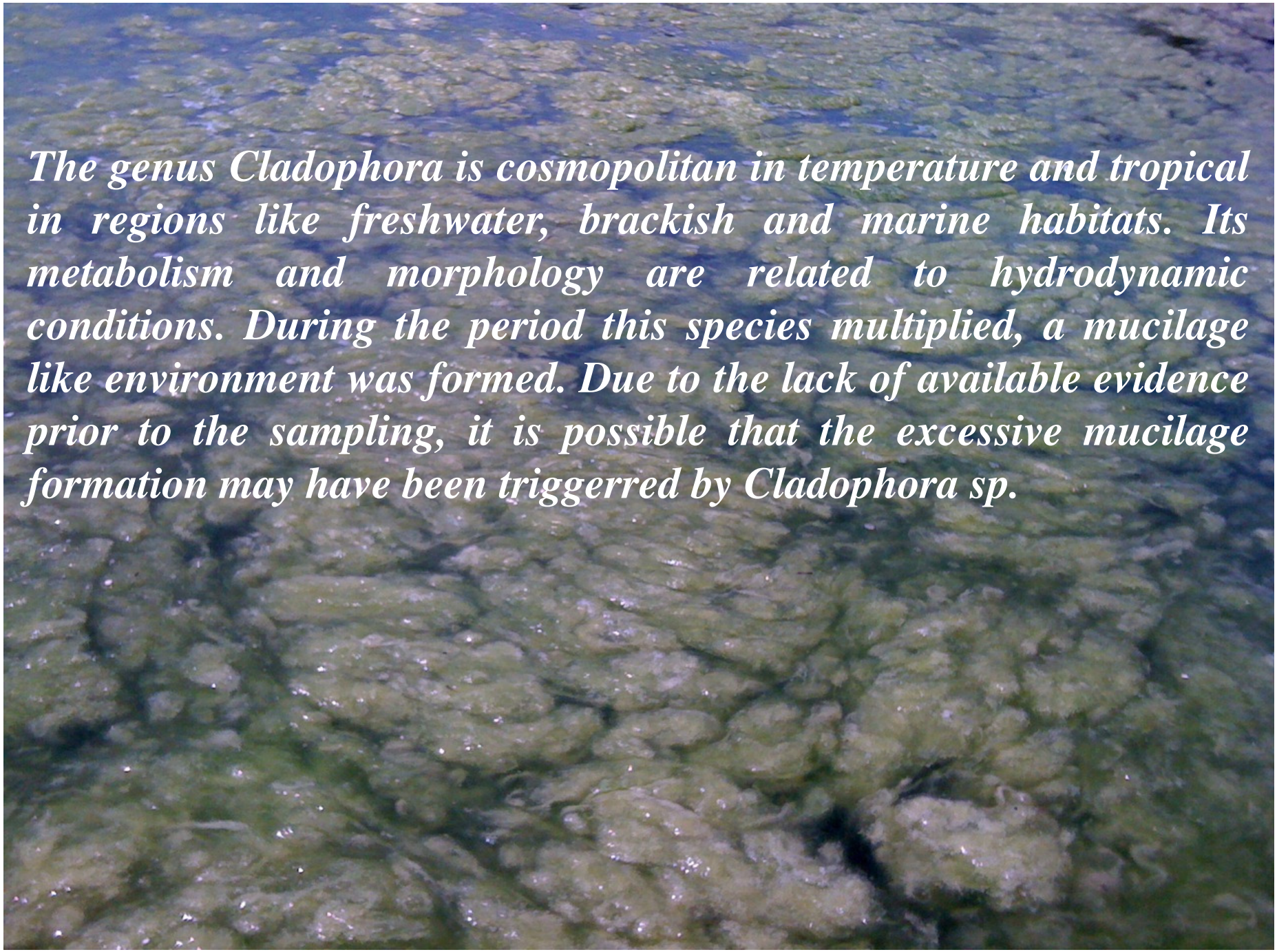
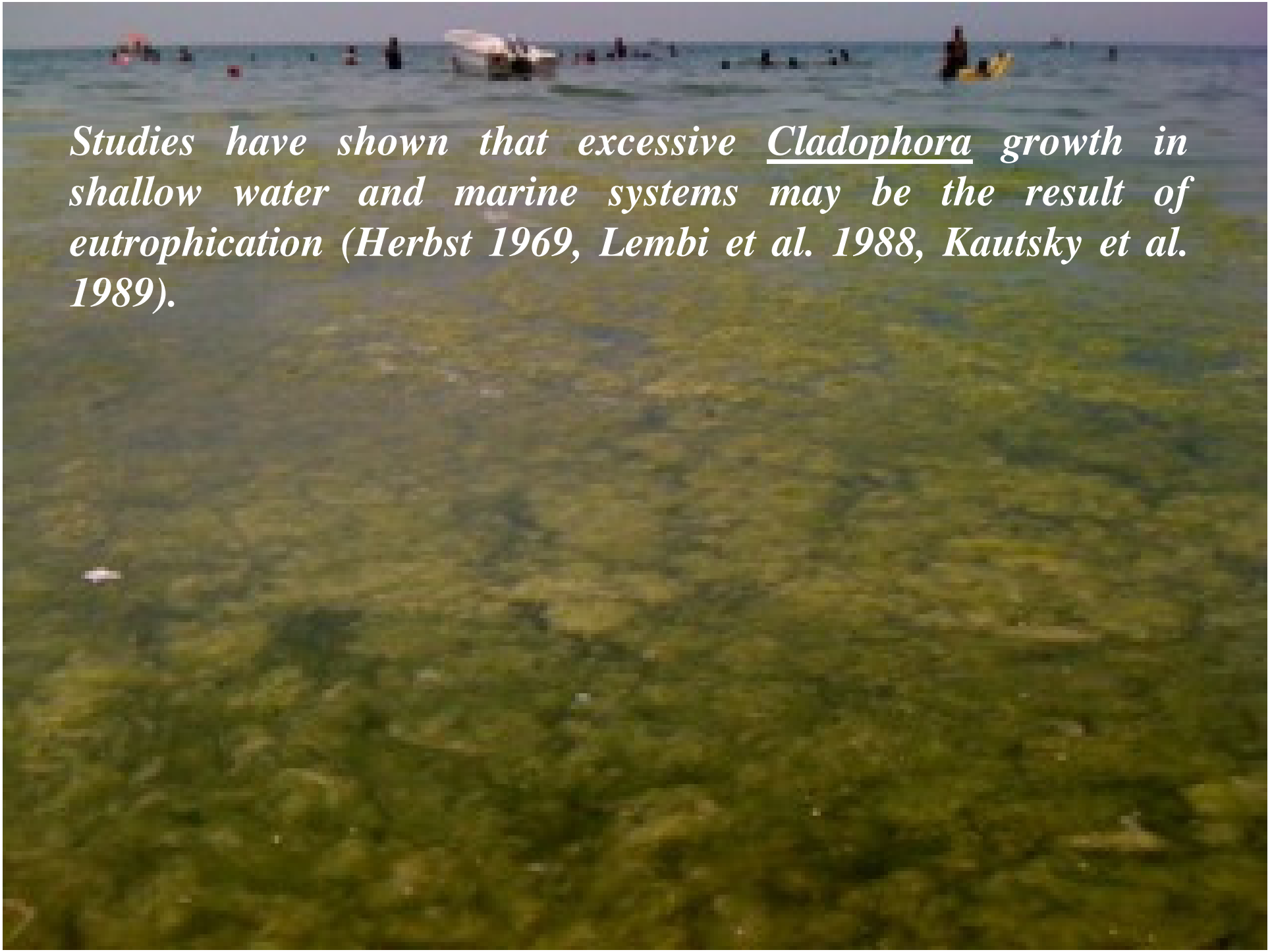
Excessive Growth of Cladophora sp. in the Southwestern Istanbul Coast (Marmara Sea)

Neslihan Balkıs[1], Nüket Sivri[2], N. Linda Fraim[3],
Muharrem Balcı[1], Turgay Durmuş[1]

[1]Istanbul University, Faculty of Science, Department of Biology, Vezneciler, Istanbul, 34134, TURKEY
[2] Istanbul University, Faculty of Engineering, Department of Environmental Engineering, Avcılar, Istanbul, 34320, TURKEY
[3] Serenity Counseling, Psychological Support Services, Beşiktaş, Istanbul
[3]Fatih University, Department of Psychology, B.Cekmece, İstanbul, TURKEY

Workshop on algal and jelly fish blooms, Istanbul ***7 October 2010***


The genus Cladophora is cosmopolitan in temperature and tropical in regions like freshwater, brackish and marine habitats. Its metabolism and morphology are related to hydrodynamic conditions. During the period this species multiplied, a mucilage like environment was formed. Due to the lack of available evidence prior to the sampling, it is possible that the excessive mucilage formation may have been triggerred by Cladophora sp.



Studies have shown that excessive Cladophora growth in shallow water and marine systems may be the result of eutrophication (Herbst 1969, Lembi et al. 1988, Kautsky et al. 1989).

The offending plant is primarily Cladophora, a common filamentous green alga. Growing on submerged rocks, it looks like long green hair waving in the water.


Cladophora is an important component of water ecosystems, providing food and shelter for invertebrates and small fish. The recent excessive blooms signal an ecosystem responding to both natural changes and human impacts.


Research has noted that Cladophora members appear in eutrophic habitats ranging from arctic to temperate marine waters and cability of enduring salinity variations between 5-30 ‰ (van den Hoek 1982, Jansson 1974).

Therefore;

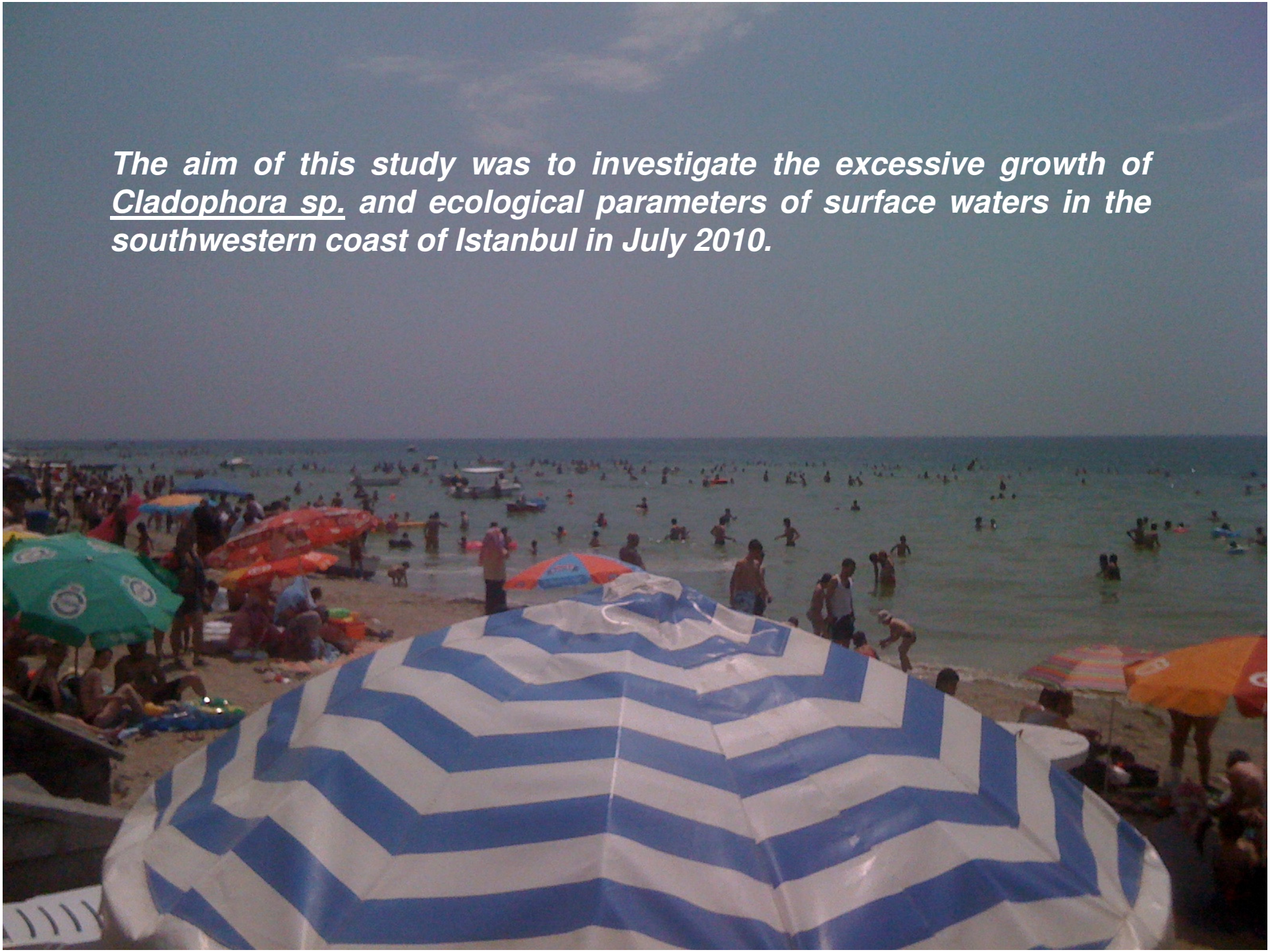
- ***Factors affecting growth include (Harris, 2005):***
  - ***Phosphorous***
  - ***Light***
  - ***Temperature***

Istanbul, which is Turkey's largest metropolitan city with a population of over 12 million (2010), tries to solve its encountered environmental problems.


•coastal erosion,
•shoreline recession
•excessive pollution


As a result, in the past 20 years, coastal responses to human impacts have varied in magnitude including Cladophora blooms in distinct locations.


In addition, the global temperature increase negatively effects the life in water ecosystems day by day. In recent years, the temperature has been above normal seasonal levels and has started to show its effects in sea water systems too.


The aim of this study was to investigate the excessive growth of Cladophora sp. and ecological parameters of surface waters in the southwestern coast of Istanbul in July 2010.

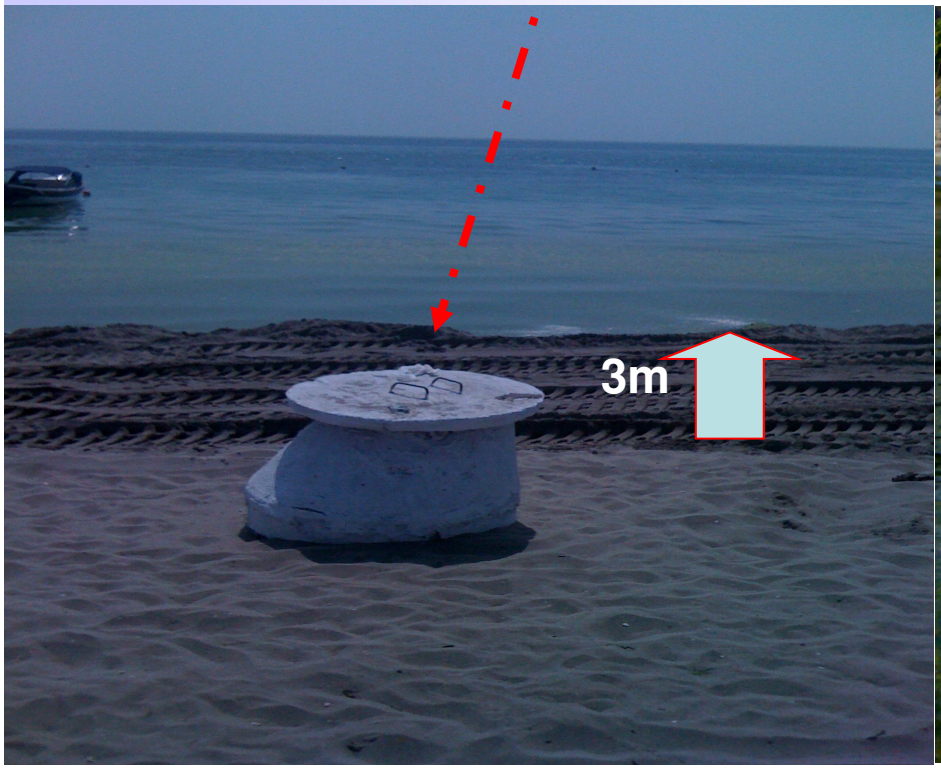
The southwestern shoreline of Istanbul carries great importance for recreational activities and recent excessive blooms have drawn major attention.

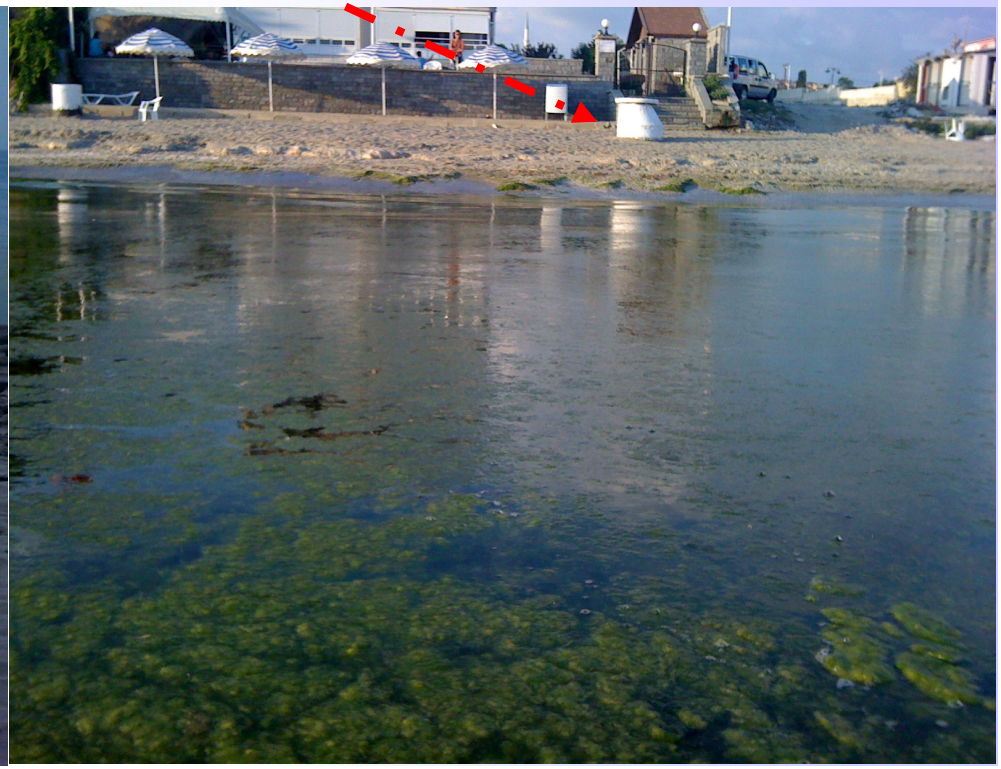
Study Area


BLACK SEA
Istanbul
Turkey
MEDITERRANEAN SEA
Buyukcekmece
Lake
Marmara Sea
Cerkezköy
Durusu
Çorlu
Kaval
Silivri
Istanbul
E80
O-3
E84
B
POWERED BY
Google
Map data ©2010 Basarsoft, Tele Atlas

Study Site Municipal Public Works

- ***The sewage line is installed infront of the residential complexes parallel to the sea (approximately 3m's in distance).***





Physico-chemical parameters

Date	TºC	Salinity ‰	$P\text{-}PO_4$*	Si*	$N\text{-}NO_2$+ NO_3*	$N\text{-}NH_4$*	Chl-a (µg/L)
07.2010	26	14	0.65	9.625	0.257	0.723	4.385
08.2010	29	33	3.50	14.952	0.223	0.428	14.114
08.2010	29	17	0.53	15.303	0.214	0.937	3.680

*µg-at/L

WHY IS THE BLOOMING OF *Cladophora* SO IMPORTANT?


In addition to risks of chemical pollutants, WHO (2003) draws attention to the potential pathogenic risks that may be neglected.
Therefore, this study aimed to place extra emphasis on the microbiological and pathogenic criteria in waters used for recreational purposes.

Because the Bacterial Water Quality Standards for Recreational Waters (Freshwater and Marine Waters) Status Report provides a brief overview of the bacterial water quality standards that have been adopted by states for their marine and fresh recreational waters in the United States.

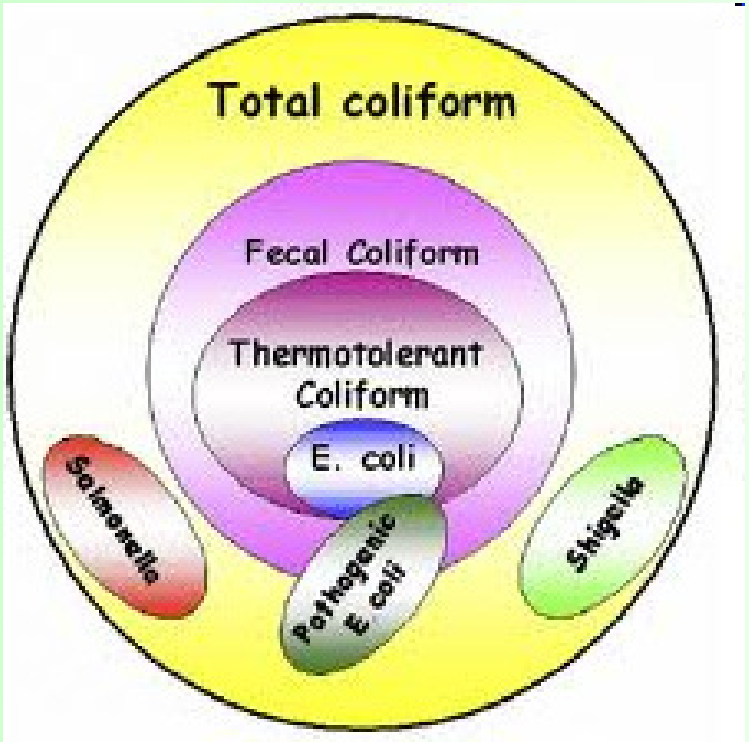
This report is based on consultations with EPA water quality standards coordinators.

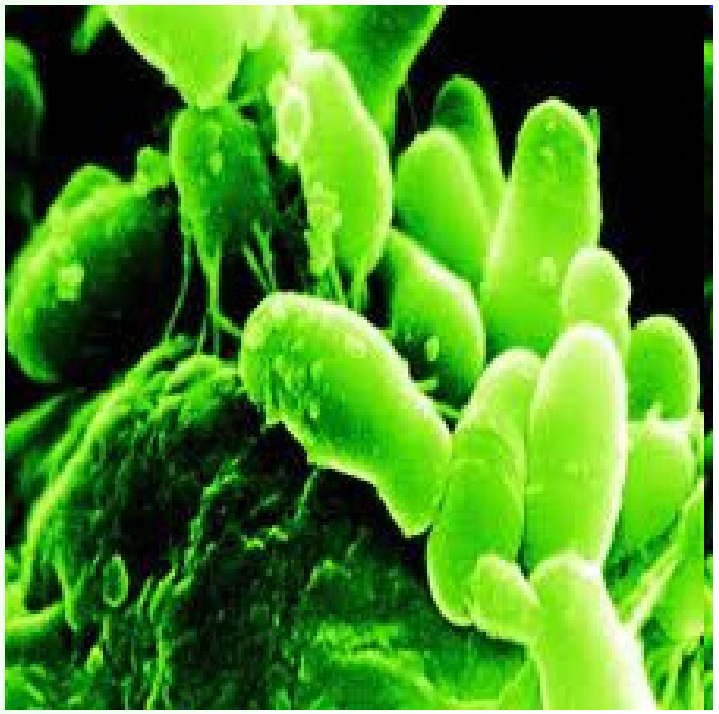
Our findings from this study are much higher than the criteria for EU countries, Blue Flag Criteria and our Country's reference values used as recreational areas.

Parameters	Standard value (Turkey)	EU Directive (76/160/EEC)	Blue Flag Criteria (Canada)	Max value (Turkey)
Total coliform / 100 ml	1000	500	200	10000
Fecal coliform / 100 ml	200	100	100 (*E.coli*)	2000
Fecal enterococ / 100 ml	100	100	35	1000

In our study, the total coliform values were found to be between ***10^5 and 10^8*** *MPN/100 mL.*

By obtaining ***high levels*** *of total coliform, our findings suggest the presence of pathogenic bacteria (Salmonella, Shigella, etc.)*





APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Aug. 2003, p. 4714–4719 Vol. 69, No. 8
0099-2240/03/$08.00+0 DOI: 10.1128/AEM.69.8.4714-4719.2003

(Ch

USGS
science for a changing world

Great Lakes Science Center

in

Algal (*Cladophora*) Mats Harbor High Concentrations of Indicator Bacteria and Pathogens

Indicator bacteria and human enteric pathogens have been recovered from *Cladophora* mats and may influence recreational water quality.

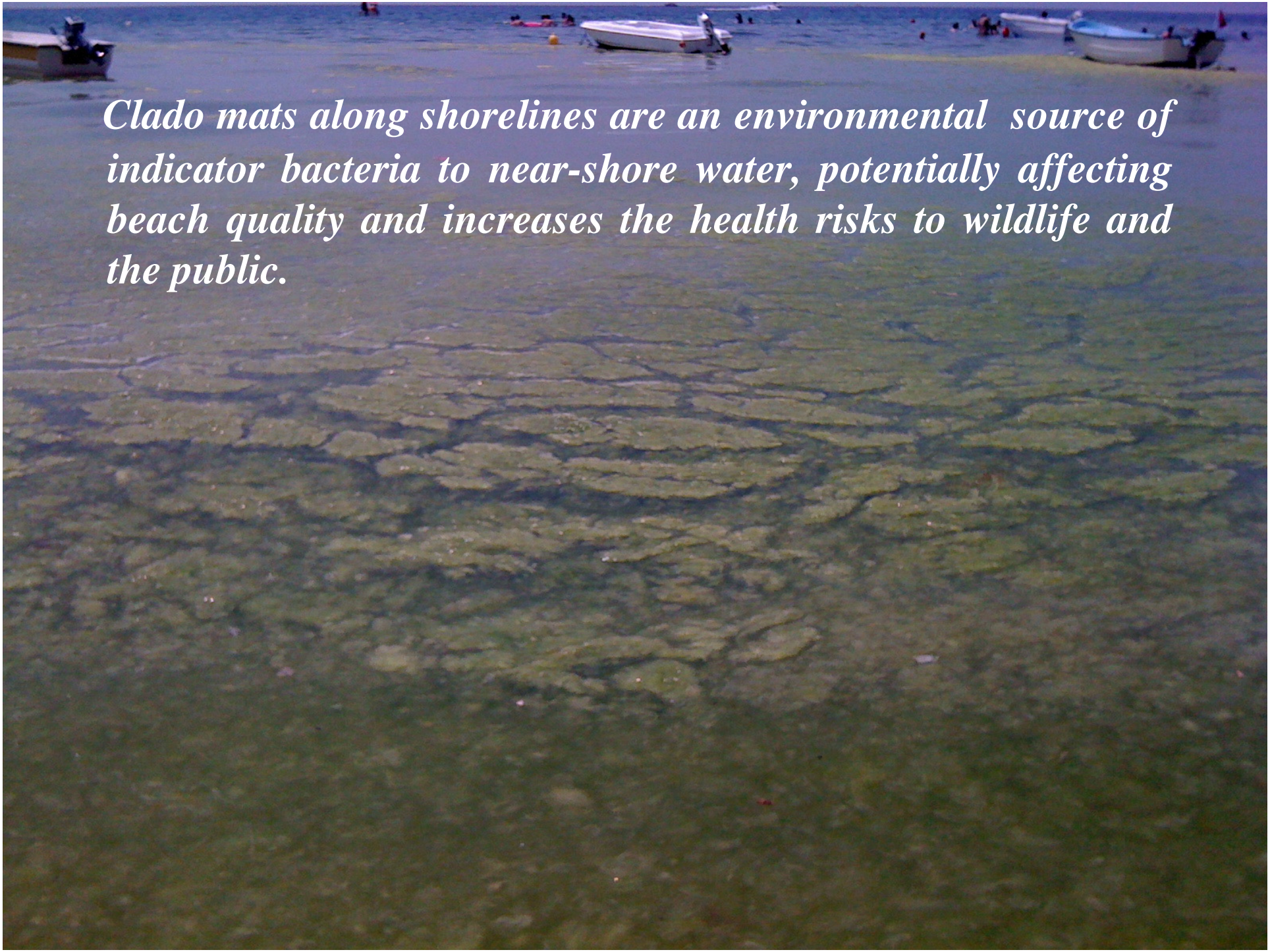
Researchers at the Lake Michigan Ecological Research Station (LMERS), USGS Great Lakes Science Center have studied the enteric bacteria in *Cladophora* mats found along the Lake Michigan shoreline. LMERS scientists and their collaborators have found that *Cladophora* is a potential environmental reservoir of enteric bacteria, including some pathogens of public health concern:

- *E. coli*
- Enterococci

Cladophora mats. Photo by Ken Hyde, Sleeping Bear Dunes National Lakeshore

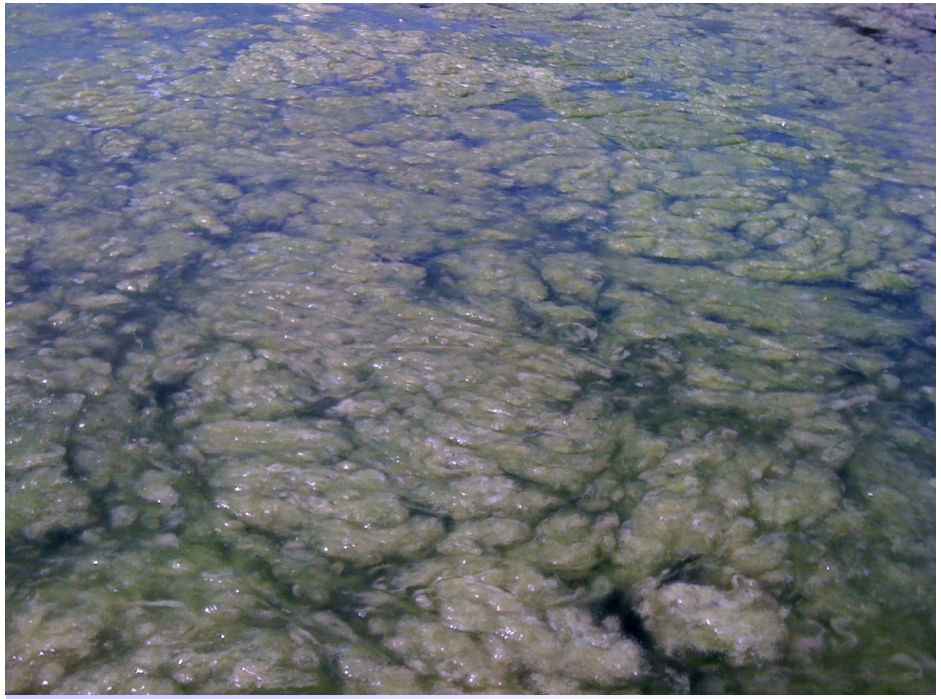
Cladophora

pathogens to persist and grow, which may in turn impact recreational beach water quality. Also, *Clostridium botulinum* was detected in *Cladophora* samples collected from two locations in an area along the upper eastern Lake Michigan shore, suggesting a possible link between *Cladophora* and bird botulism. The source of these enteric bacteria in *Cladophora* is unclear, but they likely originate from shore bird waste and human contaminants (e.g., sewage, run-off, agricultural operations). Our investigations show that the relationship between *Cladophora* and enteric bacteria is

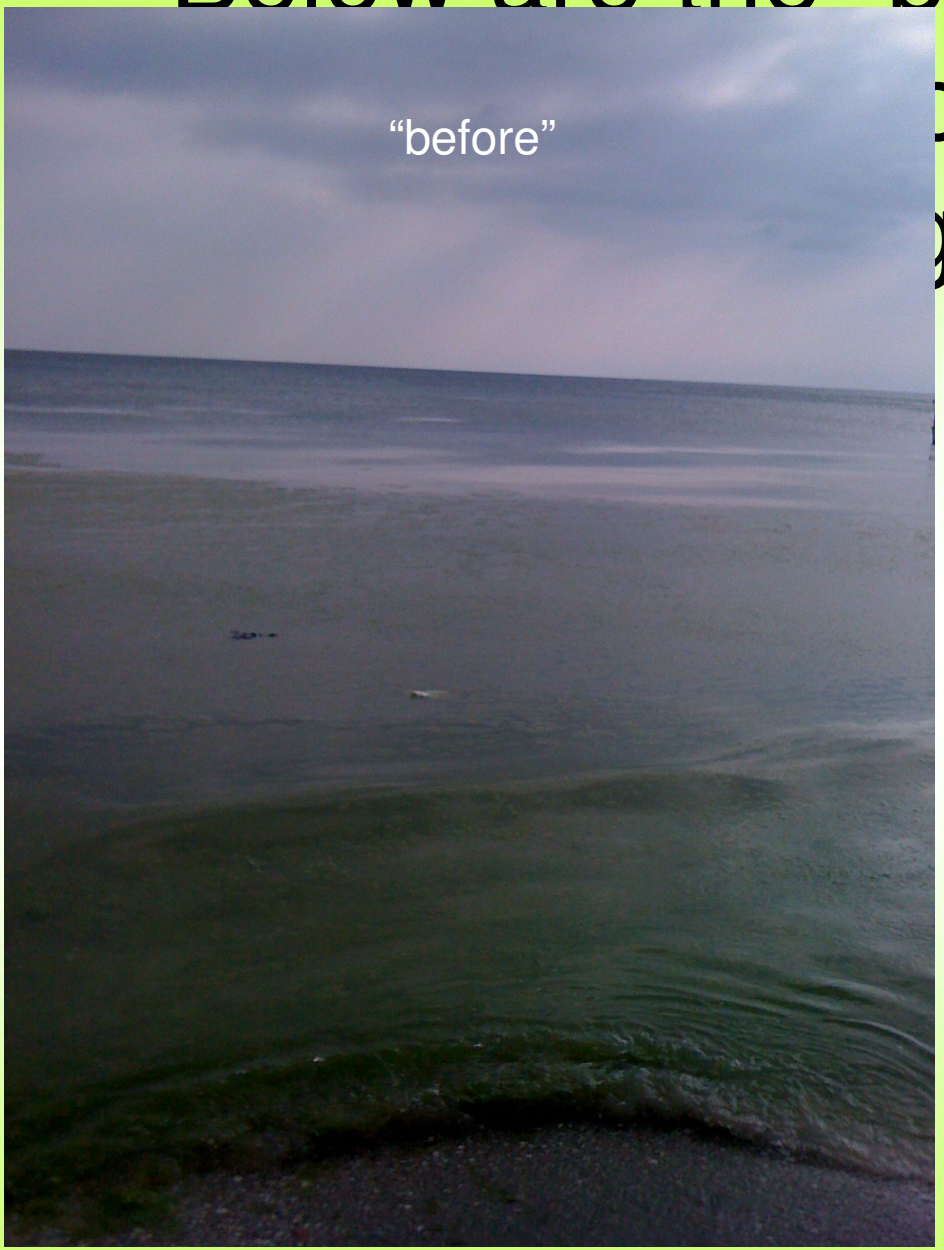


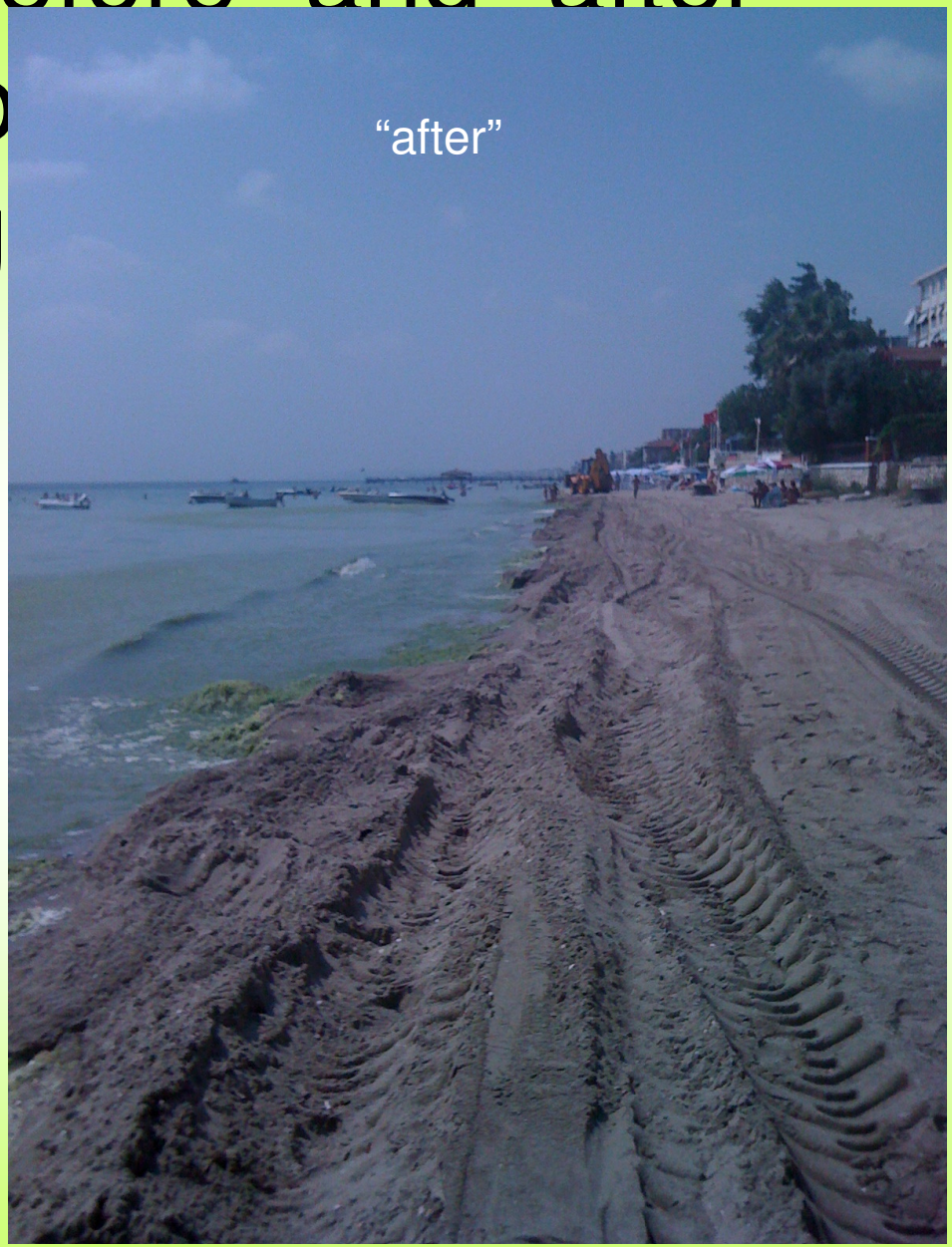
Clado mats along shorelines are an environmental source of indicator bacteria to near-shore water, potentially affecting beach quality and increases the health risks to wildlife and the public.

- ***Large masses of <u>Cladophora</u> accumulations not only create mats but also negatively affect recreational areas and influence water quality.***



Below are the “before” and “after”



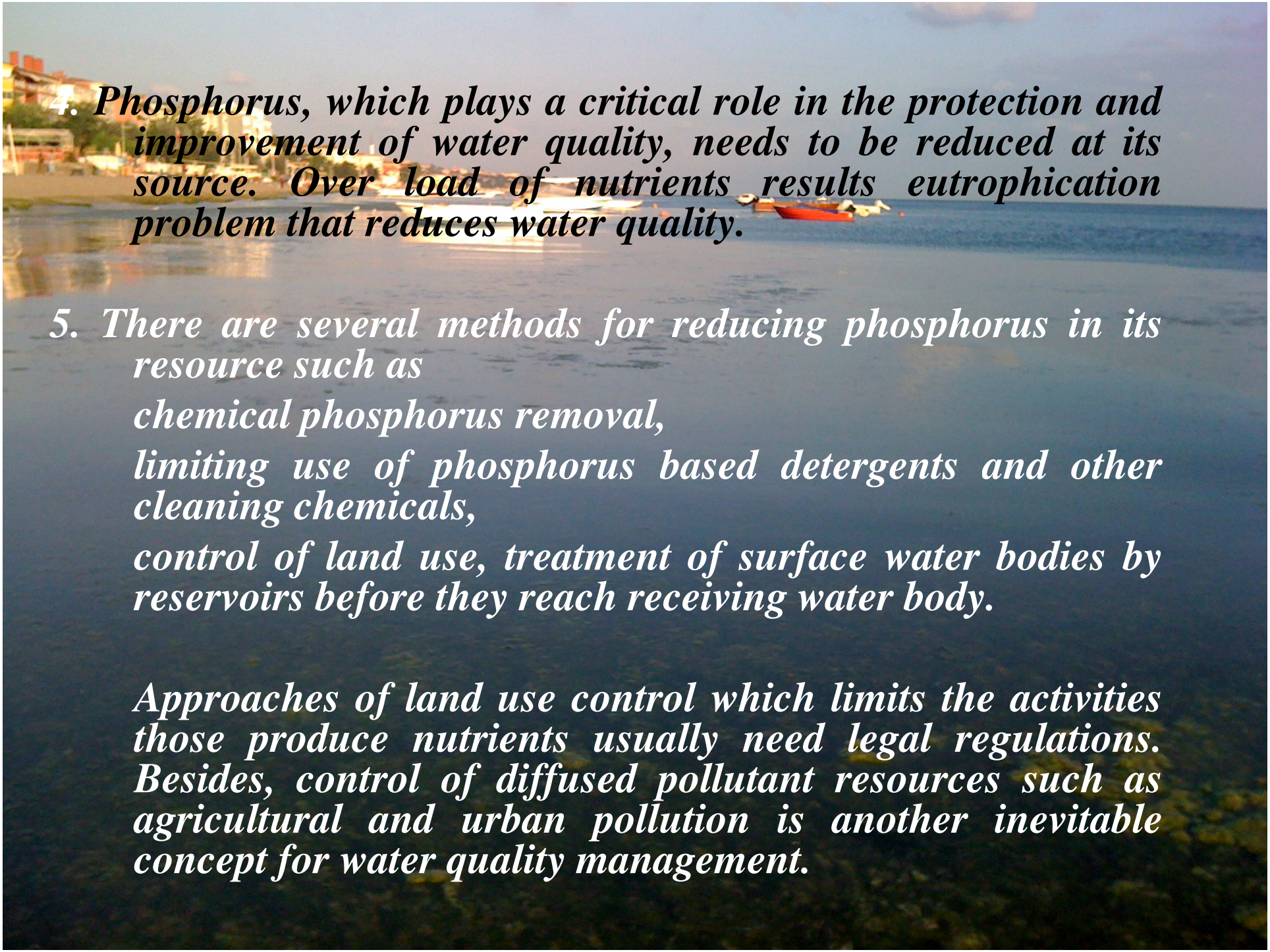


CONCLUSION

1. *Data from the study site indicates that there is a loss of quality in recreational areas and is faced with an increase in pathogenic threats.*

2. *Periodic monitoring efforts to determine water quality in coastal areas parameters may be insufficent.*

3. *If Cladophora mats, with increased stability, are created and aged, then the survival and replication ability of E.coli is simplified.*



4. *Phosphorus, which plays a critical role in the protection and improvement of water quality, needs to be reduced at its source. Over load of nutrients results eutrophication problem that reduces water quality.*

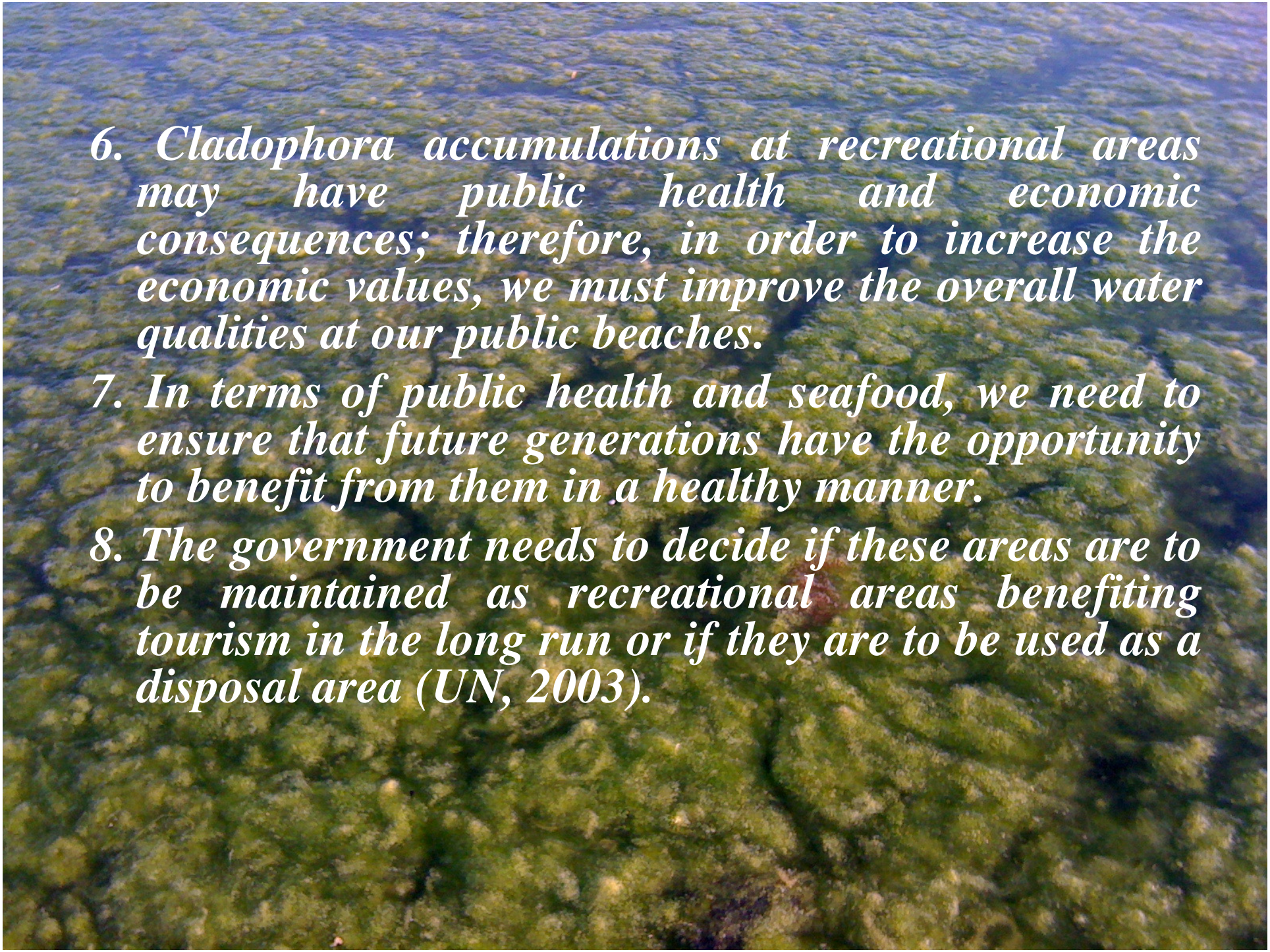
5. *There are several methods for reducing phosphorus in its resource such as*

   chemical phosphorus removal,

   limiting use of phosphorus based detergents and other cleaning chemicals,

   control of land use, treatment of surface water bodies by reservoirs before they reach receiving water body.

   Approaches of land use control which limits the activities those produce nutrients usually need legal regulations. Besides, control of diffused pollutant resources such as agricultural and urban pollution is another inevitable concept for water quality management.



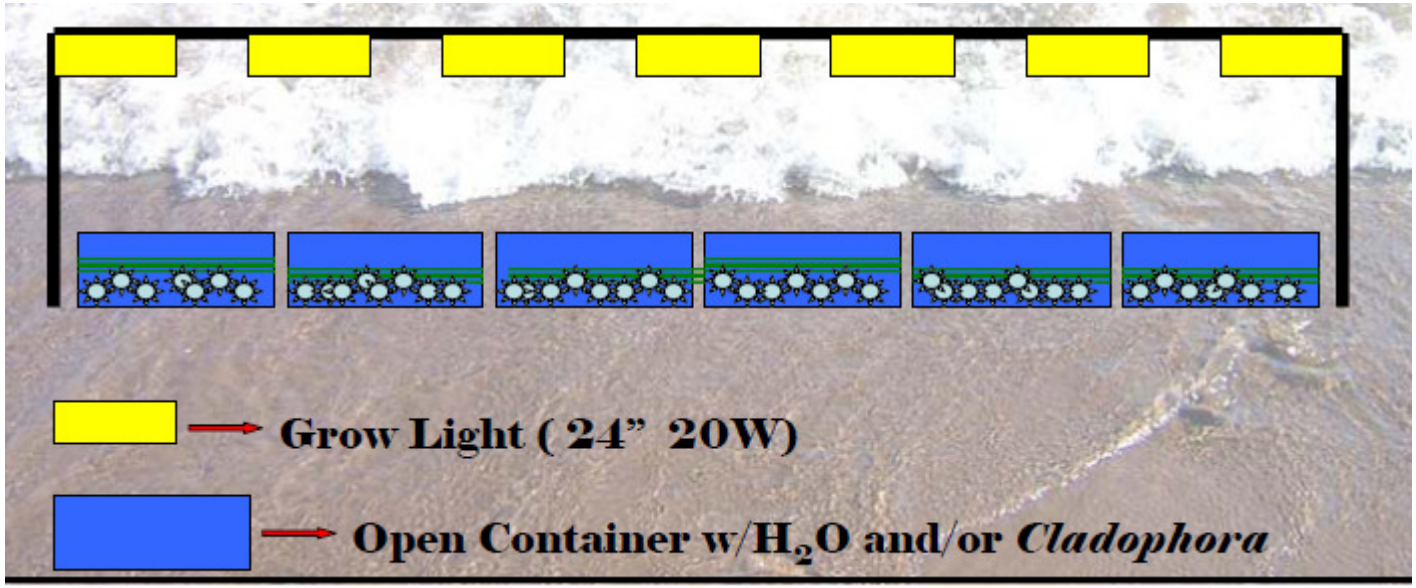
6. *Cladophora accumulations at recreational areas may have public health and economic consequences; therefore, in order to increase the economic values, we must improve the overall water qualities at our public beaches.*
7. *In terms of public health and seafood, we need to ensure that future generations have the opportunity to benefit from them in a healthy manner.*
8. *The government needs to decide if these areas are to be maintained as recreational areas benefiting tourism in the long run or if they are to be used as a disposal area (UN, 2003).*


THANK YOU FOR YOUR
ATTENTION

Lab Microcosm Study

Not easy to assess pathogen survival in environment
-Use seawater & *Cladophora* from local station
-Specific influence on *E.coli* and pathogens in a controlled setting
- Microorganism + water
- Microorganism + water & *Cladophora*

Measure :
-Microorganism free in water
- Microorganism attached to *Cladophora*



McDermott, 2008