Outcomes of the Climate Change conference in the Black Sea

BS - HOT' 2008

Hypothesis, Observations, Trends, Scenarios & Mitigation Strategy for the Ecosystem

Sofia, Bulgaria, 6-9 October 2008

Prof Ahmet E. KIDEYS

Executive Director
Permanent Secretariat
Black Sea Commission

www.blacksea-commission.org

10th Global Meeting of the Regional Seas Conventions and Action Plans

Guayaquil, Ecuador, 25th– 27th November 2008

AIM

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- To initiate a concerted effort to use science, information technology and policy measures to understand and deal with the consequences of global warming in the Black Sea towards better governance, sustainable exploitation of resources and conservation of the marine environment.

SCOPE

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- The Conference provided for the scientists and policy makers the opportunity to share new knowledge and to discuss adaptation strategies.

THE ORGANIZATION AND SPONSORS

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The Conference was jointly organized by the

- BLACK SEA COMMISSION and
- EC FP7 Project BLACK SEA SCENE

under the auspices of the Ministry of Environment and Water – Bulgaria and Bulgarian Academy of Sciences

With the support of

- ✓ GEF/UNDP/BSERP,
- ✓ BALKAN ENVIRONMENT ASSOCIATION (B.E.N.A),
- ✓ TURKISH MARINE RESEARCH FOUNDATION (TUDAV – TURKEY)
- ✓ BRITISH EMBASSY, ANKARA

LEVEL OF PARTICIPATION

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- ✓ In total 204 people attended the Conference.
- ✓ 62 oral presentations
- ✓ 76 posters
- ✓ BS Commissioners also joined

OBJECTIVES

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- ✓ **synthesize regional and basin-wide studies** and provide a forum for the integration of climate change related results, data and hypotheses;
- ✓ **discuss and evaluate climate forcing mechanisms** of physical, biological and biogeochemical processes at various time- spatial scales
- ✓ **formulate projections and future scenarios** of economic and sociological impacts of a changing ecosystem on the coastal communities and resource users
- ✓ **frame scientific, technological and policy measures** against global warming towards sustainable ecosystem management

SESSIONS

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- **1.** Climate forcing mechanisms in the Black Sea
- **2.** Black Sea ecosystem responses to climate change
- **3.** Data availability and data base management
- **4.** Economic and sociological impacts – scenarios and measures

Selected results

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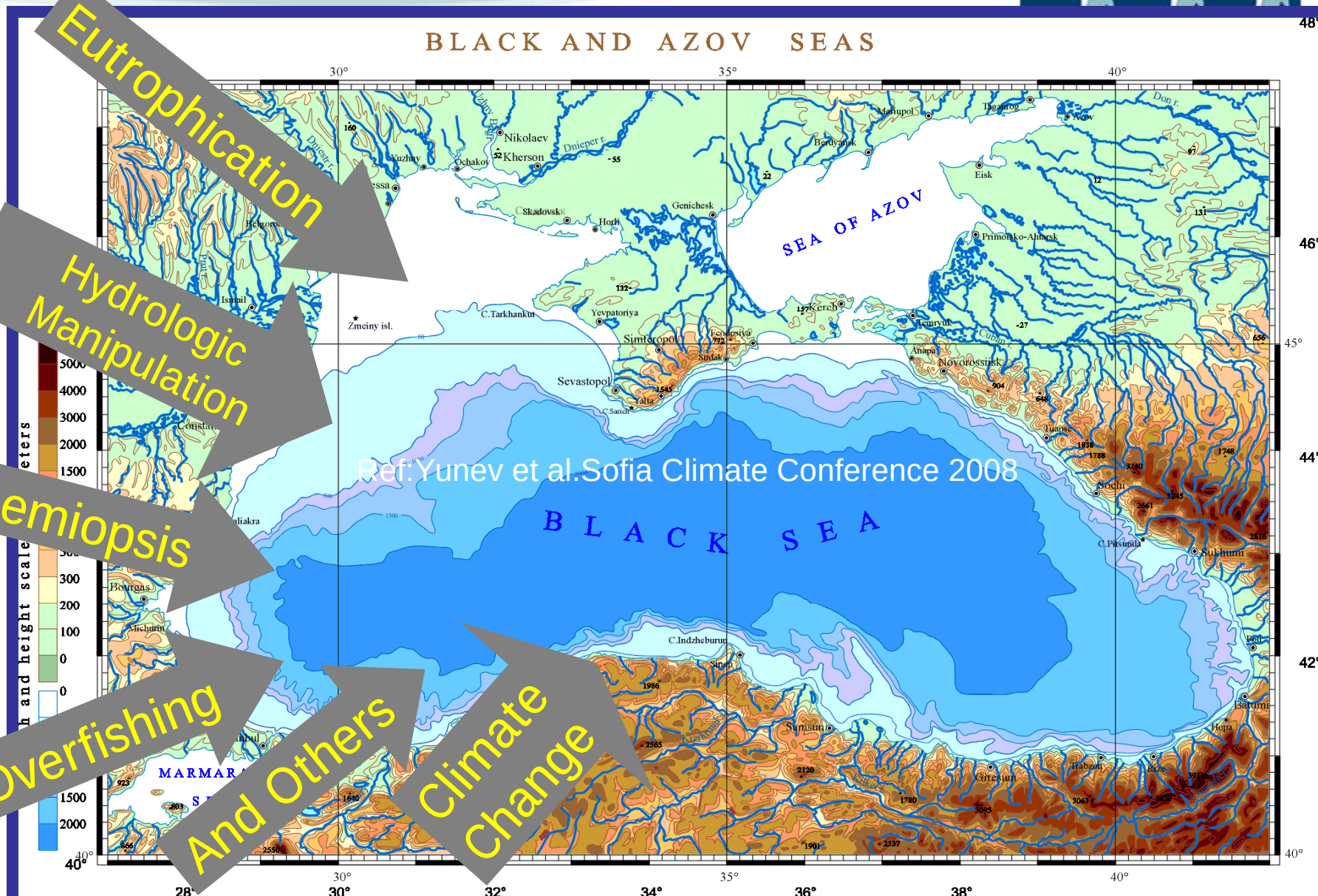
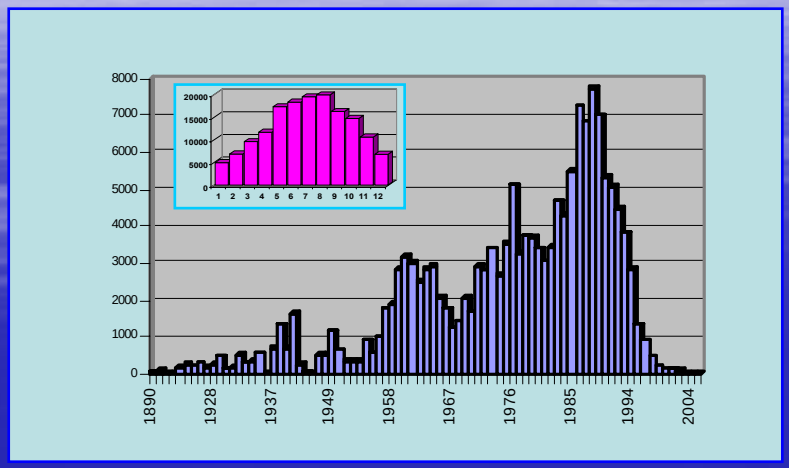
- Black Sea has substantial amount of data and information
- Black Sea is under a process of warming up both in the surface as well as in the deep layers;
- The sea level is raising slowly but constantly;
- Number of foods in the region increasing;
- There are visible changes in the Black Sea ecosystems

After the beginning of the 1970s

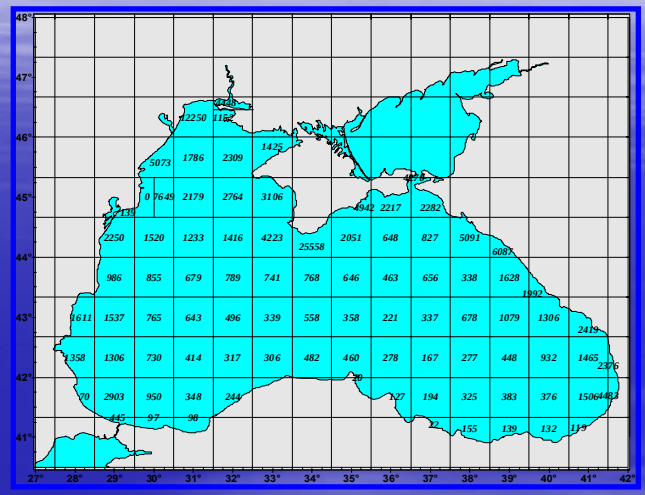


Data bank of MHI

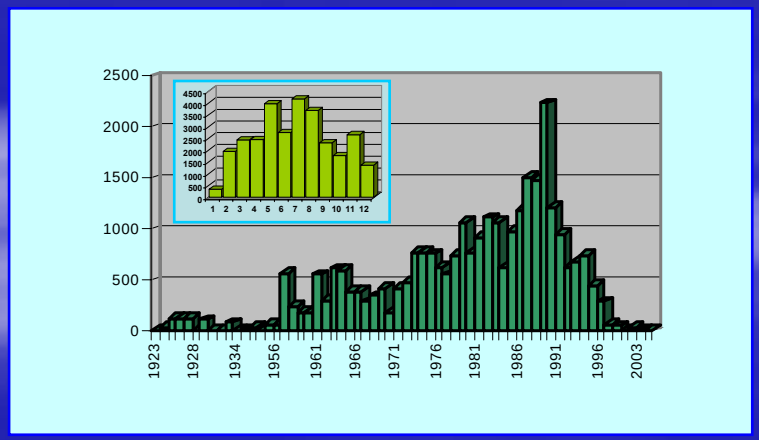
Distribution of hydrographic and hydrochemical stations



Distribution of hydrographic stations on years and months



Count of oceanographic stations on squares for the Black Sea.

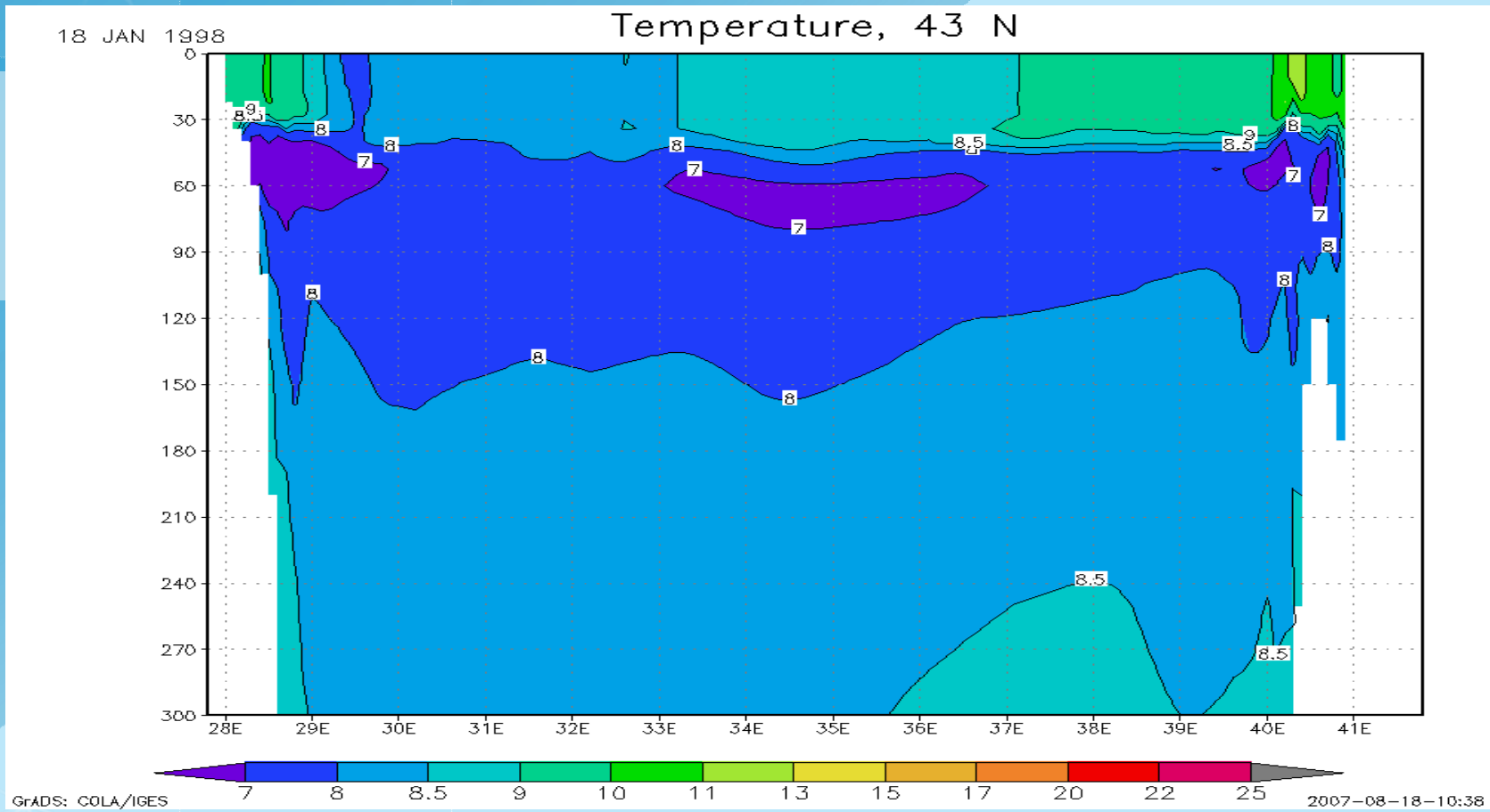


Distribution of hydrochemical stations on years and months

The Black Sea is a well-investigated marine basin. However, distribution of stations in time and location is not uniform and the number of observations significantly decreases with depth.

Ref: Eremeev et al. Sofia Climate Conference 2008

Formation and evolution of the Cold Intermediate Layer

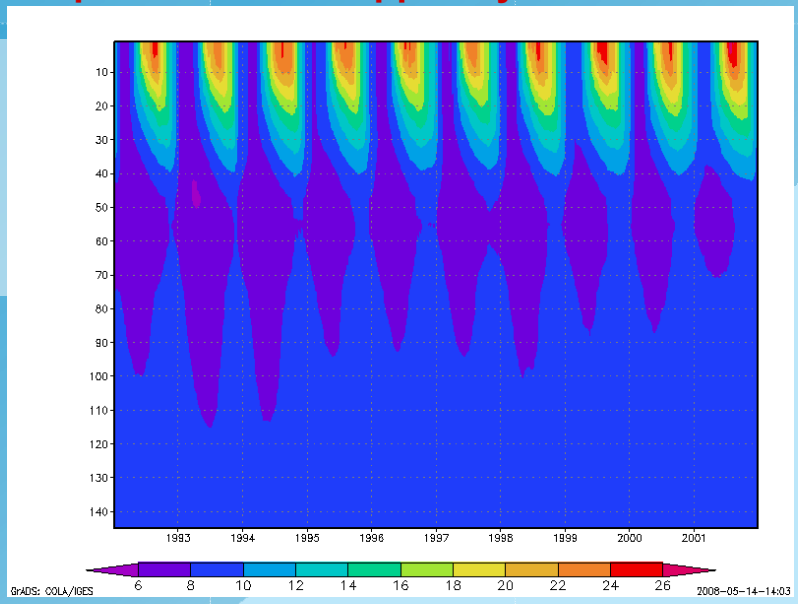


The Cold Intermediate Layer (CIL) is characterized traditionally by temperatures colder than 8^{0}C. This cold water mass, convectively generated every winter within the upper 50–75 m of the water column, preserves its identity between the seasonal and permanent thermocline during rest of the year.

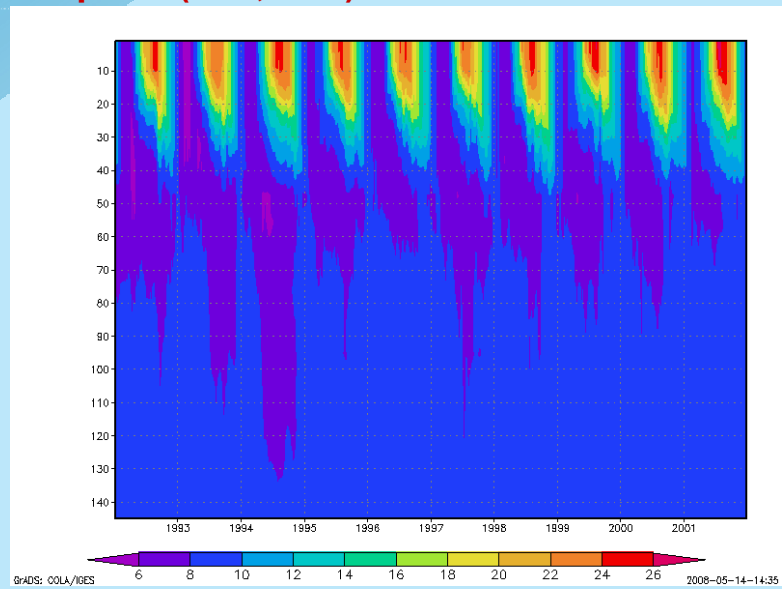
Ref: Kubryakov et al.2008

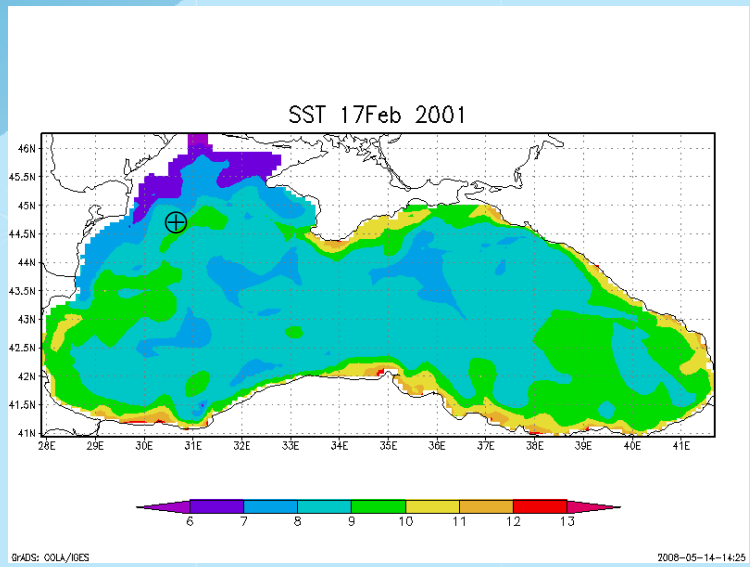
Subsurface Signature of Warming: Disappearance of the Cold Intermediate Layer

Ten year distribution of basin averaged temperature within upper layer column



Ten year distribution of temperature in the point (31E, 43N)



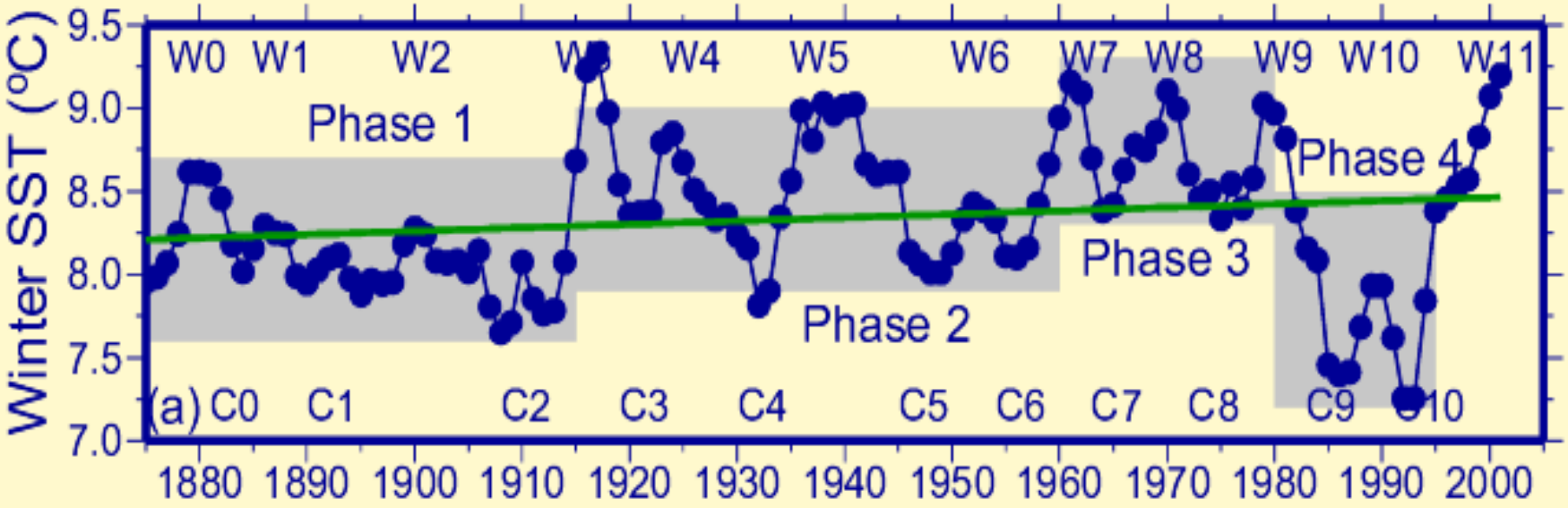


Behaviour of the Cold Intermediate Layer (characterized by temperature lower than 8^0) clearly indicates warming in the Black Sea. The CIL evidently disappears. During the warmest winters (1999, 2001) sea temperature was mainly higher than 8^0 degrees in surface layer, except North-West Shelf and some places in central part of the sea. It means that CIL is provided with cold water mainly from North West Shelf, which winter temperature is the coldest and lower than 8^0.

Ref: Kubryakov et al.2008

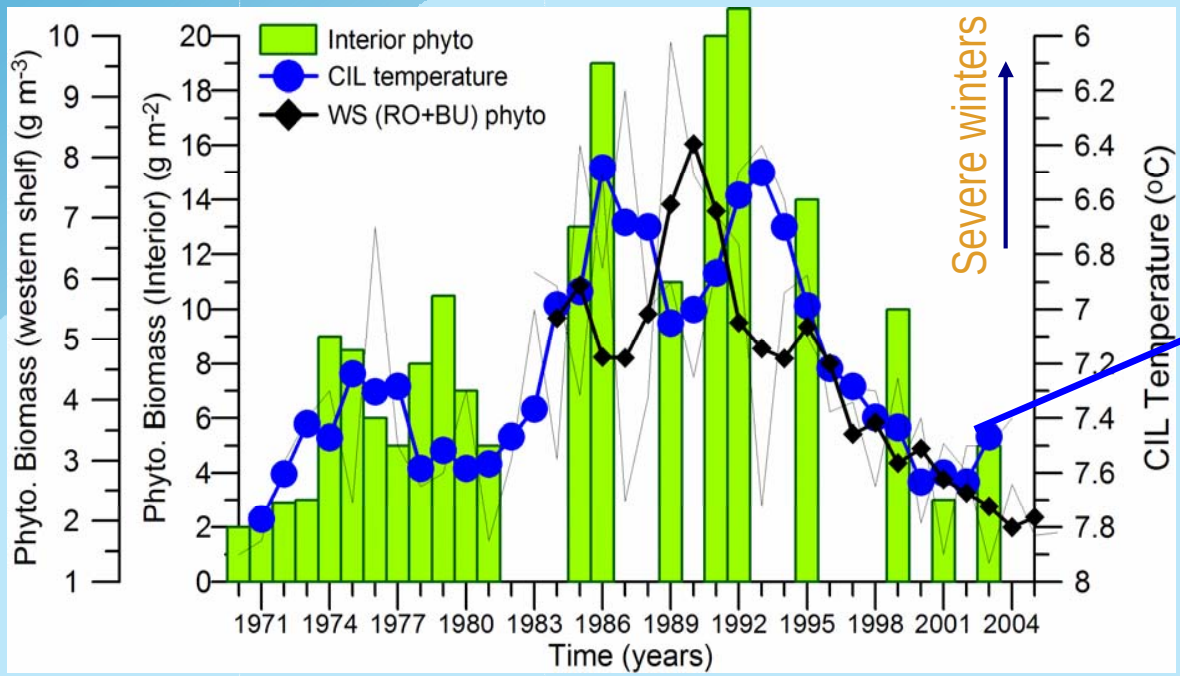
Long-term warming trend ~0.25 °C / 100 years

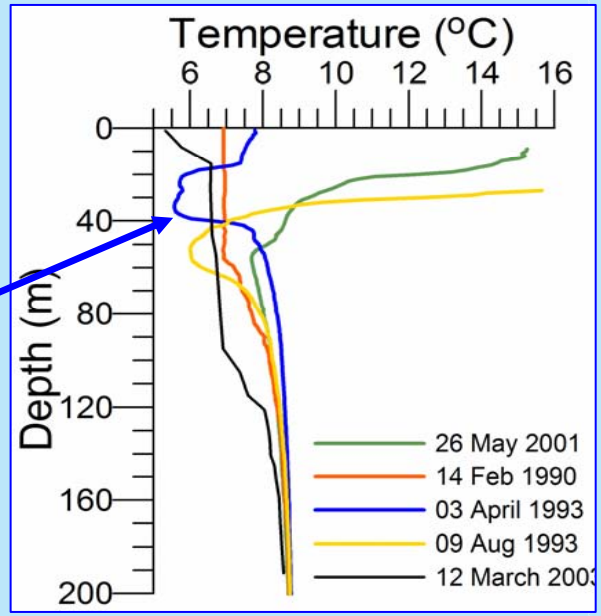
(ref: Oğuz, Sofia Climate Conference 2008)



3b) PHYTOPLANKTON (Amalgamated biomass data)

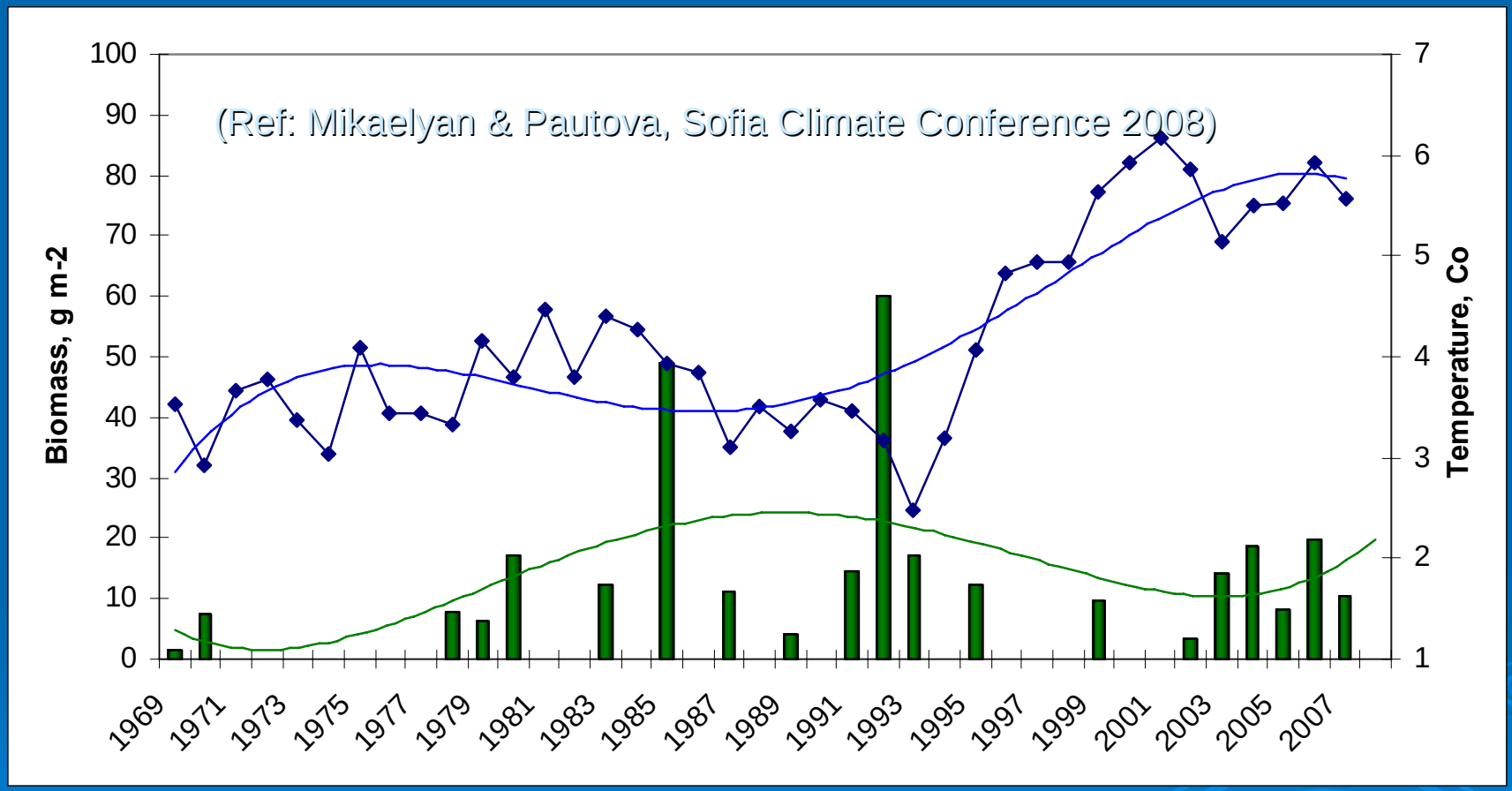
- An order of magnitude decrease in phyto biomass (both interior and WS) since the early1990s; due to combination of weakning of eutroptication and climatic warming.





Ref: Oguz, Sofia Climate Conference 2008

Long-term changes of the total phytoplankton biomass (May-September) and the average winter air temperature (December-November)



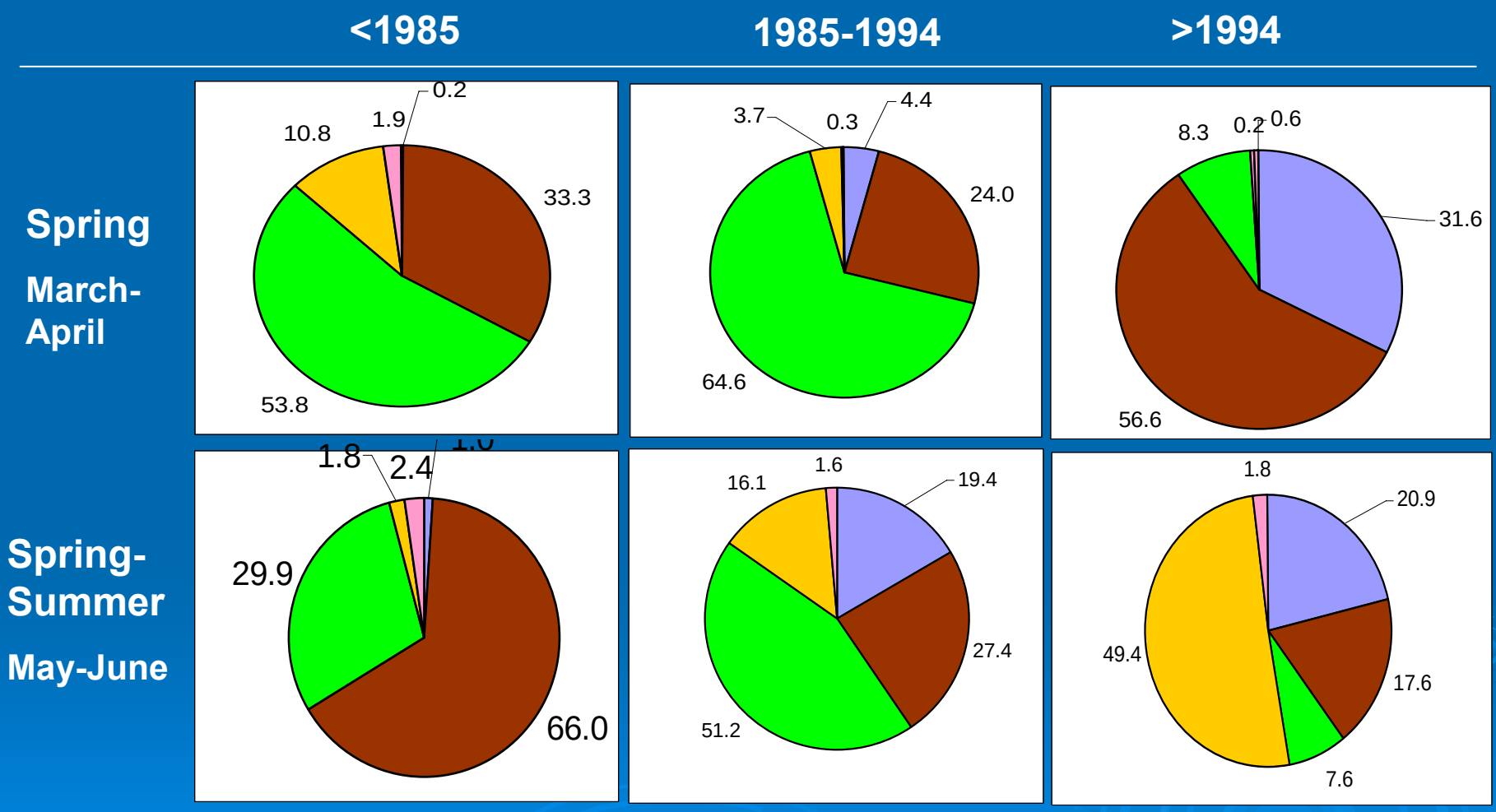
Phytoplankton biomass (columns) averaged for bottom depths > 100 m

Air temperature (dots) after Titov, 2007 and data of Tuapse weather station

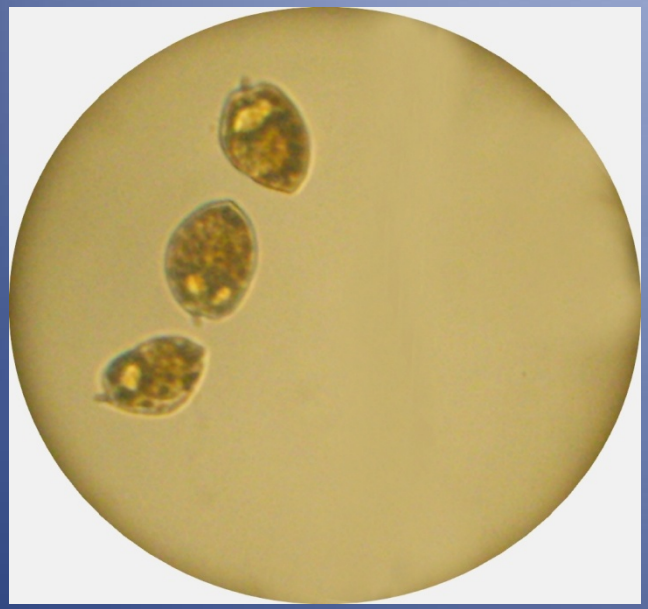
Lines – trendlines for both parameters

Share (%) of 5 taxonomic groups in the total phytoplankton biomass

under water column, sea bottom depths > 150 m (Ref: Mikaelyan & Pautova, Sofia 2008)



Dominant species of Dynophyceae in Sevastopol bay



Prorocentrum micans
(h = 30 – 50 µm)

Gymnodinium sanguineum
(h = 50 – 60 µm)

Ref: Stelmakh, Sofia Climate Conference2008

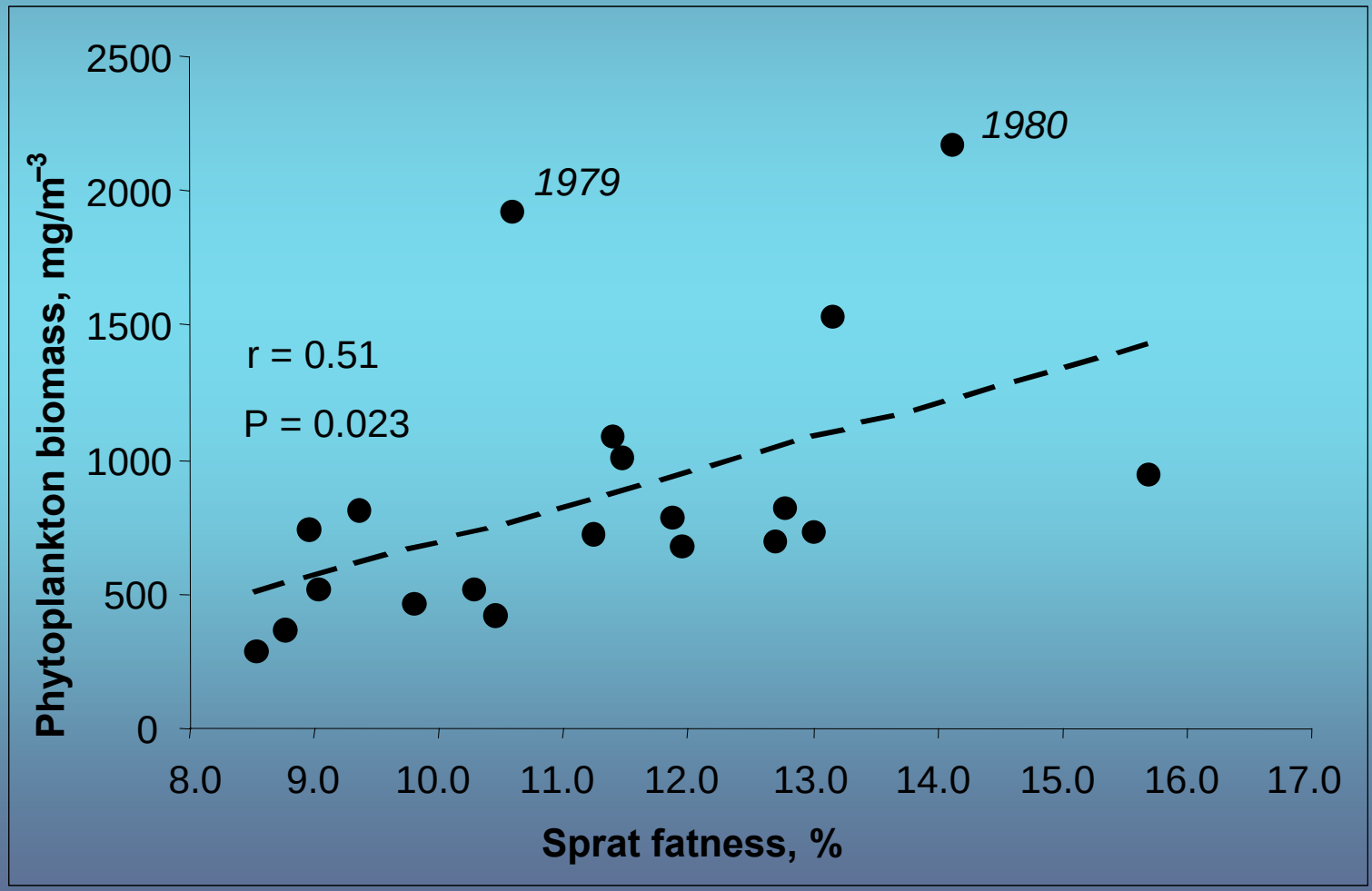
What causes disappearance of Dinophyceae summer maximum?

- Investigations on the cultures of microalgae have shown that the maximum growth of the Black Sea Dinophyceae were observed at 18 – 22^0 C.

- The summer temperatures measured in the surface of Sevastopol bay have increased from 22 – 24^o C in 1960s – 1970s to 26 – 27^o C for the latest 10 years. Increase of the summer temperature may be an inhibiting factor.

Ref: Stelmakh, Sofia Climate Conference2008

Relation between sprat fatness and phytoplankton biomass in the *NW* part of the Black Sea

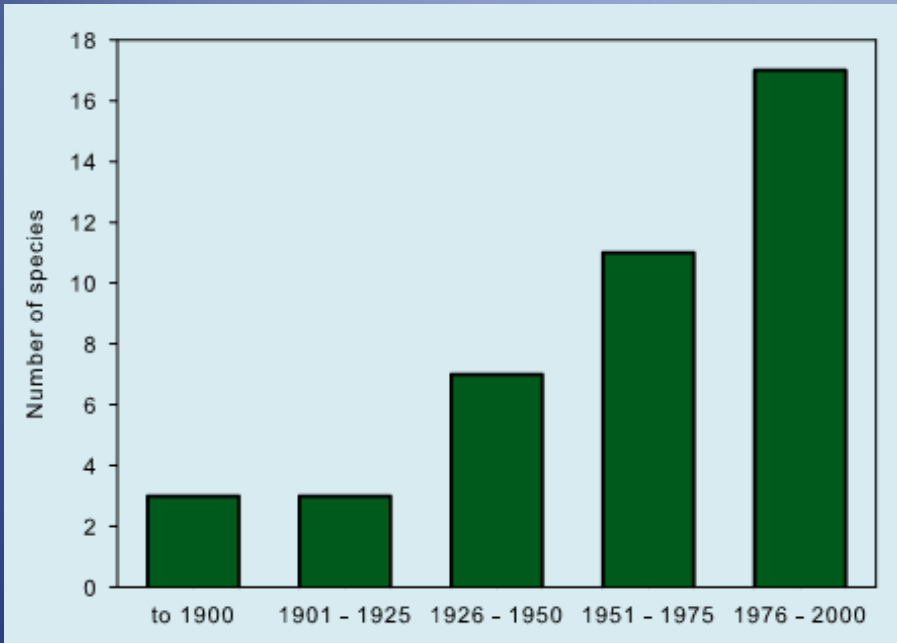


Decadal changes in the analyzed indicators for the period 1960 - 2005

Indicators	Decades				
	1960s	1970s	1980s	1990s	Beginning of the XXI century
Surface water temperature	High	Low	Low	Increasing	High
Phytoplankton biomass	Decreasing	Increasing	High	High	Low
Sprat fat content	Decreasing	Increasing	High	High	Low
	Climate	Antrhrop	Antrhrop	Climate	Climate

"Green Revolution"

The rate of introductions is constantly increasing



Trend in the introduction of alien species into the Black Sea (Zaitsev et al., 2001)

Ref: Sezgin et al, Sofia CLimate Conference 2008

MEDITERRANISATION OF THE BLACK SEA

❖In August 2003 *Asterias rubens* reported first time in the Black Sea. After being first reported from the Bosphorus Strait in 1996, this alien starfish has invaded the Sea of Marmara and is now extending its range of distribution to the Black Sea.

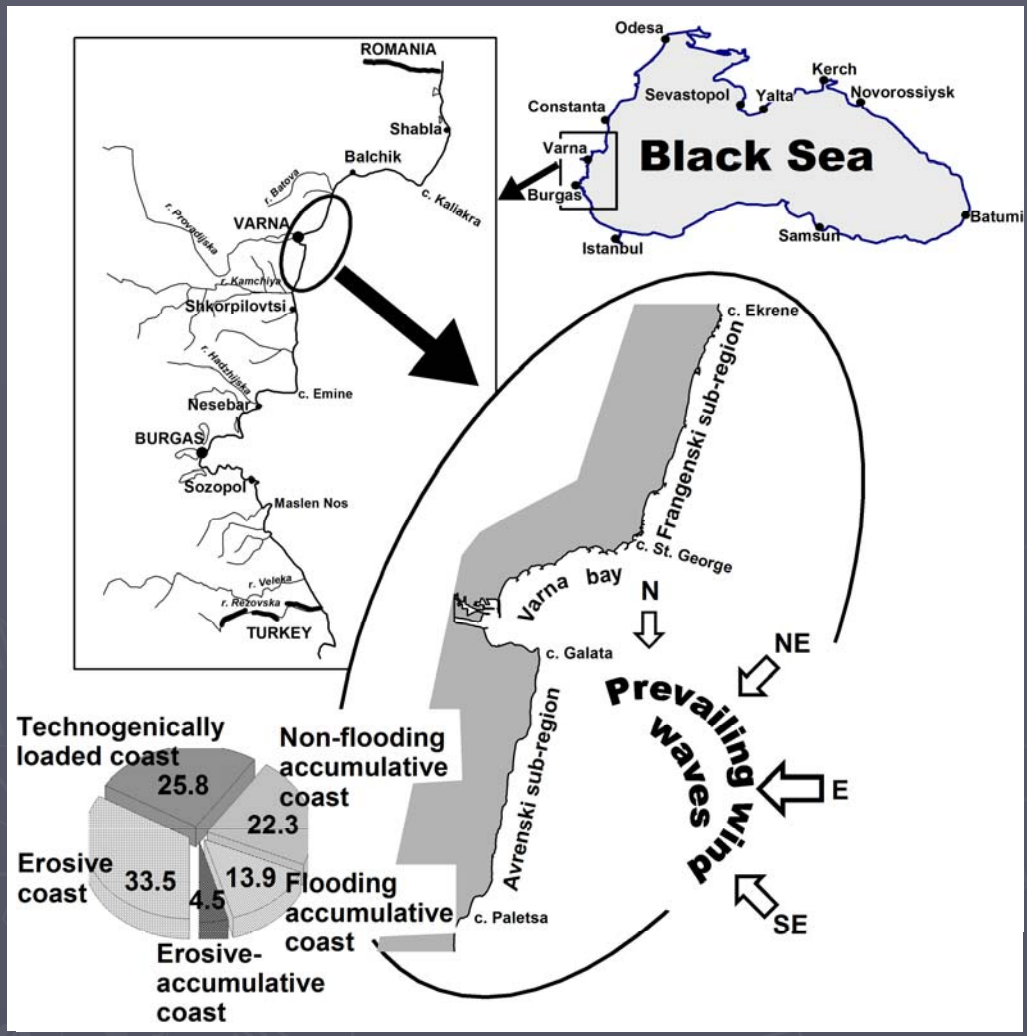
❖*A. rubens* preys on invertebrates mostly Mollusca. It would not be surprising for *Mytilus galloprovincialis* populations to be negatively affected if this alien starfish can successfully establish in this area (Karhan et al., 2007)

***Asterias rubens* Linnaeus, 1758; from Turkish coast of the western Black Sea**

Ref: Sezgin et al, Sofia CLimate Conference 2008

Climate change is expected to increase risk of erosion

(due to storminess and sea level rise) in some areas of the Varna Bay, Bulgaria



Ref: Keremedchiev et al.,Sofia Climate Conerence 2008

Suggestions from Round-table

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- To put together all the data and information in the Black Sea to come to the right conclusions;
- To design a monitoring system capable of investigation on climate change;
- Sustain the long-term observations in the Black Sea;
- To develop different scenarios of the evolution of the state of the ecosystem correlated to climatic changes;
- To investigate adaptation and mitigation strategies for the Black Sea

Suggestions from Round-table:

Mitigation and Adaptation

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- ***Mitigation*** *processes include reducing the emission of greenhouse gases and enhancing their sinks,*

- *whereas* ***Adaptation*** *refers to a series of actions performed on selected systems at local or regional scale to moderate negative effects of climate change.*

Mitigation

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- **Marine fertilization**

  The capture of man-made CO2 and its injection into the deep sea or seabed layers.

Role of the oceans in climate regulation

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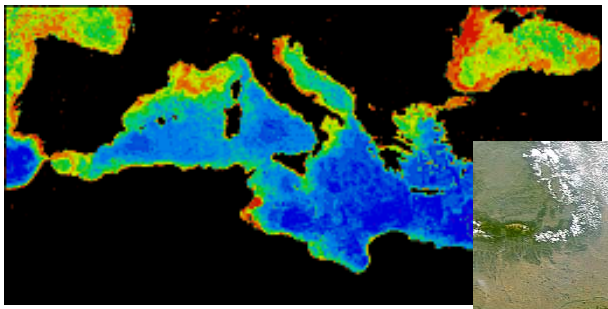
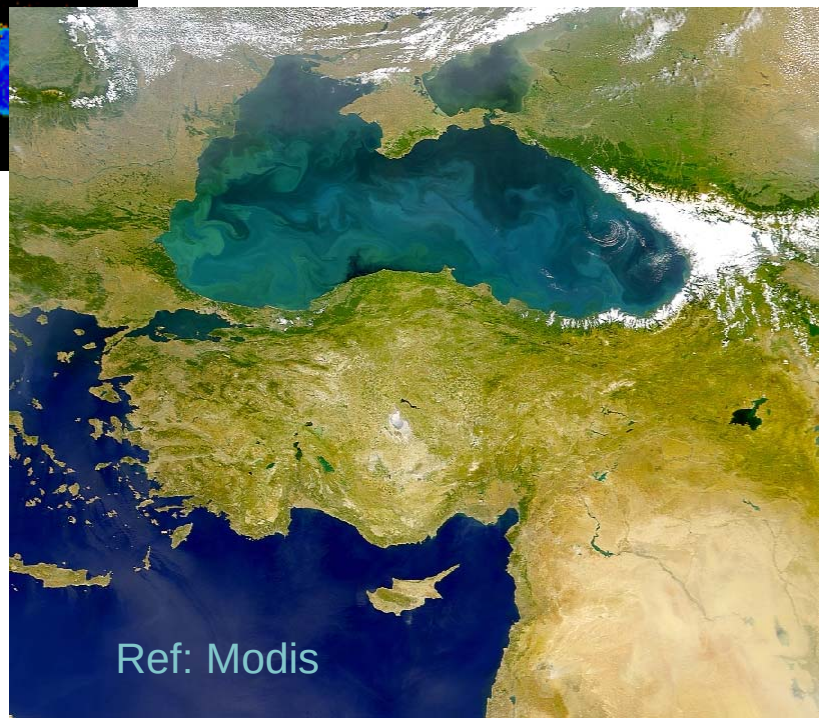
Biological Pump:

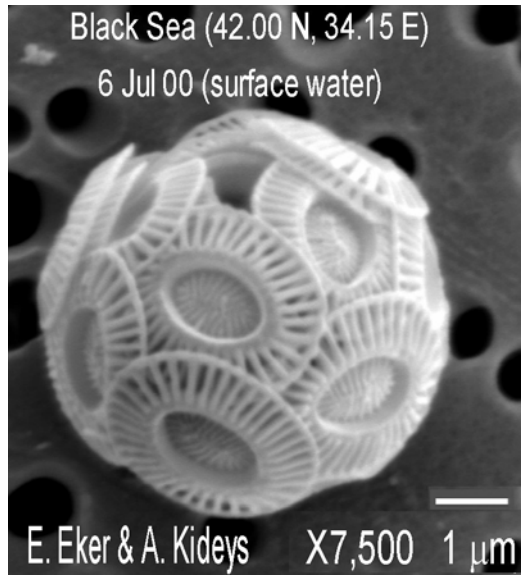
CO2 removed in two ways by organisms:

a) Transforming it to organic matter (50% of total by phytoplankton)

b) Transforming it to inorganic matter (sceletons, shells etc)







Ocean acidification could be a problem for Emiliana huxleyi

Adaptation

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- Monitoring the ecosystem for the climatic impact
- Efforts to increase resilience of the ecosystem through;

  Stringent control of invasive species

  Increasing Marine Protected Areas

  Encouraging environmentally sound aquaculture

SAP 2008
(**Strategic Action Plan for Environmental Protection and Sustainable Management of the Black Sea**)

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- "Climate" mentioned 11 times
- Cross-cutting issue
- Contributor to all four transboundary issues identified in TDA 2007

- "*Assess impacts of climate change on Black Sea ecosystem and sustainable development of the coastal population* "

What else can we do?

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CLIMATE CHANGE AND MARINE MAMMALS CONFERENCE
2-4 Mar 2008, Istanbul

23rd Conference of the European Cetacean Society

23rd Conference of the European Cetacean Society
2 - 4 MARCH 2009 ISTANBUL TURKEY

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TURKISH MARINE RESEARCH FOUNDATION

European Cetacean Society

SU ÜRÜNLERİ FAKÜLTESİ T.C. İSTANBUL ÜNİVERSİTESİ 1983

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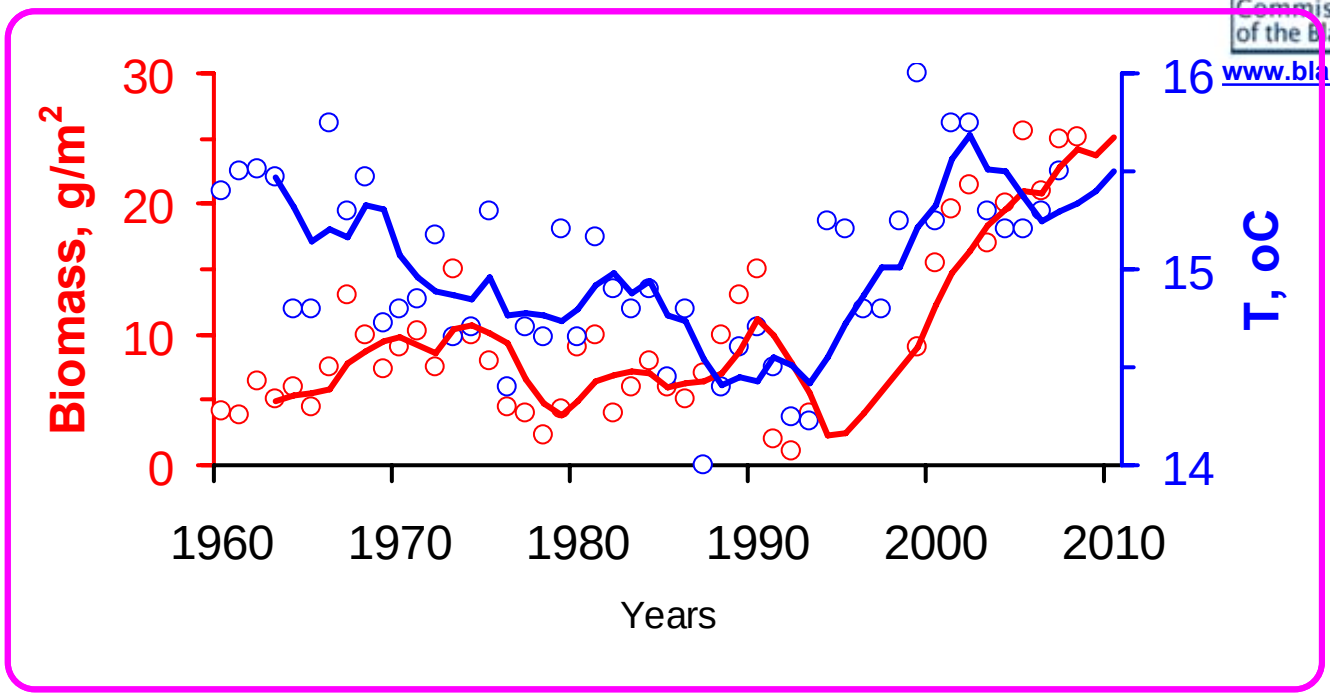
Thank you for your attention

Interannual variations in the yearly-averaged zooplankton biomass and temperature in the NE Black Sea (smoothed for four year)



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During two last decades, there was a clear trend to the increase in both SST and zooplankton biomass

Ref: Arashkevitch et al.,Sofia Climate Conference 2008