



***MISIS Project - Final Meeting***  
***Danube Delta, 23-26 of June 2014***



# **Benthic habitats**

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The evaluation of the Black Sea ecosystem state represents a complex, laborious, time-consuming and rather imprecise process.

What is the state of an ecosystem?

An open, dynamic, nonlinear, biologically controlled system, which in two consecutive moments in its succession or in a shorter or longer period, has and has not the same structure, form and functions.

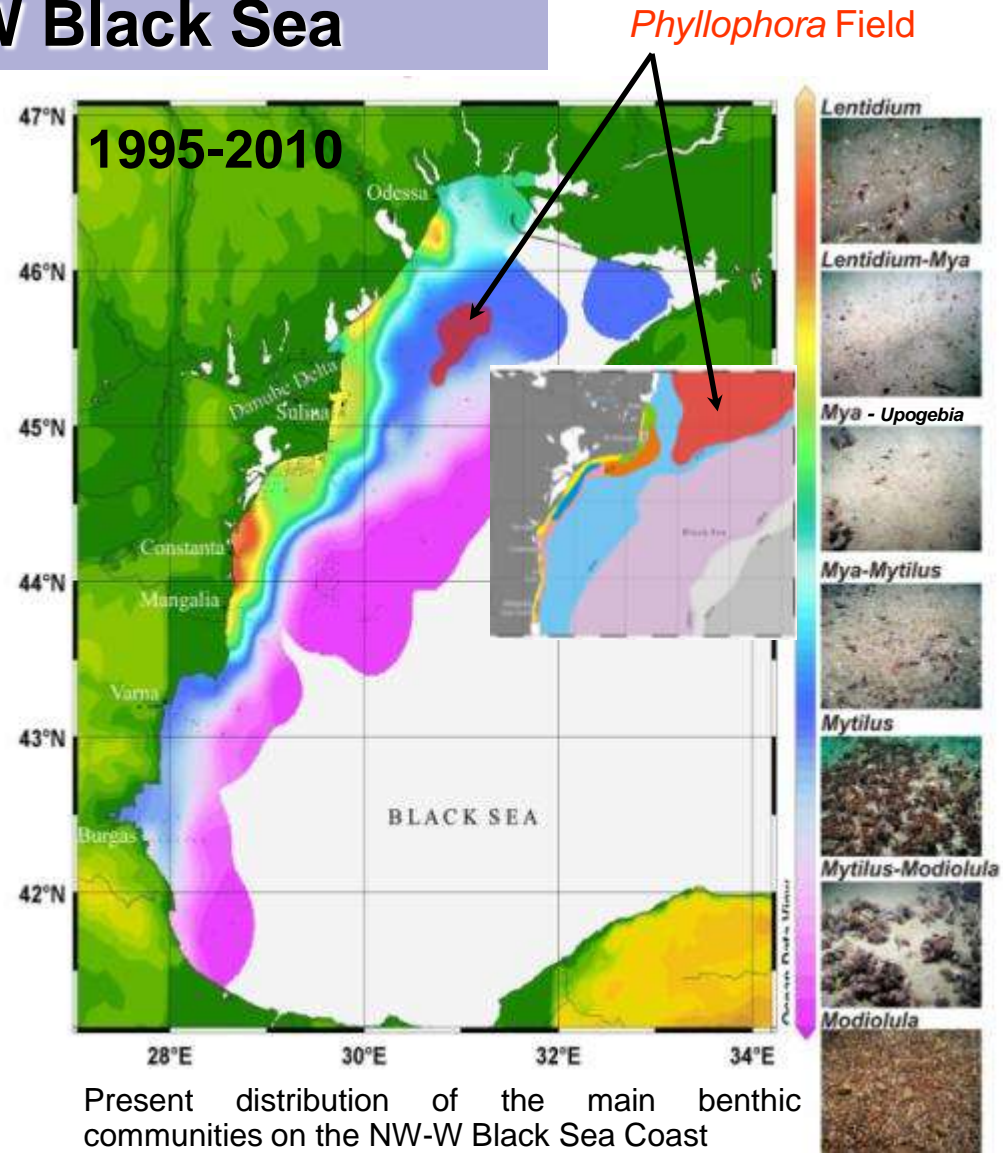
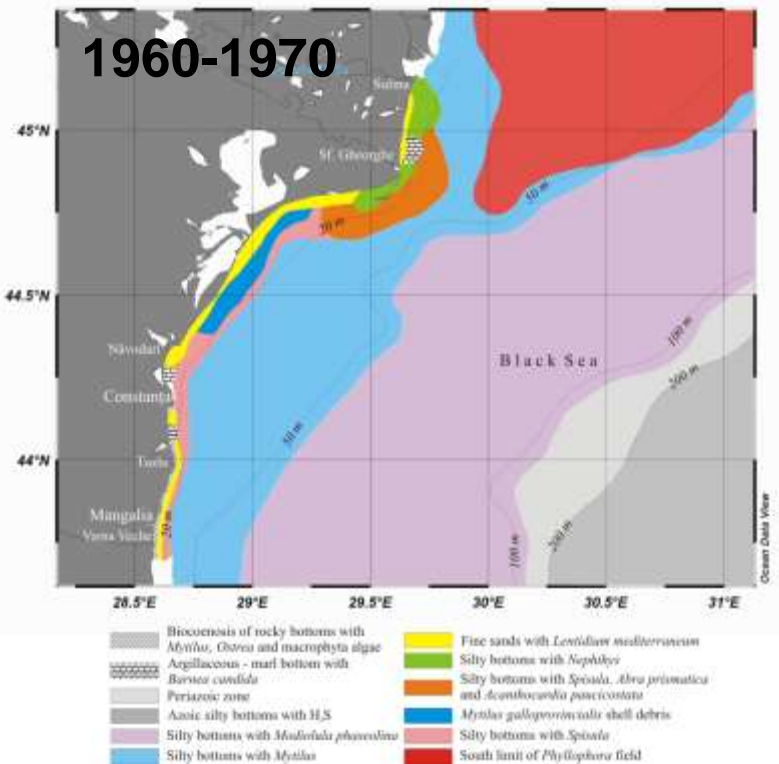
## Benthic habitats – WFD and MSFD

The **MSFD** establishes a framework in which the Member States have to take appropriate measures to achieve or maintain **GES** in the marine environment by **2020**

- One of the important ecosystem components within this EBA are macro-invertebrate species, due to their sessile, sedentary and relatively long life, which are considered as important factors to be suitable and **sensitive indicators of natural and anthropogenic variations**
- Broad spatial knowledge of the habitats and associated biological communities overlapped with human uses is essential
- The assessment of the condition of benthic habitats is one of the evaluation criteria both in the WFD (as biological quality element) as in the MSFD descriptors (**D1 - biodiversity & D6 - sea floor integrity**).

# The main changes in the benthic communities in the NW Black Sea

Distribution of the main benthic communities on the Romanian Black Sea Coast in '60s (*Bacescu et al., 1971*)



Present distribution of the main benthic communities on the NW-W Black Sea Coast  
(after Teaca et al., unpublished data)

# The NW Black Sea: Great Ecological Concern

- The Danube and Dniestr areas - still under ecological pressure;
- *Mya arenaria*, *Anadara kagoshimensis*, *Rapana venosa* survivors with a high potential to endure stressor pressure;
- Tunicates (*Ascidiella*, *Ciona*) replace losses of filter feeders from the *Phyllophora* fields;
- Filter feeders 90 % of benthic populations;
- Spectacular population development in opportunistic species of polychaeta on soft-sedimentary and hard substrates - dominant forms in zones with high organic loading or polluted zones indicating the eutrophication state.

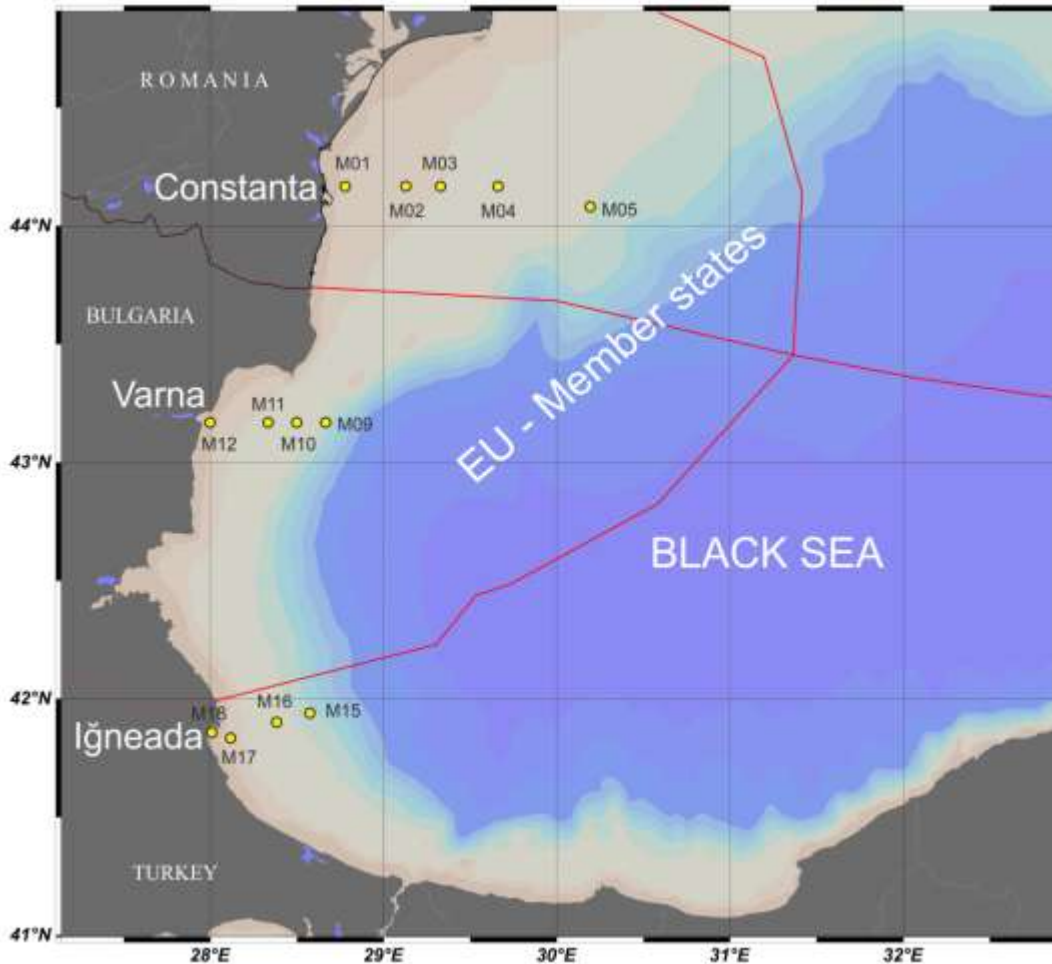


**An assessment procedure for determining the condition of soft-sediment benthic habitats requires the following aspects:**

- habitat assignation of the samples (habitat approach),
- reference or target conditions for the benthic parameters,
- the selection of indicator tools to assess the relative quality status (indicator approach).

# METHODS

- Romanian transect, Constanta-East;
- Bulgarian transect - Galata transect (Varna);
- Turkish transect (Igñeada).



**Stations: 13**  
**Samples: 47**

The distribution of samples on depth intervals were as follows:

- **20 - 30 m:** 2 stations;
- **31 - 50 m:** 3 stations;
- **51 - 100 m:** 6 stations;
- **>100 m:** 2 stations (M05 and M15).

## Description of Benthic habitats in the MISIS framework

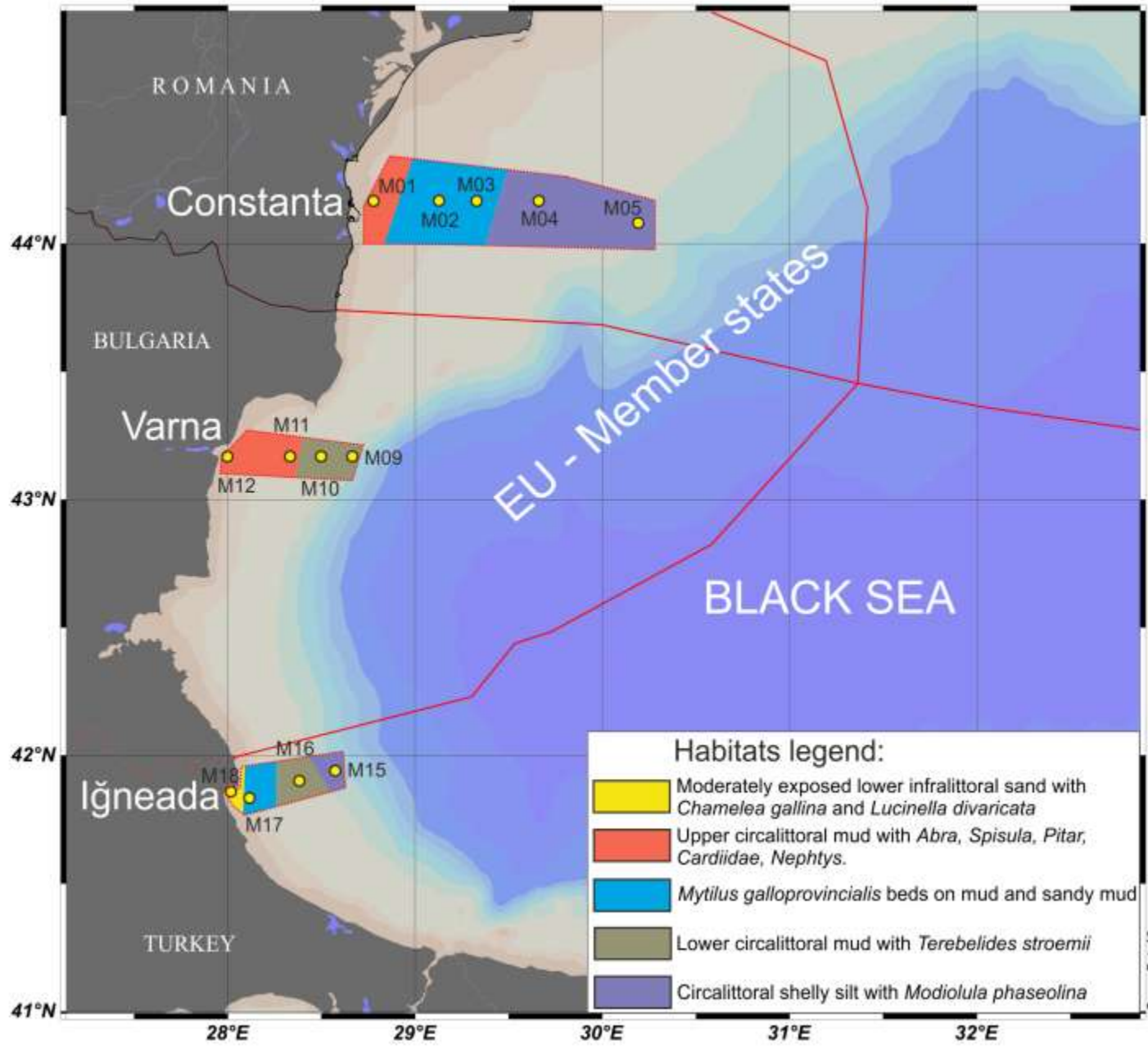
- to assess the ecological state of benthic habitats, which were classified after EUNIS;

Based on samples analysis **five benthic habitats** have been found in the study area:

1. **Moderately exposed lower infralittoral sand with *Chamelea gallina* and *Lucinella divaricata*,**
2. **Upper circalittoral mud with *Abra*, *Spisula*, *Pitar*, *Cardiidae*, *Nephtys*, etc,**
3. ***Mytilus galloprovincialis* beds on mud and sandy mud,**
4. **Lower circalittoral mud with *Terebellides stroemii*,**
5. **Circalittoral shelly mud with *Modiolula phaseolina*.**

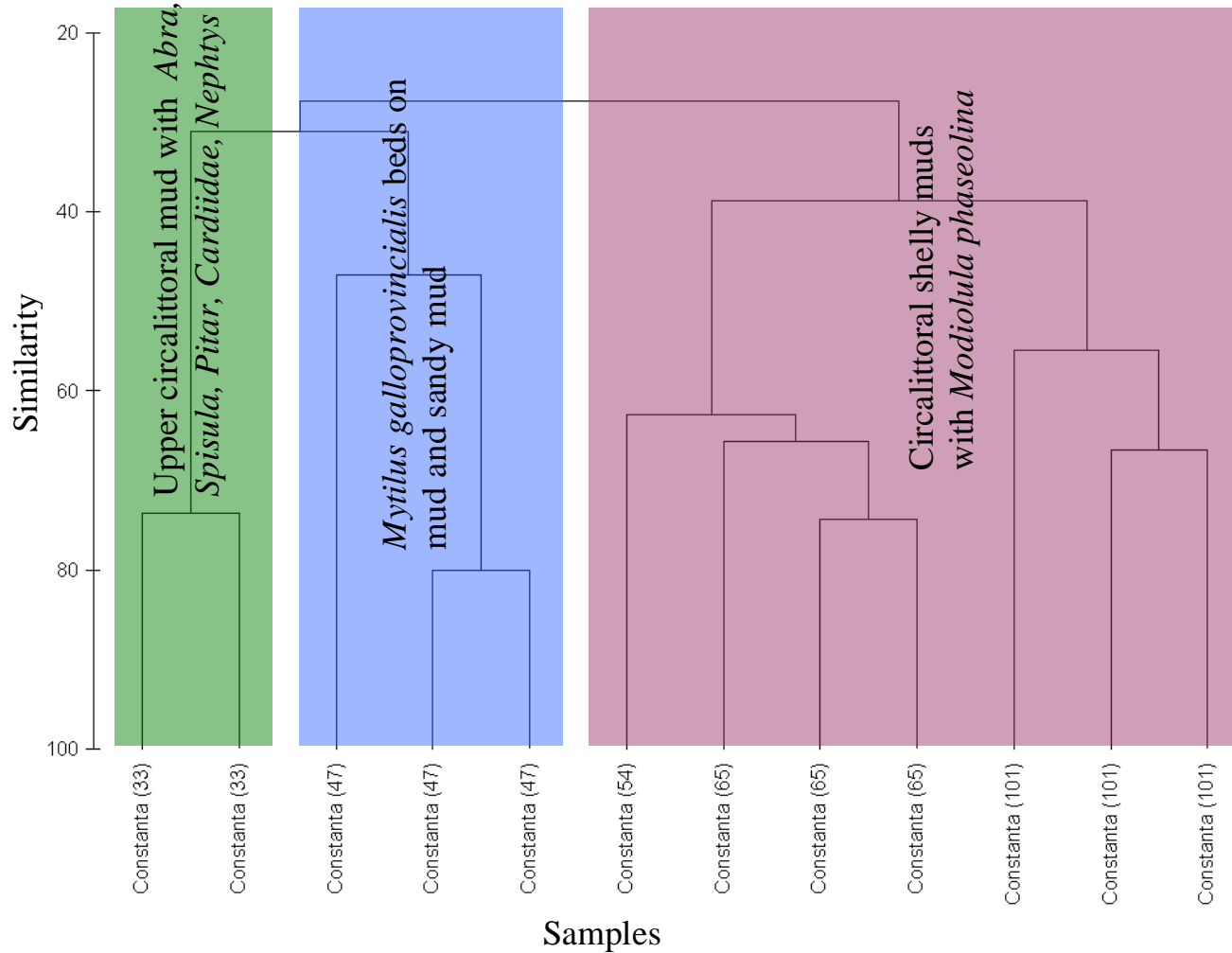
the EUNIS classification is still in its infancy in the Black Sea





# CONSTANTA TRANSECT

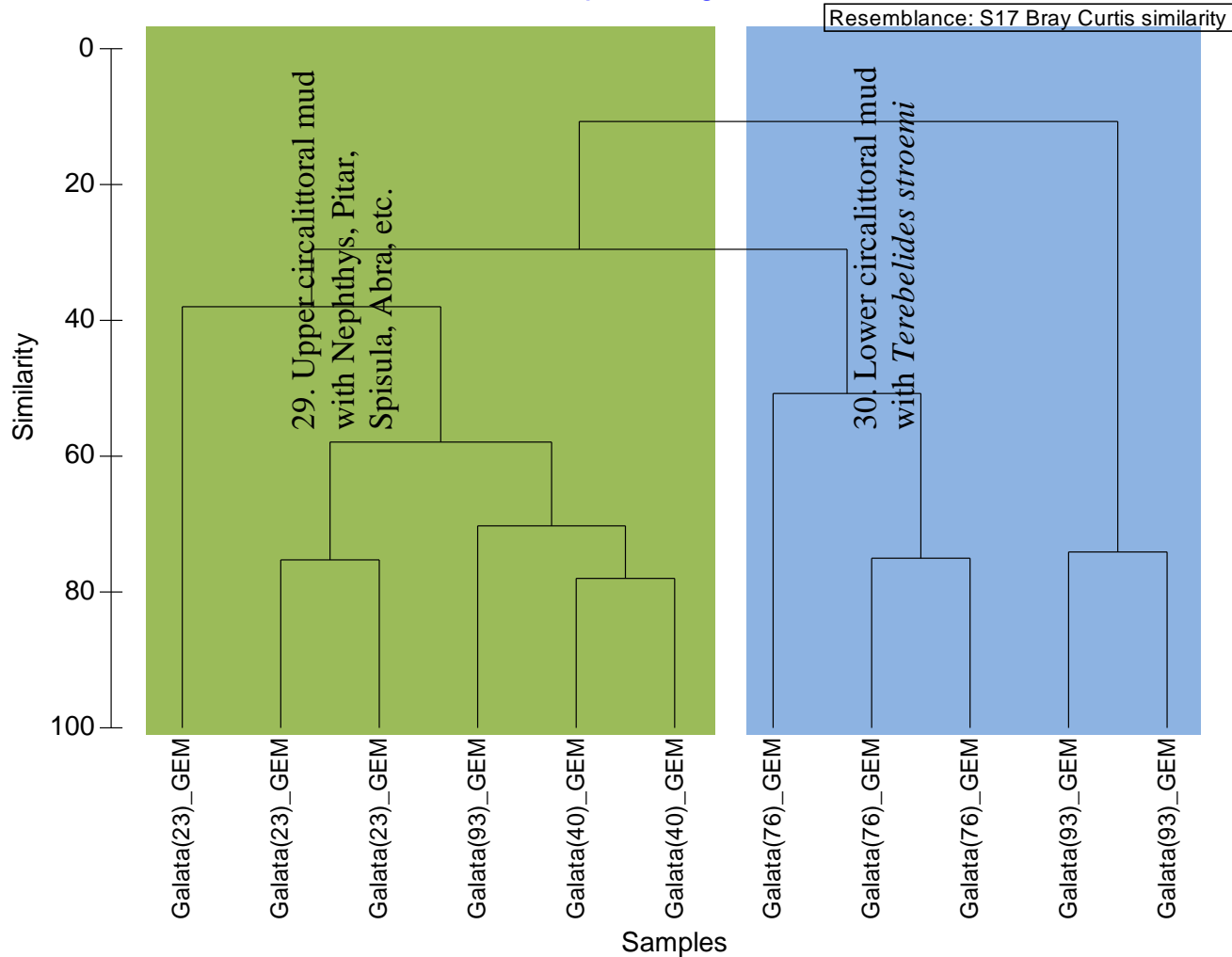
Bray Curtis similarity analysis on the presence/absence data



# GALATA TRANSECT

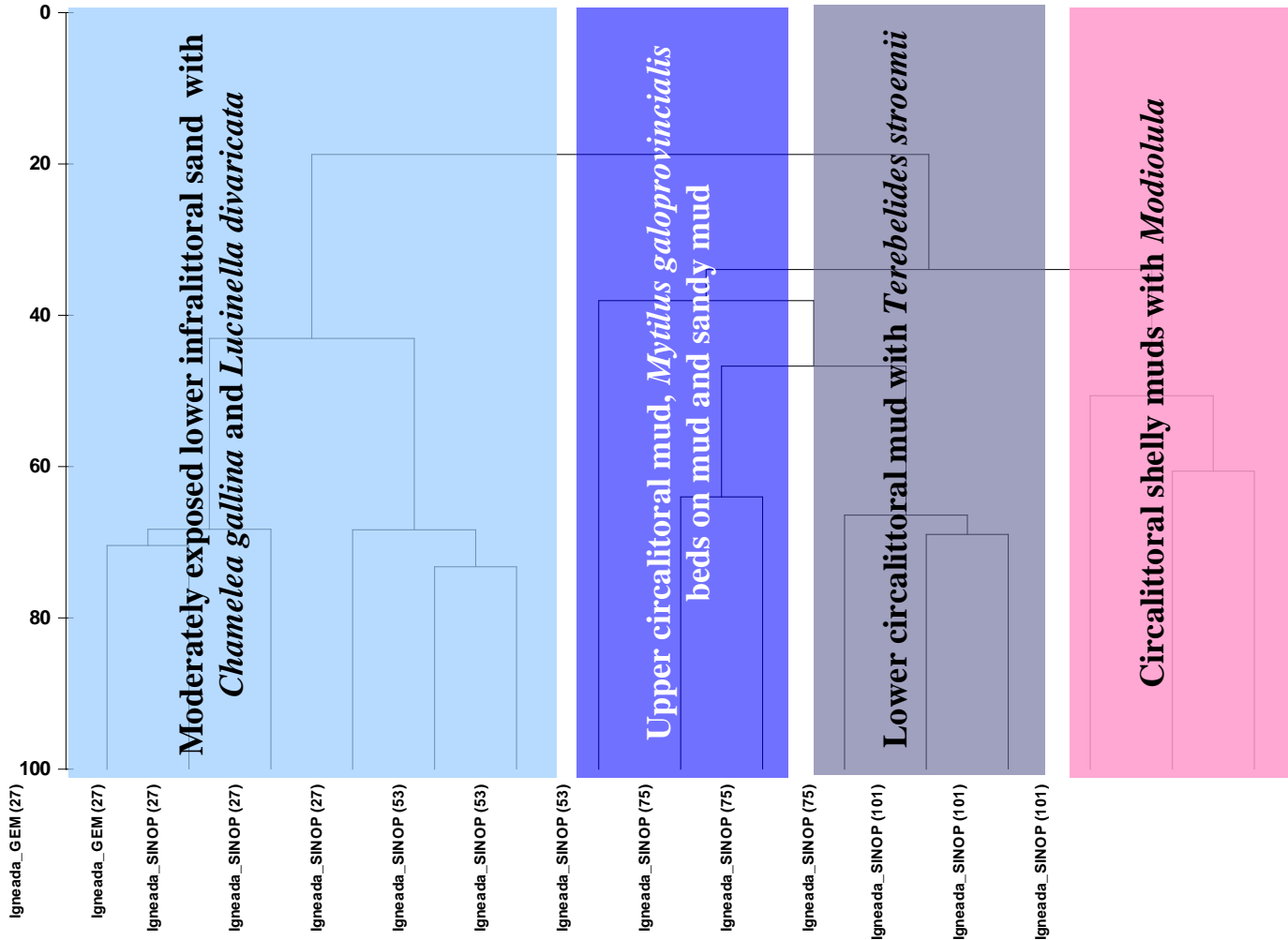
## Bray Curtis similarity analysis on the presence/absence data

Group average



# IGNEADA TRANSECT

## Bray Curtis similarity analysis on the presence/absence data



# Description of Benthic habitats

## 1. Moderately exposed lower infralittoral sand with *Chamelea gallina* and *Lucinella divaricata*

### D1.4. Habitat distribution

According to Bacescu et al. (1970) this habitat lies between Igneada (at border with Bulgaria) and Istanbul.

Substrata - coarse sandy sediments, is characterized by a relative high species richness, diversity and densities.

### D1.6. Habitat condition

#### 1.6.1 Species state and communities

The typical species in this habitat were the mollusks *Chamelea gallina*, *Lucinella divaricata*, *Pitar rudis*, *Bittium reticulatum*, polichaets *Aricidea claudiae*, *Spio decoratus*, crustaceans *Upogebia pusilla*, *Pseudocuma longicorne*, etc.

## Univariate statistical analysis of the macrozoobenthos

	N. sp.	Min	Max	Sum	Stand. dev
<b>Density indiv.m<sup>-2</sup></b>					
M18	71	1.23	24,971.3	57,581.87	3,554.5
<b>Biomass g.m<sup>-2</sup></b>					
M18	71	0.00001	1,064.9	2,460.64	165.1

# Description of Benthic habitats

## 2. Upper circalittoral mud with *Abra*, *Spisula*, *Pitar*, *Cardiidae*, *Nephtys*, etc

### D1.4. Habitat distribution

**RO:** 23 – 30 m depth and from Danube mouths to Kaliakra Cape.

**BG:** 20 – 40 (50) m depth from Kaliakra Cape to Maslen Cape

Substrata - mud and sandy mud.

### D1.6. Habitat condition

#### 1.6.1 Species state and communities

The typical species:

*Nephtys hombergii*,

*Melinna palmata*,

*Aricidea claudiae*,

*Heteromastus filiformis*,

*Allita succinea*

*Pitar rudis*,

*Spisula subtruncata*,

*Abra alba*,

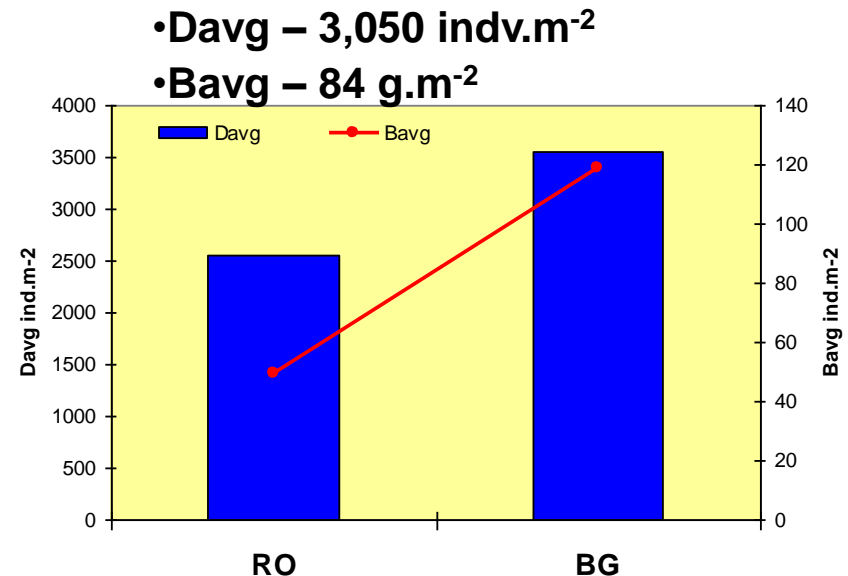
*A. prismatica*,

*Parvicardium exiguum*

*Ampelisca sarsi*,

*Phtisica marina*,

*Iphinoe elisae*.



# Description of Benthic habitats

## 3. *Mytilus galloprovincialis* beds on mud and sandy mud

### D1.4. Habitat distribution

**RO:** 30 – 50 m depth and from Danube mouths to Kaliakra Cape.

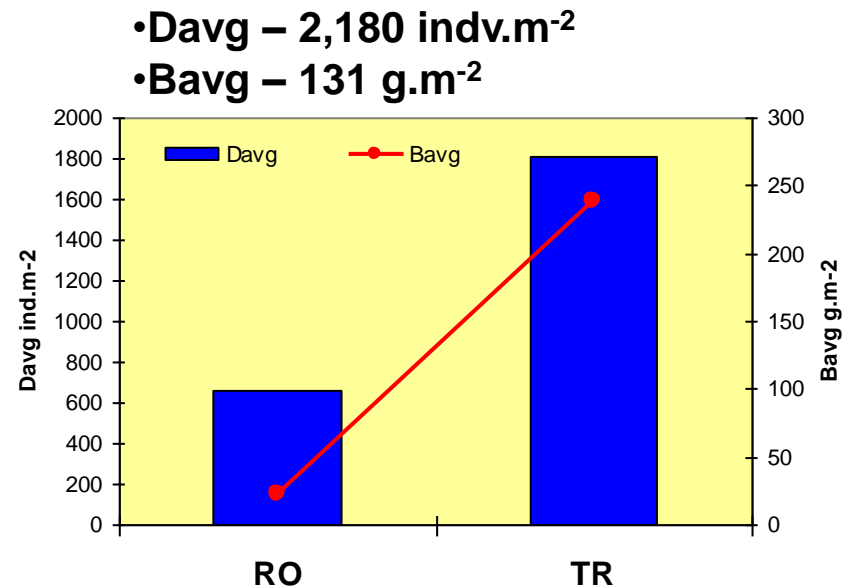
**TR:** 15 - 70 m depth, in this study 53 m.  
Substrata - muddy and muddy sand .

### D1.6. Habitat condition

#### 1.6.1 Species state and communities

The typical species:

*Nephtys hombergii*,  
*Terebellides stroemii*,  
*Aricidea claudiae*,  
*Heteromastus filiformis*,  
*Mytilus galloprovincialis*,  
*Abra alba*,  
*A. prismatica*,  
*Caprella acanthifera*,  
*Perioculodes longimanus*.



# Description of Benthic habitats

## 4. Lower circalittoral mud with *Terebellides stroemii*

### D1.4. Habitat distribution

**BG:** 40 – 100 m depth, beginning with Kaliakra

Cape to Maslen nos

**TR:** 35 - 90 m depth, in this study 76 m.

Substrata – mud sediments .

### D1.6. Habitat condition

#### 1.6.1 Species state and communities

The typical species:

*Terebellides stroemii*,

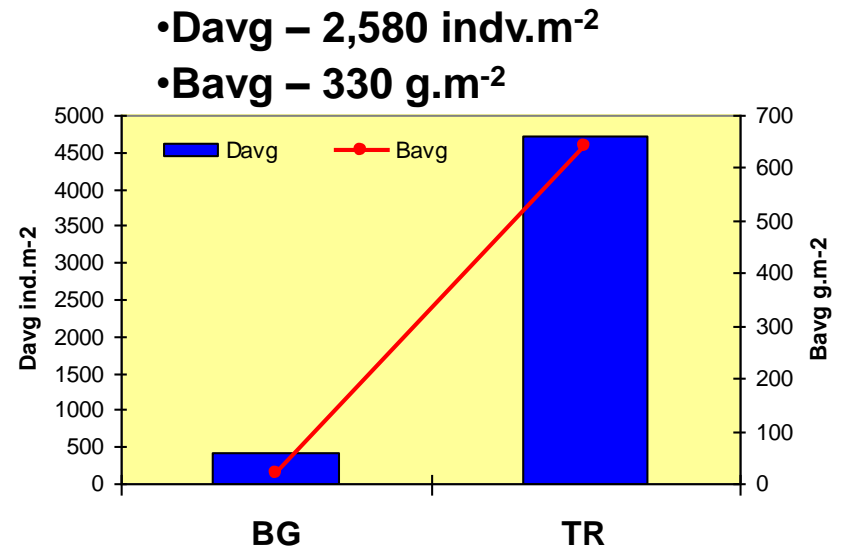
*Nephtys hombergii*,

*N. cf. paradoxa*,

*Aricidea claudiae*,

*Abra alba*,

*Retusa truncatula* etc.





# Description of Benthic habitats

## 5. Circalittoral shelly mud with *Modiolula phaseolina*

### D1.4. Habitat distribution

**RO:** 55 – 120 m depth, from Danube mouths to Kaliakra Cape

**TR:** 50 – 100 m depth

Substrata – generally flat, pretty regular surface, is muddy, mixed with a great quantity of shells

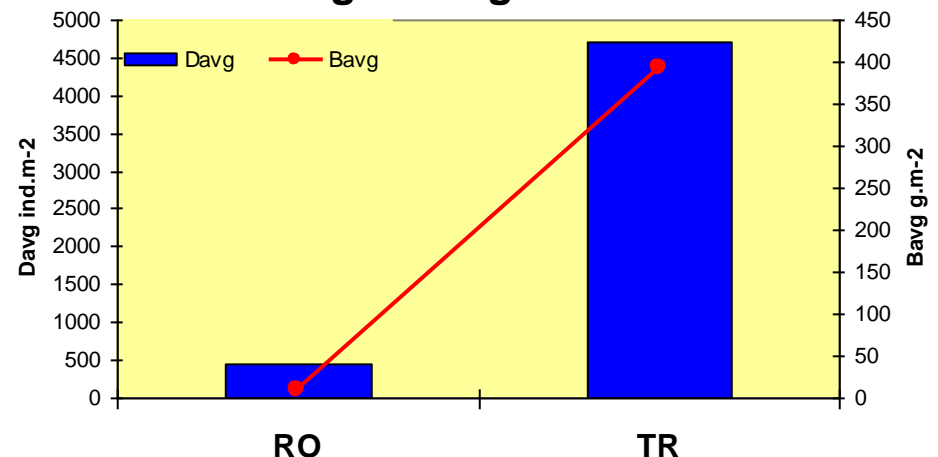
### D1.6. Habitat condition

#### 1.6.1 Species state and communities

The typical species:

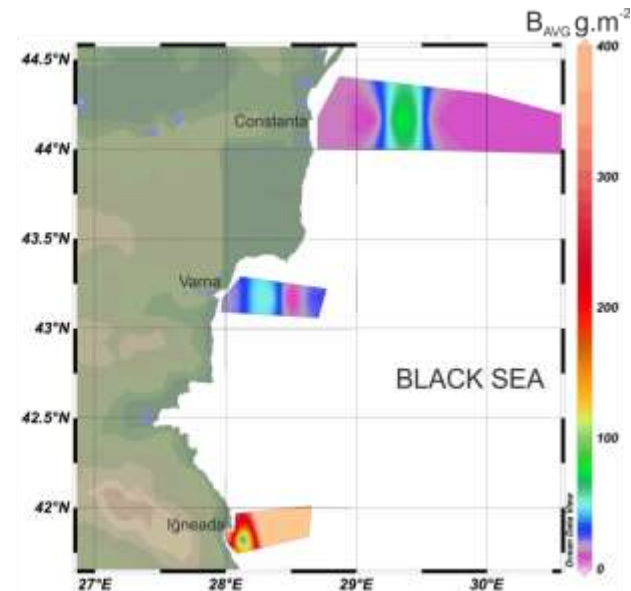
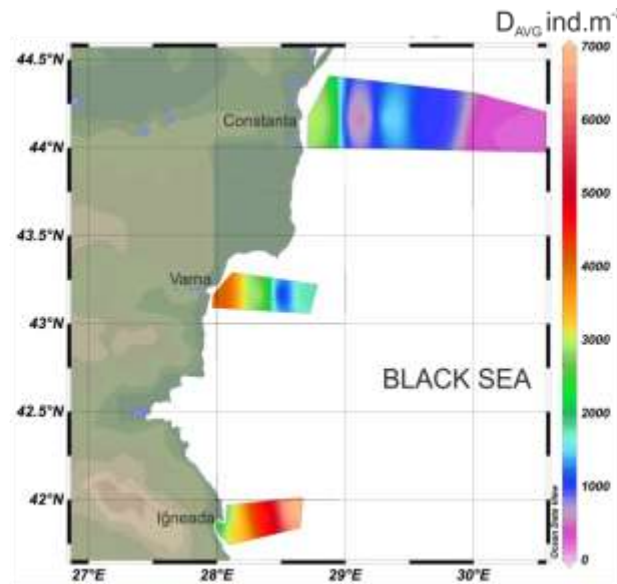
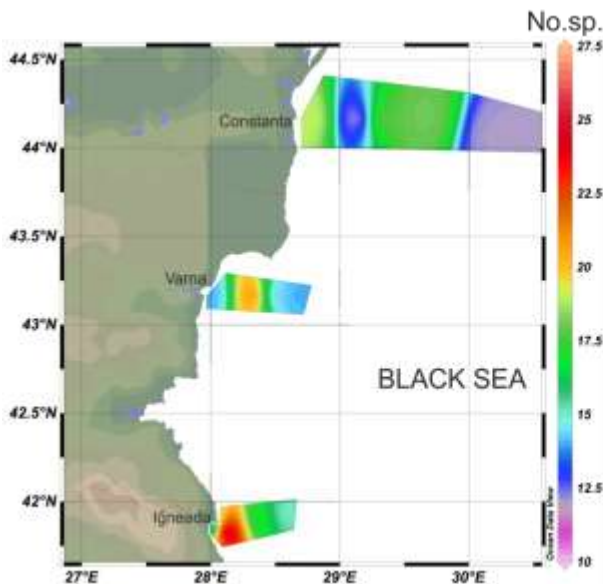
*Modiolula phaseolina*,  
*Trophonopsis breviata*,  
*Terebellides stroemii*,  
*Aonides paucibranchiata*,  
*Nephtys hombergi*,  
*Ampelisca sarsi*,  
*Apseudopsis ostroumovi*,  
*Amphiura stepanovi*,  
*Stereoderma kirchsbergii*.

- $D_{avg} - 2,590 \text{ indiv.m}^{-2}$
- $B_{avg} - 200 \text{ g.m}^{-2}$



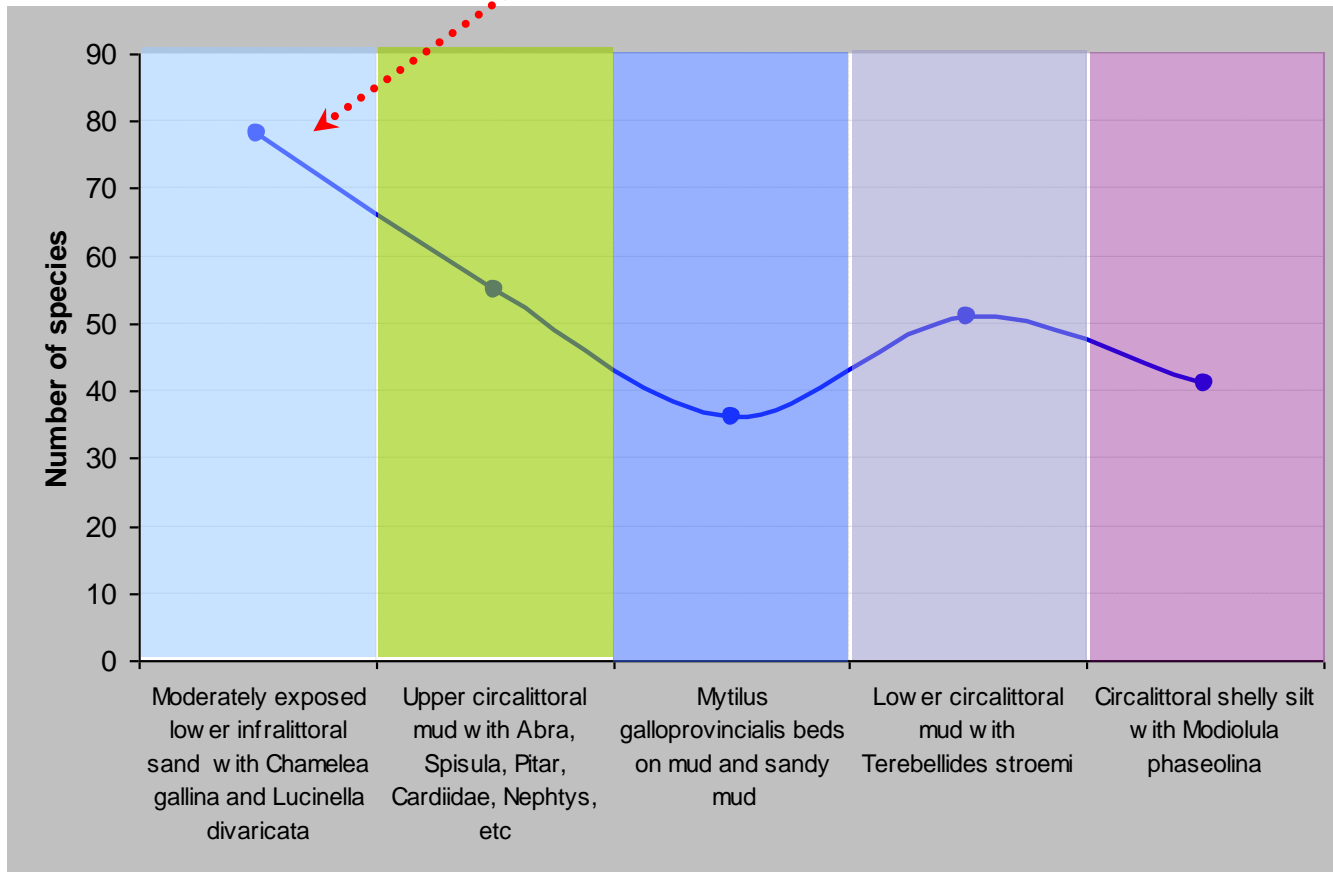
## Distributia numarului de specii, densitatii si biomasei medii a populatiilor macrozoobentale in study area

- High diversity and abundance in Igneada Transect and Coastal station of Galata Transect



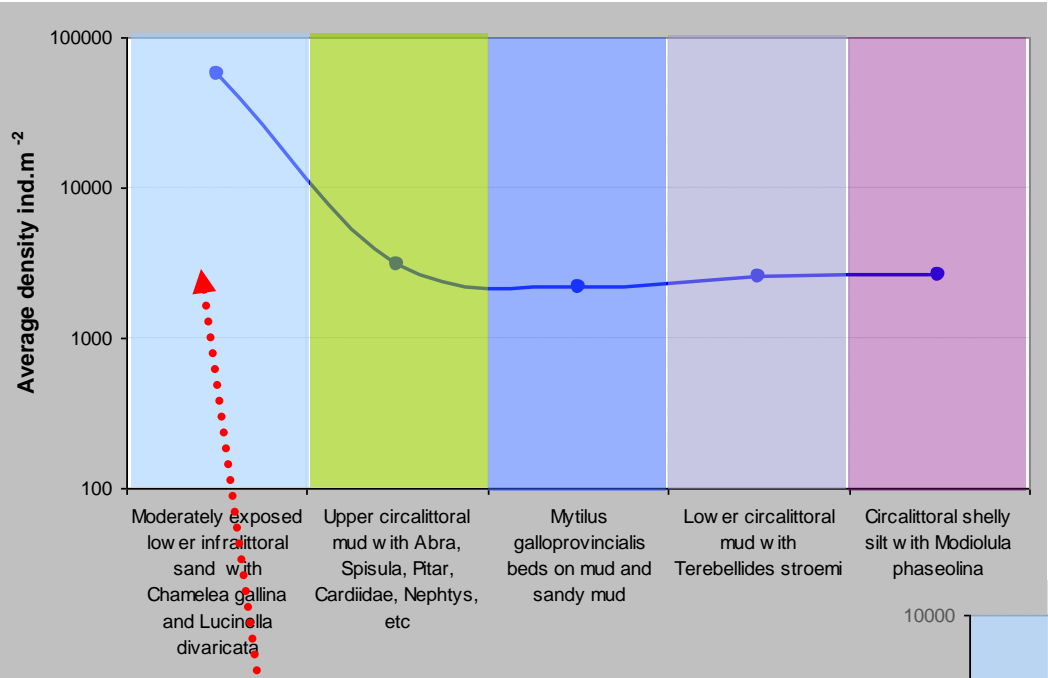
# Distribution of number of species within the five habitats found in the study area

High diversity – Igneada coastal waters –  
GES after S (number of species)

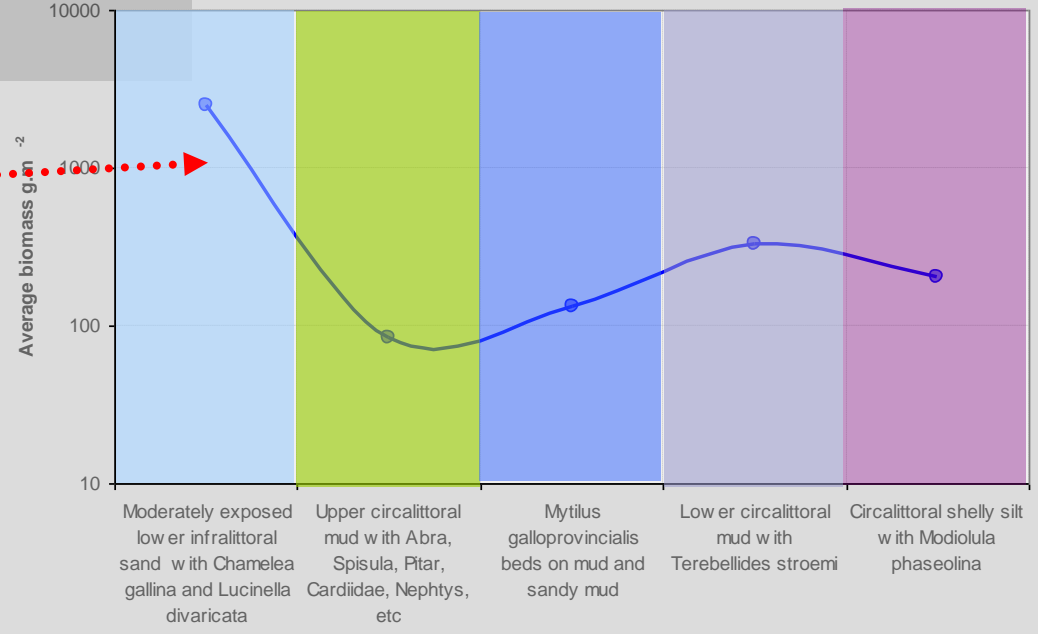




# Distribution of average density and biomass of macrozoobenthic populations in the five benthic habitats



High abundance – Igneada coastal waters



# Ecological state of macrozoobenthos after MSFD

## Descriptor 6

### 6.2 Condition of benthic community

#### 6.2.2 Multi-metric indexes assessing benthic community condition and Functionality (Species richness, Shannon, AMBI and M-AMBI)

Assessing benthic quality status of marine and transitional water habitats requires to set up both:

- indices to assess the relative quality of the considered habitat, and
- reference conditions for which such indices can be computed and used to infer the absolute ecological status of the considered habitat.

As reference value for good ecological status will be considered the period 1950 – 1970, characterized by lack of major impacts, so called the „ecological equilibrium period” (Băcescu et al., 1971). In that period there have been performed detailed studies on benthic biocoenosis in the NW Black Sea.

# Ecological state of macrozoobenthos after MSFD

Habitat	Transect	Stations	S	H'	AMBI	M-AMBI	MSFD Ecological state
Moderately exposed lower infralittoral sand with <i>Chamelea gallina</i> and <i>Lucinella divaricata</i>	Igneada	M18 (27m)_GEM	49	3.63	1.60	0.91	Good
		M18 (27m)_SINOP	46	2.49	0.07	0.87	Good
Upper circalittoral mud with <i>Abra</i> , <i>Spisula</i> , <i>Pitar</i> , <i>Cardiidae</i> , <i>Nephtys</i>	Constanta	M01 (33m)	24	2.20	4.38	0.61	Moderate (Not good)
	Galata	M12 (23m)_GEM	37	2.75	3.51	0.68	Good
	Galata	M11 (40m)_GEM	25	2.40	4.38	0.46	Moderate (Not good)
<i>Mytilus galloprovincialis</i> beds on mud and sandy mud	Constanta	M02 (47m)	13	2.36	3.56	0.56	Moderate (Not good)
	Constanta	M03 (54m)	18	3.07	3.42	0.71	Moderate (Not good)
	Igneada	M17 (53m)	17	2.88	1.57	0.64	Good
	Galata	M10(76m)_GEM	23	2.43	4.23	0.49	Moderate (Not good)
Lower circalittoral mud with <i>Terebelides stroemii</i>	Galata	M10(76m)_TUR	15	2.21	2.26	0.51	Moderate (Not good)
	Galata	M10(76m)_NIMRD	18	3.10	1.93	0.74	Good
	Galata	M09(93m)_GEM	16	2.39	2.74	0.52	Moderate (Not good)
Circalittoral shelly silt with <i>Modiolula phaseolina</i>	Igneada	M16 (76m)	24	2.93	2.11	0.64	Good
	Constanta	M04 (65m)	25	3.60	2.47	0.92	Good
	Constanta	M05 (101m)	18	3.16	1.21	0.86	Good
	Igneada	M15 (101m)	27	2.67	0.79	0.73	Good

## CONCLUSIONS AND RECOMANDATIONS

- In the present time, the human pressures on the ecosystem have apparently not exceeded the resilience of macrobenthic communities, and the investigated area achieved a good environmental status in proportion of 56%, the remaining of 44% being not good (over the study period).
- The variation in the ecological state results between teams underlines the necessity for intercalibration of the taxonomic expertise and the methodological standards in order to achieve comparable results between the countries in the Black Sea region under MSFD reporting in the future.
- The integration of all assessment levels (habitat, different eco-system components) into a single score indicating status and performance of an ecosystem is another major challenge, especially in the case of the MSFD.



*Thank you very much!*