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Effects of Algal Bloom on the Fisheries of the Sea of Marmara through the 2007/2008 Fishing Period

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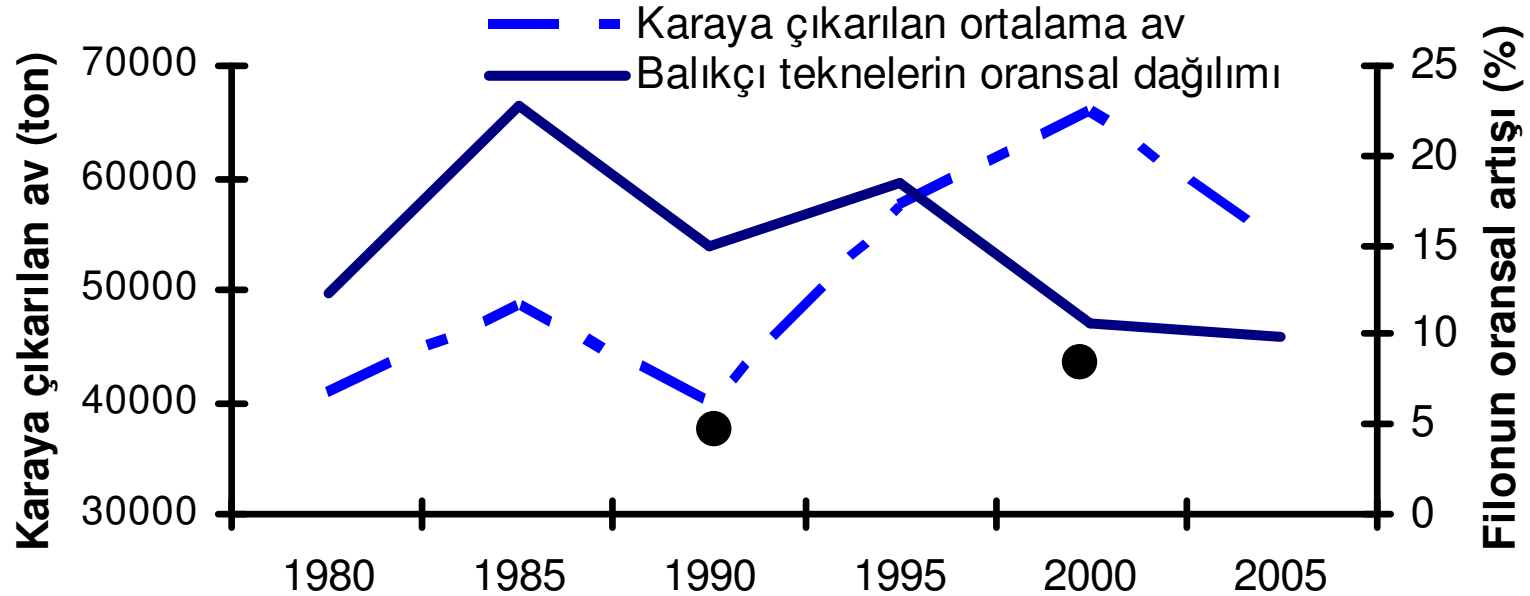
Introduction

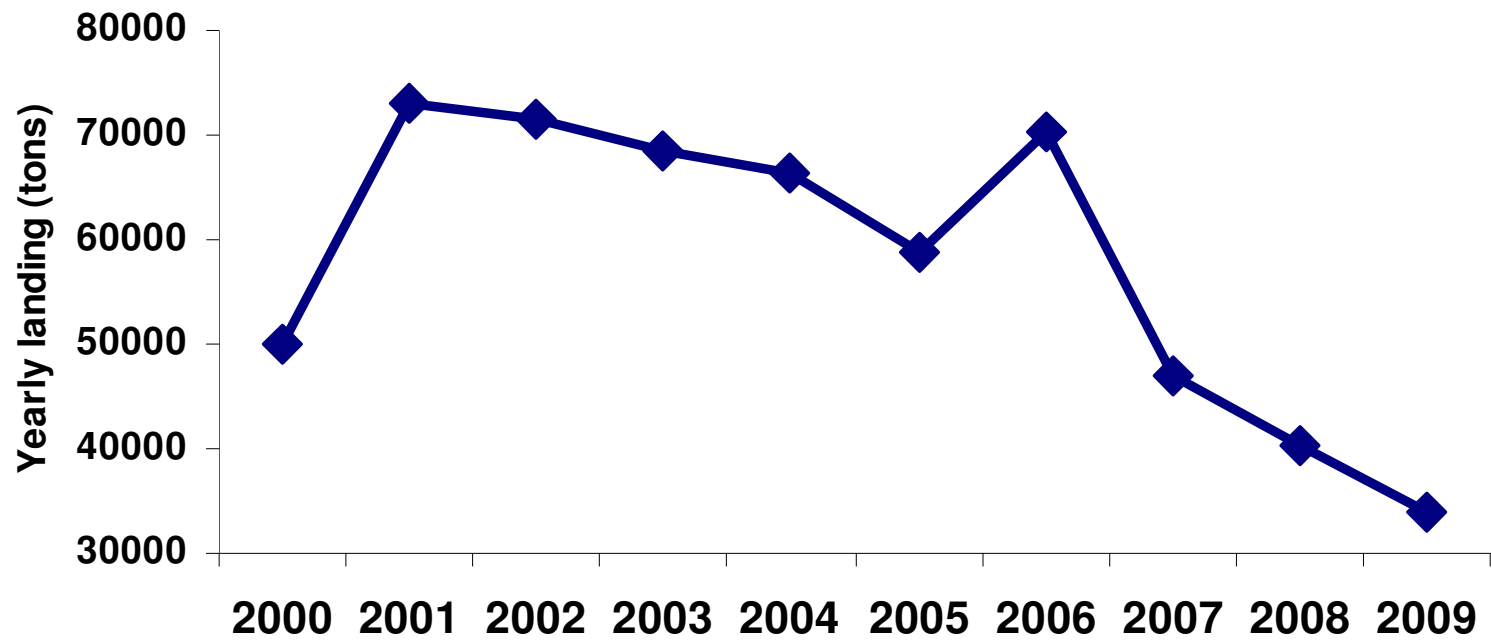
- The Marmara sea is a passing sea between Çanakkale and İstanbul straits. Its hydrological features are effected by Mediterranean and Black Seas. Upper level (about 0-25 m) waters are effected coming from Black Sea flows. In this level's salinity limits is about 22-24‰.
- After 25 m above levels' salinity is about 36-38‰. This sub levels are effected Aegean and Mediterranean waters.

Introduction

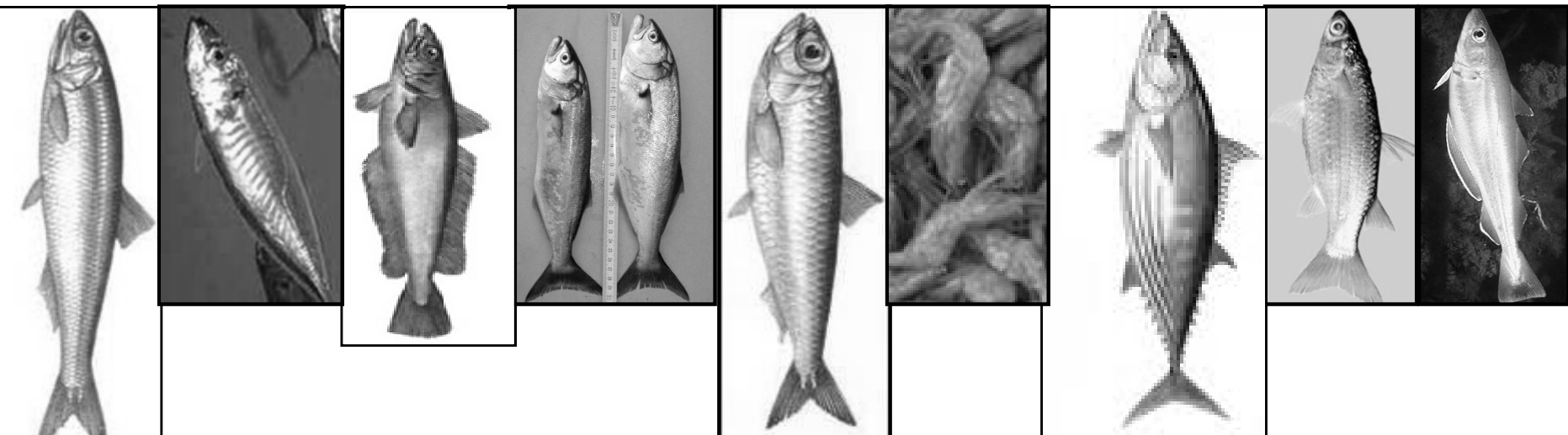
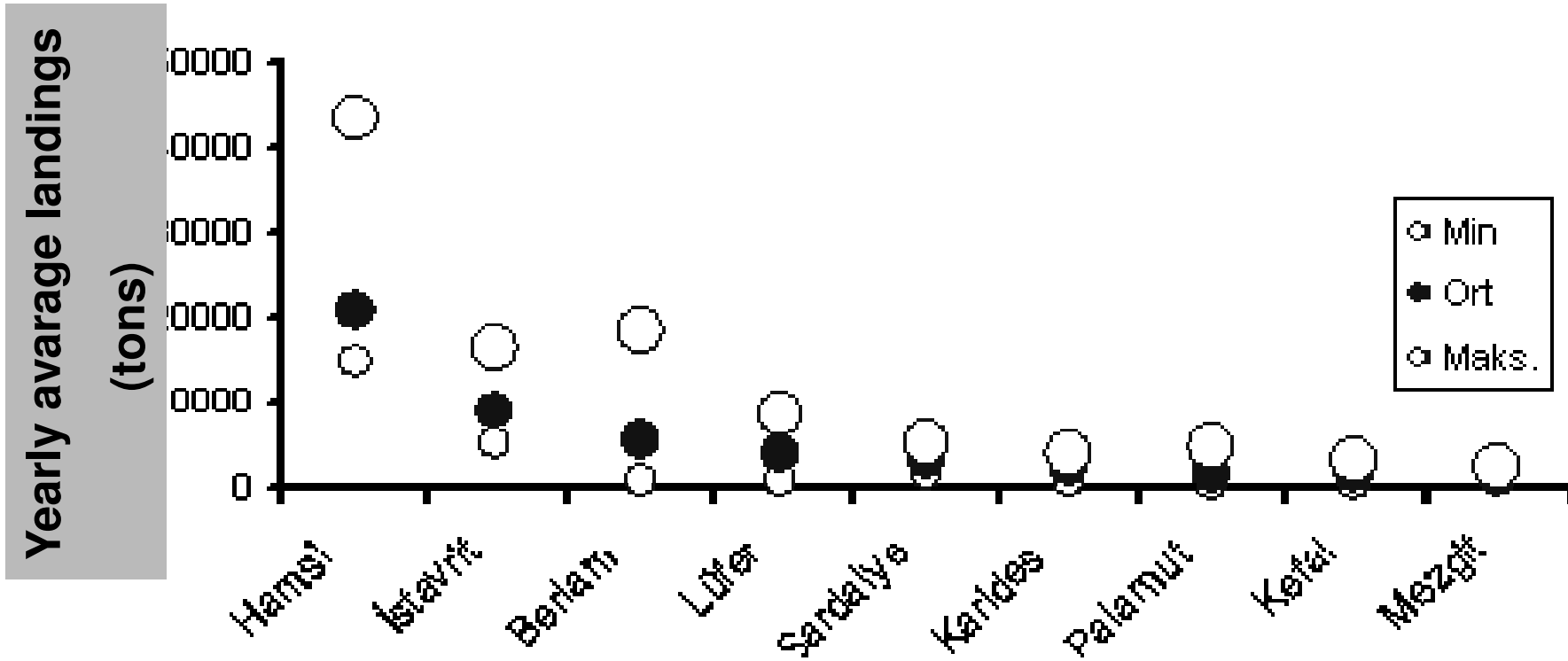
- Its variable oceanographic features, Marmara Sea has the richest and very suitable ecosystem for migration fish species (anchovy, sardine, horse mackerel, bonito, blue fish, chup mackerel) adverse direction from Black and Mediterranean Seas. Mostly these species are migrated these areas for refuge, feeding and spawning.
- Marmara Sea has a very rich benthic and demersal biodiversity. Also above of thermocline level are dominant for shrimp (*Parapenaeus longirostris*) and hake (*Merluccius merluccius*) stocks.

Ülkemiz balıkçılığında jelimsi organizmaların patlama yaptığı 1990, 2000 ve 2008 kriz dönemleri (*Bu dönemlerin ilkinde av miktarı 24 bin ton, ikincisinde 50 bin ton ve sonuncusunda ise 57 bin ton olarak gerçekleşmiştir*) hariç karaya çıkarılan ortalama av miktarları 1980'lerde 40 bin ton iken, 1990'larda 50 bin tona ve 2000'li yıllarda ise 65 bin tona yükselmiştir.





Mainly target/commercial fish species and their landing last decade



Introduction

- Second half of the 2000s; (in 2006) Marmara fisheries has been faced big ecological damage. A kind of algal and its extraction like mucilage is spread out largely on the whole fishing gear, fishing level and catching.

Introduction

Some reasons of existence mucilage formation

- Nutrients abundance
- Water temperature changes
- Increasing of the phytoplankton species composition
- Excessively biomass increase
- High concentrated dead
- Zooplanktons and particulars holding with together

Introduction

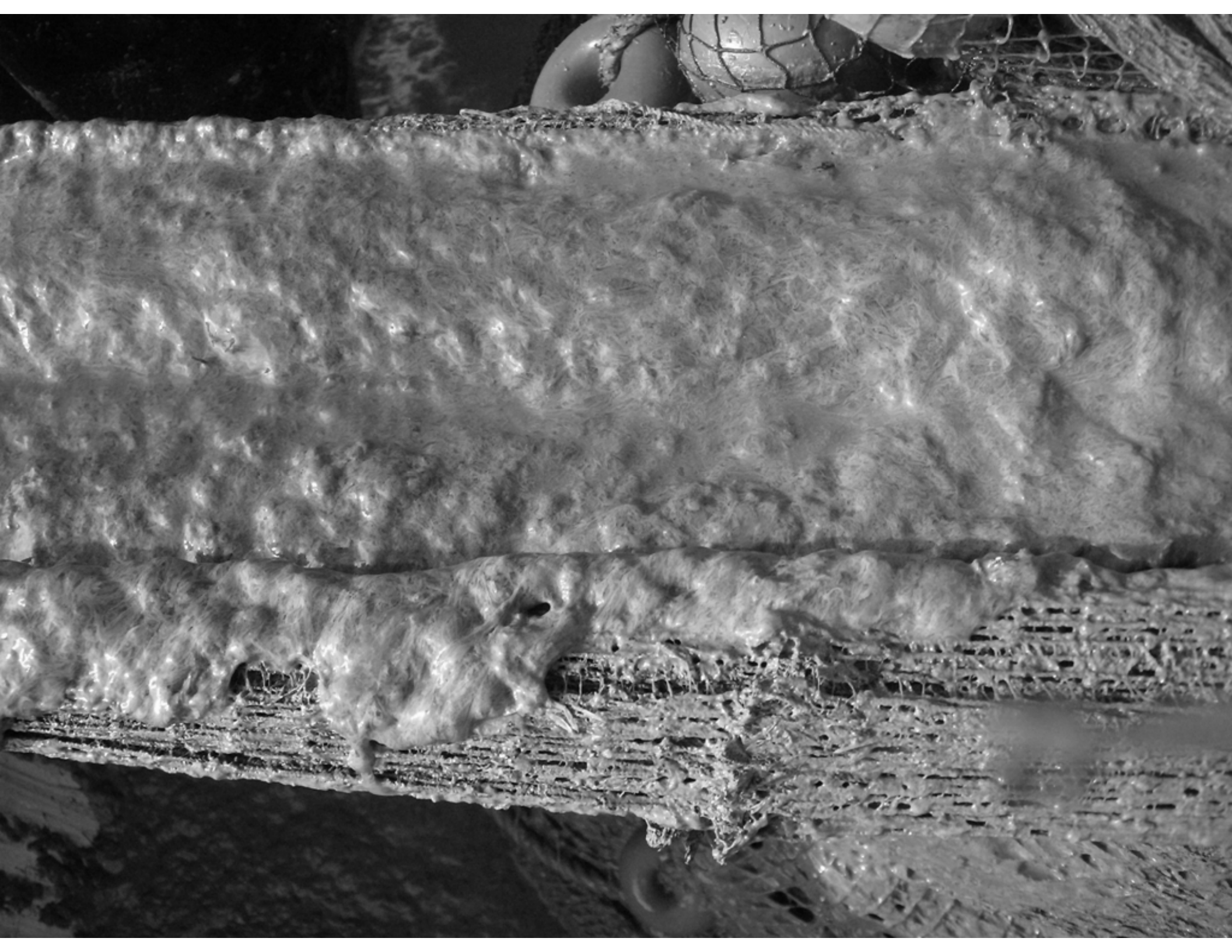
Some results of the mucilage formation

- Zooplanktons species compositions changing and replacing
- Physical and chemical changes of sea waters (pH, O²)
- Zooplanktons biomass reducing
- On the benthic organism pressure
- Fishing activities and gears prevented
- Catch loses

The musilage formation when the fishing operation time

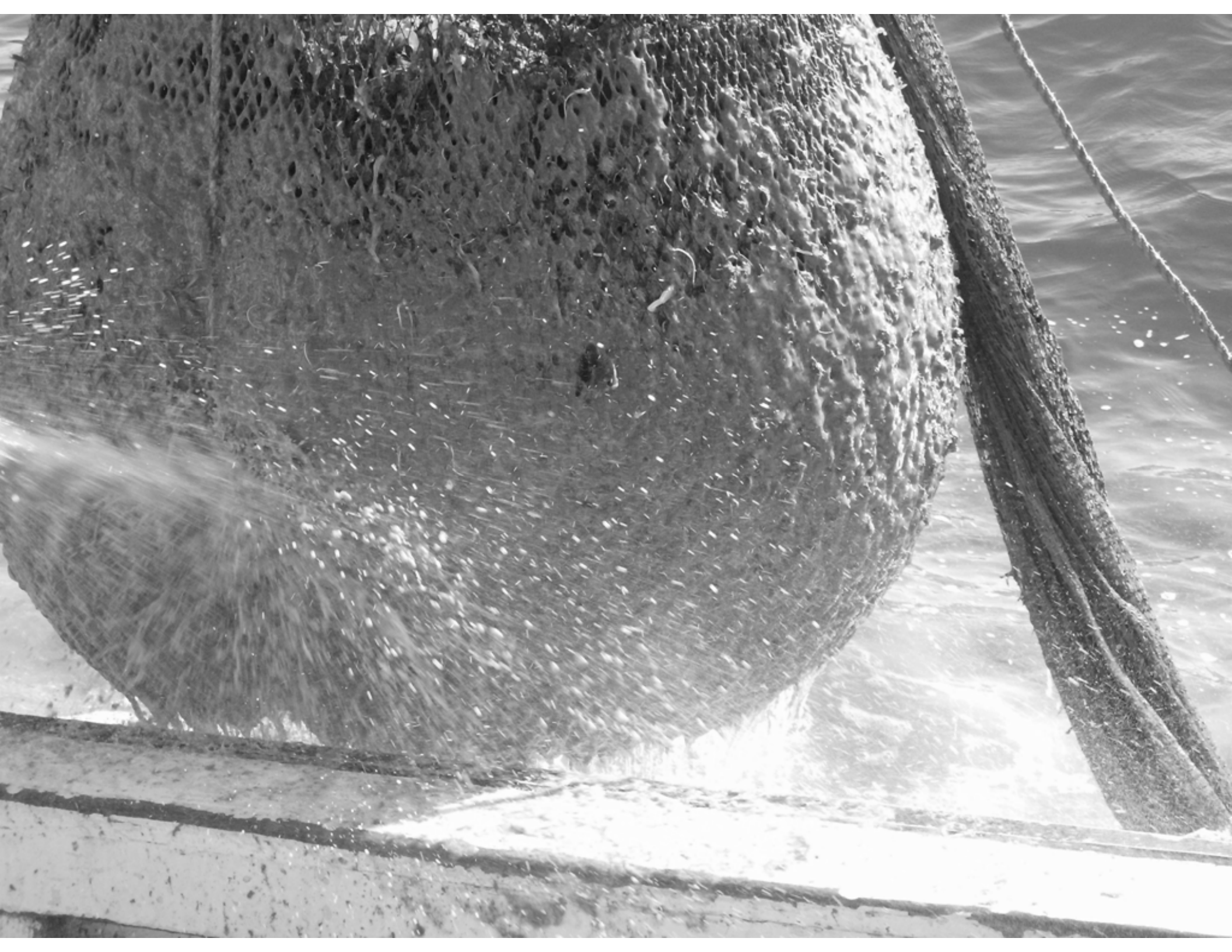












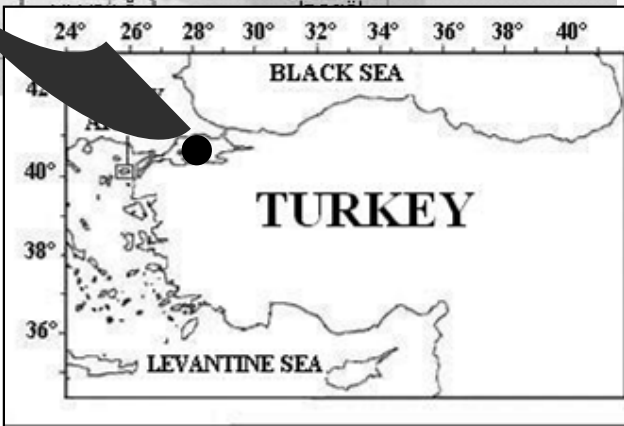
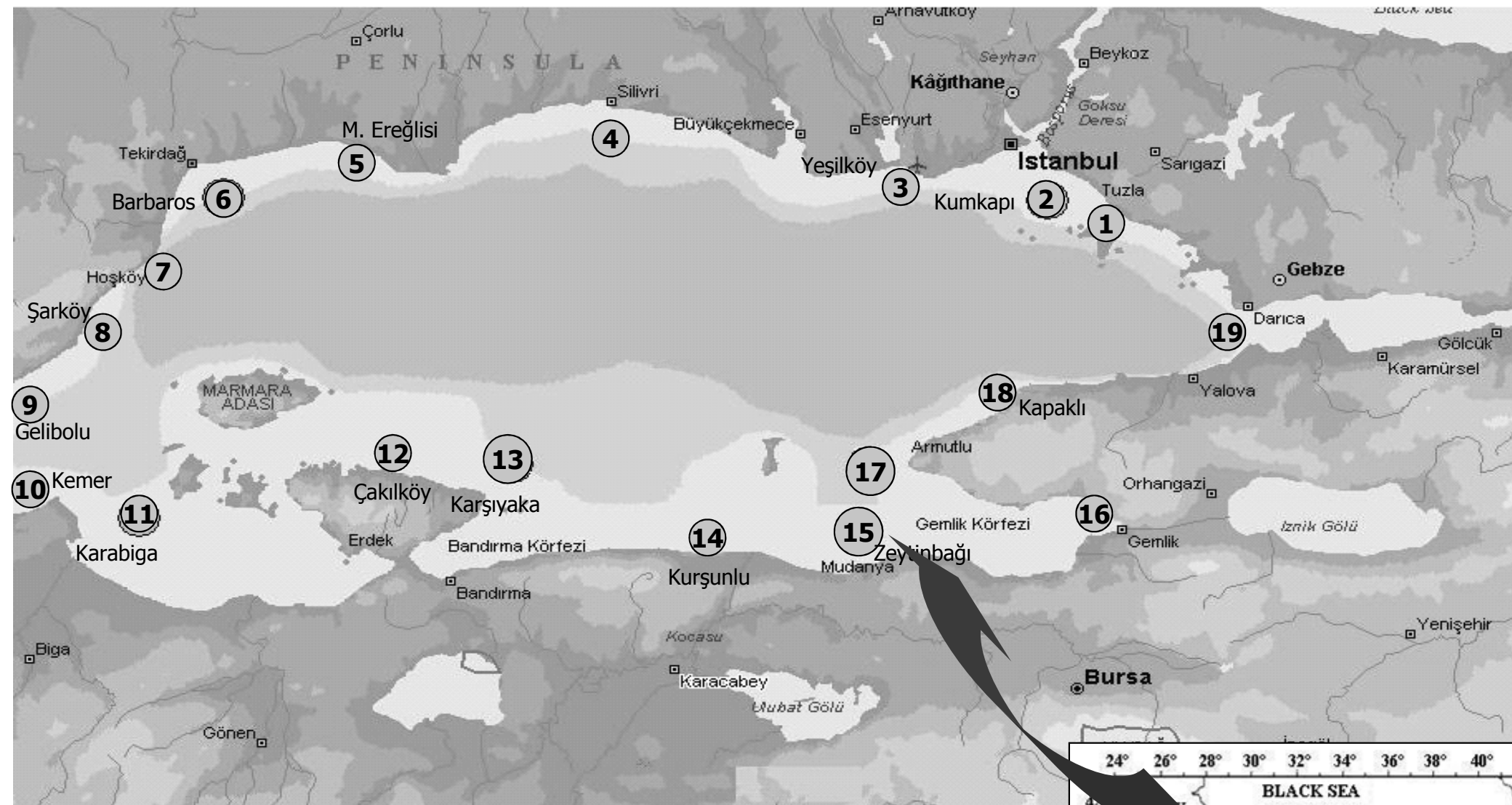


Introduction

- This subject has been studied first time in Turkish seas. It has been firstly appeared in the Marmara Sea in 2006 and densely bloomed in 2007 and 2008 in the Marmara ecosystem; on commercial fish stocks and activities.

Material and Method

- **The first time mucilage has been studied economical losses in fishing in Turkey seas.**
- **The study was realized on fishery localities those are differently characterized but representing the overall fisheries in the Sea of Marmara by means of a stratified sampling procedure regarding the vessel size and fishing method.**
- **Sampling was carried out two fishing seasons which were 2006/07 (usual season) and 2007/08 (bloomed season).**



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Derinlik (metre)

- 0 - 50 m
- 50 - 200 m

Study area and sampling stations (total 19 locations)

Sampling procedure according to the fishing type and vessel groups in the Marmara fishing fleet.

Vessel length groups (m)	Gear type and fishing methods
<8,9 (1. group)	bottom/surface gill nets, long lines and hooks
9-15,9 (2. group)	bottom/surface gill nets, circle nets, beam and small bottom trawl
16-25,9 (3. group)	circle nets, beam and small bottom trawl, purse seine
26> (4. group)	Trawl, purse seine

Results

- Gelatinous mass formed at surface locally became ticked. As a result of the excess weights, nets were destroyed
- Equipment lifting the nets were not operational due to the excess weight of nets. Time for collection of the net extended, from 1 hour, to 6-8 hours in most cases.
- This posed problems for fishers in terms of manpower and fuel used for fishing operations. Furthermore, catch were not harvested.
- Gelatinous tick layers were formed due to sudden mixture of top-water column which were degraded at the surface layer..

Results

- **Organic degradation generally were intensively observed between 5 and 10 meters.**
- **At the regions where intermediate layer was obvious, no degradation in benthic organisms and sediments was seen.**
- **Contrary, at the regions where intermediate layers were not formed, degraded gelatinous layers were sunk, posing problems for macro benthic organisms (fish and shrimp)**

Results

- According to obtained data, the loss in amount of the landings and its corresponding cost was nearly three times of the one in usual period. The rate of loss was the highest in small pelagic fishes (purse seine fishery). This was followed by the fisheries of shrimp and benthopelagic fishes (beam trawl and bottom trawl fishery). The last one was the coastal/artisanal fishery (bottom/surface gill nets, long lines and hooks).

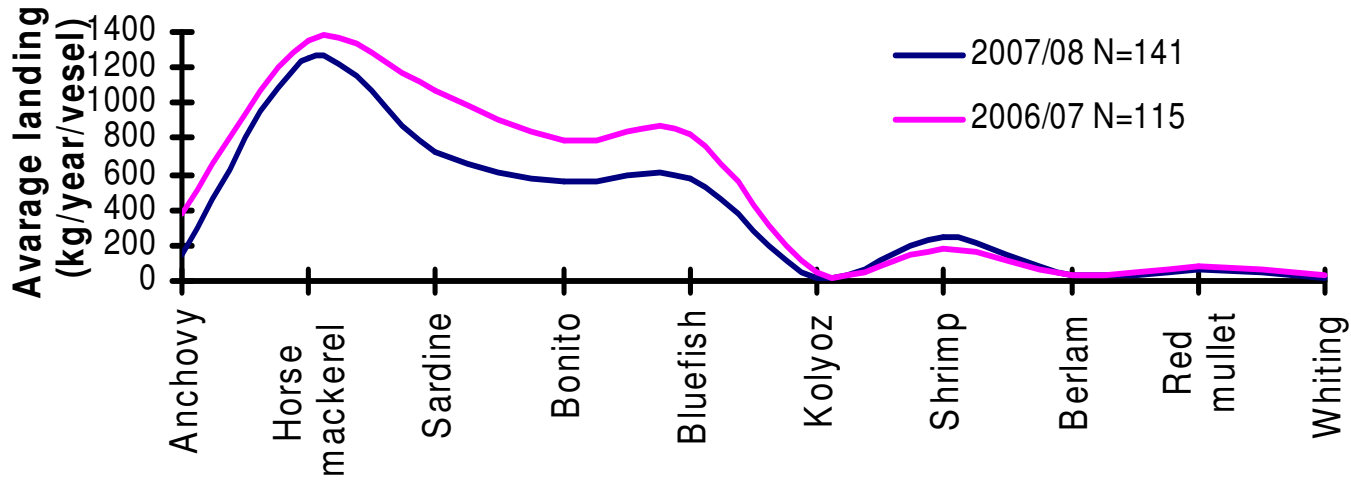
Small pelagic landings: each vessel groups and normal and mucilage seasons

Vessel groups	Anchovy		Horse mackerel		Sardine		Bonito		Bluefish		Chup mackerel	
	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07
I	155	378	1244	1352	723	1067	560	787	581	817	13	47
II	47	108	693	1363	5845	7797	1464	2432	1630	2835	7	159
III	4105	38571	4867	16500	33	41464	762	6979	2262	8714	143	13143
IV	3480	102067	23866	64383	10514	129720	830	10616	6515	12183	1450	11100

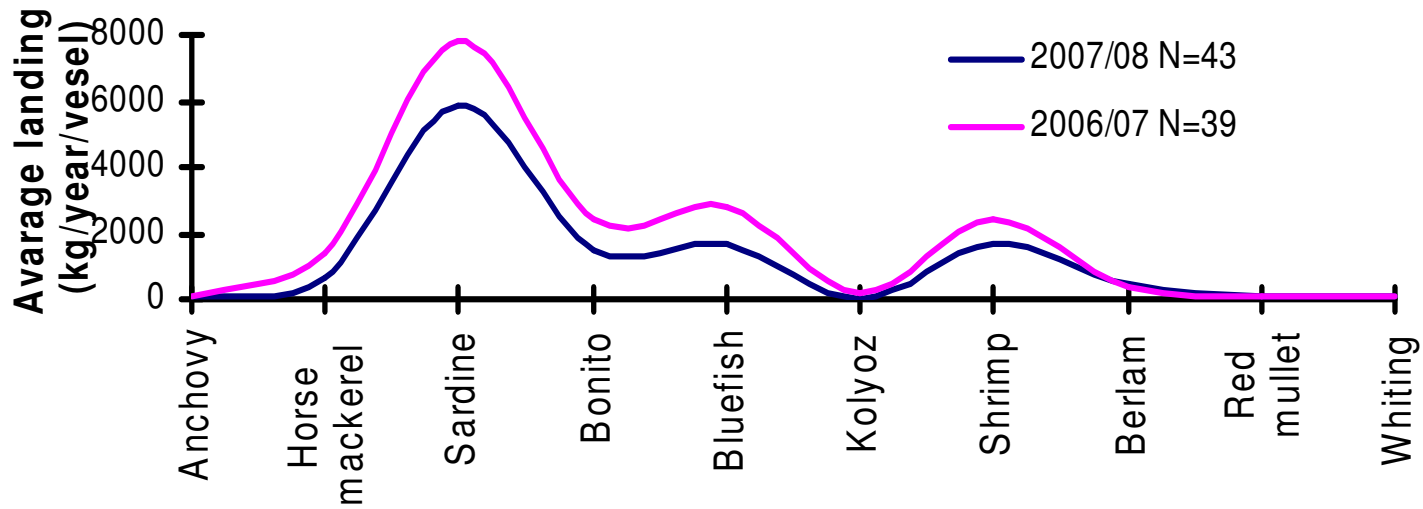
Benthic and demersal landings: each vessel groups and normal and mucilage seasons

Vessel groups	Shrimp		Hake		Red mullet		Whiting	
	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07
I	252	180	30	31	72	75	11	41
II	1638	2431	468	328	78	91	87	72
III	2405	2714	407	938	110	132	1638	6429
IV	200	500	0	0	0	37	60	83

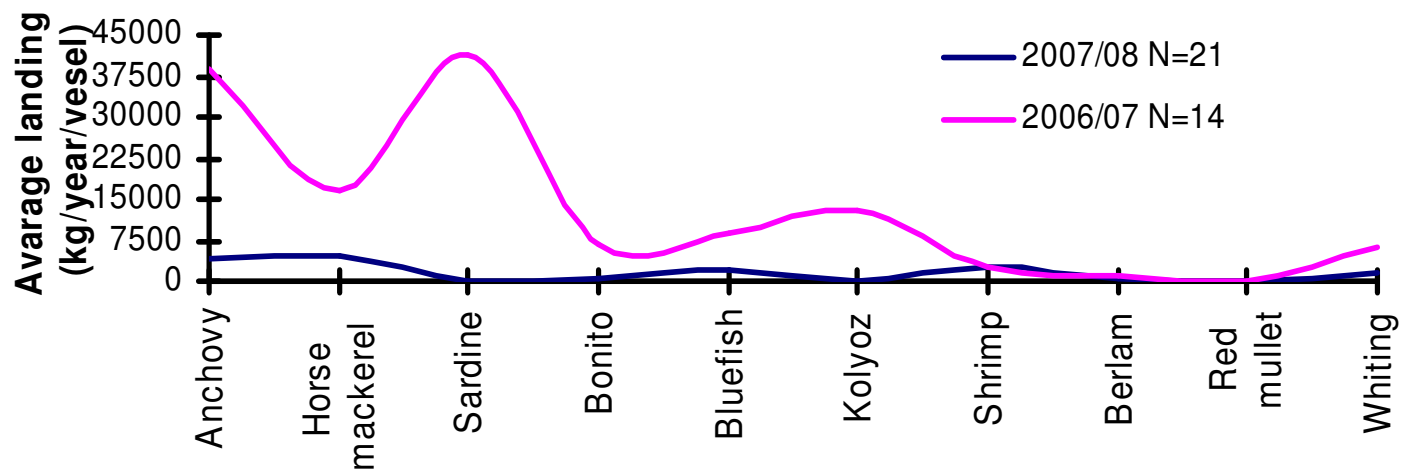
VESSEL GROUP: I (<8.9 m)



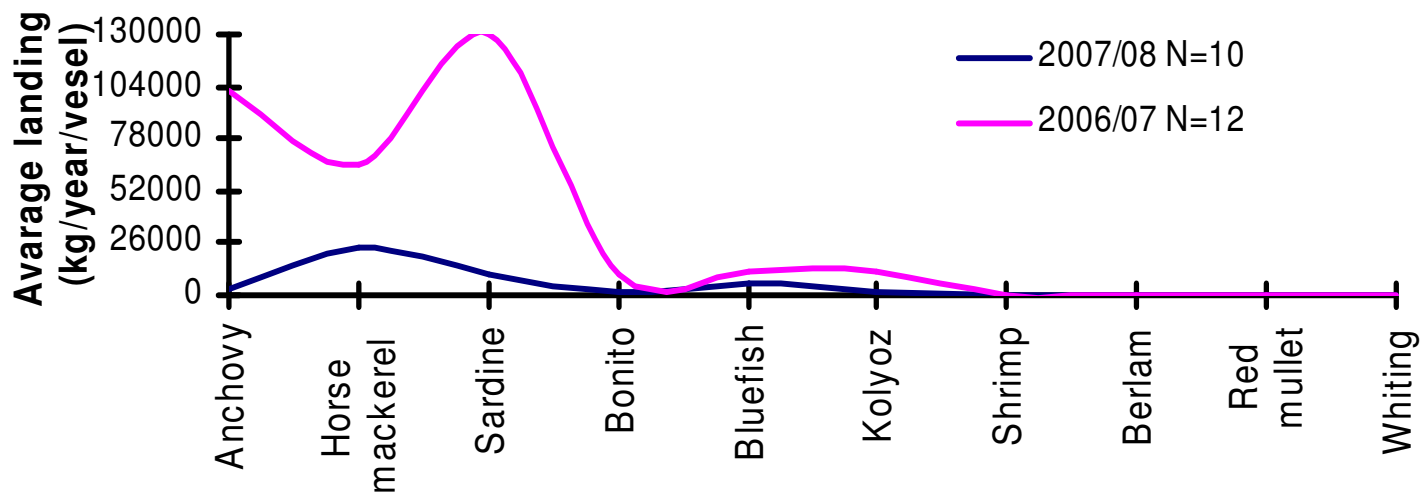
VESSEL GROUP: II (9-15,9 m)



VESSEL GROUP: III (16-25.9 m)

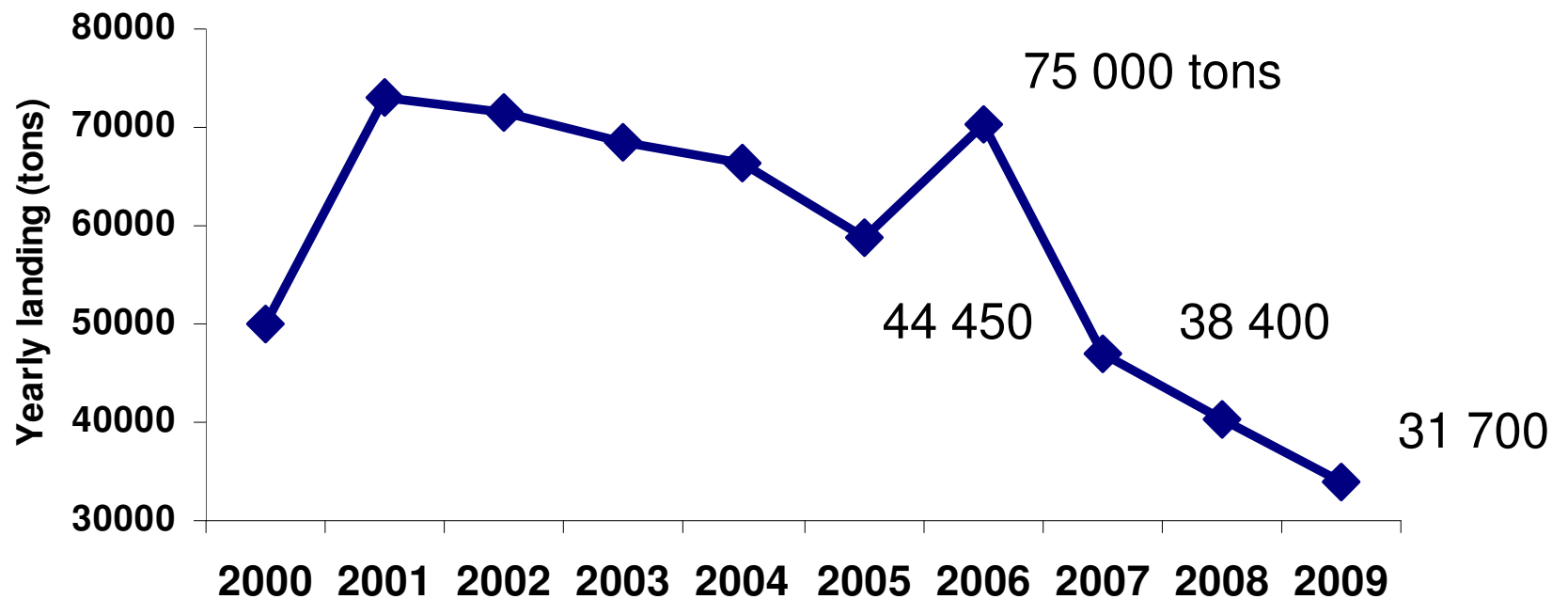


VESSEL GROUP: IV (26>)



Introduction

● The same trends were found in Marmara's official landings between 2006 and 2007, 2008, 2009 respectively



The Marmara sea landing trends last decade; between 2000 and 2009

Results

According to the vessel groups and fishing types/gears economical losses of mucilage (unit value Turkish Lira)

Vessel length group s	2006-2007 (Normal fishing season)			2007-2008 (Jellyfish bloomed season)		
	Gross income	Variable coasts	Total profit	Gross income	Variable coasts	Total profit
1	21.250	13.450	7.800	6.420	7.718	-1.298
2	32.125	20.196	11.929	8.700	10.291	-1.591
3	786.000	611.700	174.300	435.000	398.650	36.350
4	406.000	283.466	122.534	219.000	224.800	-5.800

Results

- The algal blooms which resulted in gelatinous masses affected the fishery areas of all the different levels which are inshore, offshore, surface, pelagic and benthic in the Sea of Marmara and a significant depletion occurred in fishery economics.
- It is certain that the following proposals are worth to consider, in order for reducing the effects of gelatinous organisms on fish stocks and fisheries.
- Firstly, it is required to decrease the fishing effort in the Sea of Marmara. On the other hand, the uncontrolled and unconscious fishery should be taken under control.

Suggestions

- The depletion in fish stocks creates a negative feeding competition between small pelagic fishes and jealous organisms that shares the same tropic food chain in the ecosystem.
- In order to come over this case; it is necessary to develop a long-term fishing strategy for small pelagic stocks and firstly;
 - (1) the fishery of small pelagic stocks should be completely banned for a certain period,
 - (2) a quota system which designs a reduction in the negative effect of over-exploitation should be applied after the stocks renewed and reached a significant biomass.
 - (3) In periods of fishing closures, in order to compensate the fisherman incomes, the government should provide long-term and low tax credits and donations.



**Thank you for
your attention**

