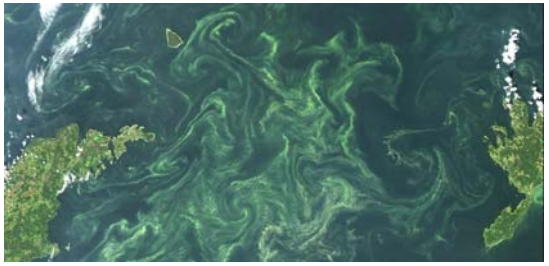
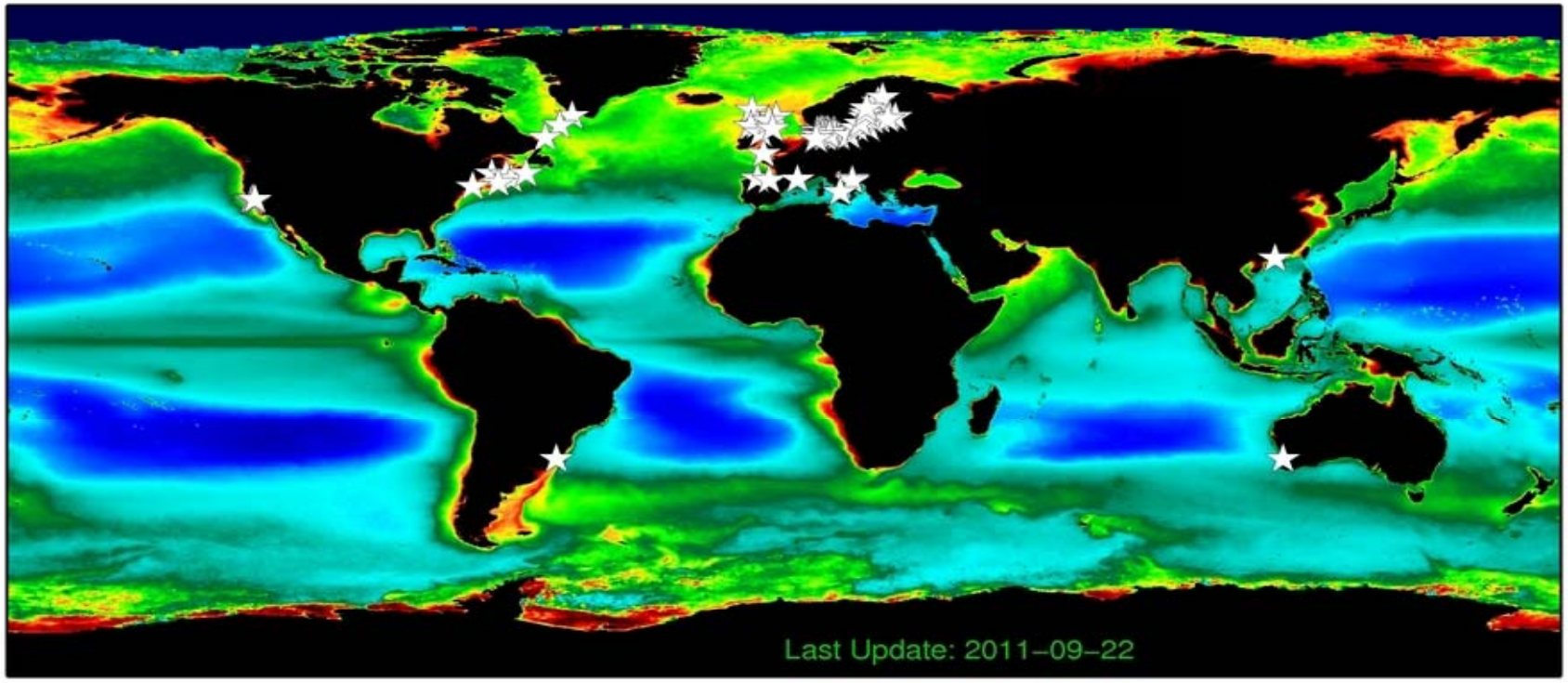


SCOR WG 137

"Global Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observations"



Map of over 110 sites: Website: http:/wg137.net

WG 137 Participants

Co-Chairs: Kedong Yin[1] & Hans Paerl[2]

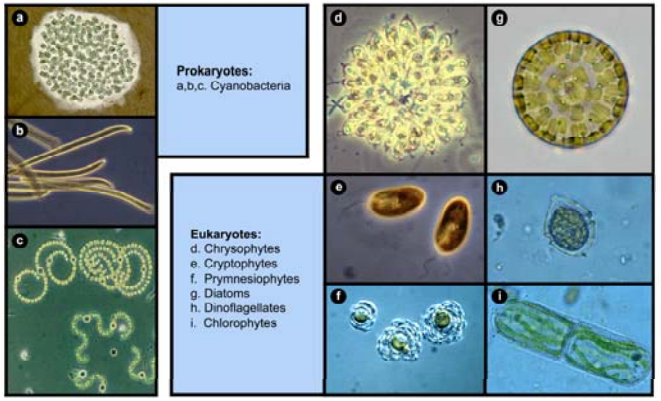
1. Sun Yat-Sen (Zhongshan) University, Guangzhou, China

2. University of North Carolina at Chapel Hill, Instit. of Marine Sciences, Morehead City, NC, USA

Members

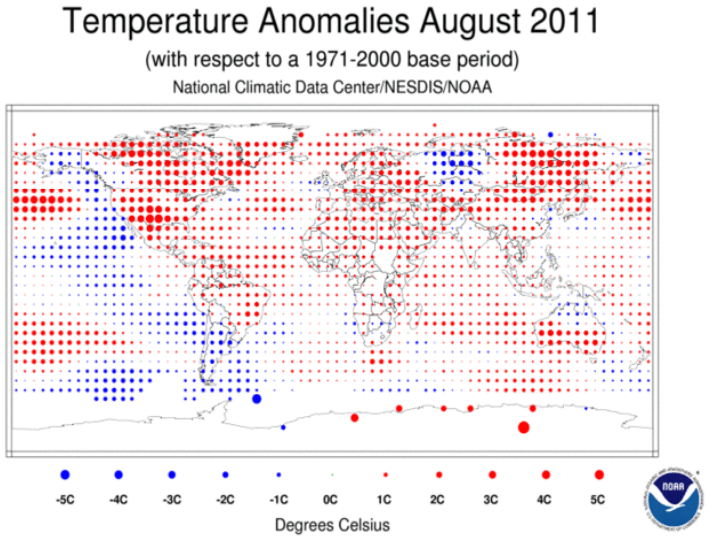
- **Jacob Carstensen** - *National Environmental Research Institute* - Denmark
- **James Cloern** - *U.S. Geological Survey, Menlo Park* - California, USA
- **Yves Collos** - *Ecologie des Systèmes Marins Côtiers , CNRS-Université* - Montpellier, France
- **Richard Gowen** - *Fisheries and Aquatic Ecosystems Branch, Agri-Food and Biosciences Institute* - Belfast, UK
- **Paul Harrison** - *Div. of Environment, Hong Kong University of Science and Technology* - Hong Kong
- **Peter Henricksen** - *National Environmental Research Institute, Aarhus University* - Denmark
- **Hans Henrik Jacobsen** - *National Environmental Research Institute, Aarhus University* - Denmark
- **Alexandra Kraberg** - *Biologische Anstalt Helgoland AWI* - Helgoland, Germany
- **Sirpa Lehtinen** - *Marine Research Centre, Finnish Environment Institute* - Helsinki, Finland
- **Li Ruixiang** - *First Institute of Oceanography, State Oceanic Administration* - China
- **Abigail McQuatters-Gollop** - *Sir Alister Hardy Foundation for Ocean Science* - Plymouth, UK
- **Todd O'Brien** - *National Marine Fisheries Service—NOAA* – Maryland, USA
- **Clarisse Odebrecht** - *Instit. de Oceanografia, Universidade Federal do Rio Grande-FURG* - Brazil
- **Katja Philippart** - *Royal Netherlands Institute for Sea Research* - Texel, The Netherlands
- **N.N. Ramaiah** - *National Institute of Oceanography* - Dona Paula, Goa, India
- **Peter Thompson** - *CSIRO Marine and Atmospheric Research* - Hobart, Australia
- **Karen Wiltshire** - *Biologische Anstalt Helgoland AWI* - Helgoland, Germany
- **Monika Winder** - *FM-GEOMAR Kiel, Germany & Univ. of Stockholm* - Sweden
- **Sinjae Yoo** - *Korea Ocean Research and Development Institute* - Ansan, South Korea
- **Mingyuan Zhu** - *First Institute of Oceanography, State Oceanic Administration* - Qingdao, China
- **Adriana Zingone** - *Stazione Zoologica A. Dohrn* - Villa Communale, Napoli, Italy

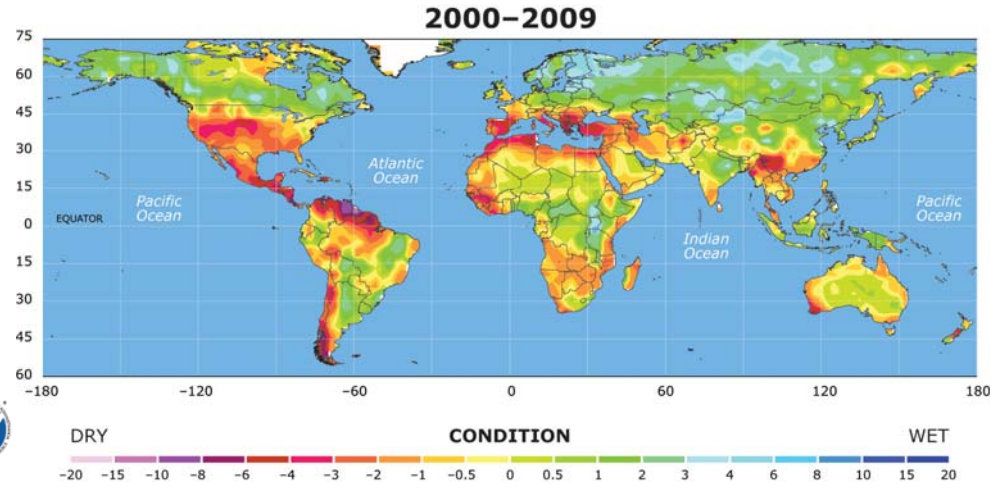
WG-137 Overarching Objective



Identify and characterize effects of changes in anthropogenic nutrient inputs from climate (change) impacts on estuarine/coastal phytoplankton communities.

Examine these effects along geographic and climatic (temperature, hydrology) gradients by comparing and synthesizing among different regional datasets.

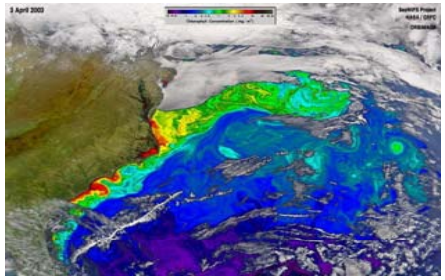




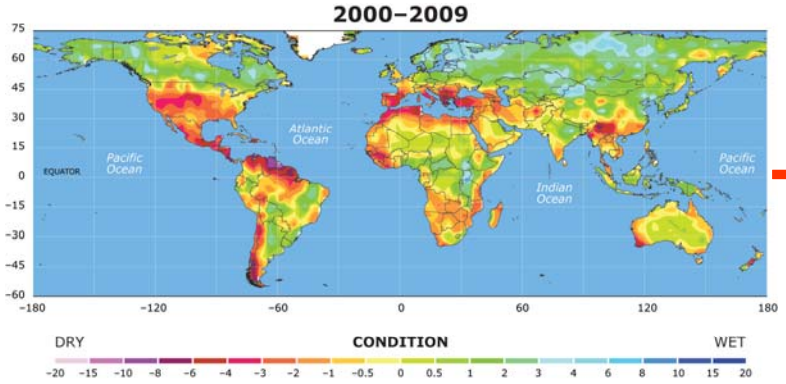
WG 137 Objectives and Products focused on and linked to

- Human development in coastal watersheds
- Regional and global climate change
- Nutrient enrichment, eutrophication, water quality
- Changes in nutrient and carbon cycling
- Changes in biodiversity, phytoplankton community structure and function
- Food web structure, trophodynamics and fisheries
- Environmental and habitat management

Key Anthropogenic and Climatic Drivers of Concern

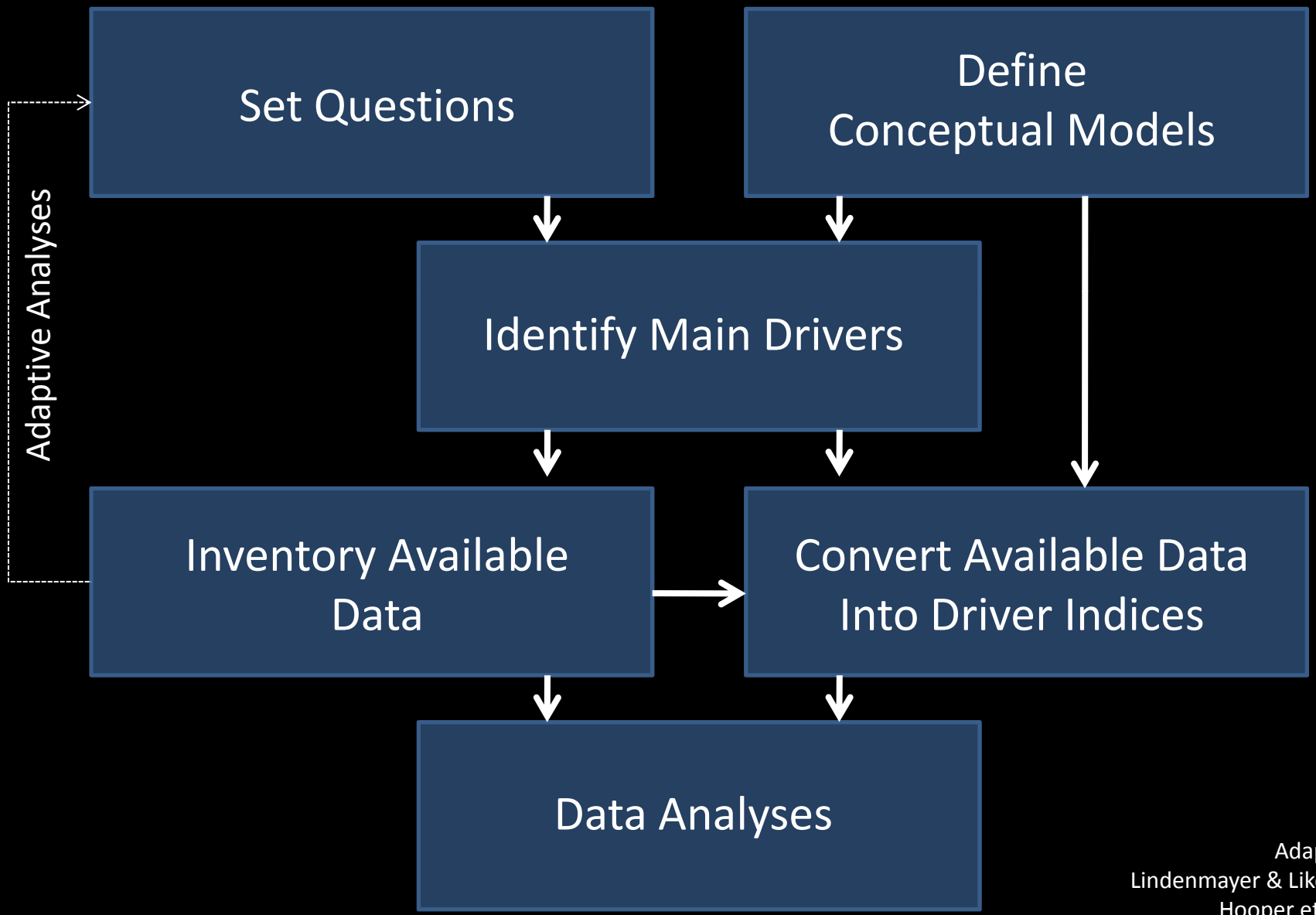


Changes in precipitation, storm events and nutrient/freshwater discharge to the coastal zone



Increased temperatures & more severe droughts

SCOR137 – Approach for Comparative Analyses

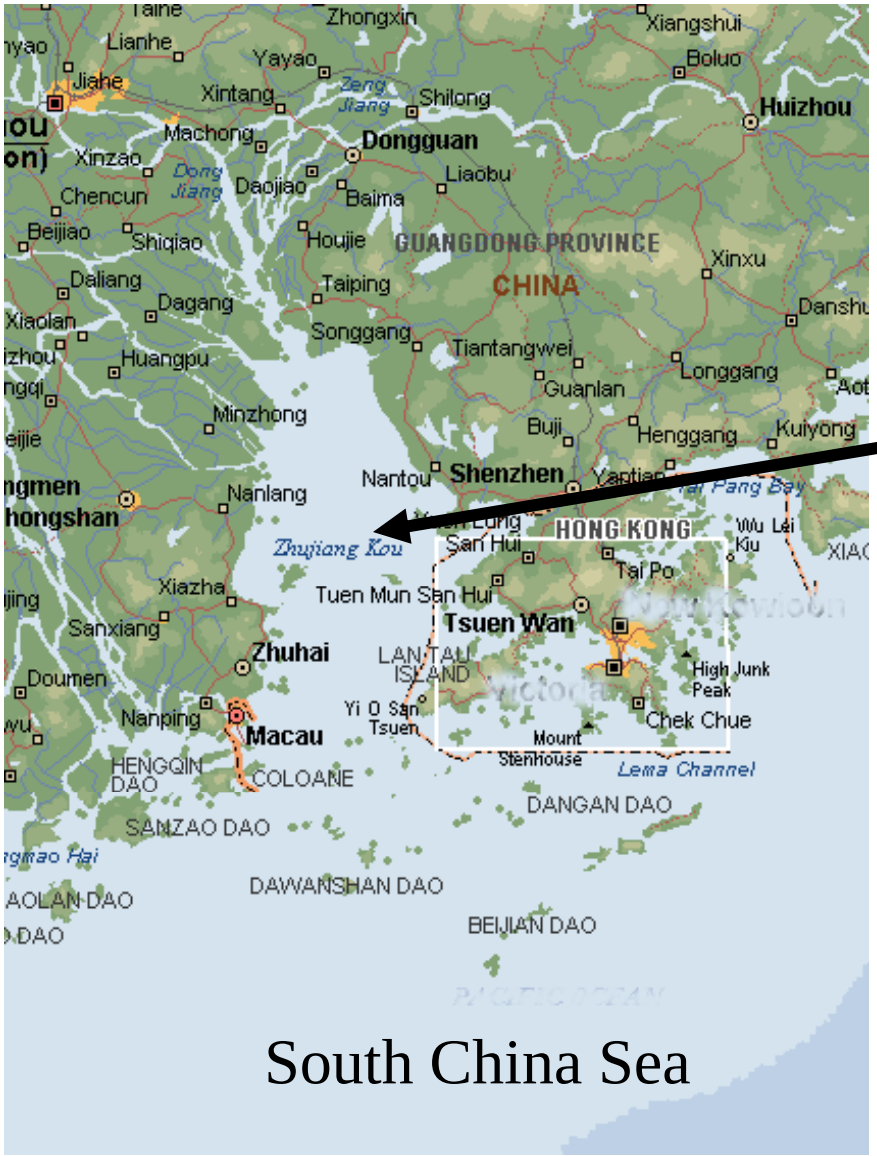


Adapted from:
Lindenmayer & Likens (2009)
Hooper et al. (2005)

Examples of anthropogenic and climatic impacts on Phytoplankton community structure and function based on WG 137 data sets

- Pearl R. Estuary: Hong Kong Harbor, China
- Neuse River-Pamlico Sound, North Carolina, USA
- Patos Lagoon, Brazil
- Thau Lagoon, France
- San Francisco Bay, California, USA

Phytoplankton species composition and climate change (warming) in the Pearl River Estuary, China

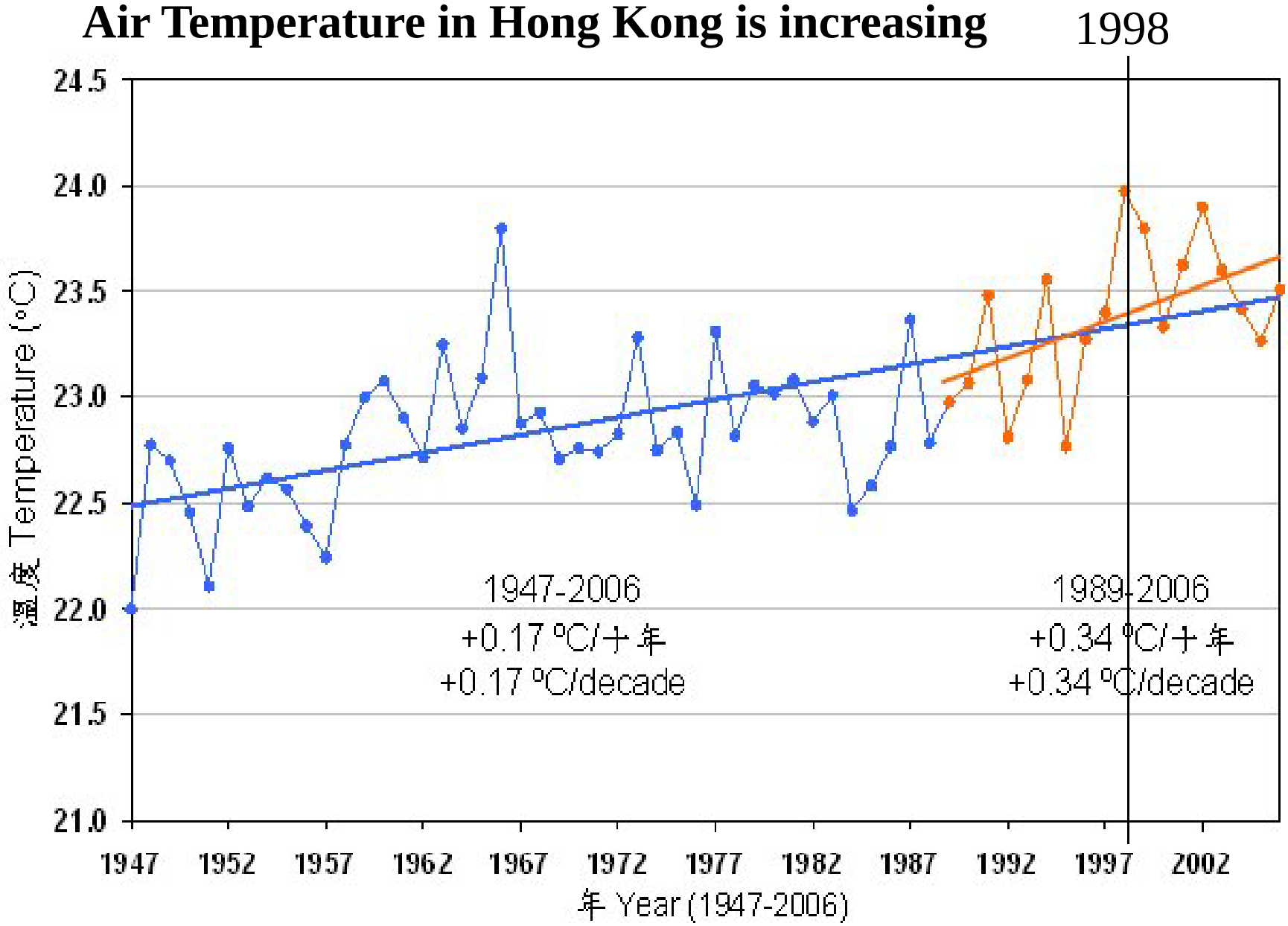


Pearl River Estuary

Pearl River

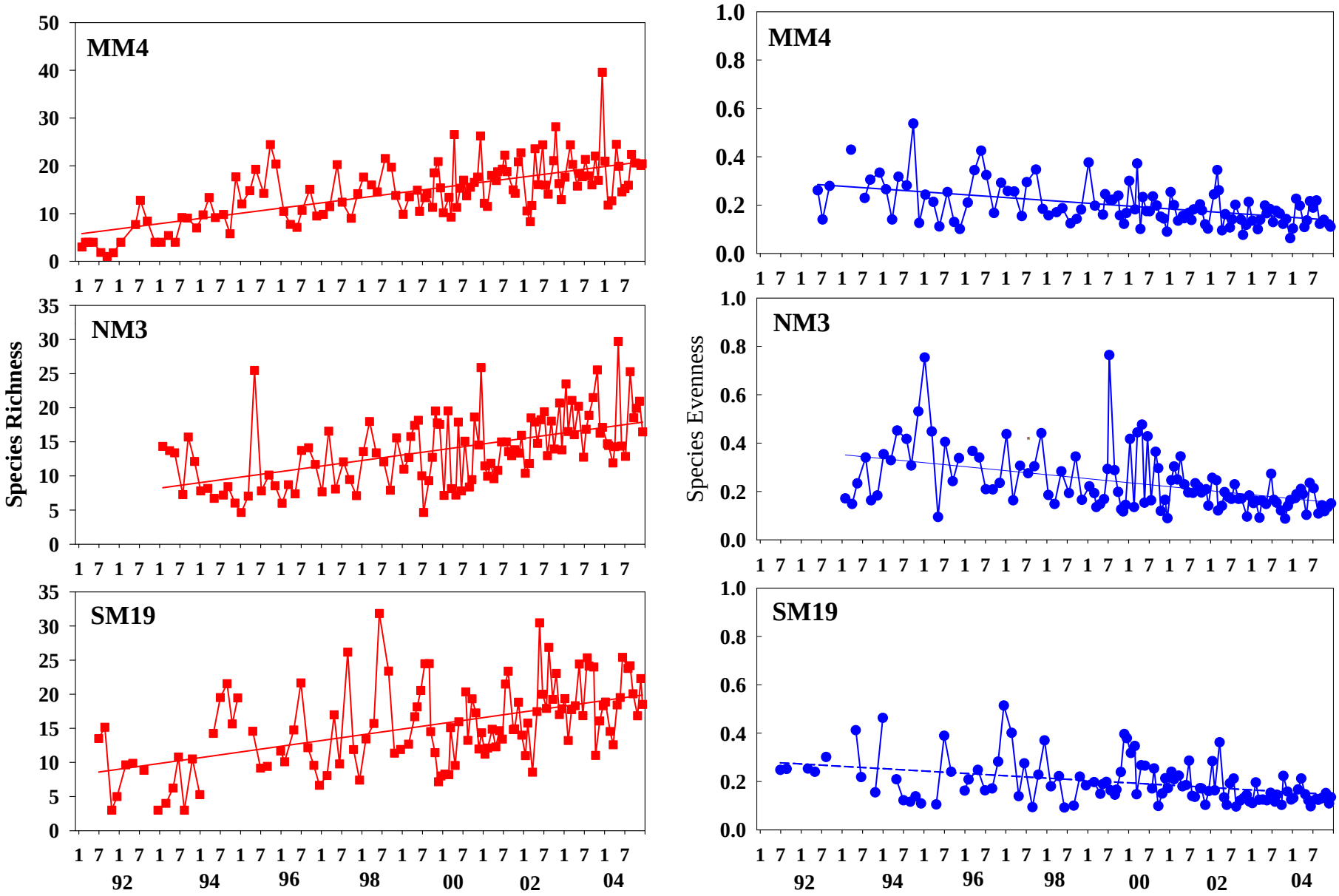
- **The second largest river in China**
- **The 13th largest river in the world**

Air Temperature in Hong Kong is increasing



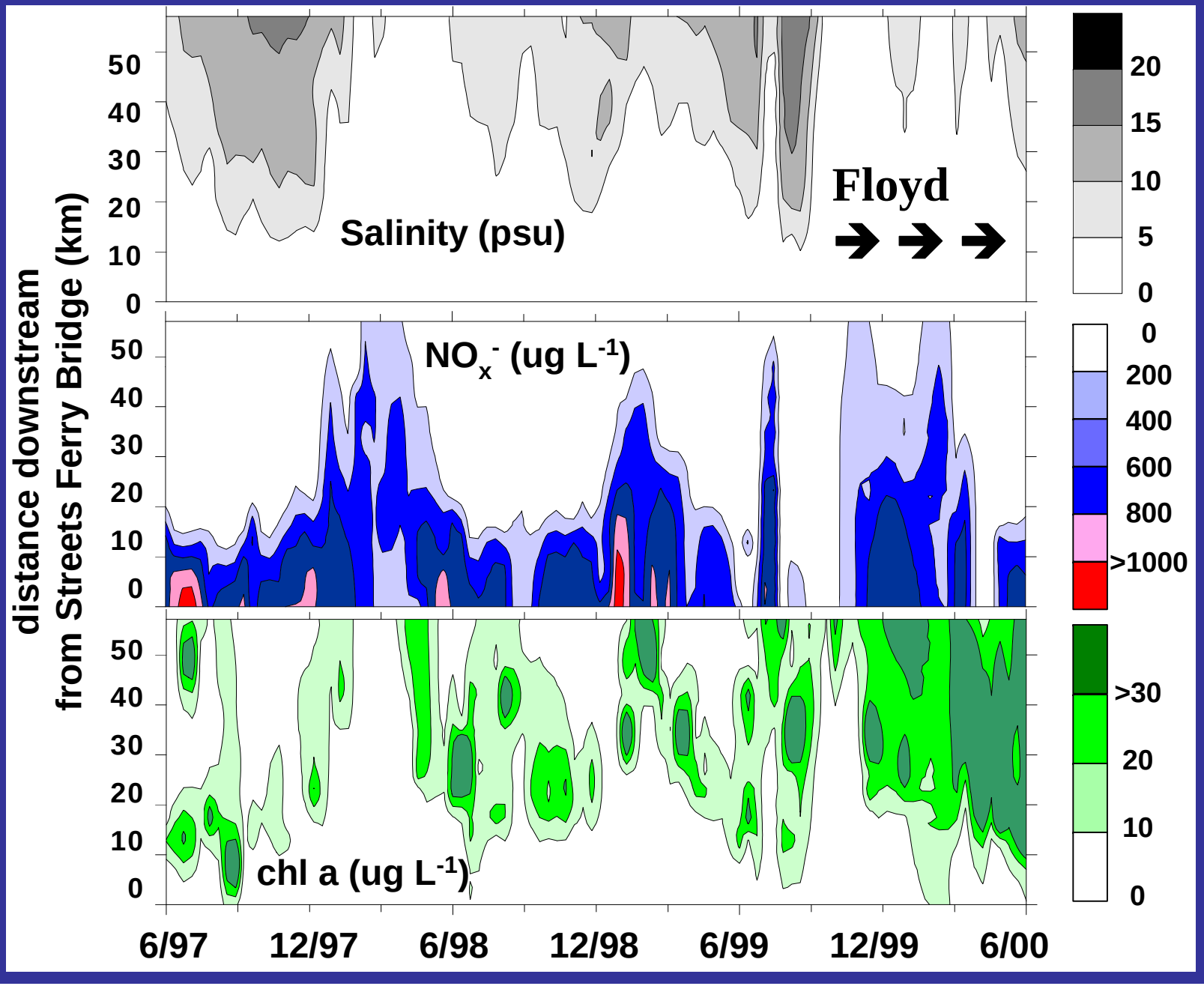
Species Richness

Simpson species evenness

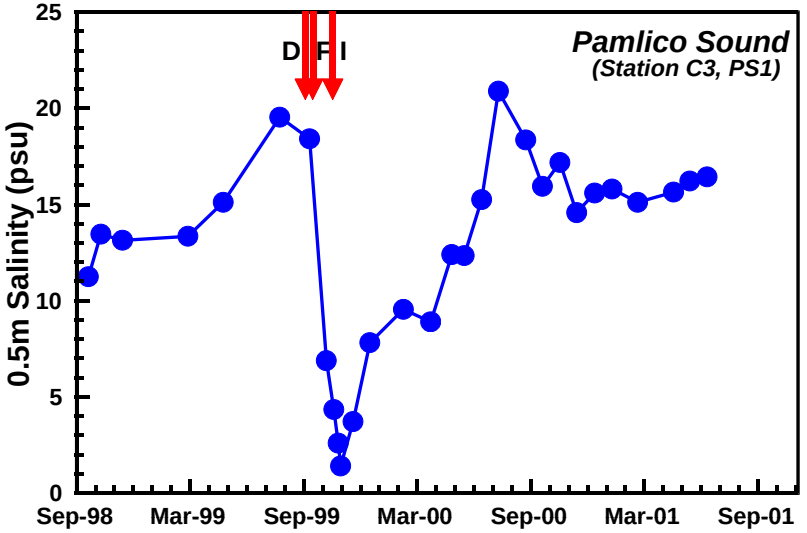


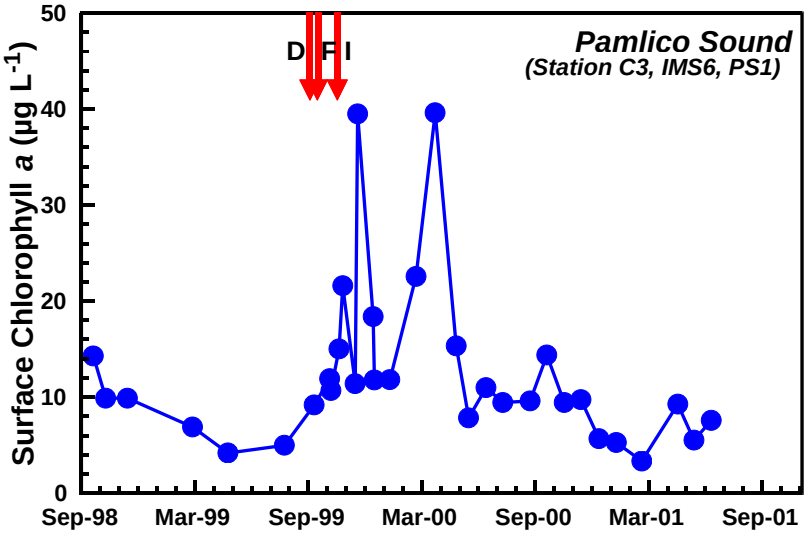
Influence of climate (change) and hydrologic perturbations (hurricane Floyd, 1999) on phytoplankton and water quality: Neuse-Pamlico Sound, NC

Hydrology, N loading and phytoplankton production in the Neuse R. Estuary, before and after Hurricane Floyd (Sept. 1999)

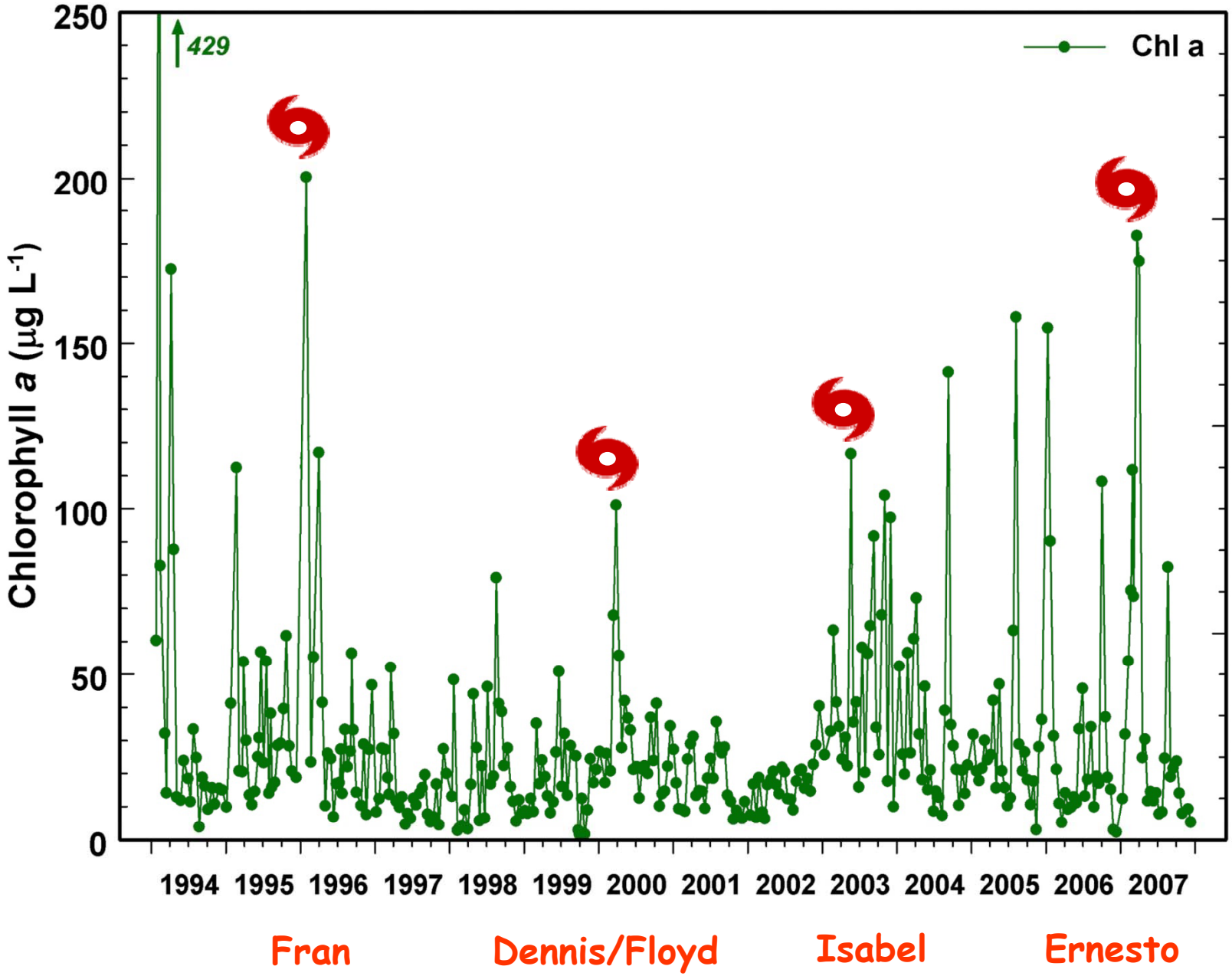


Salinity and Chlorophyll *a* responses to the floodwaters in Pamlico Sound

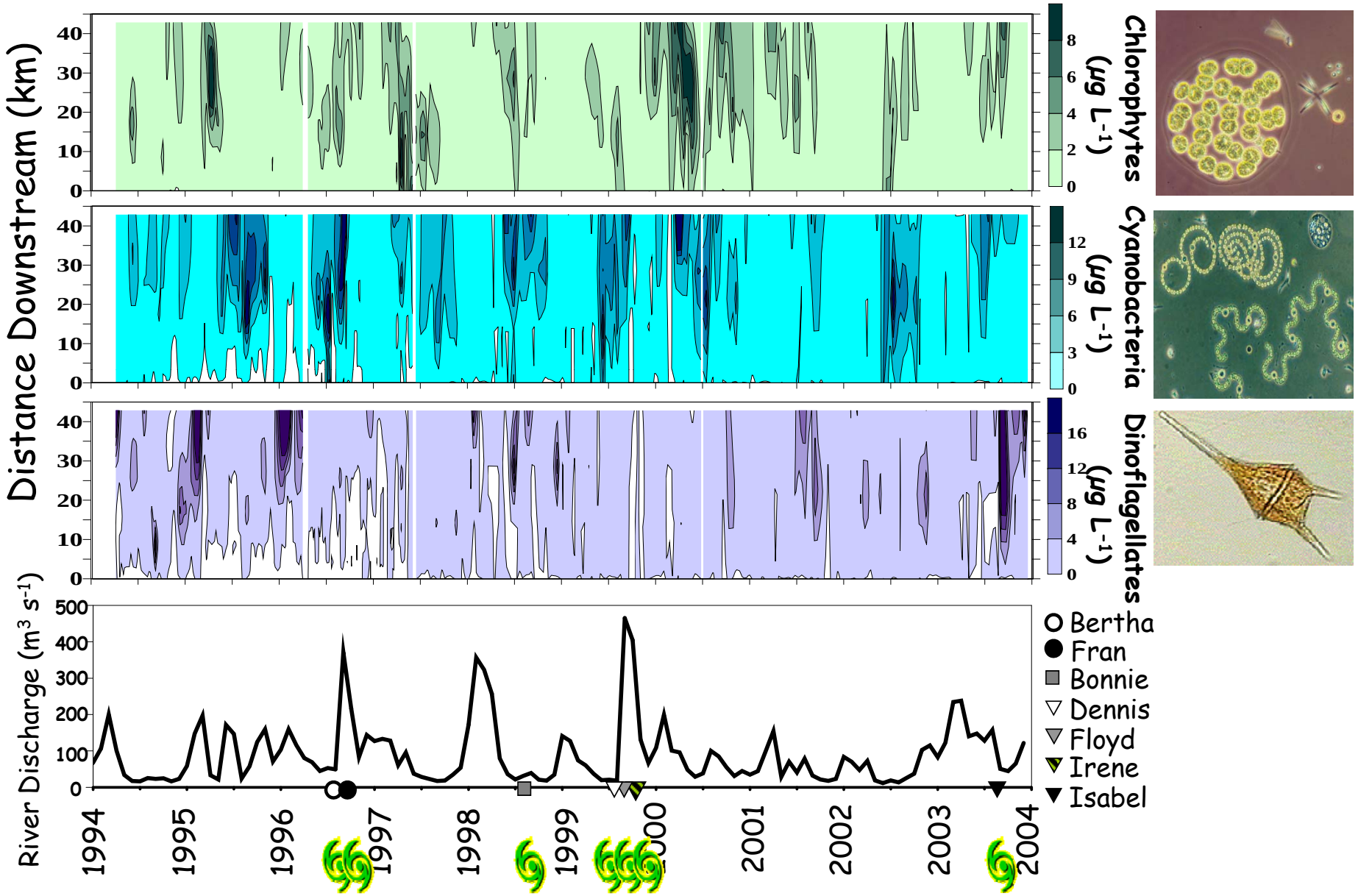




Major hurricanes/tropical storms & phytoplankton biomass (Chl *a*) responses

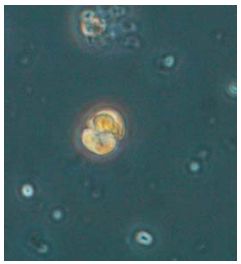


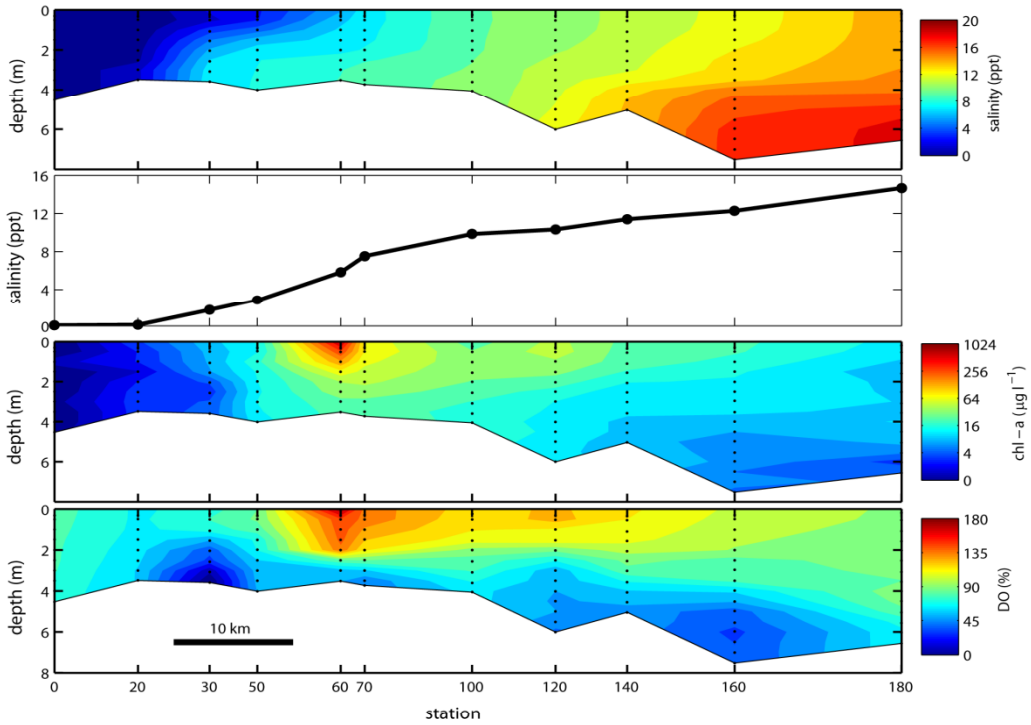
Phytoplankton group responses to flow (HPLC-PDAS)

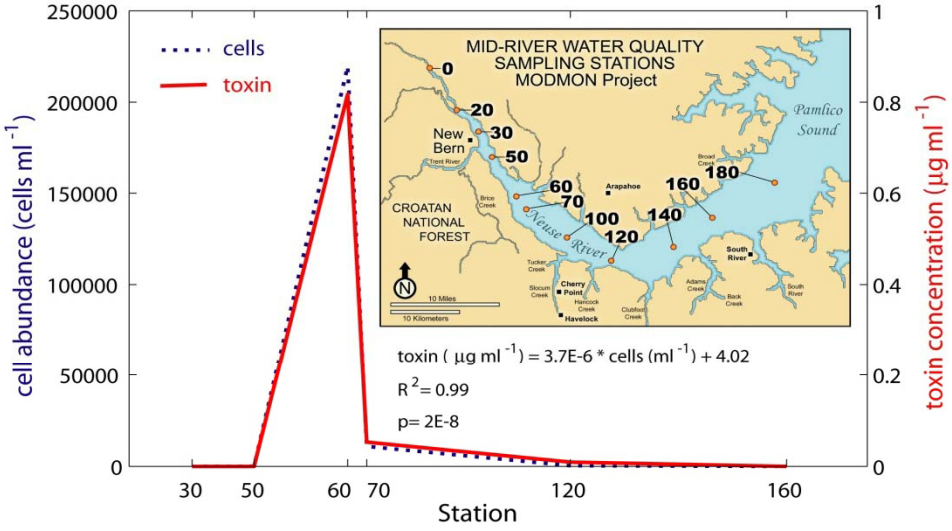


Valdes-Weaver et al. 2006

A toxic dinoflagellate (*Karlodinium)* bloom following runoff from Tropical Storm Ernesto, Oct. 2006



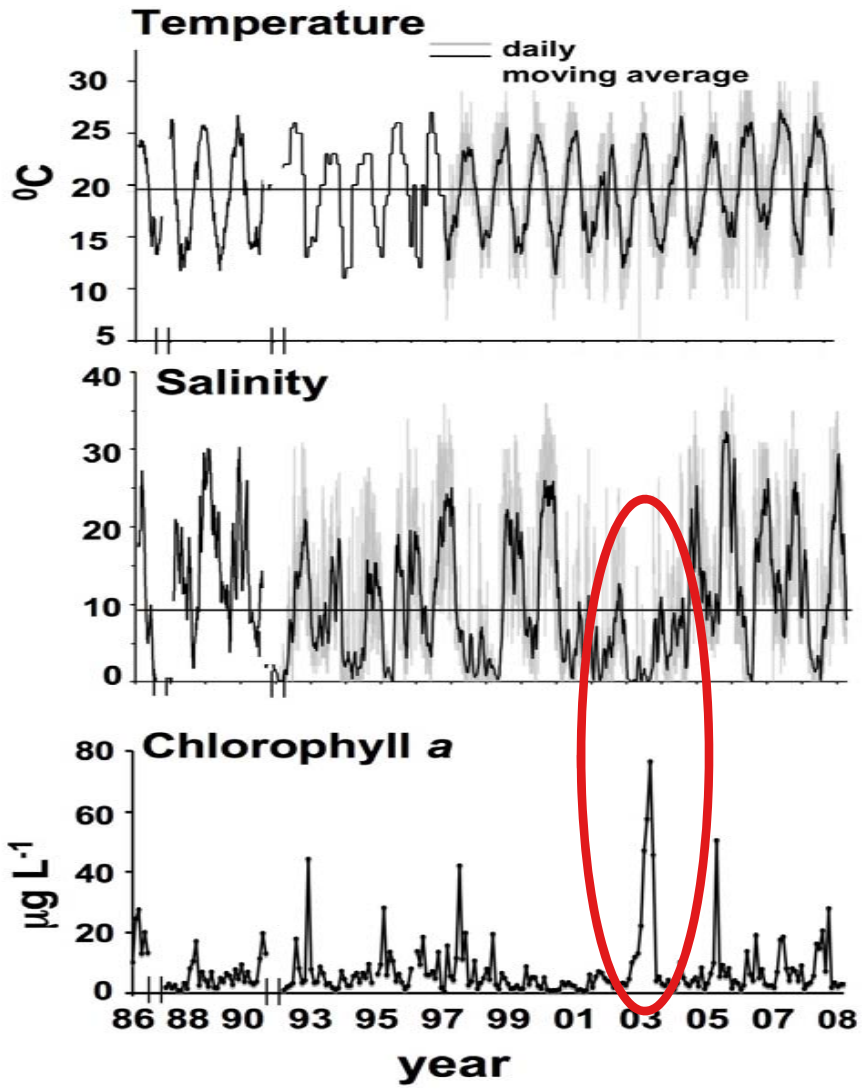




- **Runoff associated with Ernesto contained nutrient load and set up strong salinity stratification**
- **Favorable light and temperature conditions created ideal conditions for an algal bloom.**
- **Near-surface stratification was favorable for motile dinoflagellates; *Karlodinium* prefers these conditions in fall.**

Hall et al. 2008

Example of climatic forcing (*El NINO* effect) on phytoplankton in Patos Lagoon, Brazil



Low x high salinity years

HIGH Interannual variation

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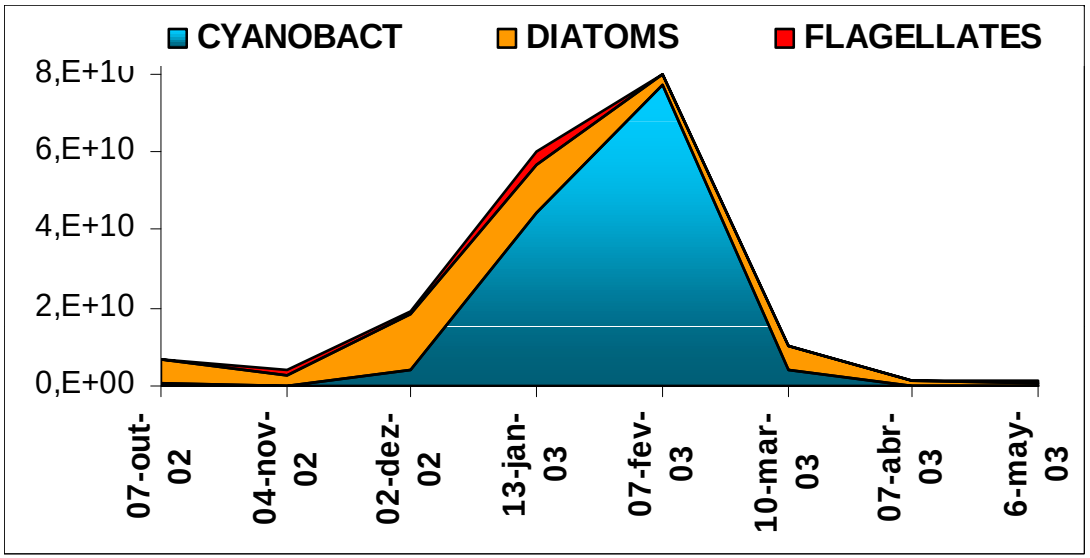
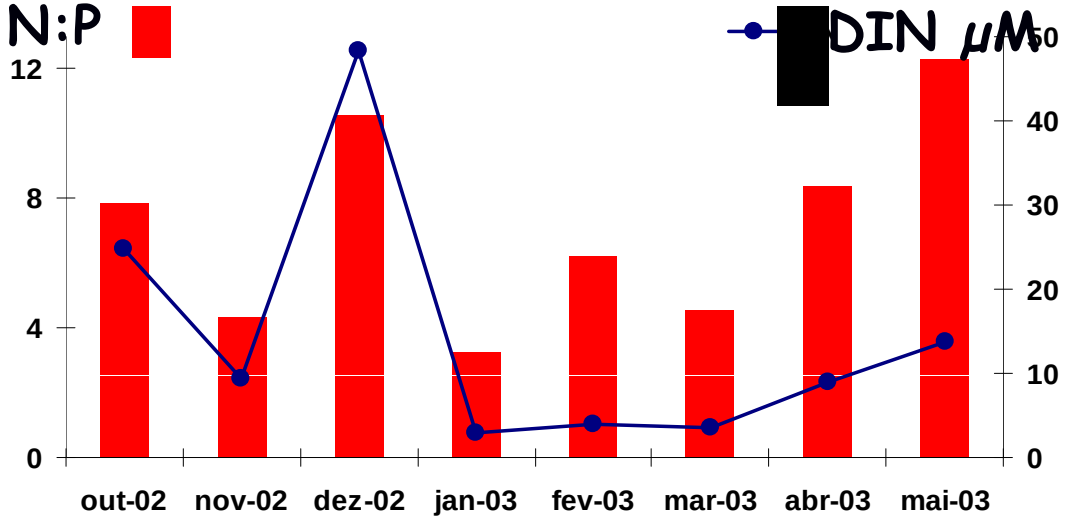
related largely *El Nino Southern* Oscillation process

2002-2003 example extreme conditions

Cyanobacteria "tracking" El Nino-related elevated freshwater discharge

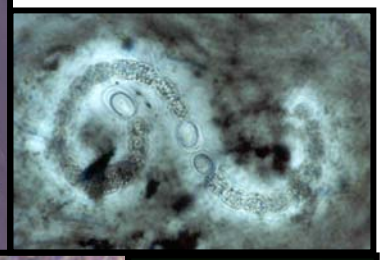


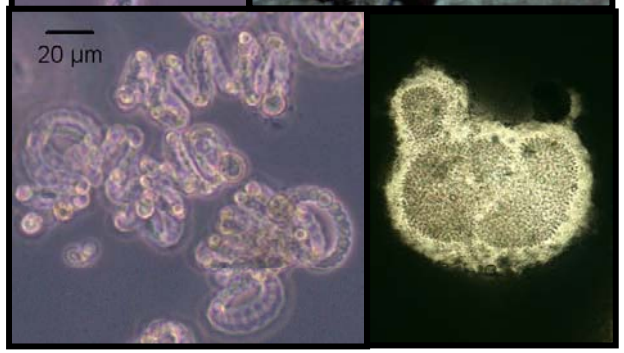


Heterocystic species

Aphanizomenon aphanizomenoides

Anabaenopsis sp.





Anabaena spp. *Microcystis novacekii*

Conclusions: Climatic forcing led to....

Low NP ratios, favoring

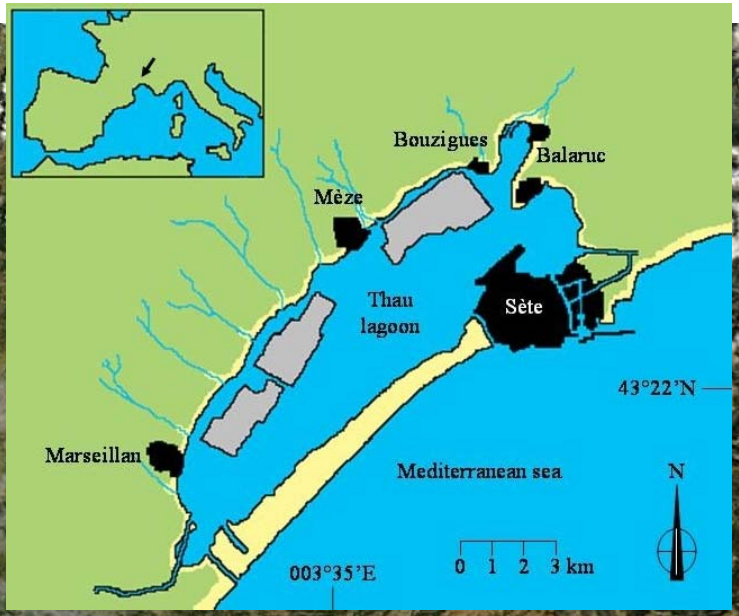
unusual Cyanobacteria growth in summer

in low salinity water due to

extreme rainfall

(El Nino phase of ENSO).

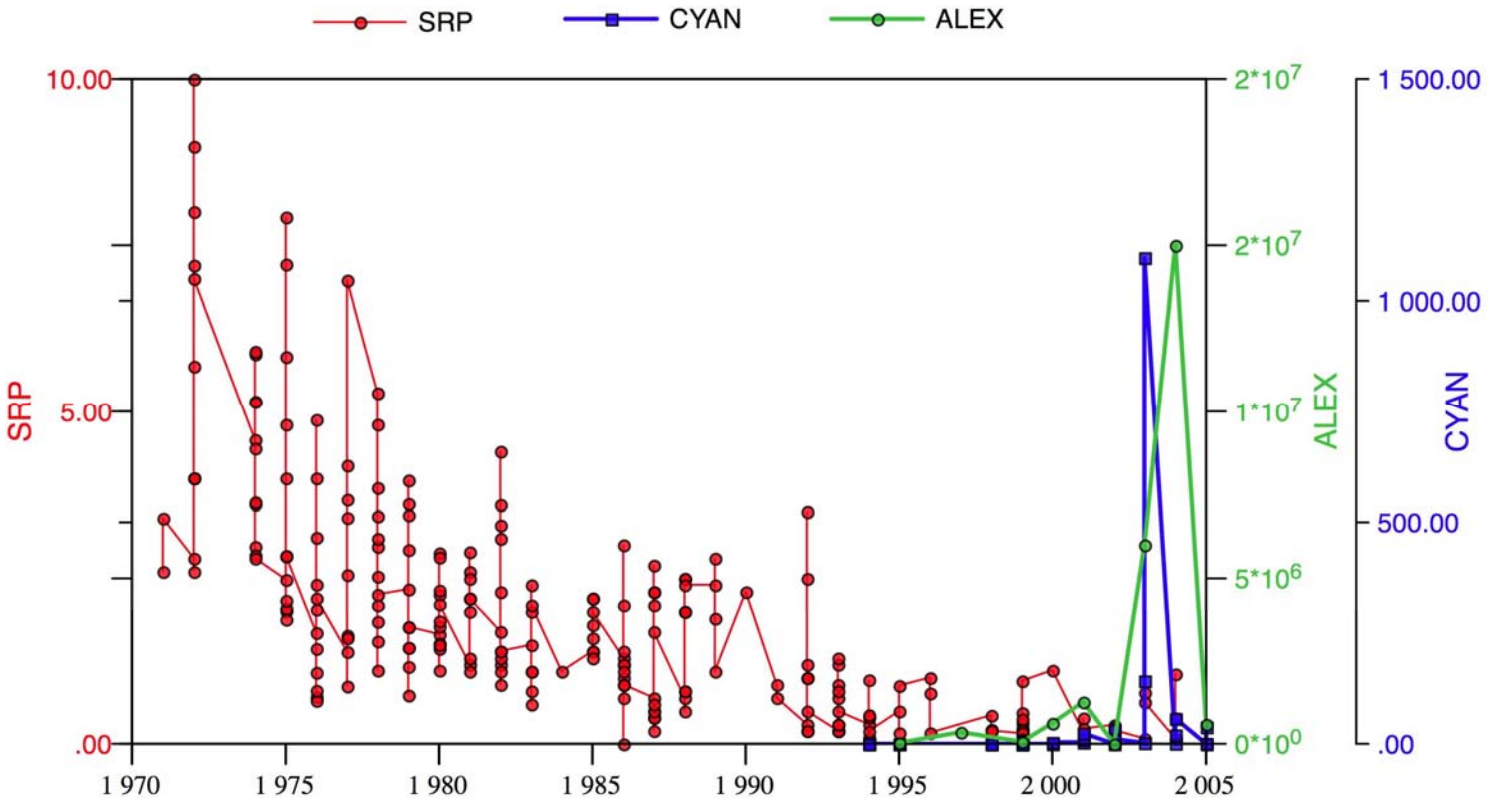
Thau Lagoon, Mediterranean Coast, France

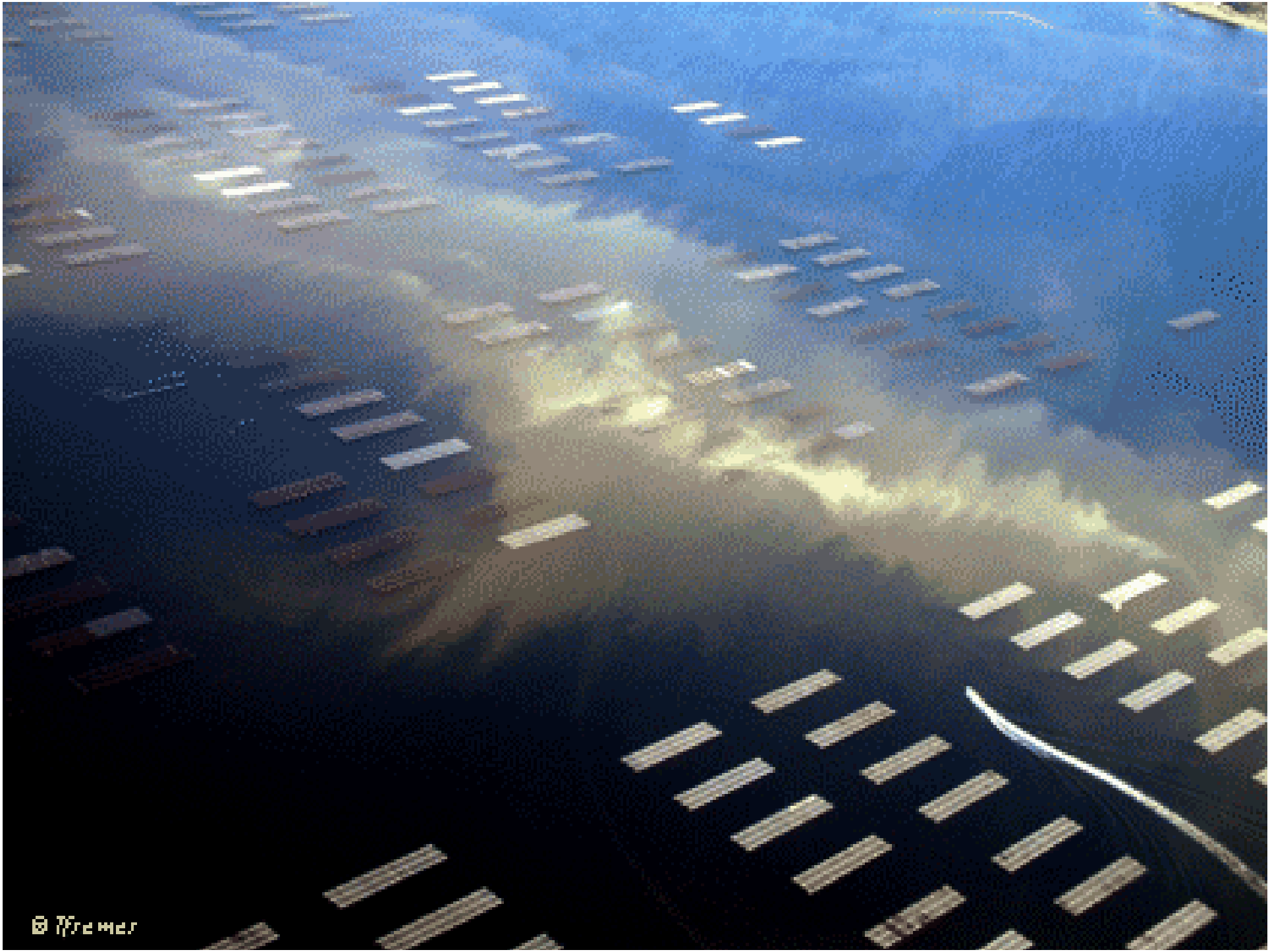


Climate change and oligotrophication:Thau Lagoon, France

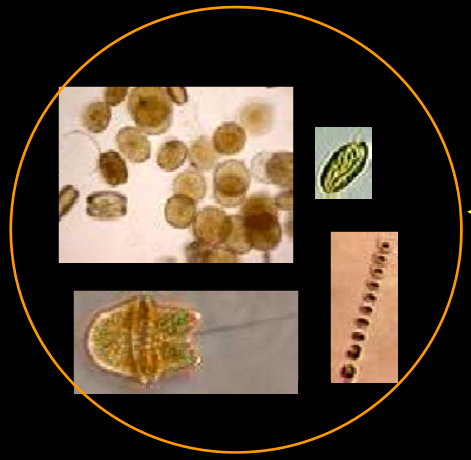
Low SRP → **picocyanobacteria** ← **High temperature**

picocyanobacteria → ***Alexandrium catenella***




© Tremer

Reorganization of Biological Communities in San Francisco Bay, CA

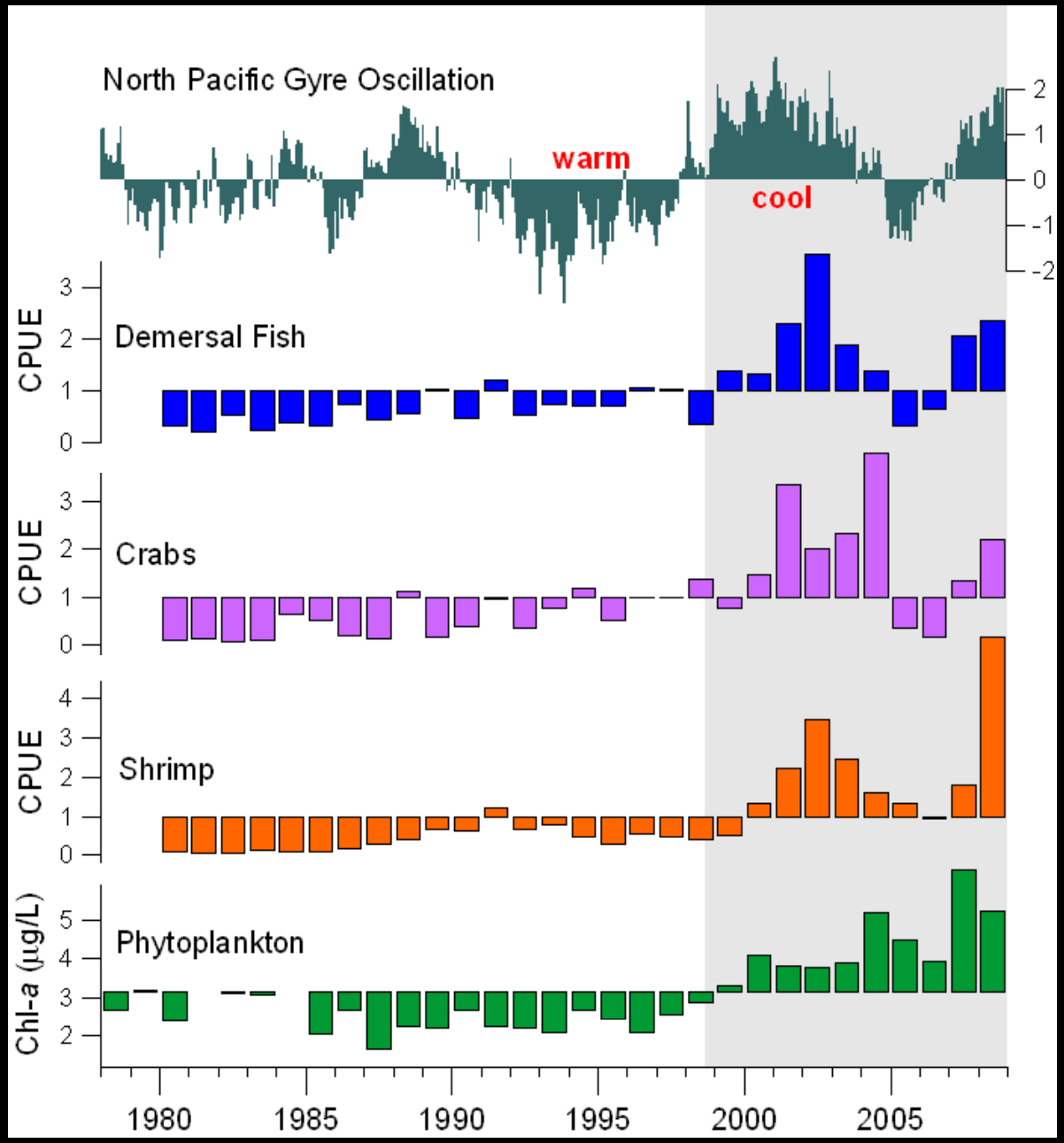


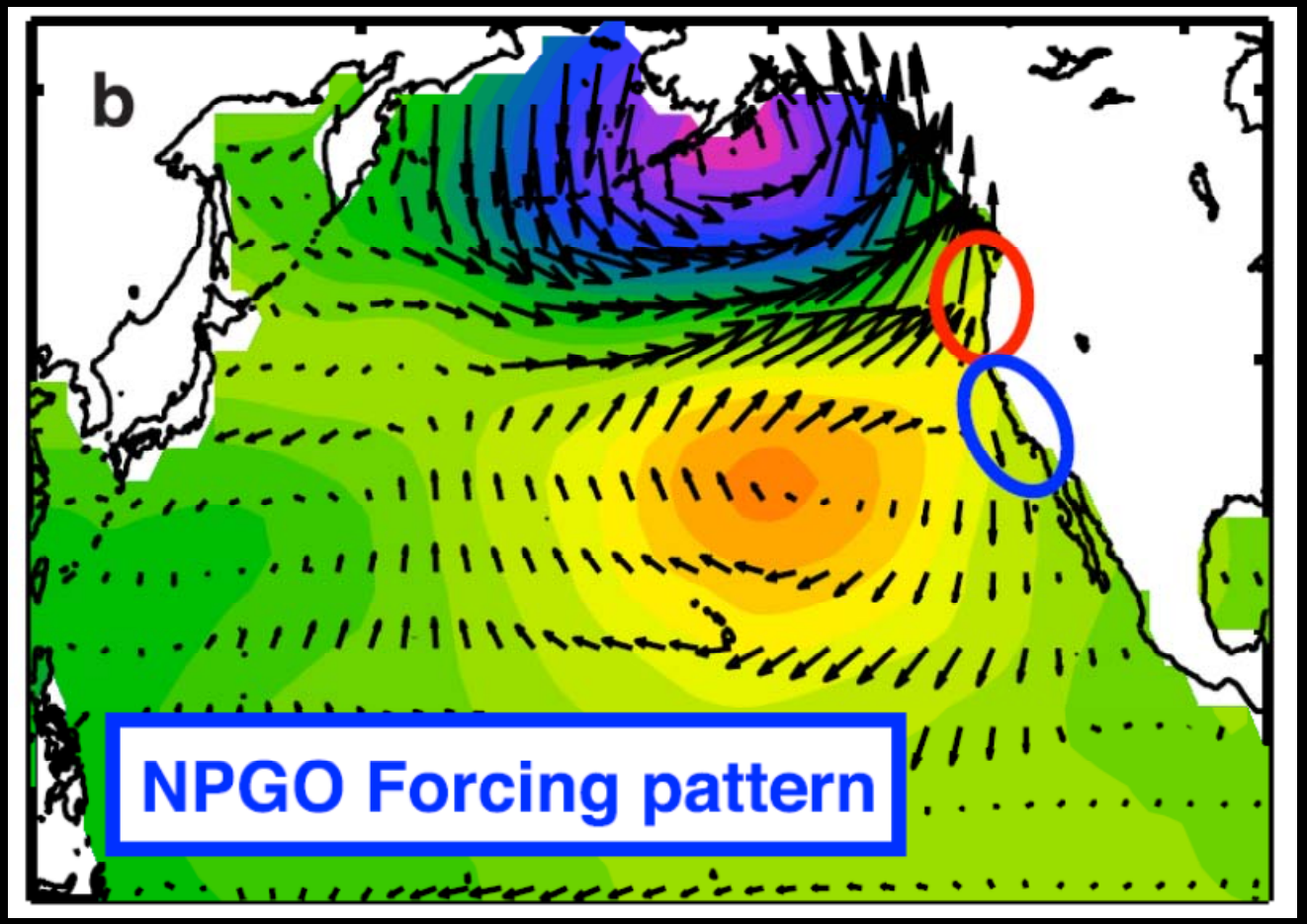
PRIMARY PRODUCERS

HERBIVORES

PREDATORS

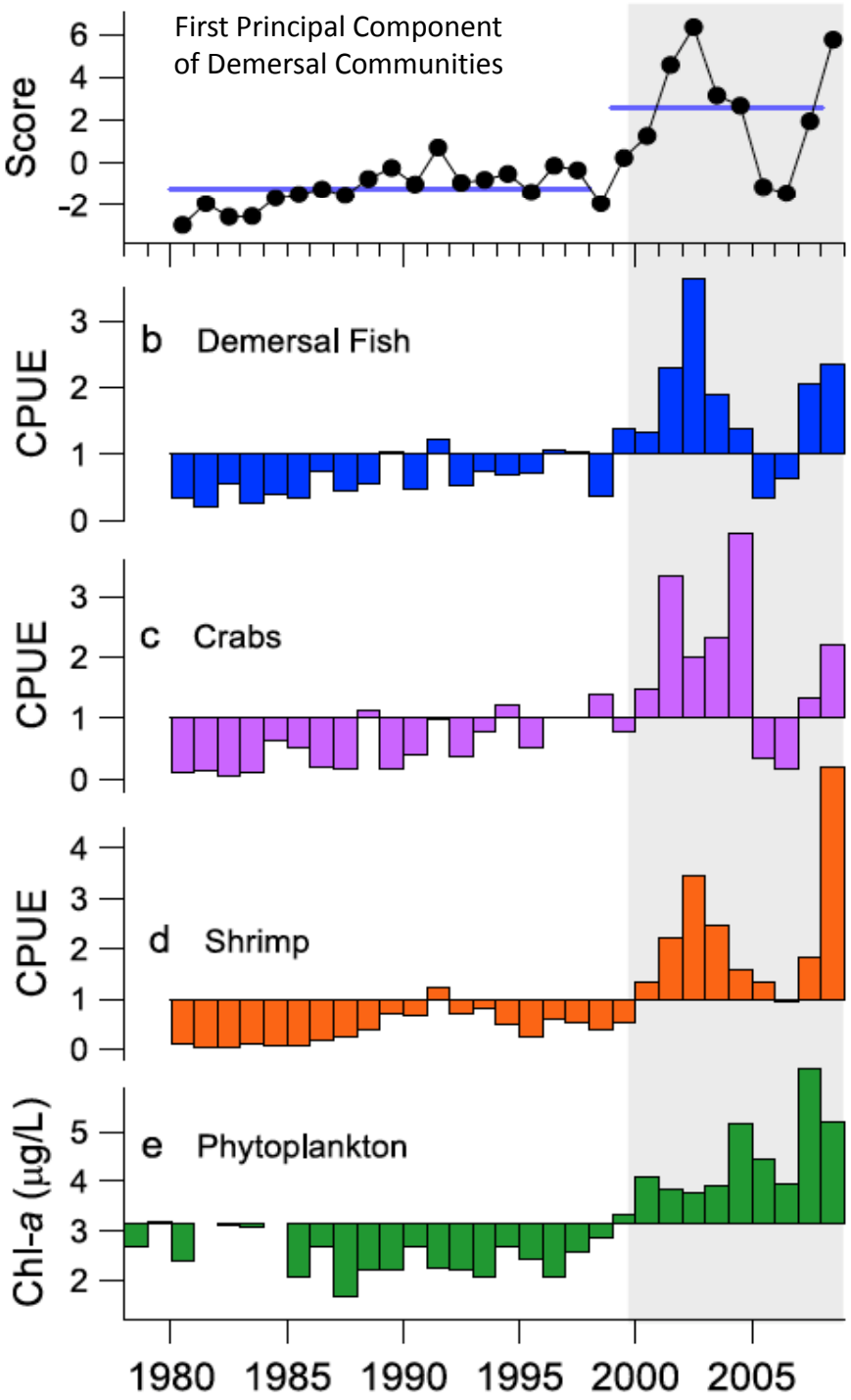
1999 Climate Shift



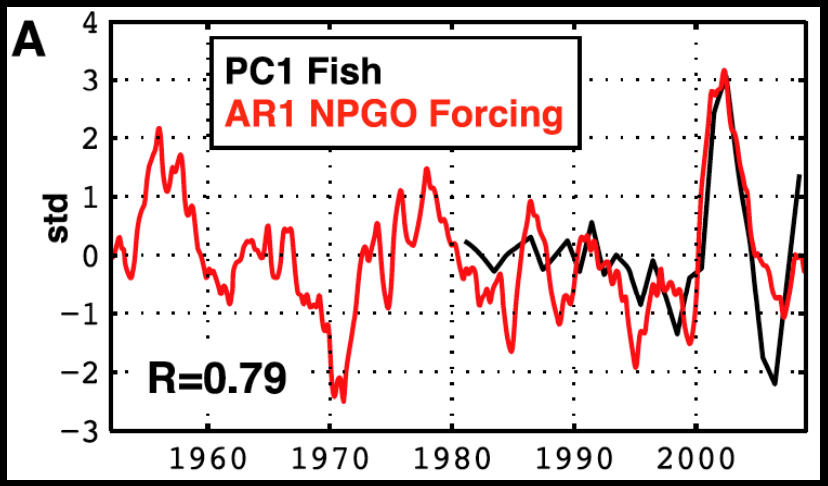


Vectors = wind stress Colors = sea level pressure

Di Lorenzo et al. 2008



Ecological Regime Shift in San Francisco Bay



Communities track atmospheric forcing of the North Pacific Gyre Oscillation

$$\frac{dPC1_{rec}(t)}{dt} = \alpha \mathrm{SLP_{HI}}(t - \Delta t) - \frac{PC1_{rec}(t)}{\tau_{PC1}}$$