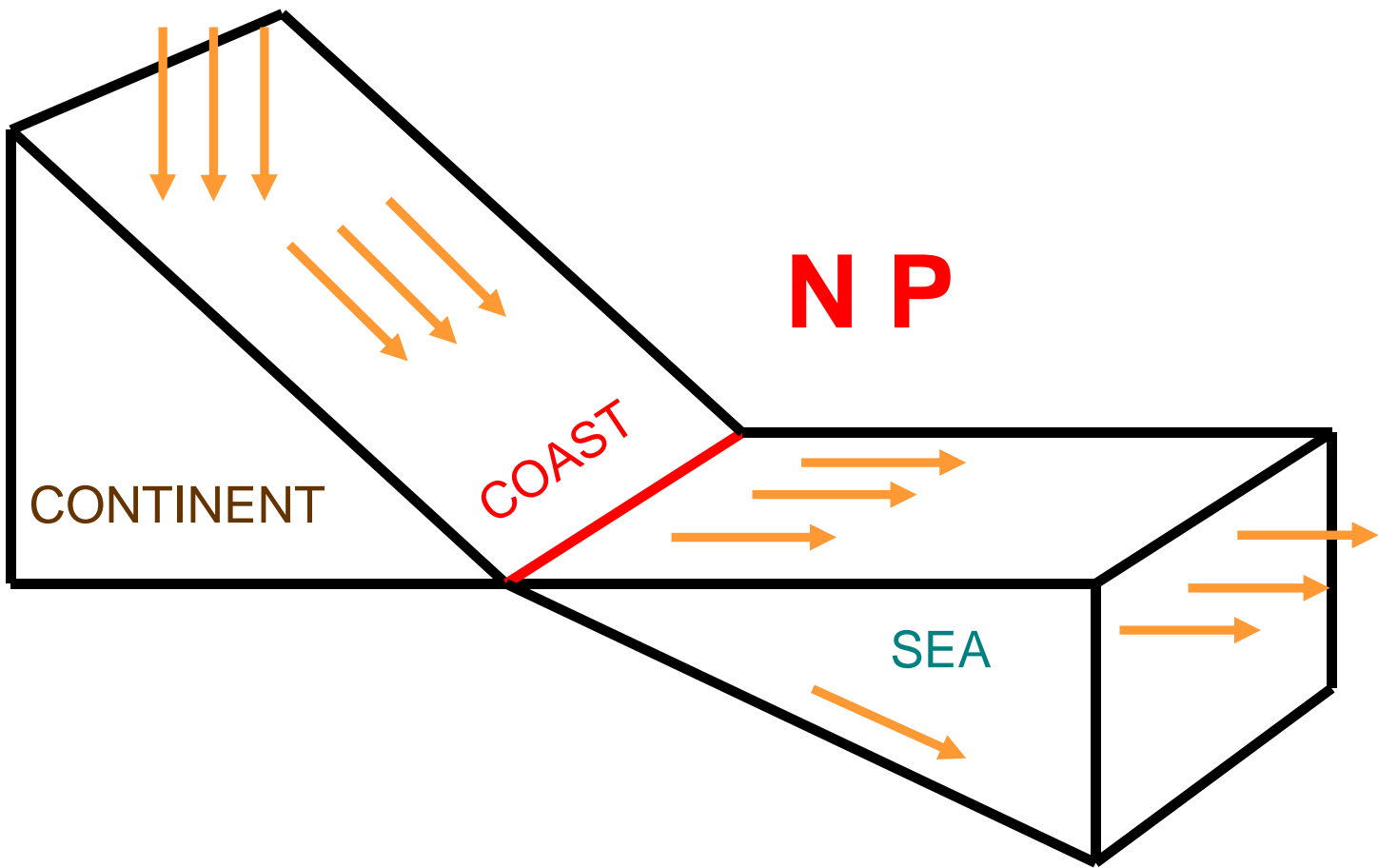


Observació de la Terra i aplicacions en l'àmbit de la salut  
Institut Cartogràfic de Catalunya i Geològic de Catalunya  
Barcelona, 15 Desembre 2016

# Qualitat de l'aigua litoral i ús del territori

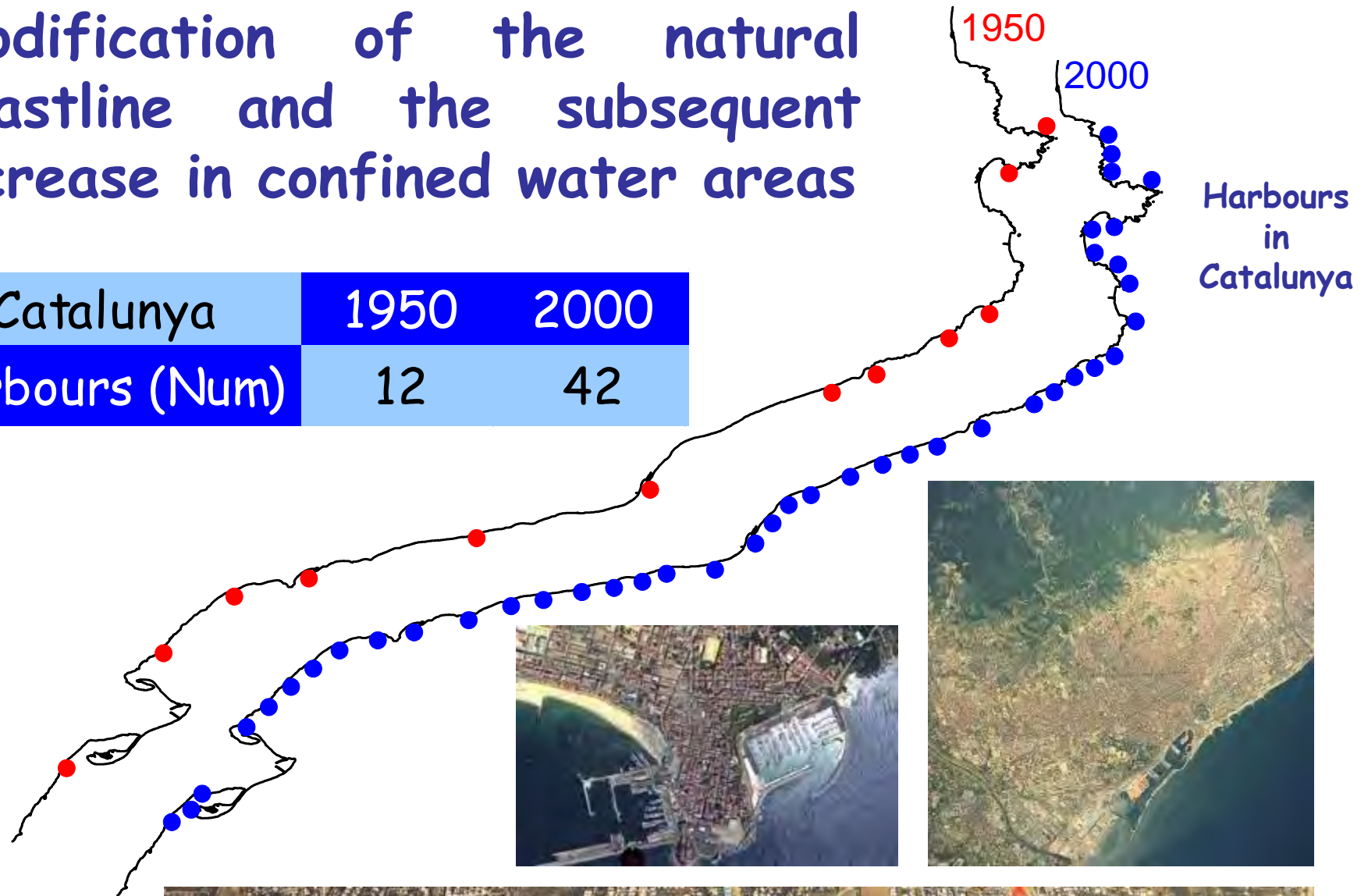
Jordi Camp, Eva Flo i Esther Garcés  
Coastal Biological Processes Research Group



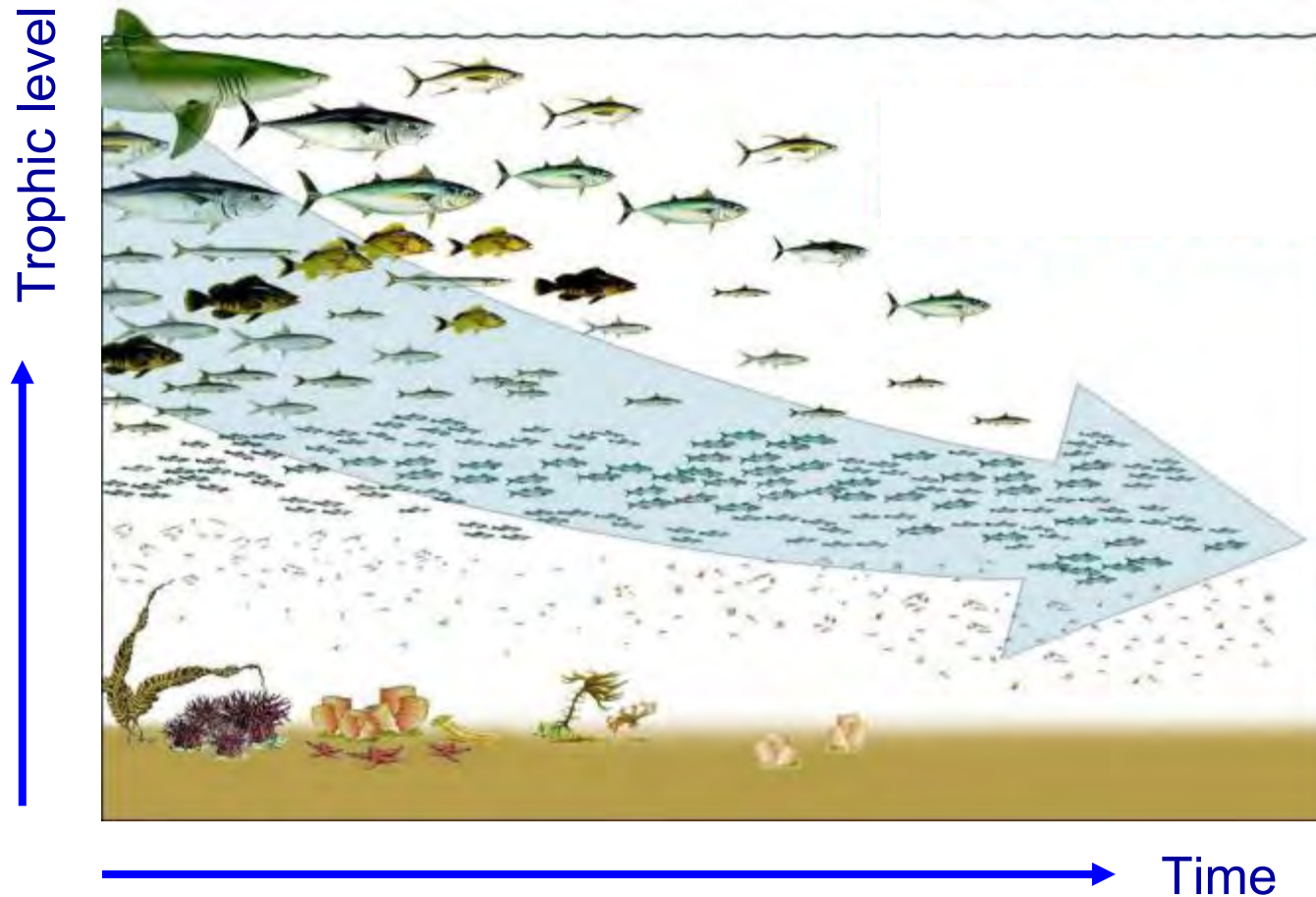


# Modification of the natural coastline and the subsequent increase in confined water areas

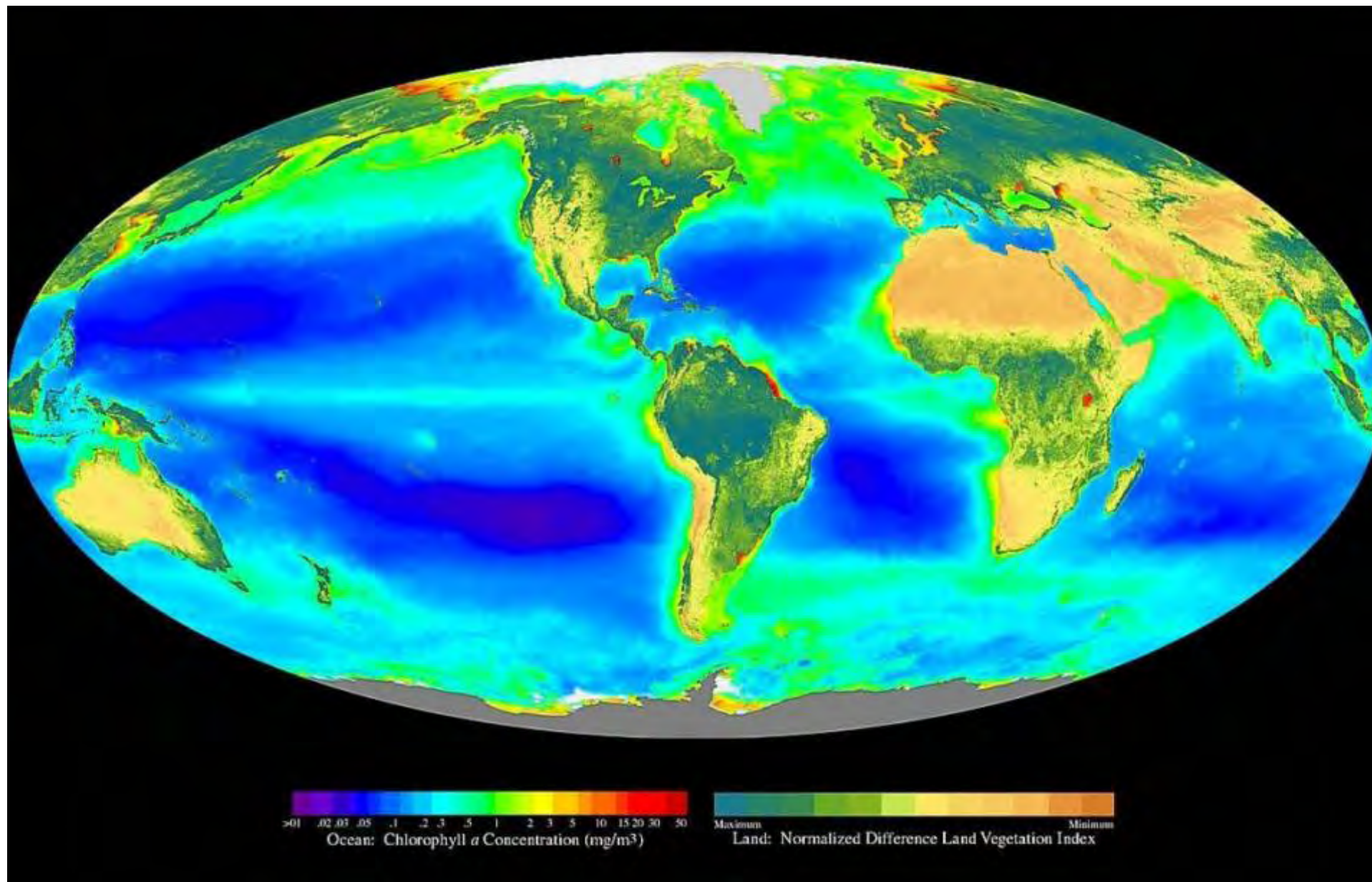
Catalunya	1950	2000
Harbours (Num)	12	42



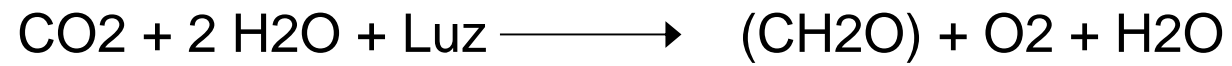
# Bottom-up and top-down



D.Pauly, V. Christensen, J. Dalsgaard, R. Froese, F. Torres Jr. Fishing Down Marine Food Webs  
*Science* 1998: 279 (5352), 860-863

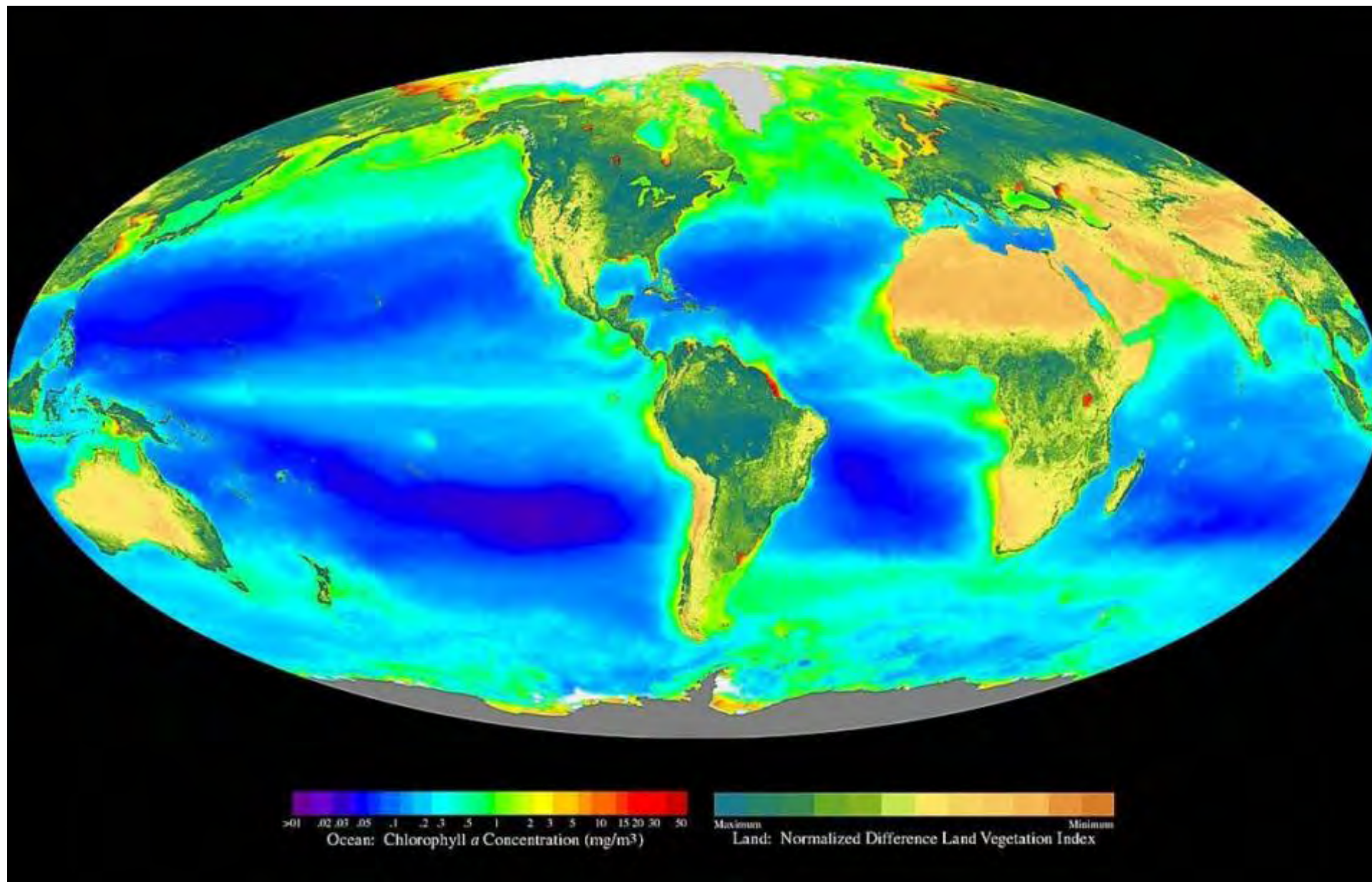


## Fotosíntesis



## Respiración







## Composición de la materia viva

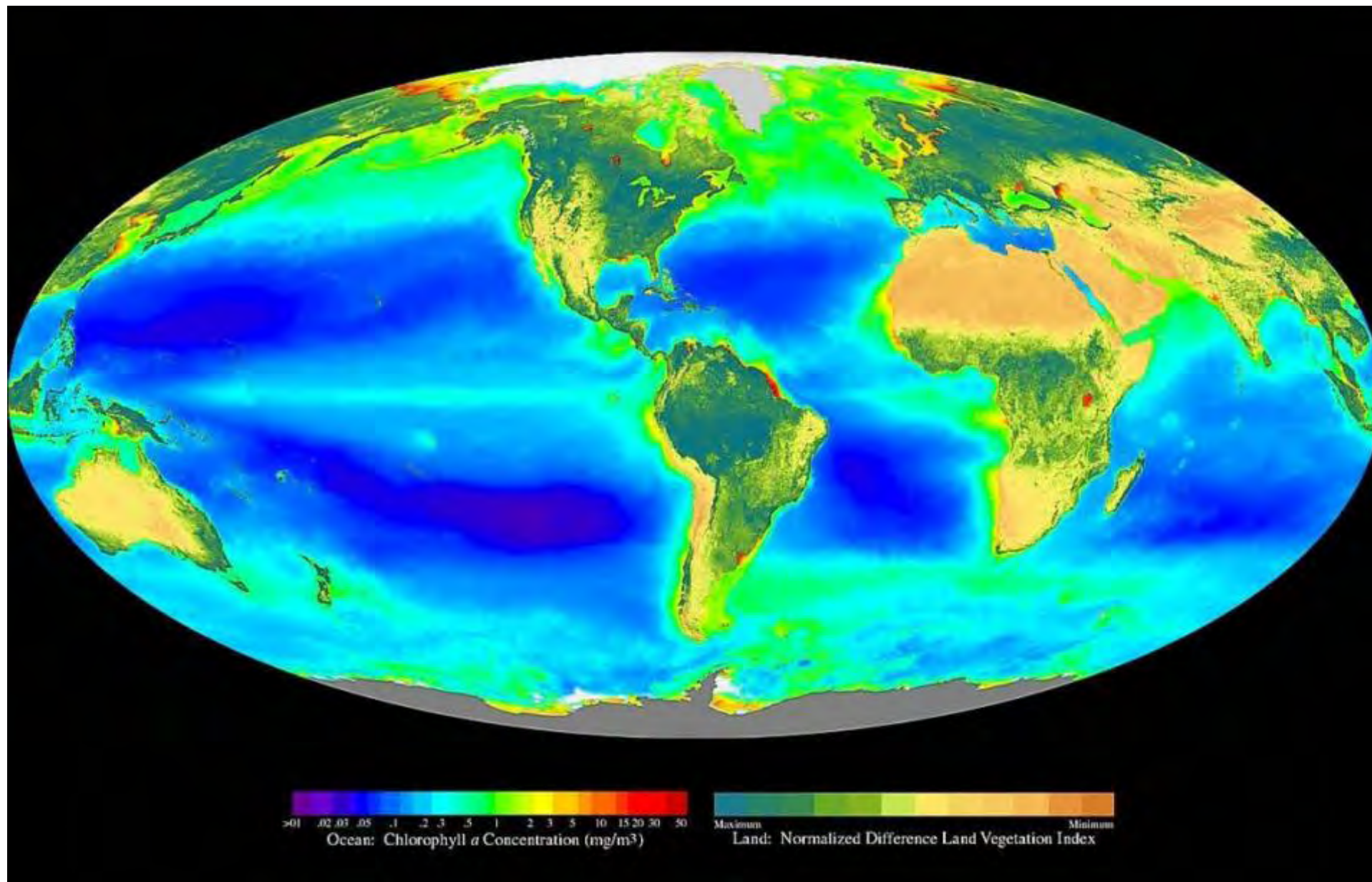
C H O N P ... Fe ... Mg ... Si ... etc.

106 CO<sub>2</sub> + 90 H<sub>2</sub>O + 16 NO<sub>3</sub> + 1 PO<sub>4</sub> + Oligoelementos + 1300 Kcal Luz

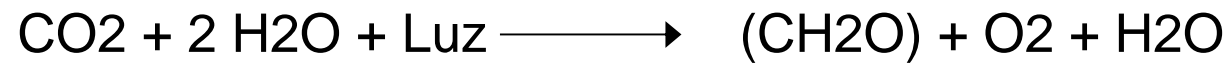


**25 g Chl**

1287 Kcal Calor + 150 O<sub>2</sub> + 3,4 Kg Biomasa



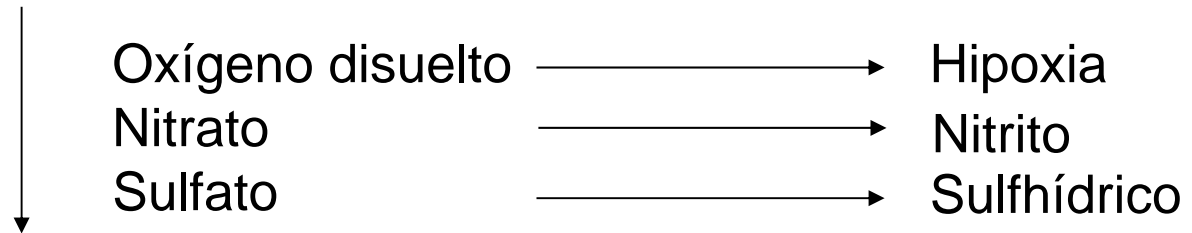
## Fotosíntesis



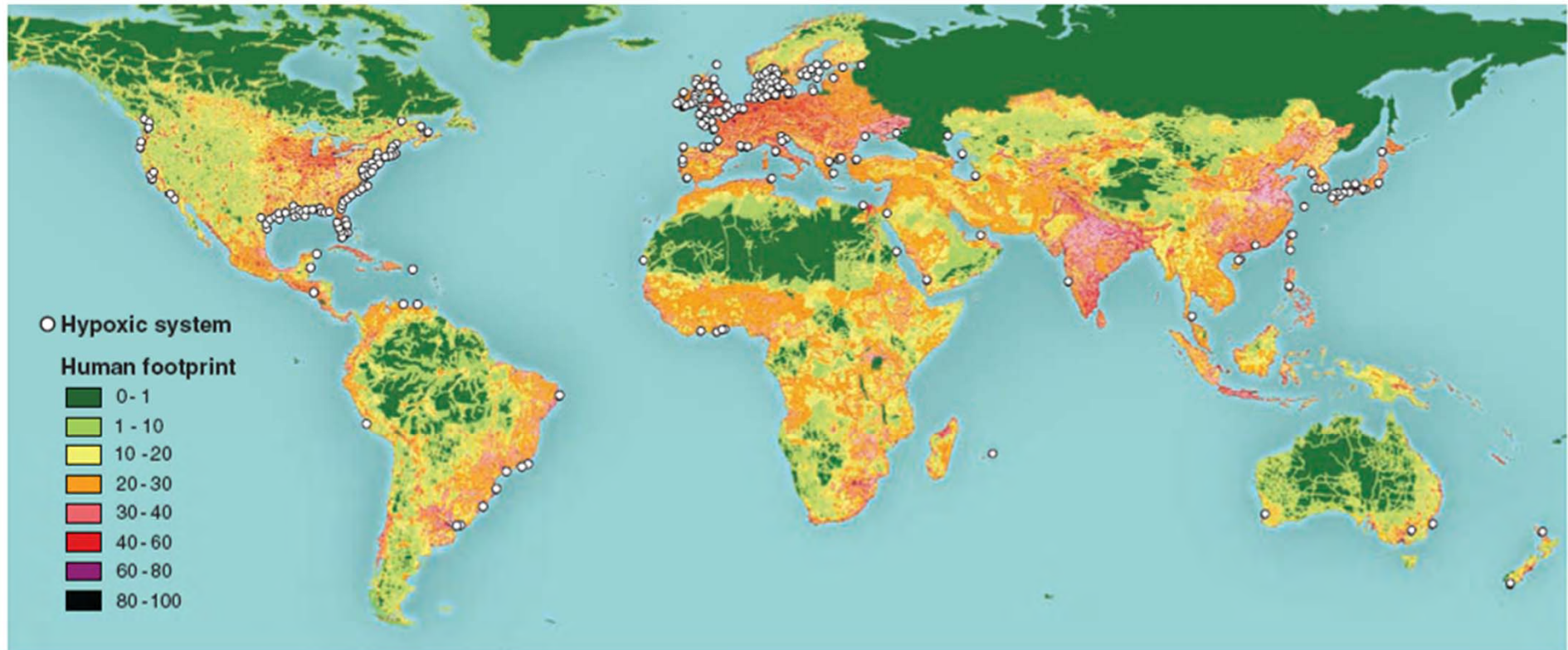
## Respiración



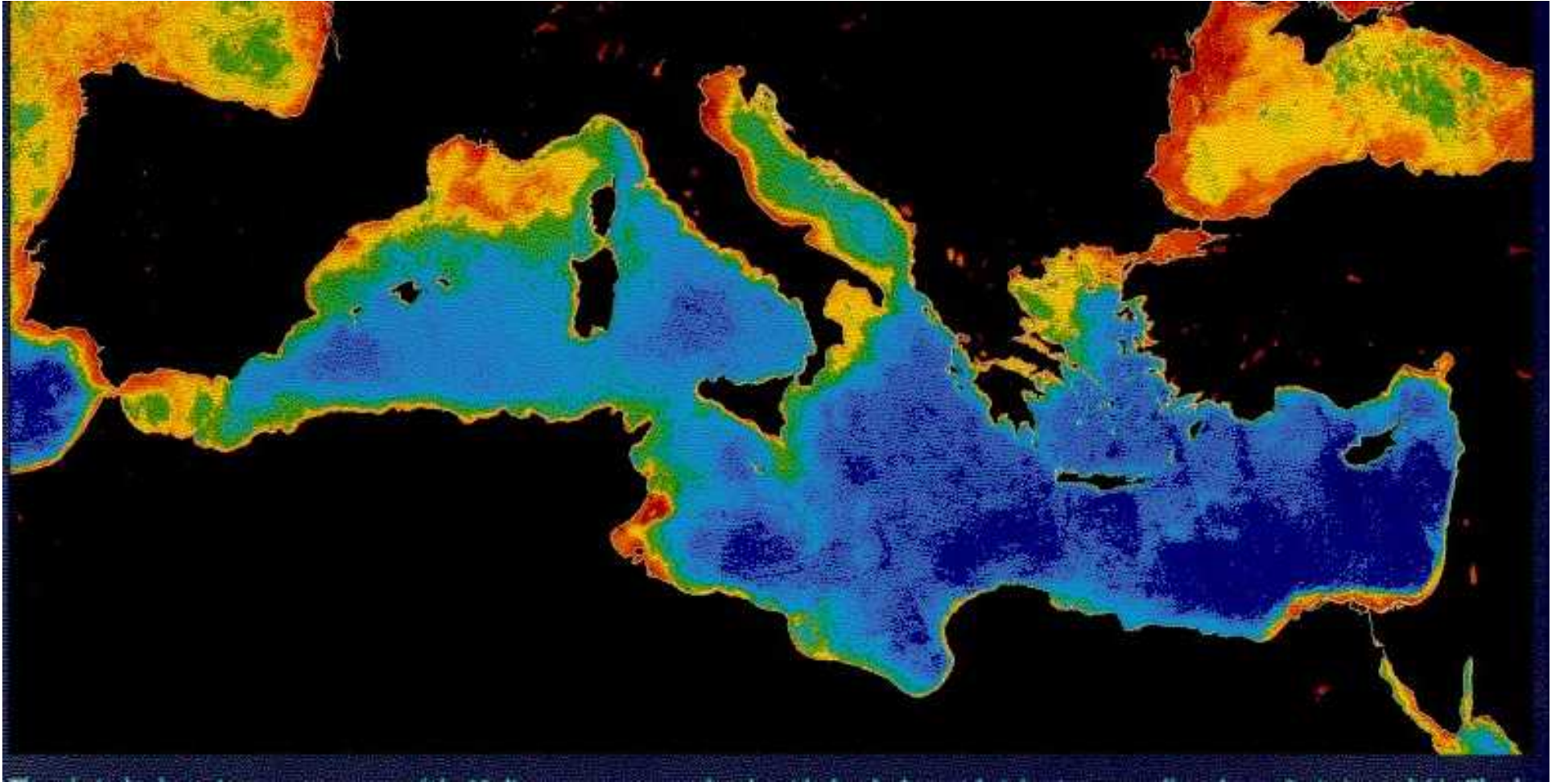
## Fuentes de oxígeno



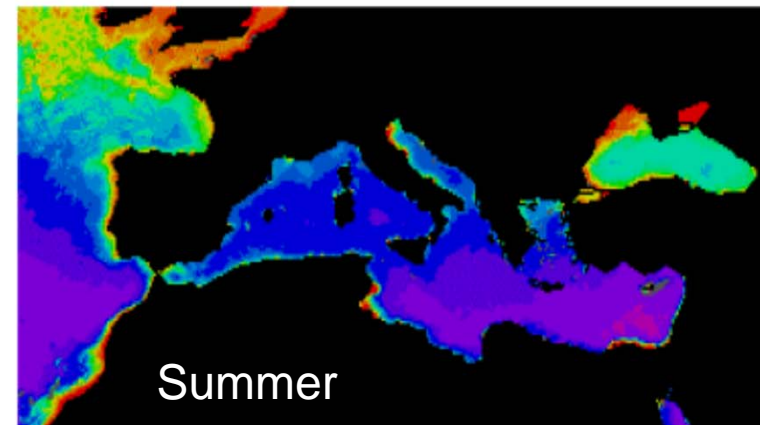
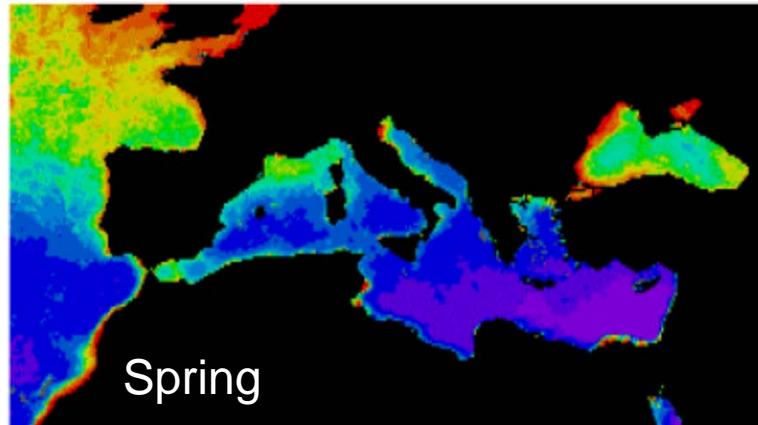
# Antropización y condiciones de hipoxia



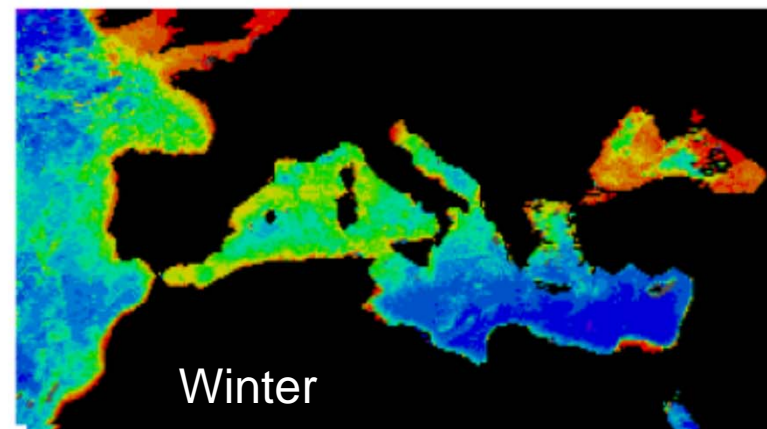
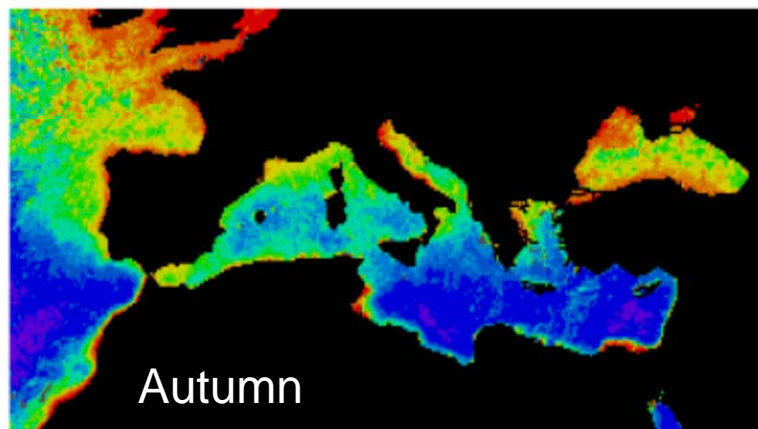
Distribución global de  
400 “zonas muertas”  
por eutrofización



# Temporal variability Coastal Zone Color Scanner NIMBUS-7, 1979-1986



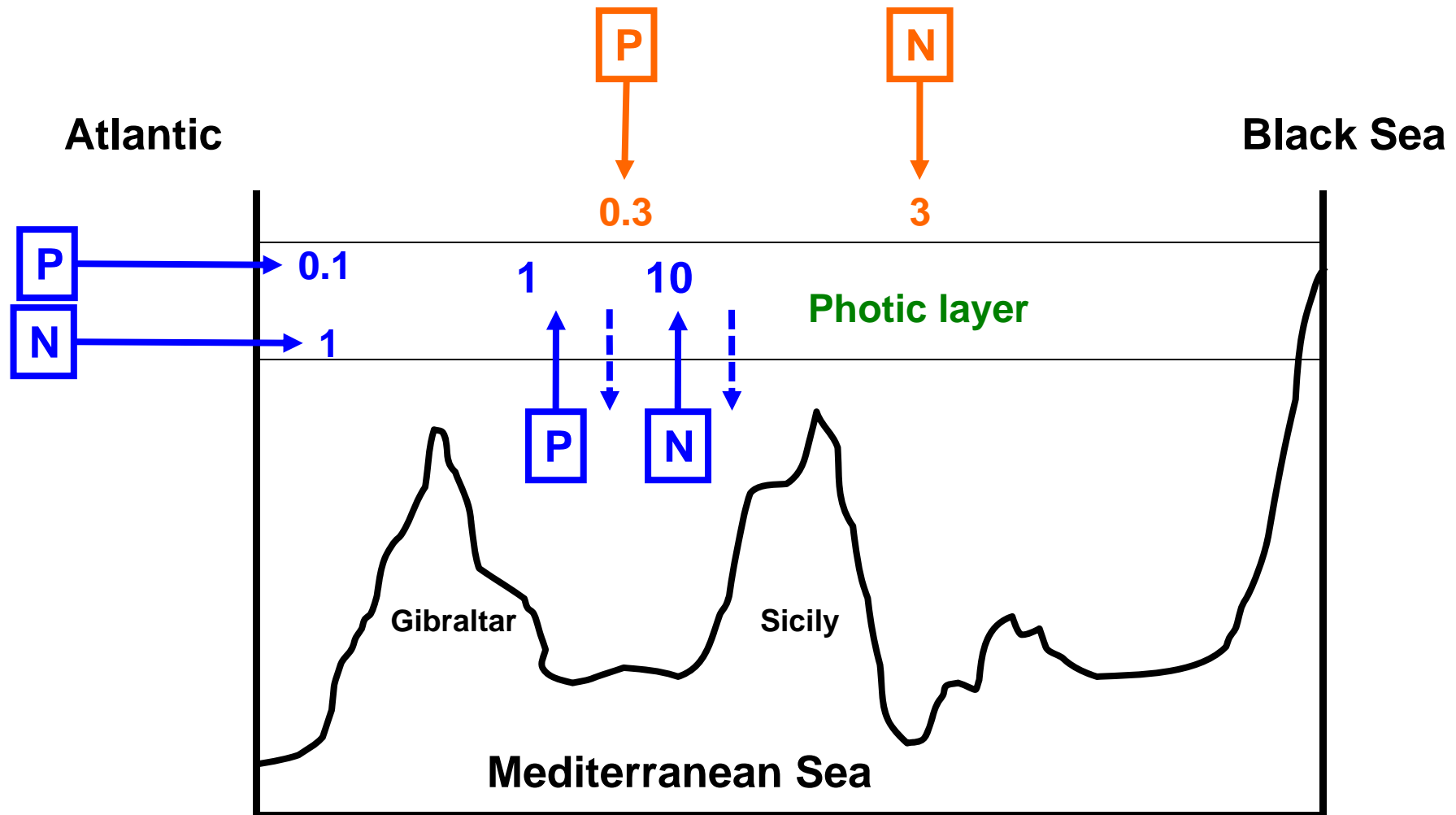
development of an upper mixed layer by summer solar heating



convective processes caused by winter cooling and strong winds

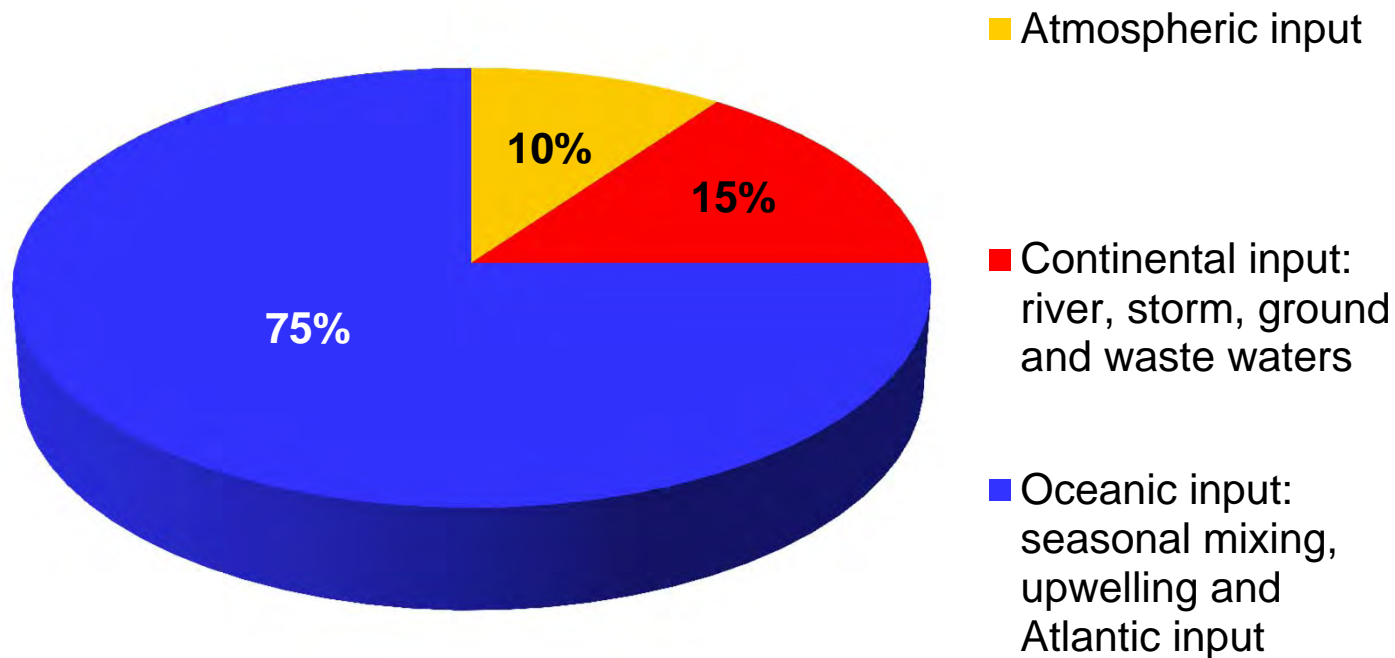


# Nutrient supply in the photic zone



Flow ( $\text{Tm} \times 10^6 \times \text{Year}^{-1}$ )

# Percentual nutrient supply in the photic zone of the Mediterranean Sea



# Coastal waters

# Oceanic waters

Extension

≈ 3%

≈ 97%

Inputs

≈ 15%  
(mainly continental)

≈ 85%  
(mainly oceanic and atmospheric)

**RATIO**

**x5**

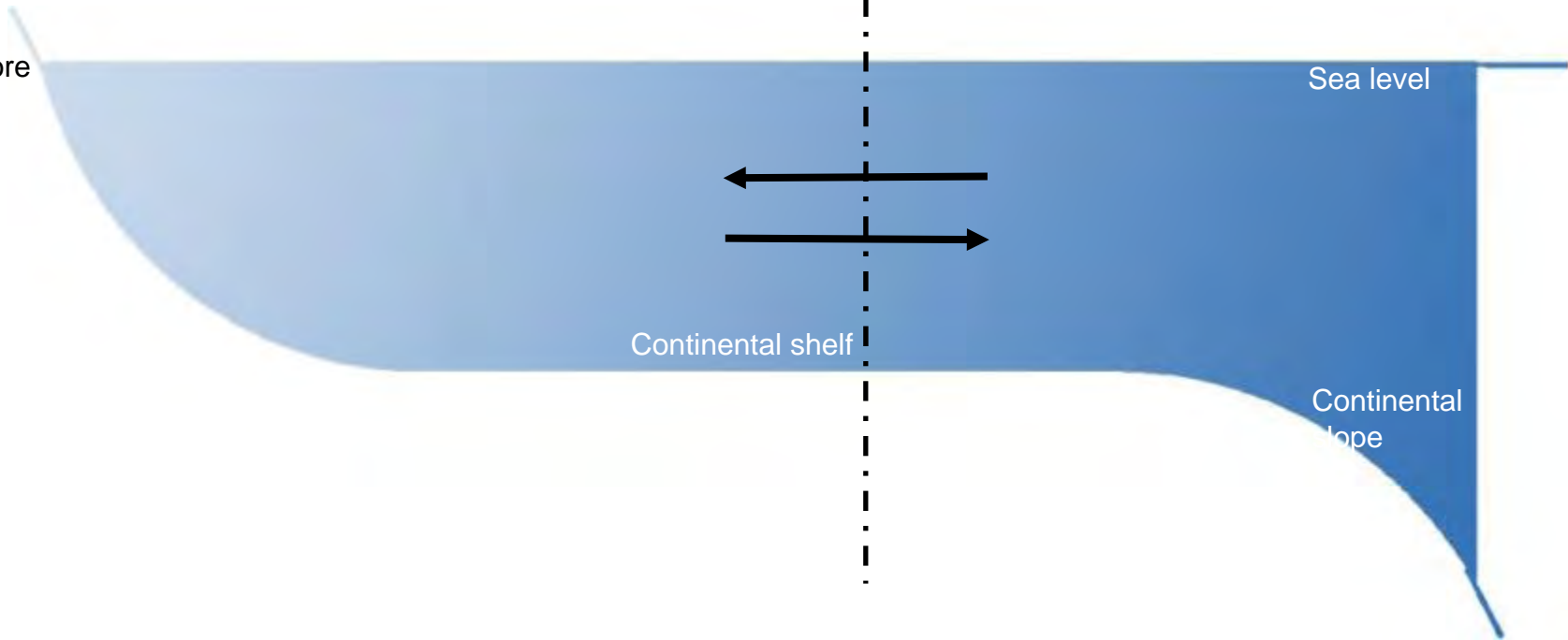
**x1**

Shore

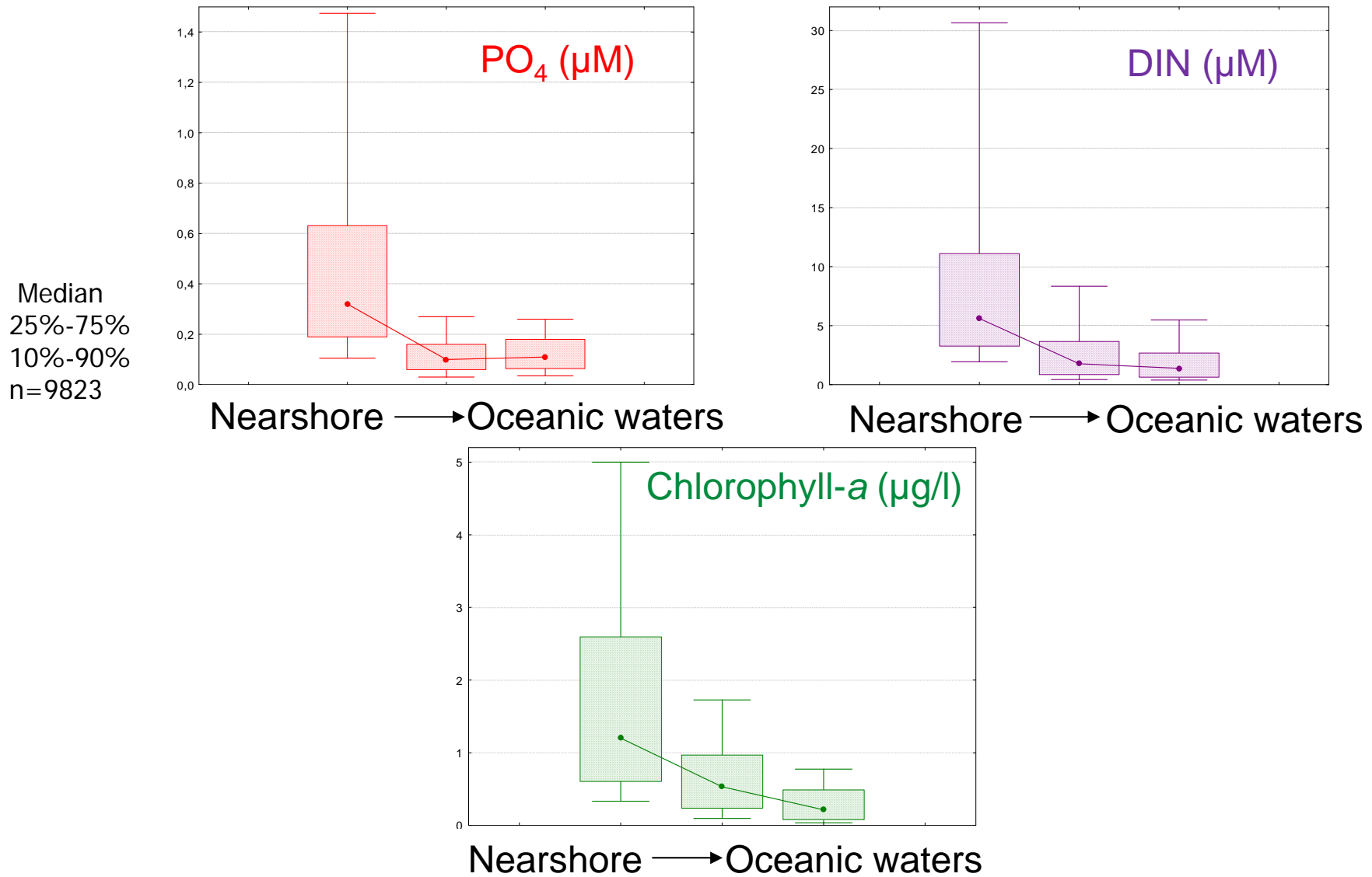
Sea level

Continental shelf

Continental  
slope

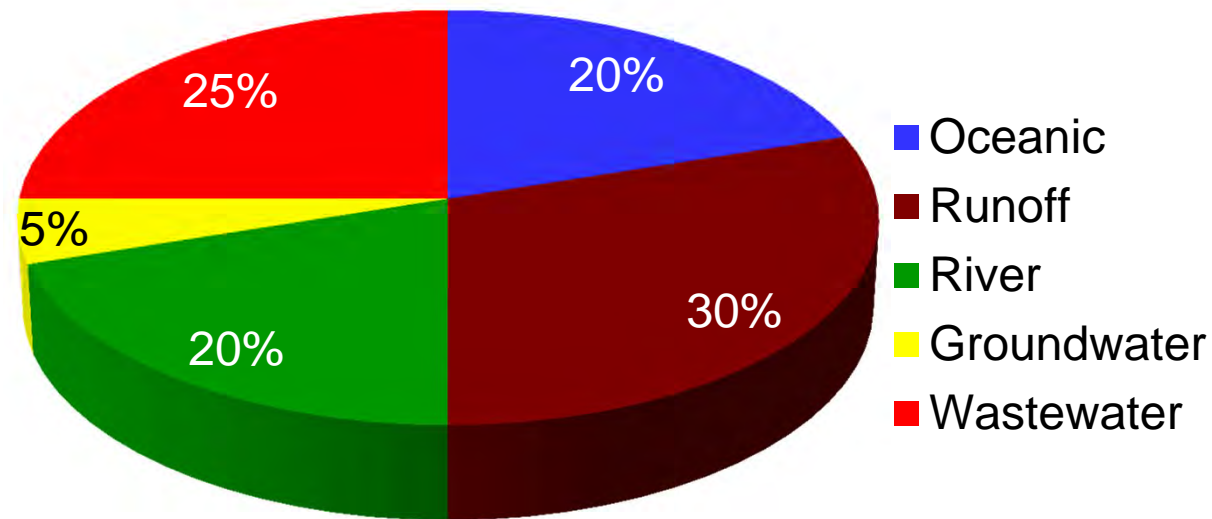


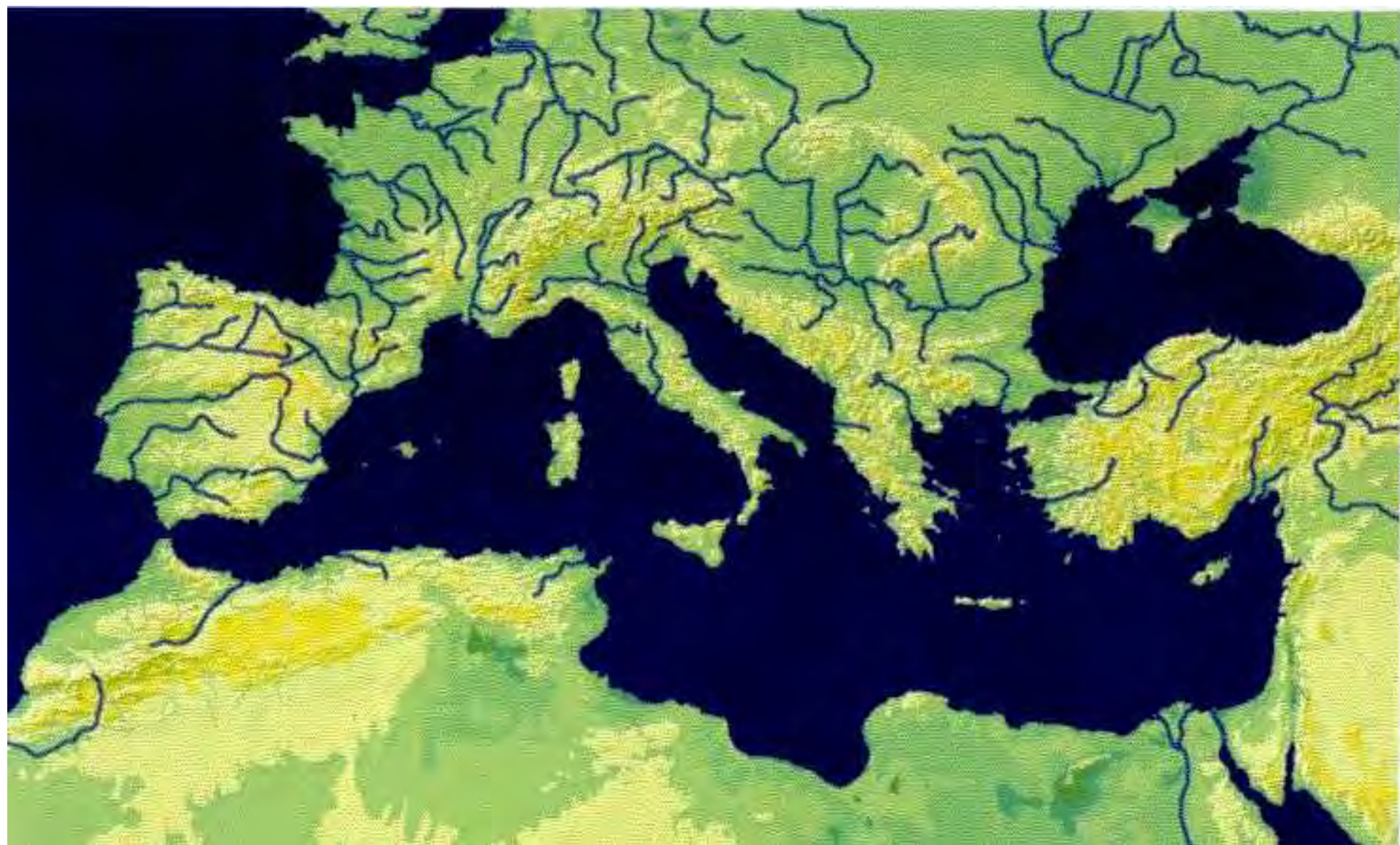
# Nearshore – offshore gradient Catalan Coast



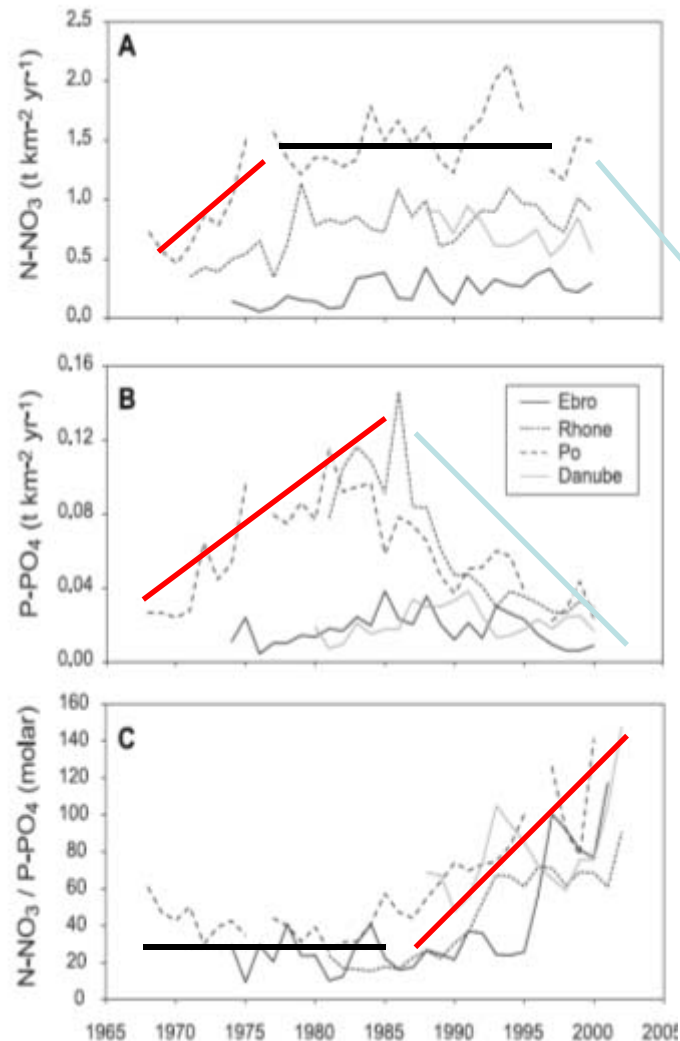
Flo E, Garcés E, Manzanera M, Camp J (2011) Coastal inshore waters in the NW Mediterranean: physicochemical and biological characterization and management implications. *Estuar Coast Shelf Sci* 93:279–289

# Percentual nutrient supply in the coastal zone





# Tendency of the nutrient inputs in the Mediterranean Sea



Mediterranean rivers suffer from a significant reduction in freshwater discharge (20 %, 1960- 2000)

A similar decrease has been observed for the fluxes of dissolved silica but ....what are the dynamics in the fluxes of N and P?

Sensors OLS of DMSP

NOAA 1994 - 1995











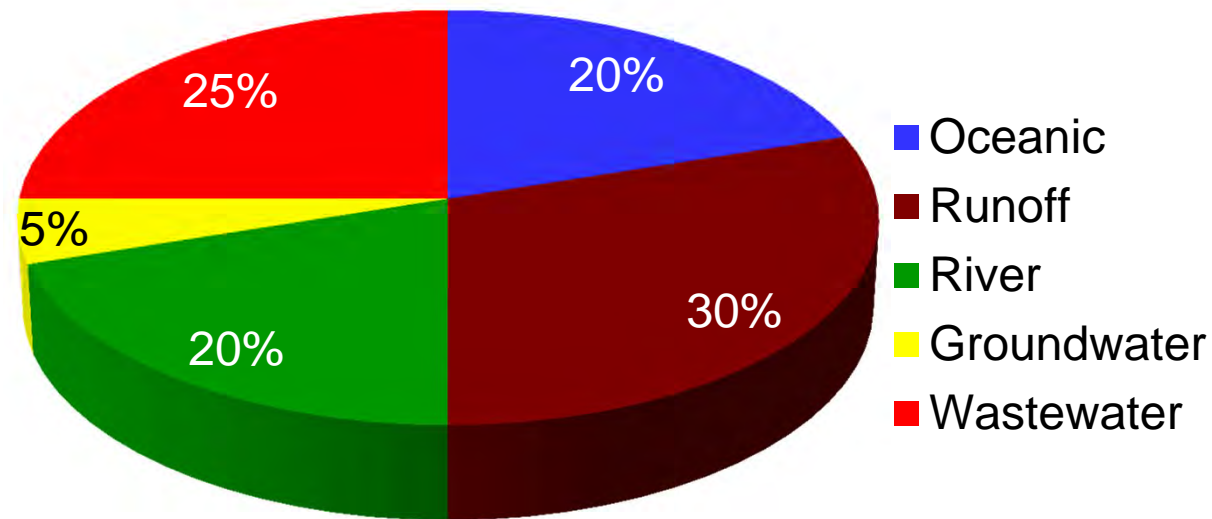
# COMPOSITION AND MASS LOADING RATES FOR STORMWATERS

Table 18-7 Composition and Mass Loading Rates for Stormwaters

Constituent	Urban Runoff		Industrial Runoff		Residential/Commercial Runoff		Agricultural		Undeveloped	
	Concentration (mg/L)	Load (kg/ha/yr)	Concentration (mg/L)	Load (kg/ha/yr)	Concentration (mg/L)	Load (kg/ha/yr)	Concentration (mg/L)	Load (kg/ha/yr)	Concentration (mg/L)	Load (kg/ha/yr)
BOD <sub>5</sub>	20 (7-56)	90	9.6	34-98	3.6-20	31.59-135.2	3.8	11.59	1.45	1.12-2.351
COD	75 (20-275)	—	—	—	—	—	—	—	—	—
TSS	150 (20-2890)	360	93.9	672-954.5	18-140	84.28-797	55.3	24.14	11.1	11.2-18.73
VSS	88 (53-122)	—	—	—	—	—	—	—	—	—
NH <sub>3</sub> -N	0.582	—	—	—	—	—	0.33-0.48	—	—	—
TKN	1.4 (0.57-4.2)	—	—	—	—	—	2.16-2.27	—	—	—
TN	2.0 (0.7-20)	11.2	1.79	7.8-18.06	1.1-2.8	9.144-32.18	2.32	10.61	1.25	0.22-2.804
Ortho-P	0.12	—	0.13	1.321	0.05-0.40	0.568-3.302	0.13-0.227	0.942	0.004	0.008
TP	0.36 (0.02-4.3)	3.4	0.31	2.2-3.151	0.14-0.51	1.412-4.85	0.344	1.362	0.053	0.04-0.120
Copper	0.05 (0.01-0.40)	0.049	—	0.077	—	0.045	—	—	—	0.007
Lead	0.18 (0.01-1.20)	0.174	0.202	0.269-2.053	0.065-0.214	0.157-2.431	—	—	—	0.022
Zinc	0.20 (0.01-2.9)	0.630	0.122	0.98-1.240	0.046-0.170	0.218-1.88	—	—	—	0.081
Chromium	—	0.28	—	0.044	—	0.026	—	—	—	0.003
Cadmium	0.0015	0.16	—	0.024	—	0.013	—	—	—	0.002
Iron	8.7	—	—	—	—	—	—	—	—	—
Mercury	0.00005	0.043	—	0.065	—	0.038	—	—	—	0.006
Nickel	0.022	0.032	—	0.030	—	0.029	—	—	—	0.004
Cyanides	0.0025	—	—	—	—	—	—	—	—	—
Total phenols	0.0137	—	—	—	—	—	—	—	—	—
Oil and grease	2.6	—	—	—	—	—	—	—	—	—

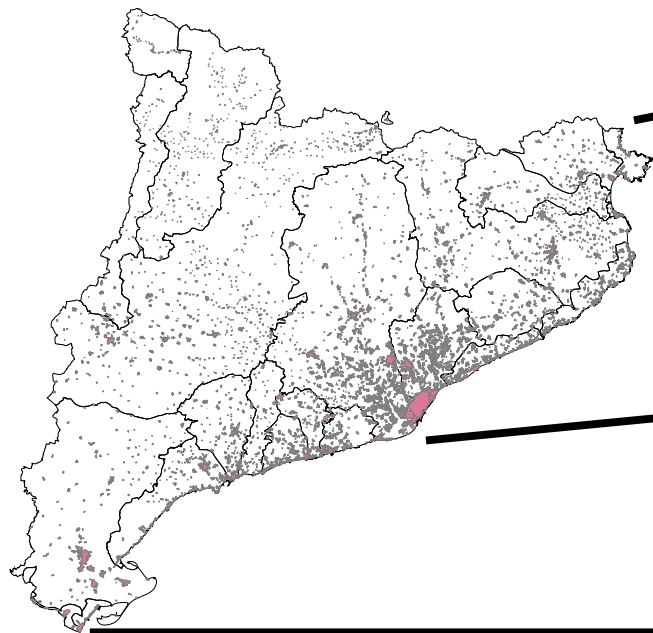
Note: Data from Dames and Moore, 1990; U.S. EPA, 1983d; Marsalek and Schroeter, 1989; Bastian, 1986; Lager et al., 1977; Marsalek, 1990; Driscoll, 1986; Shelley and Gabourv. 1986; and Novotny, 1992.

# Percentual nutrient supply in the coastal zone

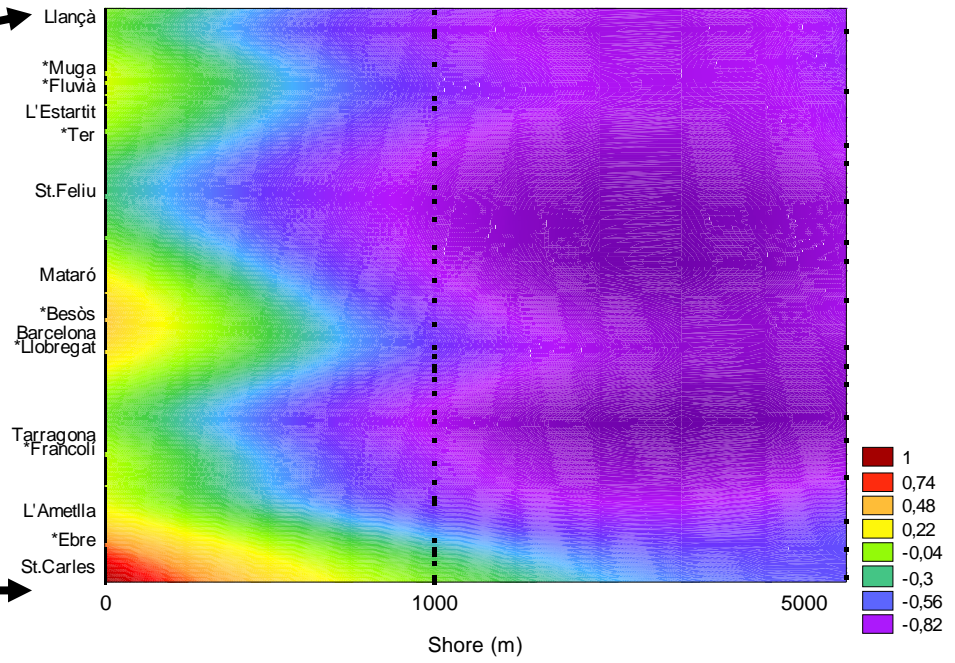


# Nearshore Mediterranean blooms

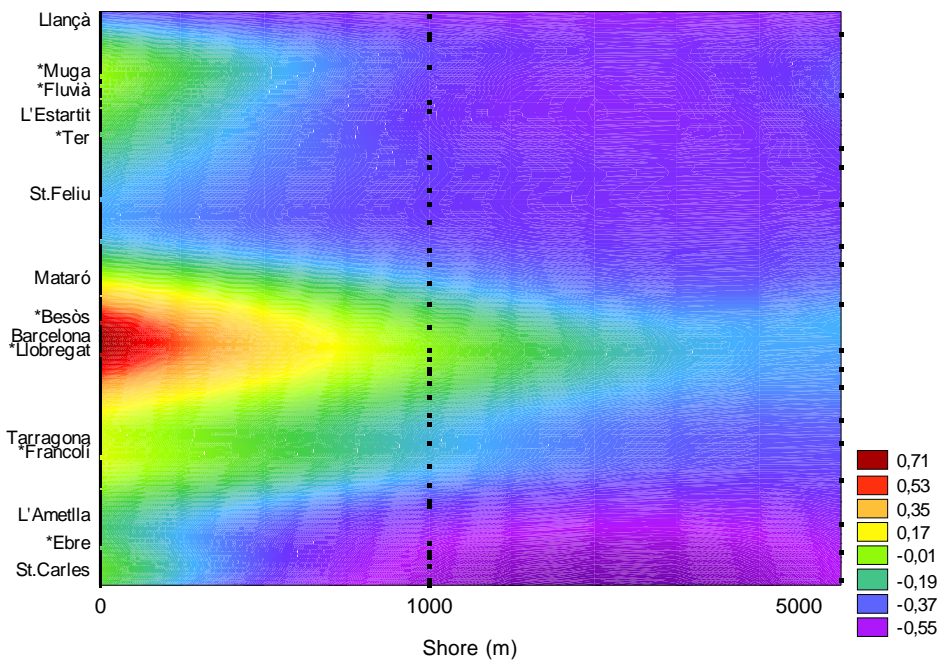




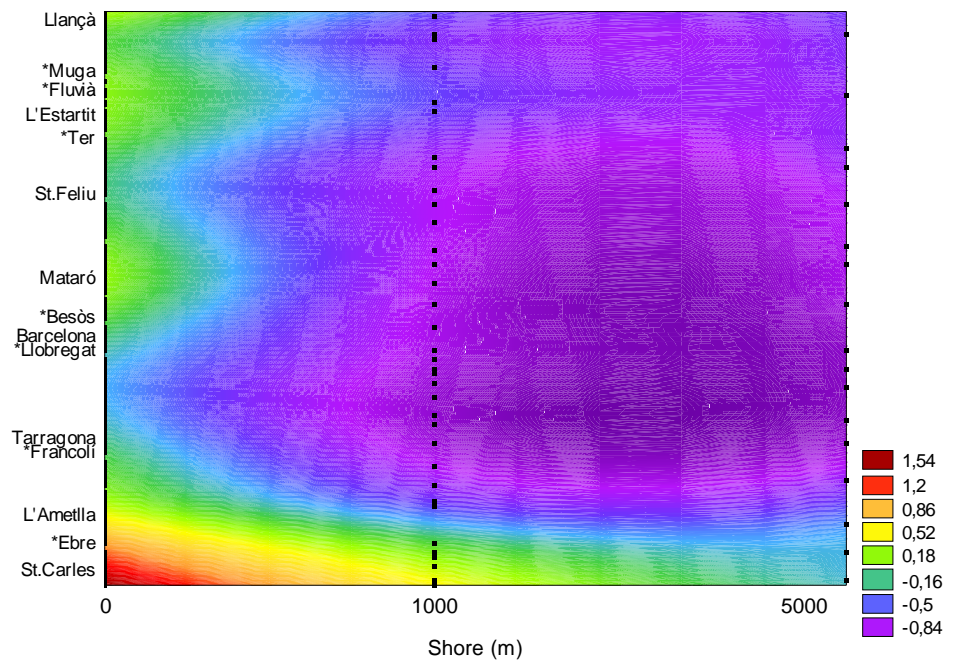
**FACTOR 1 N (-1)**



**FACTOR 1 R**



**FACTOR 2 R**



# Catalan coast as an example: dissolved nutrients and chlorophyll *a*



**N**

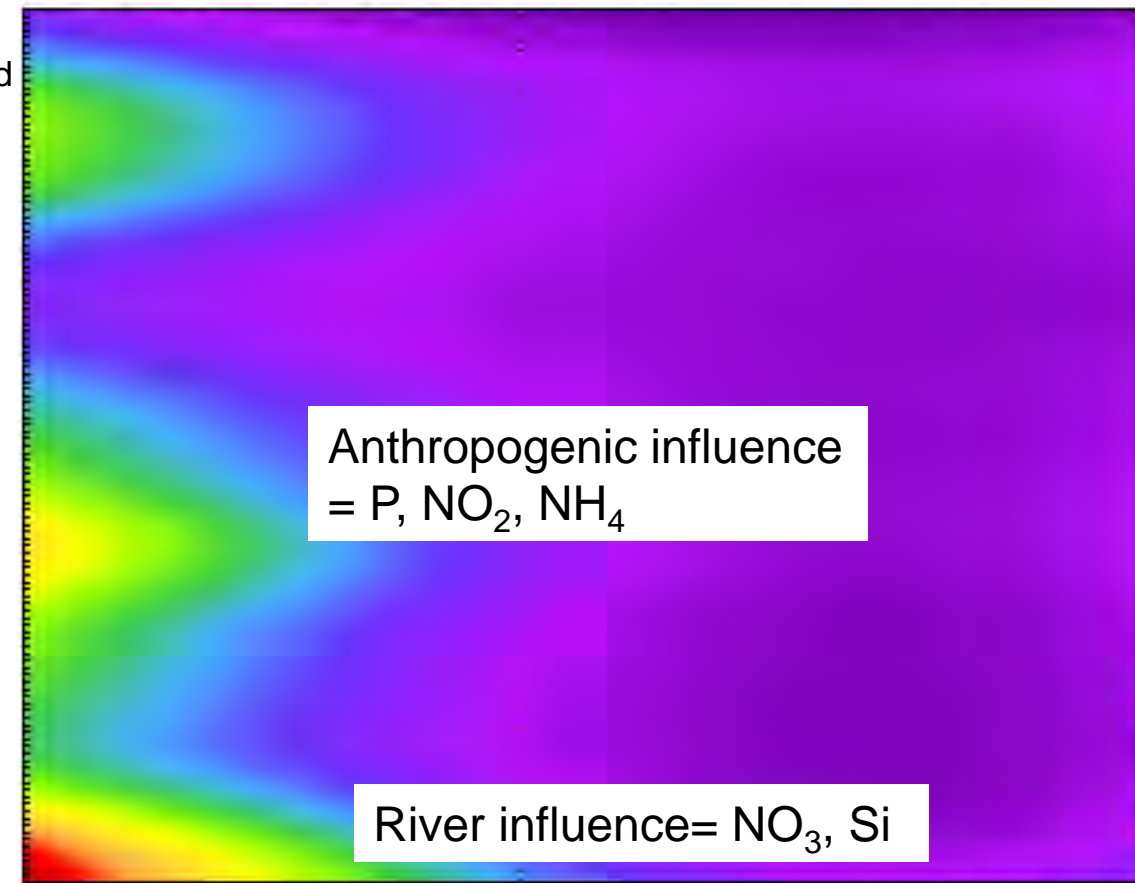
Fluvià, Muga and Ter Rivers



Barcelona



Ebre River



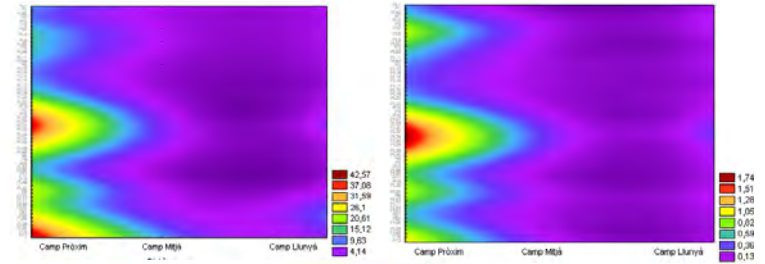
Inshore



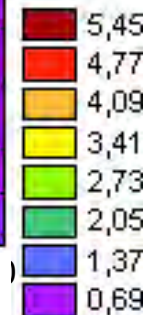
Nearshore



Offshore

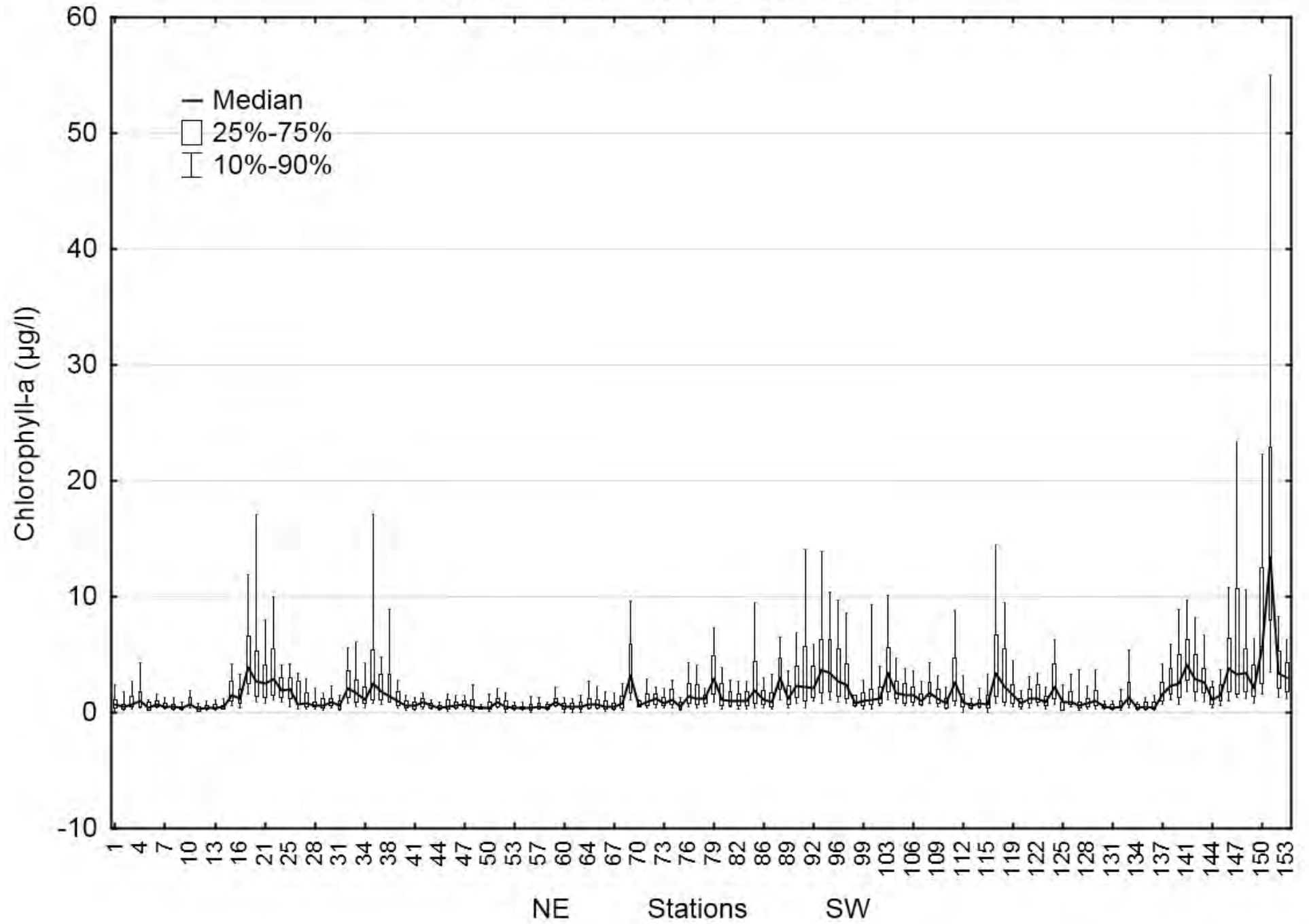


**Chl-*a* ( $\mu\text{g} \cdot \text{L}^{-1}$ )**

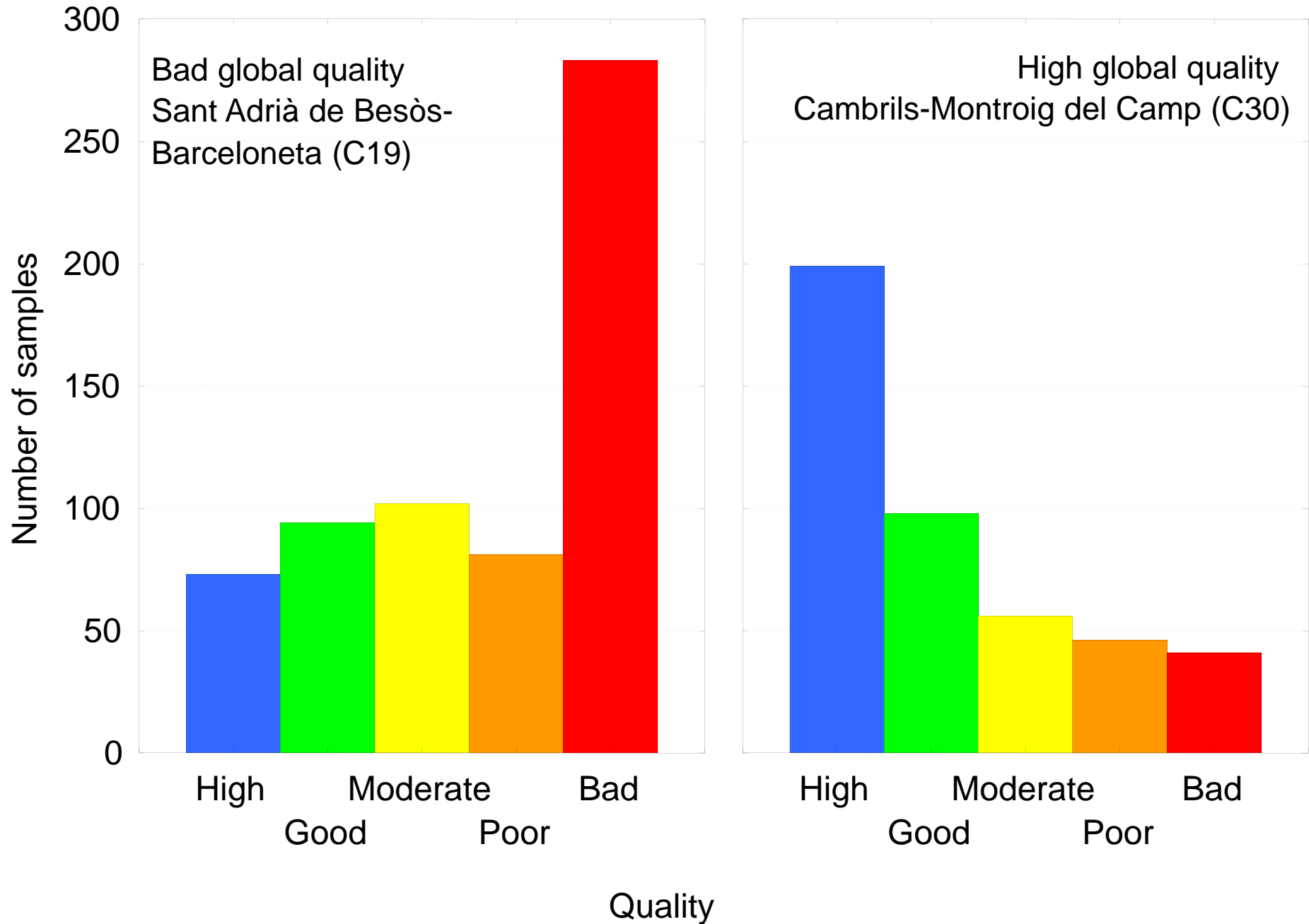




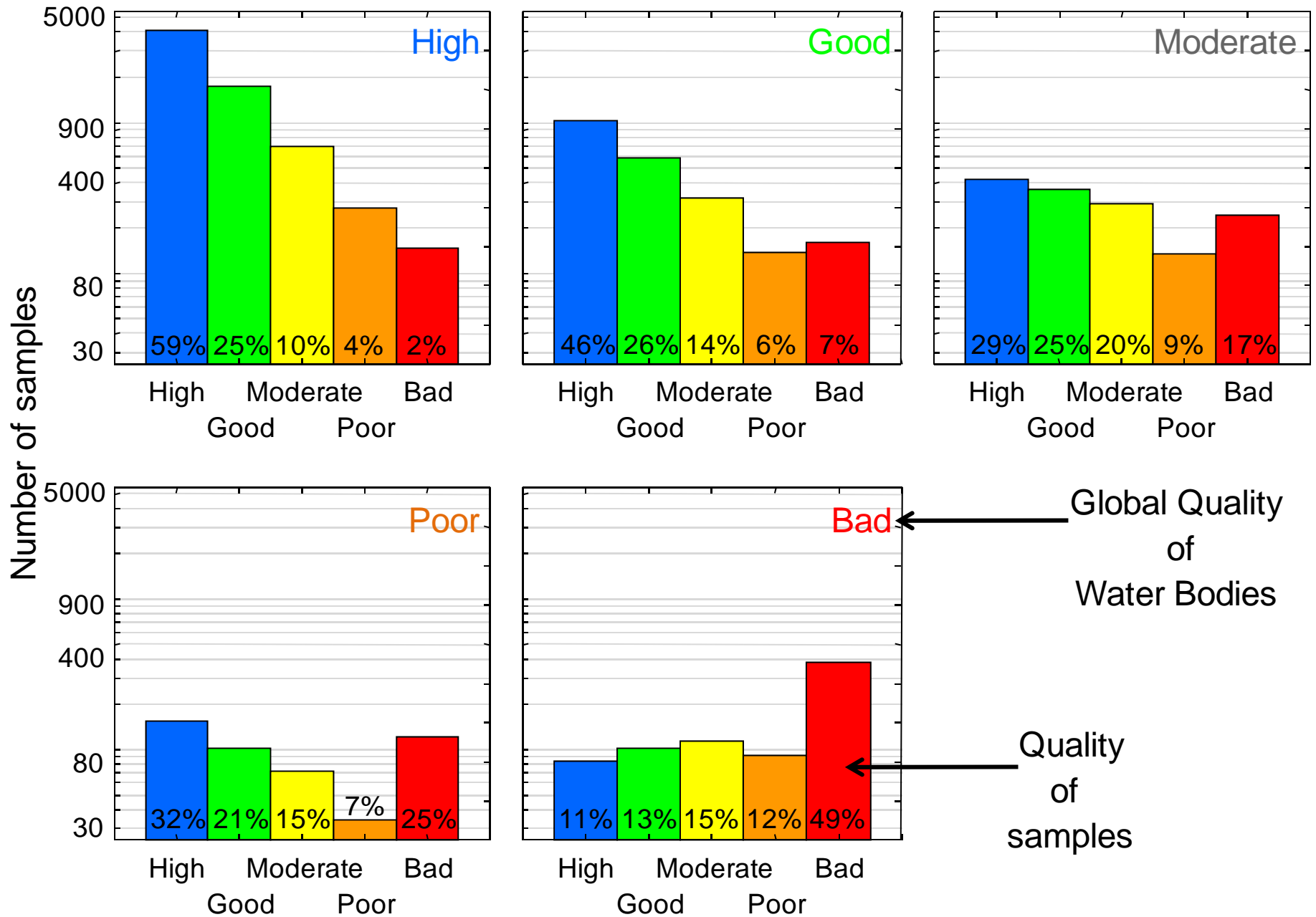
# Coastal Inshore Waters - 1994-2014



# Catalan Coastal Waters (1994-2014)



# Catalan Coastal Waters (1994-2014)



# LAND USES SIMPLIFIED INDEX (LUSI)

$$\text{LUSI} = (\text{Score urban} + \text{score agricultural} + \text{score industrial} + \text{score riverine})$$

\* Correction number

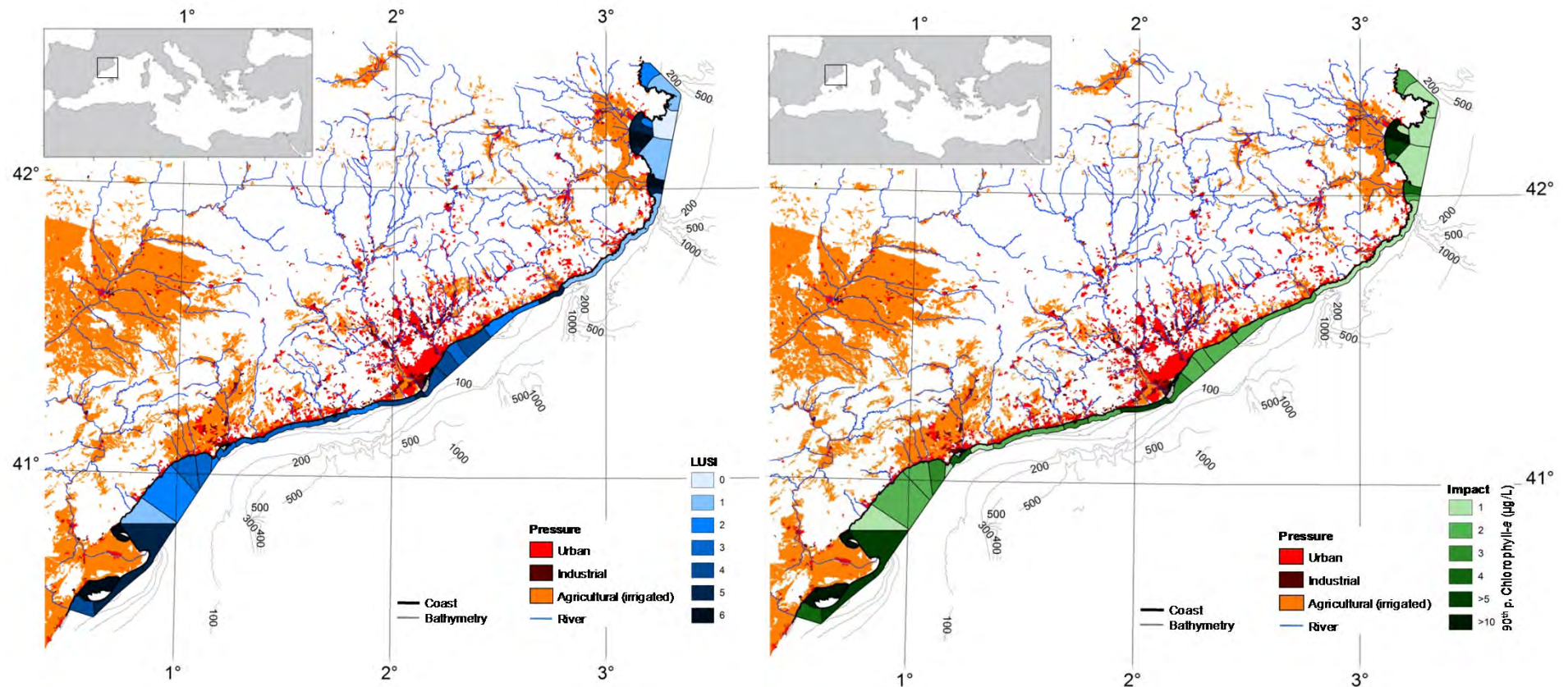
Low LUSI value



High LUSI value

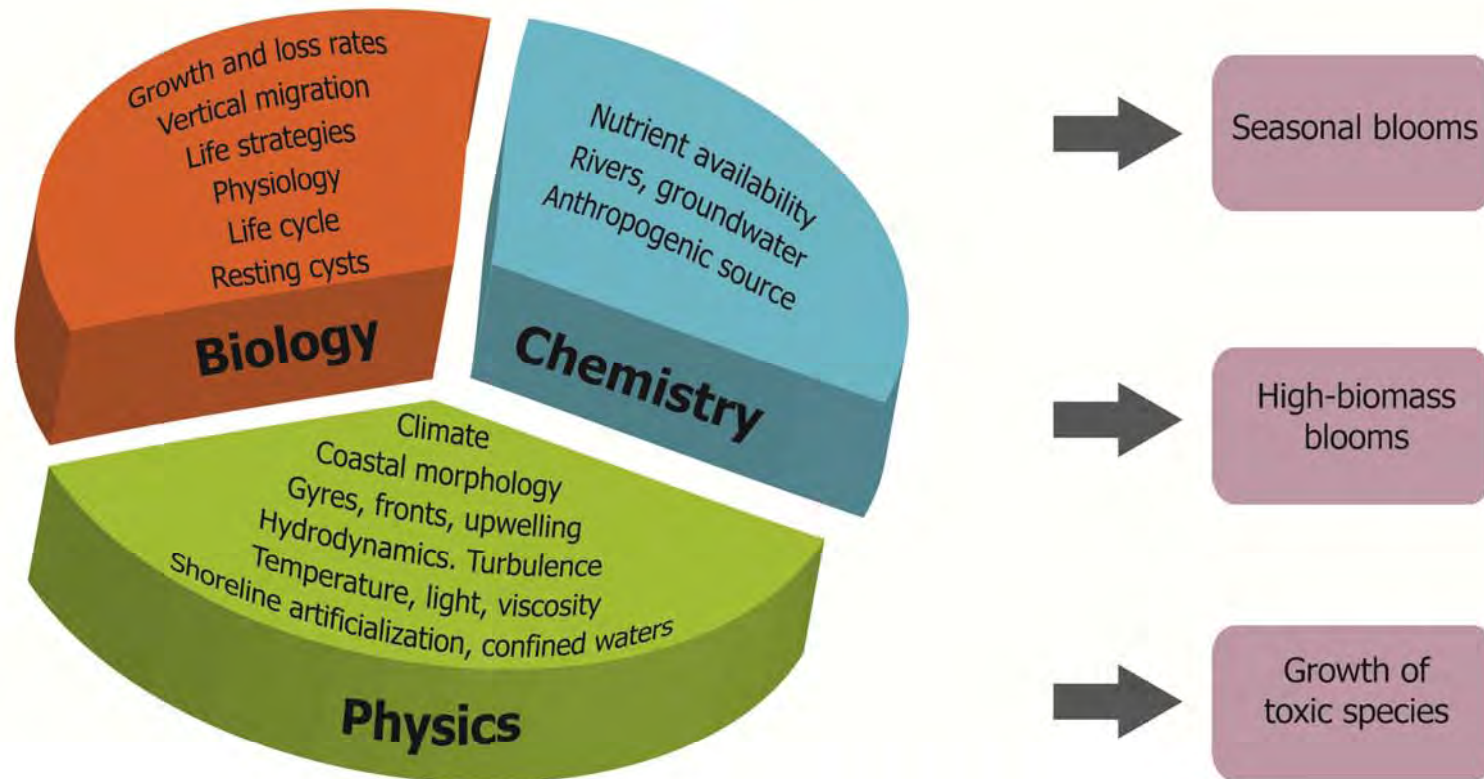


# Pressure-impact relationship: **LUSI** and **Chlorophyll-a ( $\mu\text{g/L}$ )**



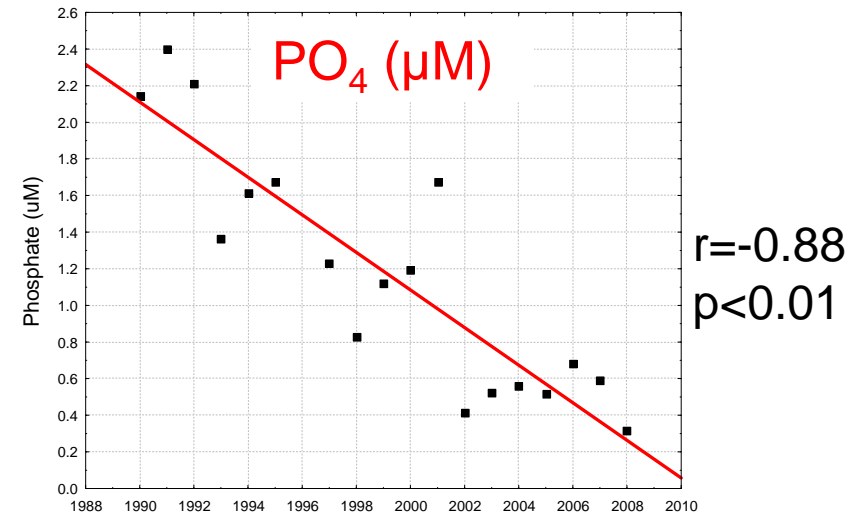
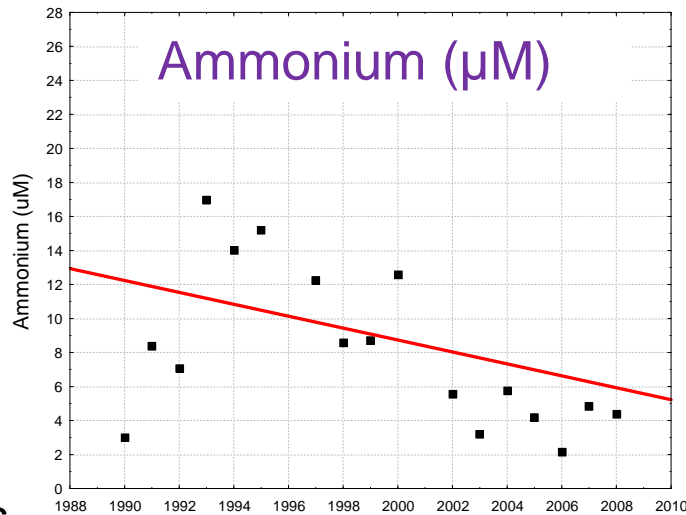
$$\text{CHLA} = 0.11 * \text{LUSI} + 0.21 \quad (R^2 = 0.61 \text{ and } p = 8.18 * 10^{-5})$$

## Conditions for HAB development and persistence

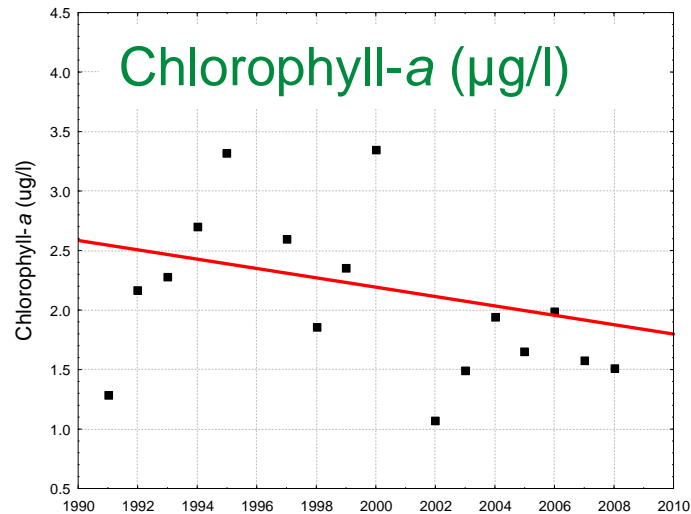
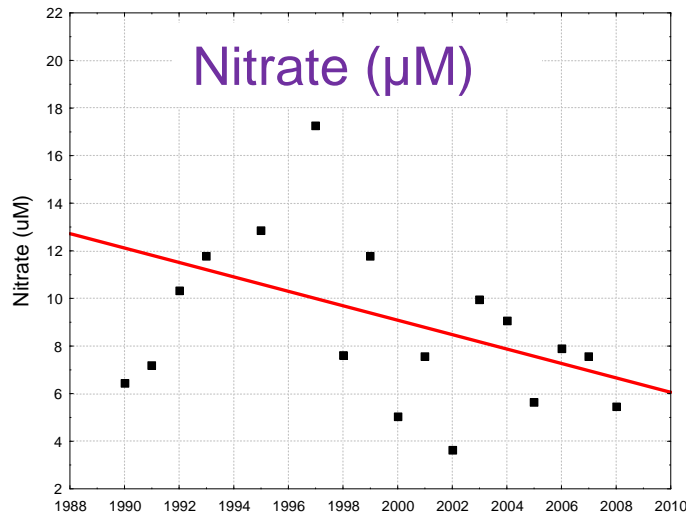


Garcés, E. and J. Camp. 2012. In "Life in the Mediterranean Sea: A look at habitat changes" Noga Stambler editor, Nova Science Publishers, Inc. New York, US, pp. 519-541

# Tendency in the nearshore Catalan Coast 1980-2008



annual Means  
n=9823



# ¿Qué nos preocupa?

