



General Fisheries Commission for the Mediterranean
Commission Générale des Pêches pour la Méditerranée
Comisión General de Pesca para el Mediterráneo



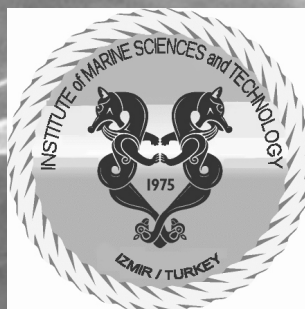
الهيئة العامة لمصايد أسماك البحر الأبيض المتوسط

Workshop on algal and jelly fish blooms
6-8 October 2010
Istanbul, Turkey

HABs incidents and monitoring efforts in Izmir Bay, Turkey

Nihayet BİZSEL, K Can BİZSEL, Burak E. İNANAN

Dokuz Eylul University
Institute of Marine Science and Technology
Izmir-Turkey



Aegean coast of Turkey; Izmir Bay



Izmir Bay

My Home

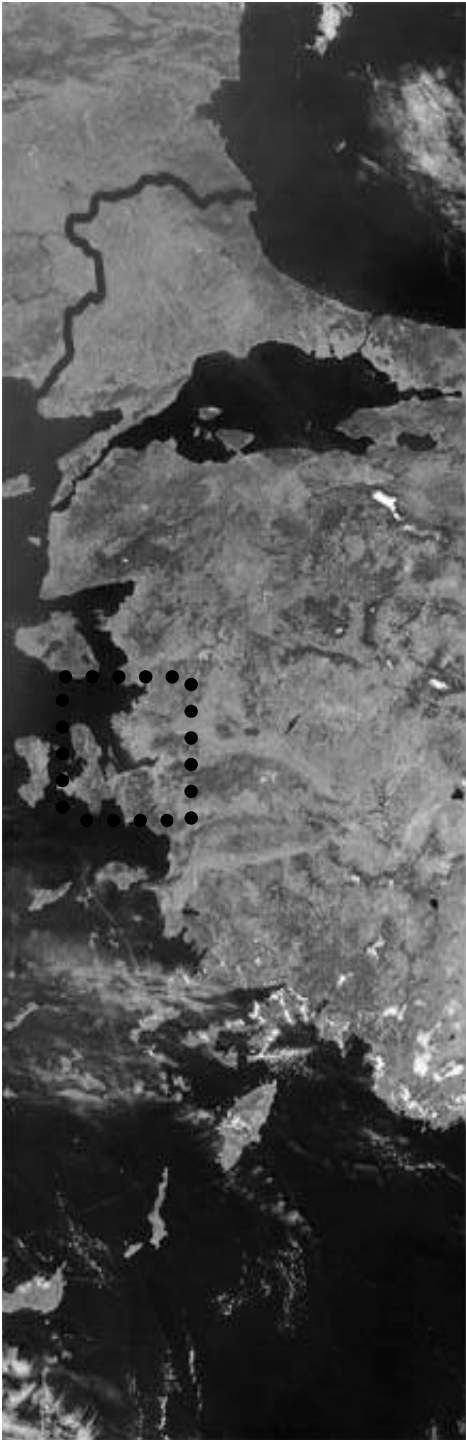


Our Institute

Harbour

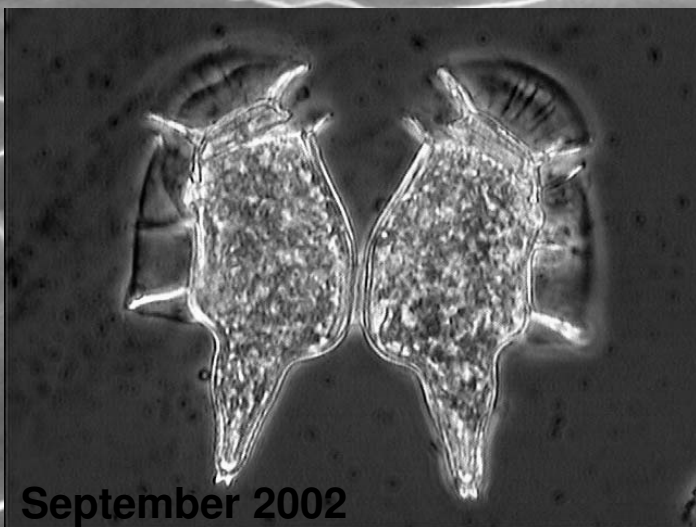
Temperature 16.0°C (in winter) 24.0 °C (in summer_coastal water max 28 °C)

The average depth of the Izmir Bay is about 20-25 meters.



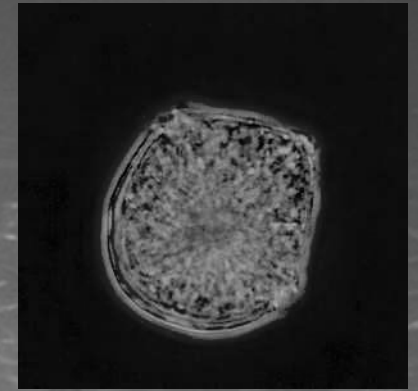
The Beginning

The First Red-tide and Mass Fish Mortalities events have been reported since 1950's



The First Record on Toxic Phtyoplankton Species was *Alexandrium minutum* in 1983

Later



focused more and more on the toxic species and HABs events, particularly towards to the end of 1980's.

Today

A check-list

(<http://bornova.ege.edu.tr/~korayt/plankweb/chklists.html>)

225	species	Bacillariophyceae
232	species	Dinophyceae
7	species	Prasinophyceae
7	species	Cyanophyceae
7	species	Dictyochophyceae
4	species	Prymnesiophyceae
2	species	Euglenophyceae
2	species	Chlorophyceae
1	species	Xanthophyceae
1	species	Ebriidea
<u>TOTAL 488 species</u>		

Harmful /Nuisance micro-algae from Turkish coastal waters

Dinophyceae (32)		Bacillariophyceae (14)
<u><i>Alexandrium minutum</i></u>	<u><i>Prorocentrum aporum</i></u>	<u><i>Chaetoceros danicus</i></u>
<u><i>Ceratium furca</i></u>	<u><i>Prorocentrum balticum</i></u>	<u><i>Coscinodiscus granii</i></u>
<u><i>Dinophysis acuminata</i></u>	<u><i>Prorocentrum cassabicum</i></u>	<u><i>Cylindrotheca closterium</i></u>
<u><i>D. acuta</i></u>	<u><i>Prorocentrum dentatum</i></u>	<u><i>Nitzschia longissima</i></u>
<u><i>D. caudata</i></u>	<u><i>Prorocentrum lima</i></u>	<u><i>Phaeodactylum tricornutum</i></u>
<u><i>D. fortii</i></u>	<u><i>Prorocentrum micans</i></u>	<u><i>Pseudo-nitzschia delicatissima</i></u>
<u><i>D. mitra</i></u>	<u><i>Prorocentrum minimum</i></u>	<u><i>P. pseudodelicatissima</i></u>
<u><i>D. rotundata</i></u>	<u><i>Prorocentrum triestinum</i></u>	<u><i>P. pungens</i></u>
<u><i>D. sacculus</i></u>	<u><i>Prorocentrum longipes</i></u>	<u><i>P. calliantha</i></u>
<u><i>D. tripos</i></u>	<u><i>Protoperidinium steinii</i></u>	<u><i>Rhizosolenia calcar-avis</i></u>
<u><i>Diplopsalis lenticula</i></u>	<u><i>Scrippsiella trochoidea</i></u>	<u><i>Skeletonema costatum</i></u>
<u><i>Gonyaulax grindleyi</i></u>		<u><i>Thalassiosira allenii</i></u>
<u><i>G. spinifera</i></u>	Euglenophyceae (3)	<u><i>T. anguste-lineata</i></u>
<u><i>Gymnodinium cf. mikimotoi</i></u>	<u><i>Euglena acusformis</i></u>	<u><i>T. rotula</i></u>
<u><i>Gymnodinium sanguineum</i></u>	<u><i>Eutreptia lanowii</i></u>	Prymnesiophyceae (1)
<u><i>Gymnodinium simplex</i></u>	<u><i>Eutreptiella gymnastica</i></u>	<u><i>Emiliana huxleyi</i></u>
<u><i>Gyrodinium spirale</i></u>		Prasinophyceae (2)
<u><i>Heterocapsa triquetra</i></u>	Cyanophyceae (2)	<u><i>Pyramimonas orientalis</i></u>
<u><i>Lingulodinium polyedrum</i></u>	<u><i>Anabaena spiroides</i></u>	<u><i>Pyramimonas propulsa</i></u>
<u><i>Noctiluca scintillans</i></u>	<u><i>Anabaena variabilis</i></u>	Raphidophyceae (1)
<u><i>Oxytoxum scolopax</i></u>		<u><i>Heterosigma cf. akashiwo</i></u>

In 1990's, MARA (Directorate of Conservation and Control) has started an action plan on monitoring HABs

the monitoring restricted with the shellfish production grounds

the considerable incompleteness of the inventory

The new phytoplankton records from Turkey

Nihayet Bizsel and Elisabeth Nezan*

* IFREMER Concarneau

During the period of 1998-1999, 38 phytoplankton species were recorded for the first time, including some **toxic** species in Izmir Bay, Aegean Sea.

BACILLARIOPHYCEAE

Achnanthes brevipes
Cyclophora tenuis
Cylindrotheca gracilis
Entomoneis sulcata
Gomphonema sp.
Gyrosigma fasciola
Hantzschia
Haslea cf. wavrikan
Rhoicosphenia curvata
Stauropsis membranacea

DINOFLAGELLATA

Alexandrium insuetum
Alexandrium margalefi
Amphidinium crassum
Amylax buxus
Blepharocysta sp.
Dinophysis cf. lenticula
Fragilidium subglobosum
Gymnodinium cf. catenatum
Gymnodinium cf. mikimotoi
Heterocapsa niei
Katodinium glaucum
Mesopores perforatus
Oblea sp.
Oxytoxum caudatum
Oxytoxum mediterraneum
Oxytoxum sphaeroideum
Oxytoxum tessellatum

Palaeophalocroma sp.

Pronoctiluca pelagica
Prorocentrum mexicanum
Protoperidinium bipes
P. cf. excentricum
Pyrocystis lunula
Pselodinium vaubanii
Scripsiella cf. spinifera

RAPHIDOPHYCEAE

Heterosigma cf. akashiwo

EBRIIDEA

Hermesinium adriaticum

PRASINOPHYCEAE

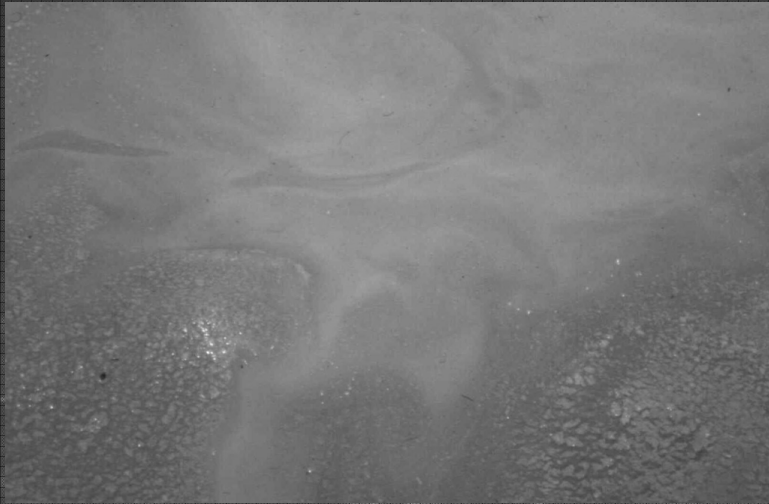
Pyramimonas longicauda

21 & 24 April 1998 Massive Fish Mortality

Izmir Bay, April 1998

Izmir Bay, April 1998





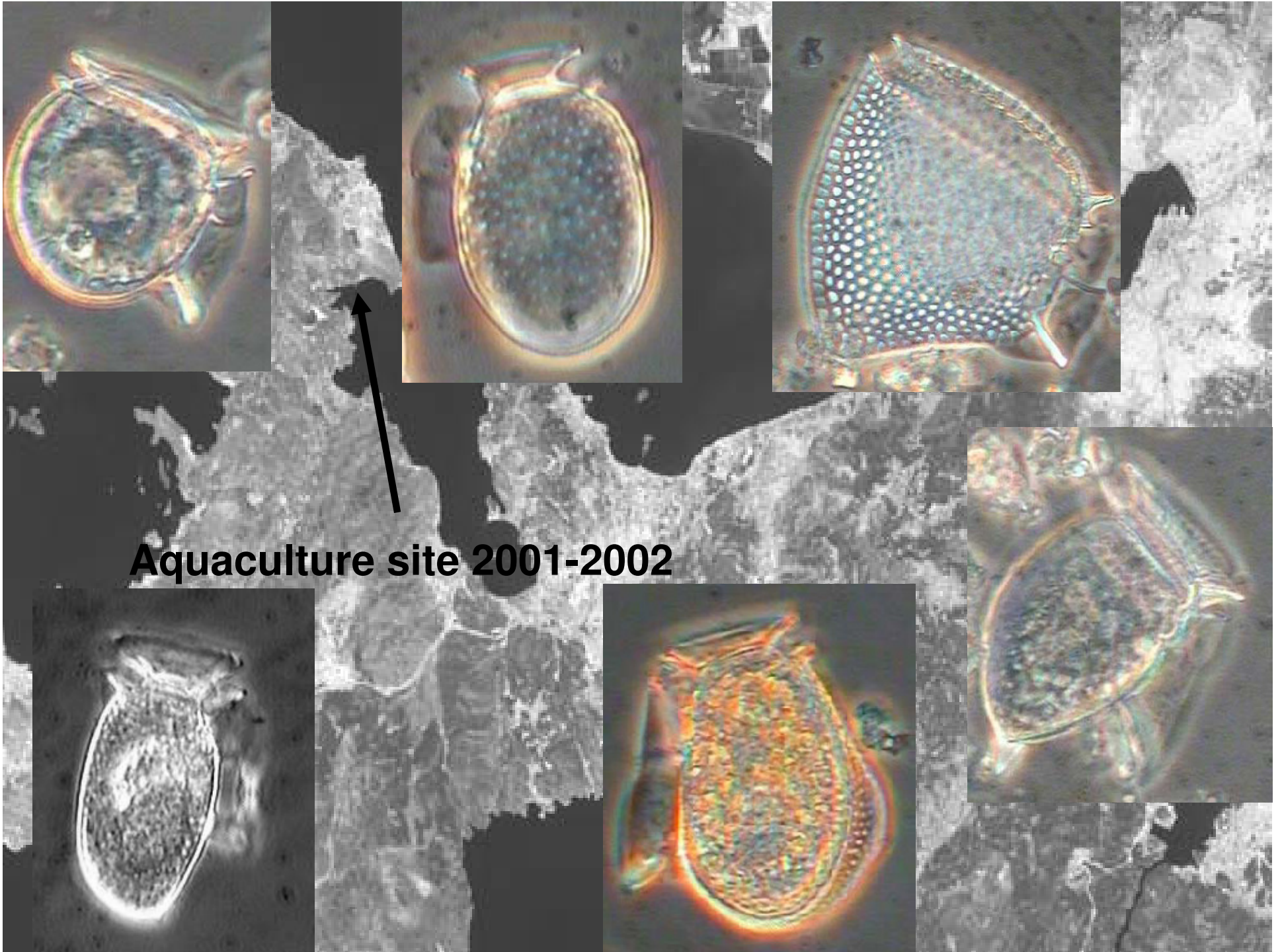
April 1998



May 1999



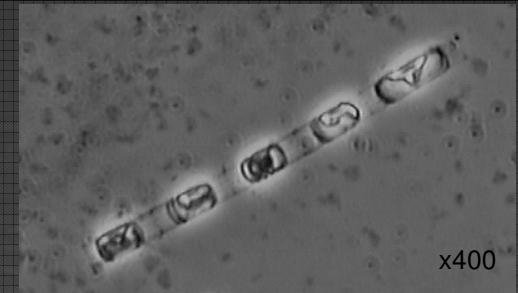
Gülbahçe Bay June 2003 bloom



Aquaculture site 2001-2002

Skeletonema costatum (Greville) Cleve

56 x 10⁶ cells/l



DO level of 215 %	Oxygen concentration 11.42 ml/l 18,5 °C 35.3 ‰ salinity
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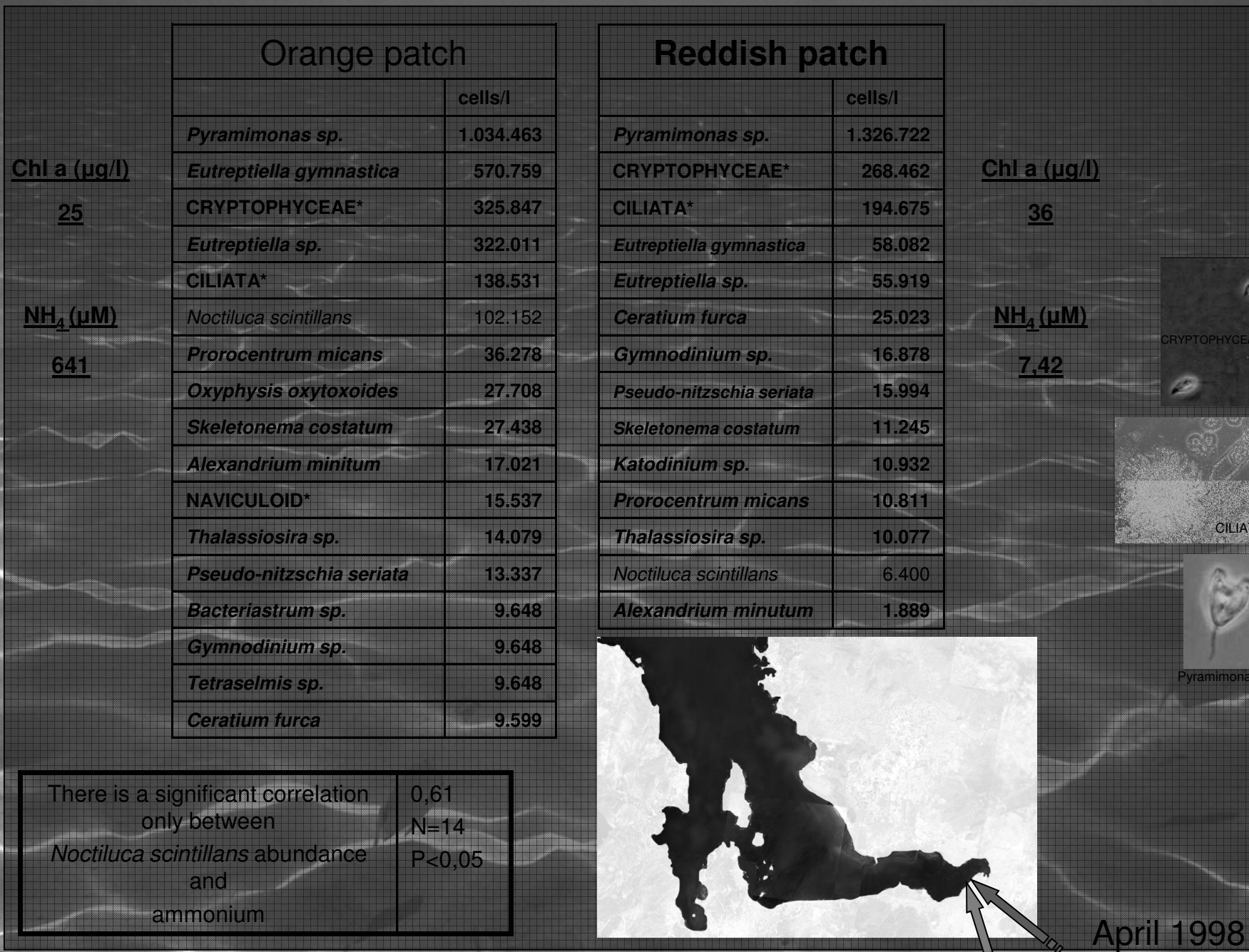
	April 94	June 94
DIP (µM)	2	49

	April 94	June 94
Silicate (µM)	3	32



the Study was carried out April 1993 – June 1994

April 1994



Orange patch

	cells/l
<i>Pyramimonas sp.</i>	1.034.463
<i>Eutreptiella gymnastica</i>	570.759
CRYPTOPHYCEAE*	325.847
<i>Eutreptiella sp.</i>	322.011
CILIATA*	138.531
<i>Noctiluca scintillans</i>	102.152
<i>Prorocentrum micans</i>	36.278
<i>Oxyphysis oxytoxoides</i>	27.708
<i>Skeletonema costatum</i>	27.438
<i>Alexandrium minutum</i>	17.021
NAVICULOID*	15.537
<i>Thalassiosira sp.</i>	14.079
<i>Pseudo-nitzschia seriata</i>	13.337
<i>Bacteriastrum sp.</i>	9.648
<i>Gymnodinium sp.</i>	9.648
<i>Tetraselmis sp.</i>	9.648
<i>Ceratium furca</i>	9.599

Reddish patch

	cells/l
<i>Pyramimonas sp.</i>	1.326.722
CRYPTOPHYCEAE*	268.462
CILIATA*	194.675
<i>Eutreptiella gymnastica</i>	58.082
<i>Eutreptiella sp.</i>	55.919
<i>Ceratium furca</i>	25.023
<i>Gymnodinium sp.</i>	16.878
<i>Pseudo-nitzschia seriata</i>	15.994
<i>Skeletonema costatum</i>	11.245
<i>Katodinium sp.</i>	10.932
<i>Prorocentrum micans</i>	10.811
<i>Thalassiosira sp.</i>	10.077
<i>Noctiluca scintillans</i>	6.400
<i>Alexandrium minutum</i>	1.889

Chl a (µg/l)

25

NH₄ (µM)

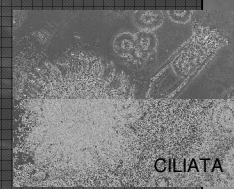
641

Chl a (µg/l)

36

NH₄ (µM)

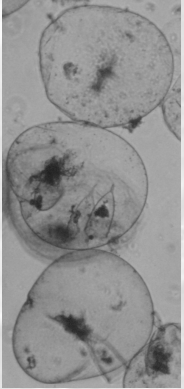
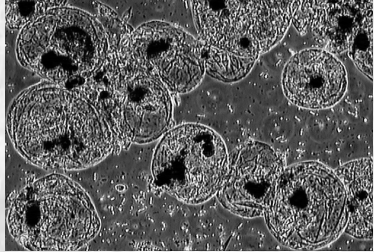
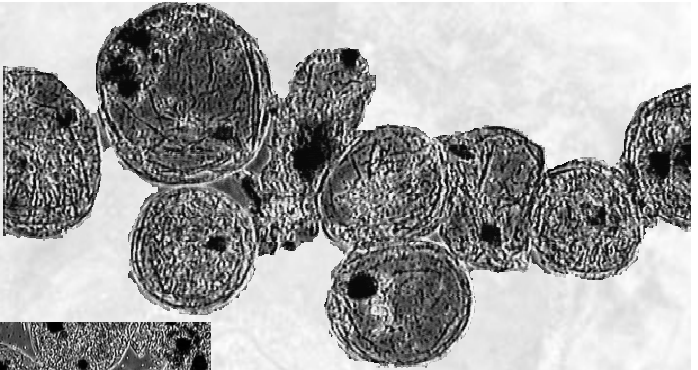
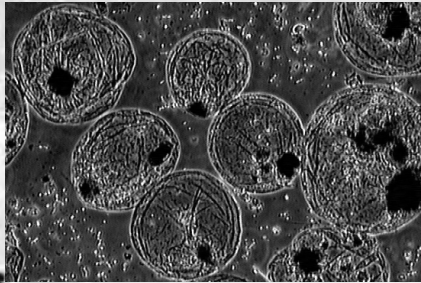
7,42



There is a significant correlation only between *Noctiluca scintillans* abundance and ammonium

0,61
N=14
P<0,05

April 1998



31 cells/l
on average

***Noctiluca scintillans* (Macartney) Ehrenberg**

Large -200 μM to >1 mm- (Tomas,1997)

8.600 cells/l
on average

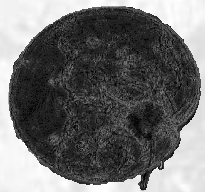
27.000 cells/l
on average

NH_4^+

4,45 μM
on average

7,5 μM
on average

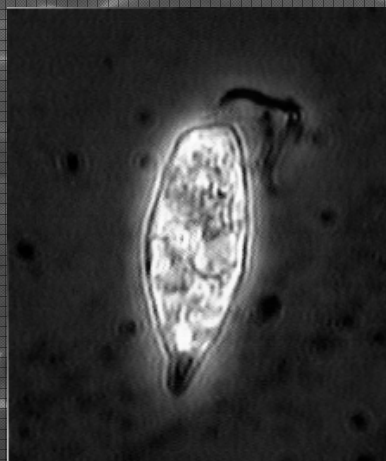
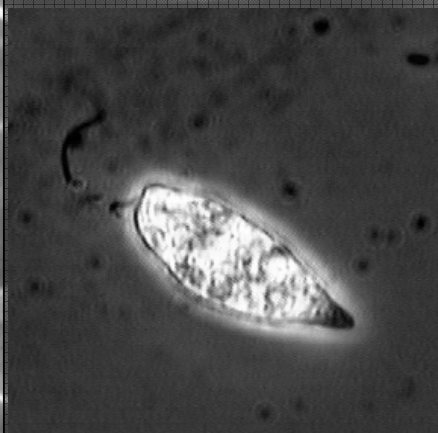
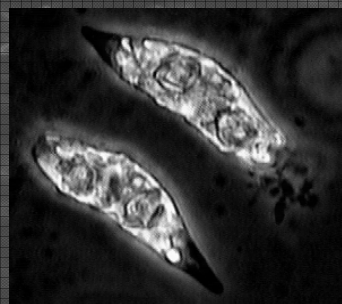
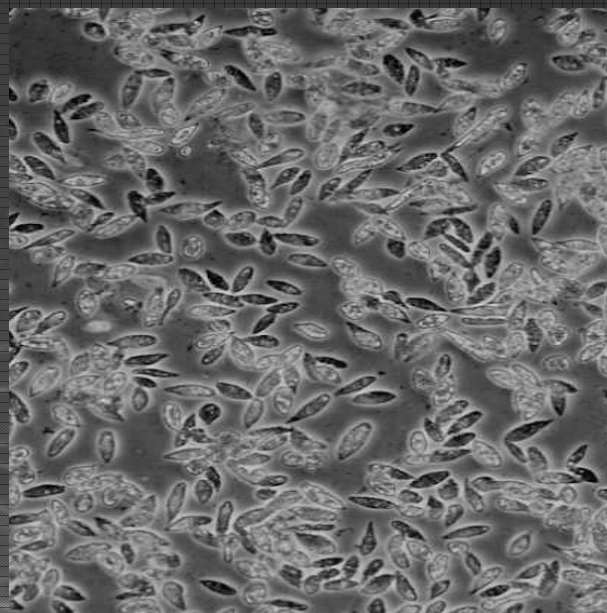
108 μM
on average



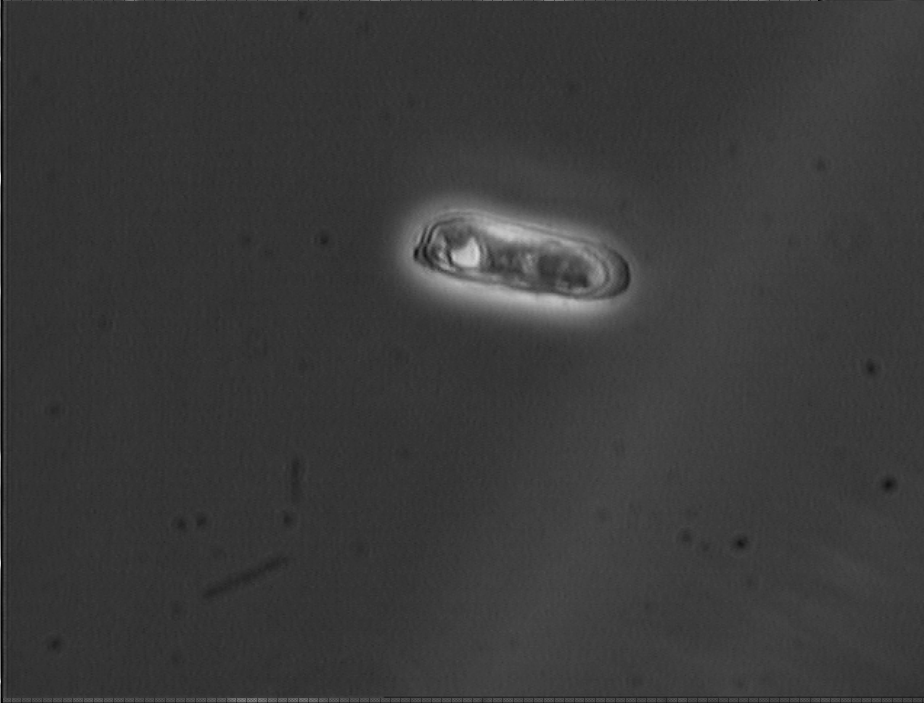
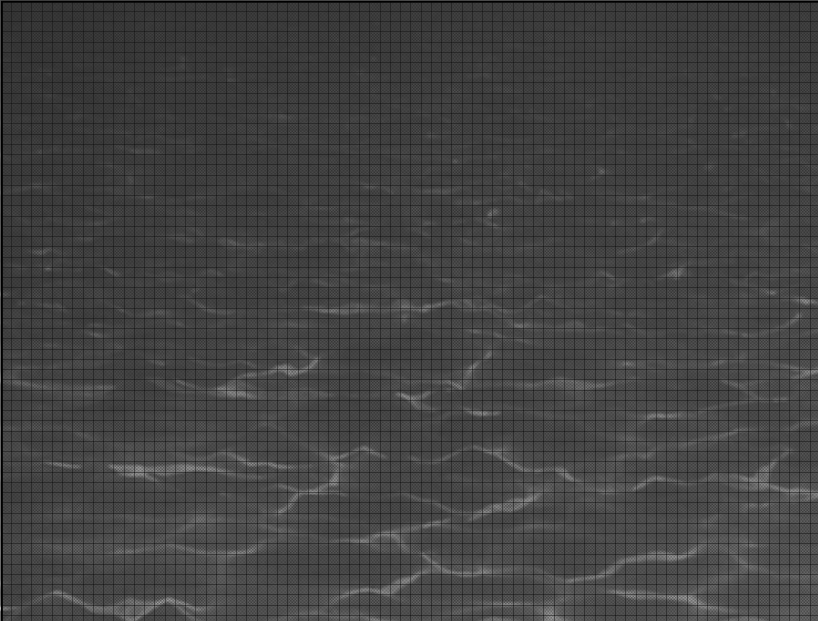
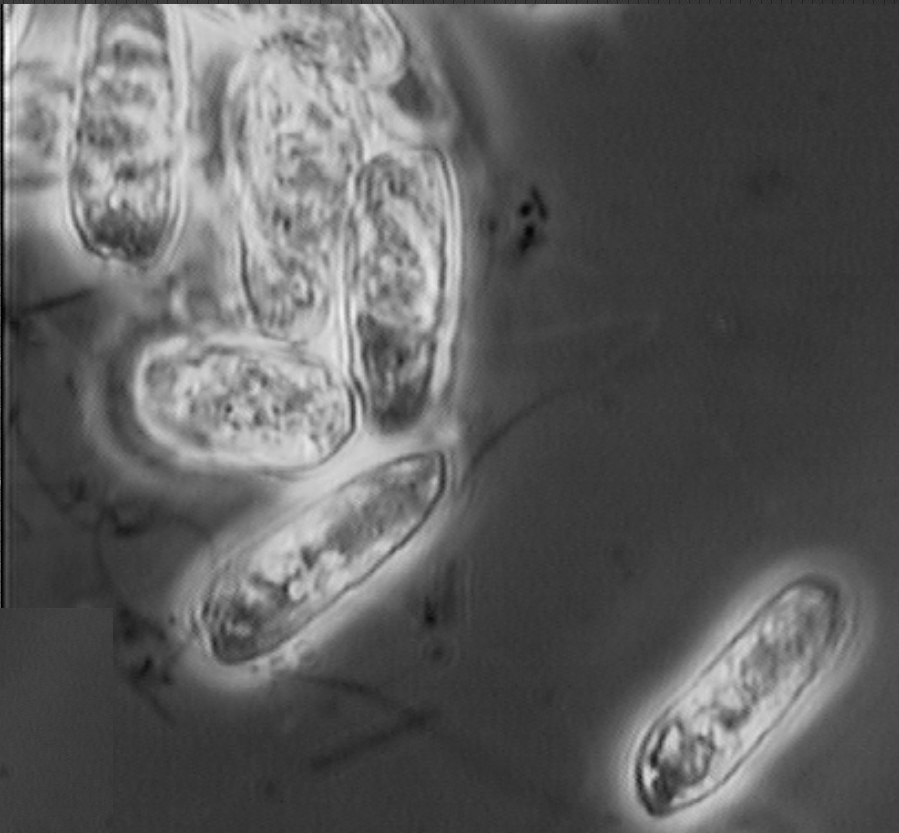
Eutreptiella gymnastica Throndsen

Green-tide

1.600.000 cells/l



May 1999



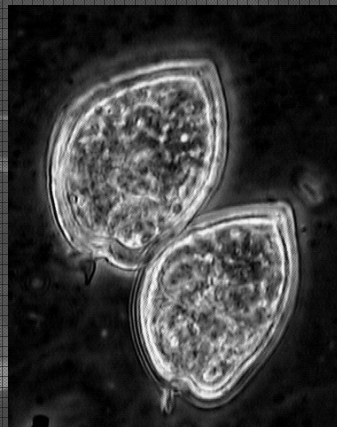
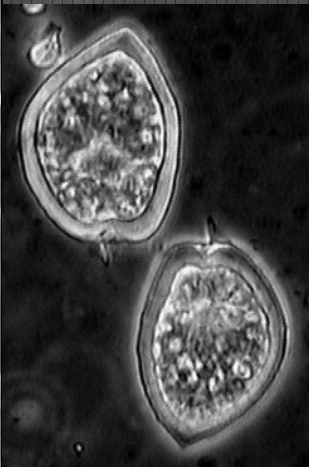
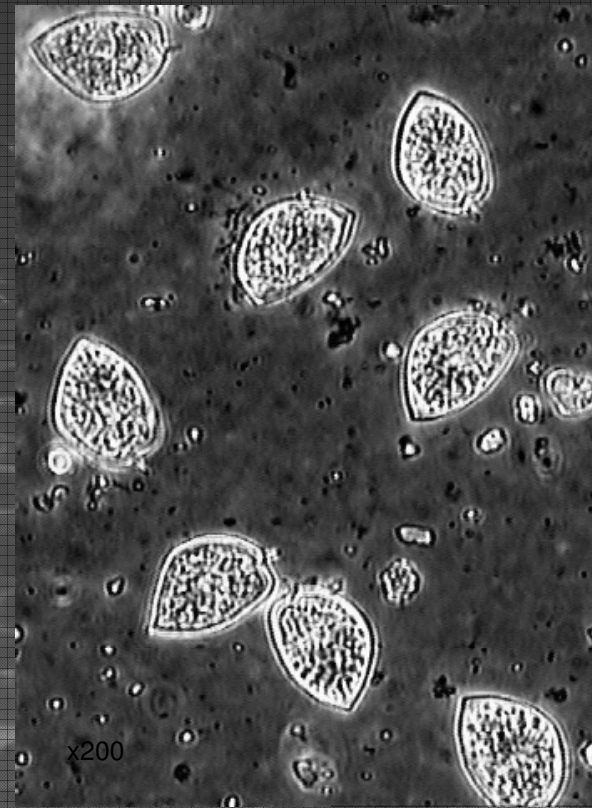
02 September 1999

Prorocentrum dentatum Stein

Prorocentrum micans Ehrenberg

Orange-tide

Station 1	530.000	Cells l ⁻¹
Station 2	500.000	
Station 3	470.000	



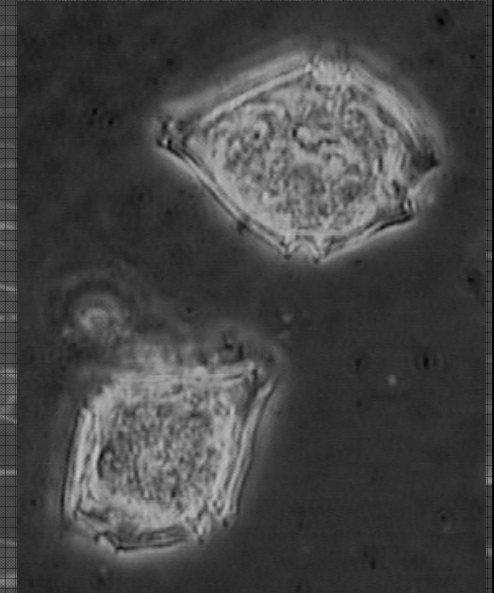
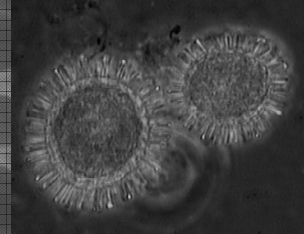
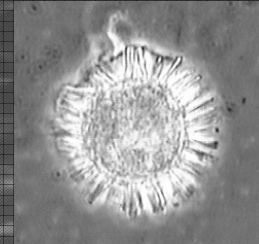
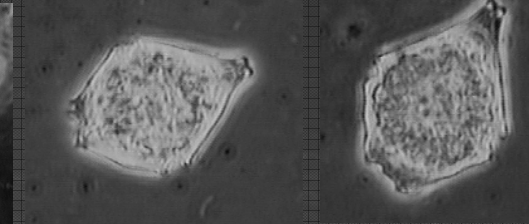
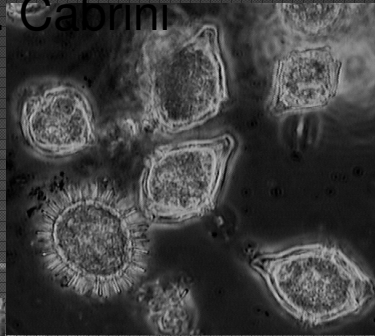
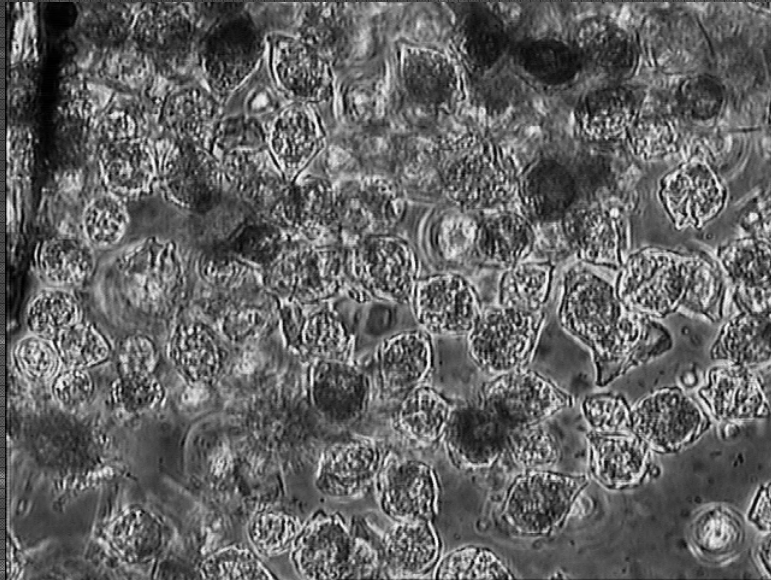
May 2001

Scrippsiella spinifera G. Honsell & M. Cabrini

Brown tide

21.2×10^6 cells/l

1.0×10^6 cysts/l



<i>Gonyaulax</i> sp.	115.000	Cells l ⁻¹
<i>Prorocentrum</i> sp	14.000	
<i>Protoperidinium</i> cf. <i>steinii</i> (Jørgensen) Balech	28.000	

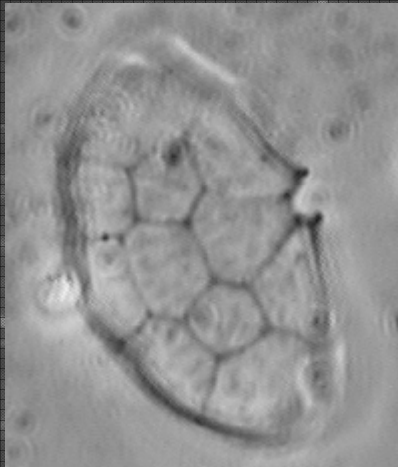
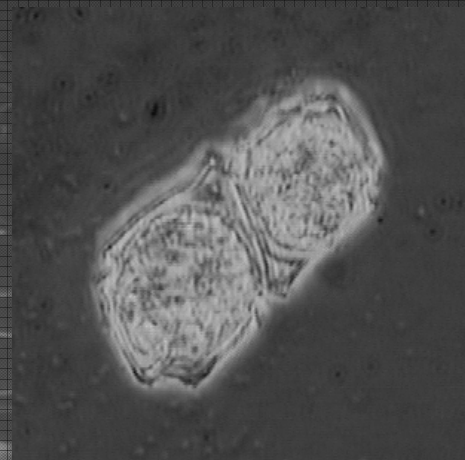
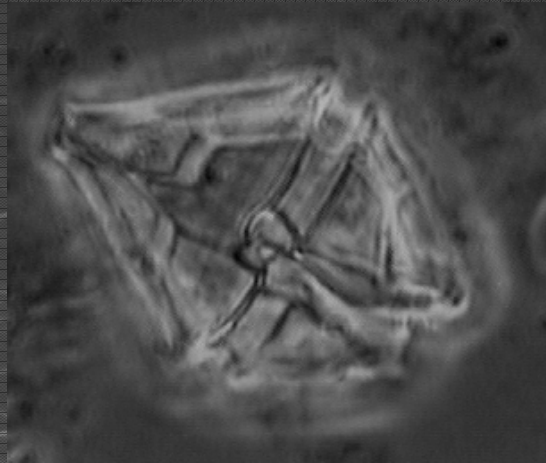


August 2006

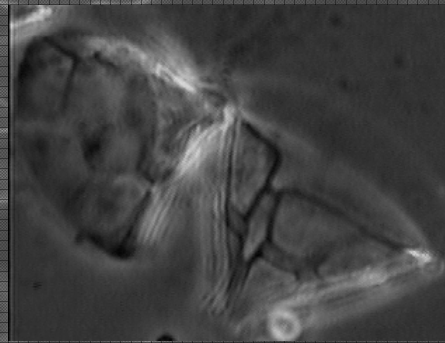
Scrippsiella spinifera G. Honsell & M. Cabrini

Length(μm) 30-44

Width (μm) 22-29

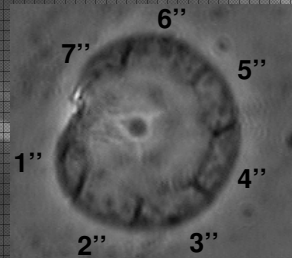
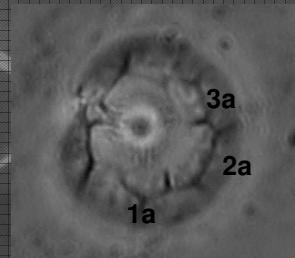
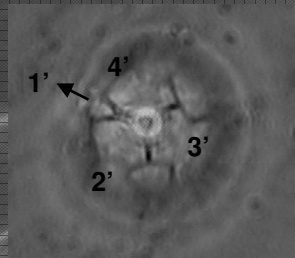
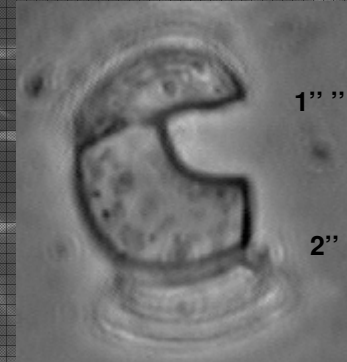


View the epitheca

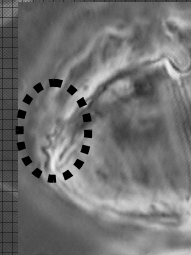
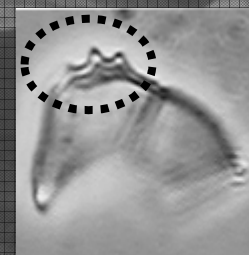


Apical view of the theca

Antapical view of the theca



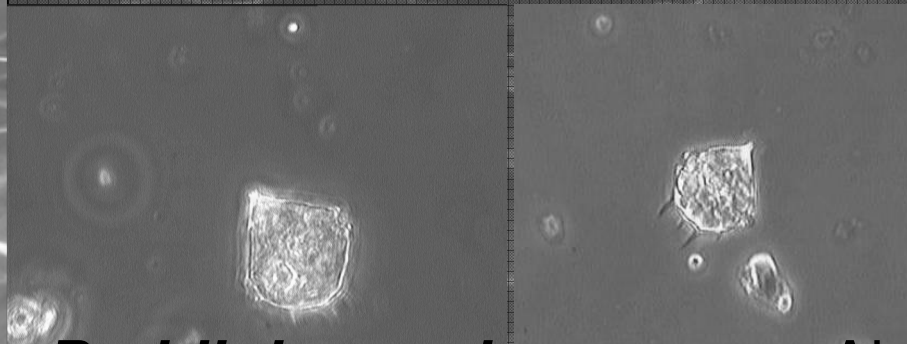
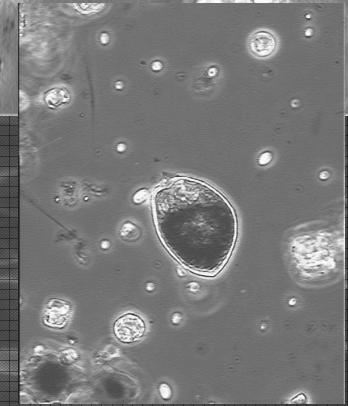
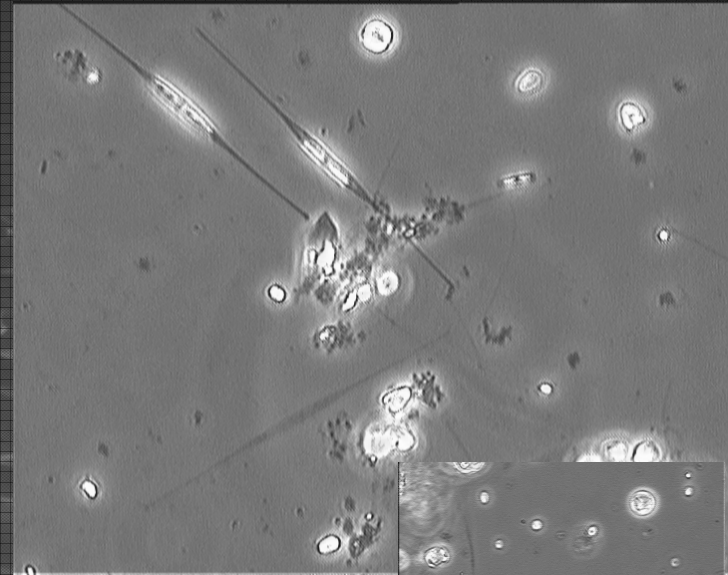
Spines



4''''

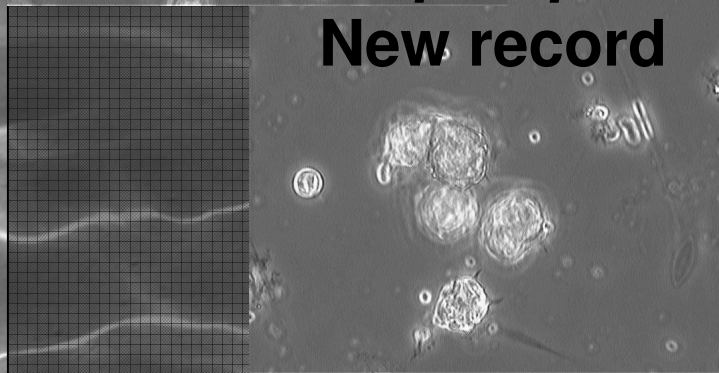
Reddish tide

<i>Cylindrotheca closterium</i>	3.681,000	Cells l ⁻¹
<i>Thalassiosira sp.</i>	3.583,000	
<i>Chaetoceros sp.</i>	1.609,000	
<i>Peridinium quinquecone</i> new record	922.900	
<i>Prorocentrum micans</i>	19.200	
<i>Favella sp.</i>	1.558,000	

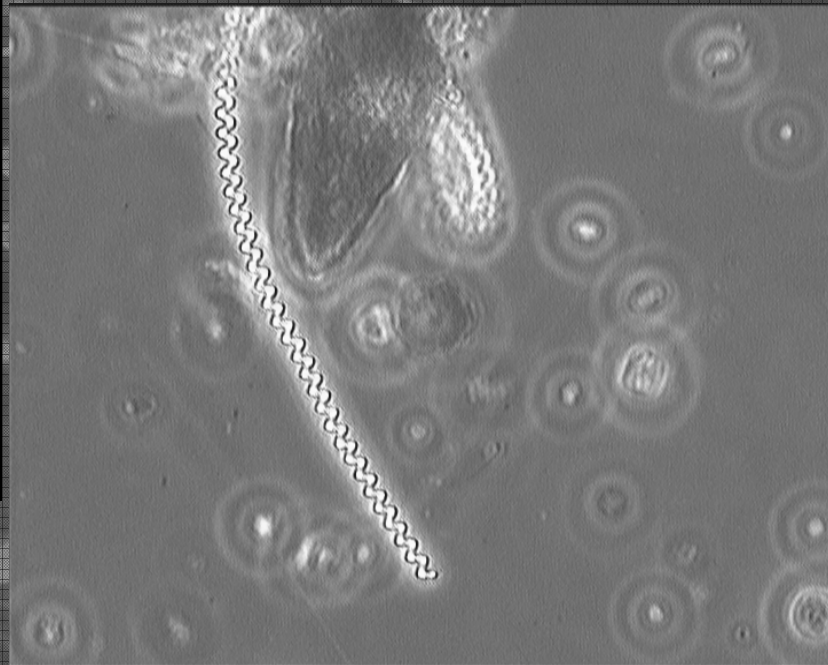
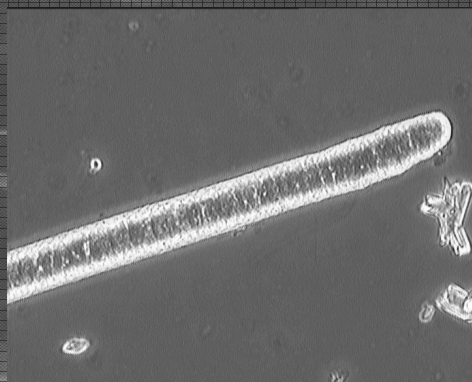
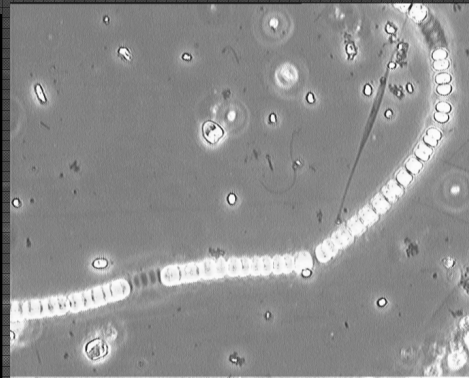
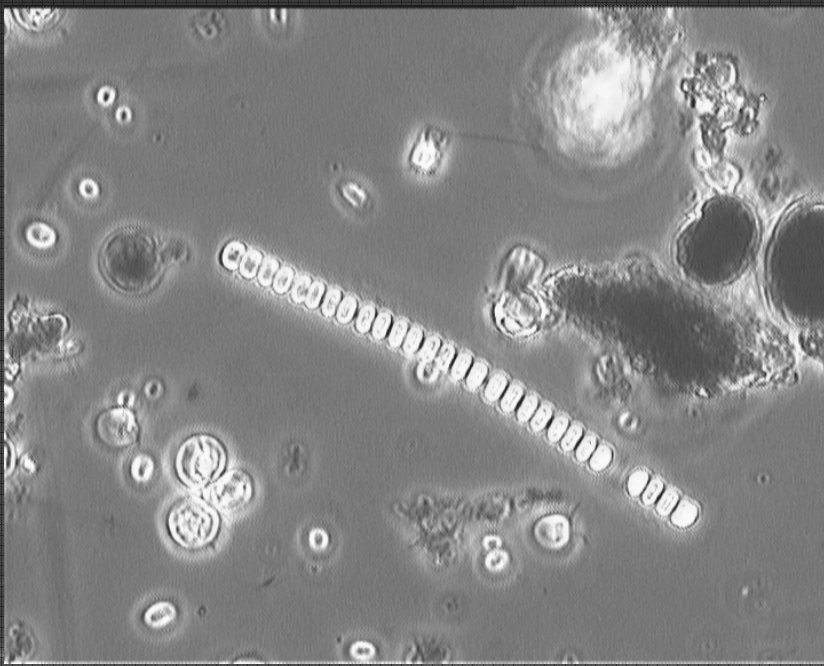


Peridinium quinquecorne Abe

New record

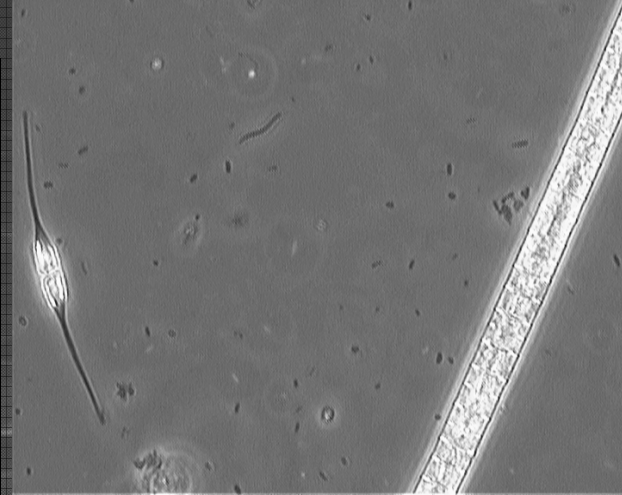
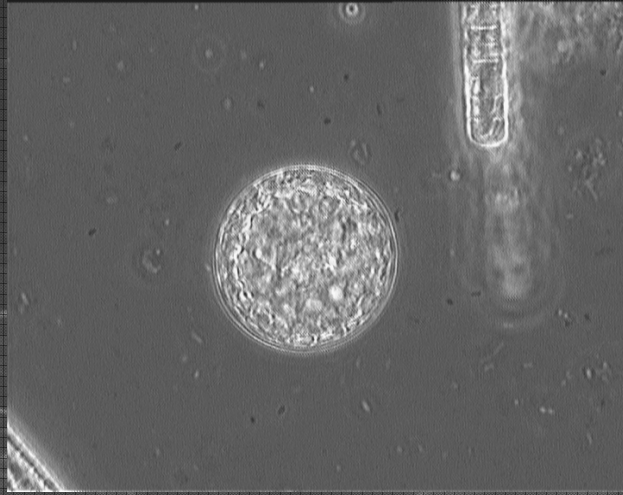


August 2010

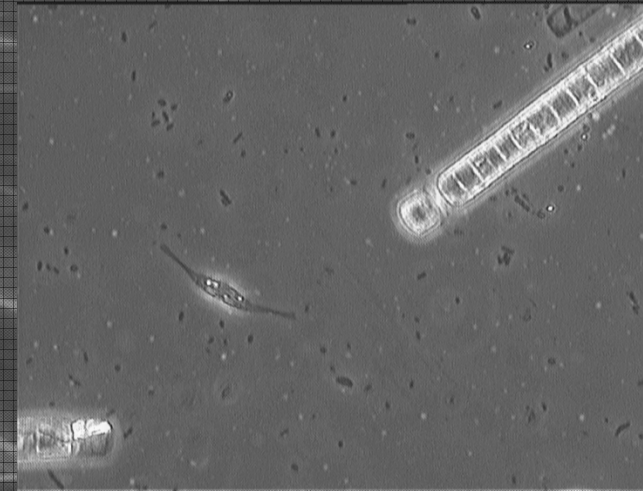
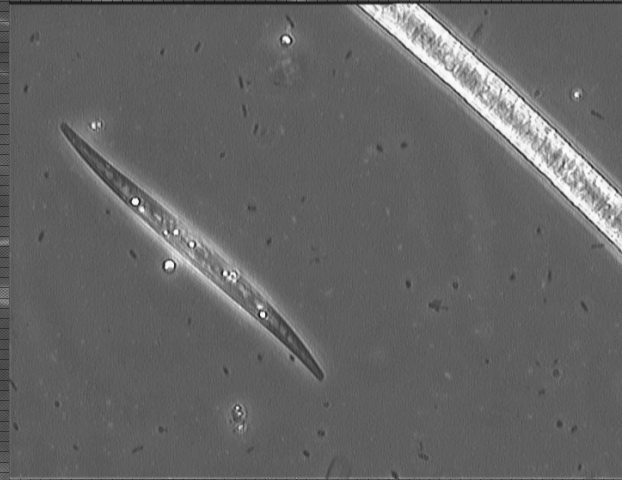


Some Cyanophyceae Species from the Same Patch

August 2010



**The
cyanobacterial
product
suppressed
growth of
phytoplankton**



**Cyanophyceae
Izmir Bay_ Urla 05 September 2010**

List of Causative Organisms of Red Tides Which occurred in Izmir Bay in 1983, 1994, 1998, 2001, 2006 and 2010 spring/summer

<u>1983</u>	<u>1994</u>	<u>1998-1999</u>	<u>2001</u>	<u>2006</u>	<u>2010</u>
<i>Alexandrium minutum</i>		<i>Alexandrium minutum</i>			
				<i>Ceratium furca</i>	
<i>Ceratium sp.</i>	<i>Ceratium sp.</i>	<i>Ceratium sp.</i>		<i>Ceratium cf. lineatum</i>	
		Cryptophyceae			Cyanophyceae
<i>Cylindrotheca closterium</i>		<i>Cylindrotheca closterium</i>			<i>Cylindrotheca closterium</i>
	<i>Coscinosira sp</i>				
		<i>Dinophysis rotundata</i>			
	<i>Euglena viridis</i>				
		<i>Ebria tripartita</i>			
<i>Eutreptiella gymnastica</i>		<i>Eutreptiella gymnastica</i>			
<i>Gonyaulax polyedra</i>		<i>Gonyaulax sp.</i>		<i>Gonyaulax sp.</i>	
<i>Gonyaulax spinifera</i>					
		<i>Gymnodinium cf mikimotoi</i>			
		<i>Gyrodinium spirale</i>			
		<i>Heterocapsa sp.</i>			
		<i>Heterosigma cf akashiwo</i>			
		<i>Katodinium glaucum</i>			
	<i>Lauderia sp.</i>				
		<i>Nitzschia longissima</i>			
<i>Nitzschia pungens</i>	<i>Nitzschia pungens</i>				
	<i>Pleurosigma sp.</i>				
					<i>Peridinium quinquecorn</i>
		<i>Prorocentrum dentatum</i>			
<i>Prorocentrum micans</i>	<i>Prorocentrum sp.</i>	<i>Prorocentrum micans</i>	<i>Prorocentrum micans</i>	<i>Prorocentrum sp</i>	<i>Prorocentrum micans</i>
		<i>Prorocentrum minimum</i>			
<i>Prorocentrum triestinum</i>		<i>Prorocentrum triestinum</i>			
<i>Protoperidinium sp.</i>	<i>Protoperidinium sp.</i>	<i>Protoperidinium sp.</i>		<i>Protoperidinium cf. steinii</i>	
<i>Pyramimonas propulsum</i>		<i>Pyramimonas sp.</i>			
				<i>Scrippsiella spinifera</i>	
<i>Scrippsiella trochoidea</i>	<i>Scrippsiella trochoidea</i>	<i>Scrippsiella trochoidea</i>			
	<i>Skeletonema costatum</i>				
<i>Thalassiosira allenii</i>	<i>Thalassiosira sp.</i>	<i>Thalassiosira sp.</i>			<i>Thalassiosira sp.</i>

List of Causative Organisms of Red Tides Which occurred in Izmir Bay in 1983, 1994 and 1998 spring period. (CONTINUED)

<u>1983</u>	<u>1994</u>	<u>1998-1999</u>	<u>2001</u>	<u>2006</u>	<u>2010</u>
<i>Noctiluca scintillans</i>	<i>Noctiluca scintillans</i>	<i>Noctiluca scintillans</i>			
<i>Mesodinium rubrum</i>		<i>Mesodinium rubrum</i>			
					<i>Favella sp.</i>

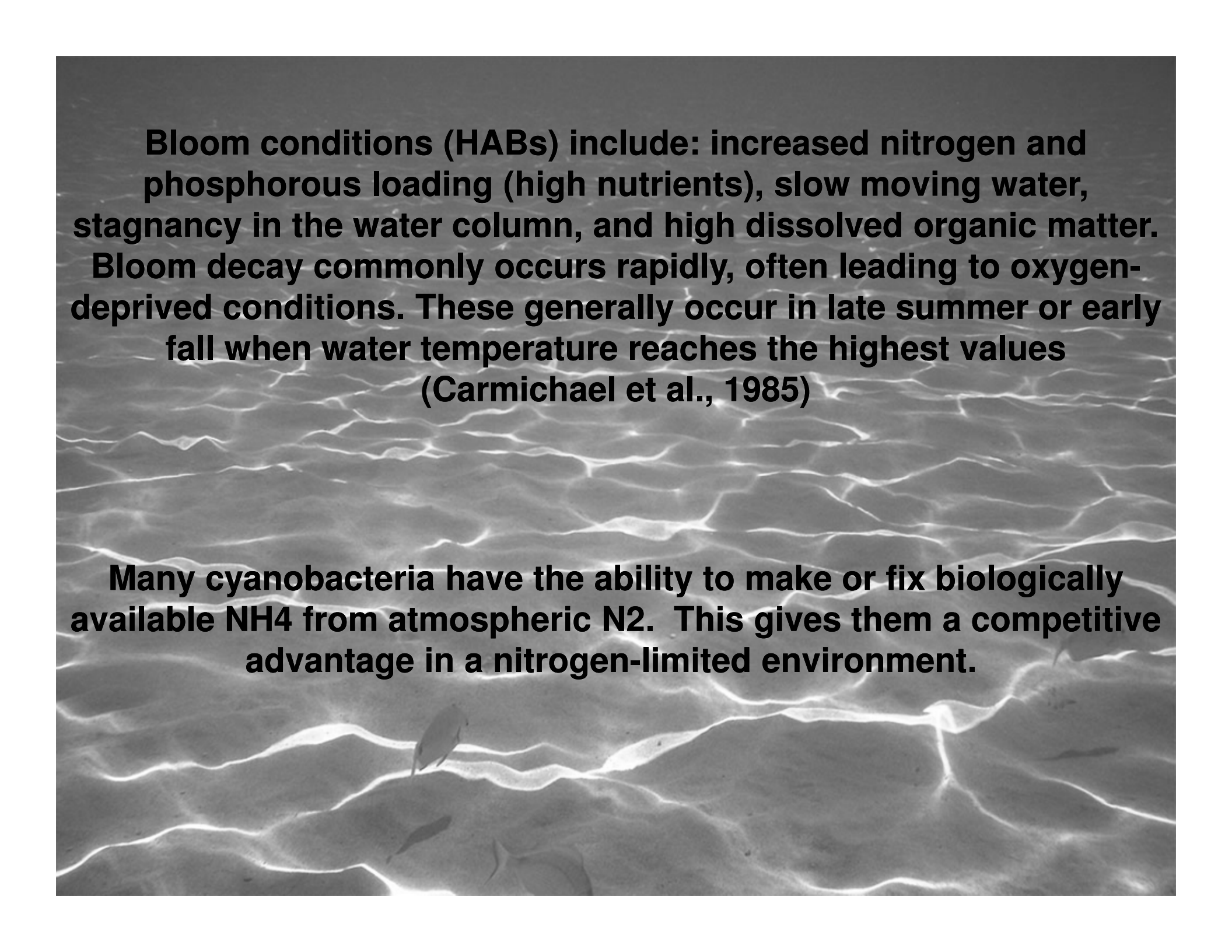


The growth of phytoplanktonic organisms can also be related with global climate change:

- Increase in sea surface temperature
- Alterations in water mass movements

3 September 2010
Gülzelbahçe Bay





Bloom conditions (HABs) include: increased nitrogen and phosphorous loading (high nutrients), slow moving water, stagnancy in the water column, and high dissolved organic matter. Bloom decay commonly occurs rapidly, often leading to oxygen-deprived conditions. These generally occur in late summer or early fall when water temperature reaches the highest values (Carmichael et al., 1985)

Many cyanobacteria have the ability to make or fix biologically available NH_4 from atmospheric N_2 . This gives them a competitive advantage in a nitrogen-limited environment.

**Cyanobacteria
form dense
floating mats**

**Oscillatoria
species have a
worldwide
distribution in
freshwater,
marine and
brackish water**



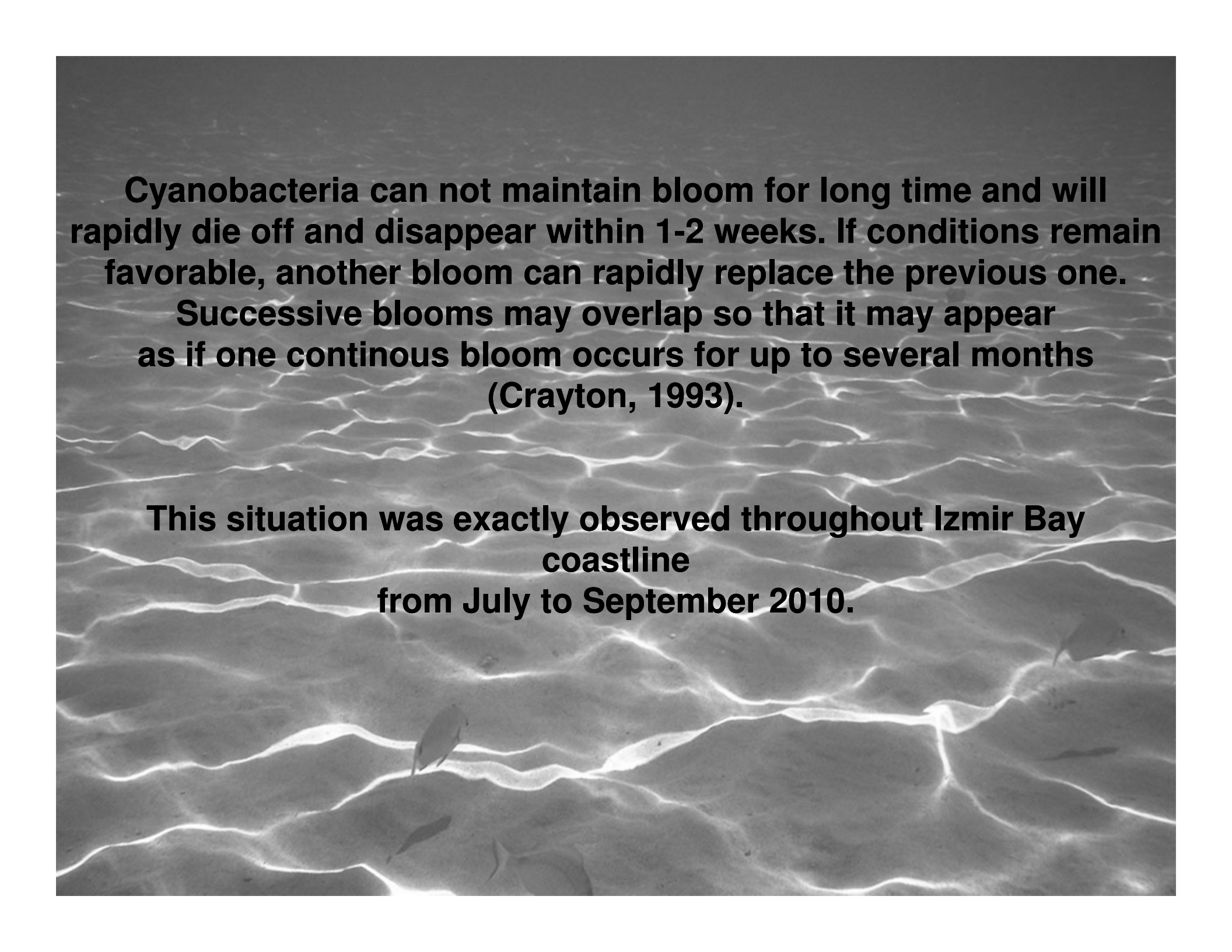
September 2010



Oscillatoria

Izmir Bay July-September 2010



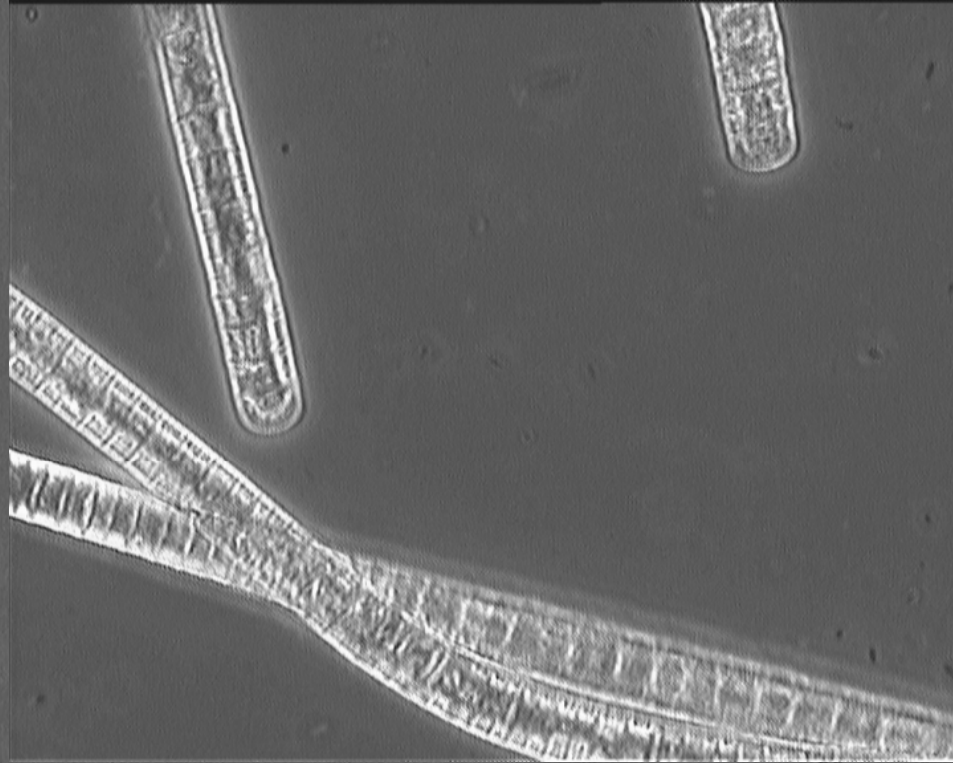


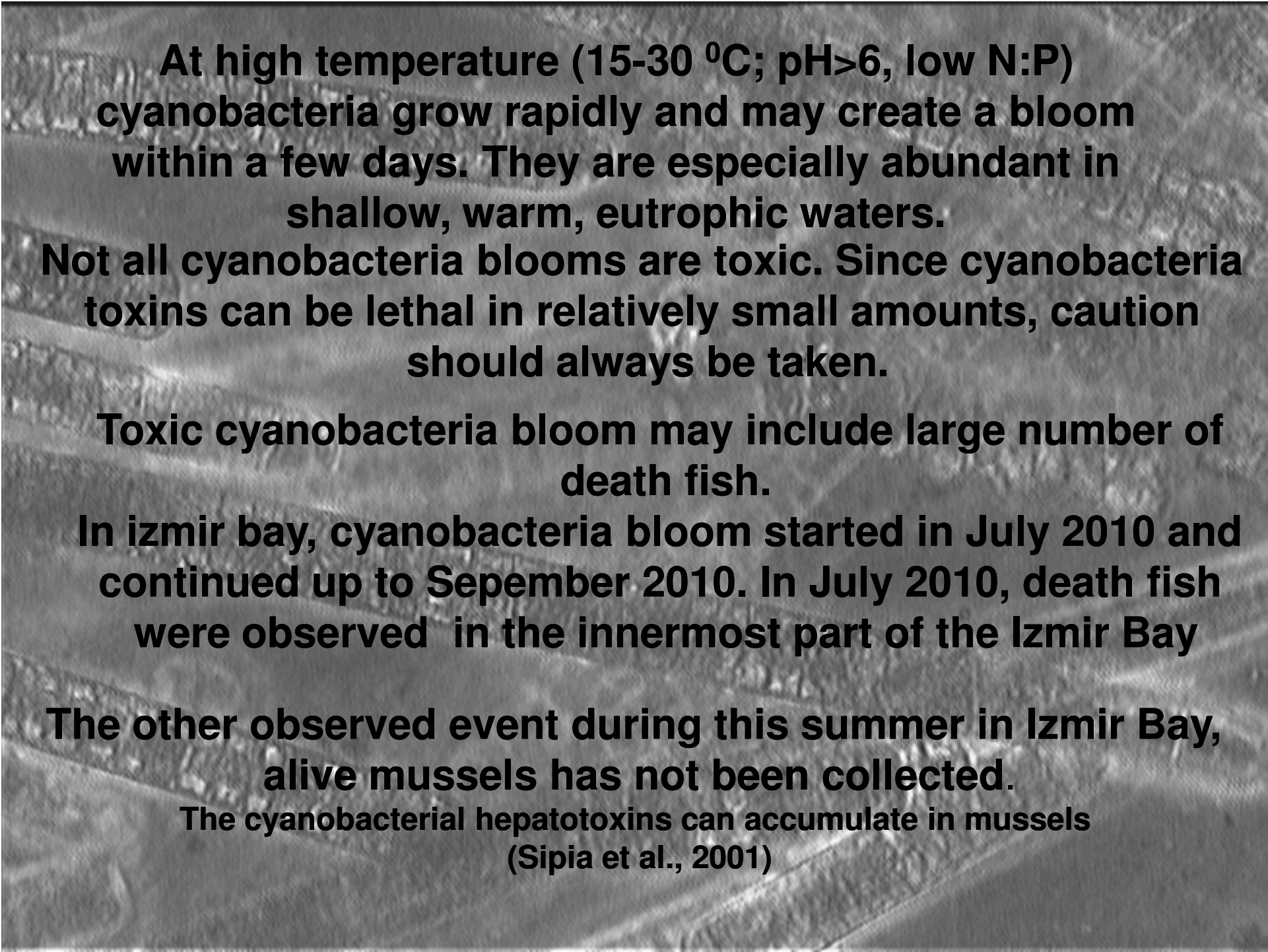
Cyanobacteria can not maintain bloom for long time and will rapidly die off and disappear within 1-2 weeks. If conditions remain favorable, another bloom can rapidly replace the previous one.

Successive blooms may overlap so that it may appear as if one continuous bloom occurs for up to several months (Crayton, 1993).

This situation was exactly observed throughout Izmir Bay coastline from July to September 2010.

Oscillatoria cf. princeps



An aerial photograph of a coastal area, likely Izmir Bay, showing a large, dark, irregularly shaped area in the water, which is a cyanobacteria bloom. The surrounding water is lighter in color, and the coastline is visible with some buildings and infrastructure.

At high temperature (15-30 °C; pH>6, low N:P) cyanobacteria grow rapidly and may create a bloom within a few days. They are especially abundant in shallow, warm, eutrophic waters.

Not all cyanobacteria blooms are toxic. Since cyanobacteria toxins can be lethal in relatively small amounts, caution should always be taken.

Toxic cyanobacteria bloom may include large number of death fish.

In izmir bay, cyanobacteria bloom started in July 2010 and continued up to Sepember 2010. In July 2010, death fish were observed in the innermost part of the Izmir Bay

The other observed event during this summer in Izmir Bay, alive mussels has not been collected.

**The cyanobacterial hepatotoxins can accumulate in mussels
(Sipia et al., 2001)**

A black and white electron micrograph showing several parallel filaments of cyanobacteria. The filaments are composed of individual cells, some of which are clearly visible as rectangular structures with internal details. The background is a textured, granular surface.

Over 40 species of cyanobacteria, belonging mainly to the Chroococcales, Oscillatoriales or Nostocales orders, produce a great variety of toxins.

Anatoxins and **Microcystins** are produced by *Oscillatoria spp.*

EXPERTS RECOMMEND THAT ALL CYANOBACTERIA BLOOMS BE CONSIDERED POTENTIALLY TOXIC UNTIL TESTED.

trilyon lira ile üçüncü sıradaki kurum açıklanmasını istemedi.

36'lık artışla 303.4 trilyon liraya ulaştı. ■ 6. sayfada

Ege Mine Kirazoğlu

Ege Mine Kirazoğlu

vekaletname çıkartan eşinin şirket genel kurulunda oy kullanacağını öne sürdü.

Kirazoğlu suçlamaları reddetti, "Benden intikam almak istiyer" dedi. ■ 6. sayfada

**Uzmanlar
vatandaşı
uyardı**

Hürriyet

EGE
EGE

10 Mayıs 2000 Çarşamba

Bölge Gazetesi

**Necdet Durmuş
SSK Başhekimi**

DENİZLİ Devlet Hastanesi Başhekimliği'nden alınan Necdet Durmuş, SSK'ya transfer oldu. Durmuş, ikinci kez SSK Bölge Hastanesi Başhekimliği'nden alınan Metin Sürmeli'nin yerine getirildi. Durmuş, "SSK Hastanesi'nin sorunlarının yarısını bir yılda çözeceğiz" dedi.

MİDYEYE DİKKAT

Izmir Körfezi'nden çıkarılan ve uzman kontrolünden geçmeyen midyelerden yüzlerce kişiyi zehirleyerek hastanelik etti

**Be Careful Against Mussels
(10 May 2000)**

**Due to the deficiencies in
controlling efforts, the
mussels from Izmir Bay can cause
serious health
problems for hundreds of people
who needed medical
treatments in the ERs of the
hospitals**

rüzlerce kişiyi hastanelik eden en yapılan dolma paniği anlar, ilkbaharda sayıları bakteriler ile beslenen midye-üğü hastalıkların önlenmesi ve midye satıcılarını uyardı.

ayrı zehir var

rsitesi Su Ürünleri Prof. Dr. Tufan Koray, 10 n midye toplanmaması arılarda bulduklarını izmir Körfezi'nde 10 tür zehirli saptandı. Ayrıca ağır metaller lacak organizmalar var" dedi.

ışına izin yok

la, midyenin bakterileri bir a attığını belirten Prof. Dr. ve Köy İşleri Bakanlığı ile taklaşa olarak 13 midye i Avrupa'ya ihracat yapma dik. Bunların dışında satışa i" dedi.

rolden geçiyor

midye dolması yapanların, endi topladıkları midyeyi i söyleyen Koray, "Midye i bir süre bünyesinde tutup, takip edip, bu süre içinde



Balçova Belediyesi zabıta ekipleri Körfez'den çıkarılan iki kamyon dolusu midyeye önceki gün el koydu. Ancak 20 ton ağırlığındaki midyelerin ne yapacağına önce karar verilemedi, sonra tahli sonuçlanıncaya kadar Karaburun'a götürülerek denize bırakıldı.



**Yaşlılarda
ölüm olabilir**

PROF. Dr. Tufan Koray, İzmir Körfezi'nde de bulunan "psp" adlı

Deniz renginin değişimi tedirgin etti



Urla'da geçtiğimiz günlerde deniz yüzeyinde oluşan kırmızı tabaka halkı tedirgin etti.

Konuyla ilgili görüştüğümüz Ege Üniversitesi Su Ürünleri Fakültesi yetkilileri; "Urla-Güzelbahçe arasındaki kıyısal bölgeden 6 Eylül pazartesi günü aldığımız iki canlı ve bir formülle fikse edilmiş toplam üç örnek, Su Ürünleri Fakültesi Temel Bilimler Bölümü'nce incelendi. Tüm örneklerde baskın olarak tek bir tür bulundu. Cyanobacteria sınıfından olan bu tür aşırı çoğalma yaparak ortamı anoksik yapan bu tür denizsel ortama kahverengi-koyu kırmızı rengi vermektedir. Bu tür, dalga ve rüzgarla sahilde karaya yığıldığında ise ölererek yeşil ve köpüklü görünümü vermektedir. Tür bozularak metan dimetilsülfat ve hidrojen sülfür gazlarının açığa çıkmasına sebep olmaktadır. Toksik olmayan bu tür ortamda aşırı çoğalarak ortamı anoksik yaparak eko-sisteme zarar vermektedir" dediler.

Yetkililer olayın denizsel faktörlü olduğunu, zamanla kendiliğinden yok olacağını belirterek endişe edecek bir durum bulunmadığını söylediler.



**Discoloration of sea
triggerred the worries**

***HABs Monitoring requires
a regional and/or national Dbase
structure!!!***

***Thus, a Network that can feed the Dbase is
first essential step to be taken
This will offer an easily and rapidly accesible
up-to-date data and/or information and hence
an active collaborative and productive
expertise platform can be built up***



**Finally,
On behalf of my colleagues in my
institution, I would like to express
our will and enthusiasm to
offer our potential contribution to
the future efforts**

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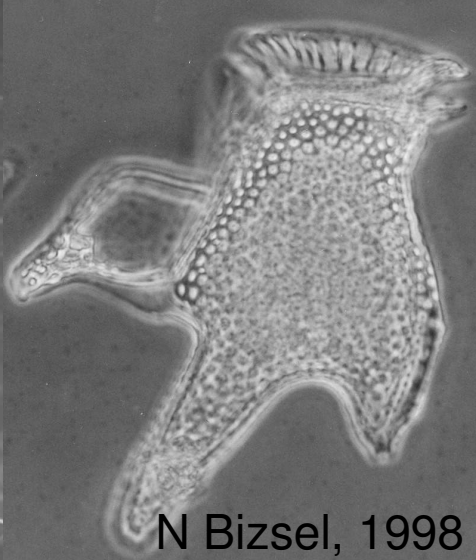
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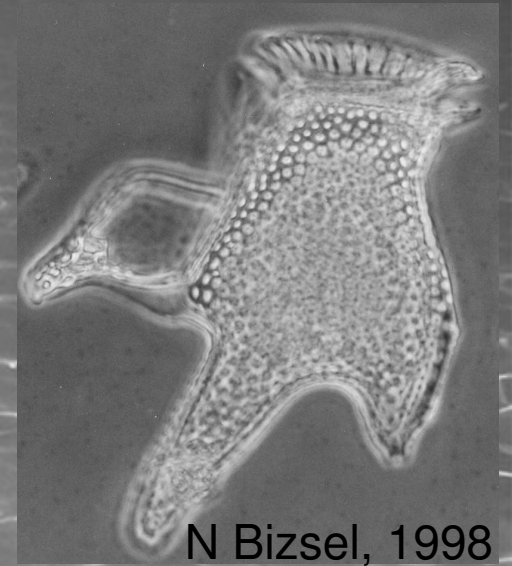
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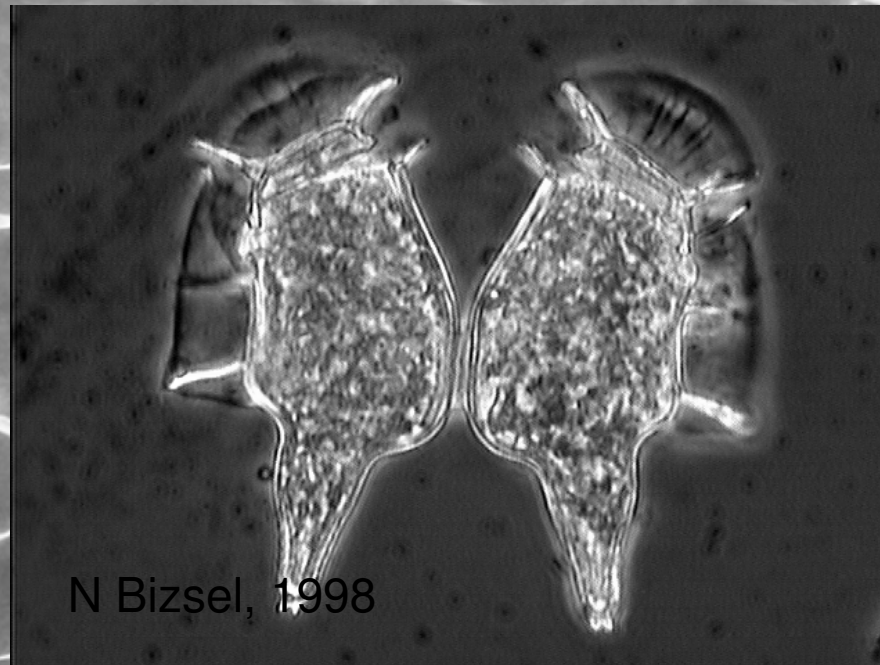
*Thanks for
your
attention*



N Bizsel, 1998



N Bizsel, 1998



N Bizsel, 1998