

# LINKING CLIMATE AND ECOSYSTEM CHANGE IN THE SOUTHERN CALIFORNIA CURRENT

Tim Baumgartner<sup>1</sup>,  
Bertha Lavaniegos<sup>1</sup>,  
Reginaldo Durazo<sup>2</sup>,  
and Gilberto Gaxiola<sup>1</sup>

<sup>1</sup>División de Oceanología, CICESE, Ensenada,  
B.C.México

<sup>2</sup>Facultad de Ciencia, Universidad Autónoma de Baja  
California, Ensenada, B.C., México

*PaCOOS Board of Governor's Meeting  
La Jolla, California 21, 22 May, 2008*

## **OBJECTIVE:**

**Explore links between interannual and decadal climate variability and the changes in the state of the pelagic ecosystem in the California Current System off Baja California.**

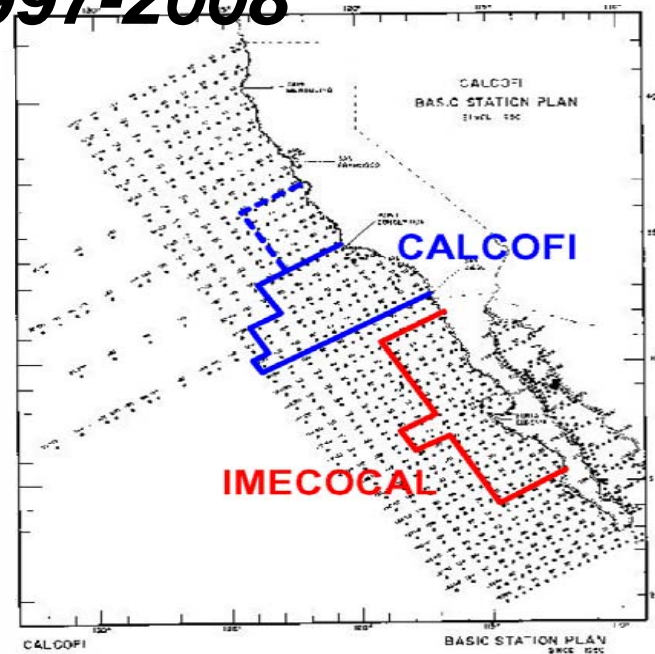
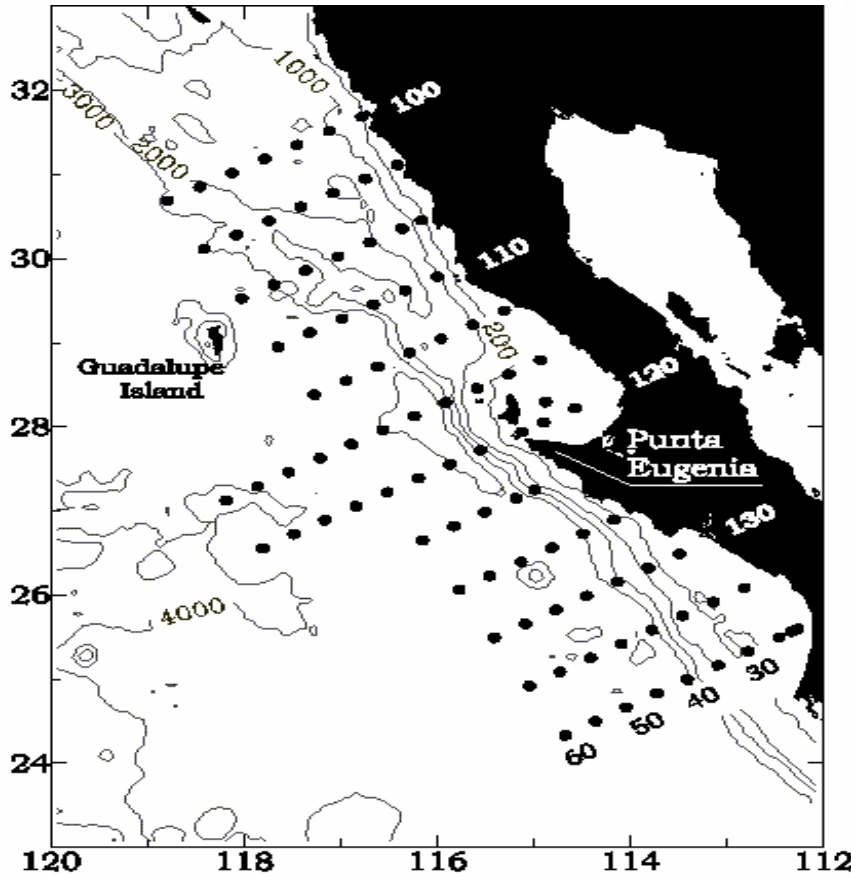
.

## **APPROACH:**

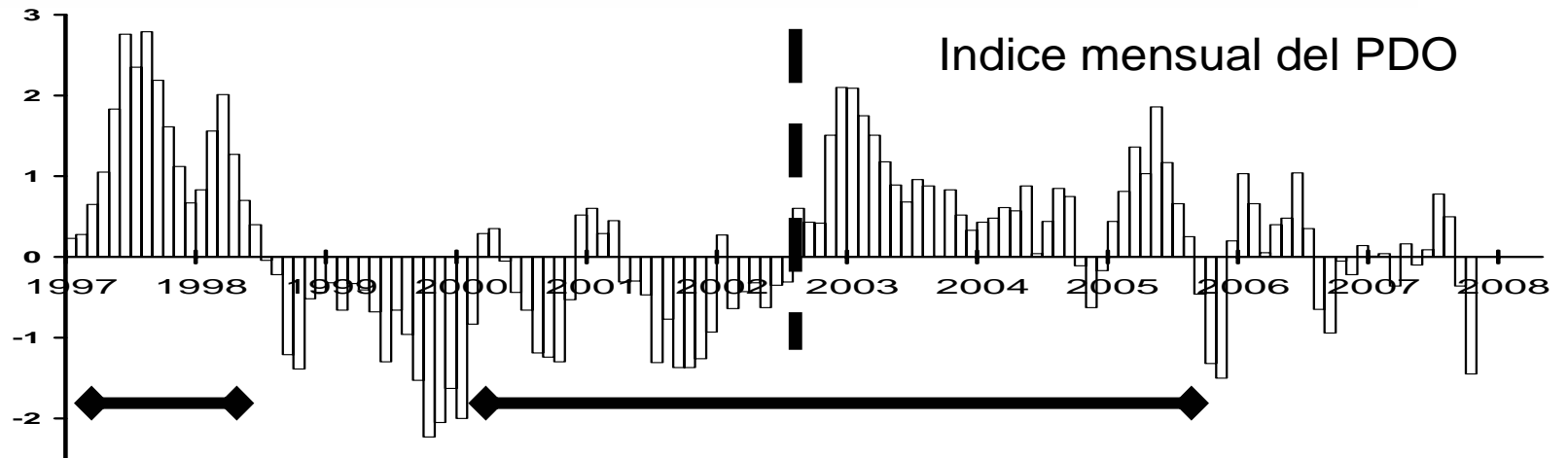
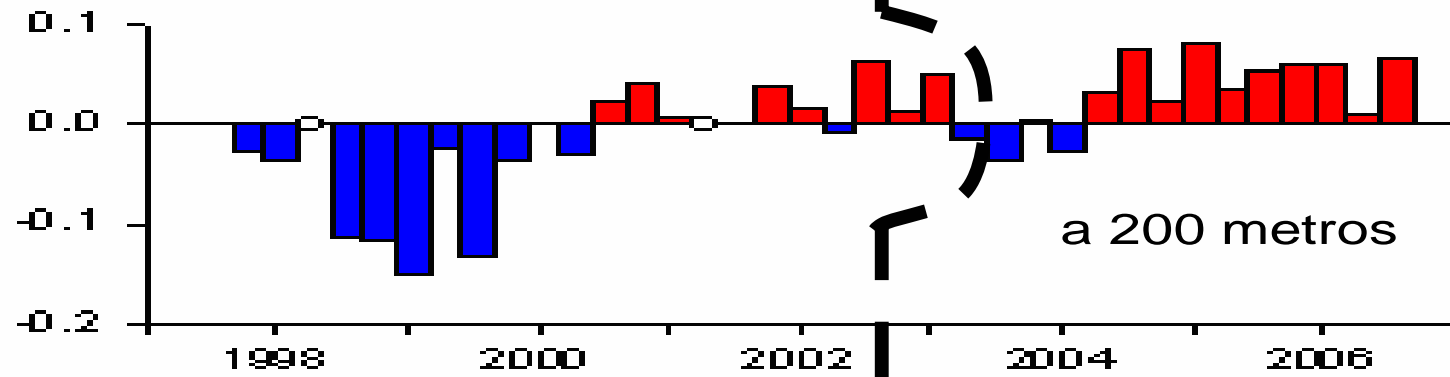
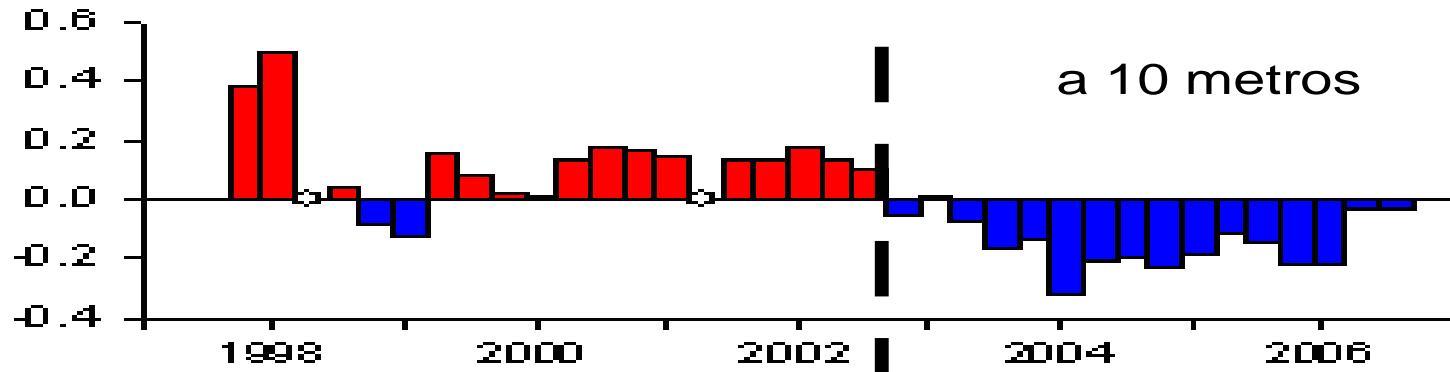
**Compare and contrast the ecosystem changes associated with the period of the strong El Niño and La Niña during 1997-1999 with the period of more moderate but prolonged cooling and warming from 2000 through 2005.**

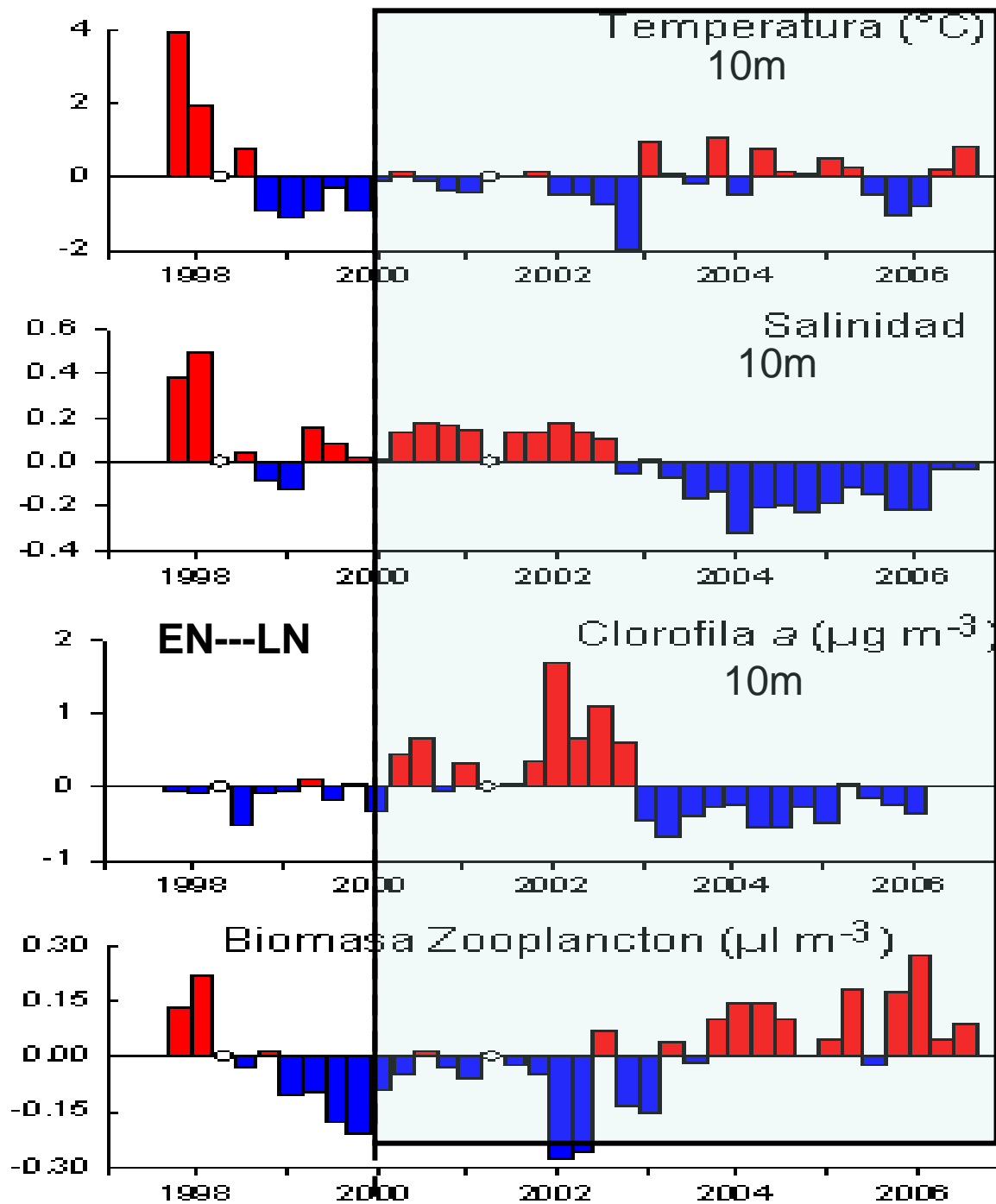
**Ecosystem Indicators are taken from data collected during the past 10 years of ocean monitoring by the IMECOCAL program off Baja California.**

# IMECOCAL 1997-2008



# Anomalías estacionales de salinidad





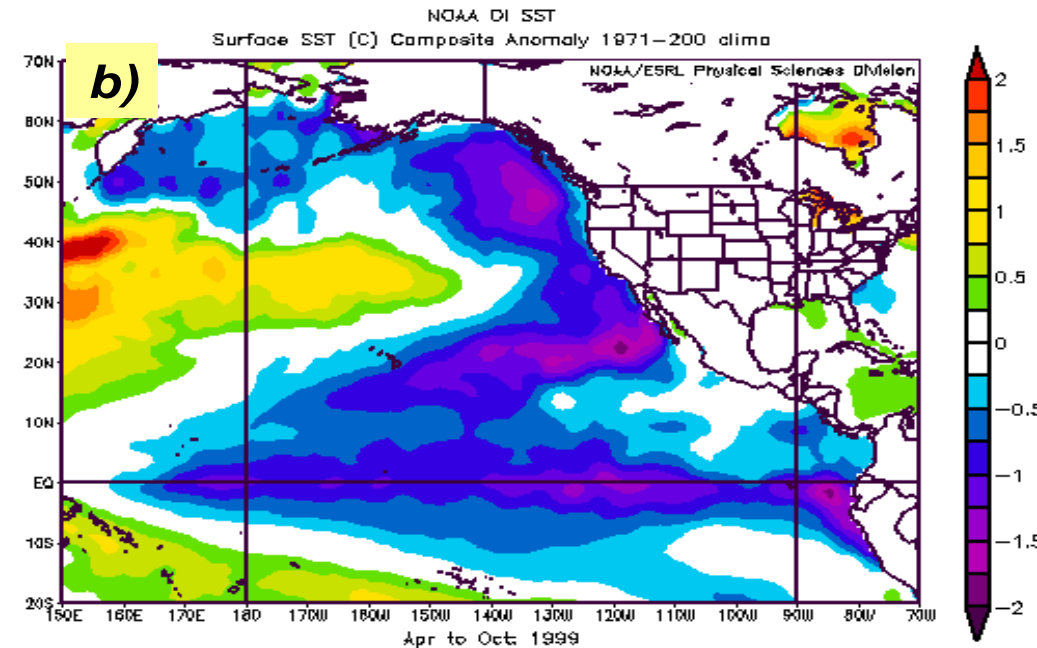
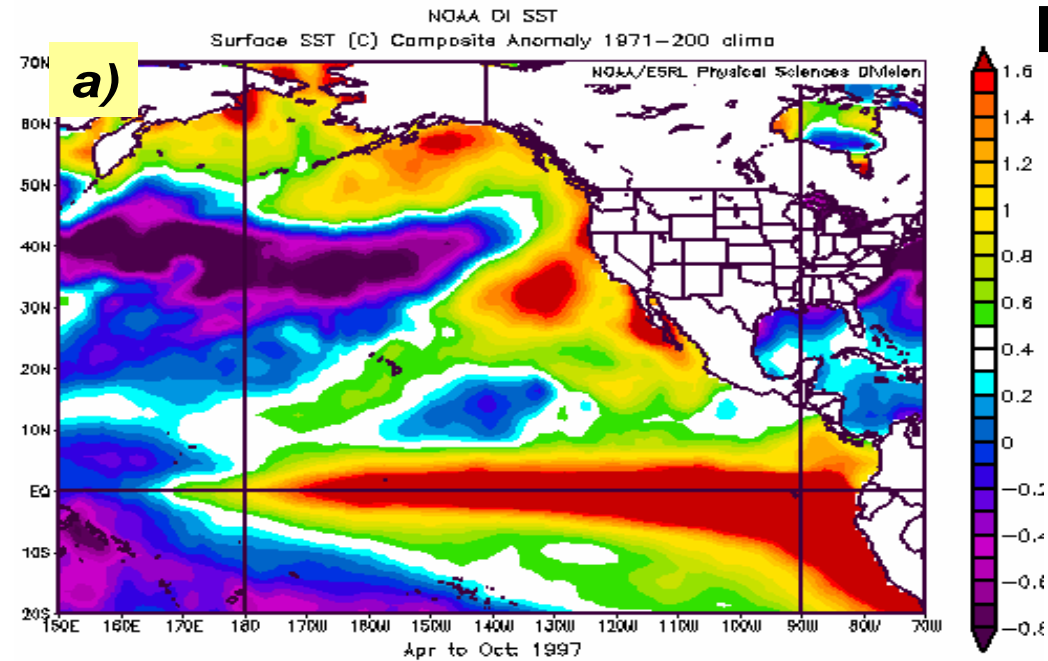
**Leading indicators  
of change in  
physical and  
biological state  
of pelagic  
ecosystem –  
from quarterly  
IMECOCAL  
cruises  
1997 – 2006.**

*Anomalies*

# El Niño – La Niña 1997-1999 Ocean Climate Patterns

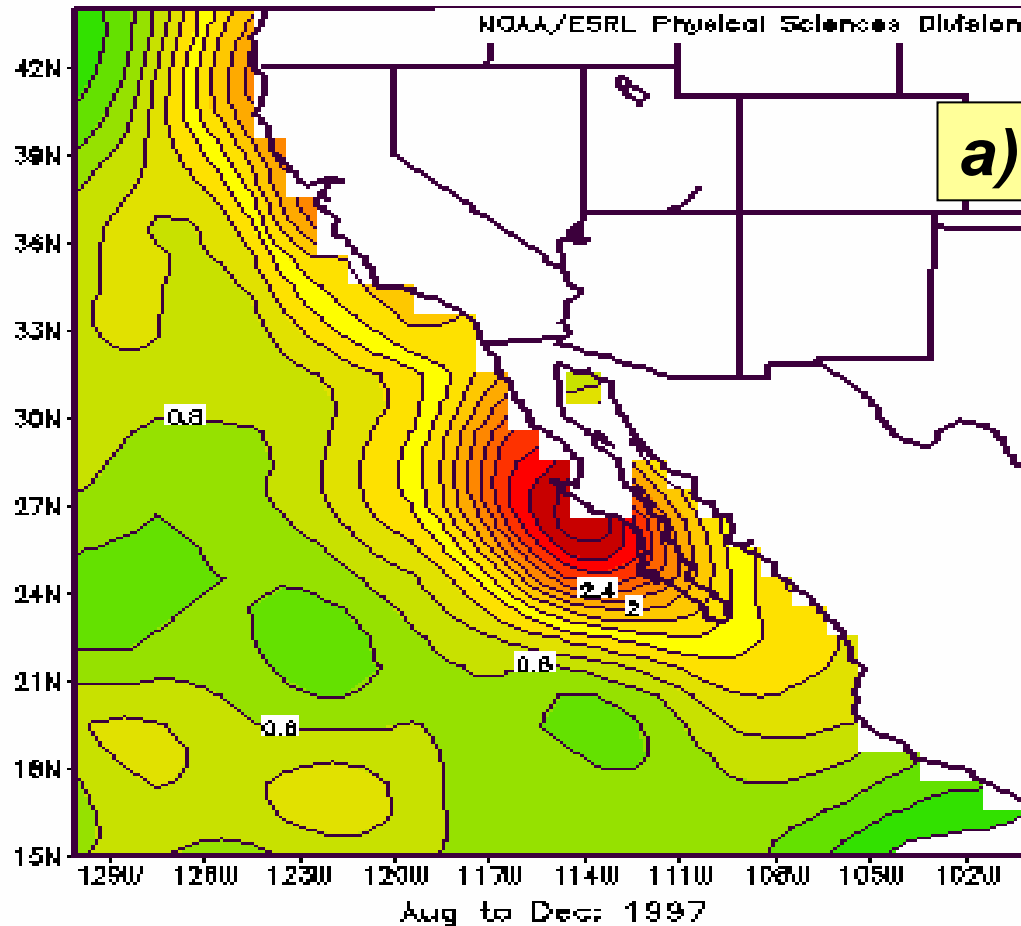
**Development of SST anomaly  
during the 1997-98 El Niño  
(abr-oct 1997)**

Data from NOAA-CDC website

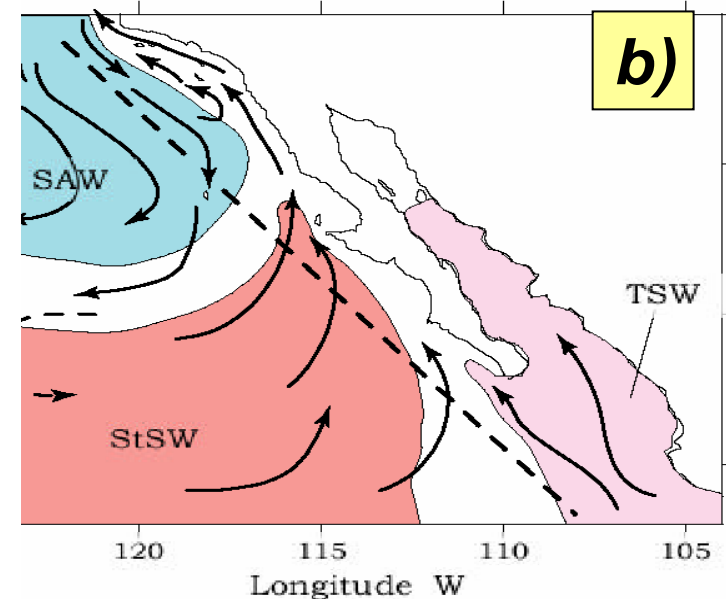


**Development of SST anomaly  
during the 1998-99 La Niña  
(abr-oct 1999)**

Data from NOAA-CDC website

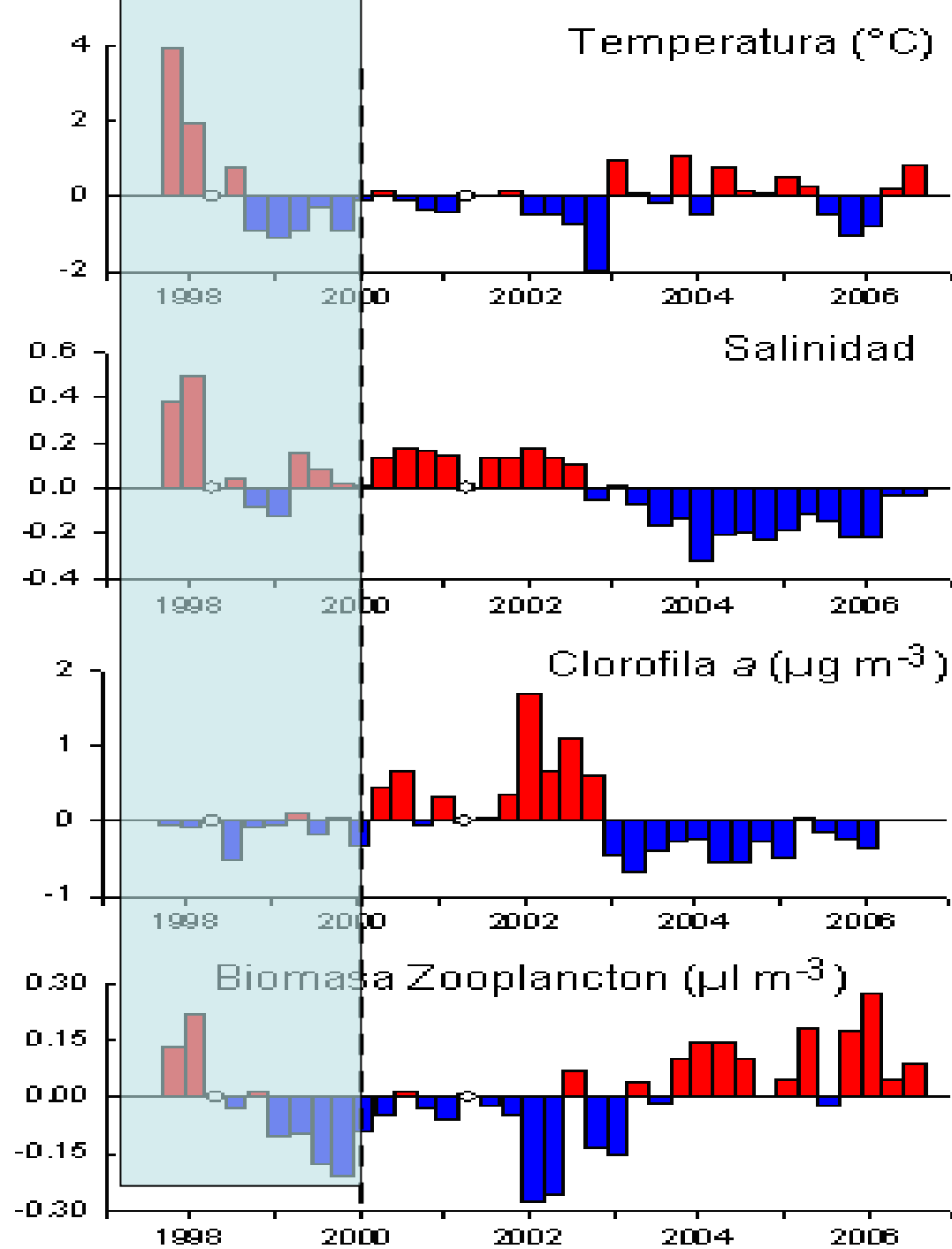


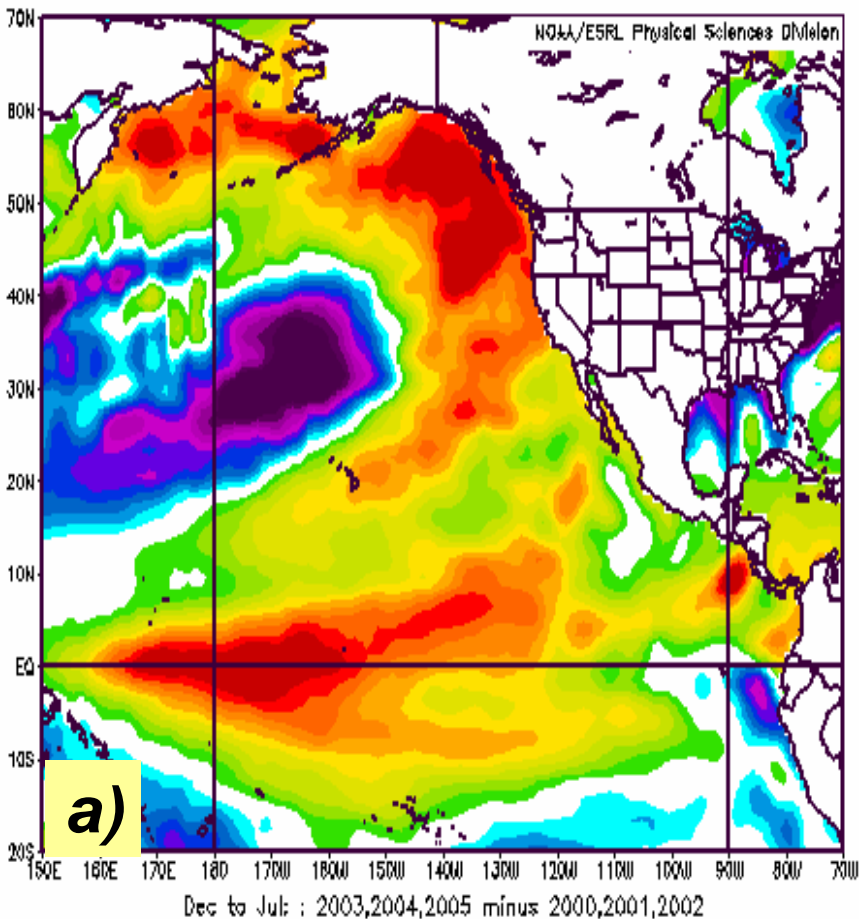
***Possible mechanism  
for amplification of the warm  
anomaly centered off Baja  
California during 1997-98 El  
Niño***



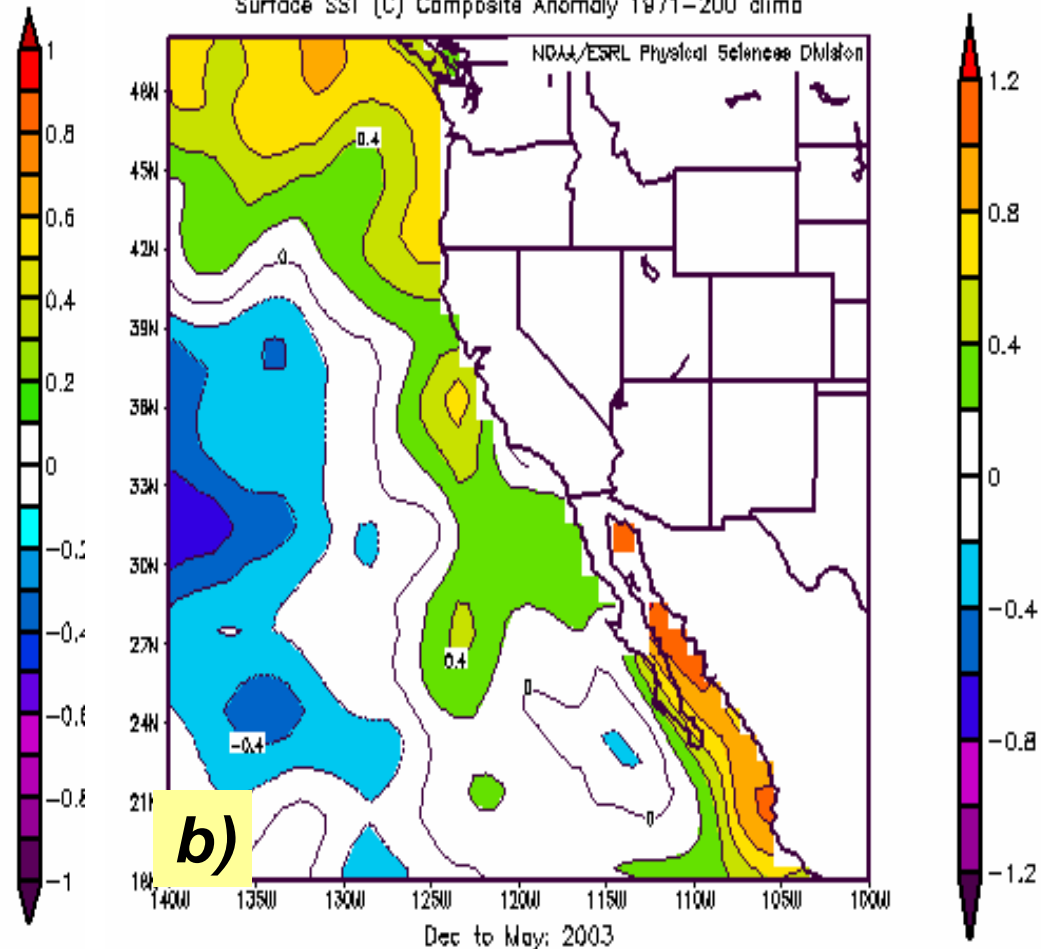
**a) Development of warm anomaly centered off Baja California (Aug-Dec. 1997) and**

**b) Process proposed by Durazo and Baumgartner (2002) to explain water mass distributions observed in Oct. 1997 and Jan. 1998: cool-fresh CC Water displaced by advection and convergence of offshore warm-salty StS Water towards coast.**





**Development of SST anomaly associated with prolonged warming from mid 2002 through 2005 (Dec-July 2003-2005 minus 2000-2002)**



**Development of SST anomaly in CCS region during El Niño period 2002-2003 (Dec-July)**

Changes in California Current during period of 2000-2005 were apparently dominated by shifts in regional wind field that led to large-scale relaxation of coastal upwelling between spring of 2002 and spring of 2003— leading to lowered salinity but generally warmer temperatures (opposite to what occurred during El Niño 1997-98)

LAS 6.5/Ferret 5.81 -- NOAA/PMEL

FERRET Ver. 5.81  
NOAA/PMEL TRIP  
Jan 28 2008 11:10:12

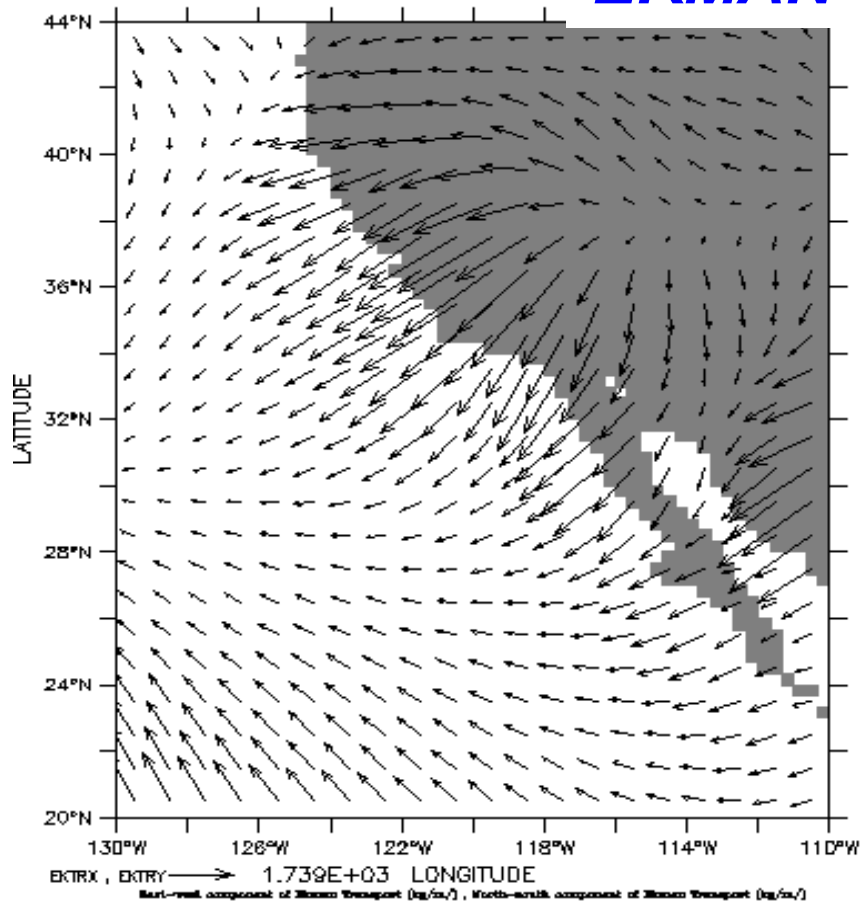
LAS 6.5/Ferret 5.81 -- NOAA/PMEL

FERRET Ver. 5.81  
NOAA/PMEL TRIP  
Jan 28 2008 11:10:12

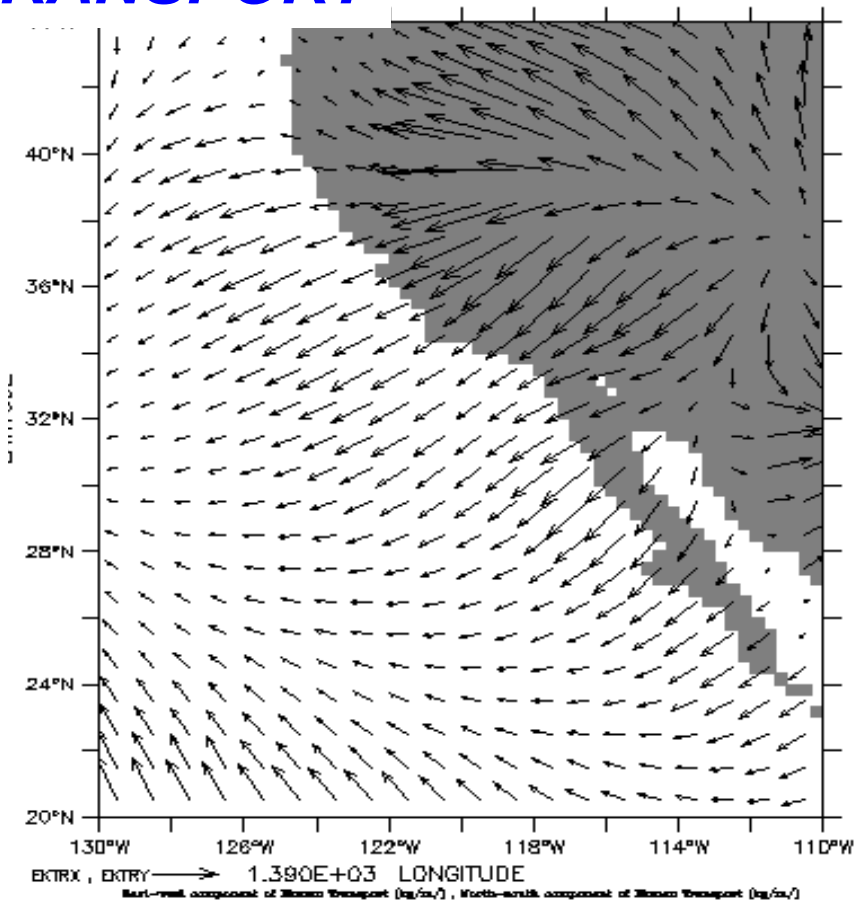
TIME : 17-APR-2001 00:00 DATA SET  
Transports from FNMOC 144x72

## EKMAN TRANSPORT

00:00 DATA SET: wind\_from\_pressure  
FNMOC 144x72 6-hr pressure



→ 1.739E+03

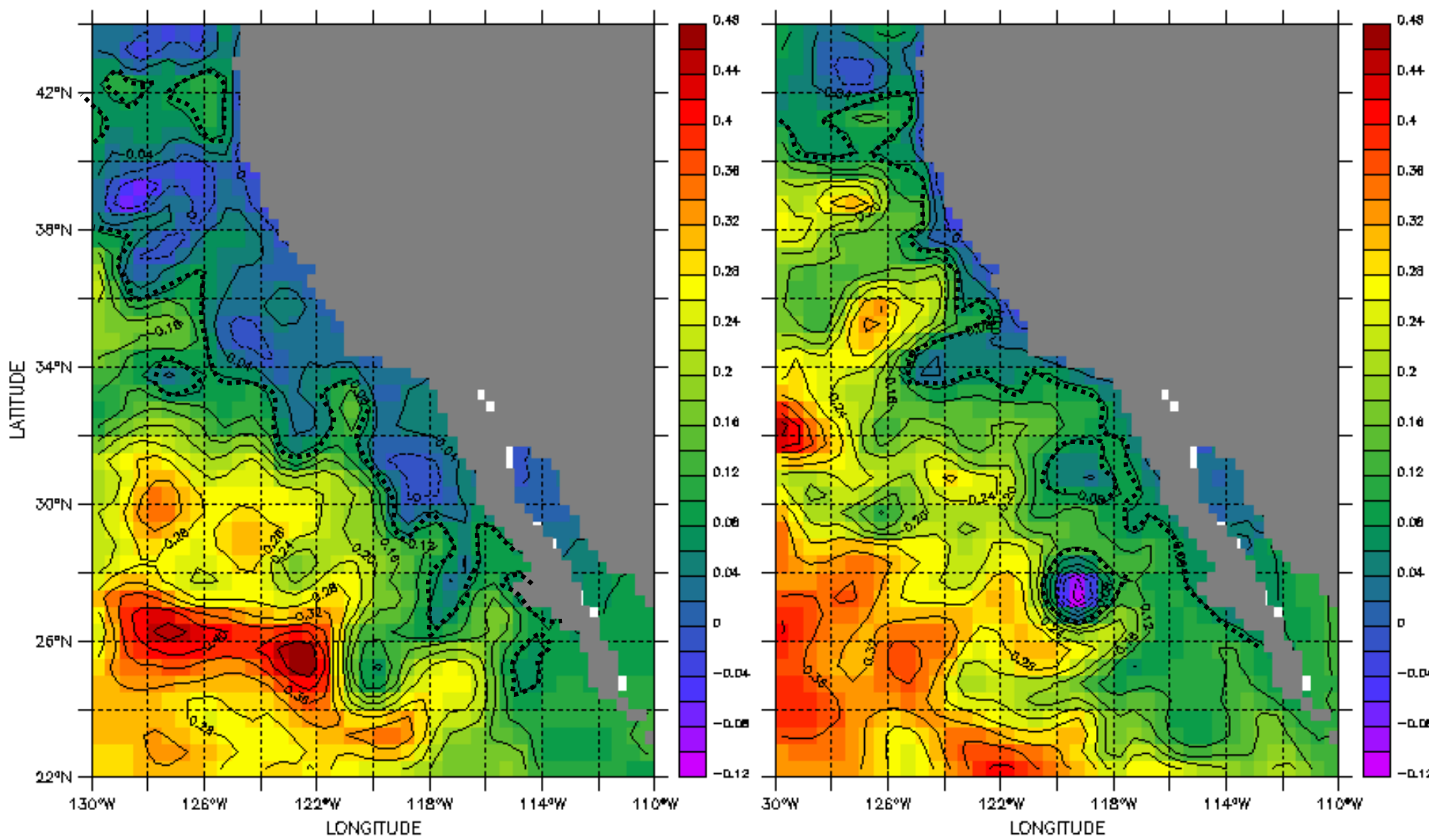


→ 1.390E+03

Courtesy NOAA PFEL Live Access Server

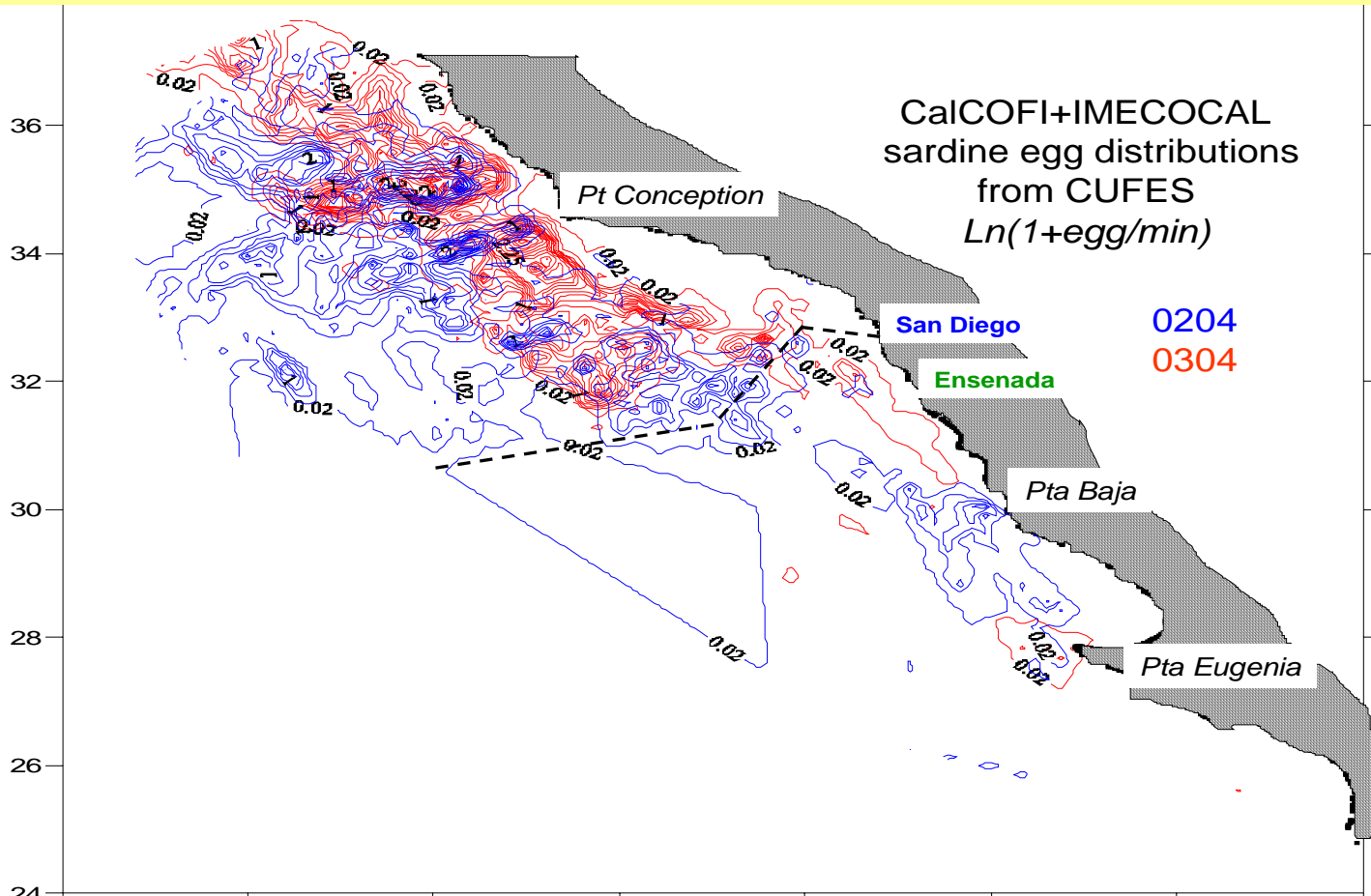
TIME : 15-APR-2001 00 DATA SET: soda\_pop2.0.2  
SODA-POP v2.0.2 monthly means

TIME : 15-APR-2004 00 DATA SET: soda\_pop2.0.3  
SODA-POP v2.0.3 monthly means

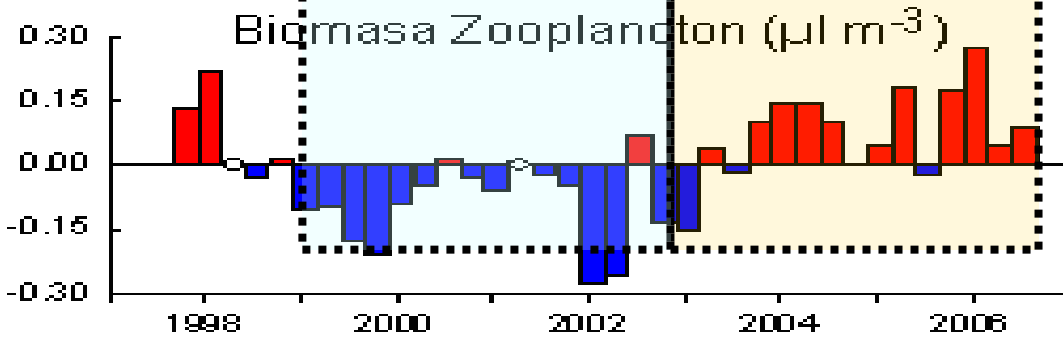
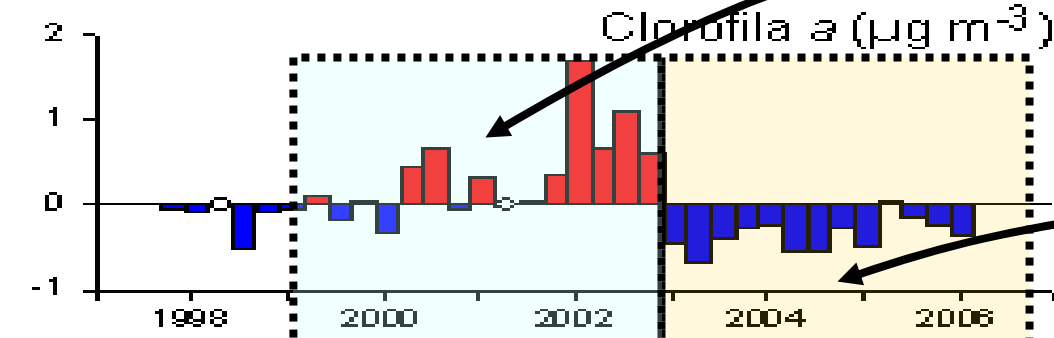
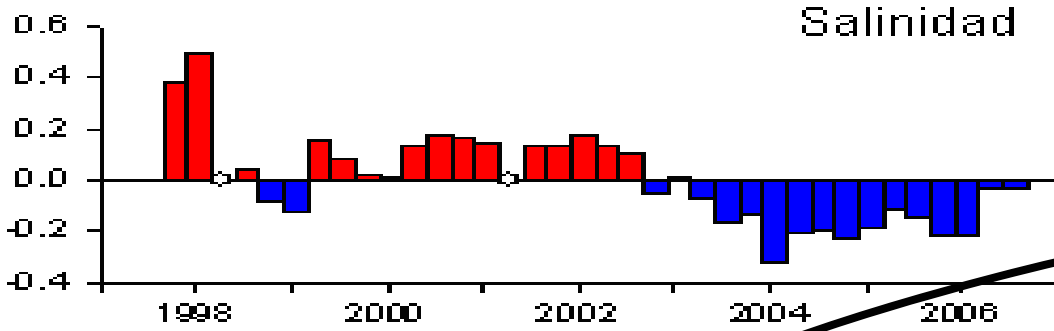
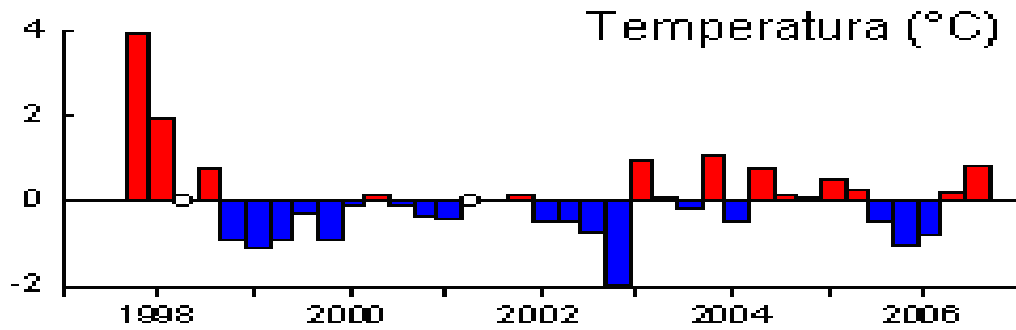


Sea Level (cm) Sea Level (cm)  
**Output of SODA Model, Sea Level Height (cm): April 2001 vs April 2004**  
Courtesy of PFEL Live Access Server

**Contrast in sardine egg distributions  
between April 2002 and April 2003  
from CalCOFI and IMECOAL surveys**



**Consistent with major shift in offshore Ekman transport  
and weakened geostrophic flow of California Current  
between April 2002 and April 2003**



Our concept of change in ecosystem organization/structure as a response to:

Strong regional upwelling and offshore Ekman Transport

Relaxation of upwelling and offshore Ekman transport

May be determined by our sampling tools...