



***Dynamics and variability
of pelagic fish populations and
environmental influences***

Marzo 12, 2008

Miguel Ñiquen Carranza
IMARPE

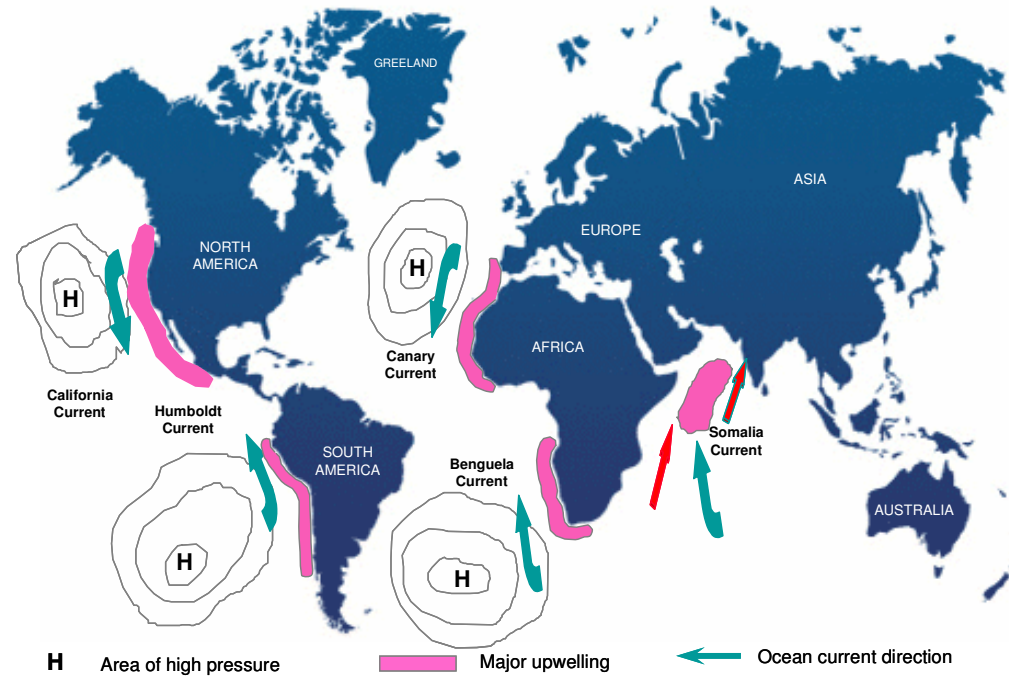
Outline

- Small pelagic & Main upwelling areas
- Spatial and temporal scales
- Impact of El Niño events on pelagic
- Highlight proposals: Physical and biological process
- Long-Term trends: implications for management
- Practical approach of environmental influences

Small pelagic and main upwelling areas

- Small pelagic fish account for about one third of the world catches
- They live on main upwelling areas of the world
- They are highly sensitive to environmental forcing and extremely variable in their abundance.

CHARACTERISTIC OF THE MAIN UPWELLING AREAS



HIGH PRODUCTION OF
FIRST TROPHIC LEVEL

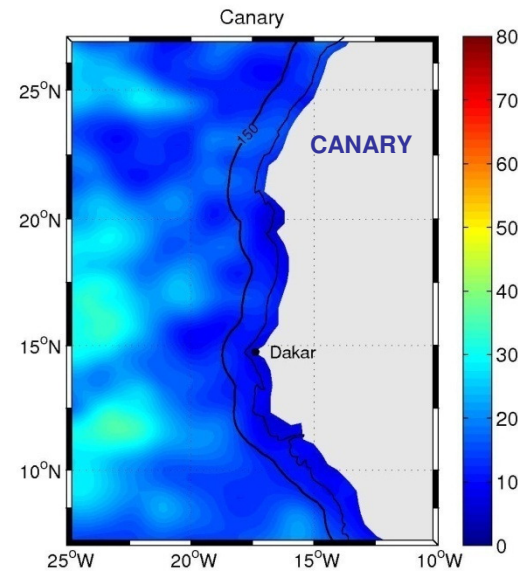
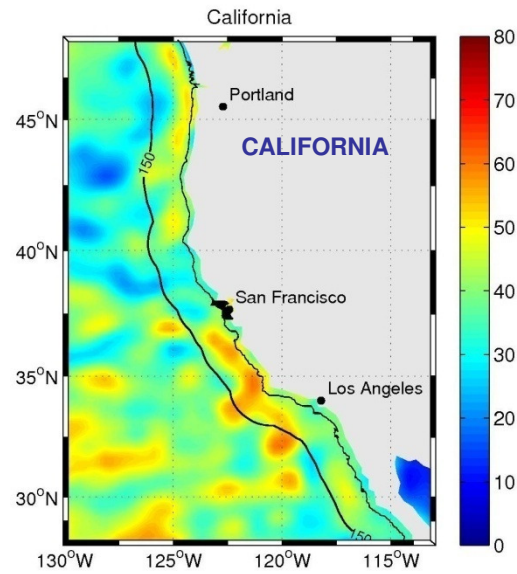
PHYTOPLANKTON PRODUCTION (mgm ⁻³)	HUMBOLDT	BENGUELA	CALIFORNIA	CANARY
	3 - 10	1 - 5	0.1 - 04	1 - 3

SIMILAR PELAGIC
FISH DYNAMIC

	ANCHOVY	PILCHARD	JACK MACKEREL	CHUB MACKEREL
HUMBOLDT	<i>Engraulis ringens</i>	<i>Sardinops sagax</i>	<i>Trachurus murphyi</i>	<i>Scomber japonicus</i>
CALIFORNIA	<i>E. mordax</i>	<i>S. sagax</i>	<i>T. Symmetricus</i>	<i>S. japonicus</i>
BENGUELA	<i>E. capensis</i>	<i>S. ocellatus</i>	<i>T. trachurus</i>	<i>S. japonicus</i>
CANARY	<i>E. Encrasicolus</i>	<i>Sardina pilchardus</i>	<i>T. trachurus</i>	<i>S. japonicus</i>

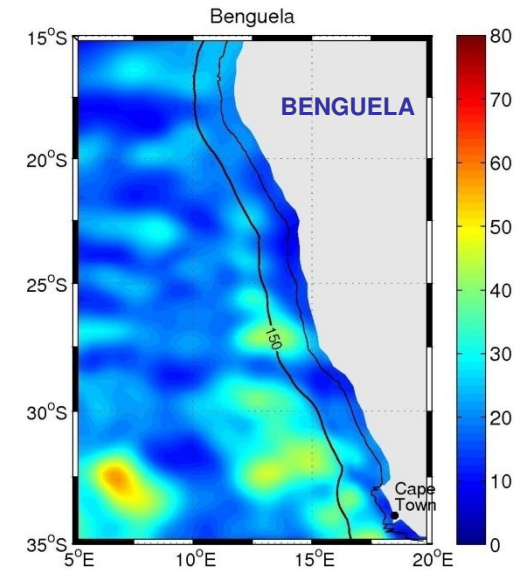
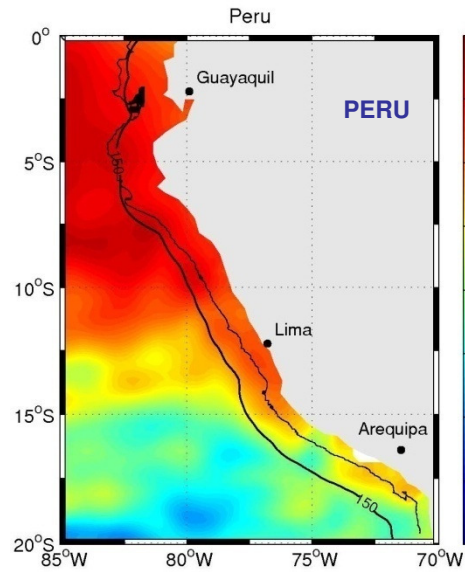
HOW DO UPWELLING SYSTEMS COMPARE IN TERMS OF VARIABILITY?

Some of each



Seasonal

Interannual

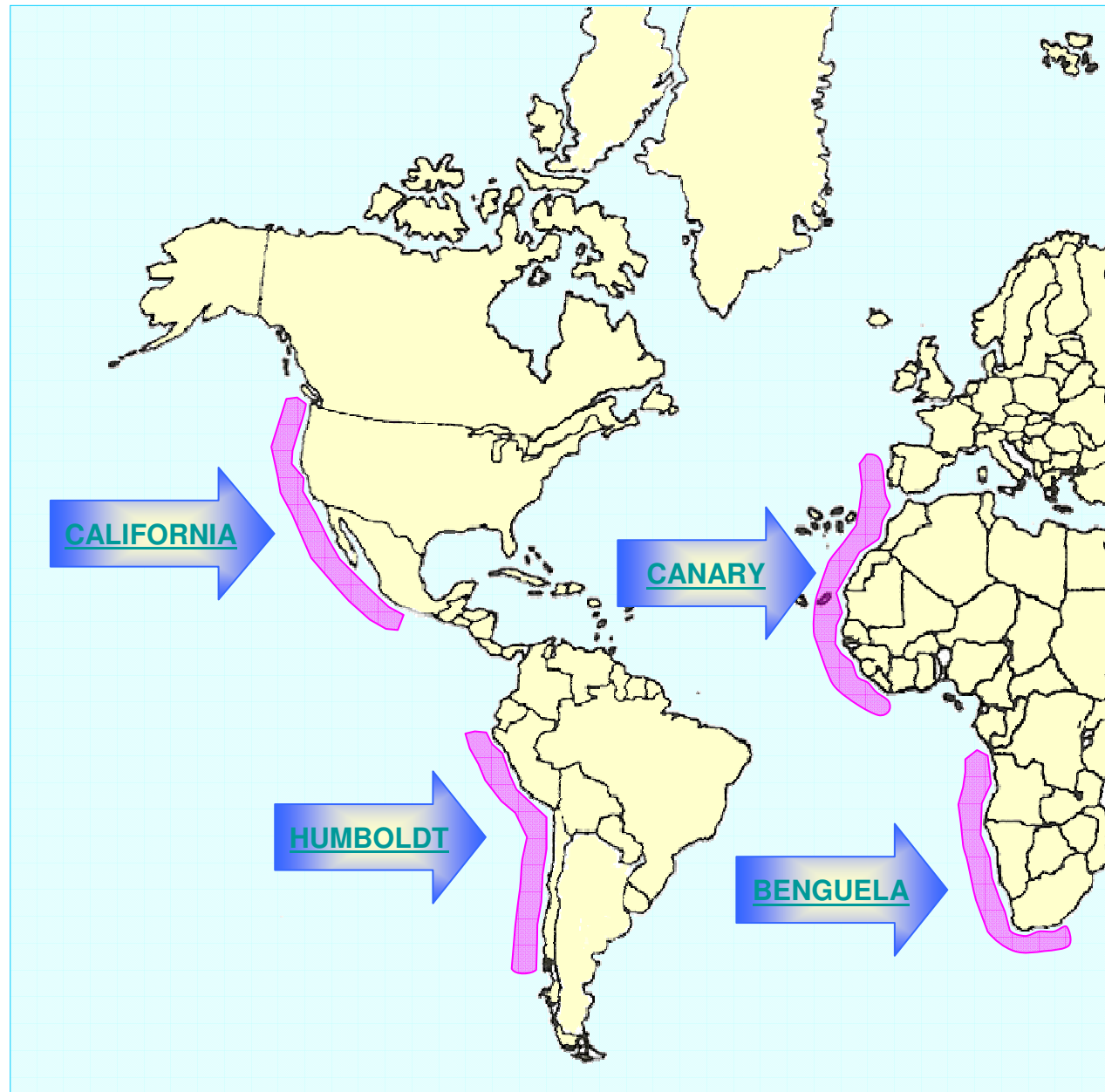


Intraseasonal

Pacific more variable interannually

Atlantic less variable interannually

MAIN UPWELLING AREAS OF THE WORLD'S OCEAN



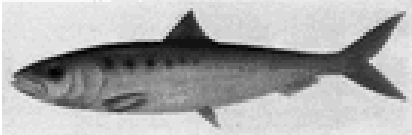
CALIFORNIA CURRENT



Main pelagic resource



Engraulis mordax



Sardinops sagax caerulea

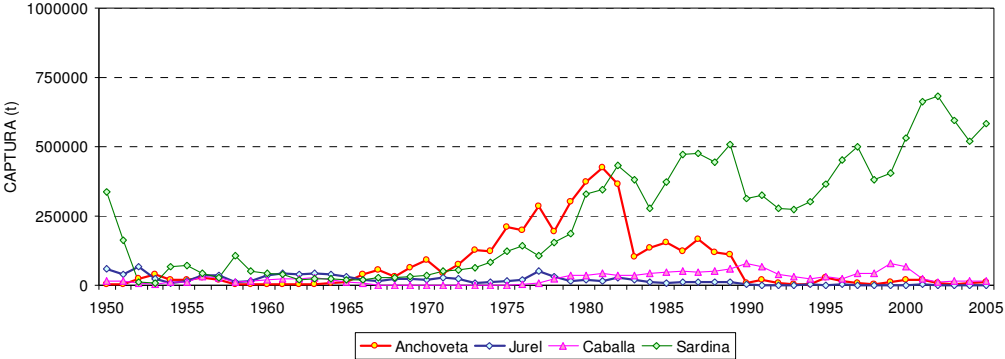


Trachurus symmetricus



Scomber japonicus

Catch (tonnes)



CANARY CURRENT

Main pelagic resource



Engraulis encrasicolus



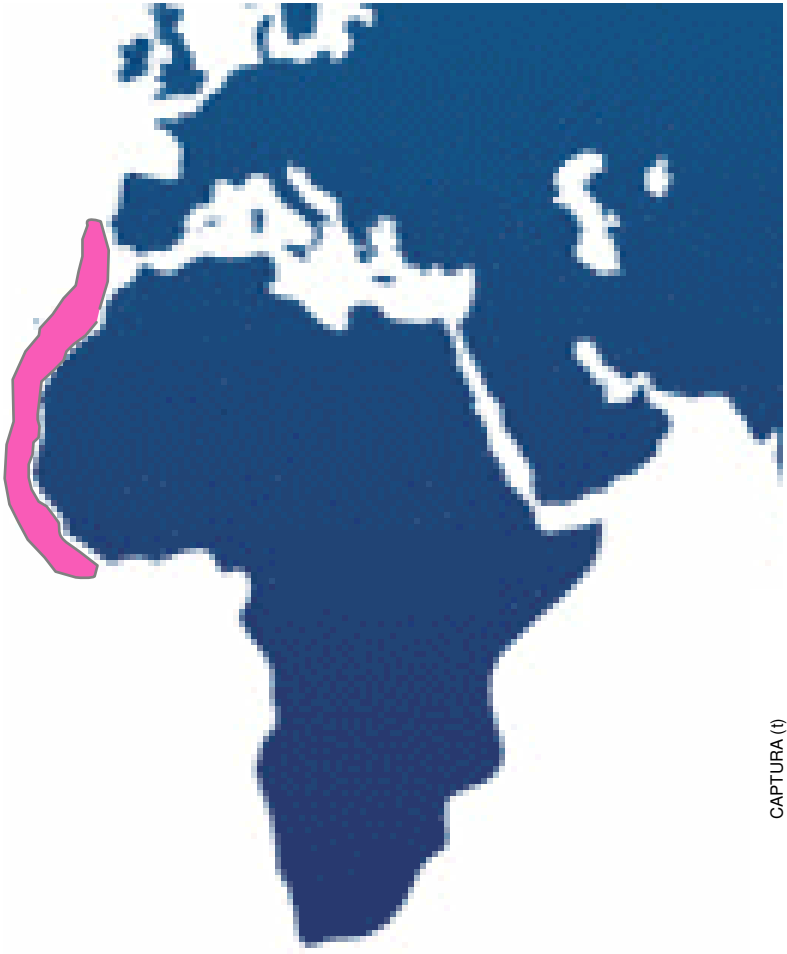
Sardina pilchardus



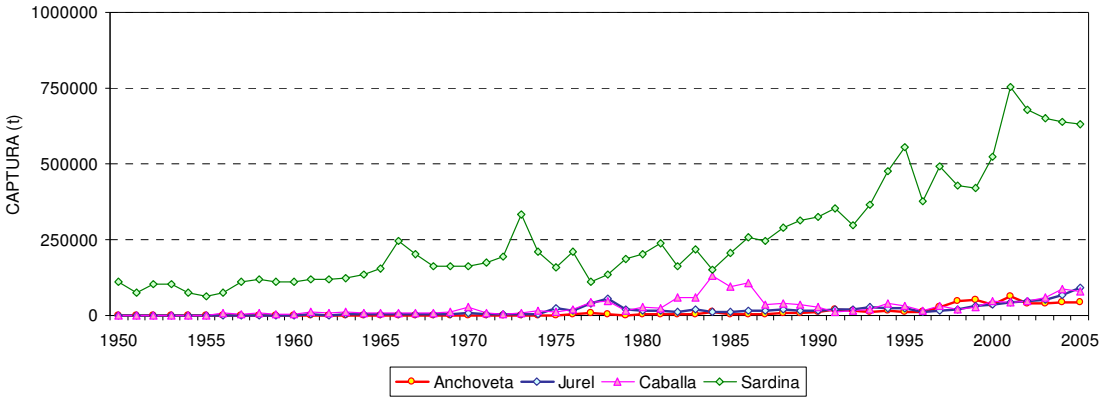
Trachurus trachurus



Scomber japonicus



Catch (tonnes)



BENGUELA CURRENT



Main pelagic resource



Engraulis capensis



Trachurus trachurus

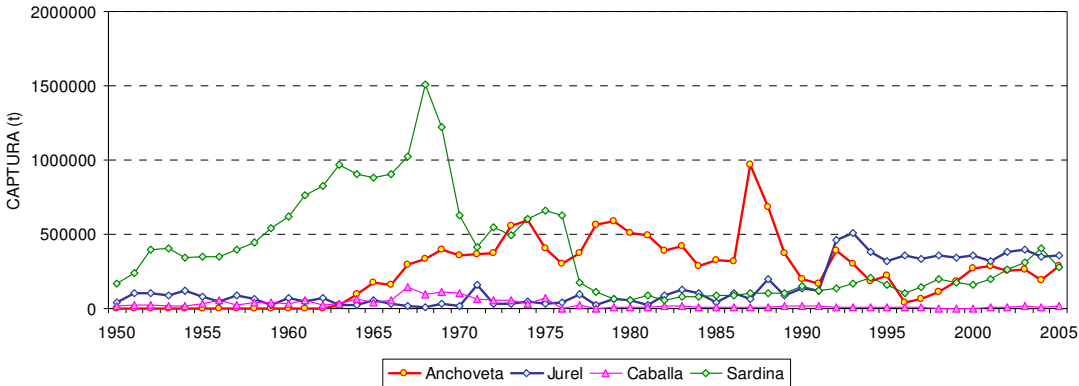


Sardinops ocellatus



Scomber japonicus

Catch (tonnes)



HUMBOLDT CURRENT

Main pelagic resource



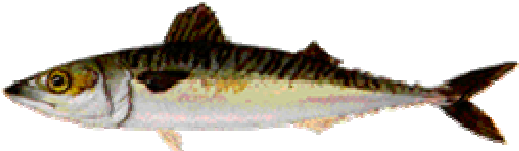
Engraulis ringens



Sardinops sagax sagax



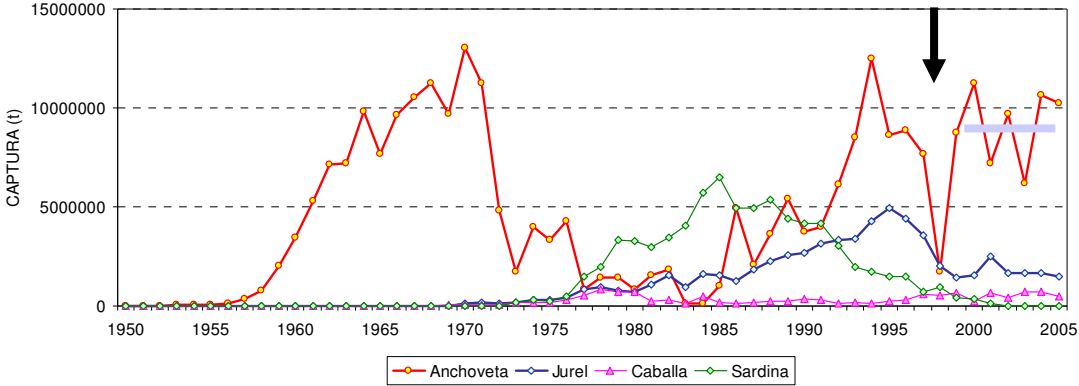
Trachurus murphyi



Scomber japonicus

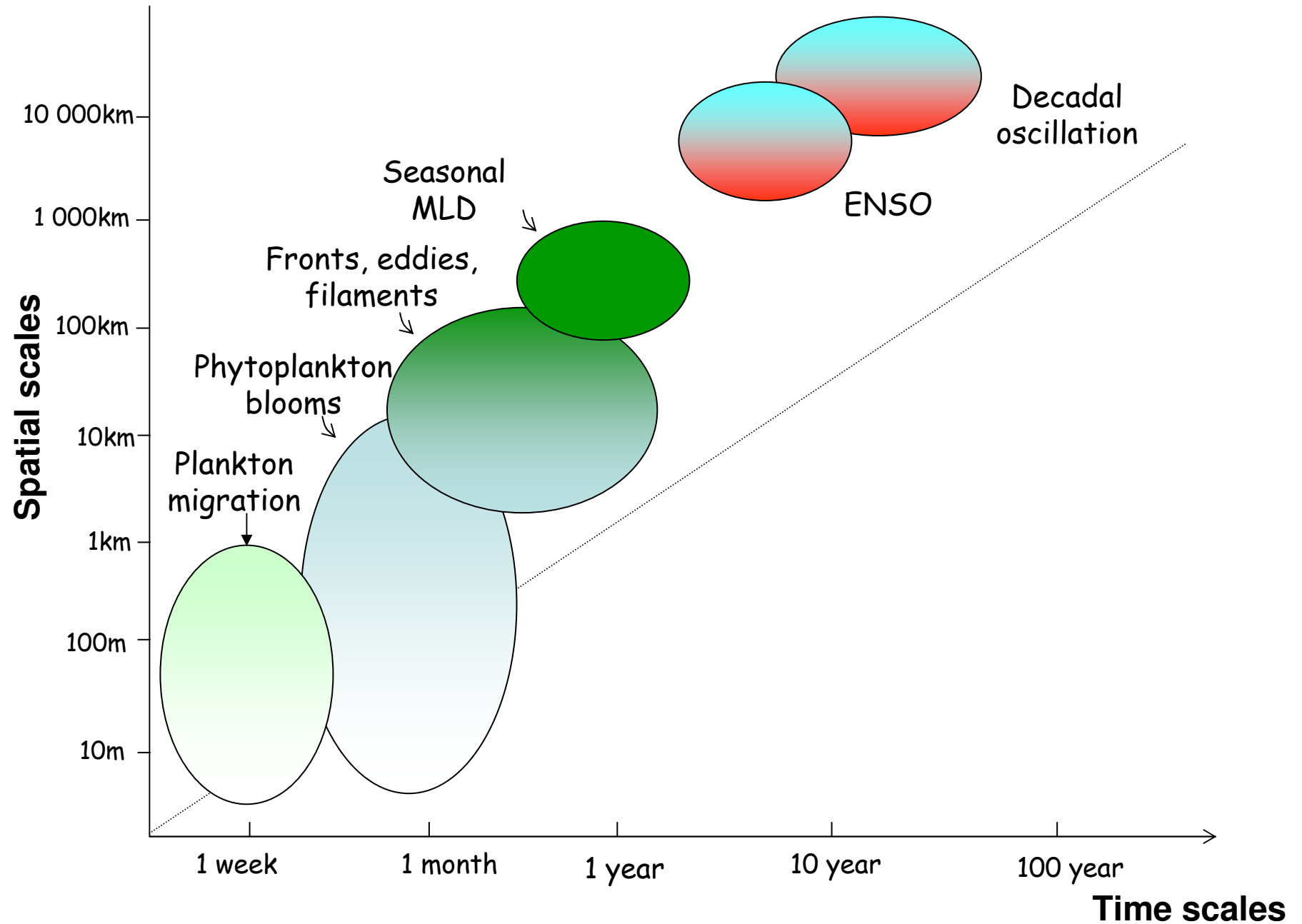


Catch (tonnes)

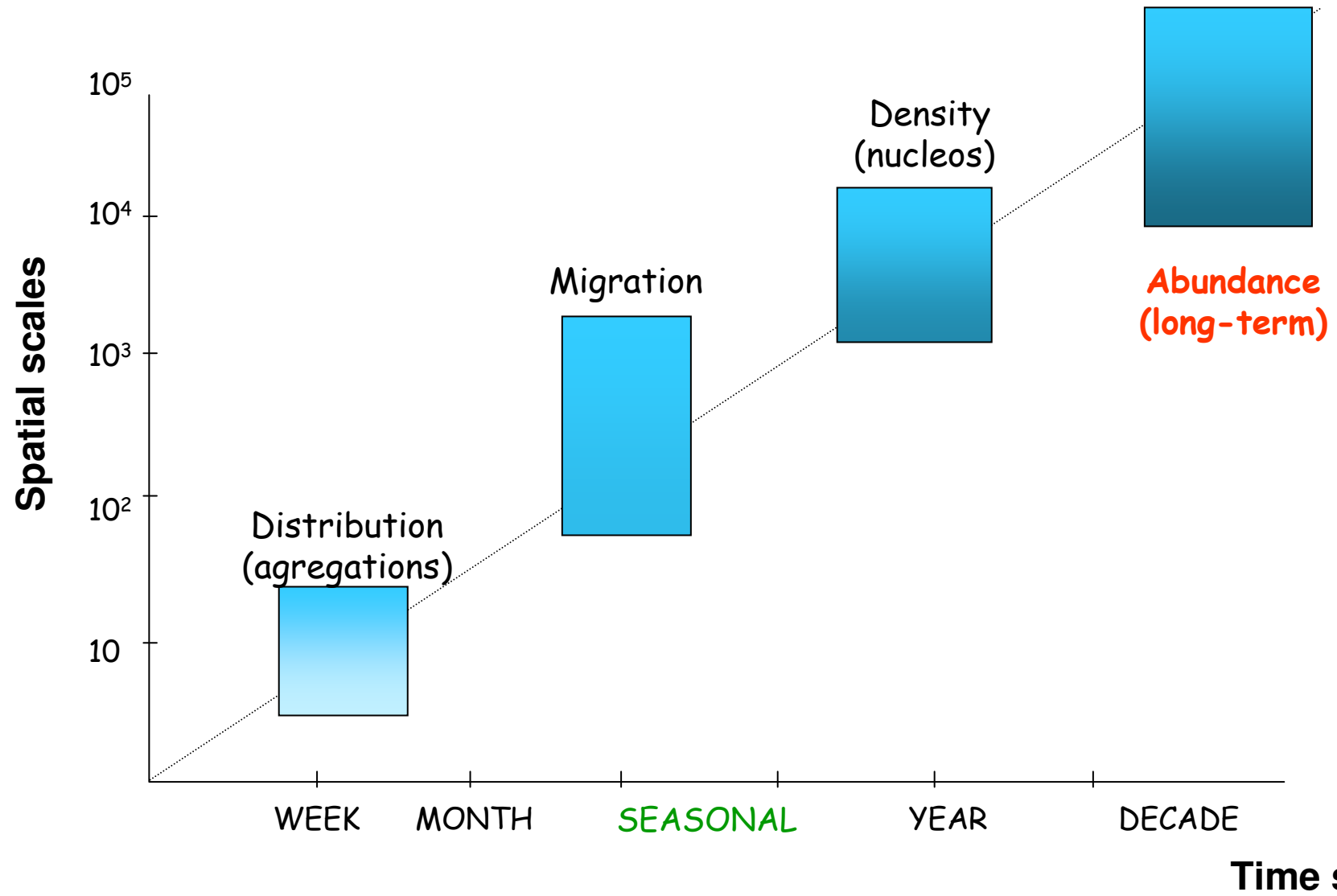


Spatial and temporal scales

SPATIAL AND TEMPORAL SCALES IN THE ENVIRONMENTAL PROCESS



SPATIAL AND TEMPORAL SCALES IN THE RESOURCES



(Kawasaki, 1989)

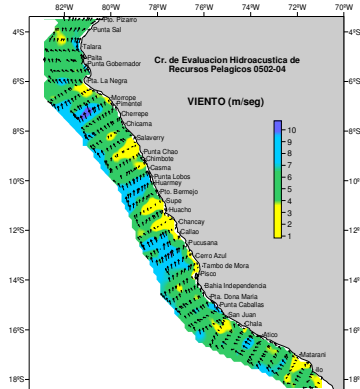
EFFECTS OF THE ENVIRONMENTAL PROCESS IN THE FISHERY RESOURCES

VARIABLE

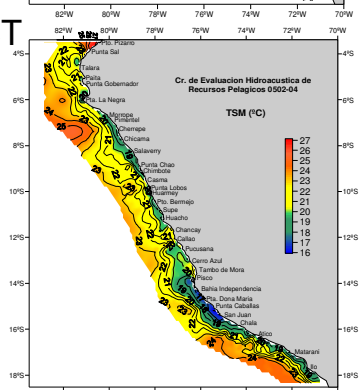
BIOLOGICAL PROCESS

EFFECTS

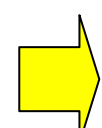
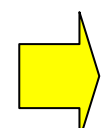
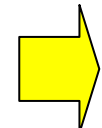
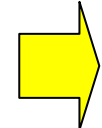
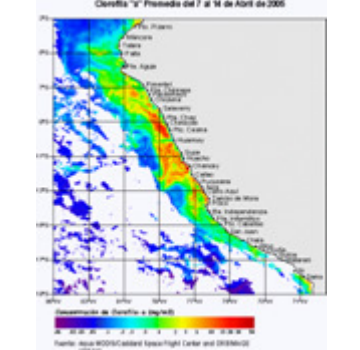
Wind



SST



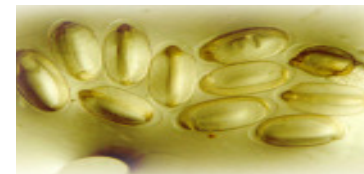
Chl-a



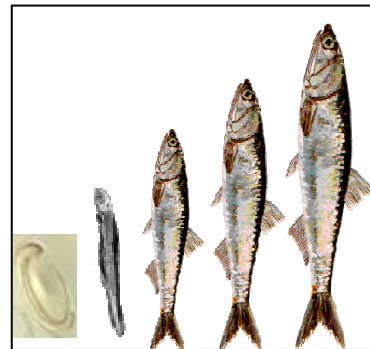
Fecundity:



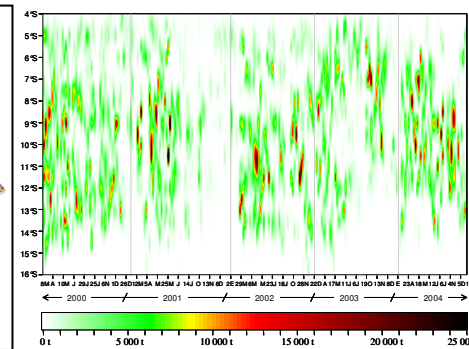
Natural Mortality (M):



Growth:



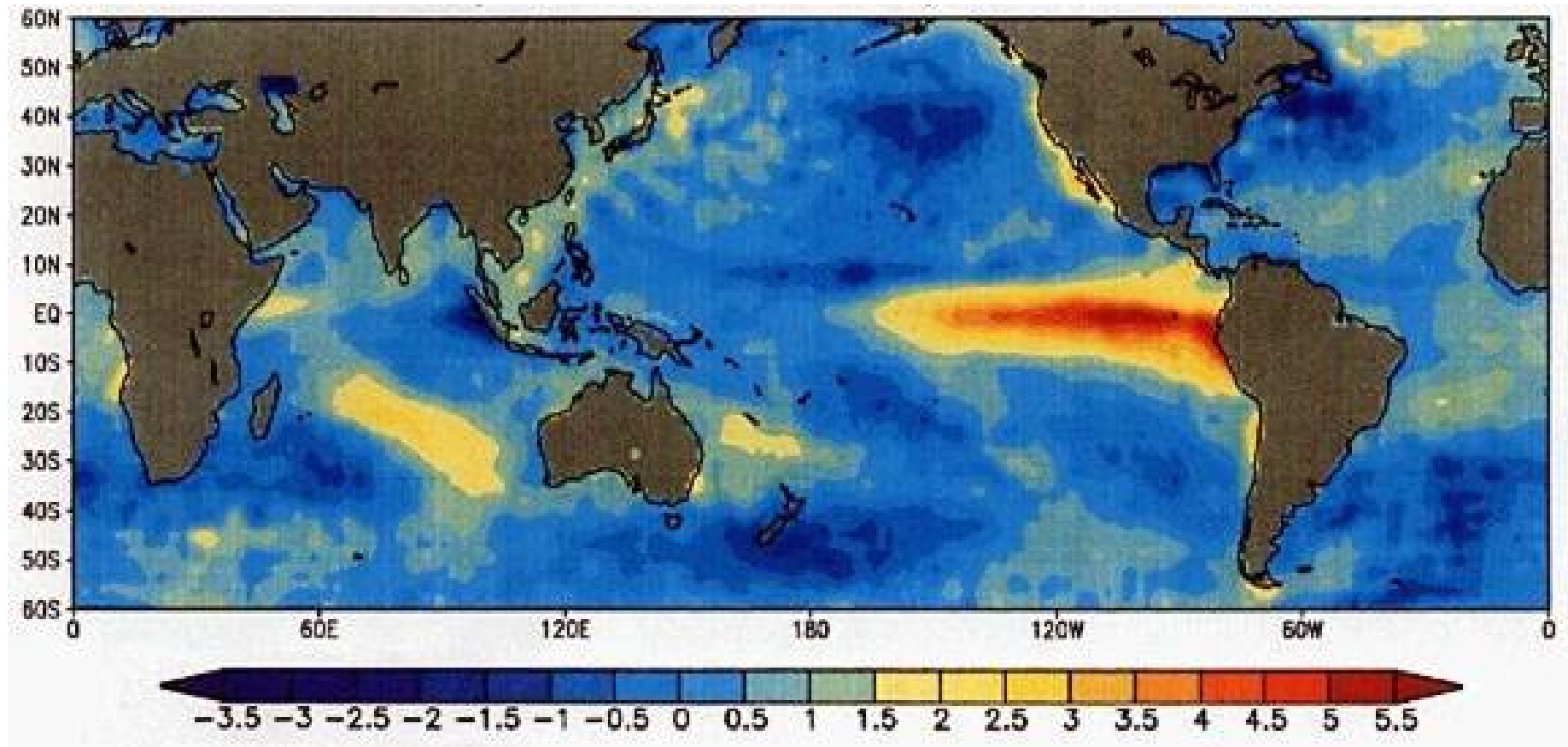
Distribution:



ABUNDANCE
CATCHABILITY

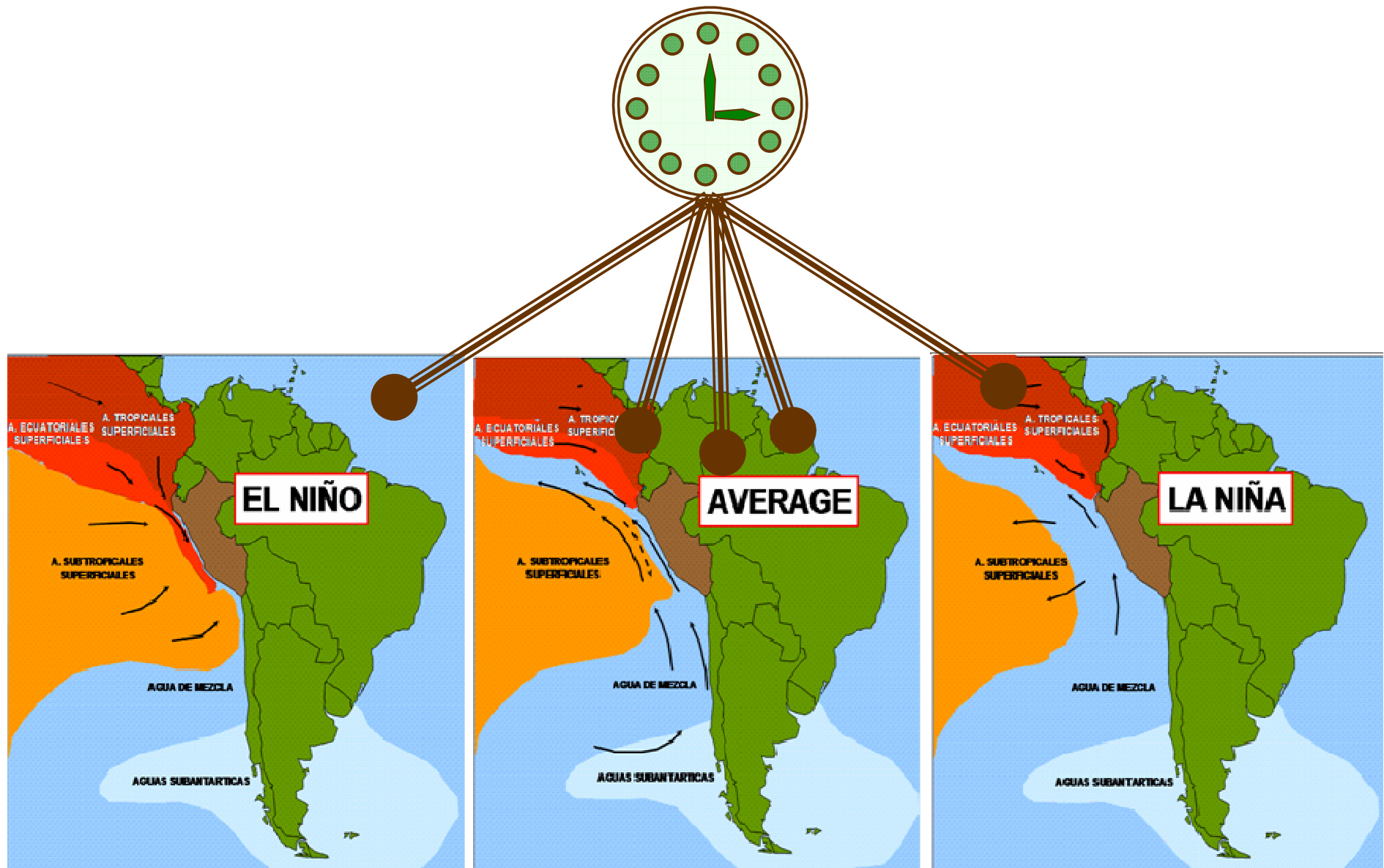
**Impact of
El Niño event on
pelagic resources**

IMPACT OF THE NIÑO IN THE HUMBOLDT CURRENT

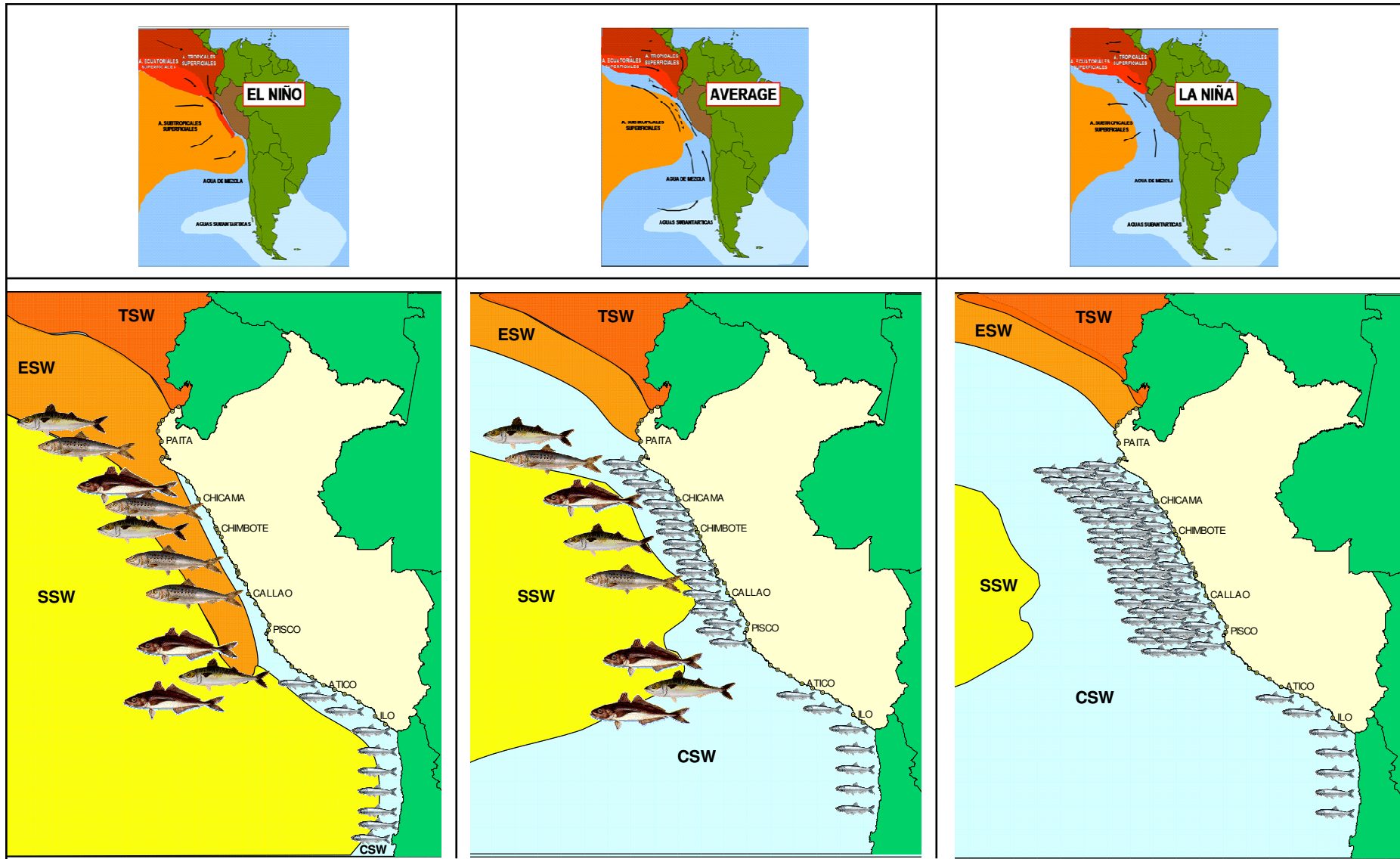


INTERANNUAL VARIABILITY OF THE PERUVIAN SEA: EL NIÑO SOUTHERN OSCILLATION

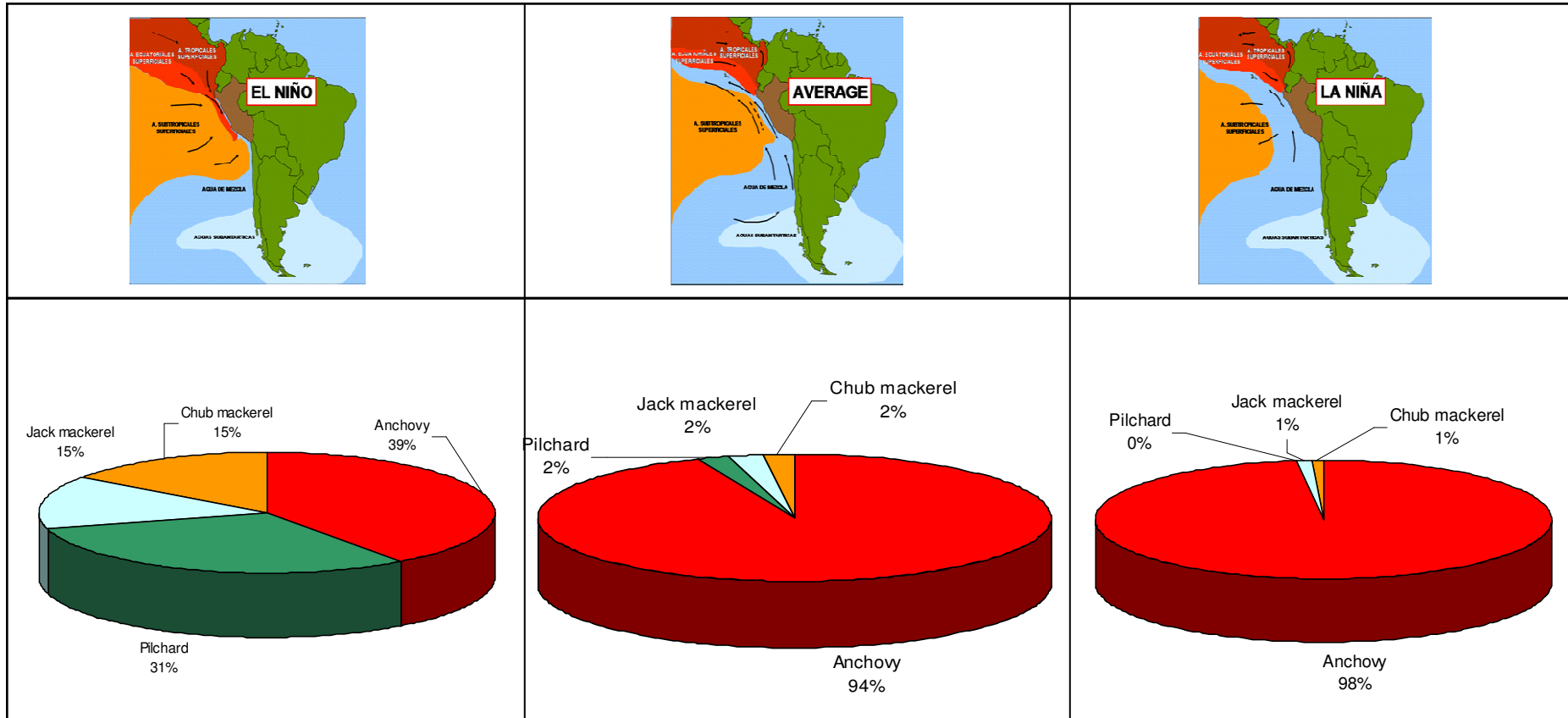
WORKING AS A PENDULUM CLOCK



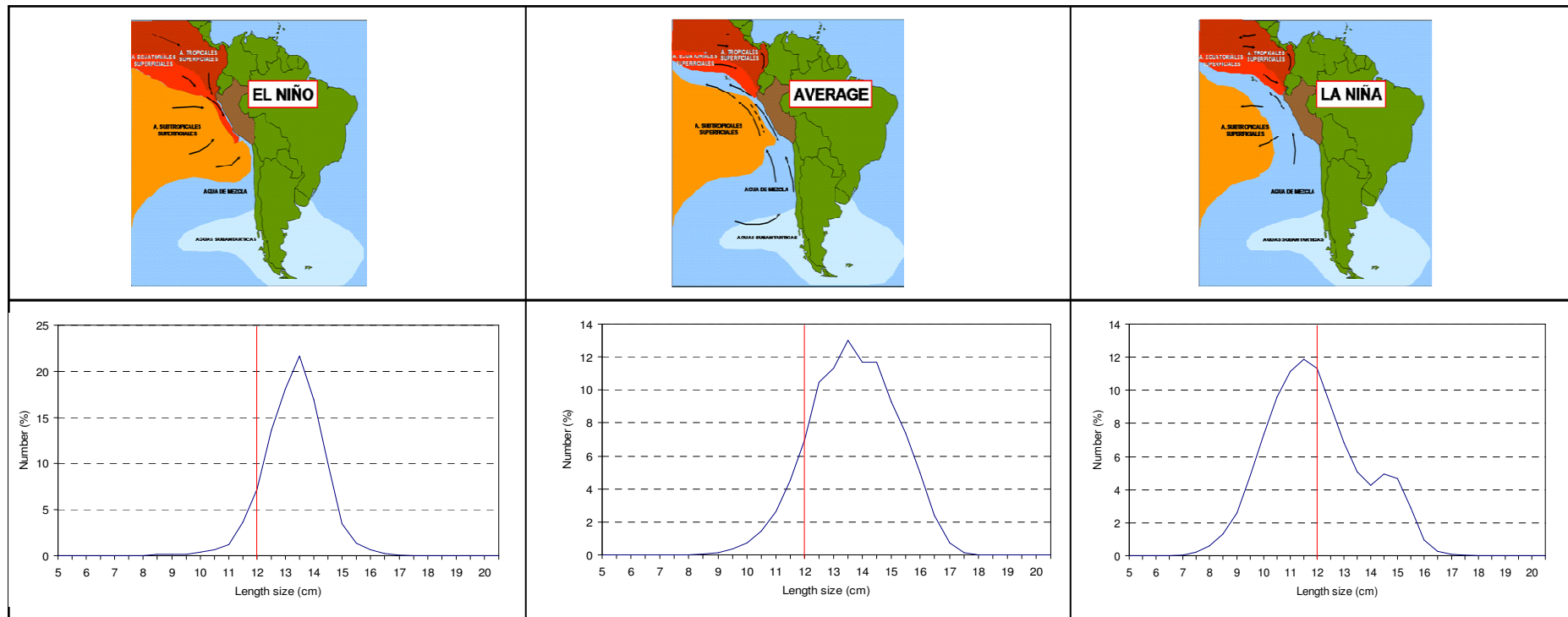
DISTRIBUTION OF THE MAIN PELAGIC RESOURCES



AVERAGE CATCH COMPOSITION IN PERUVIAN LANDINGS



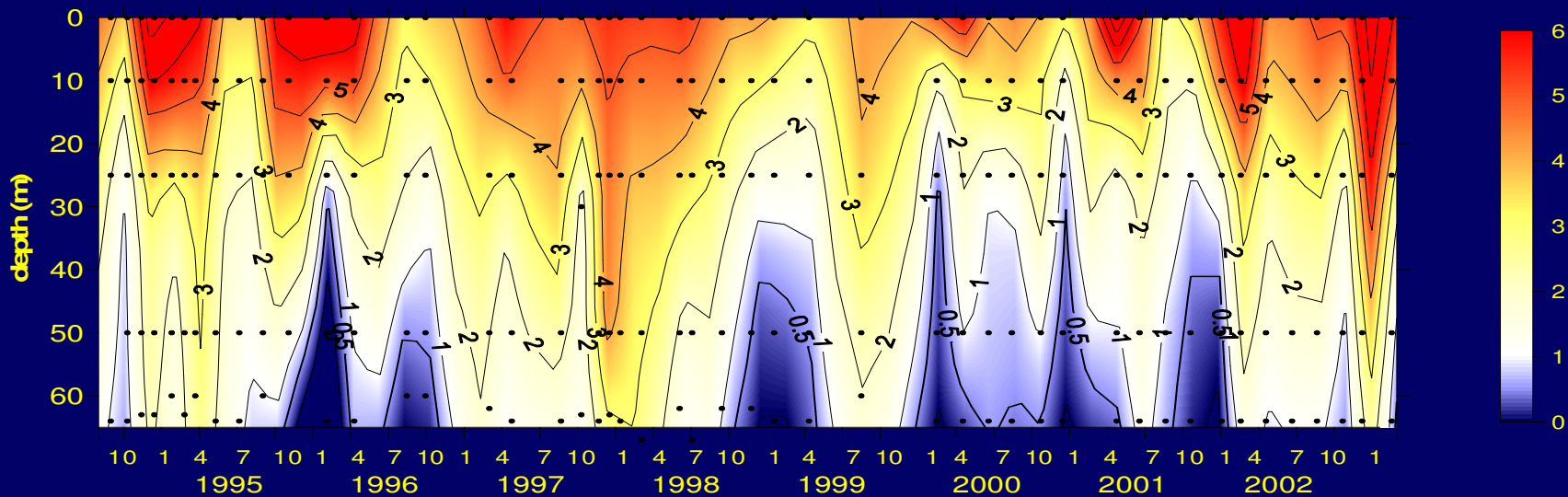
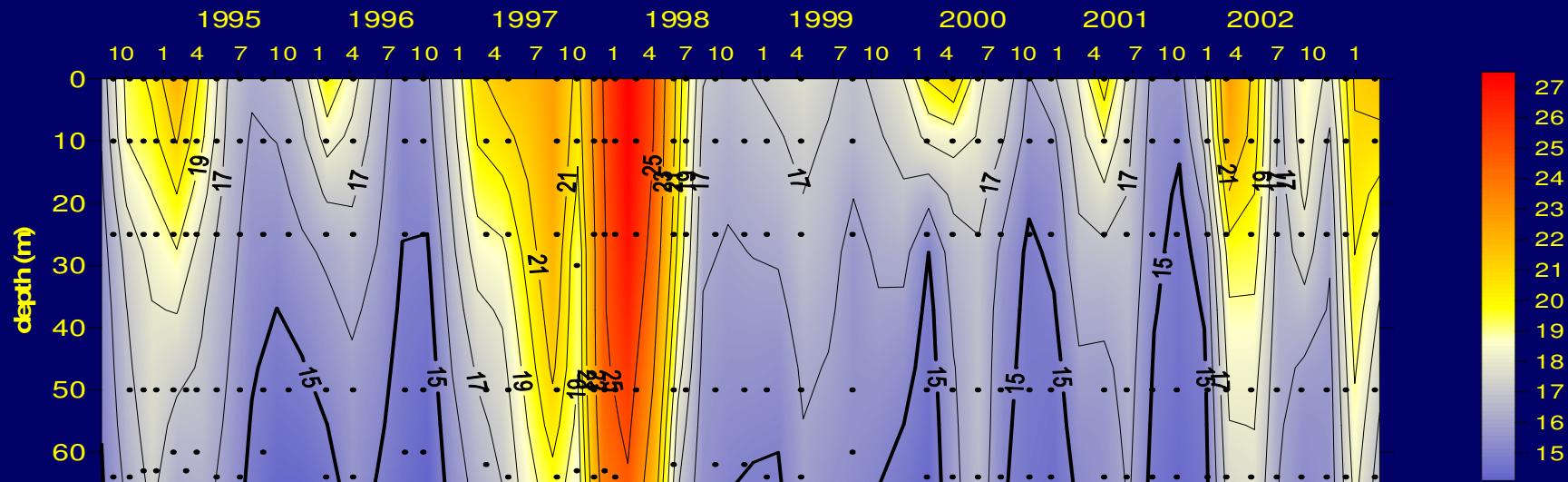
ANCHOVY LENGTH COMPOSITION IN PERUVIAN LANDINGS



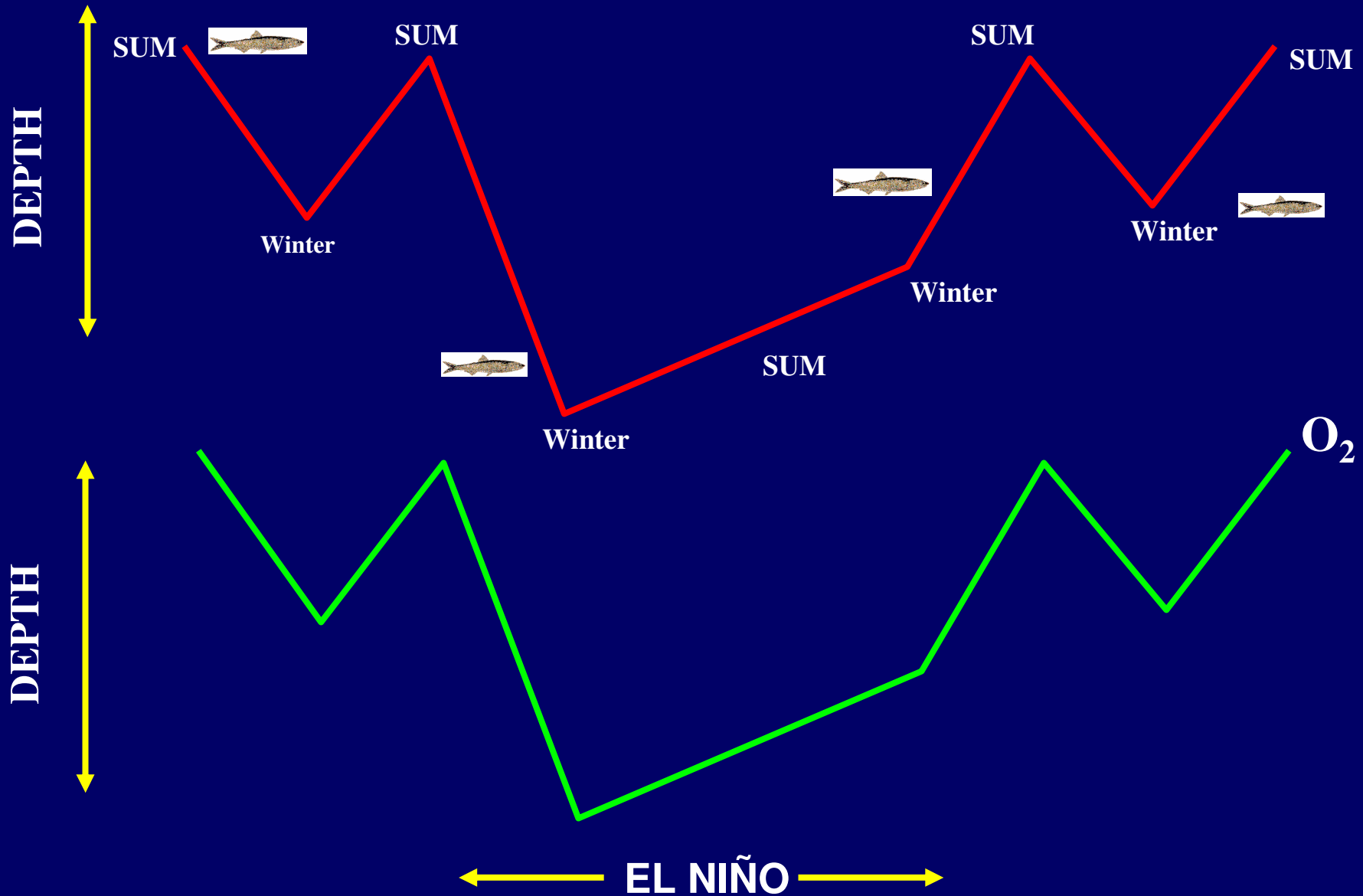
Low
recruitment

High
recruitment

SEASONALITY OF MINIMUM OXYGEN ZONE DEPTH AT 5° AND 8° S



CONCEPTUAL MODEL OF THE SINCHRONICITY BETWEEN ANCHOVETA AND MOZ DEPTH

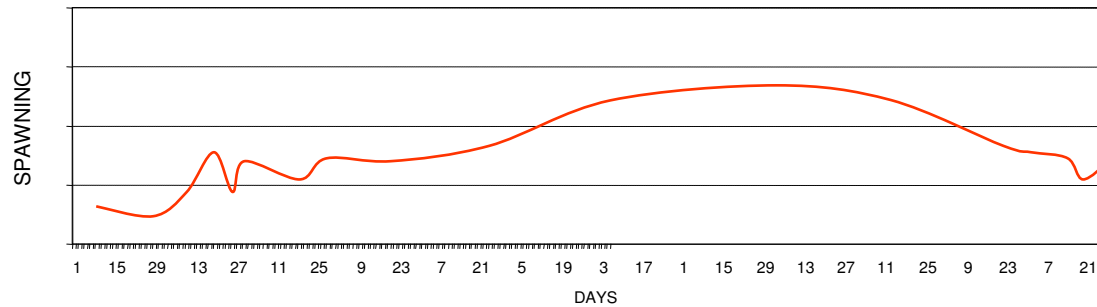
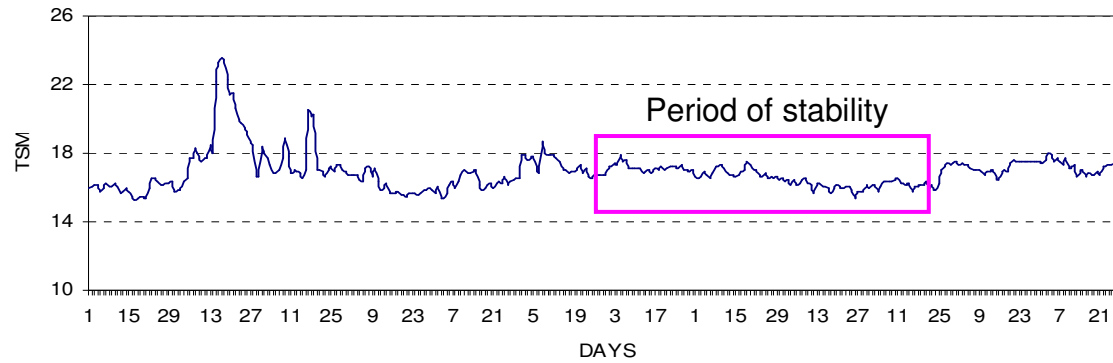
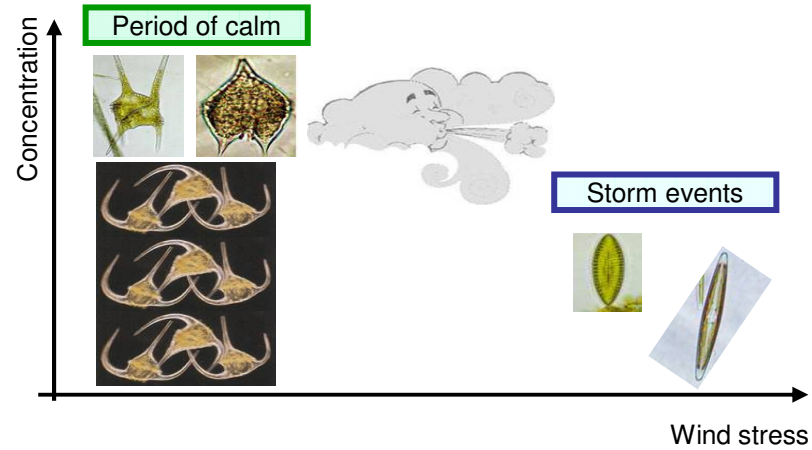


Highligh proposals:

Physical and biological process

HIGHLIGHT PROPOSAL: PHYSICAL AND BIOLOGICAL PROCESS

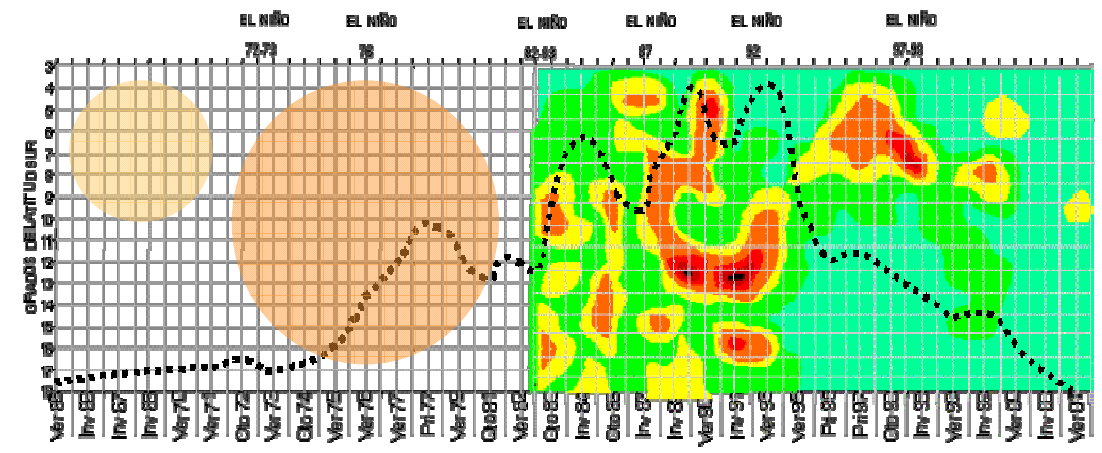
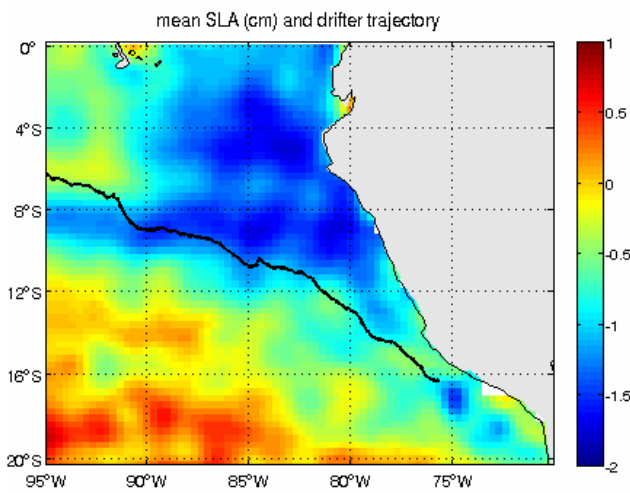
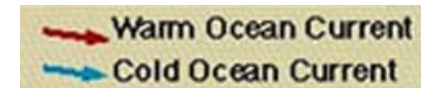
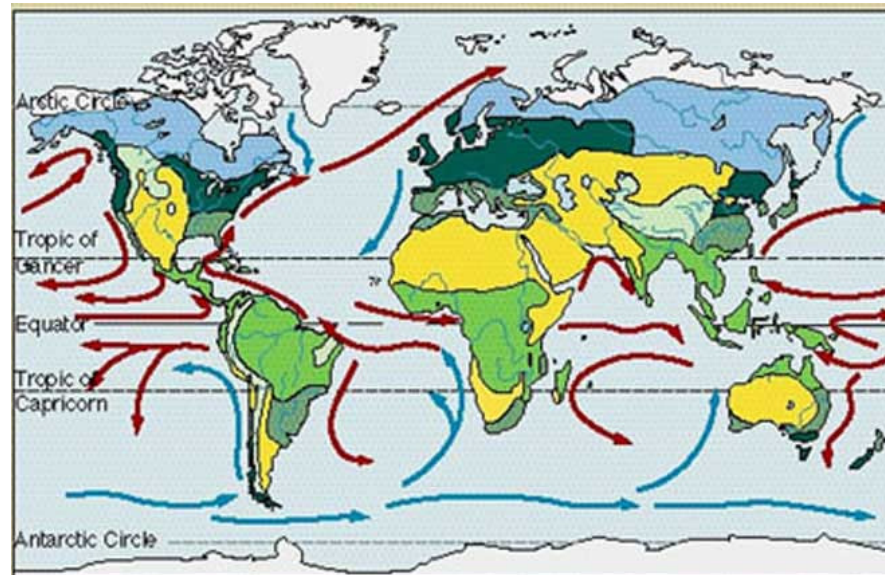
LASKER "STABLE OCEAN" HYPOTHESIS



Biological weight

HIGHLIGHT PROPOSAL: PHYSICAL AND BIOLOGICAL PROCESS

MACCALL "FLOW-BASED" HYPOTHESIS



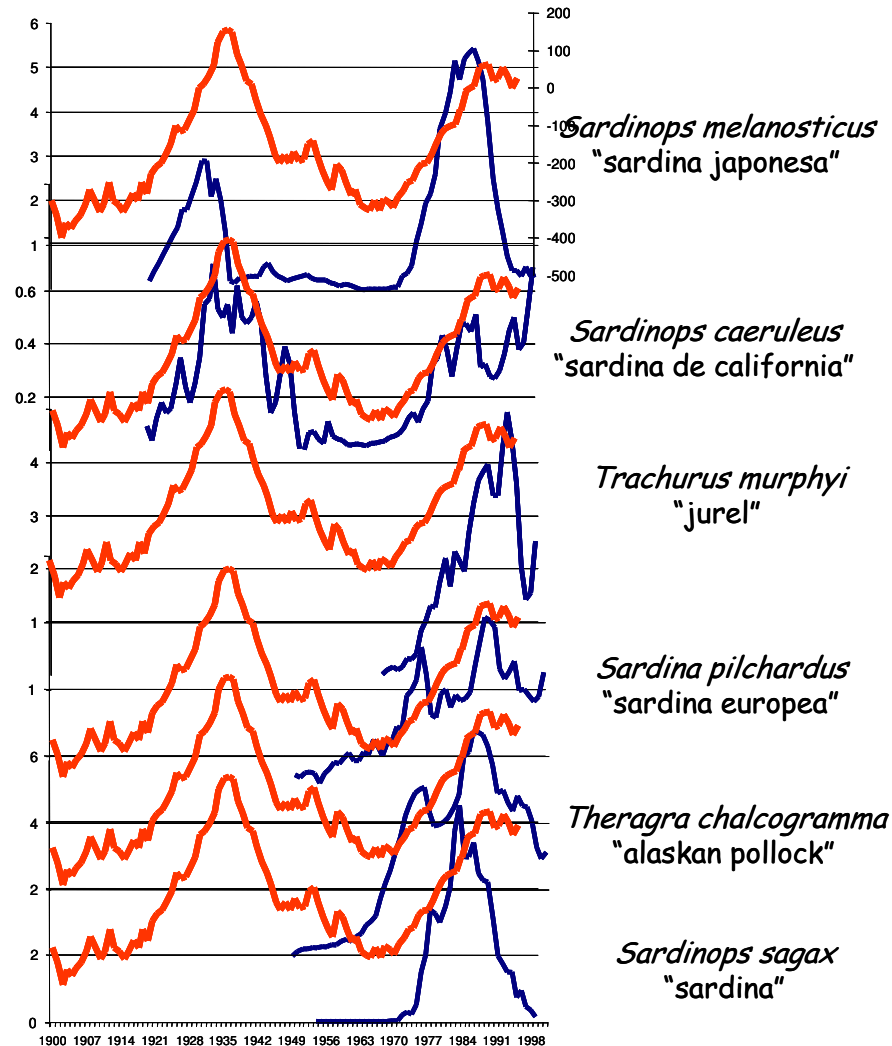
SARDINE distribution with time and latitude

HIGHLIGHT PROPOSAL: PHYSICAL AND BIOLOGICAL PROCESS

KLYASHTORIN "CLIMATE CHANGE AND LONG-TERM FLUCTUATIONS"

Atmospheric Circulation Index (ACI).- based on dominance of zonal and meridional winds

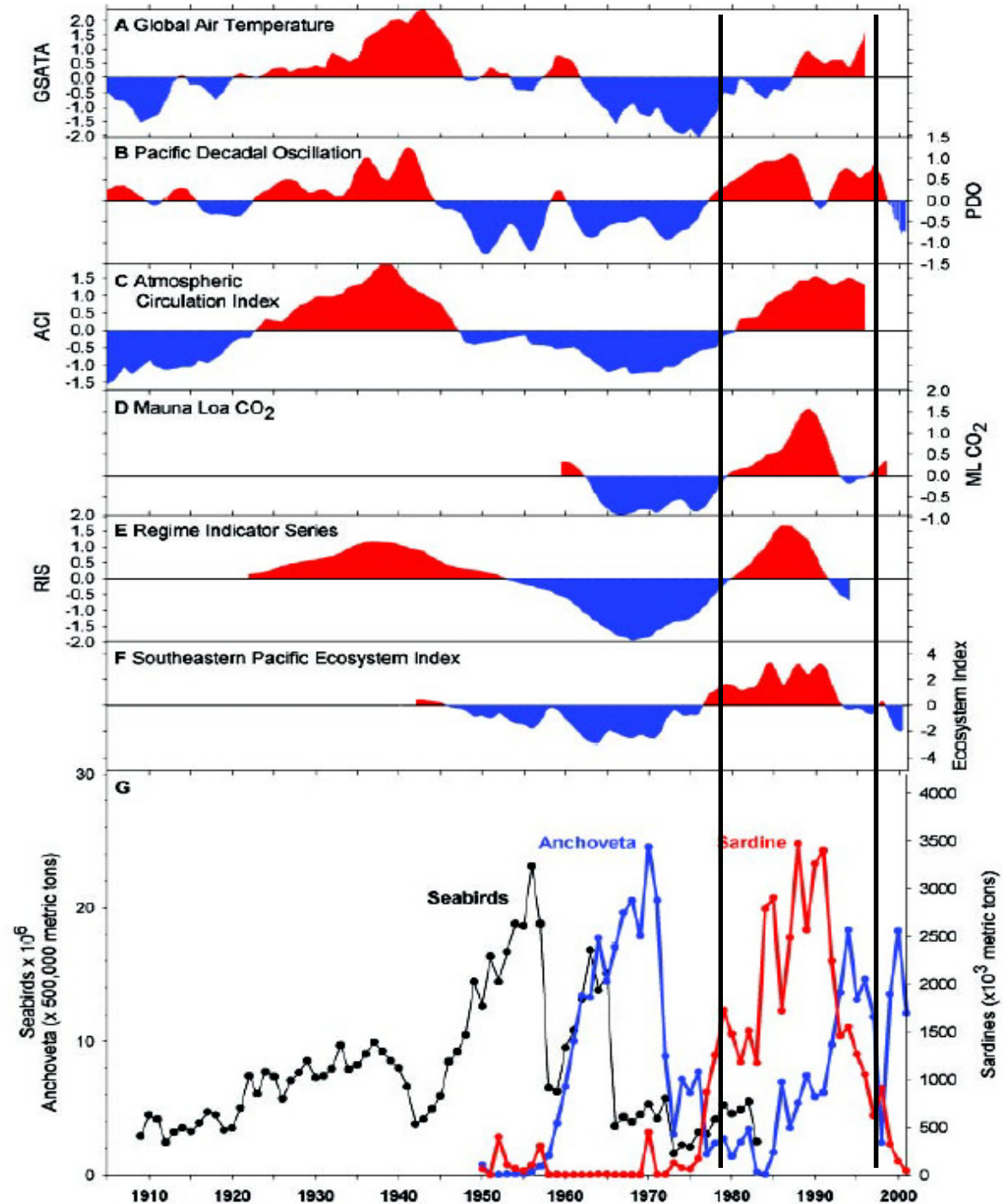
**Correlación entre
el índice global de
circulación
atmosférica (ACI)
y las capturas de
Las principales
especies
comerciales**



Long-Term trends:

Implications for management

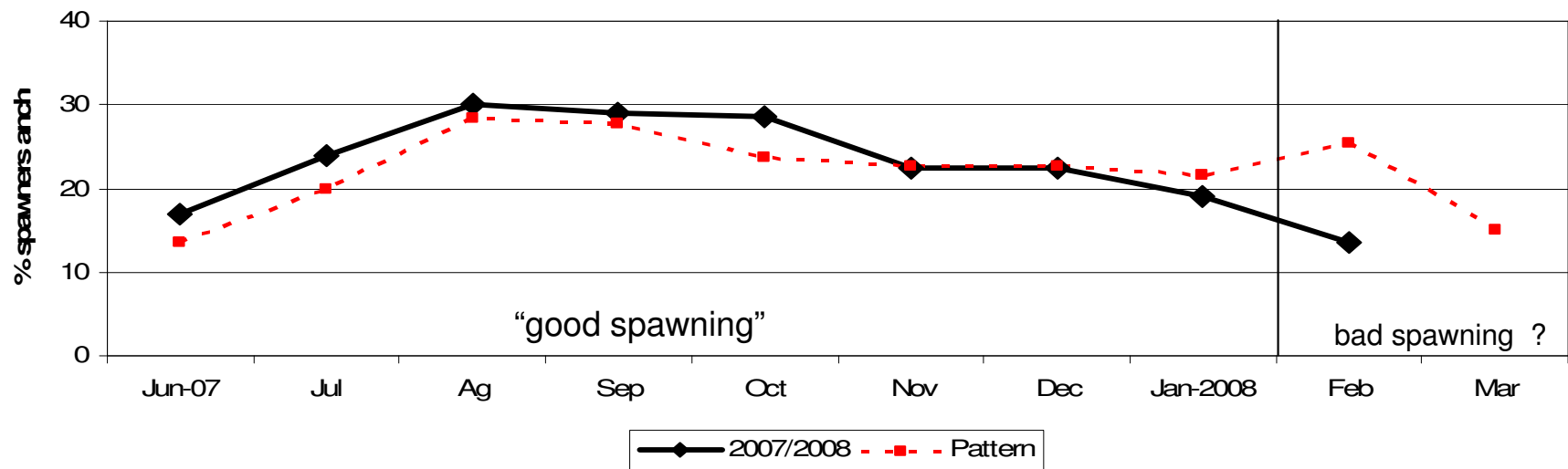
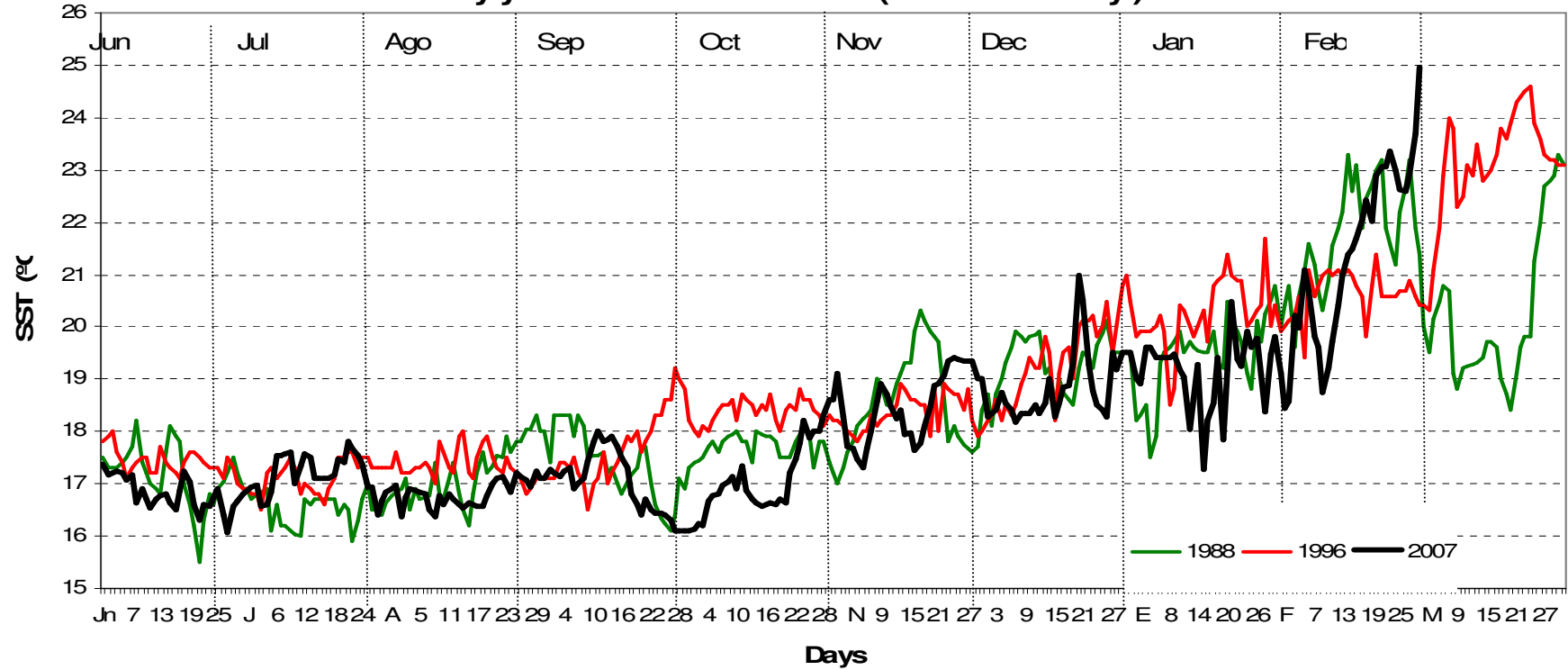
Trends of climatic and oceanographic variables in the Pacific Basin



(Chavez et al. Science 2003)

Practical approach of the environmental influences

Dayly SST at Chimbote 9° S (June - February)



Some important remarks:

To tackle environmental uncertainty:

**We need an intense fishery monitoring is developed and frequent scientific cruises are conducted.
It is necessary includes spatialization**

To incorporate natural long-term changes and use of environmental indices:

Adopted precautionary reference limits to annual yield, according to different possible “states” or “regimes”.

Propose environmental indices of use in the management of pelagic fish populations

To implement ecosystem approach:

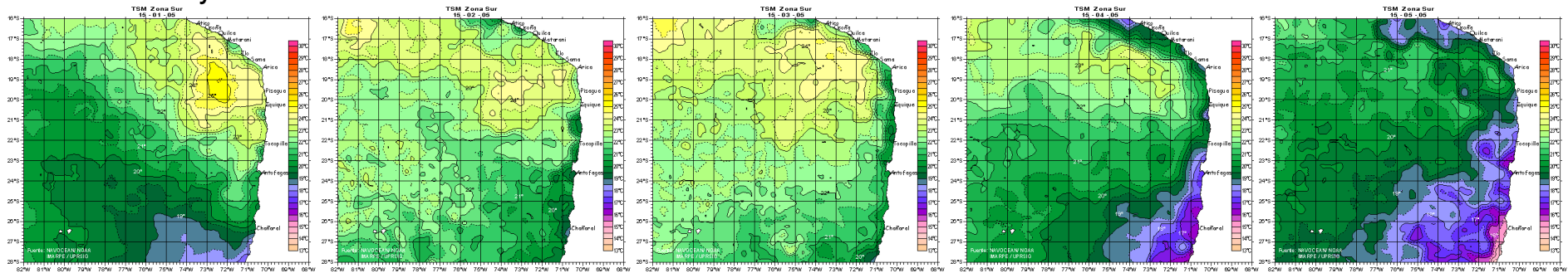
There is a permanent and increasing observation of “other components” of the ecosystem.

More Detailed information on IMARPE web at:
<http://www.imarpe.gob.pe>

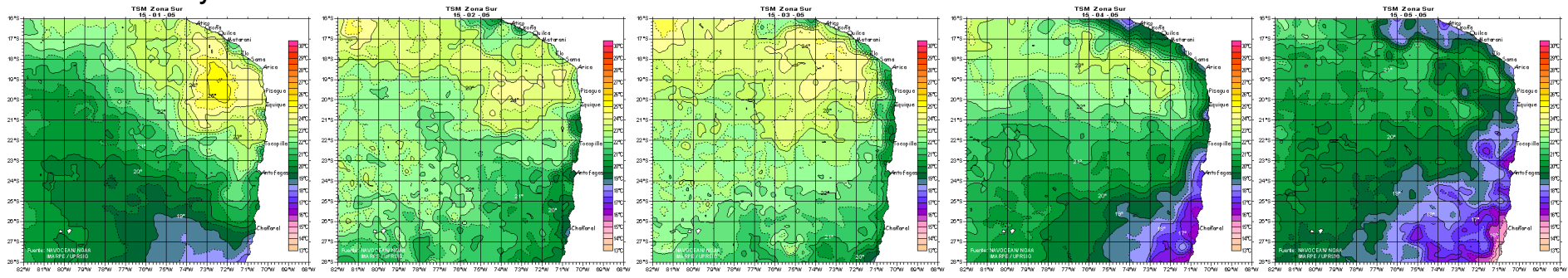
Muchas Gracias

SEA SURFACE TEMPERATURE IN THE SOUTHERN PERU – NORTHERN CHILE (2005)

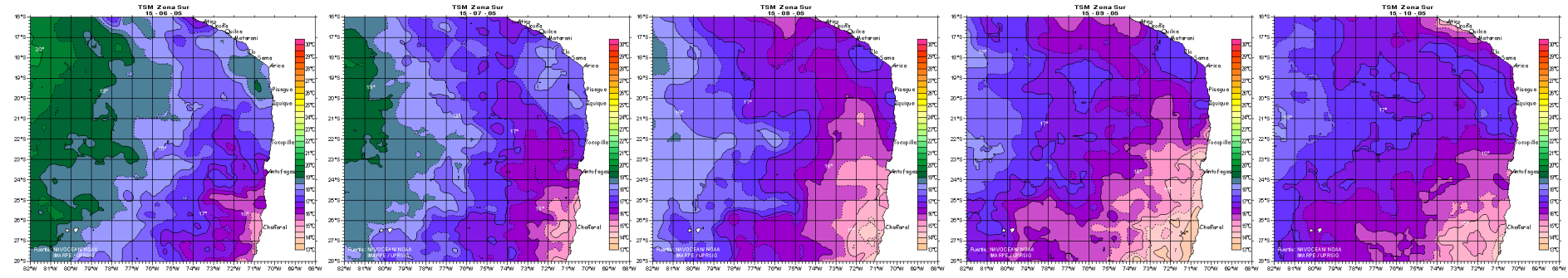
January



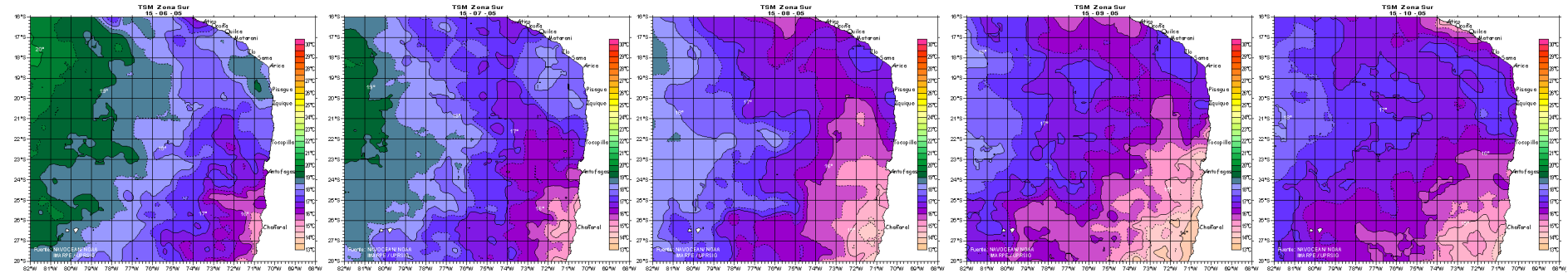
May



June



October



ANCHOVY TEMPORAL- SPATIAL DISTRIBUTION (January - June 2005)

