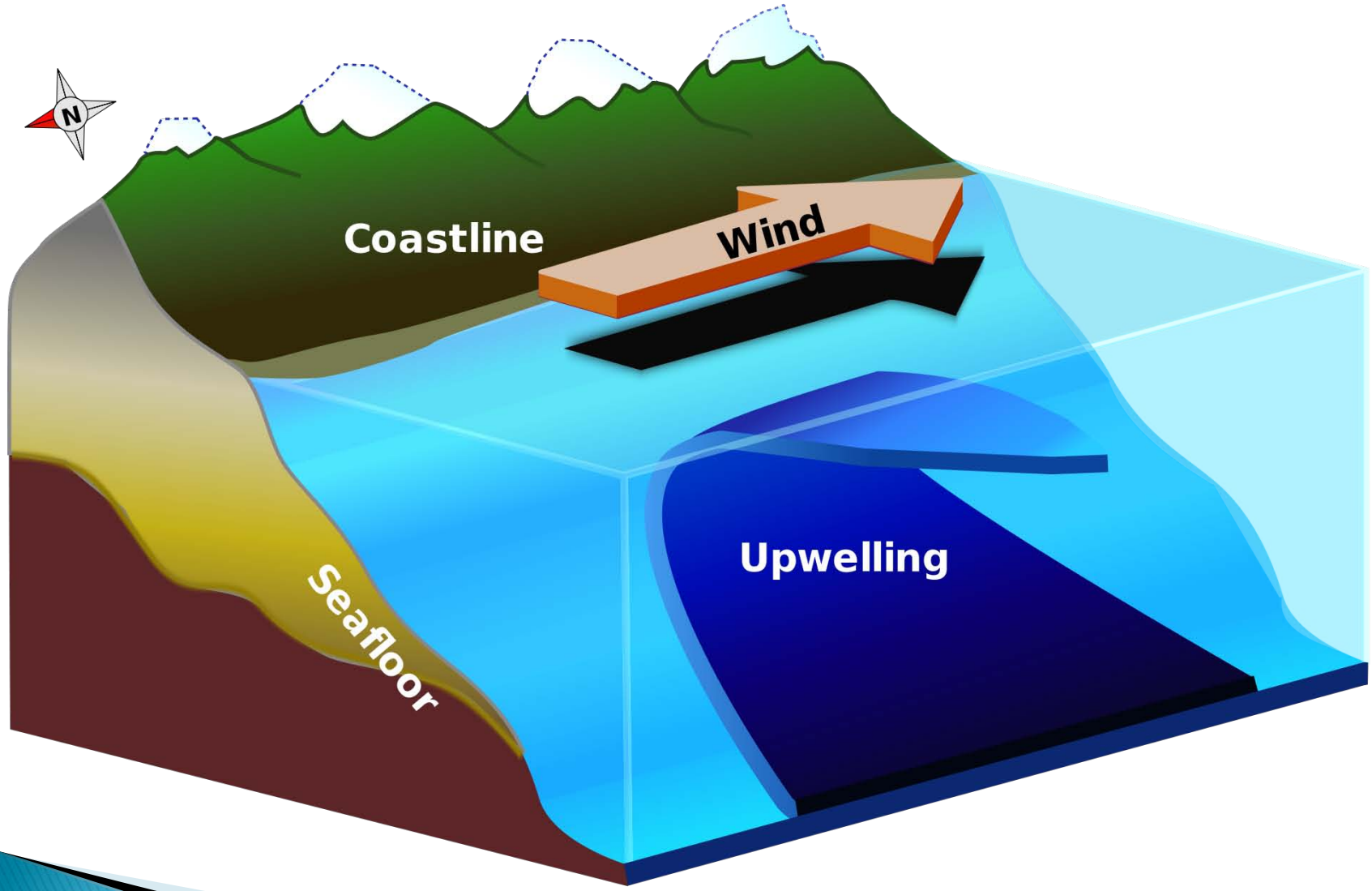
SURGENCIAS COSTERAS

Que es una surgencia costera



Por que son tan importantes?

Table 5.1 The relation between primary production and fish production in three different marine habitats.

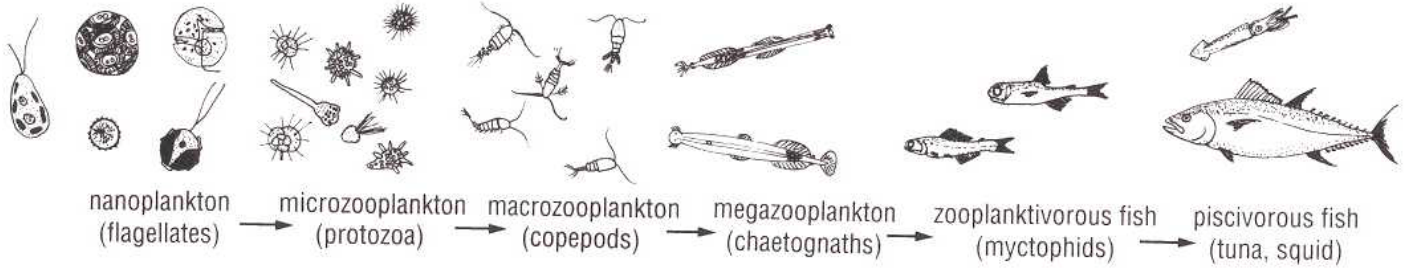
Habitat	Oceanic	Coastal	Upwelling
Percent ocean area	90	9.9	0.1
Mean primary productivity (g C m^{-2} yr^{-1})	50	100	300
Total plant production (10^9 tonnes C yr^{-1})	16.3	3.6	0.1
Number of energy transfers between trophic levels	5	3	1.5*
Average ecological efficiency	10%	15%	20%
Mean fish production** (mg C m^{-2} yr^{-1})	0.5	340	36 000
Total fish production*** (10^6 tonnes C yr^{-1})	0.2	12	12

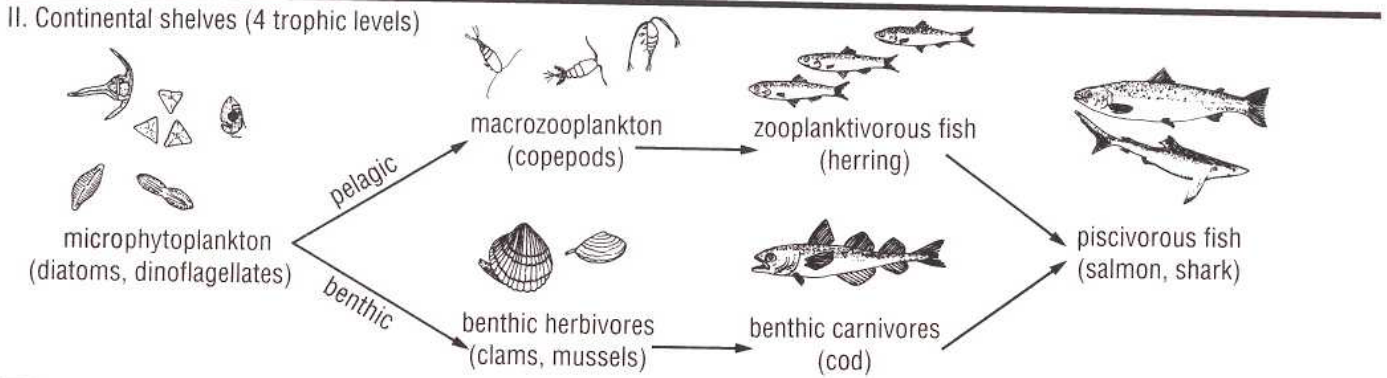
* The number of trophic levels in upwelling areas may be 2 (if fish are predominantly herbivores), or 3 as represented in Figure 5.3; 1.5 represents an average value for the number of energy transfers.

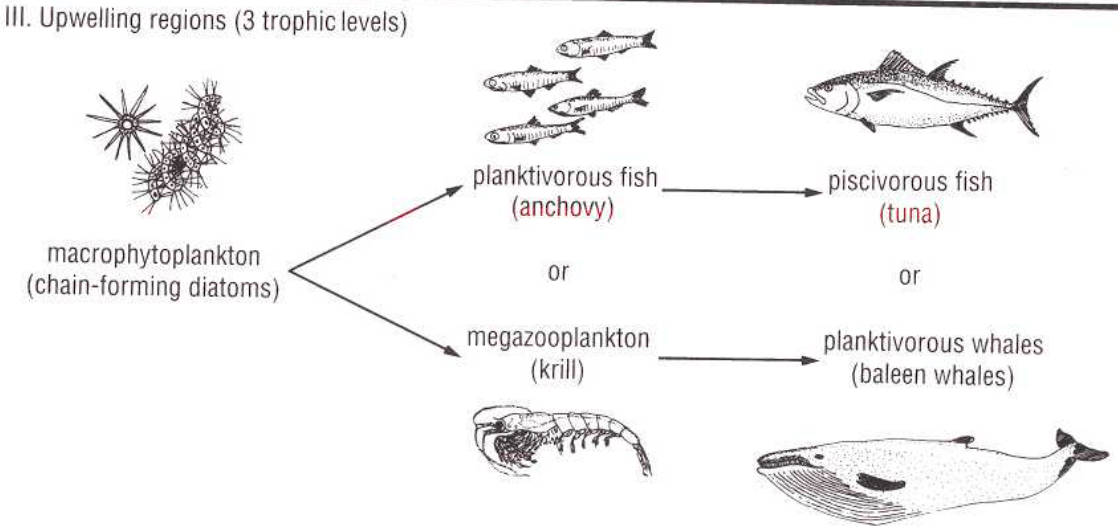
** Calculated from equation 5.2, $P = BE^n$.

***Corrected for percent ocean area occupied by each habitat (total area = 362×10^6 km^2).

La cadena trofica tipica







Cadena Trófica Oceánica

Tipo	Producción Primaria $gCm^{-2}y^{-1}$	Niveles Tróficos	Eficiencia	Producción Pesquera Potencial $mgCm^{-2}y^{-1}$
Oceánico	50	5	10	0.5
Plataforma	100	3	15	340
Surgencia	300	1.2	20	36,000

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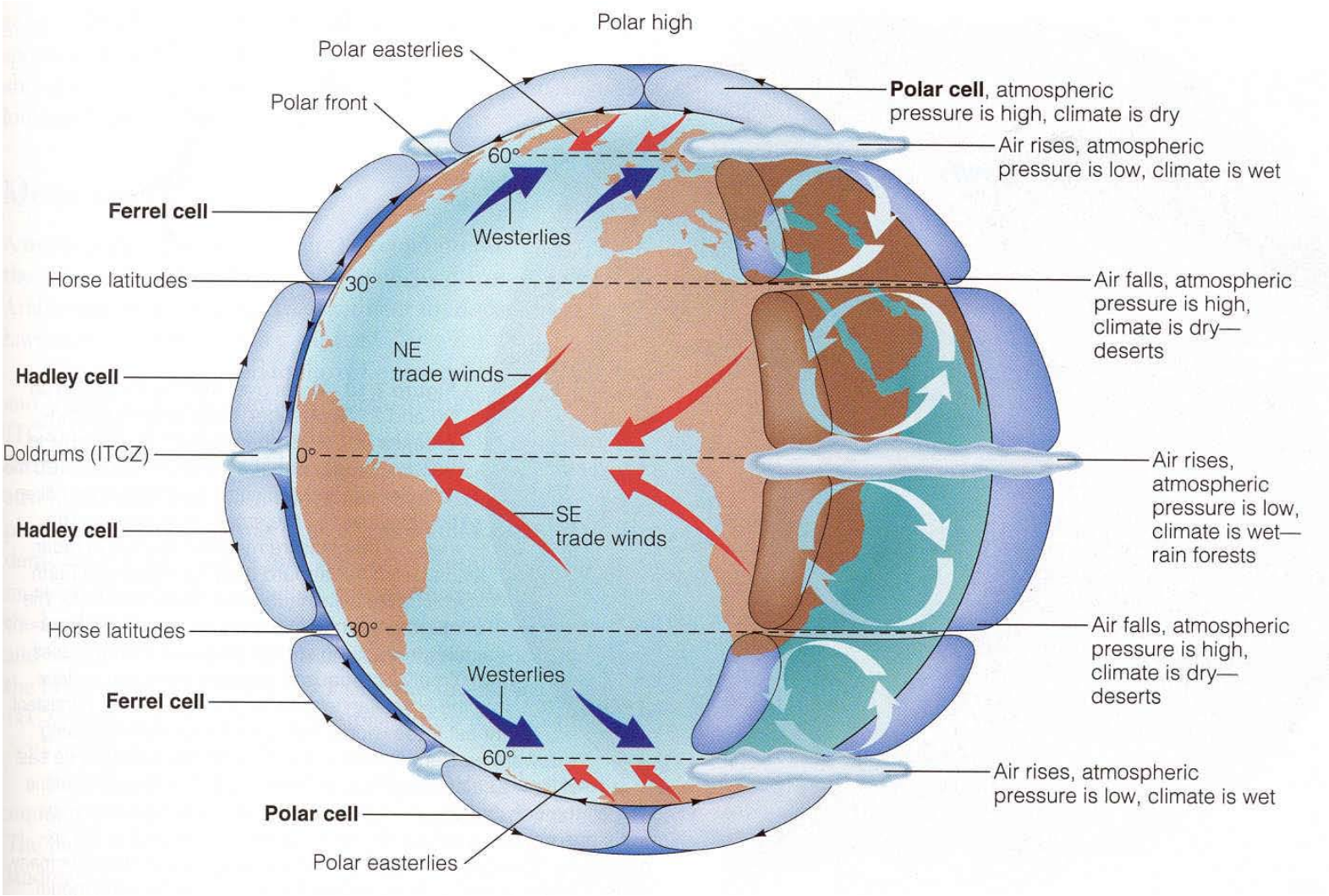
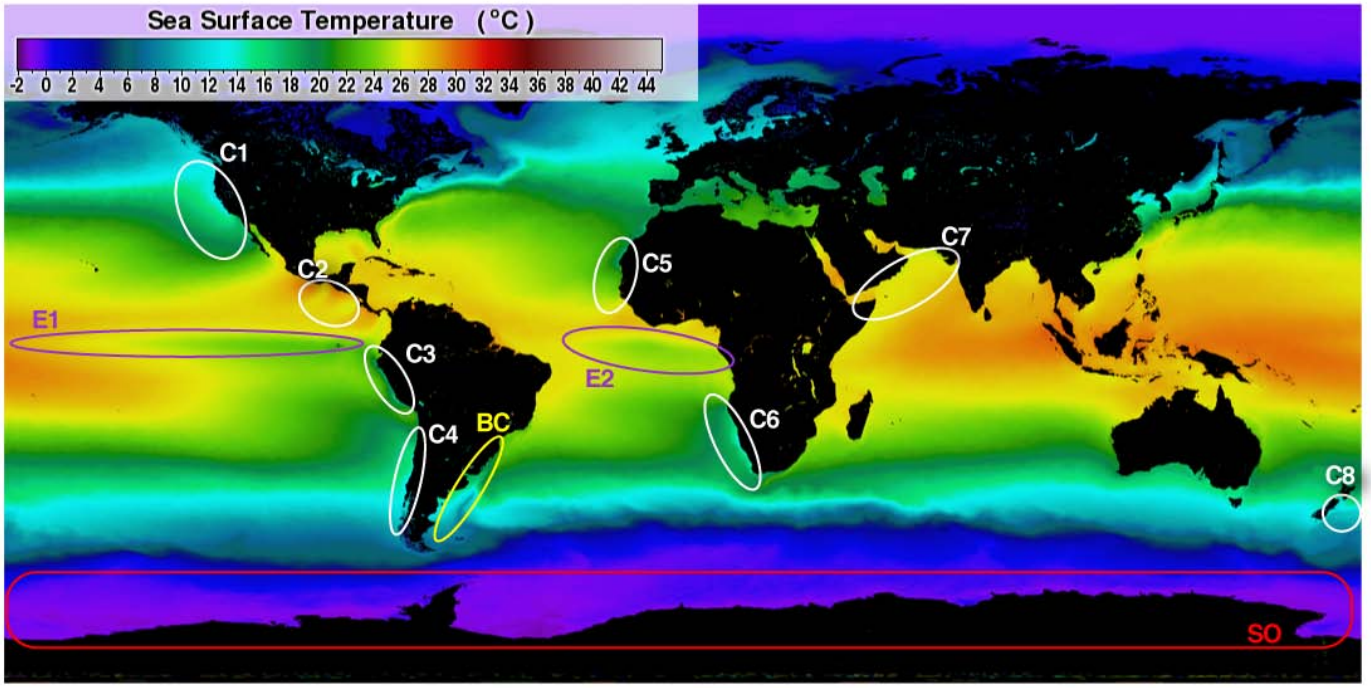
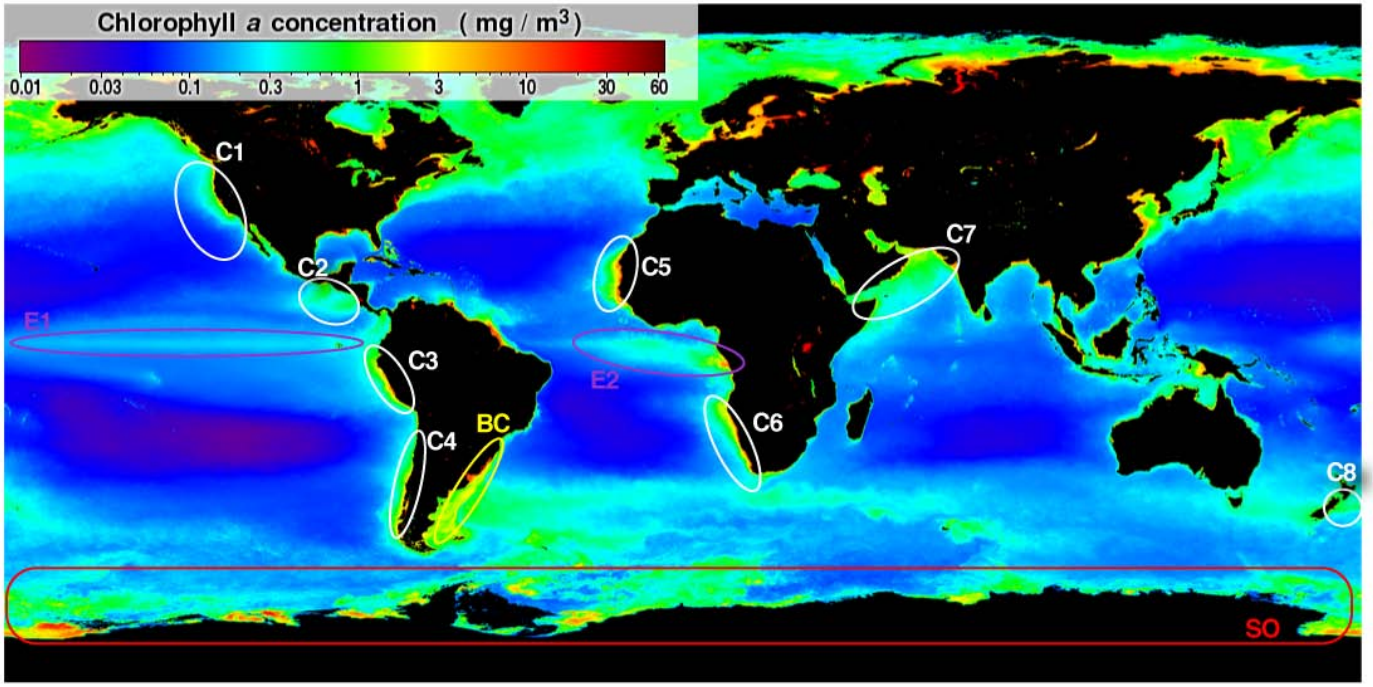
Plataforma	100	3	15	**340**
Surgencia	300	1.2	20	**36,000**

El motor de las surgencias: *VIENTO*







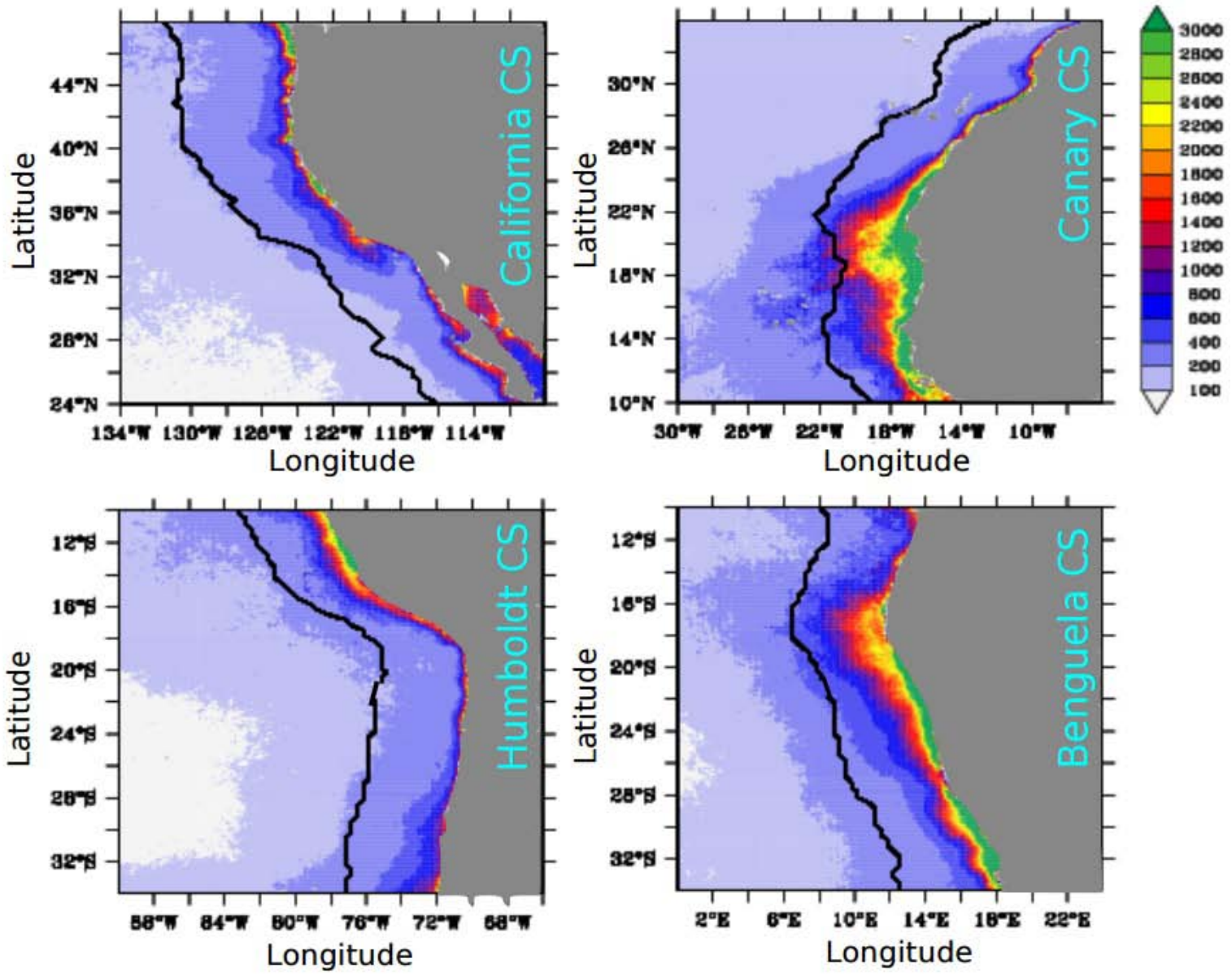
C1. California
C2. Pacifico Central
C3. Perú
C4. Chile
C5. África Oeste
C6. Benguela
C7. Mar de Arabia

E1. Pacifico Ecuatorial
E2. Atlántico Ecuatorial

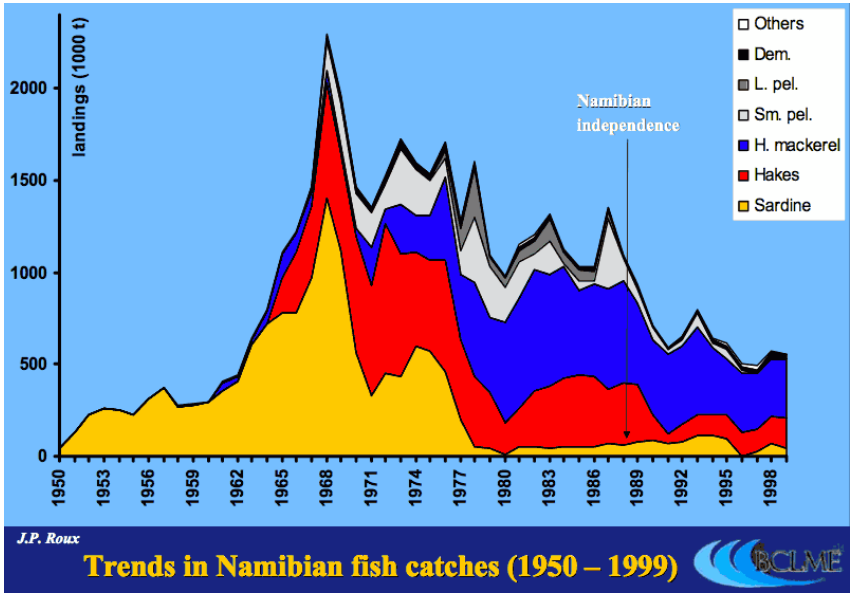
BC: Brasil-Malvinas

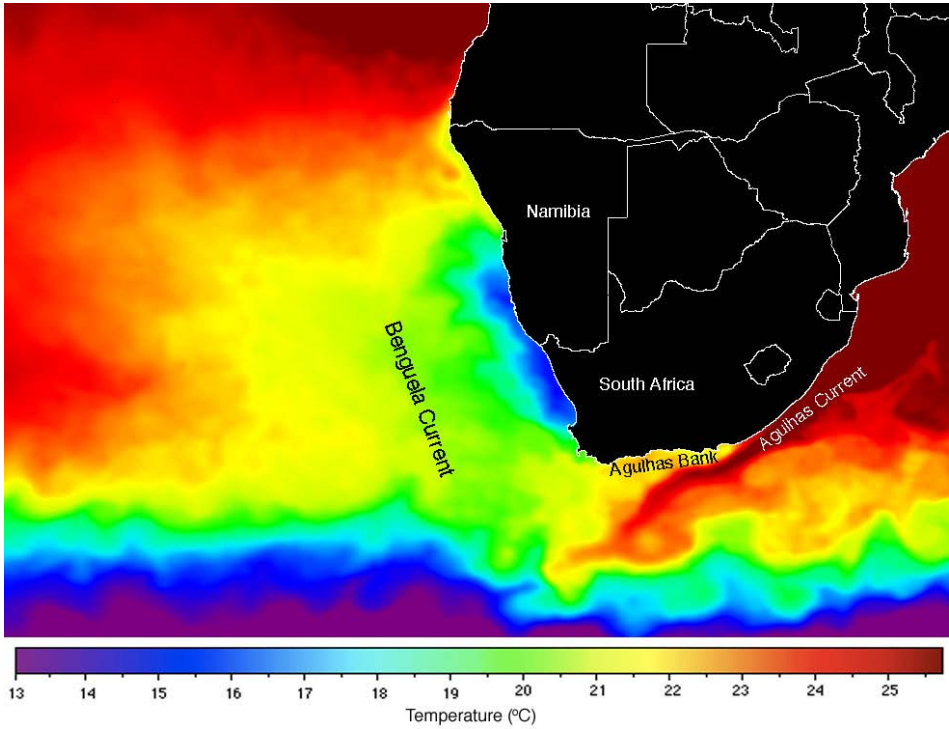
SO: Océano Sur

Producción Primaria anual (gC m^{-2} yr^{-1})



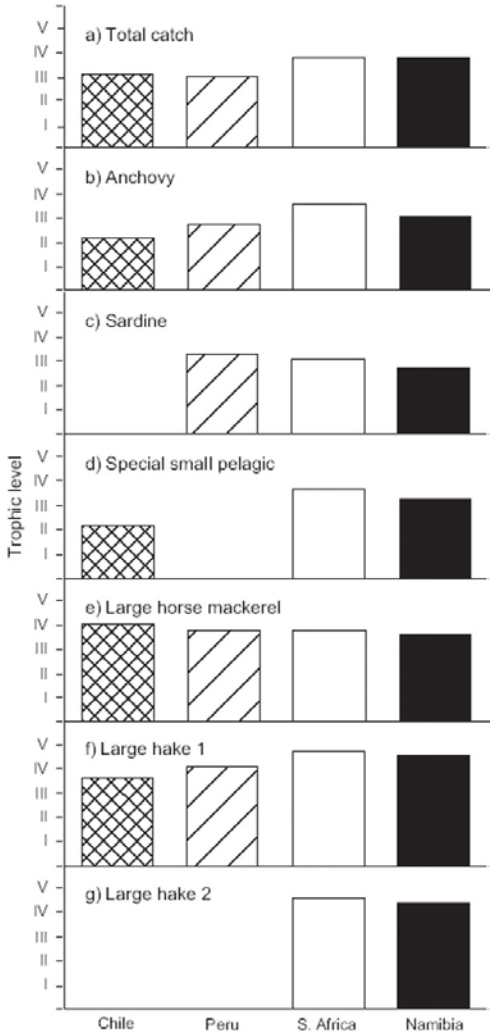
Corriente de Benguela: *la mas intensa*





Florecimientos algales nocivos

Trophic levels of selected species groups for the four models: a) total catch, b) anchovy, c) sardine, d) special small pelagic, e) large horse mackerel, f) large hake 1, g) large hake 2.



Captura total

Anchoveta

Sardina

Pelágicos menores

Chile Sudáfrica

Perú Namibia

Coleen L. Moloney et al. ICES J. Mar. Sci. 2005;62:493-502

ICES JOURNAL OF MARINE SCIENCE

Corriente de California

Vientos favorables mas fuertes en verano

(agua mas fria en verano que en invierno!)

Enero **Abril** **Julio** **Octubre**

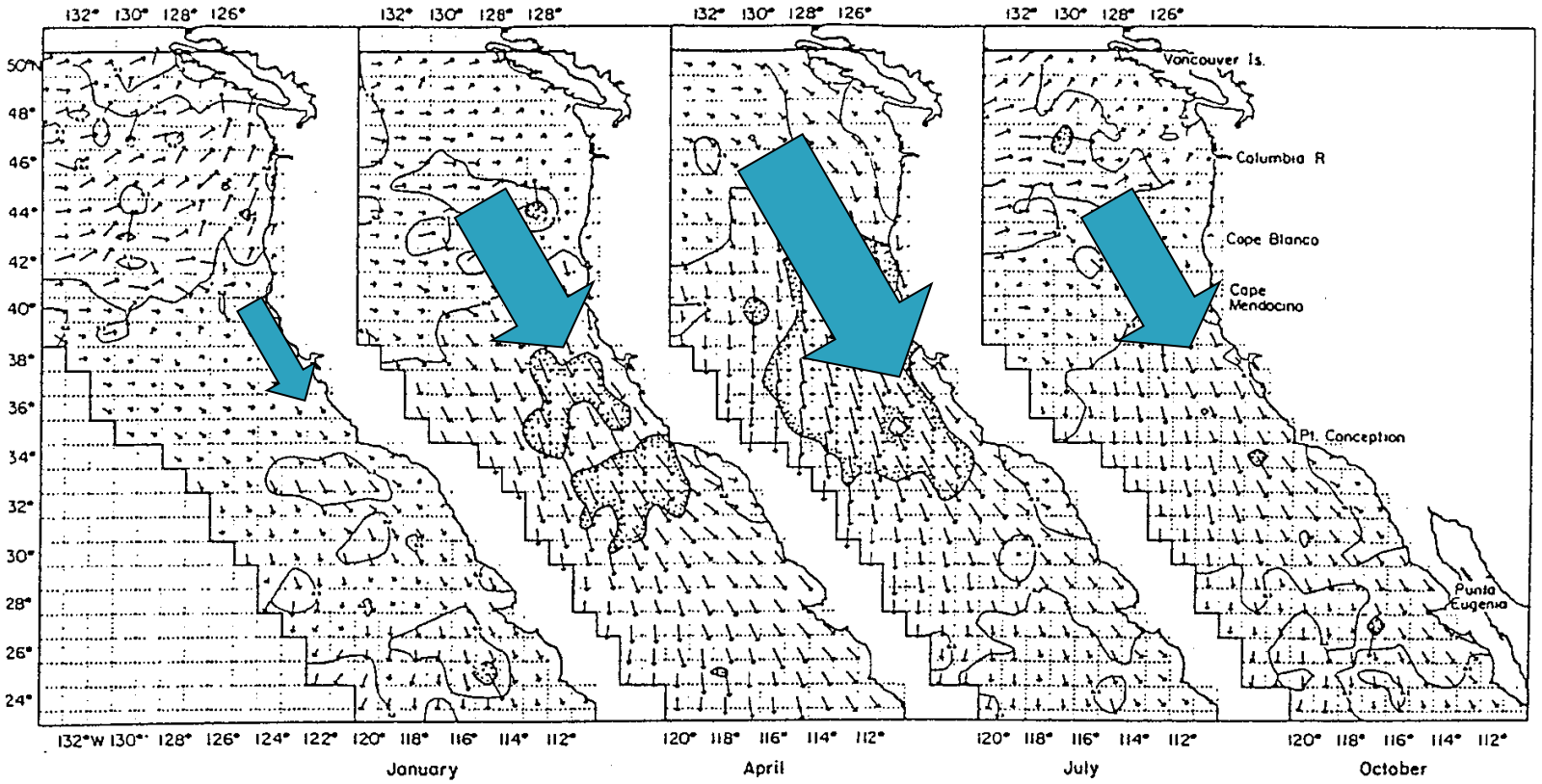
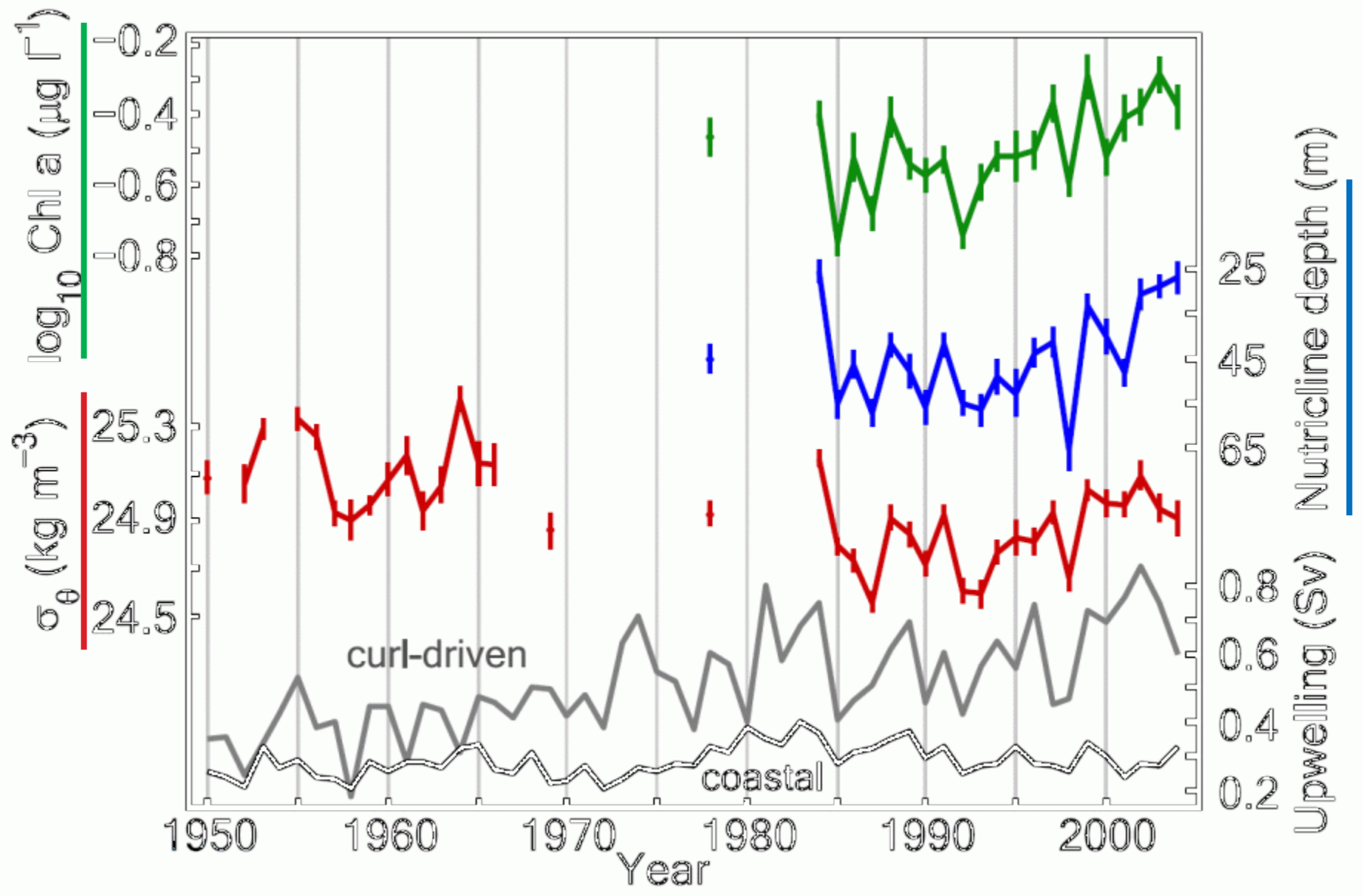
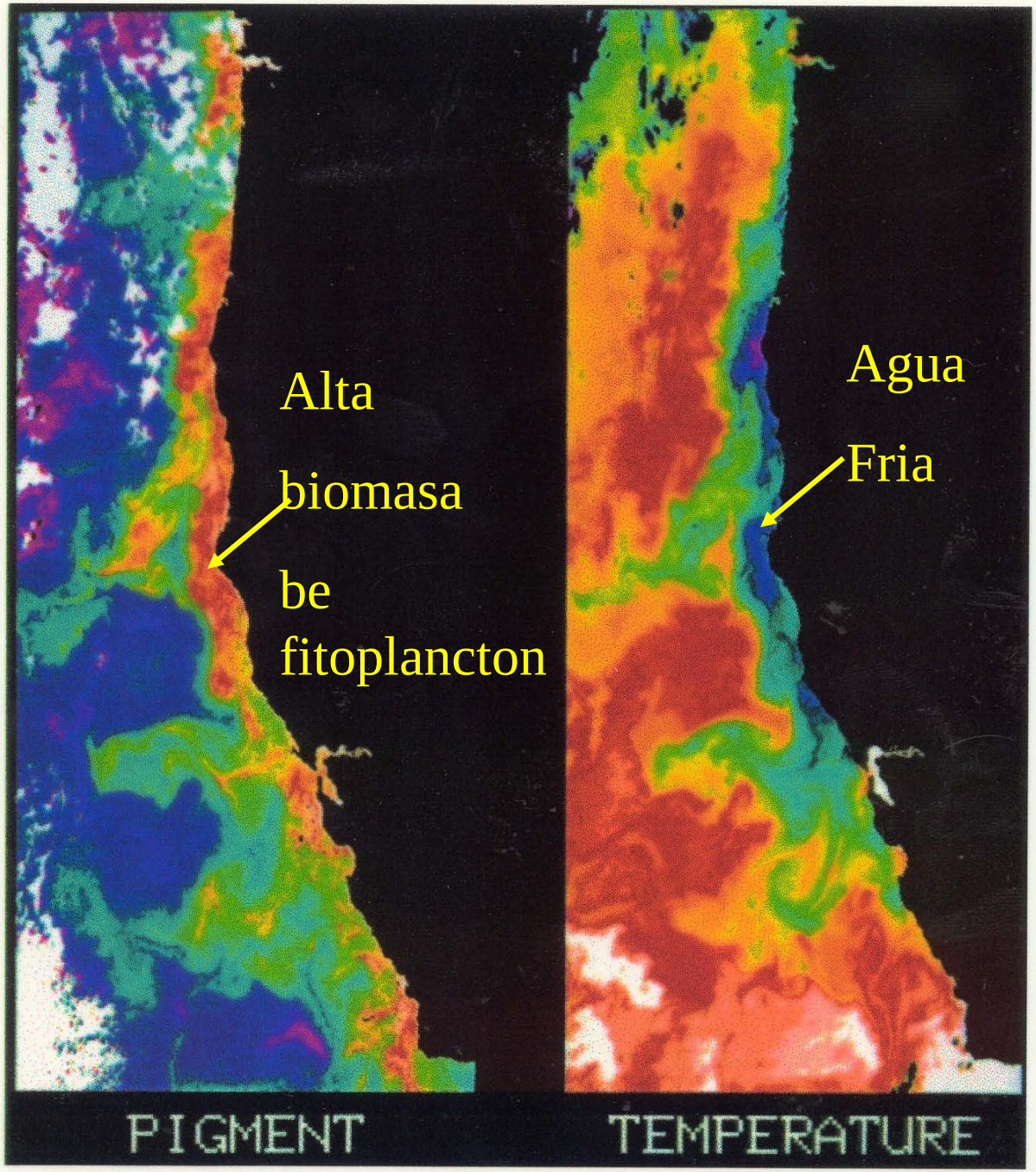


FIG. 2. Long-term (1854–1972) mean wind stress (dynes cm^{-2}) by one-degree squares, from ship reports (NELSON, 1977). Contours correspond to constant magnitudes of 0.5, 1.0 and 1.5 dynes cm^{-2}; areas where the wind stress exceeds 1.0 dynes cm^{-2} are shaded.


log10 Chl a (μg l−1)
−0.2
−0.4
−0.6
−0.8
σθ (kg m−3)
25.3
24.9
24.5
curl-driven
coastal
25
45
65
Nutricline depth (m)
0.8
0.6
0.4
0.2
Upwelling (Sv)
1950
1960
1970
1980
1990
2000
Year

Mucha inestabilidad: remolinos filamentos …

Alta producción biológica



Ejemplo

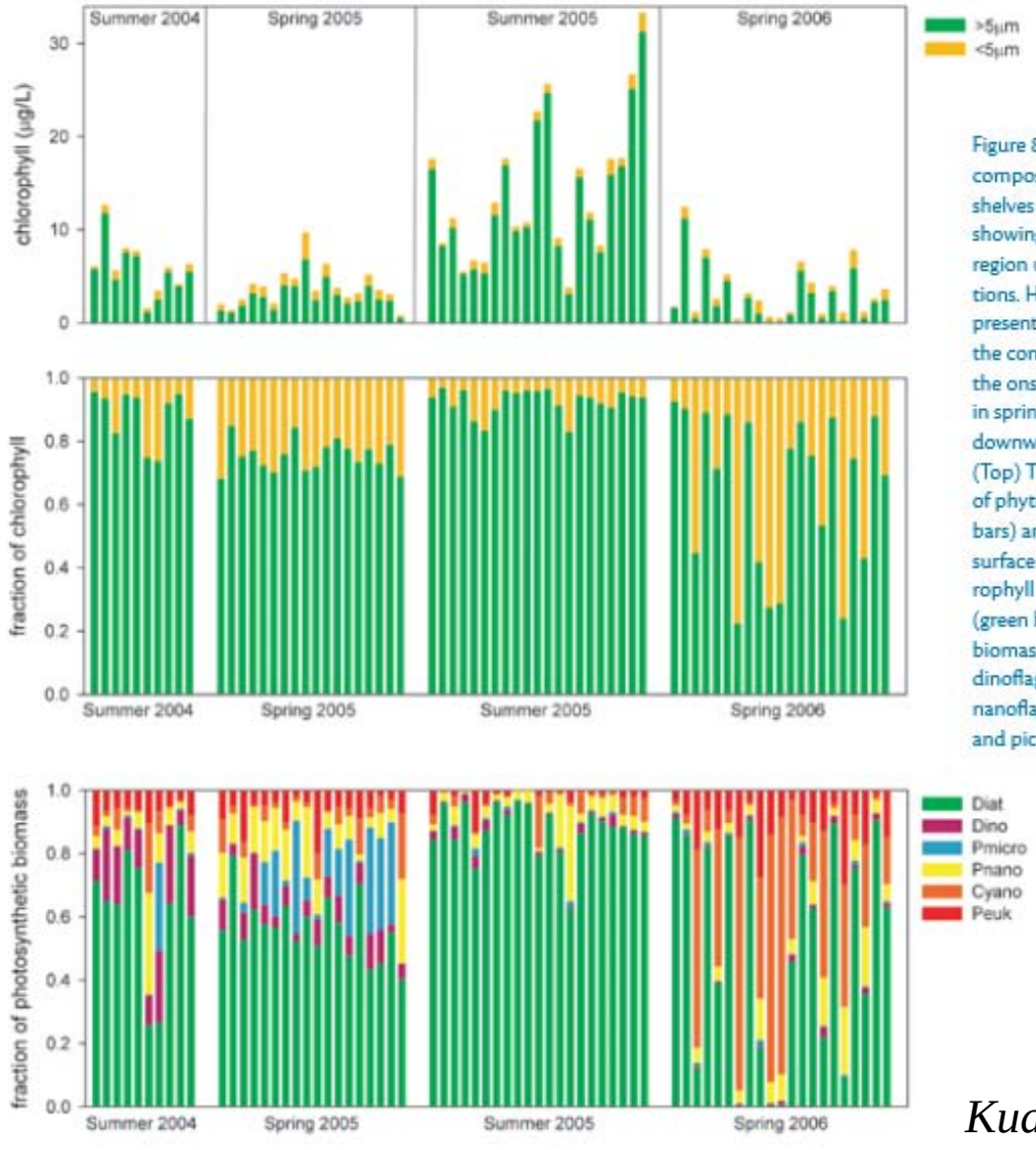
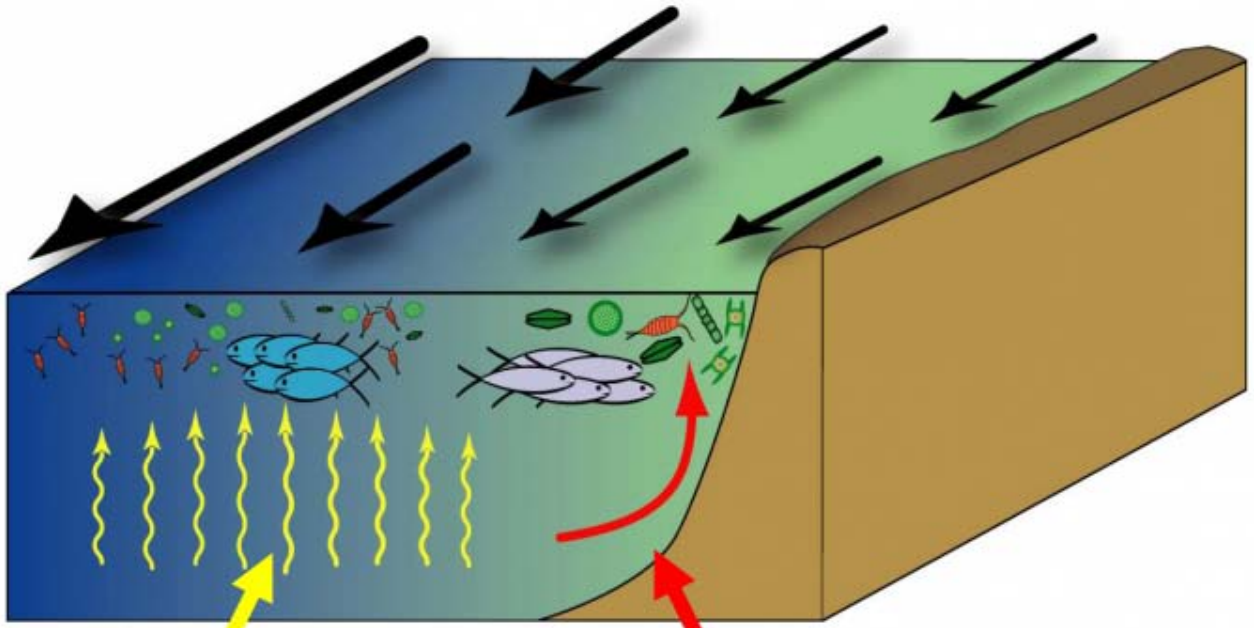


Figure 8. Phytoplankton community and size composition on the Washington and Oregon shelves during the 2004–2006 RISE cruises, showing that diatoms typically dominated the region under widely varying upwelling conditions. However, small cells (< 5 µm) were always present and were a much larger proportion of the community than usual in spring 2005, when the onset of seasonal upwelling was delayed, and in spring of 2006, during a period of extended downwelling that followed strong upwelling. (Top) The concentration of chlorophyll, an index of phytoplankton biomass, in the < 5 µm (yellow bars) and > 5 µm (green bars) size fraction in surface samples. (Middle) Fraction of total chlorophyll in the < 5 µm (yellow bars) and > 5 µm (green bars). (Bottom) Fraction of phytoplankton biomass in different taxa groups (diatoms [diat], dinoflagellates [dino], microflagellates [pmicro], nanoflagellates [pnano], cyanobacteria [cyano], and picoeukaryotes [peuk]).

Kudela et al., 2008

Sardina x Anchoveta en la CC



Wind stress curl upwelling:
sardine

Coastal boundary upwelling:
anchovy

Anomalía de Temperatura

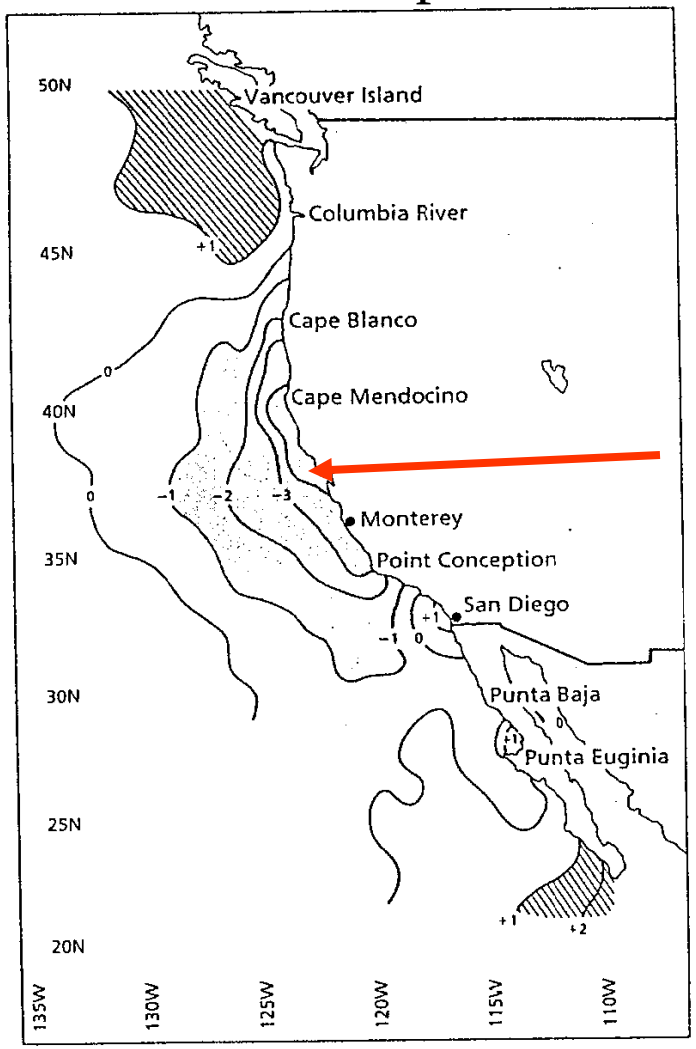
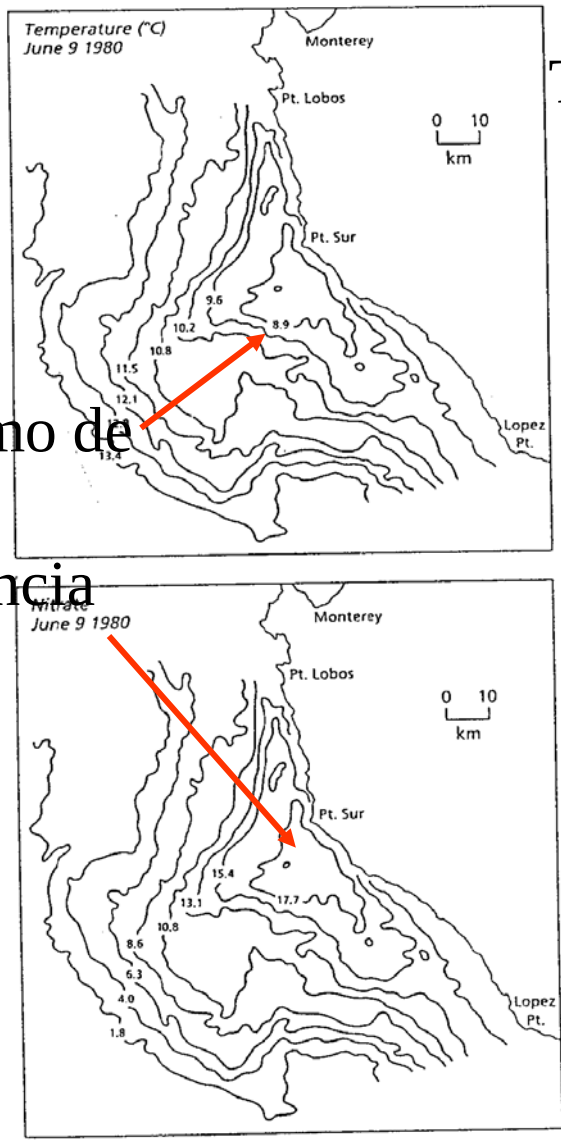


Fig. 5.15 Average coastal temperature anomaly (°C) in summer, calculated as the difference between each location and a smoothed reference temperature for offshore conditions at the same latitude. From Bakun and Parrish (1982).

Máximo de la Surgencia



Temperatura

Nitratos

Fig. 5.16 Temperature and nitrate distributions off Pt Sur, California, from satellite and shipboard operations. Note the difference between actual field data and the averaged long-term trends in the previous figure. From Traganza *et al.* (1983).

Las areas mas extensas de desove y la poblacion de adultos NO ocurren en las zonas de surgencia intensa.

Posibles razones:

- **Transporte de Ekman**
- **mucha turbulencia para las larvas**

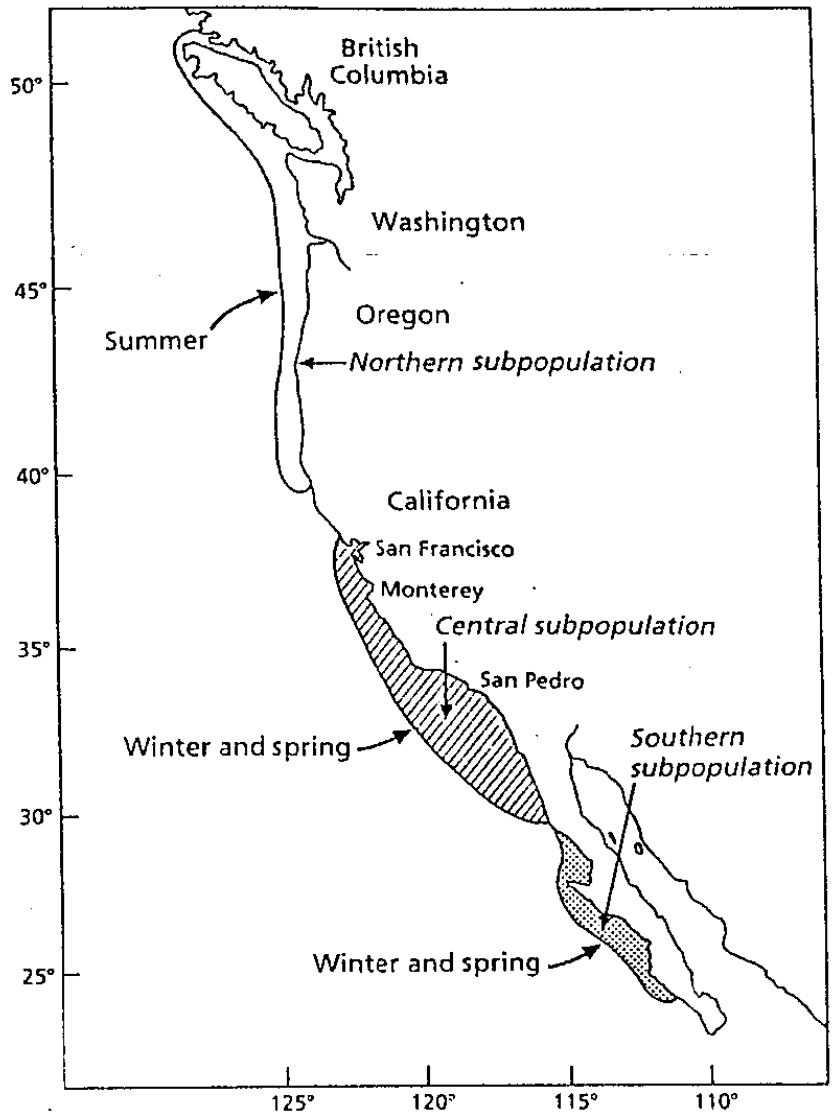


Fig. 5.17 The major spawning areas and seasons of the three subpopulations of the northern anchovy off the west coast of North America. From Smith and Lasker (1978).

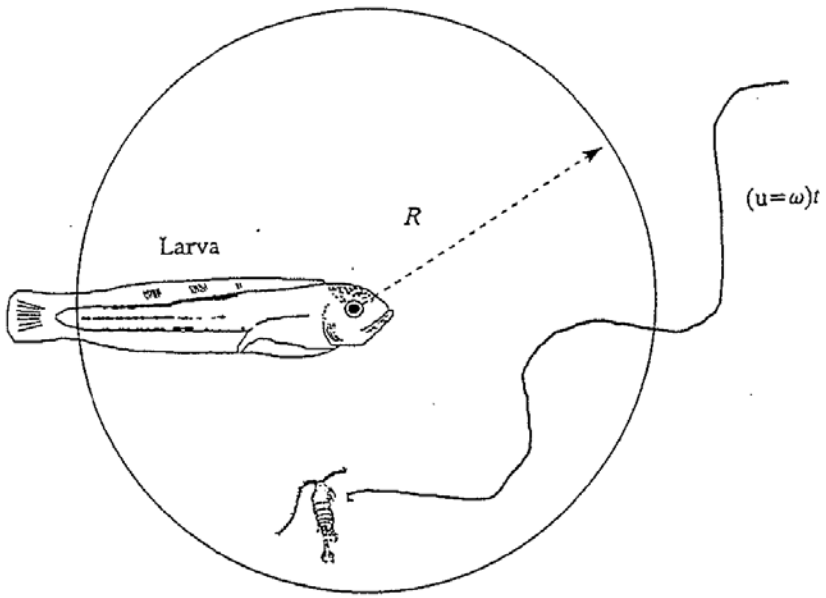


Figure 1 Schematic of the factors necessary for encounter. A larval fish is shown frozen in time. The larvae can see a distance R, which encompasses the area shown in this figure as a circle (note that this representation is highly simplified, as the actual search geometry is 3-dimensional and is likely not to be spherical). A prey organism is initially outside the reactive volume. However, during some period of time, t, it is moved (either under its own locomotion, by turbulence or by a combination of the two) so that it enters the reactive volume, hence leading to an encounter.

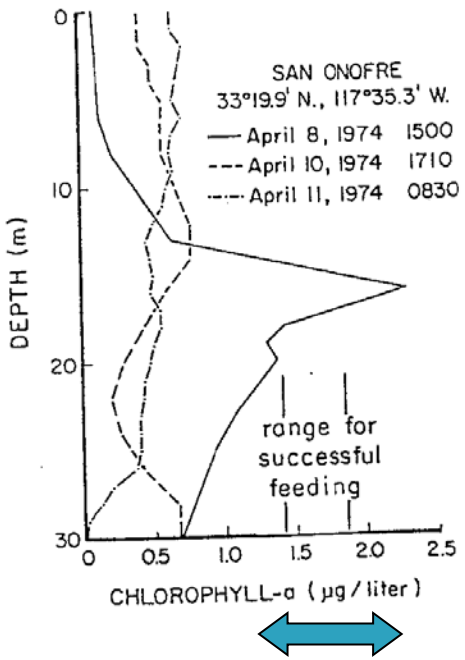


Figure 4.16 Vertical profiles of chlorophyll off southern California before a windstorm (8 April) and after it (April 10 and 11). Vertical bars indicate the range of chlorophyll concentrations where shipboard experiments indicated successful feeding by larval anchovy on large dinoflagellates. From Lasker 1975.

Hipótesis de Estabilidad del Océano de Lasker: se necesita estabilidad para que el alimento se agregue ⇒ *turbulencia no favorable*

La Corriente de Benguela x Anchoveta

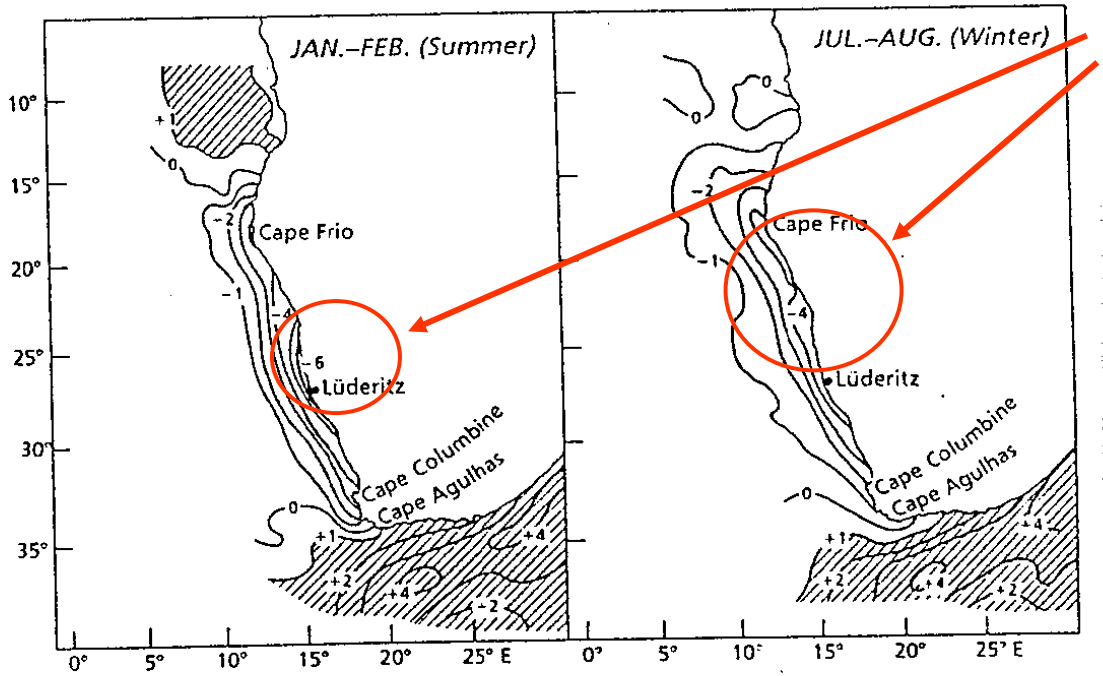


Fig. 5.18 Average sea-surface temperature anomalies in the Benguela current system, in summer and winter. From Parrish *et al.* (1983).

Anomalias de temperatura mayores en verano (-6 en verano vs -4 en invierno)

Area de desove "upstream" durante la surgencia (similar a las poblaciones de California)

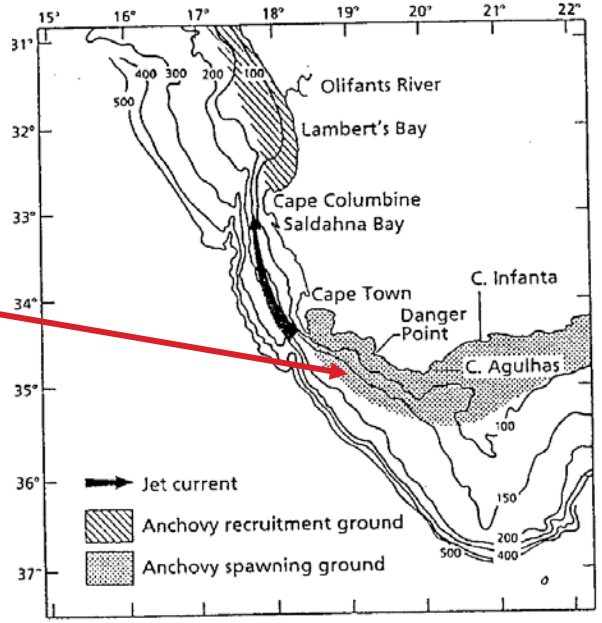
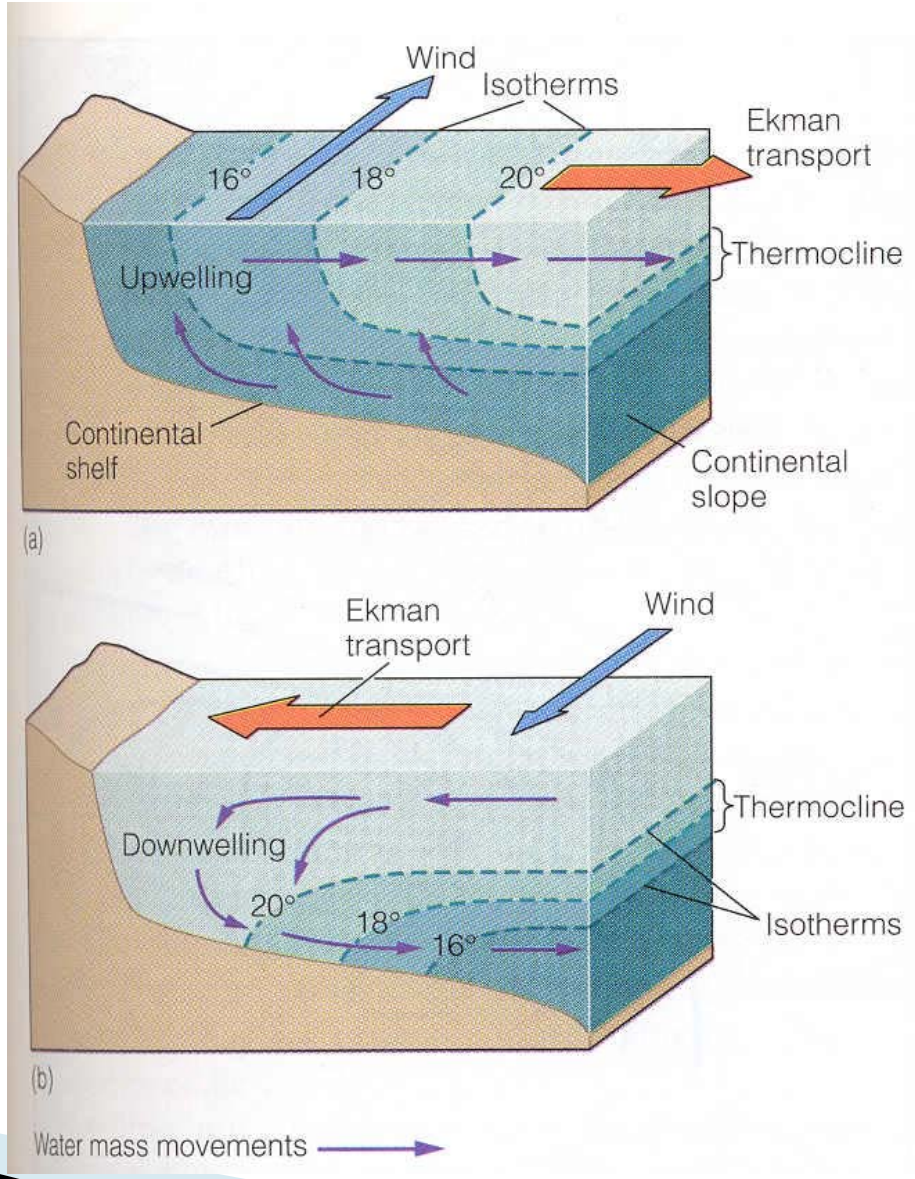


Fig. 5.19 Spawning and recruitment grounds of the South African anchovy, and the jet current that connects them. From Shelton and Hutchings (1982).

Zonas de surgencia estacionales

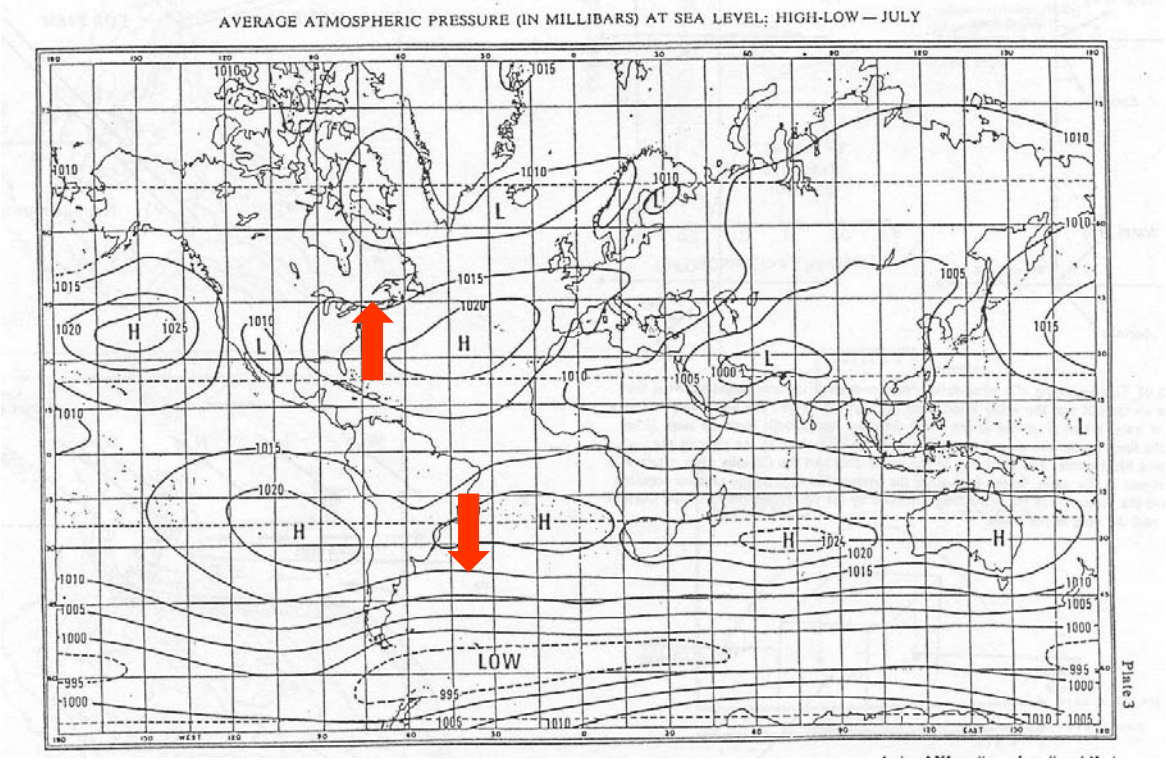
SURGENCIA –
Transporte de Ekman
Hacia afuera de la costa

DIVERGENCIA –
Transporte de Ekman
Hacia la costa

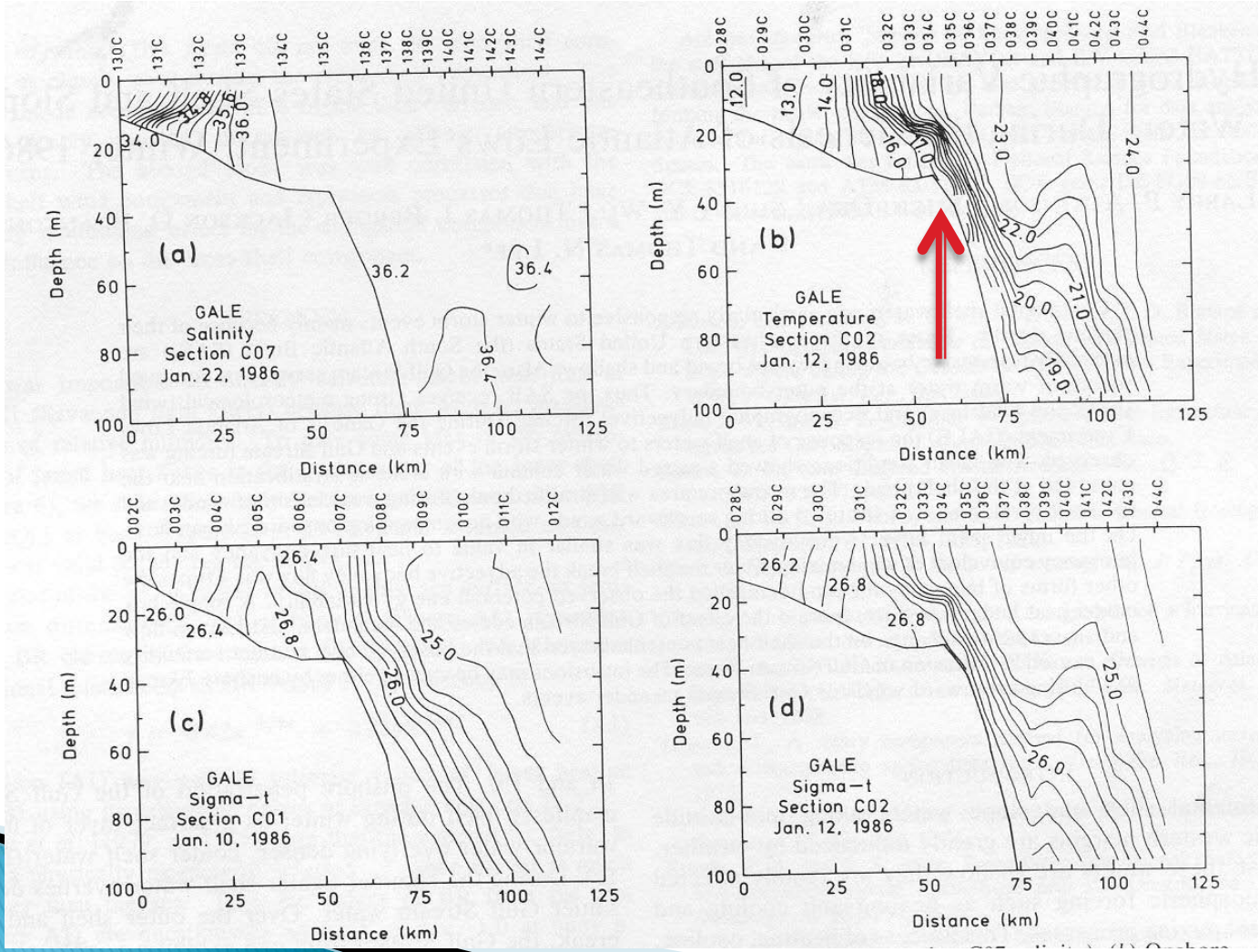


SI hay vientos favorables a surgencias en las costas este de los continentes:

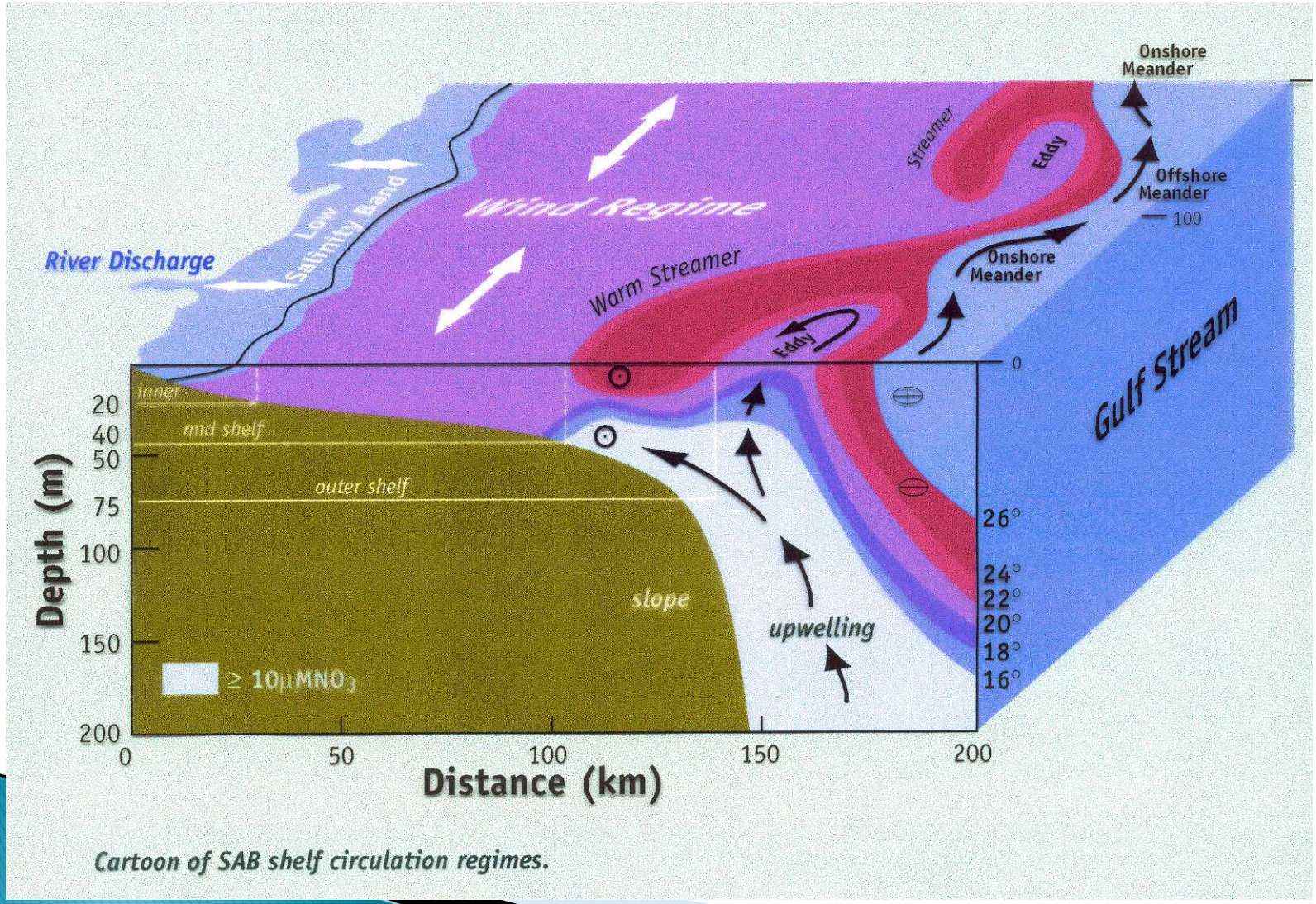
- ✓ ESTACIONALES
- ✓ ANCHO DE LA PLATAFORMA CONTINENTAL



Perfiles y transectos en invierno en la plataforma continental de la costa este de USA: *surgencia solo afecta la plataforma externa*.



Surgencia o Frente de quiebre de plataforma



Cartoon of SAB shelf circulation regimes.