

# The effect of warming ocean on subtropical zooplankton: The case of the Canary Current

Santiago Hernández-León

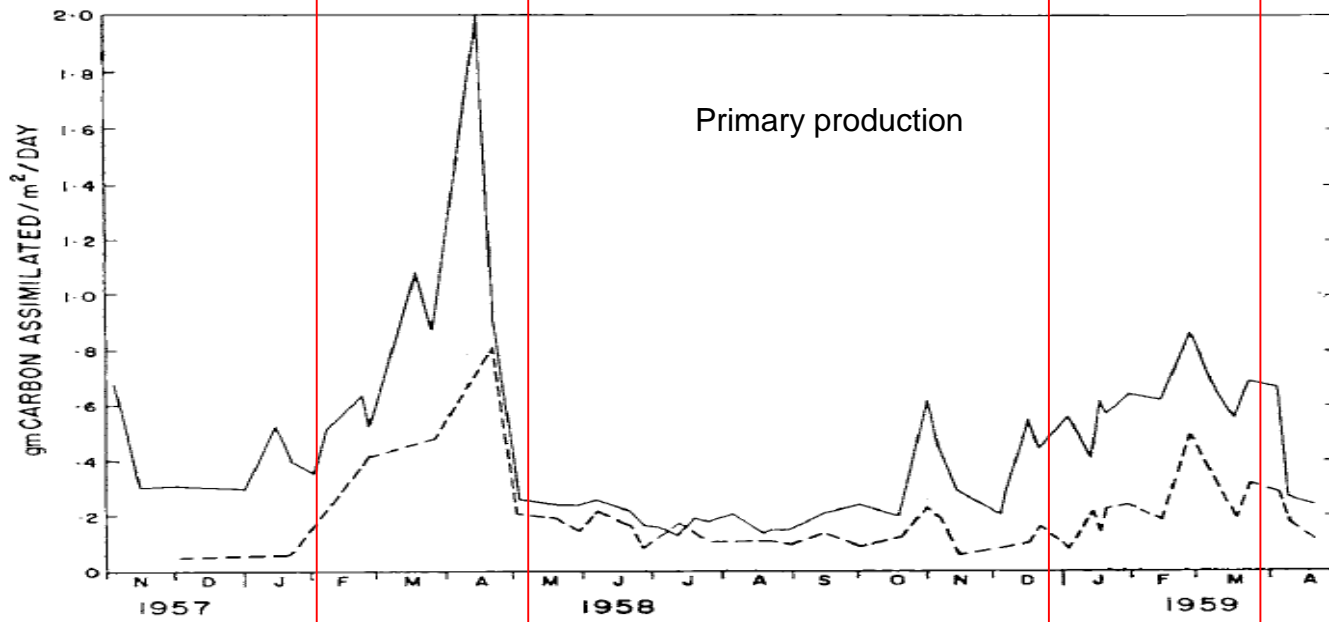
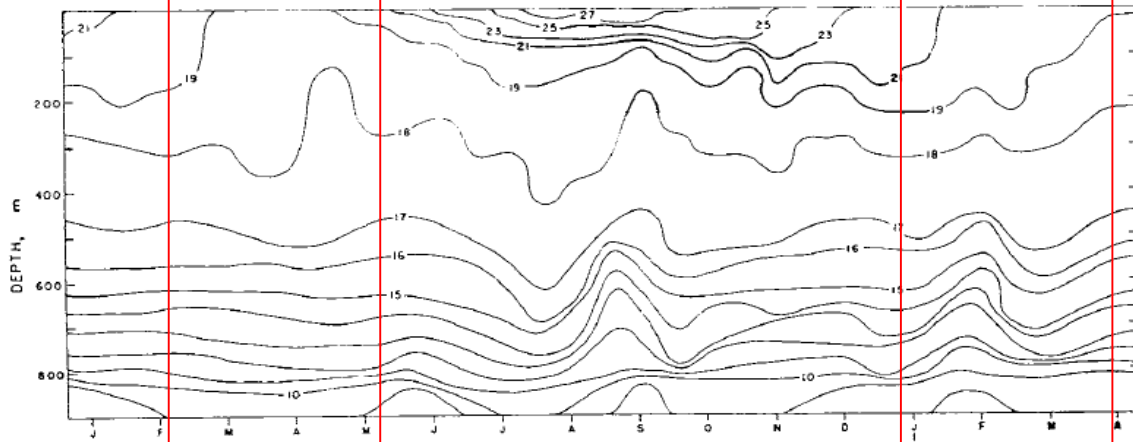
Instituto de Oceanografía y Cambio Global (IOCAG)

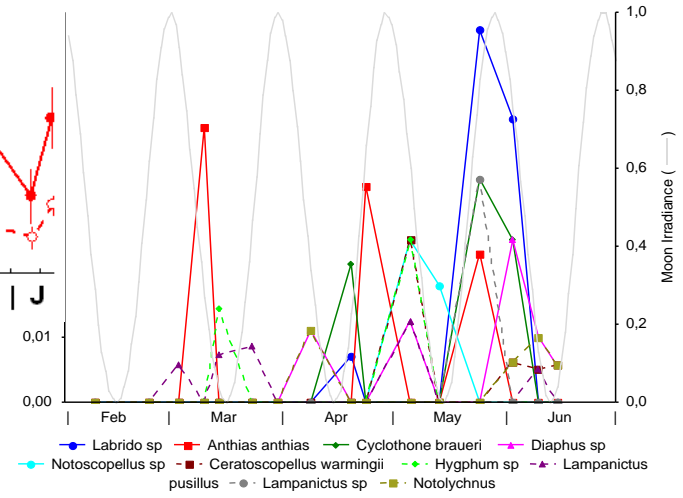
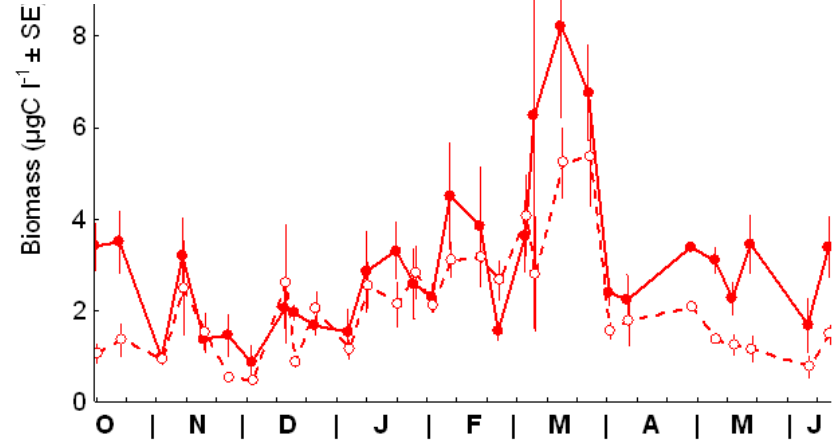
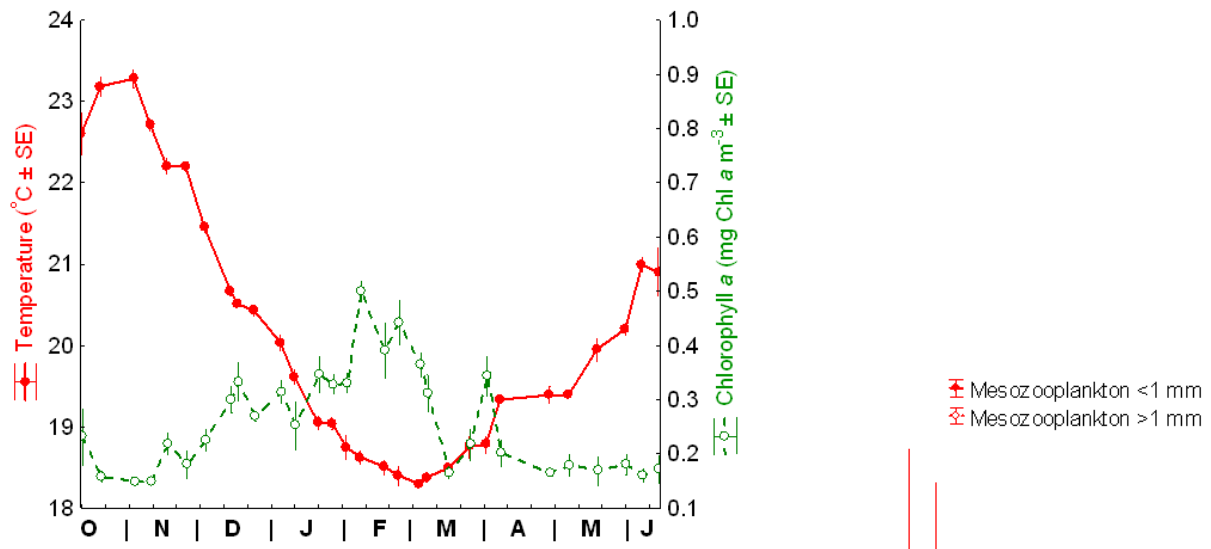
Universidad de Las Palmas de Gran Canaria

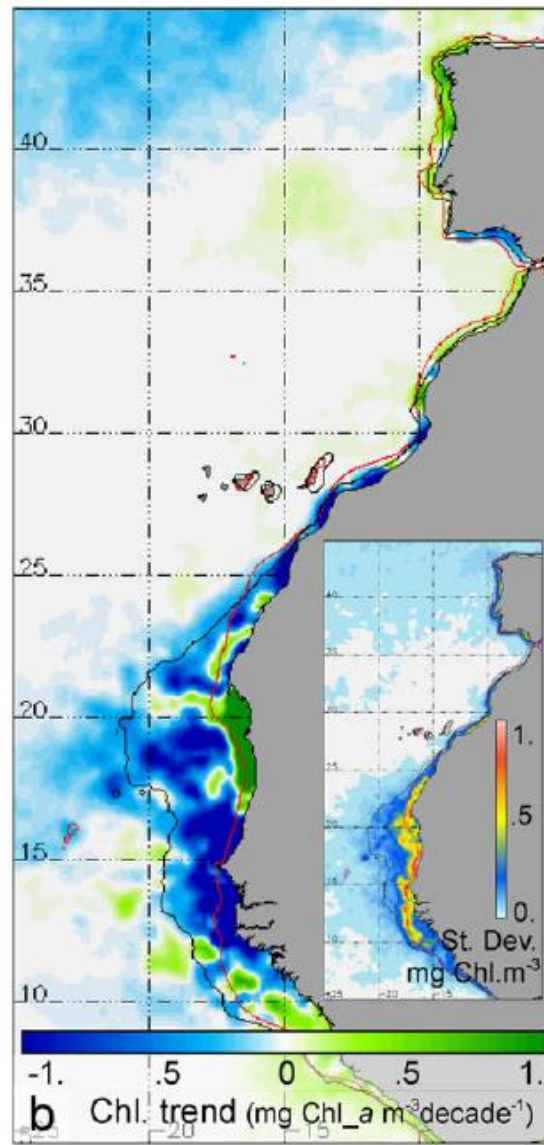
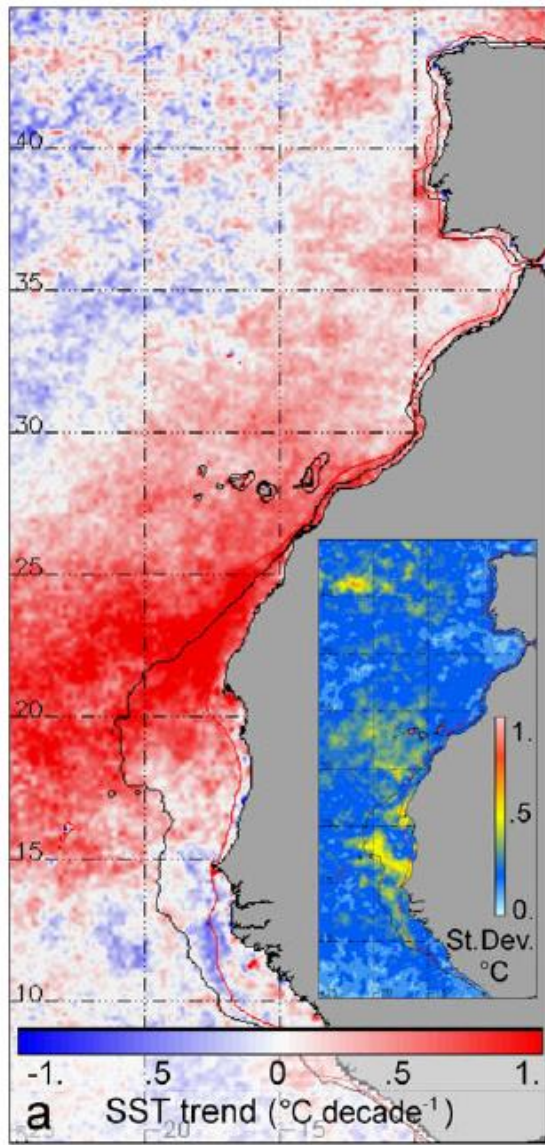
Canary Islands

# Bermuda

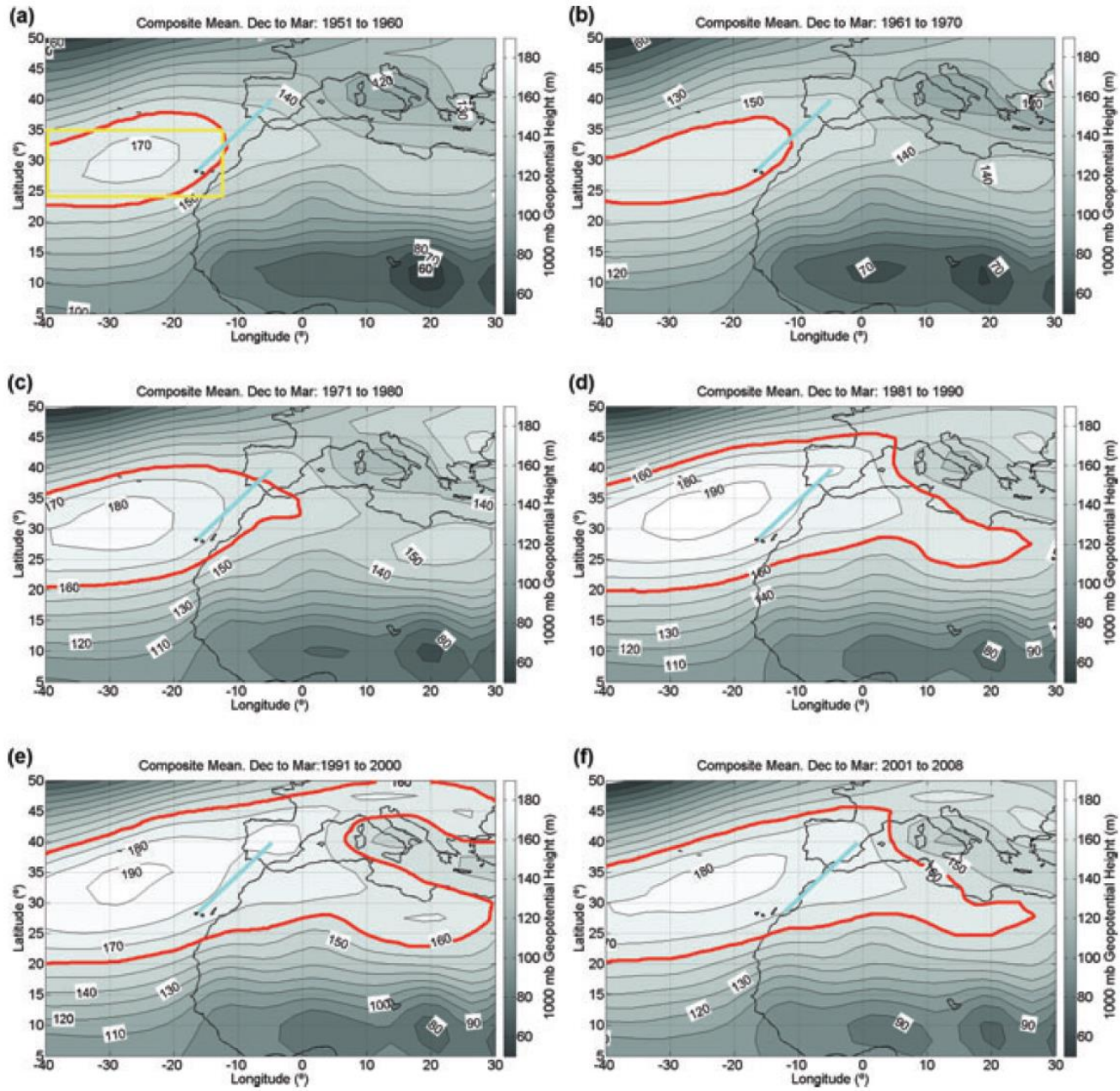
## Temperature



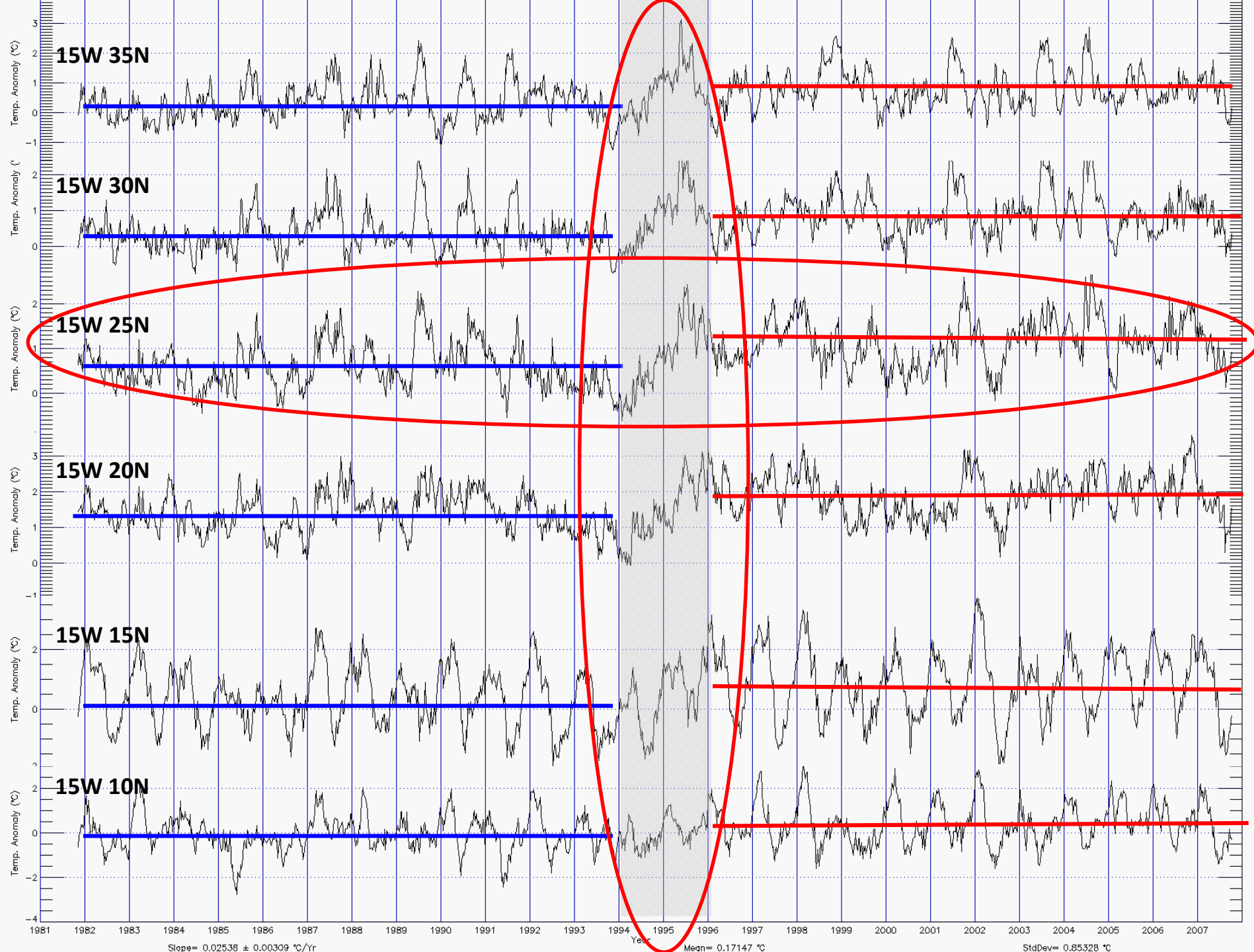




**Arístegui et al. (2009)**



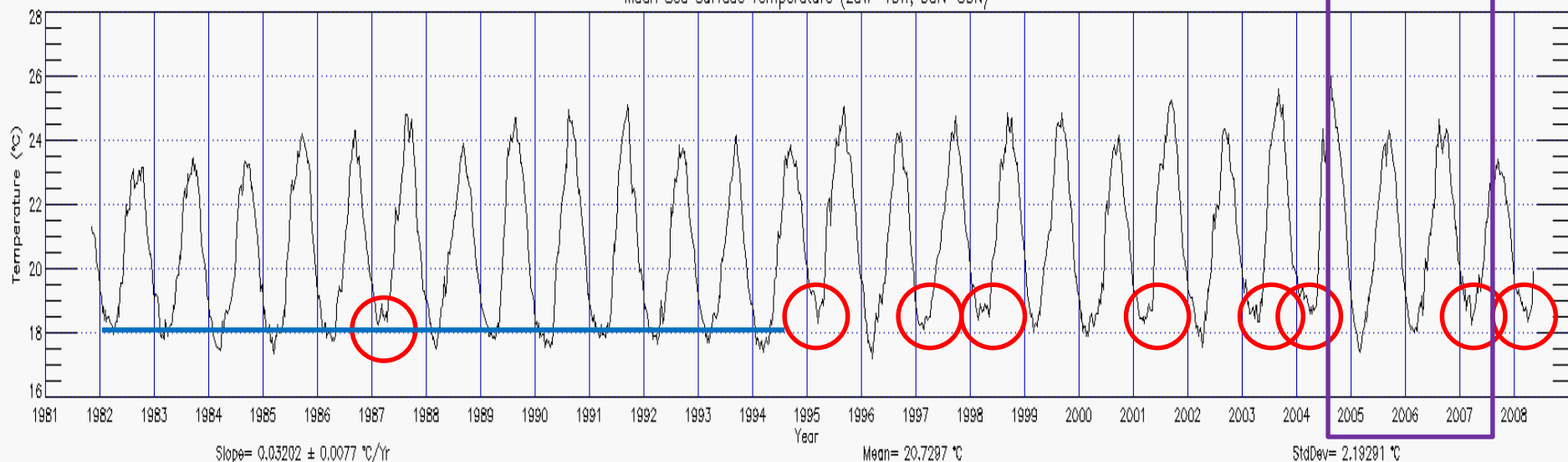




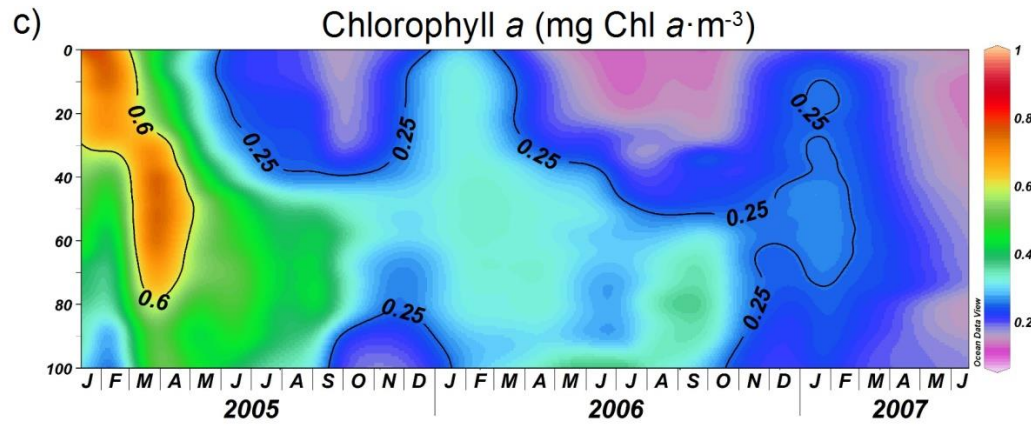
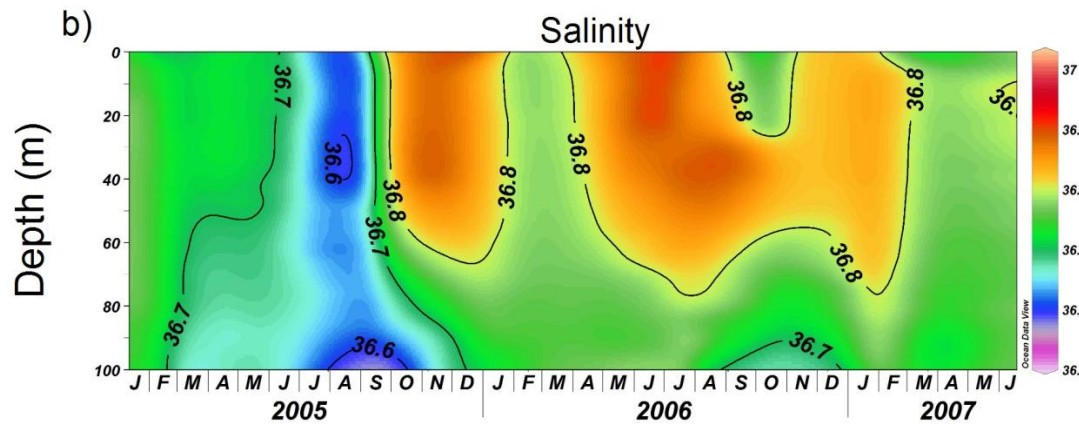
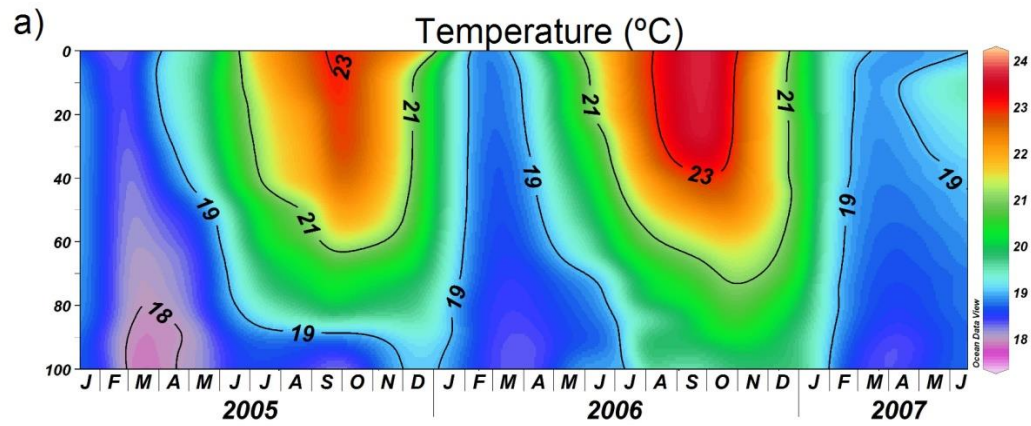
Mean Sea Surface Temp. Anomaly (20W-15W, 25N-30N)

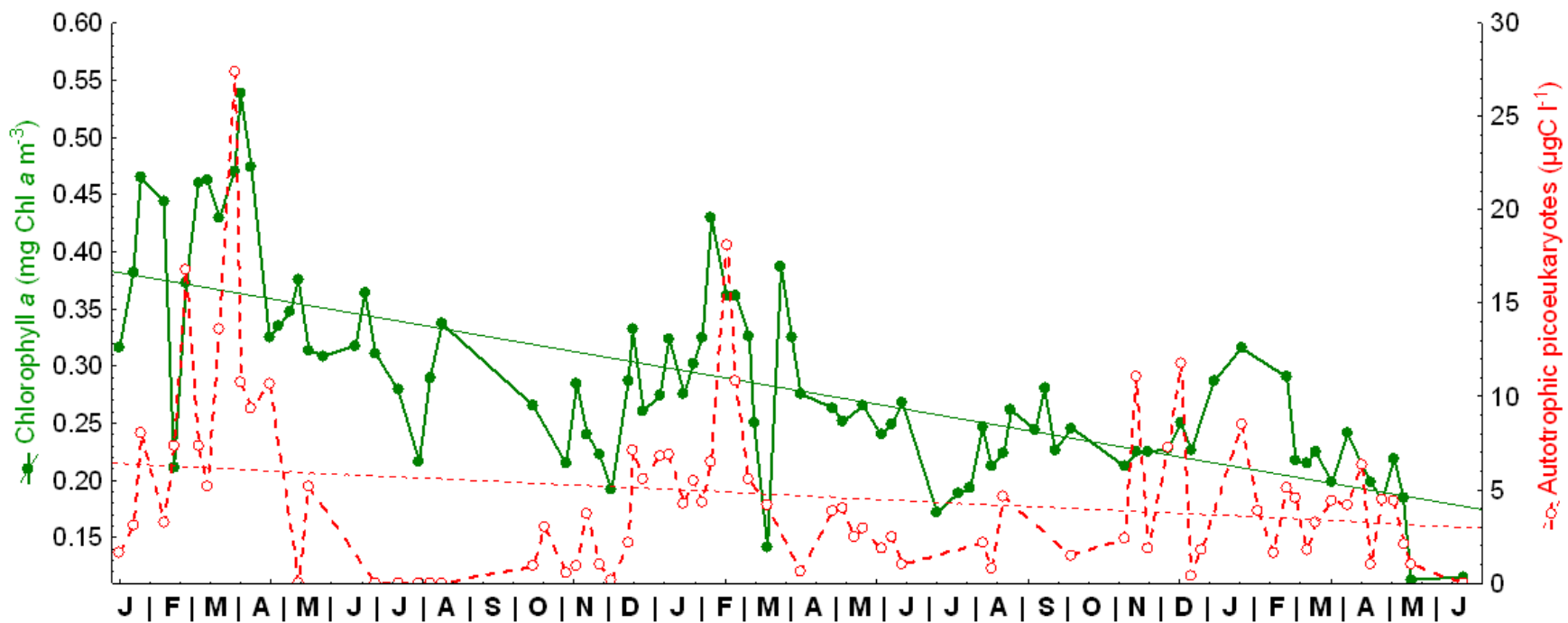


Mean Sea Surface Temperature (20W-15W, 30N-35N)

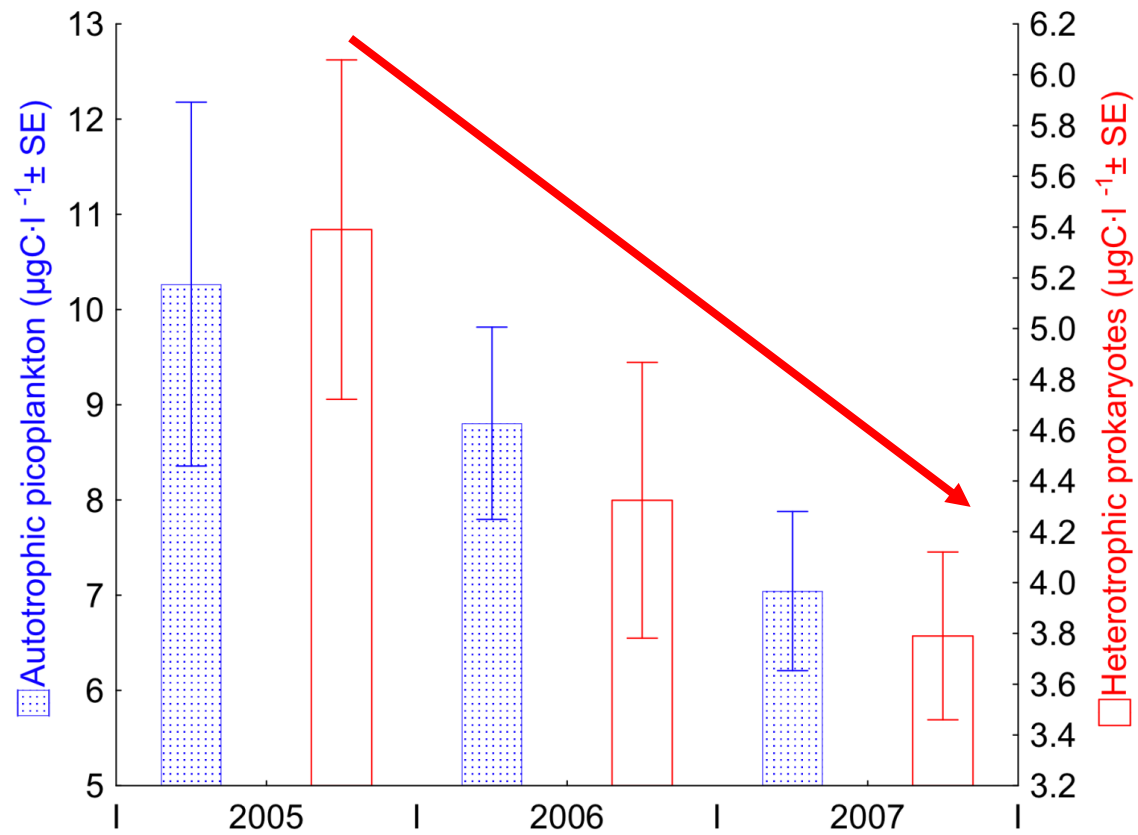




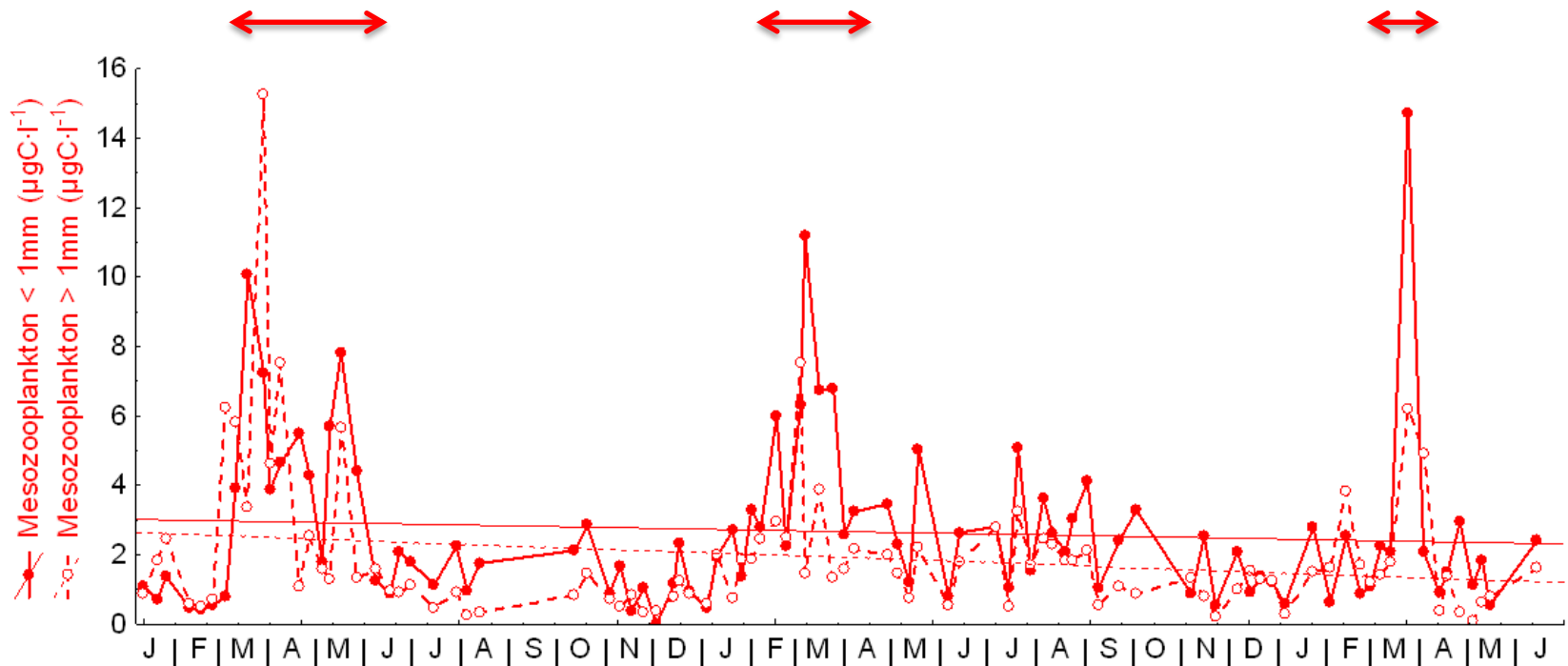


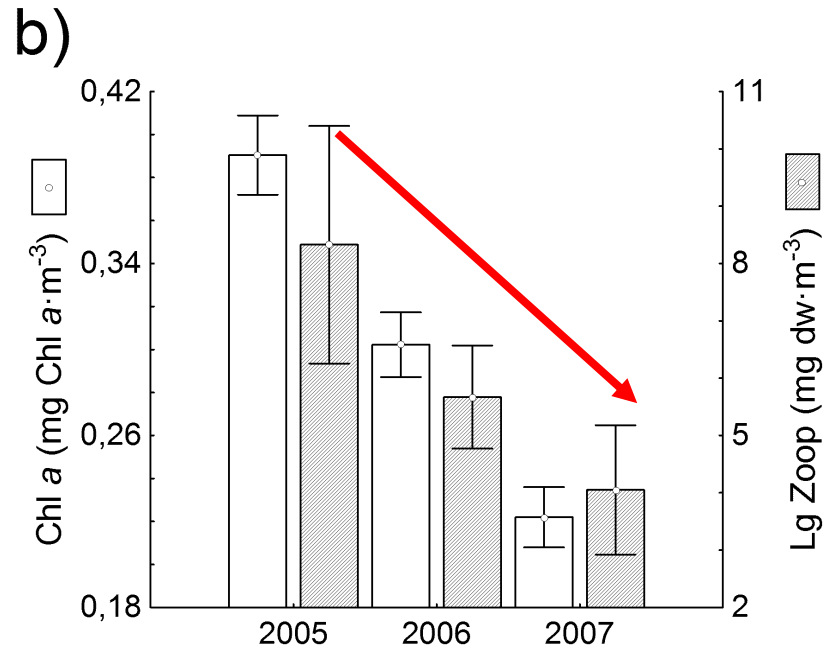
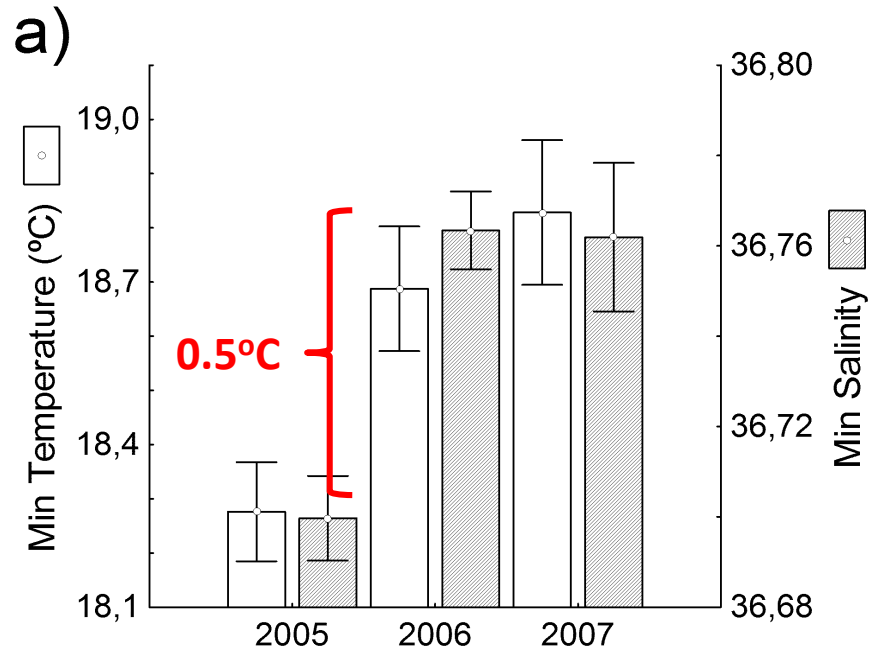


Schmoker and Hernández-León (2013)

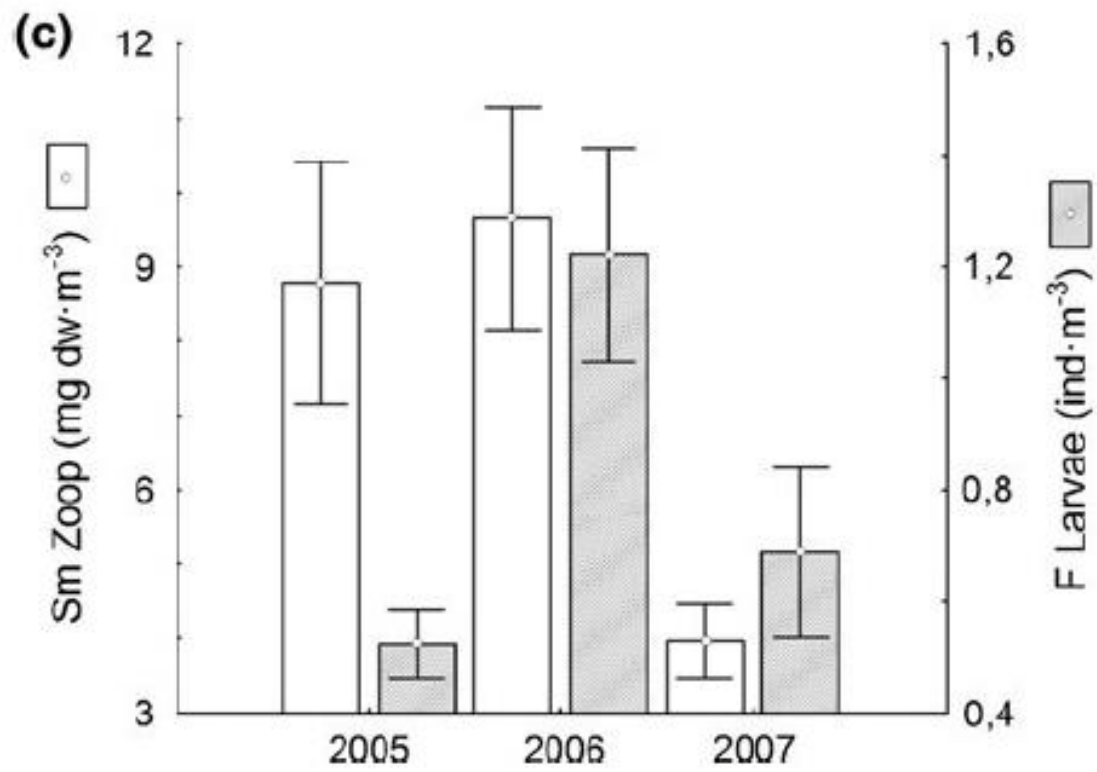


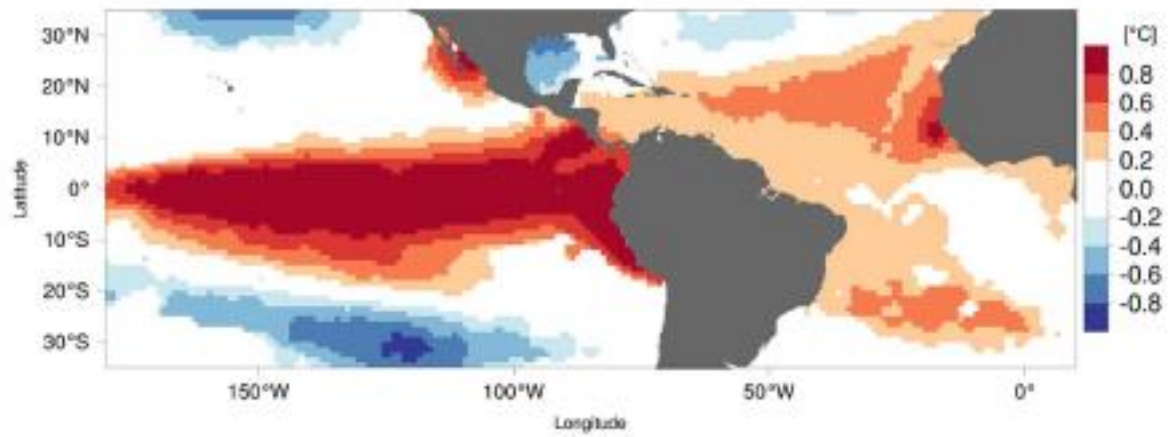
Schmoker and Hernández-León (2013)





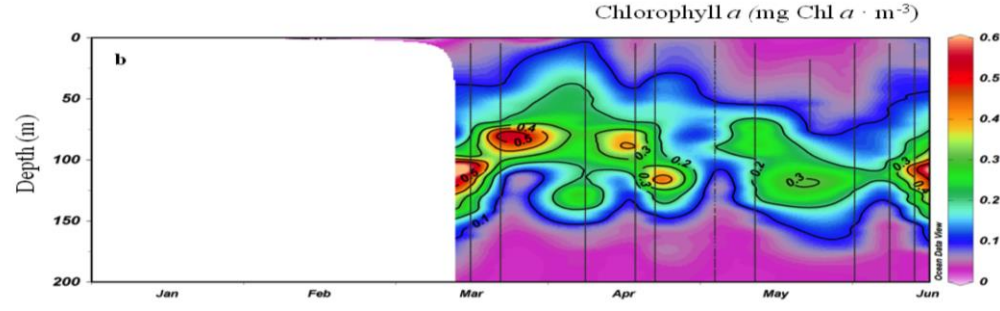
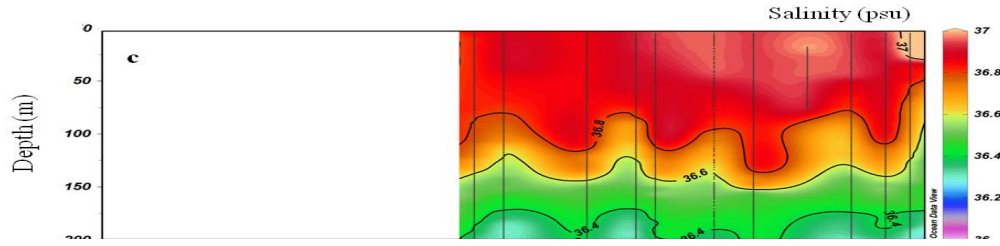
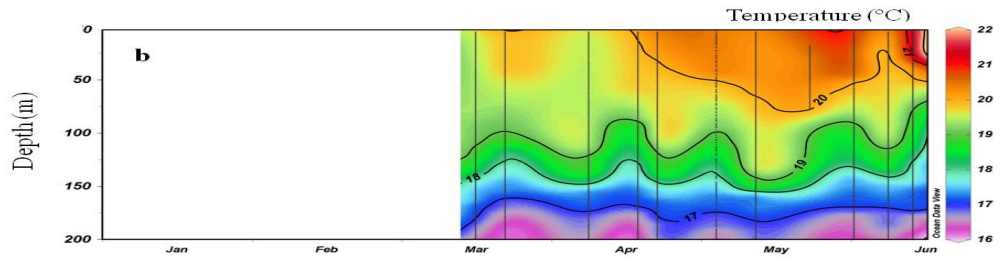
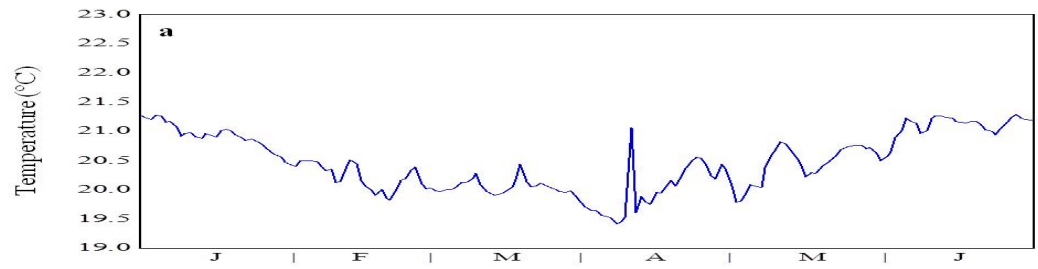
Moyano et al. (2010)





Oettli et al. (2016)

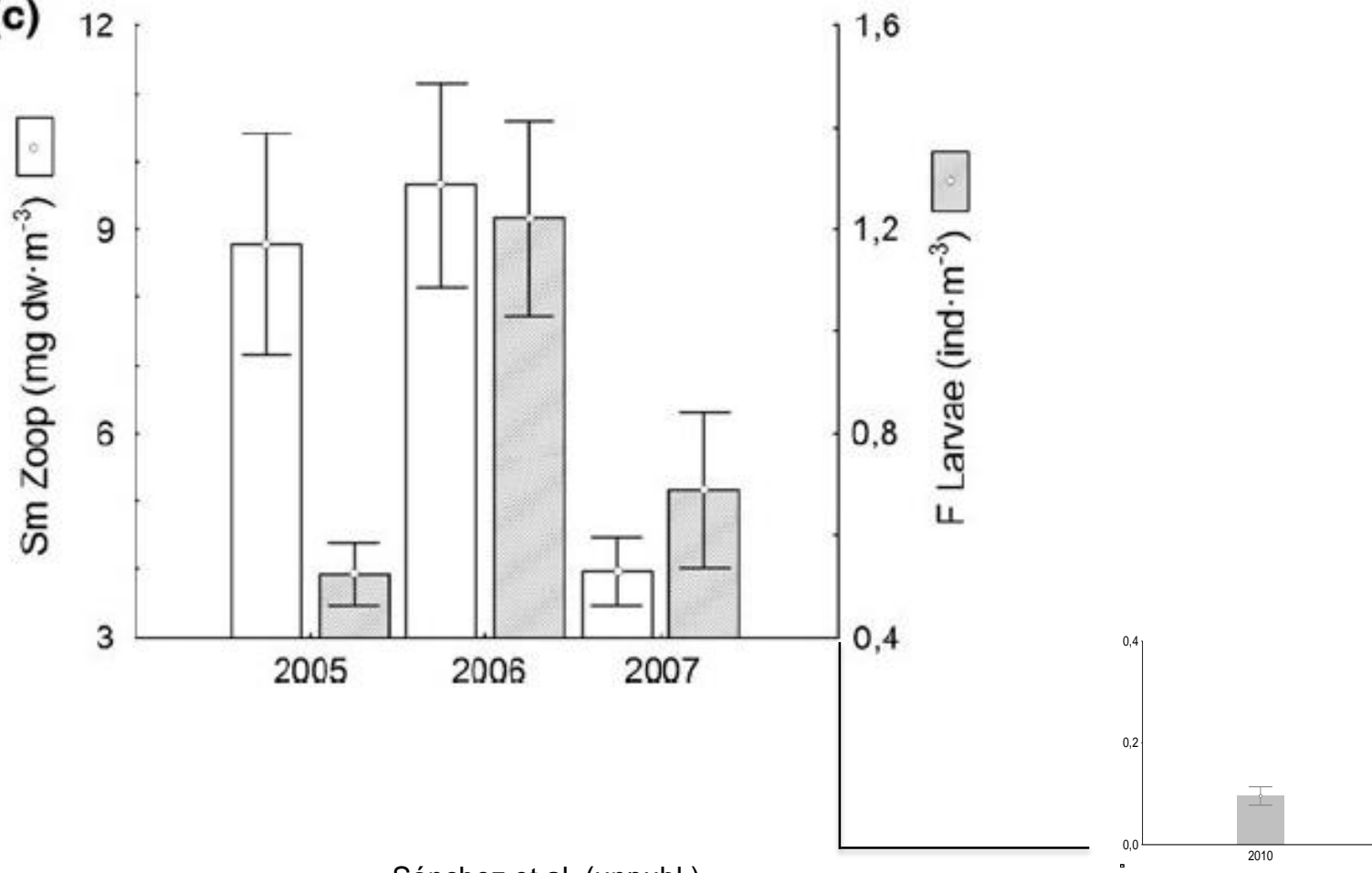




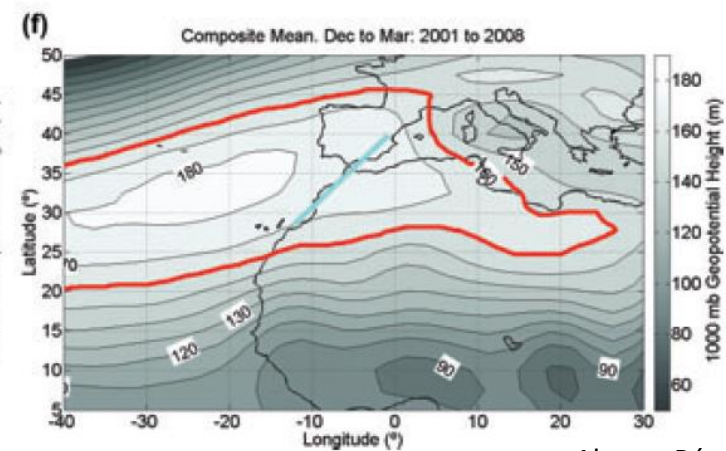
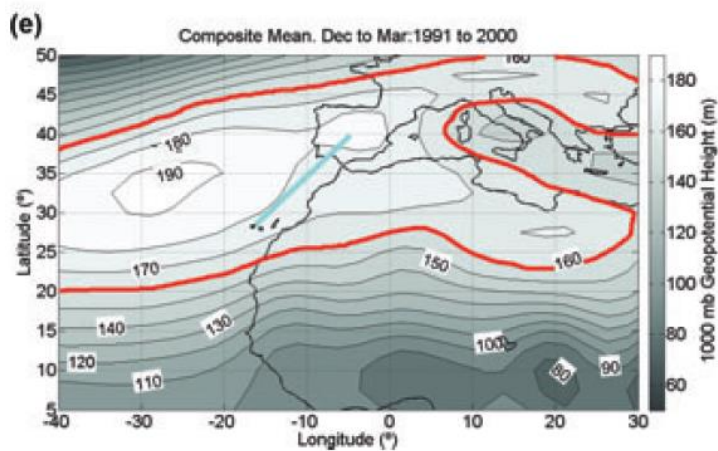
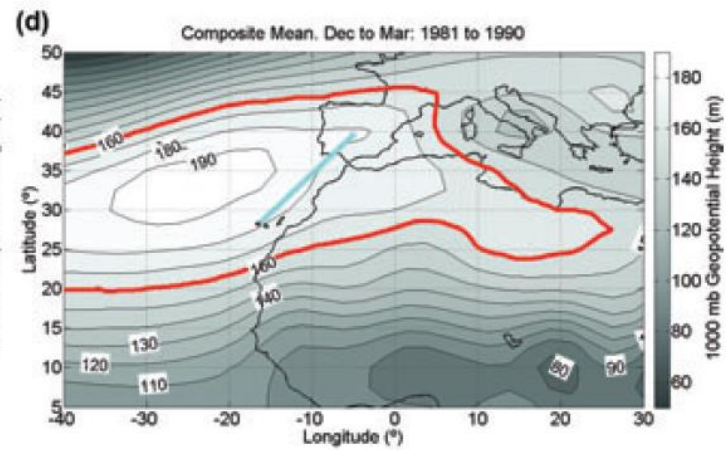
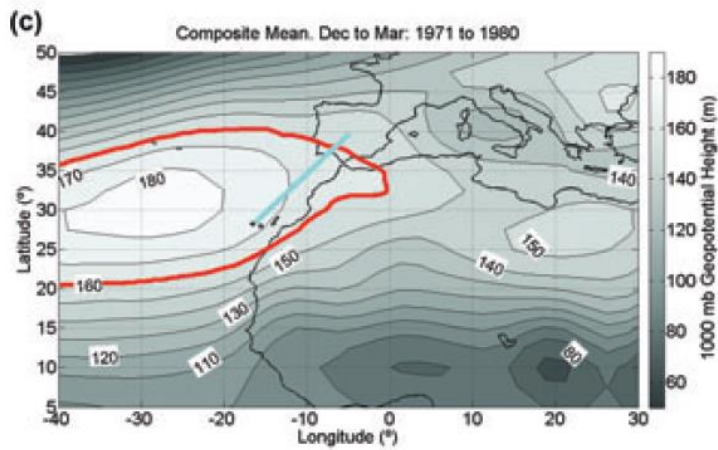
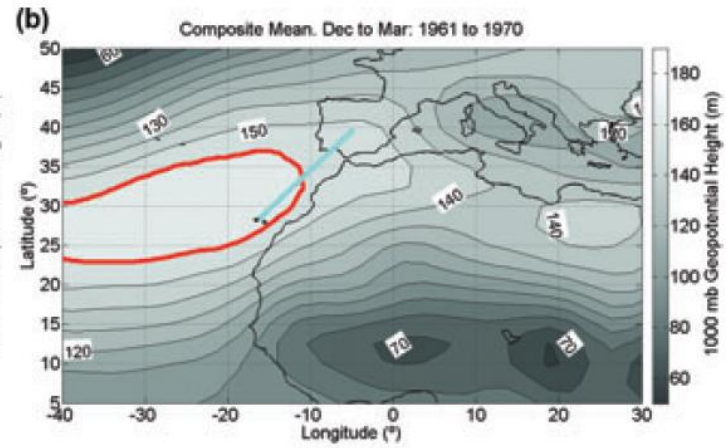
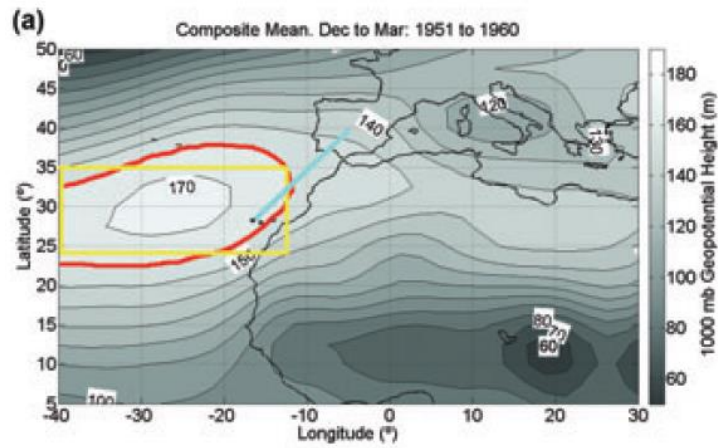
		2005	2006	2007	2010	Average
<b>During Bloom</b>	<b>T °C</b>	18.52 (± 0.48)	18.83 (± 0.51)	19.11 (± 0.55)	19.78 (± 0.08)	18.84 (± 0.58)
January-March	<b>Chl <i>a</i></b>	0.56 (±0.20)	0.30 (±0.07)	0.25 (±0.05)	0.07 (±0.01)	0.36 (± 0.20)
	<b>Biomass</b>	1228.64 (±874.41)	1531.53 (±719.67)	1178.65 (±1369.76)	465.38 (±122.91)	1240.38 (± 949.51)
<b>Post-Bloom</b>	<b>T °C</b>	19.87 (± 0.75)	19.99 (± 0.77)	19.07 (± 0.46)	20.30 (±0.43)	19.86 (± 0.74)
April-June	<b>Chl <i>a</i></b>	0.33 (±0.11)	0.20 (±0.04)	0.18 (±0.05)	0.07 (±0.03)	0.21 (± 0.13)
	<b>Biomass</b>	1381.01 (±824.83)	943.86 (±221.40)	661.16 (±435.46)	723.59 (±167.49)	975.93 (± 606.45)

Herrera et al. (2015)

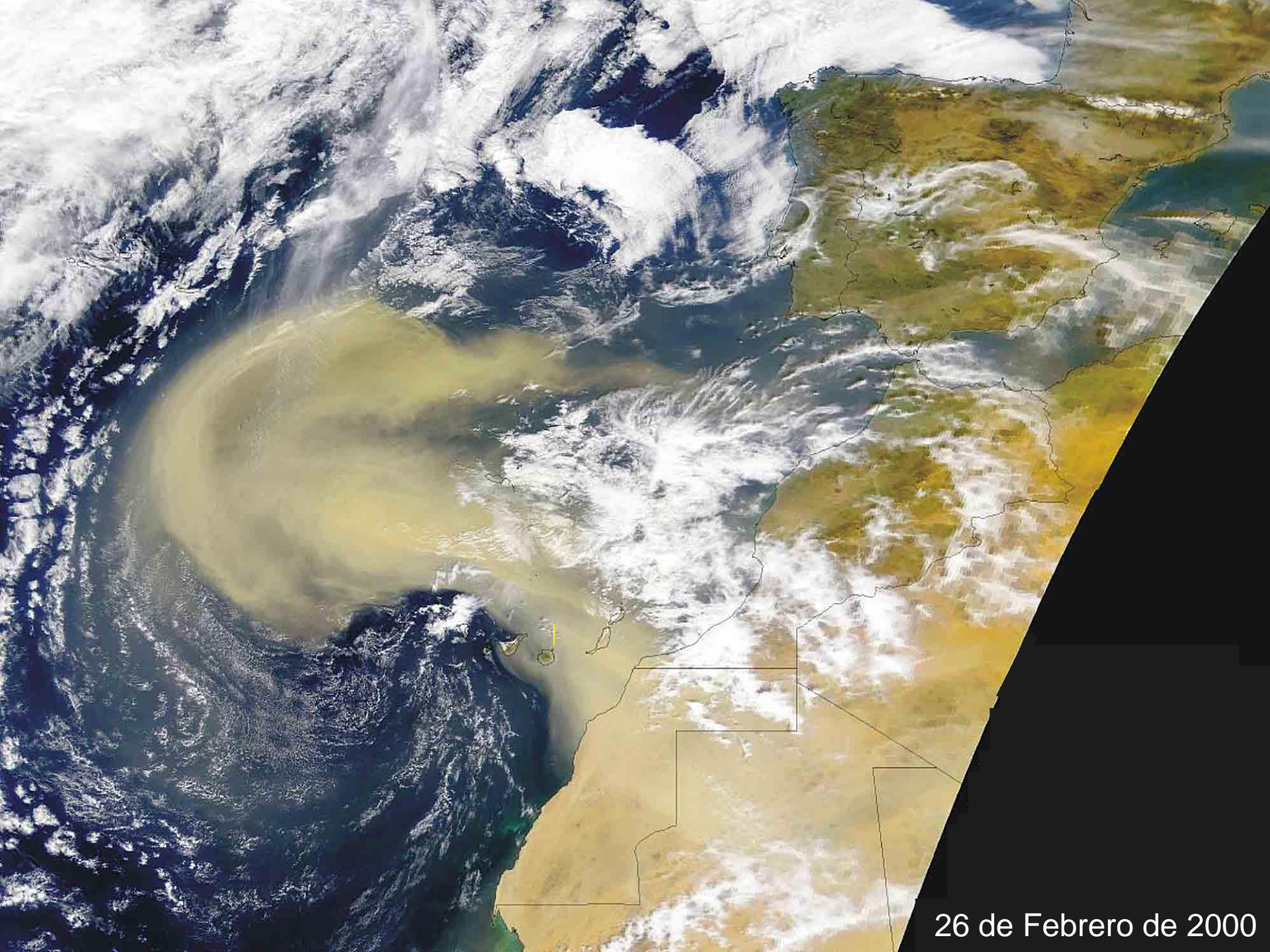
(c)



Sánchez et al. (unpubl.)

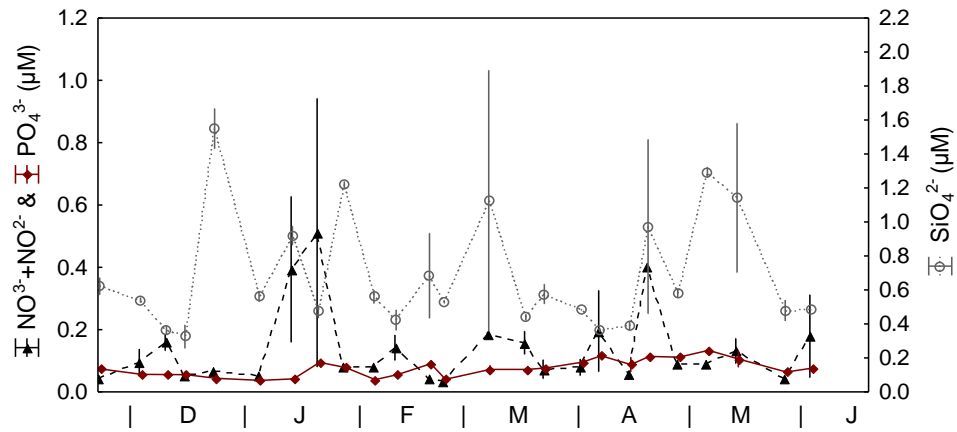






26 de Febrero de 2000

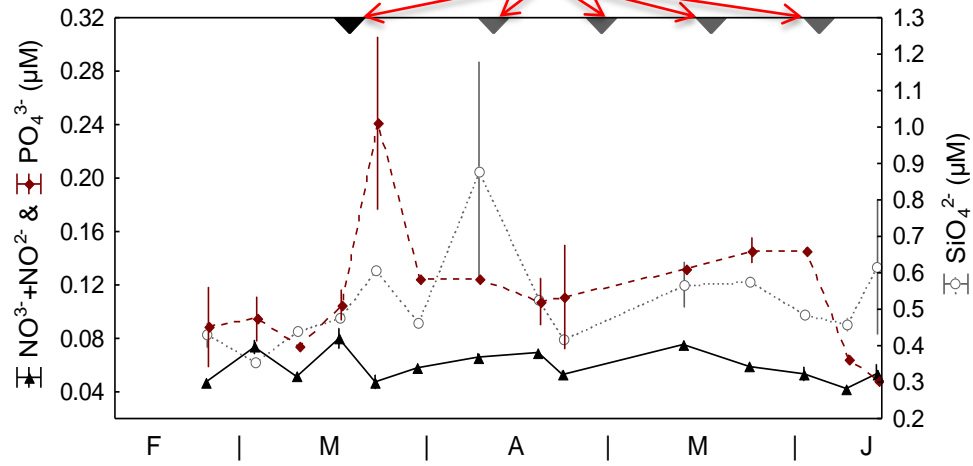
2011



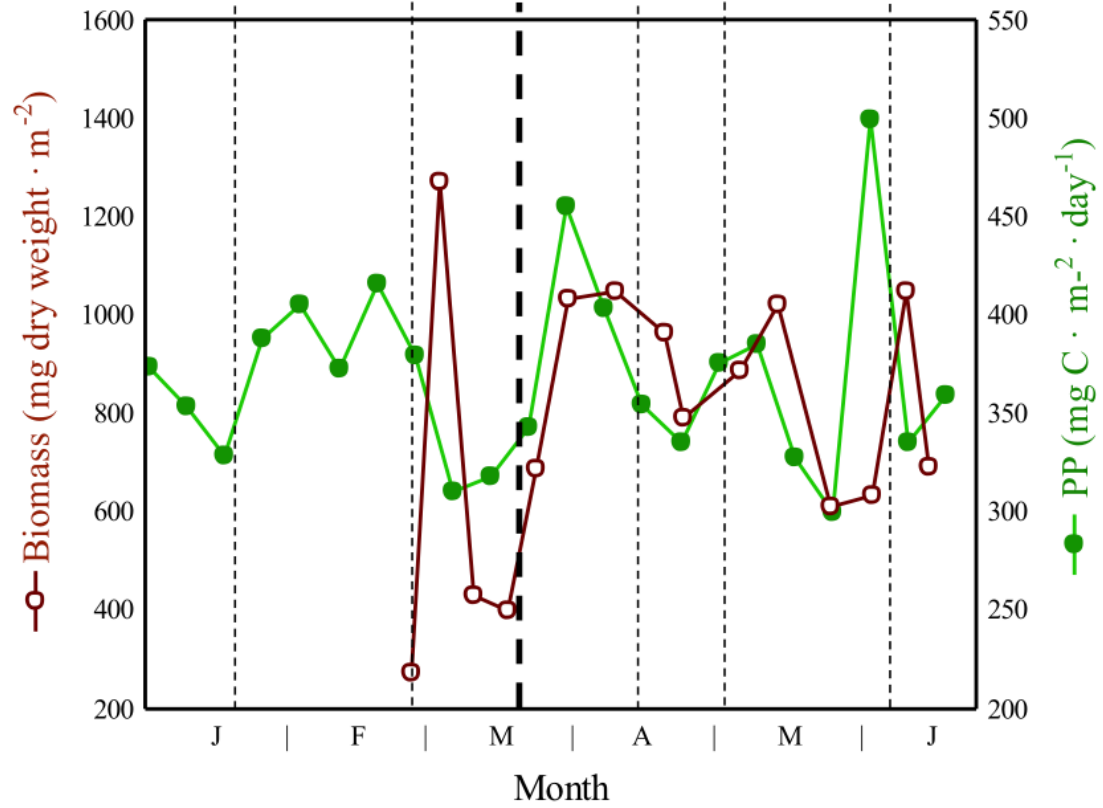
No dust

Dust events

2010



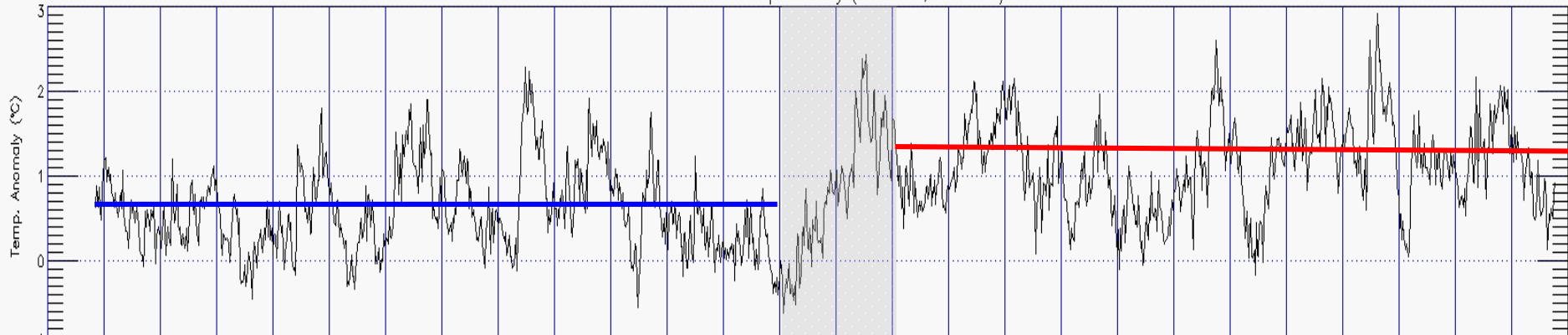
Dust



Herrera et al. (2015)



Mean Sea Surface Temp. Anomaly (20W-15W, 25N-30N)



*Sardina pilchardus*

*Sardinella aurita*



Commercial value



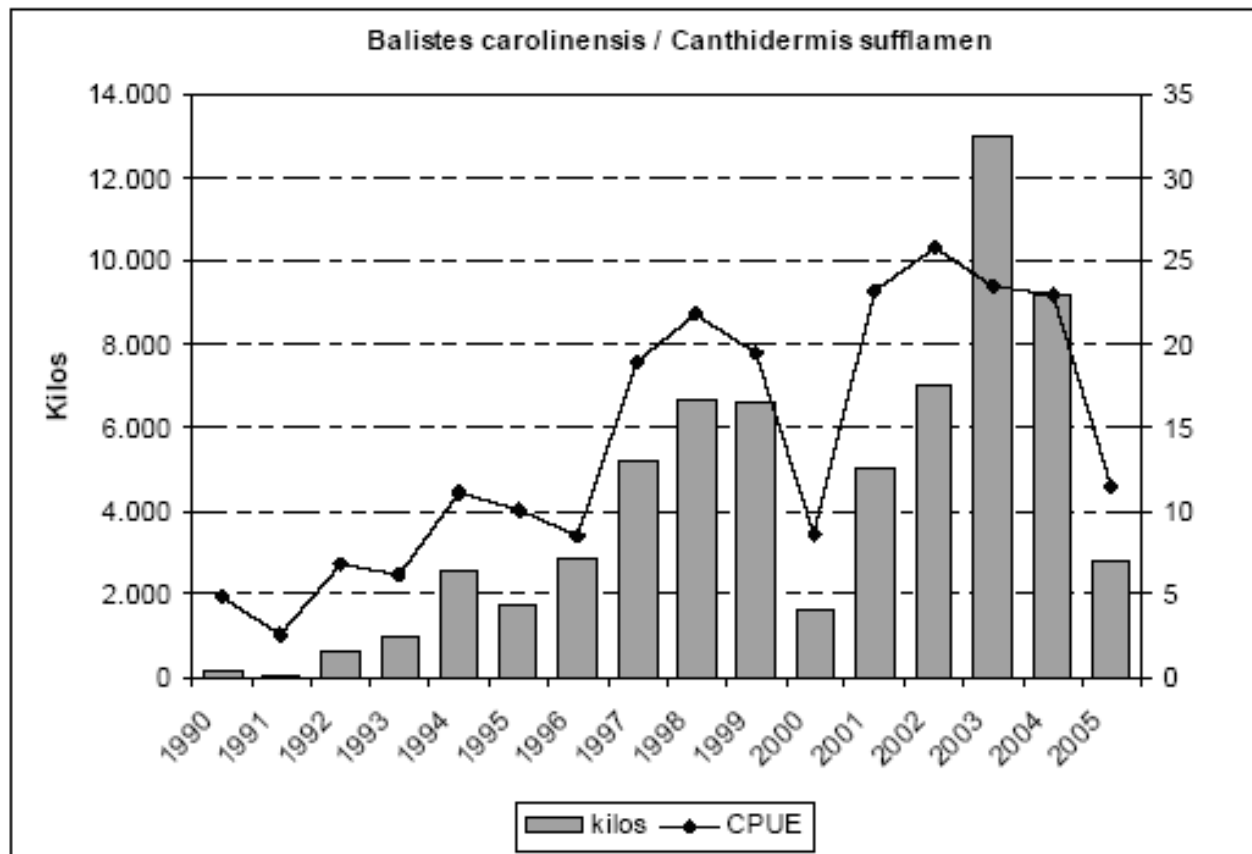


Fig. 4. Capturas de gallos, total y por unidad de esfuerzo pesquero, en El Hierro entre los años 1990 y 2005; se puede observar el notable incremento de este recurso desde la aparición en el ecosistema del Gallo aplomado (*Canthidermis sufflamen*) en 1994.

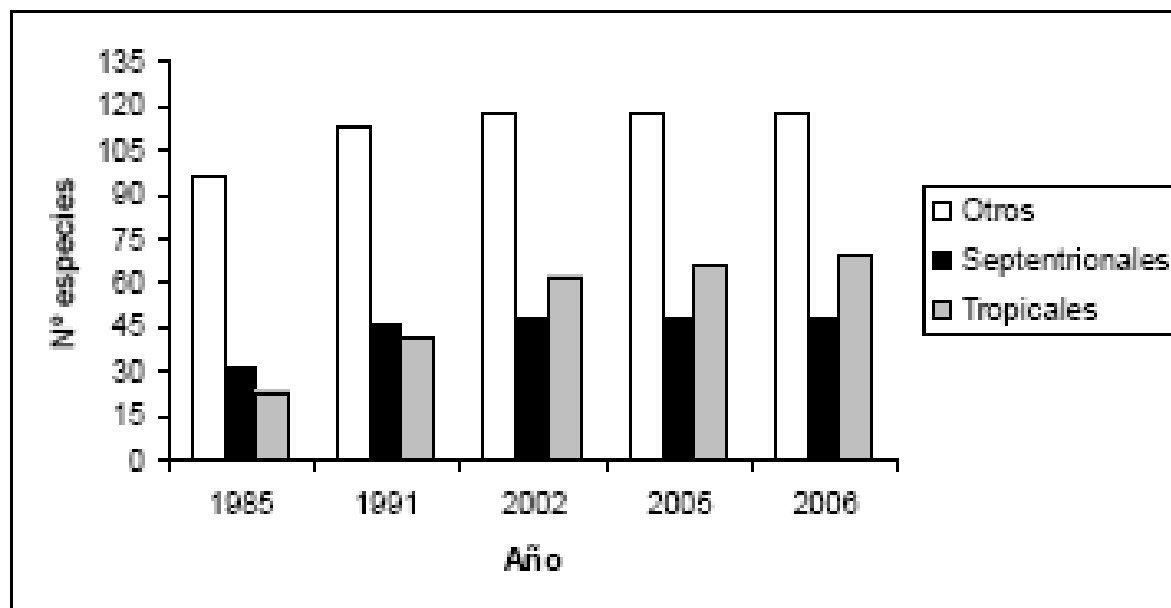
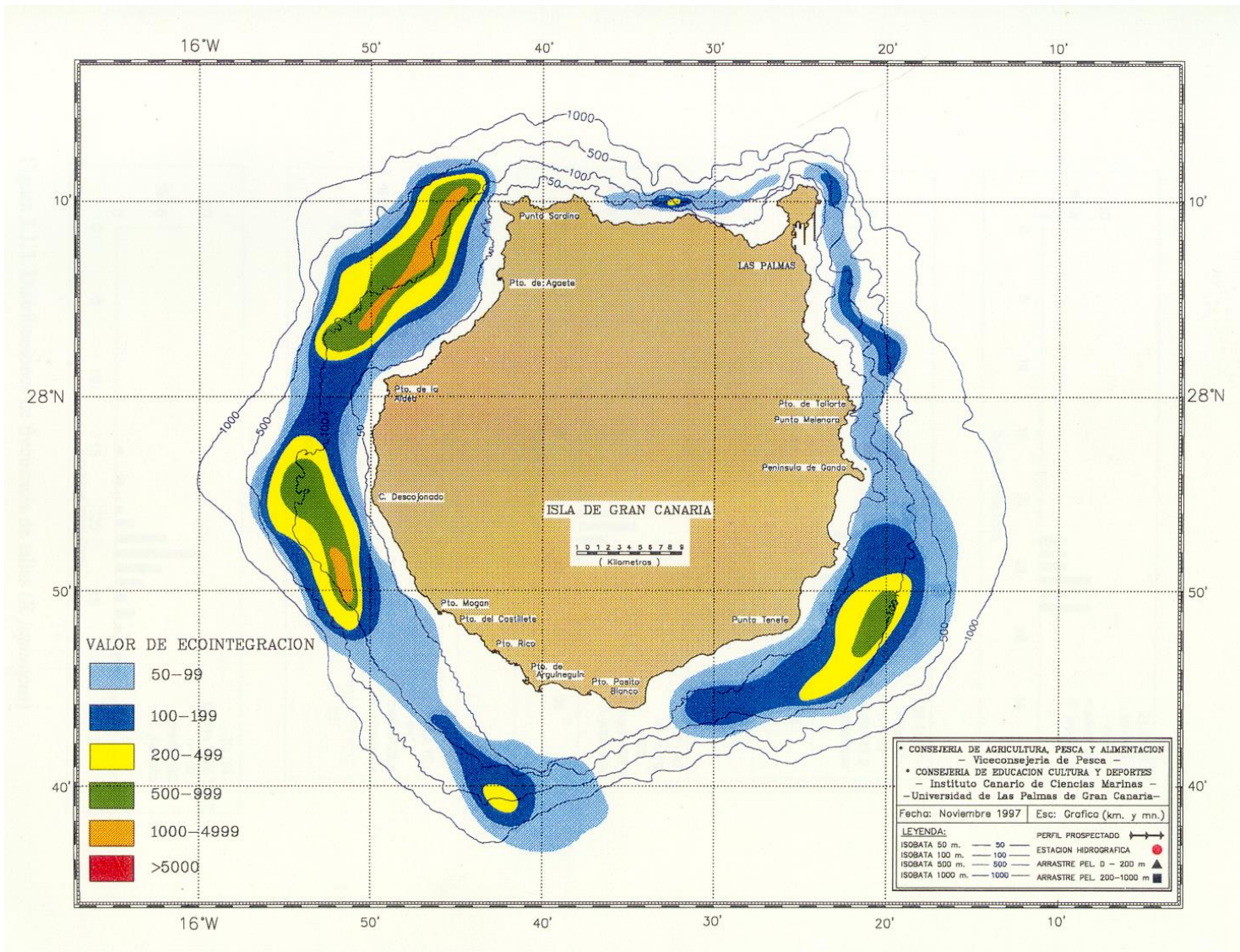
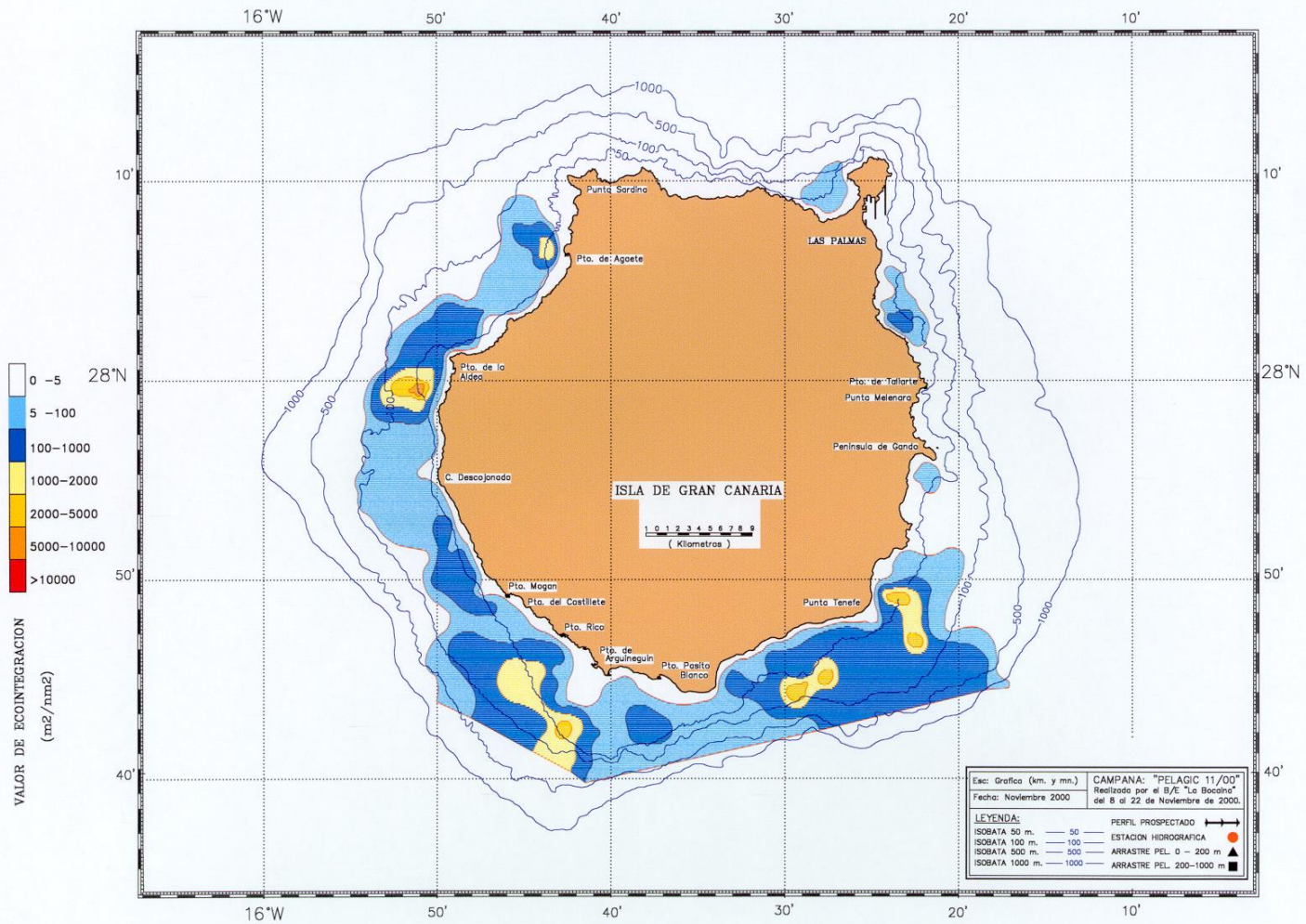


Fig. 2. Incremento del número de especies de peces óseos litorales de Canarias, organizados por amplios grupos de distribución, en los diferentes catálogos publicados; se observa como a partir de 1991 –cuando se considera que este componente de la ictiofauna es ya bien conocido– sólo crece el grupo de las de origen tropical.









In summary,

- The bloom differs among years depending on temperature
- Phyto-, zoo-, and ichthyoplankton showed a decreasing trend in their average values from cold to warm years
- A persistent warming trend would increase stratification and decrease duration and intensity of the productive “Late Winter Bloom”
- Global warming is expanding the “ocean deserts” but also decreasing the short productive “oasis”
- Need to understand the role of dust
- Need to study the effect on upper trophic levels, especially meso- and bathypelagic fauna



Thank you

