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TUNISIE

Phytoplankton blooming in Gabes Gulf (Tunisia): "Twenty years of monitoring"

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INTRODUCTION

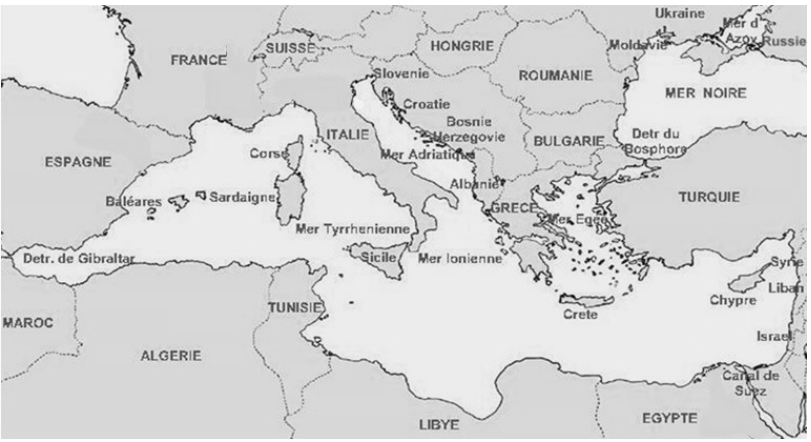
Region of the Gulf of Gabes constitue the half of Tunisian coasts and offers the greatest wealth of the country's fisheries in other shellfish products. This area is also caracterized with specific oceanographic and bionomic parameters as tide, meadows of Posidonia, etc..

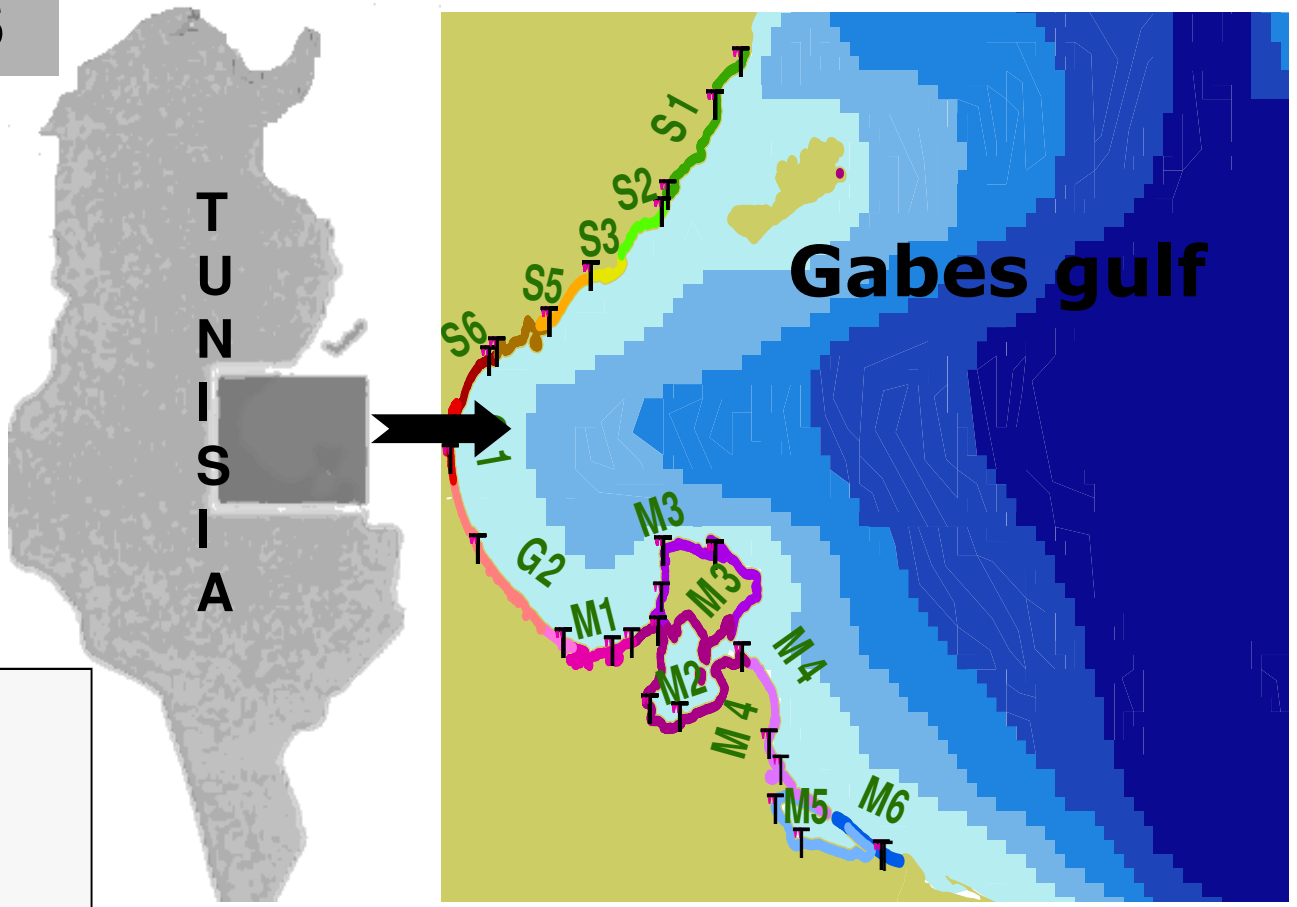
Eutrophication is considered one of the most serious environmental problems in the gulf of Gabes. Since 1988, Harmful Algae blooms started to be regular and some serious problems of fish kills are reported in some years (1991, 1994, 2006).

Diversity and abundance of phytoplankton, recurrent blooms, spatio-temporal distribution of toxic phytoplankton are more studied with the lunch of the monitoring phytoplankton program in march 1995 in shellfish areas production. All phytoplanktondata are archived in electronic base with oceanographic parameters.

Twenty years (1988-2008) of monitoring **I**nformation and **D**ata are **E**valuated. Relationships between climatic fluctuations, hydrological caracteristics and annual and seasonal pattern variability of phytoplankton abundance and toxic species occurrences are analysed.

MATERIAL & METHODS





Monitoring Shellfish production Areas 'REPHY'(1995-2008)

REPHY

- Weekly sampling in 27 costal stations (1L in 1m depth with bottels)
- Sampling of physico chemical parameters with probes (T°, Salinity and pH)
- Uthermohl method for lecture

RED TIDE Monitoring: Reports of the naval brigade for each event (1988-2008

Identification of area

Identification of species

Oceanographic cruise witness

RESULTS

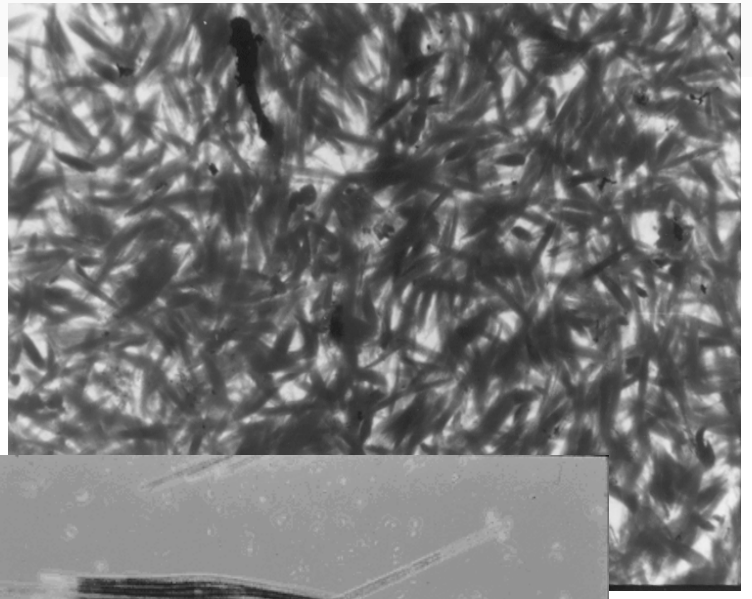
Two forms of algal blooms affect the Gabes gulf :

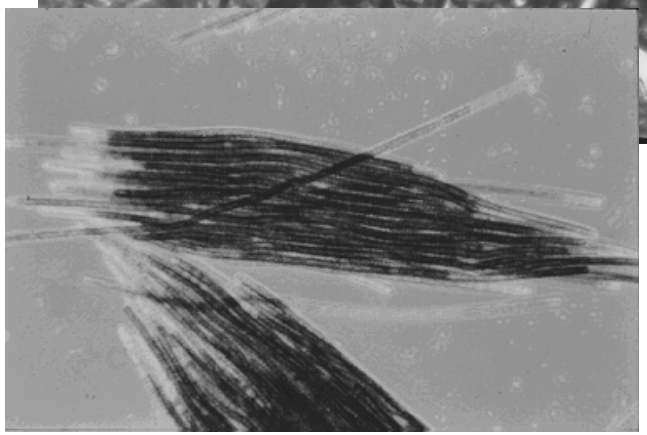
Algal blooms in open sea

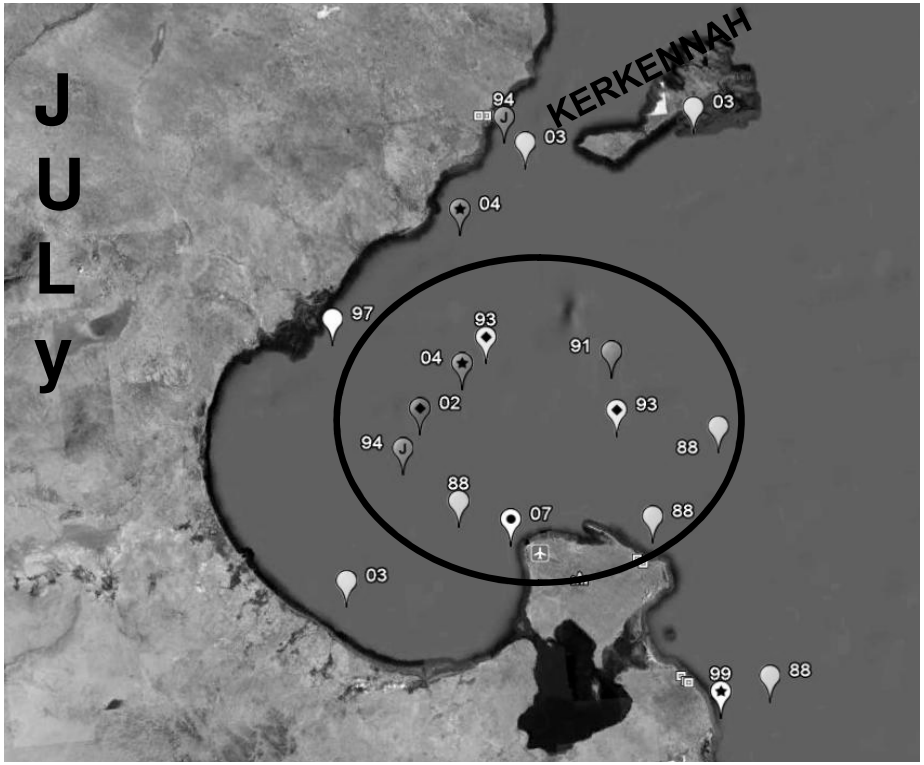
- Monospeific species Cyanobateria *Trichodesmium erythreum* (>80.10^6 *aggregate* of trichomes)
- Reddish brown color
- Summer occurrences
- Any toxic events associated

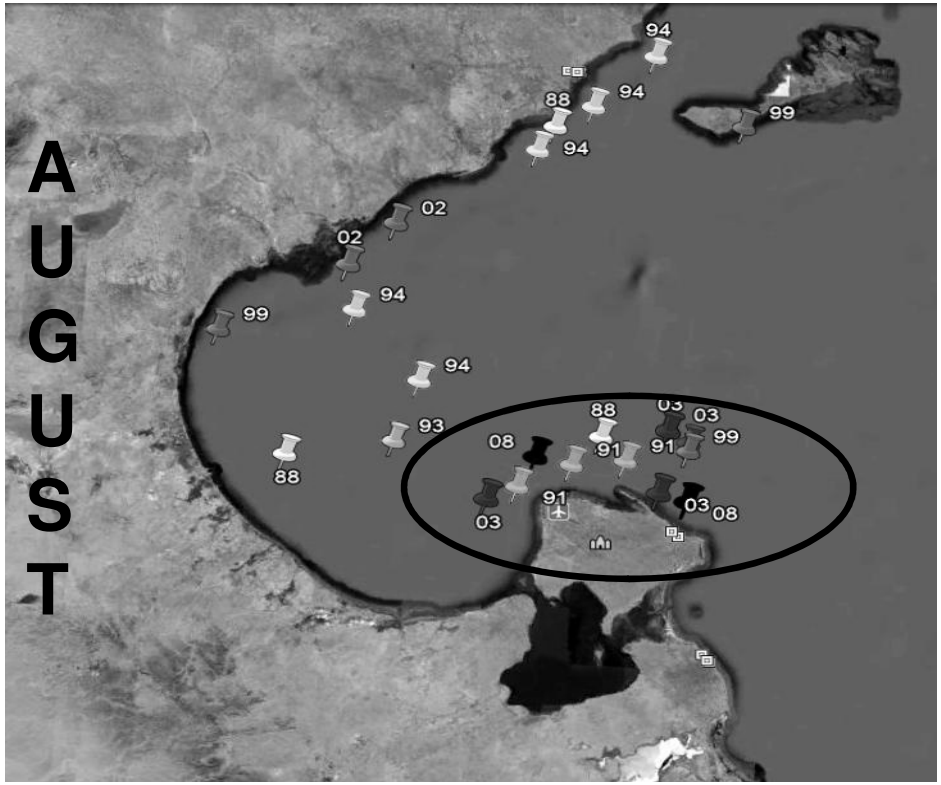
Algal blooms in coasts (shellfish area)

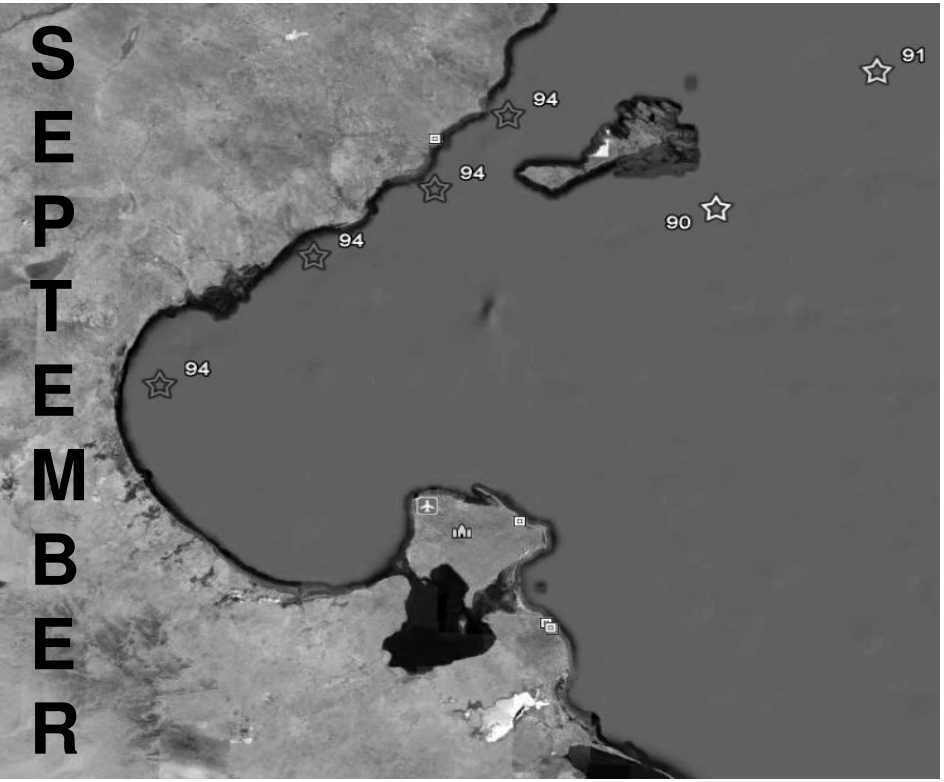
- **Various species mainly of dinoflagellates**
- **Period of bloom depend of specie**
- **some toxic events**



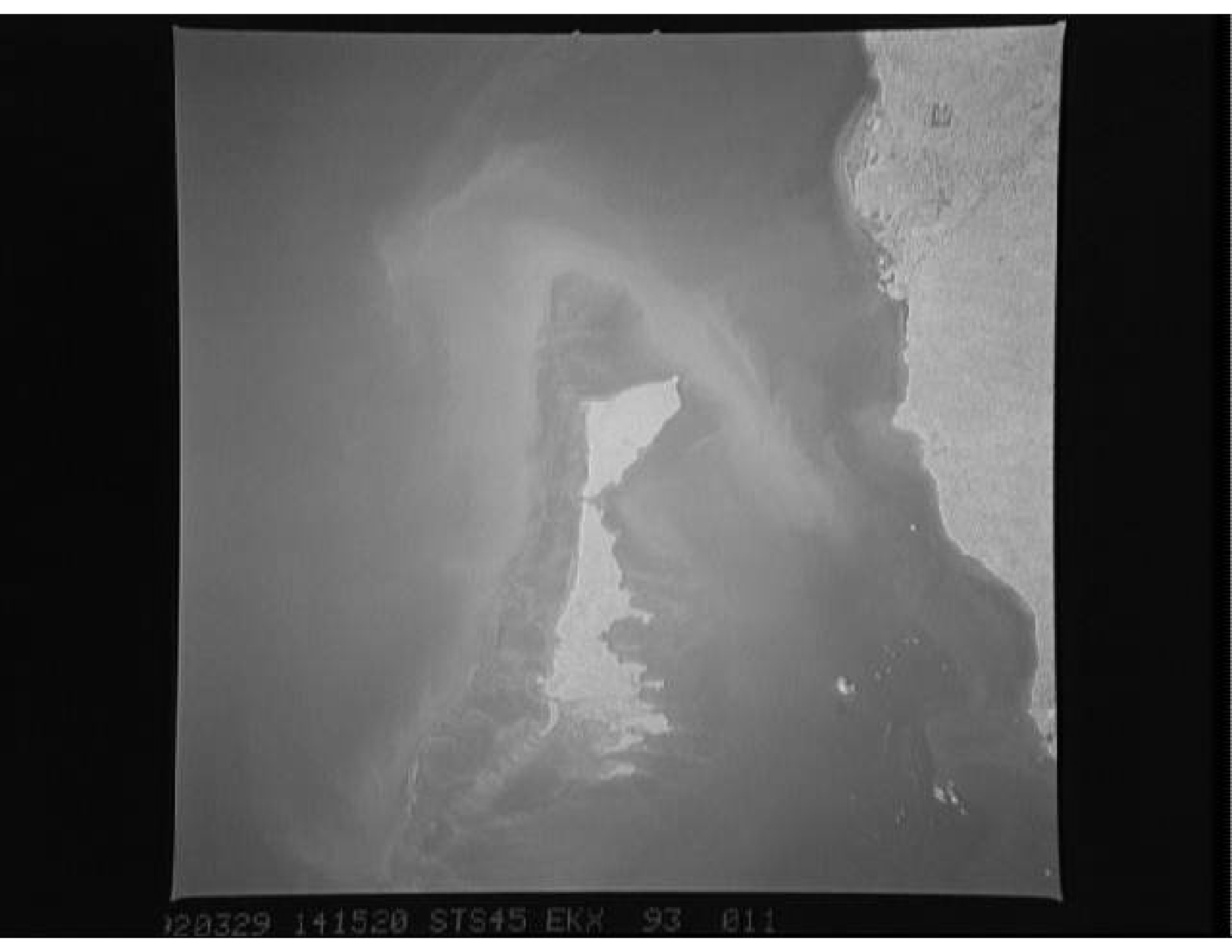








- First report of *Trichodesmium « Muffa »* is localised in Kerkennah, 1935 (Fremy A., *Bull.SOS*, 1935)
- Annual event in each summer since 1988
- Different distribution for each month: in july blooms occuped the center of the gulf, in August and september all observations arise the north of Jerba island
- The Most of records are in **1988, 1991, 1994. 2000. 2003. 2008**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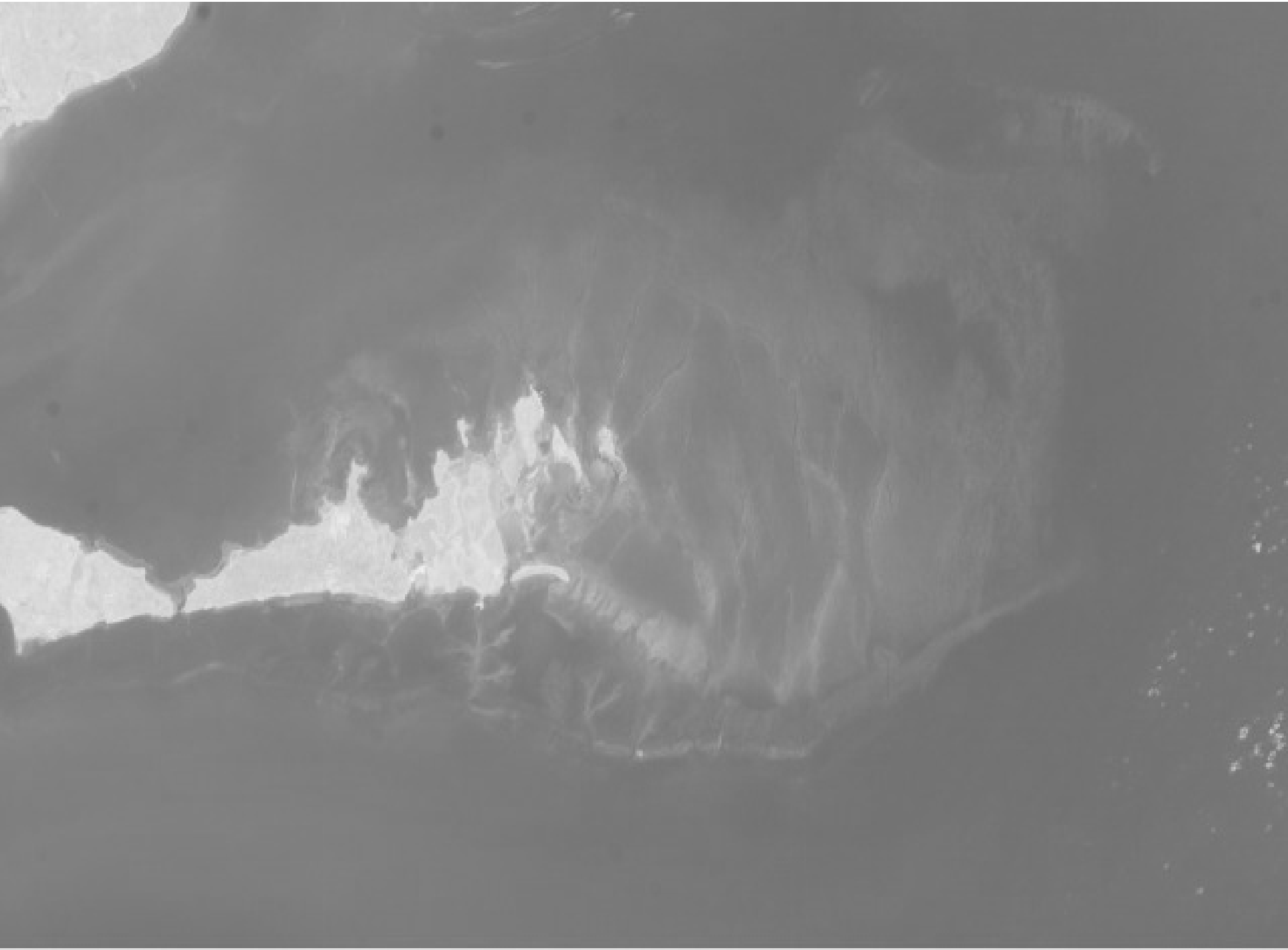
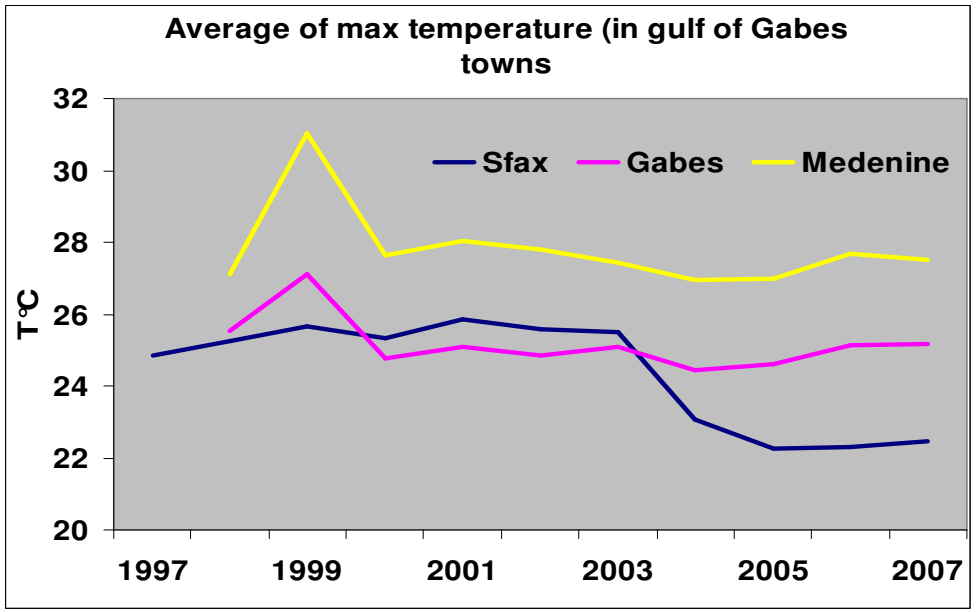
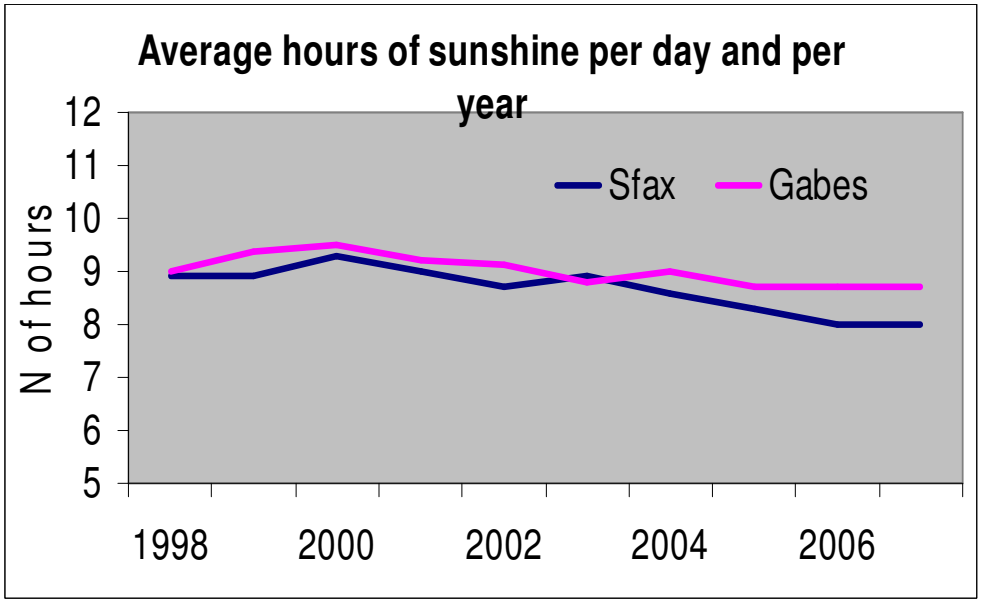


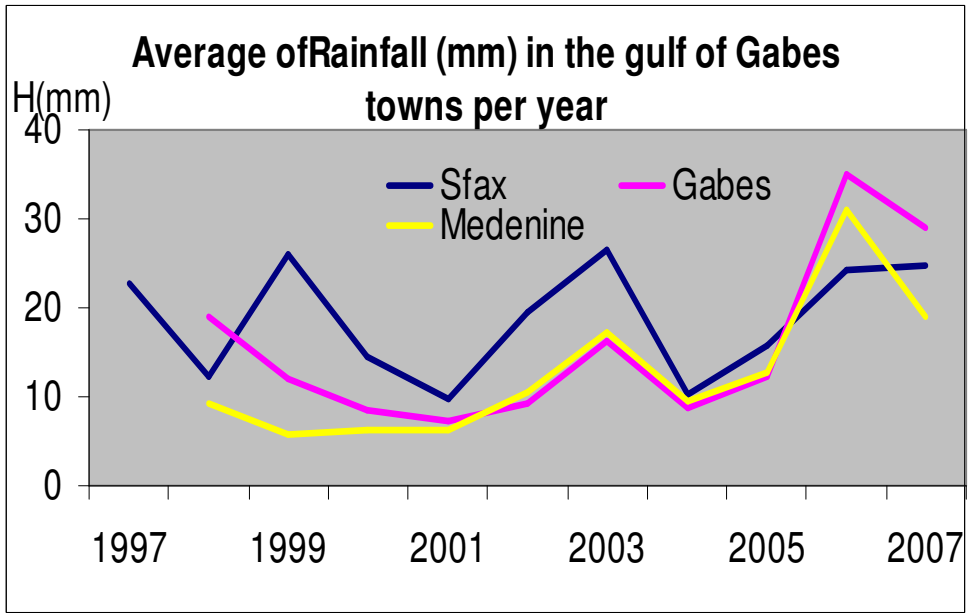
Meteorological data in some area of Gabes gulf

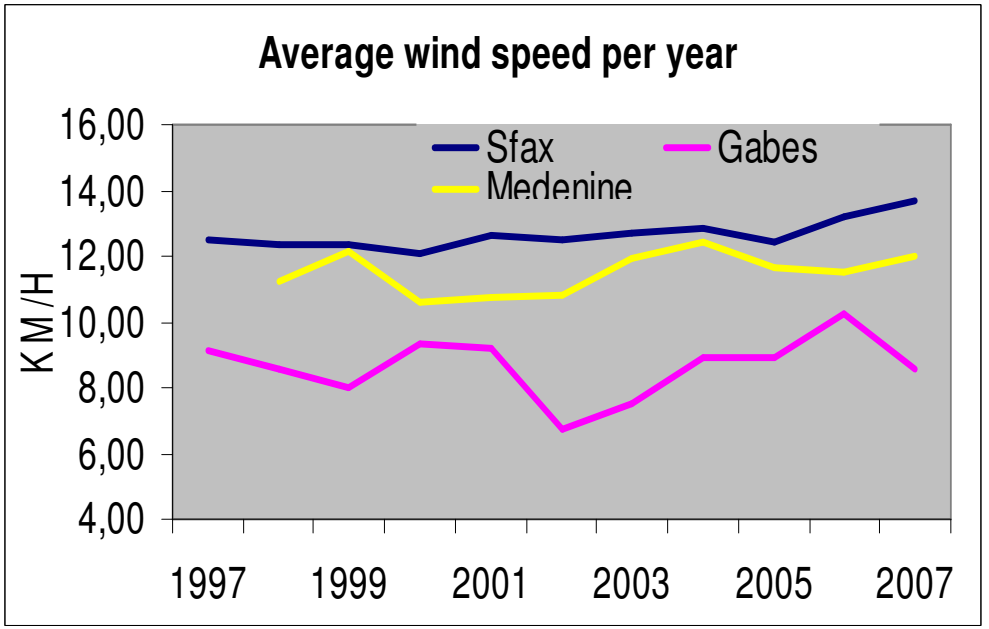
1999, 2003 and 2007 are the specific years of high rainfall.

Increase of rainfall appear to favor blooms. Increase of temperature and sunshine could limit the developpement of phytoplankton.







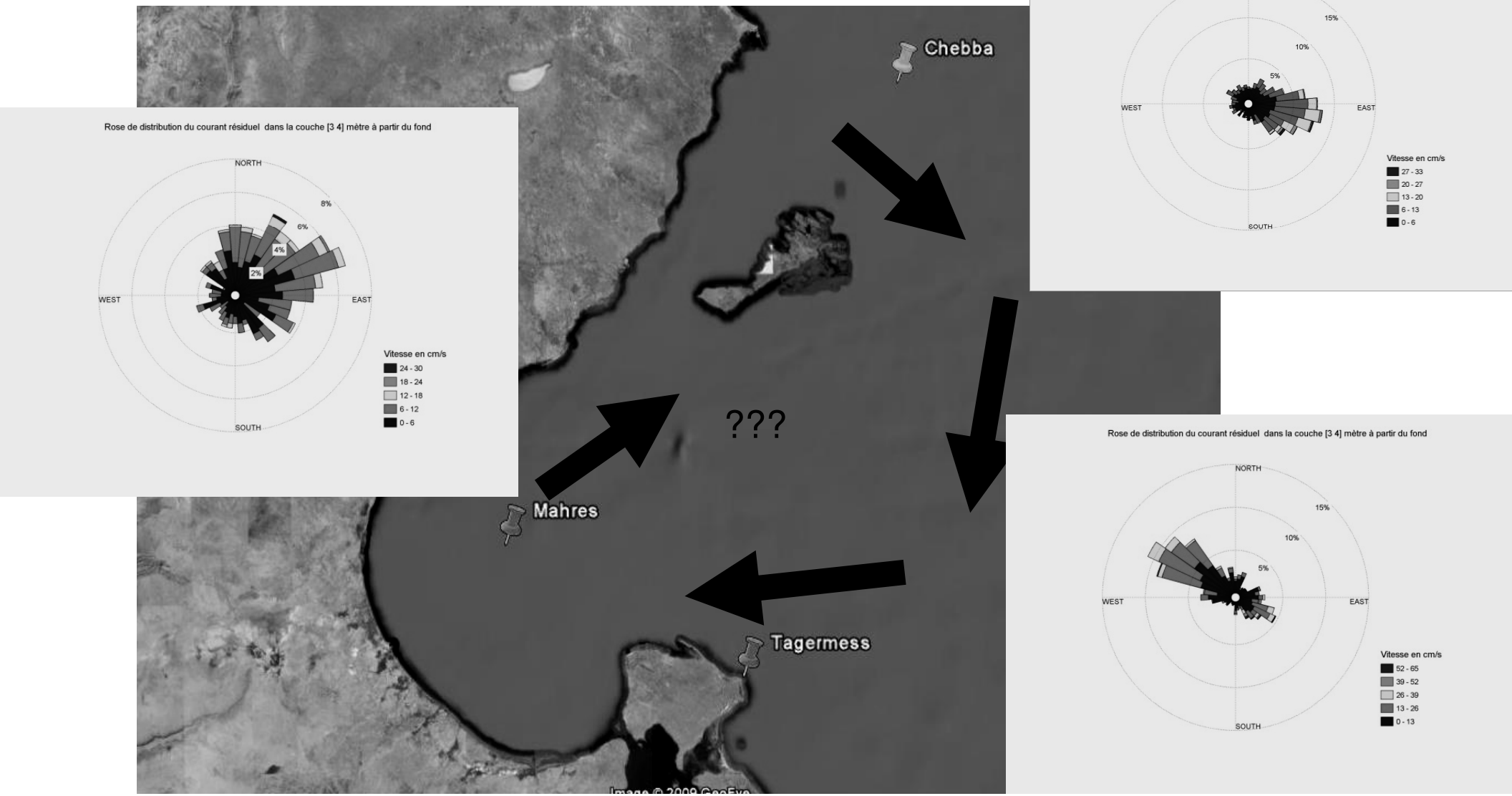


Hydrodynamic parameters : 3 ADCP + maregraph

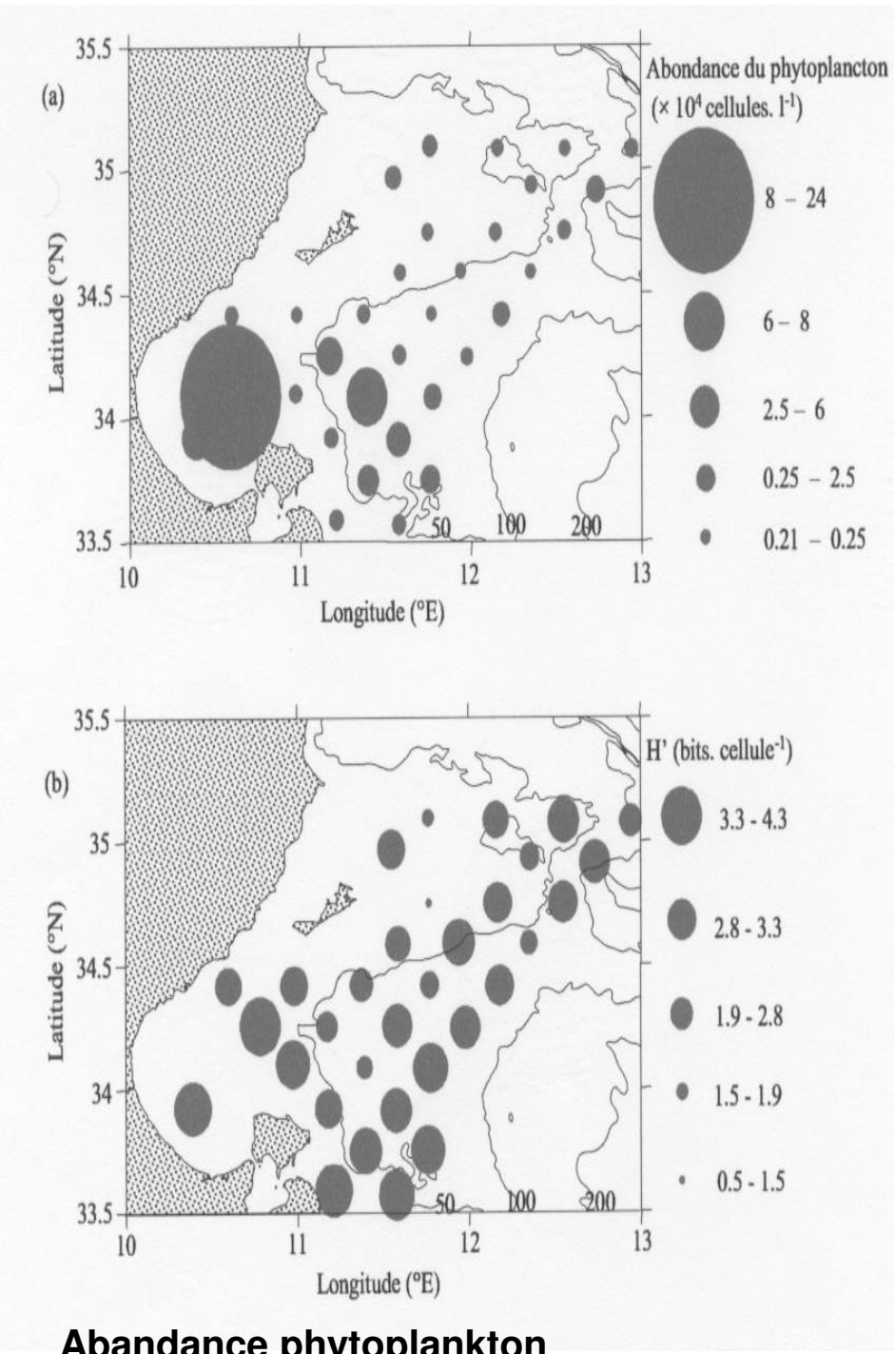
The residual current in the gulf at these stations is unidirectional and parallel to the coastline average. We suppose:

✓ General curent of the western Mediterranean has engulfed one or more branches in the Gulf of Gabes !!

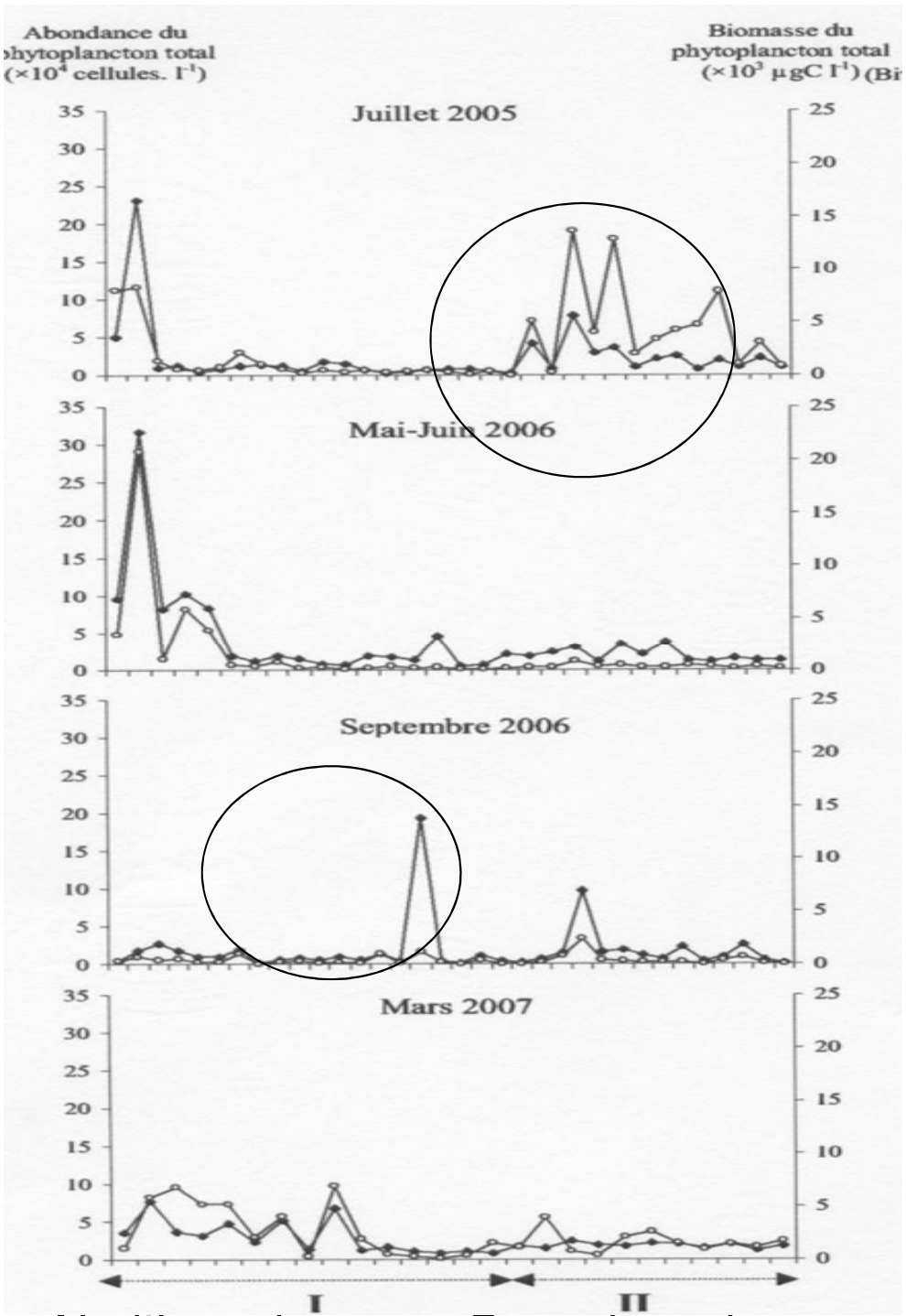
✓ Presence a gyratory movement : « explication of july situation » !!



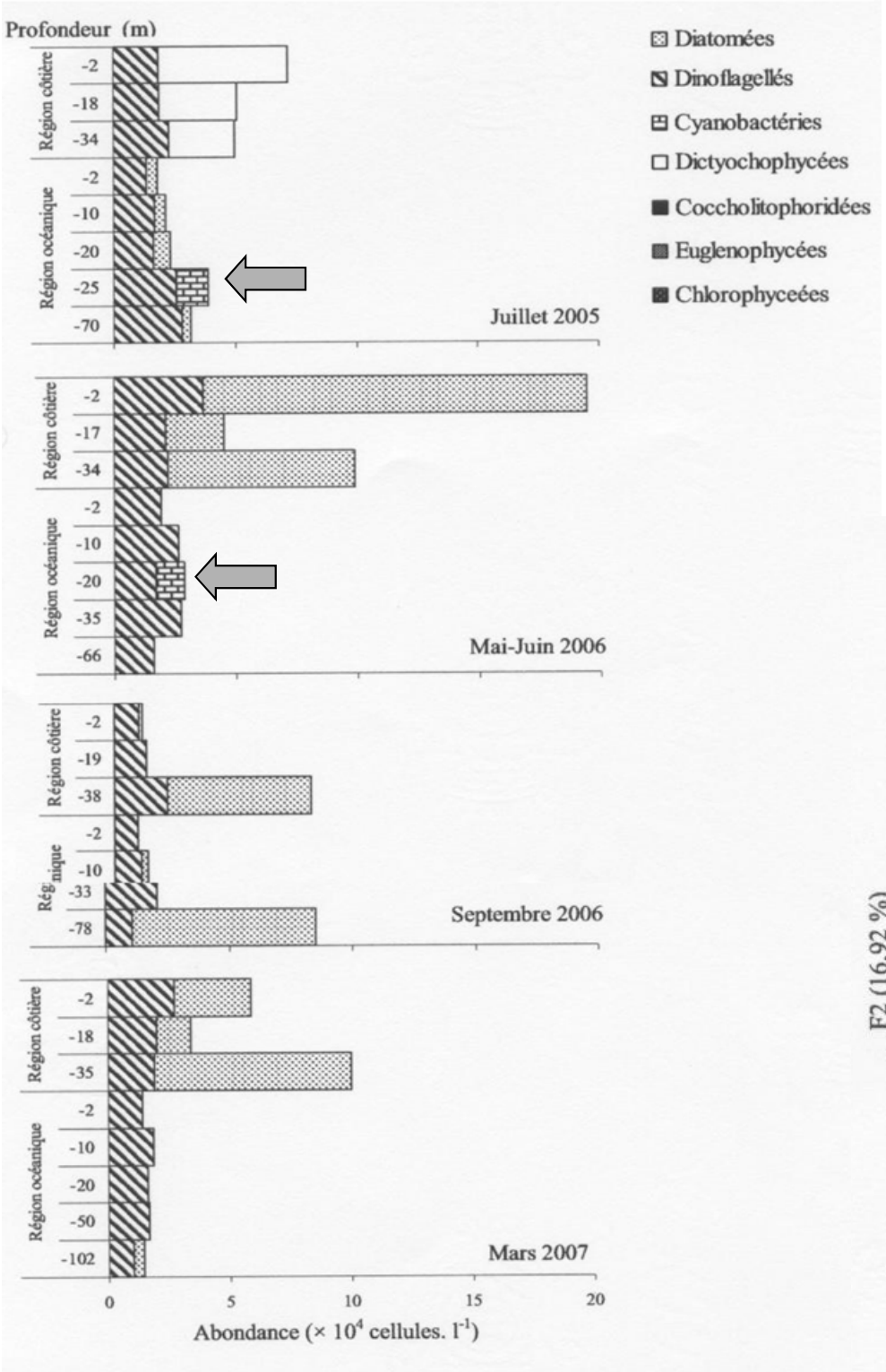
Oceanographic cruises witness (July 2005 ; May 2006 , Septembre 2006, March 2007)



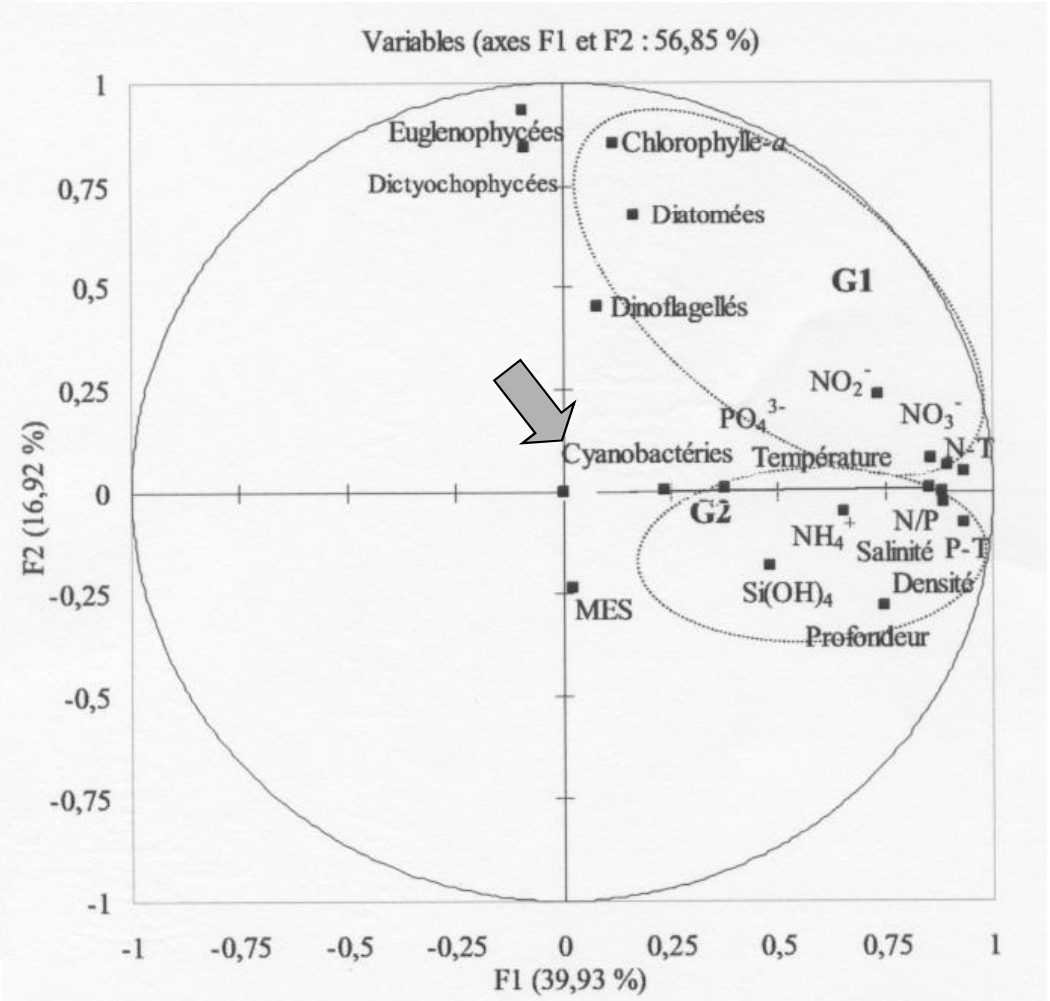
Abandance phytoplankton (July, 2005)

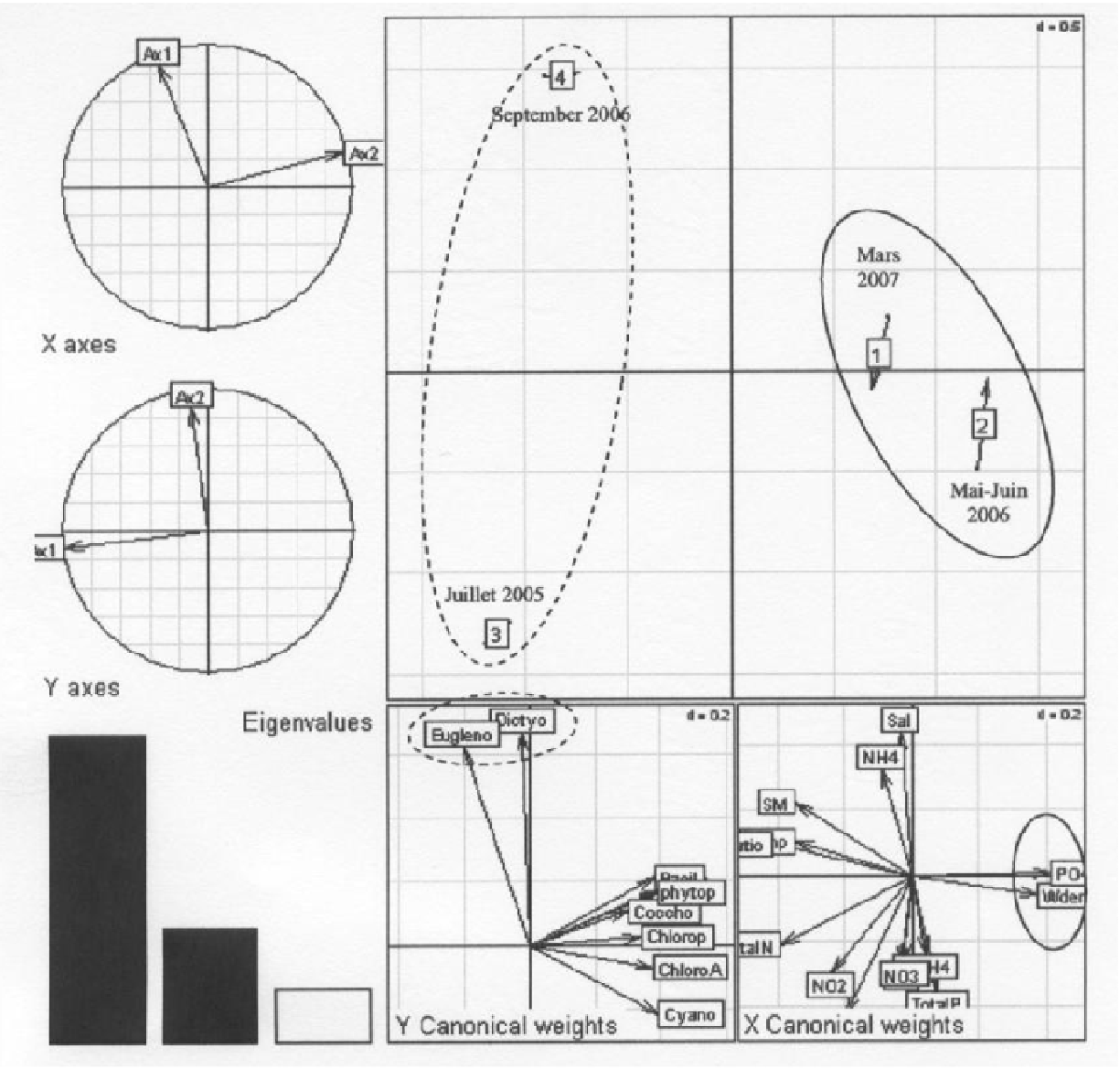


Neritic region Oceanic region



In summer cyanobacteria contribute at 50% of total abundance, and it is present in all strata of the water column in oceanic regions. The most important concentration was observed at the thermocline. At this level, abundance of cyanobacteria is correlated with nitrate (r = 0.343, p <0.05, df = 119), with the ion ammonium (r = 0.466, p <0.05, df = 119) and especially with the N / P ratio (r = 0.566, p <0.05;d.d.l. = 119).





The analysis of co-inertia illustrates the intra-and inter annuel variabiliy to find relationships between phytoplankton community composition of and abiotic characteristics of the water column during the four study periods :

✓Periods for the months of May-June and March showed close relationship between water density and phosphate concentrations and composition of phytoplankton

✓In contrast, during the months of July and September, the axis show a high difference in phytoplankton number which are independant of majorities of abiotic parameters

The relationship between hydrographic structures, and the spatial and temporal distribution of microphytoplankton community in Gulf of Gabes revele that Cyanobacteria are present mainly in the semi-mixed conditions and when a thermocline is established. The role of water circulation seems to be responsible of blooms

Phytoplankton dynamics related to water mass properties in the Gulf of Gabes: Ecological implications
M. Bel Hassen,, Z., A. Hamza , H. Ayadi, F. Akrout, S. Messaoudi
,H. Issaoui, Lotfi Aleya, Abderrahmen Bouaïn. *Journal of Marine Systems 75 (2009) 216–226*

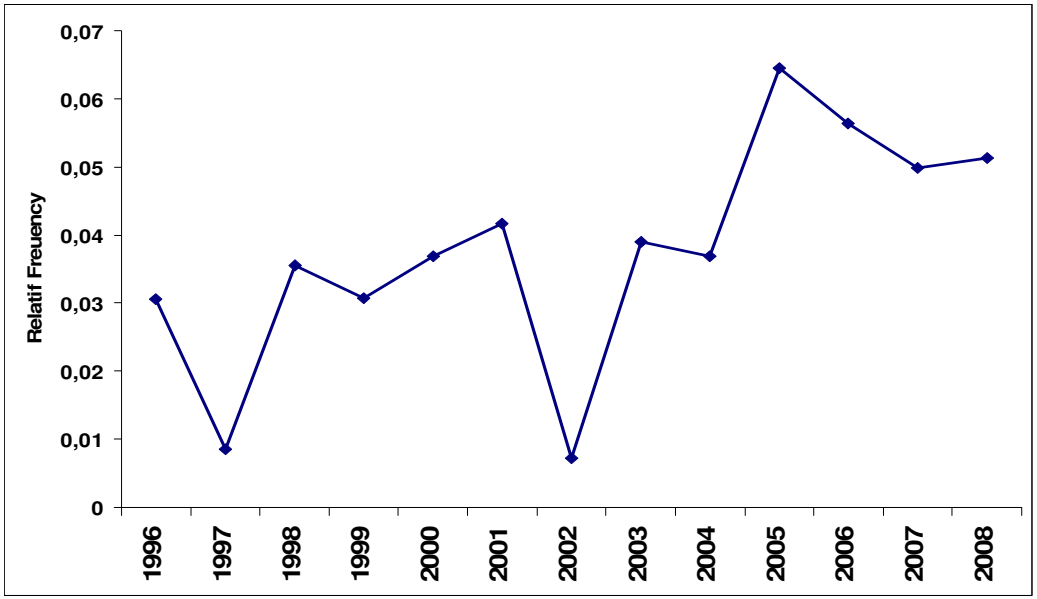
Dynamics of dinofagellates and environmental factors during the summer in the Gulf of Gabes (Tunisia, Eastern Mediterranean Sea)
Zaher Drira, Asma Hamza, Malika Belhassen, Habib Ayadi, Abderrahmen Bouaïn and Lotfi Aleya *Scientia Marina 72(1) 2008, 59-71,*

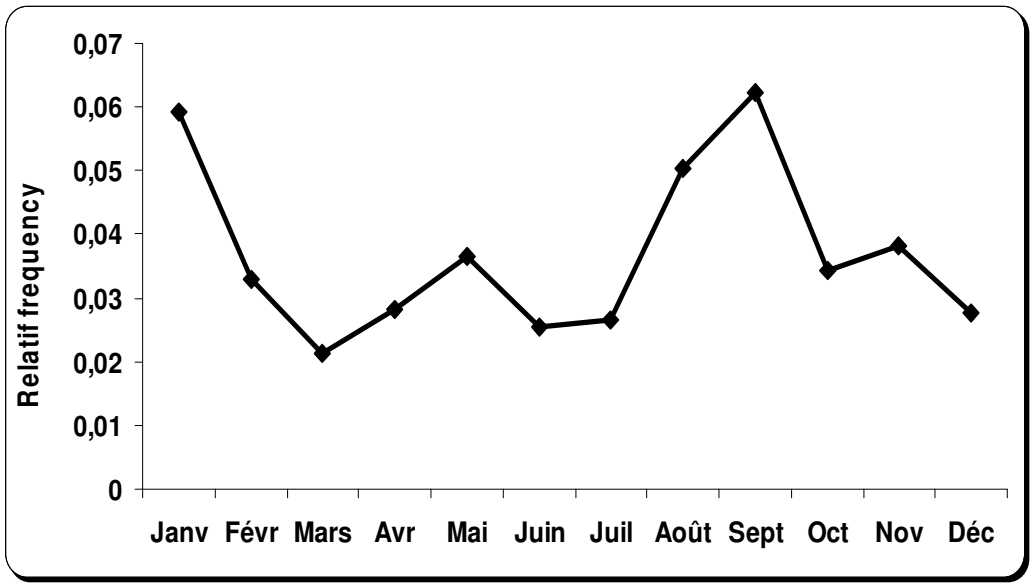
Summer phytoplankton pigments and community composition related to water mass properties in the Gulf of Gabes
M. Bel Hassen,, Z. Drira, A. Hamza, H. Ayadi, F. Akrout, H. Issaoui *Estuarine, Coastal and Shelf Science (2007) 1et2*

Phytoplankton-pigment signatures and their relationship to spring–summer stratification in the Gulf of Gabes
M. Bel Hassen, A. Hamza, Z. Drira , A. Zouari, F. Akrout, S. Messaoudi, L. Aleya , H. Ayadi *Estuarine, Coastal and Shelf Science 83 (2009) 296–306*

REPHY (1995- 2008)

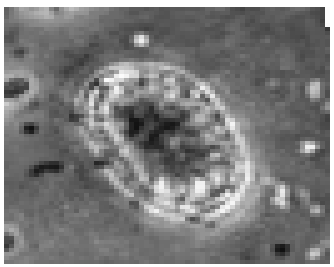
Algal blooms DINO	17
Algal blooms DIATO	8
Species with toxic event	7



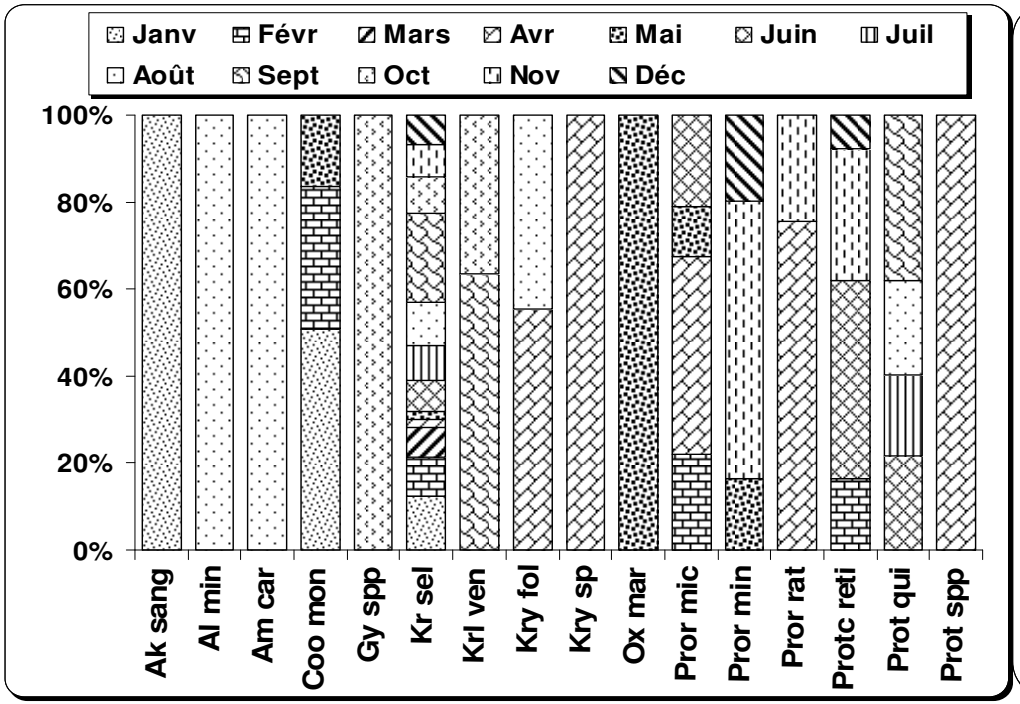


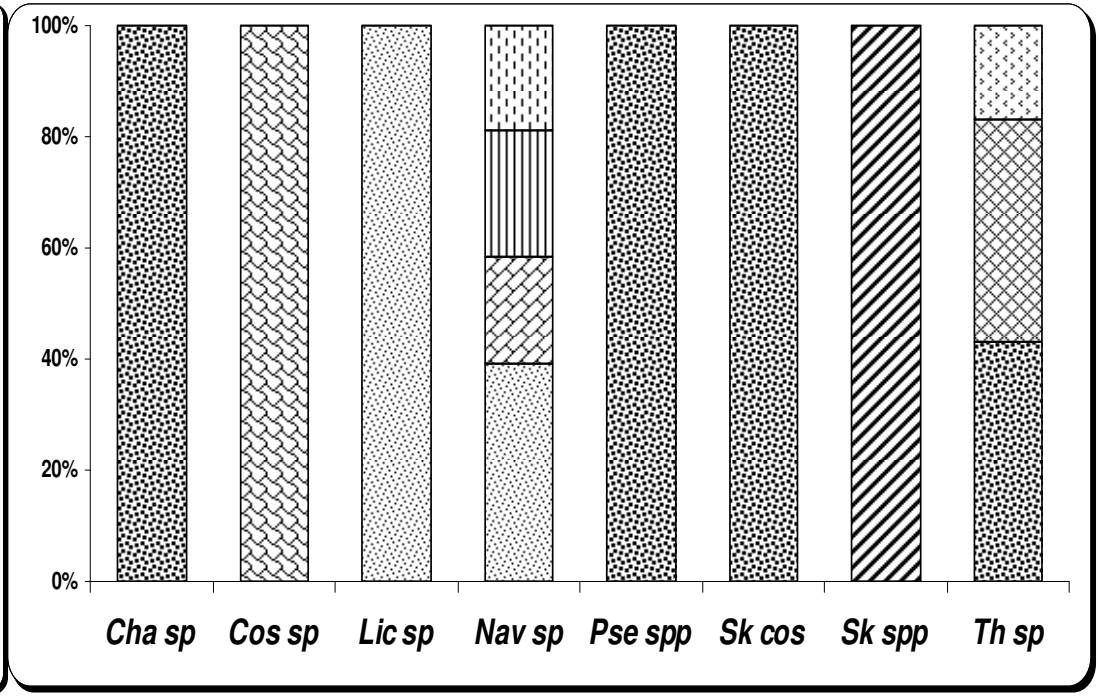
Species	Relative Frequency	Max con
Chaetoceros sp.	1%	$35,86.10^4$
Coscinodiscus sp.	1%	
Licmophora sp.	1%	
Navicula sp.	3%	$19,68.10^5$
Pseudo-nitzschia spp.	1%	
Skeletonema costatum	2%	
Thalassiosira spp.	2%	
Akashiwa sanguinea	1%	
Alexandrium minutum	2%	$32,8.10^5$
Amphidinium carterae	1%	$18,91.10^4$
Coolia monotis	2%	$32,8.10^5$
Gymnodinium catenatum	1%	20.10^5
Karenia selliformis	64%	$12,29.10^6$
Karlodinium veneficum	1%	$46,28.10^6$
Kryptoperidinium foliaceum	2%	
Oxyrrhis marina	1%	
Prorocentrum micans	4%	
Prorocentrum minimum	2%	57.10^6
Prorocentrum rathymum	1%	$21,60.10^6$
Protoceratium reticulatum	2%	
Proto. quinquecorne	4%	36.10^5
Protoperidinium spp.	1%	

Kyste of Karenia



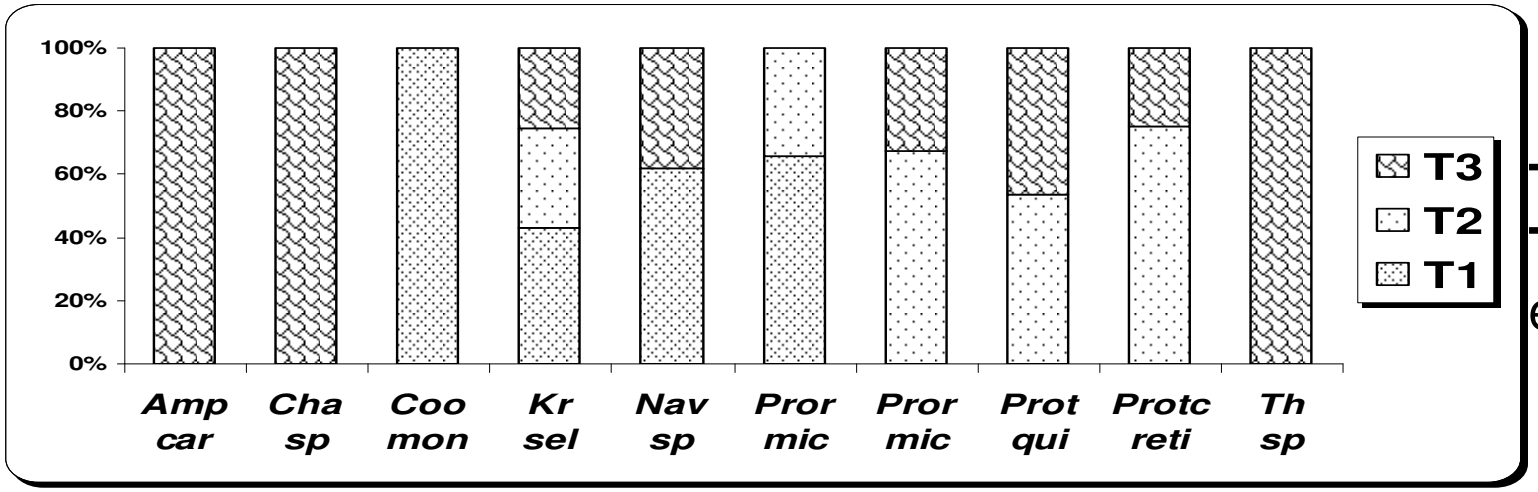
Karenia selliformis





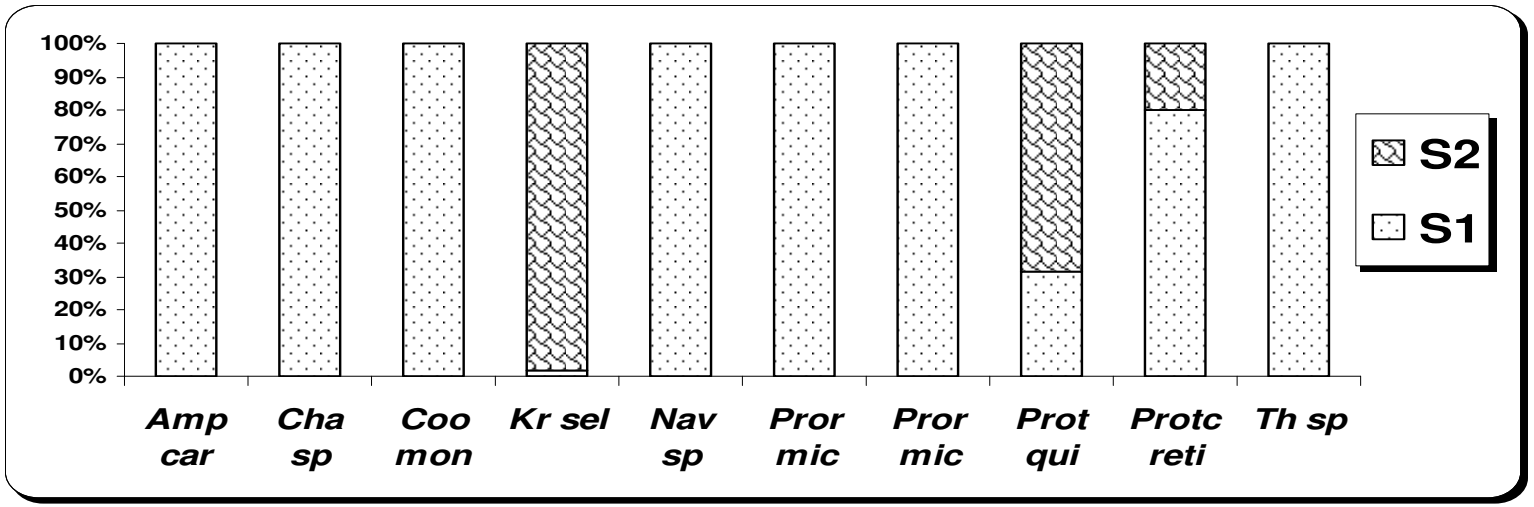
Espèces et leurs abréviations	Effet année	Effet mois	Effet zone
	Signification	Signification	Signification
Navicula sp.	****	**	****
Thalassiosira spp.	****	**	****
Alexandrium minutum	NS	**	NS
Coolia monotis	****	**	****
Karenia selliformis	NS	NS	NS
Prorocentrum micans	****	****	****
Prorocentrum minimum	NS	NS	NS
Protoceratium reticulatum	NS	NS	NS
Protoperidinium quinquecorne	NS	****	NS

(NS): Non Significatif,
(*): Significatif à 95%,
(**): Significatif à 99%,
(***): Significatif à 99,95%,
(****): Significatif à 99,99%,



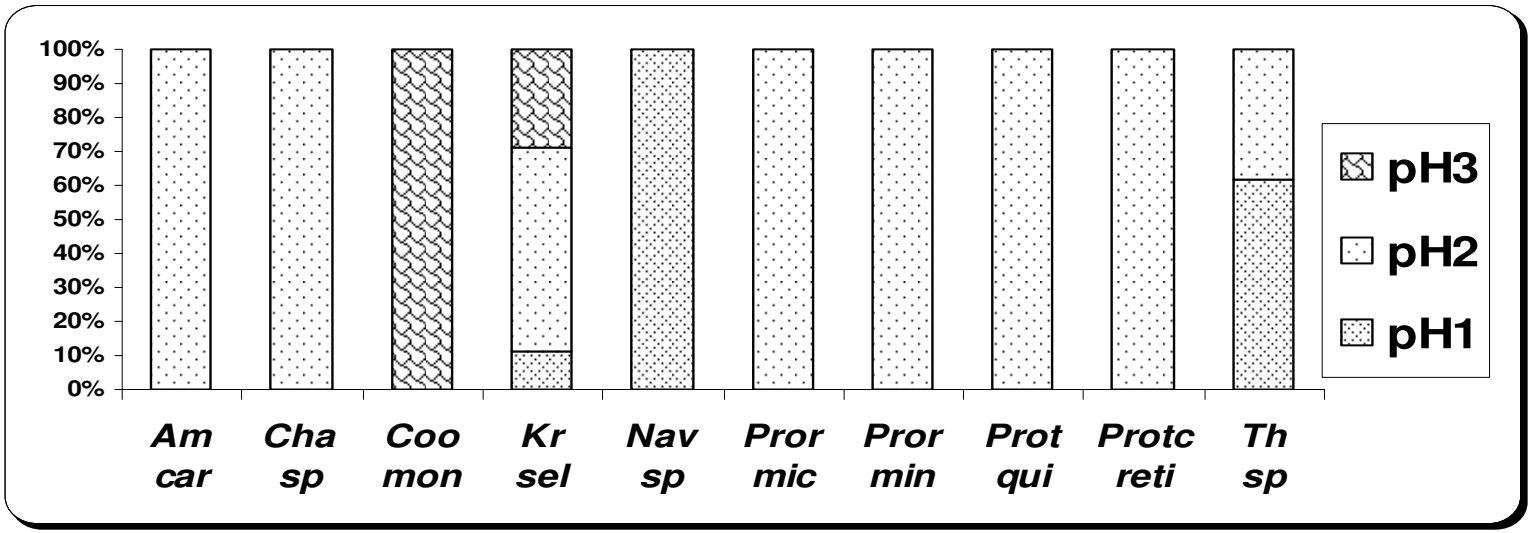
Temprature

T1< 18°C
T2: between 18°& 22°C
et **T3** > 22°C.



Salinity

S1 between 38 g/l & 42 g/l **S2** > 42 g/l.



pH1 < 8 ,
pH2 between 8 &8,5
pH3 > 8,5

DISCUSSION AND CONCLUSION

The Gulf of Gabes is dominated by a recurring phytoplankton population presenting some specificities in some regions.

HABs are predictable and they are well localized in specific regions.

2002 and 2006 seems to be a specific years of phytoplankton in Gabes gulf.

Spring and autumn are the most sensitive periods to Habs occurences. The increase in temperature and the heavy rainfall seem to trigger the efflorescences. Statstic analysis showed that the majority of these organisms choice a stable climate parameters.

Meteorological conditions certainly interact with the phytoplankton populations but they aren't determinant. Only a few correlations have been found.

Eutrophication of this region contributes intensively to the development of phytoplankton, but the biological processes regulate more these appearances.

The tide which characterizes the Gabes Gulf also plays an important role in the distribution of phytoplankton.