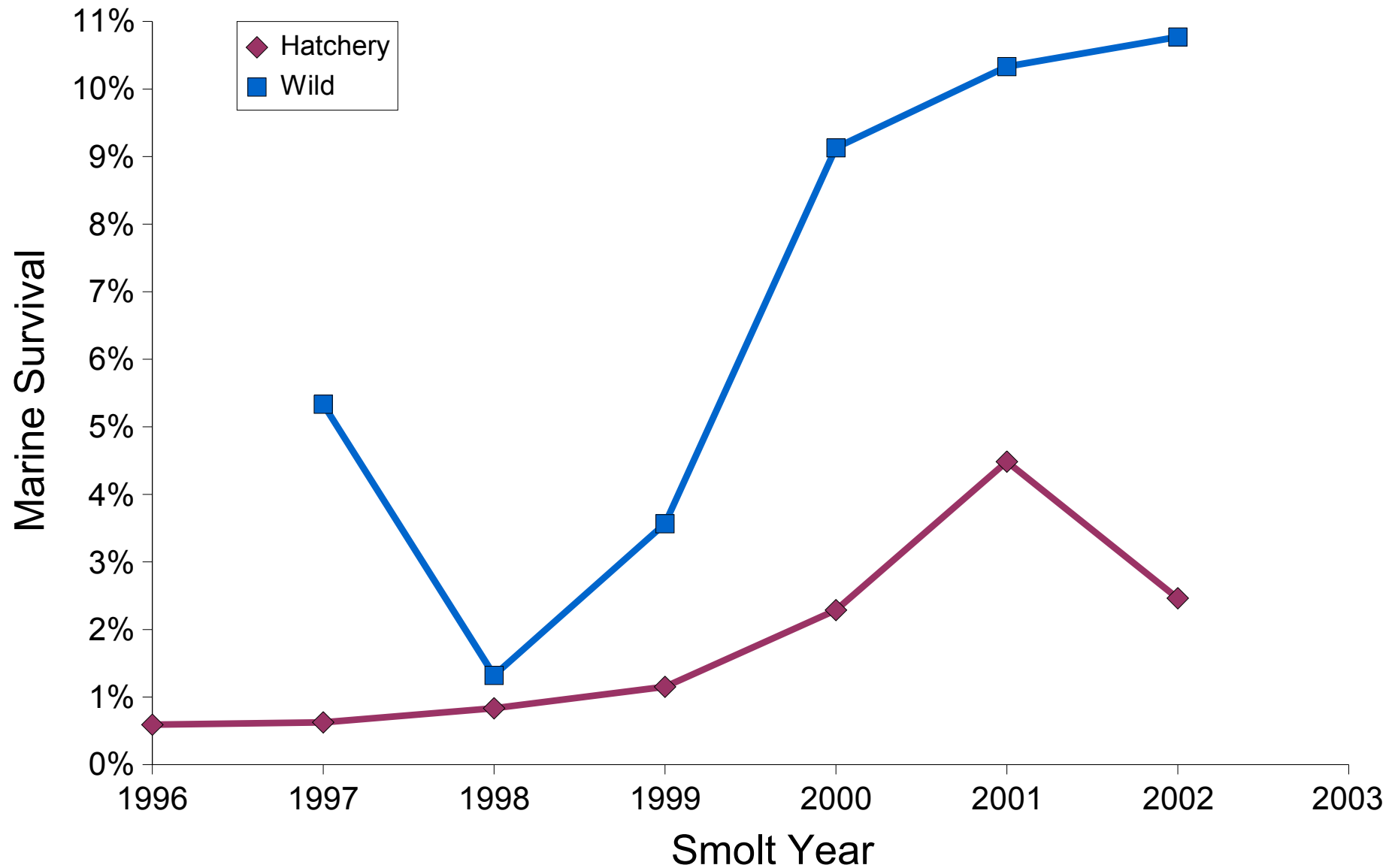13–SEP–2004 to 20–SEP–2004

GLOBAL NCOM
5m CURRENTS

0.5 m/sec

Surface Height
Cl=0.05m

mg/m³

Courtesy of The Naval Reasearch
Laboratory - Stennis Space Center

Upwelling-Driven System

WIND STRESS VECTOR

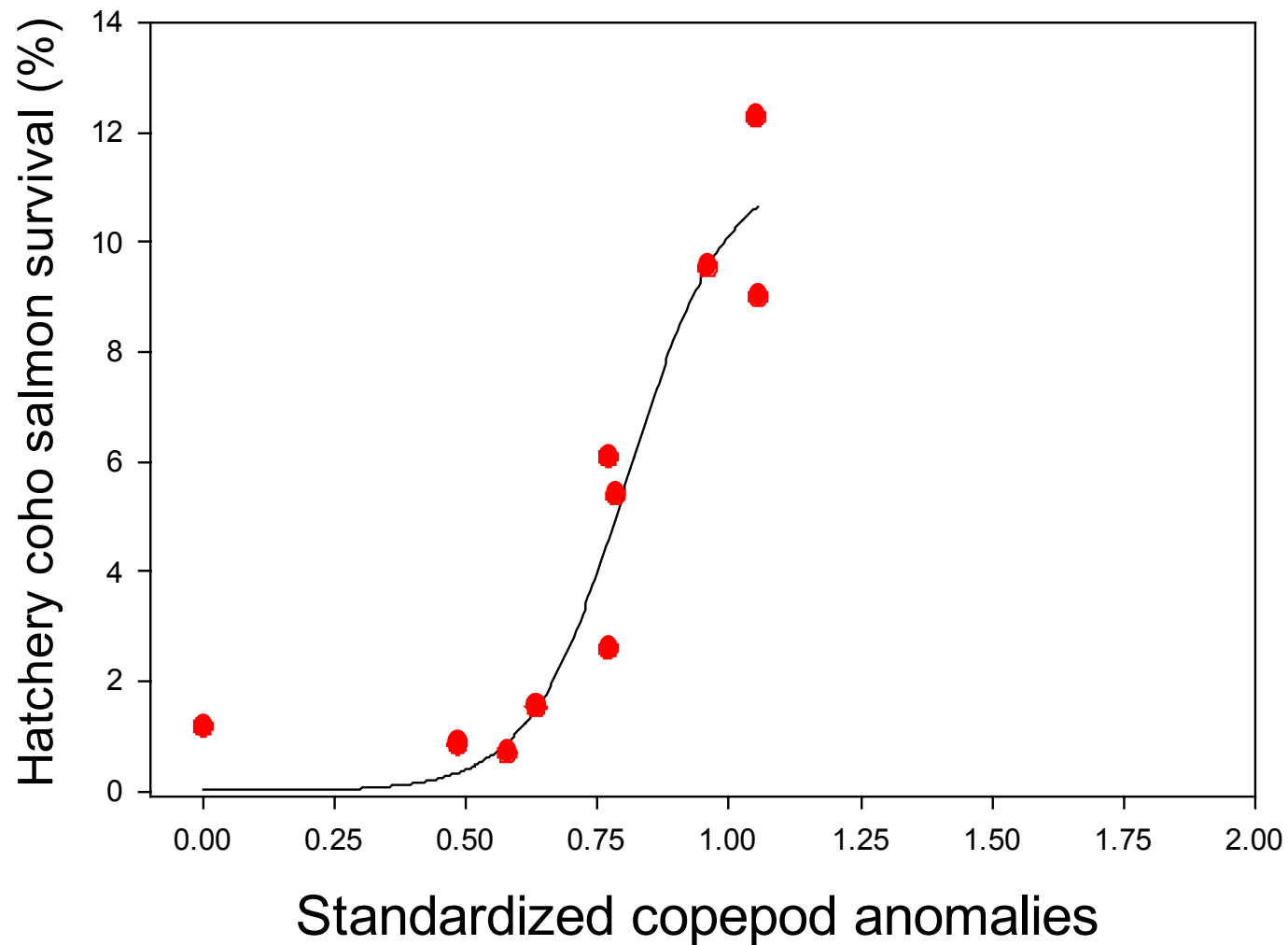EKMAN TRANSPORT VECTOR

UPWELLING VECTOR

Courtesy of NOAA/PFEL

Oregon Coho Salmon Survival
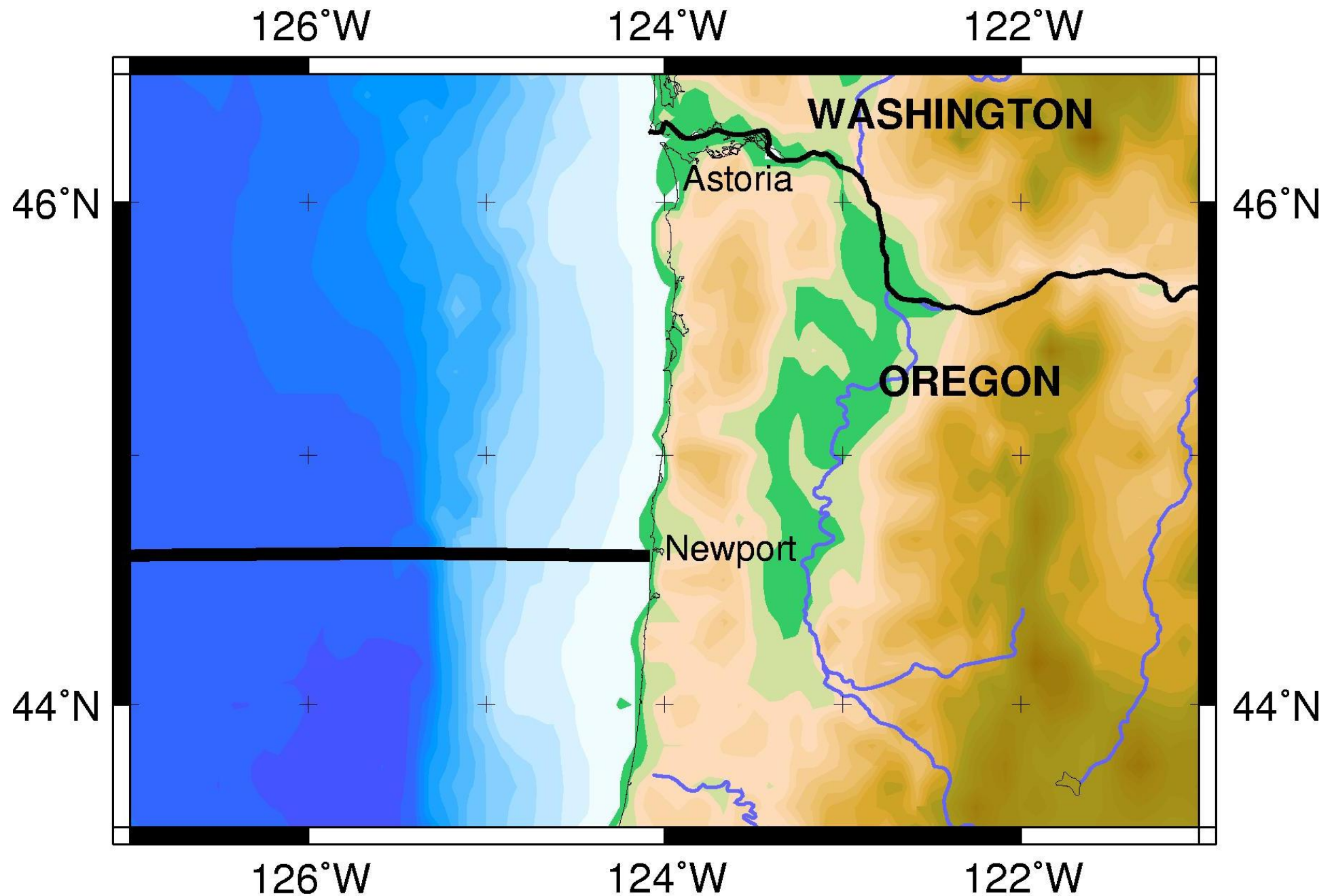
Coho Salmon Survival

Conceptual Model

Fish
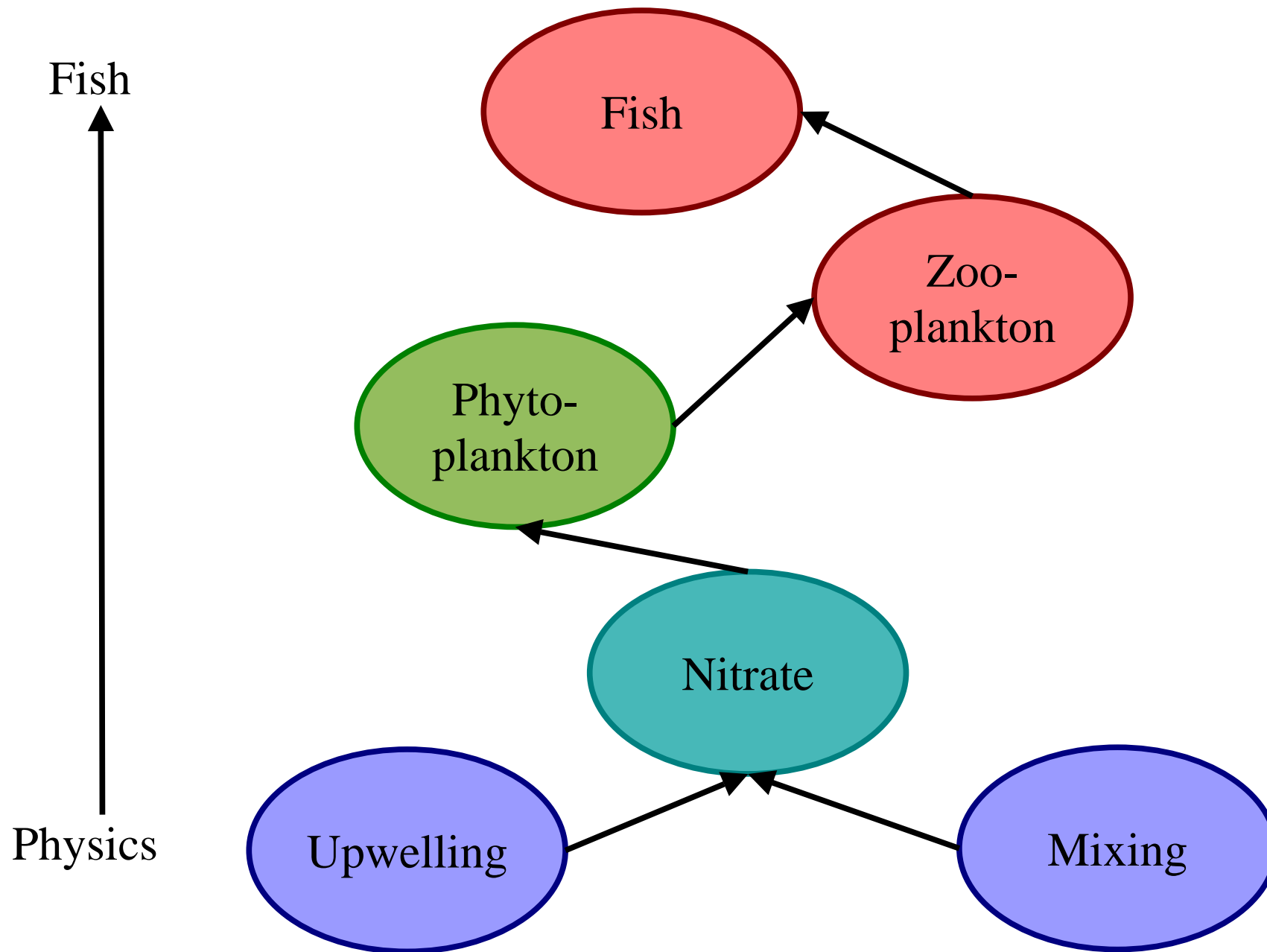
Physics
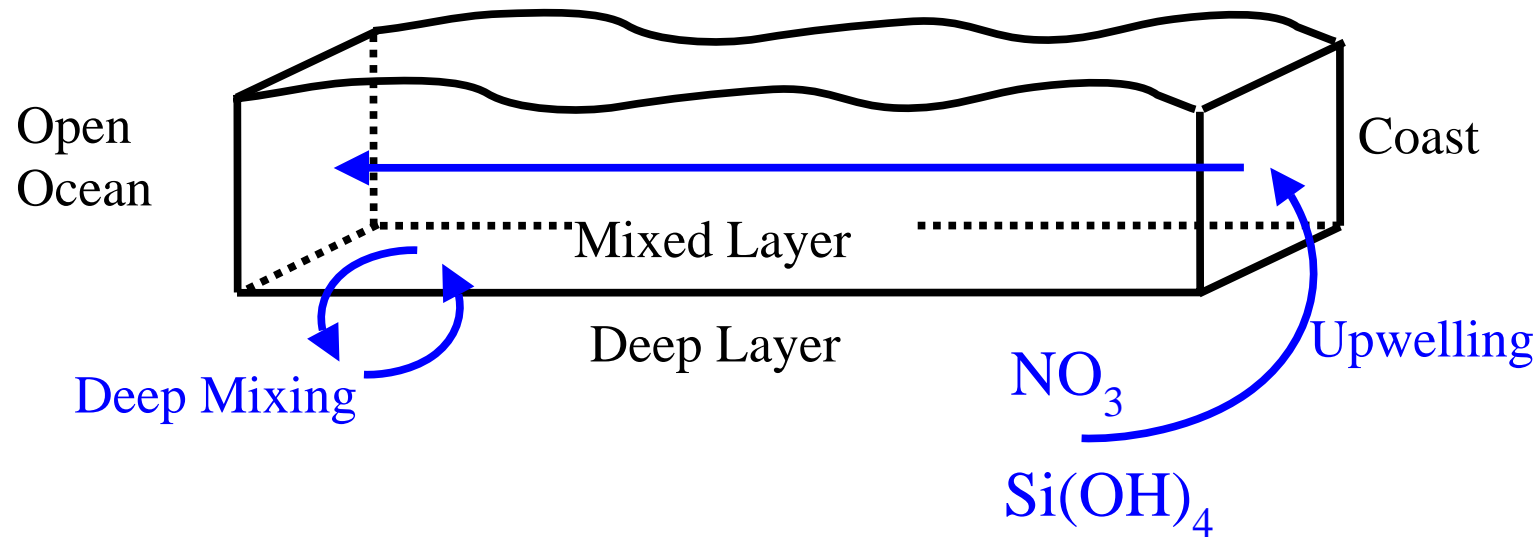
Newport Hydrographic Line

Simplified Physics

- Conveyor Belt Model
  - Not quite entirely unrealistic
  - Easy to compute
  - Allows parameter estimation

Model Design

- Balance

  - **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
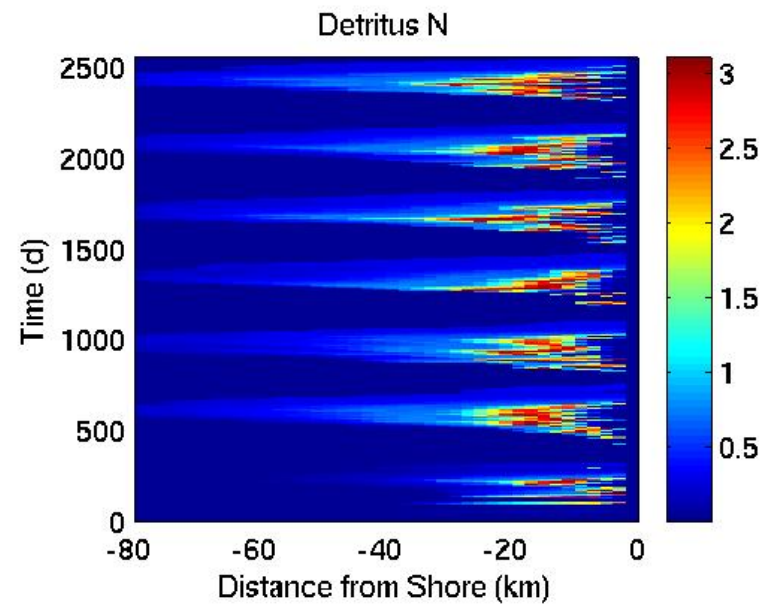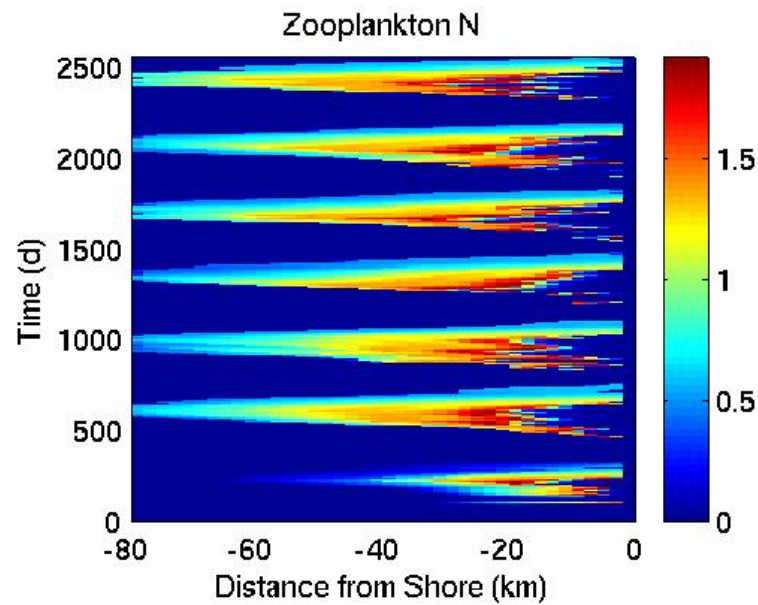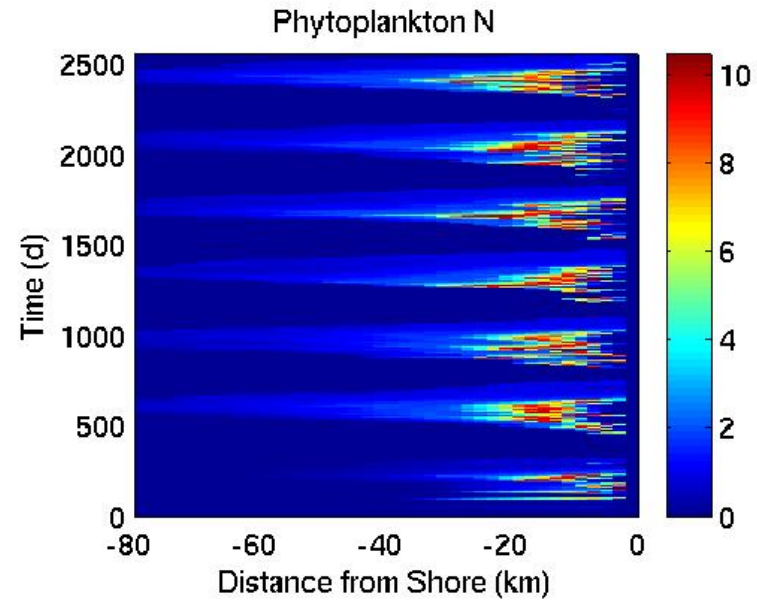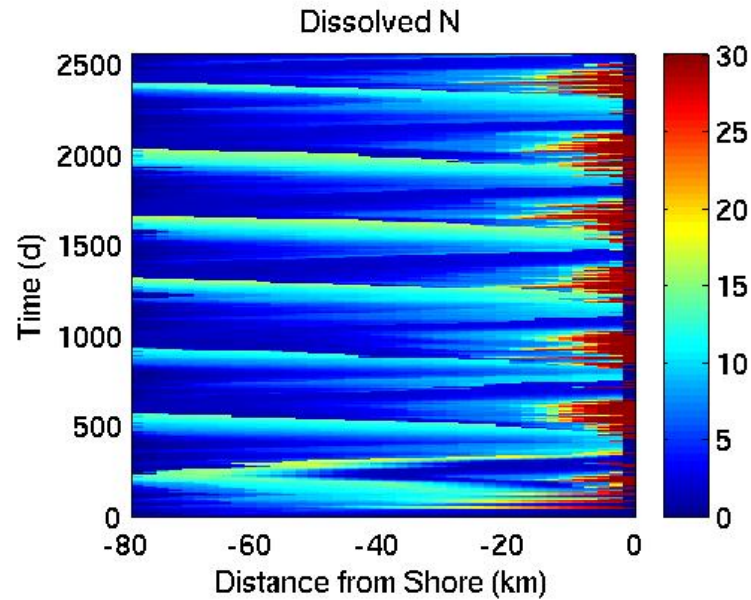
NEMURO Model
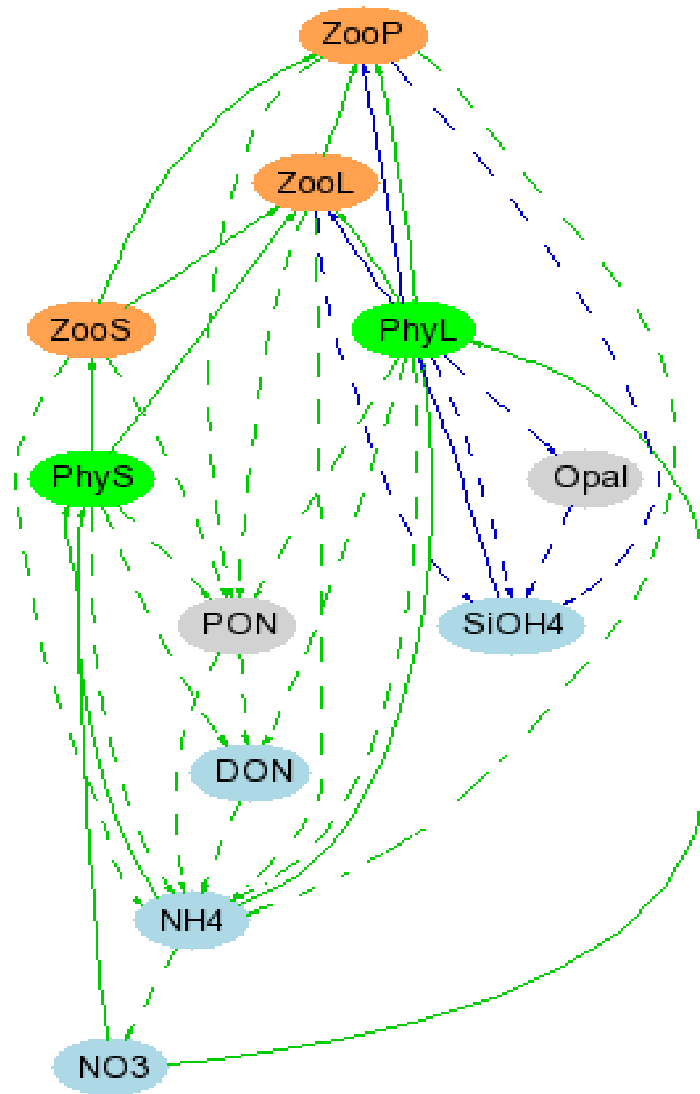
- Eleven-component model

- Tracks both Nitrogen and Silicon

- Multiple size classes for both phyto- and zoo-plankton

- Simplifications
  - No temperature dependence
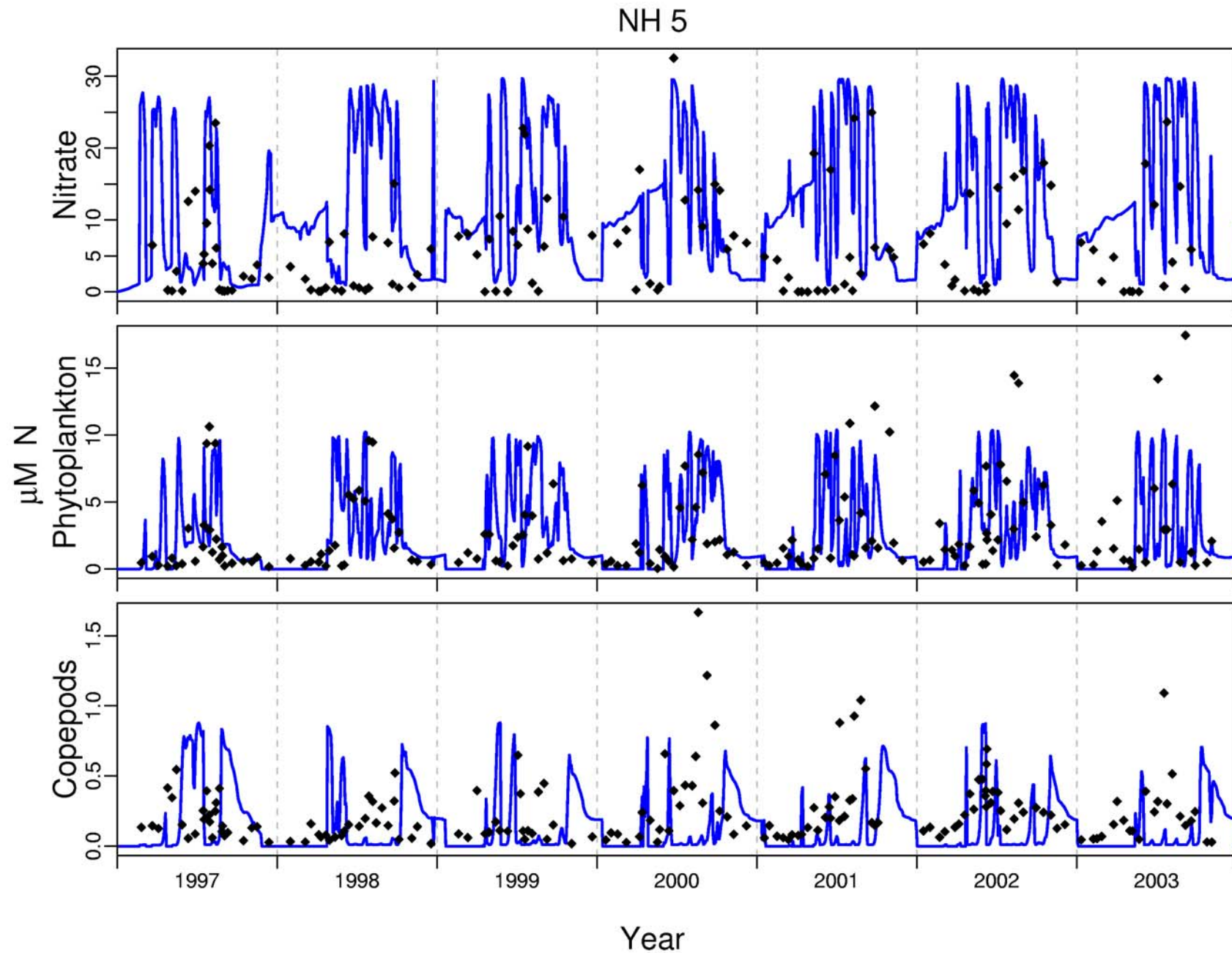 - Simplified light response
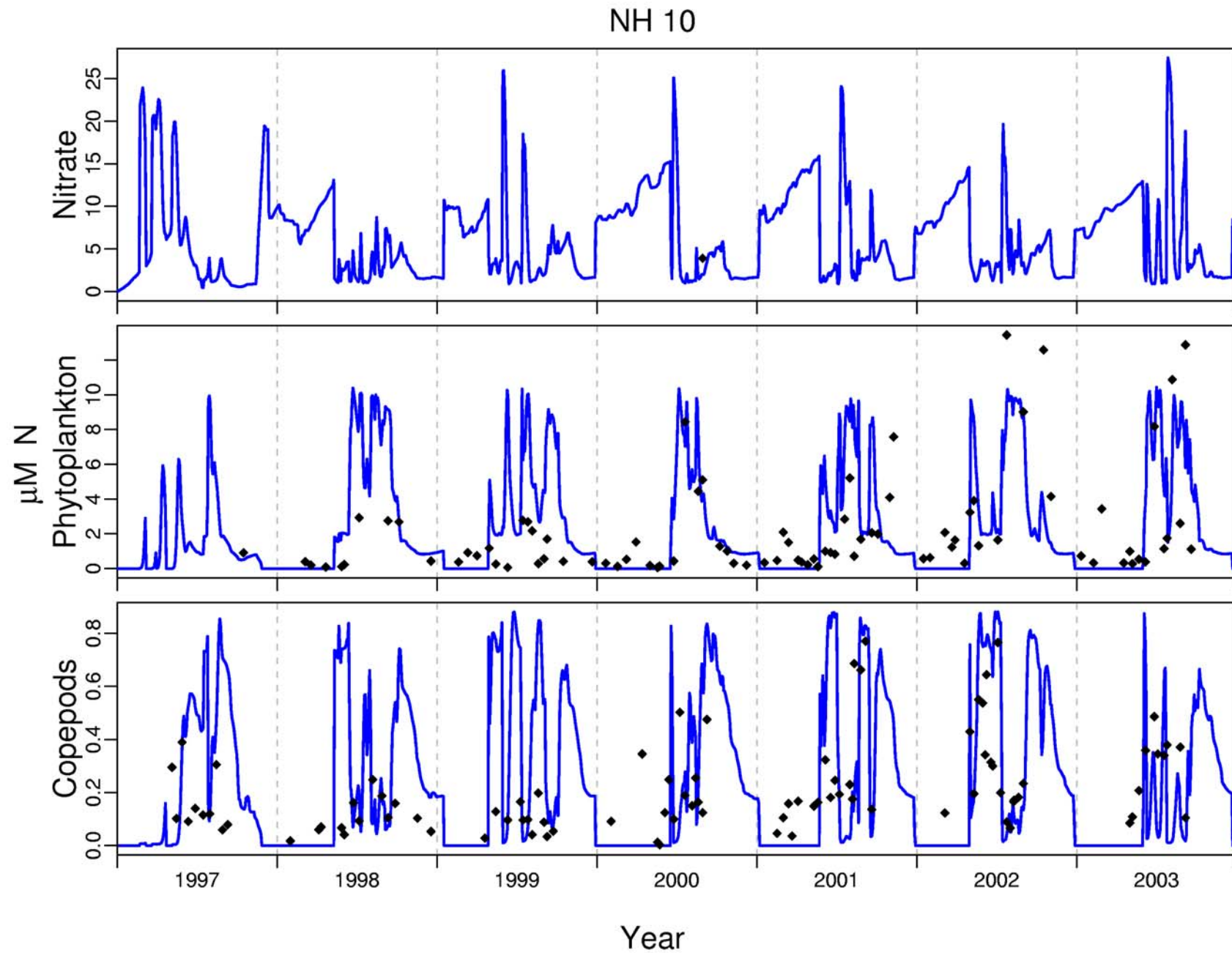 - Grouped parameters
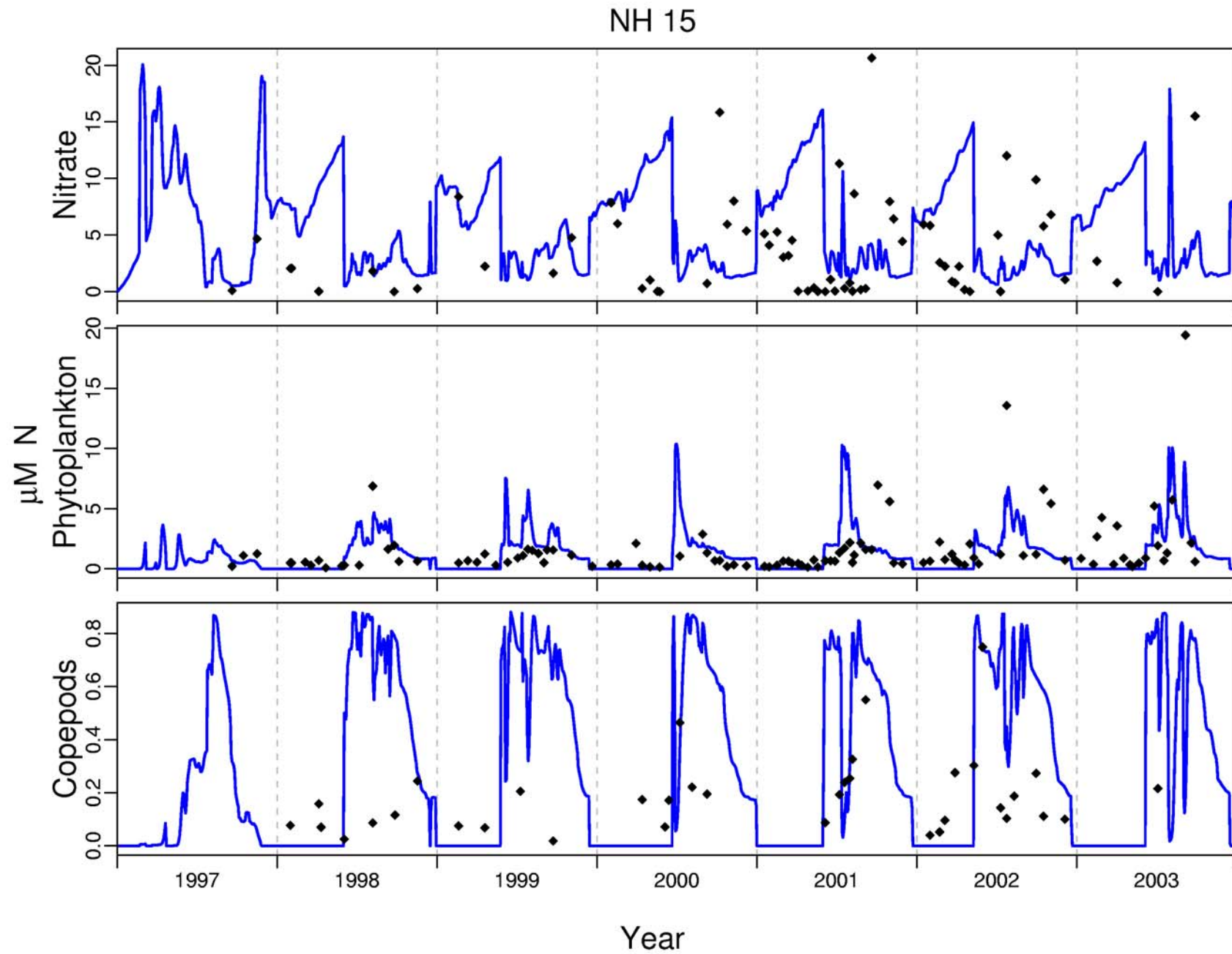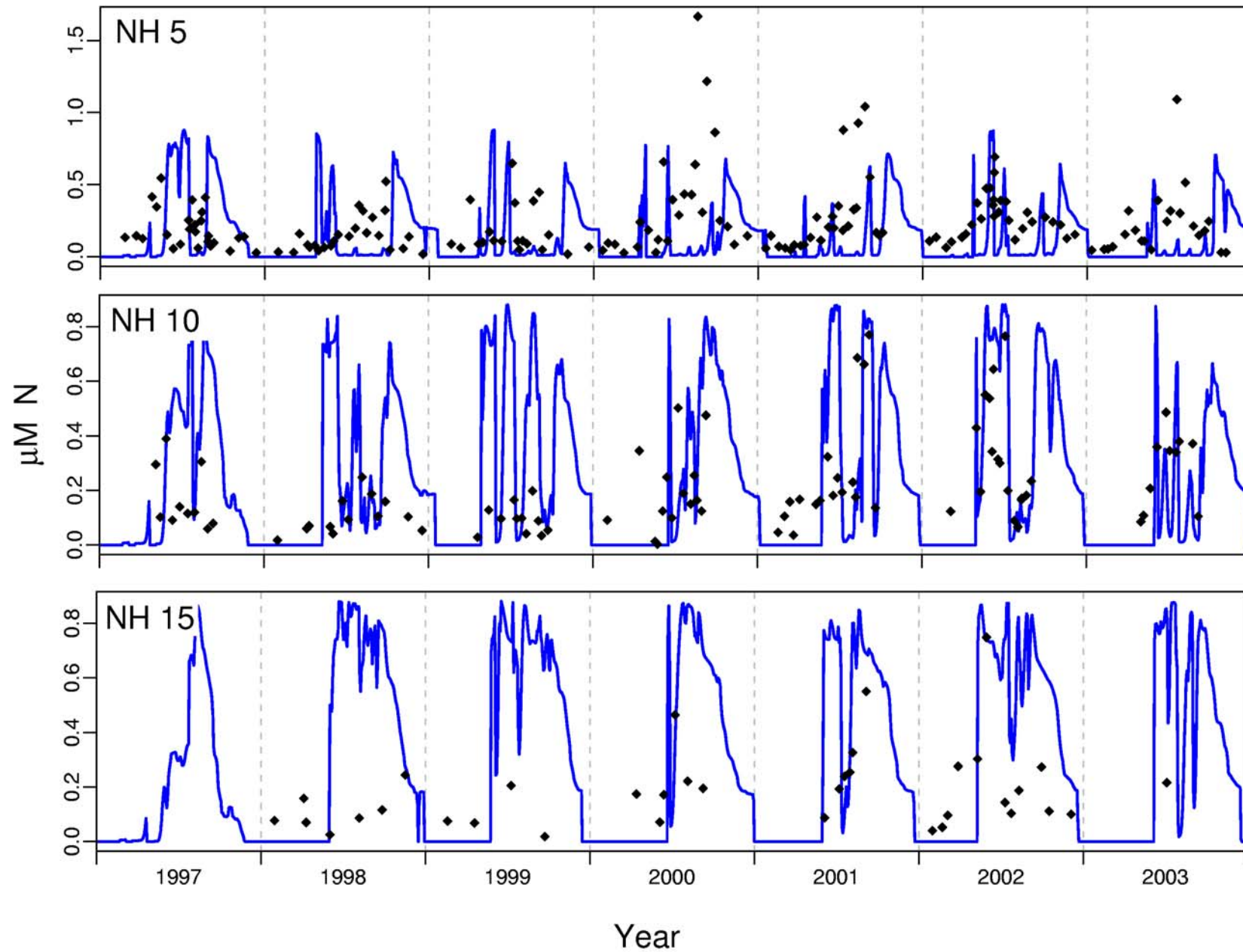
Inputs
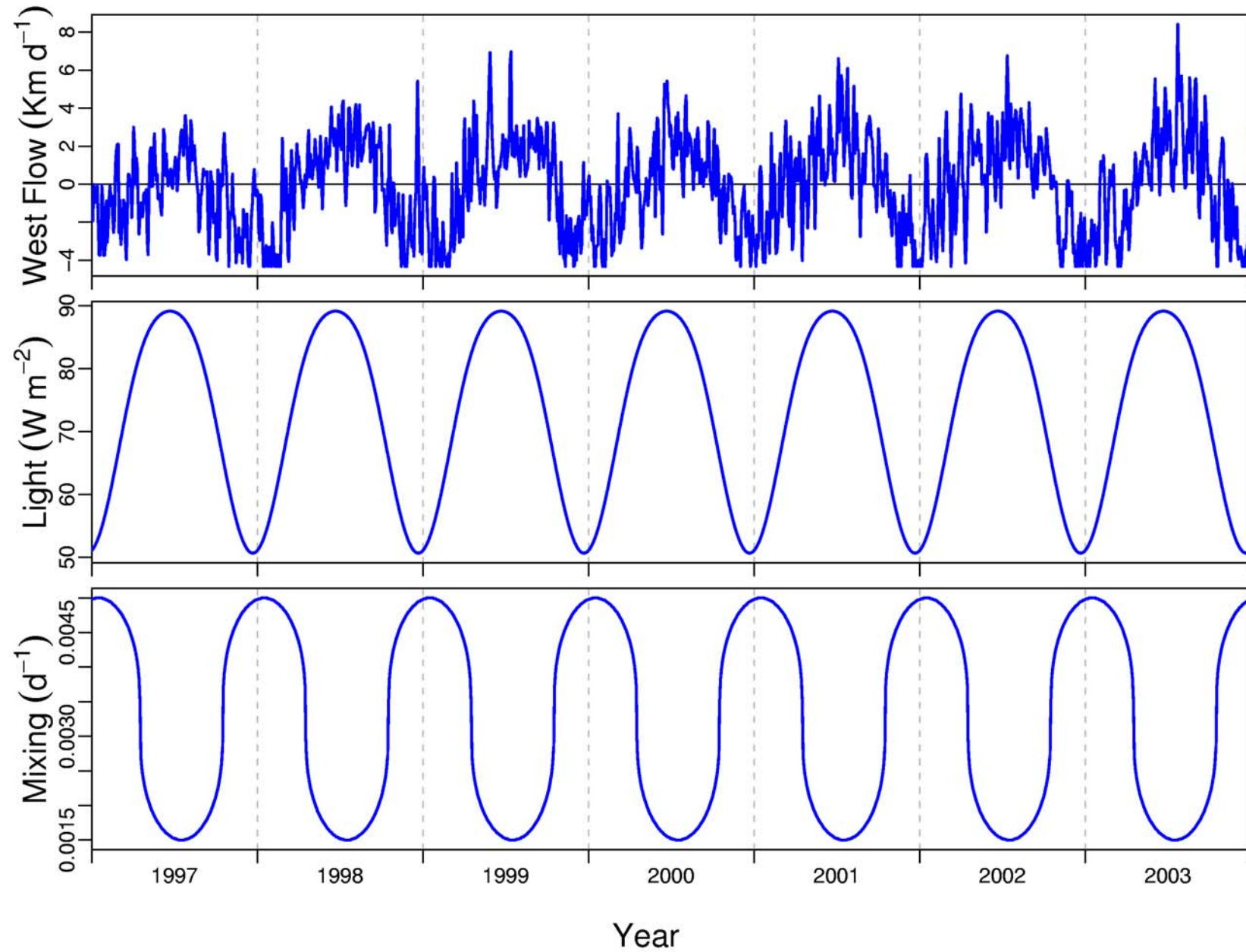
Model Predictions

Results: NH05

NH 5

Results: NH10

NH 10

Results: NH15

NH 15

Copepods @ All Stations

OPC Data, May 2000
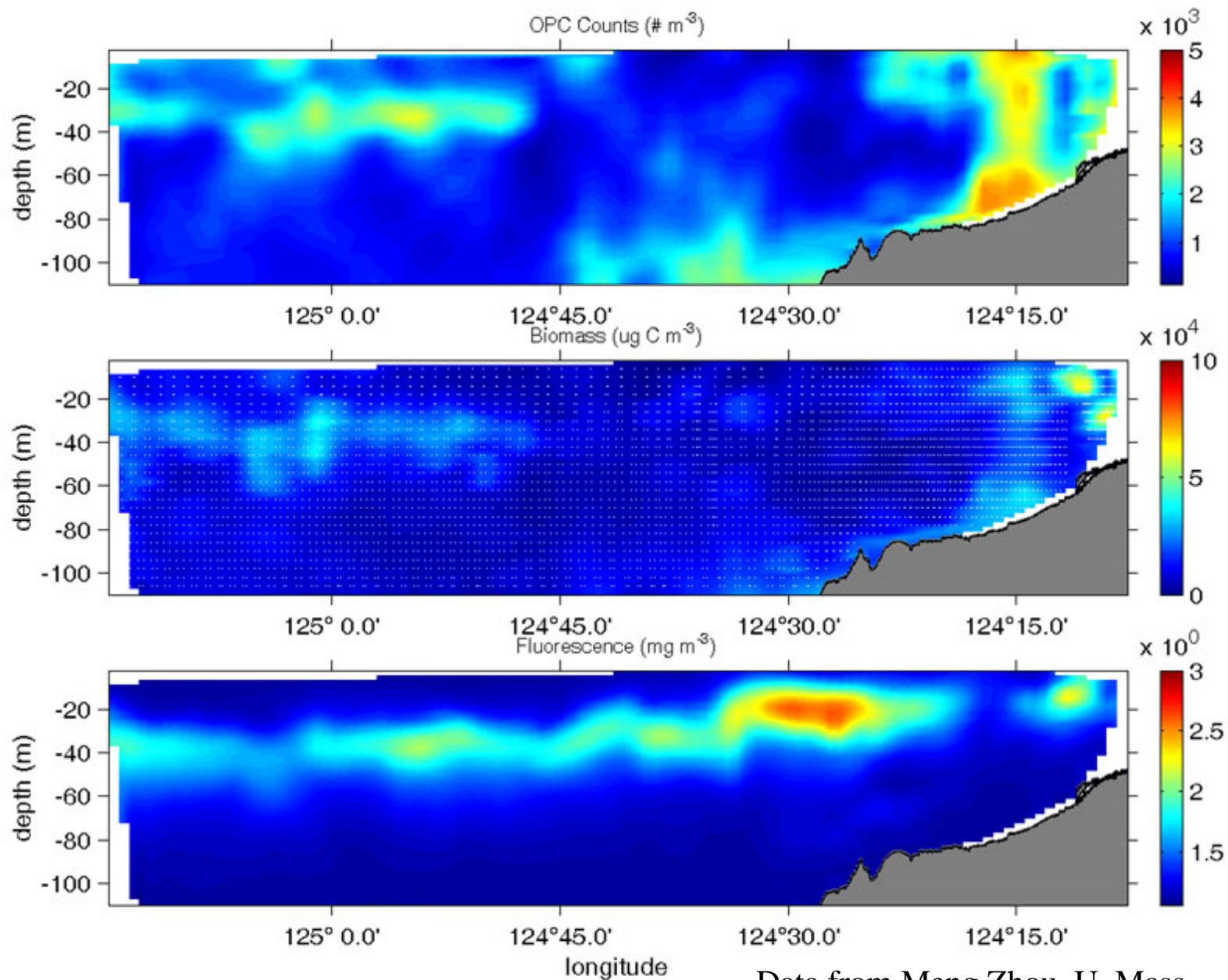
Data from Meng Zhou, U. Mass.

Summer Production

Net Apr–Jul Production
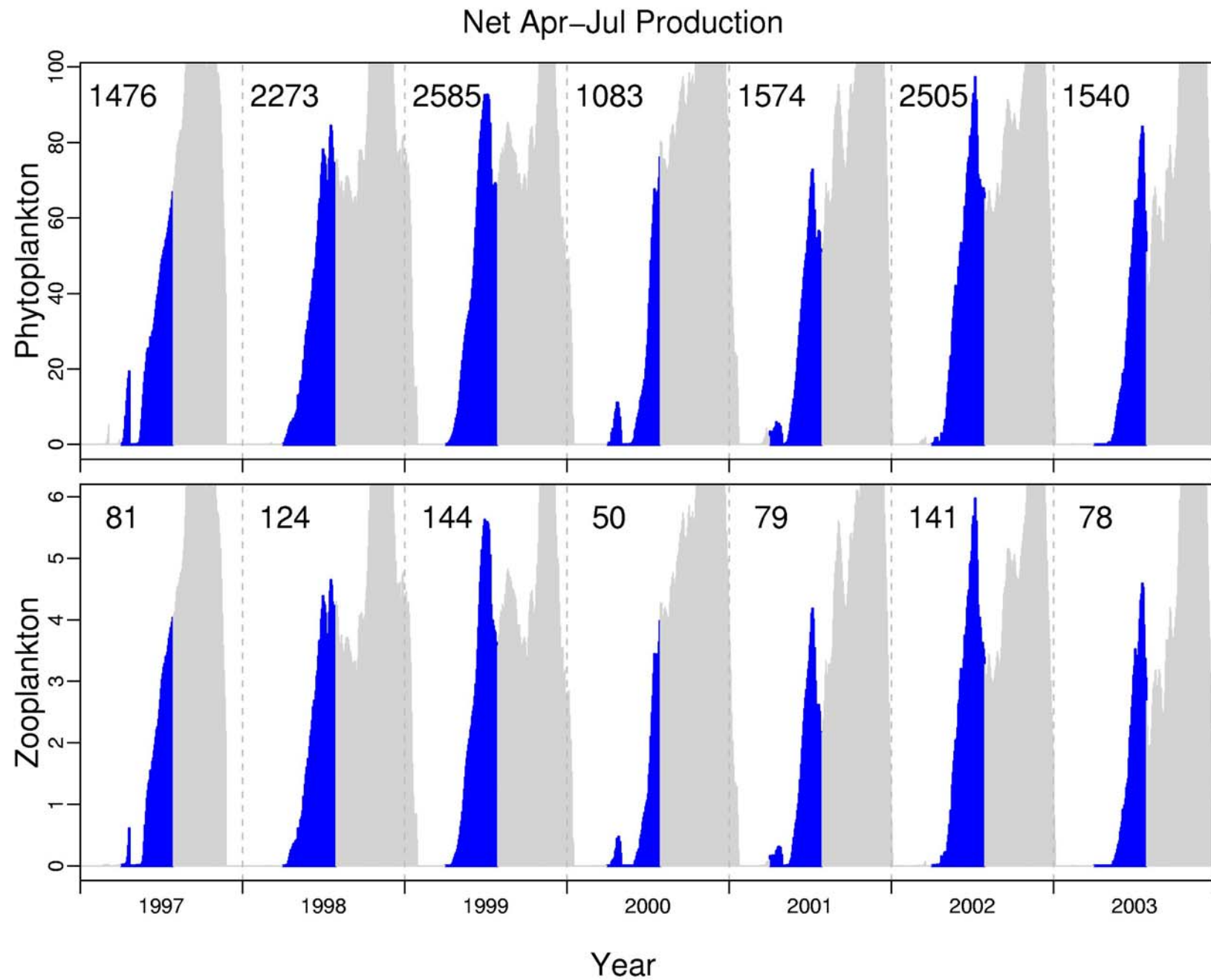
Conclusions

- The model appears adequate in predicting spring-summer nitrate and phytoplankton concentrations.

- The model does not reflect the observed spatial distribution of copepods, apparently transporting them offshore too rapidly.

- Despite this, the model may adequately reflect the seasonal dynamics of copepods when summed across the shelf region.

- Thus, the model may provide a useful translation of upwelling indices to biological production.

Next Steps

- Continue refining this one-dimensional model, particularly working with local wind and current data rather than regional upwelling indices.

- Link NEMURO with a two-dimensional cross-shelf model (Edwards, Batchelder, & Powell code).

- Consider incorporating copepod vertical behaviors into the model.

Acknowledgements