MSFD – GES Studies

Conducted in Turkey

nebil@ims.metu.edu.tr

Contributors:

Dr. Nebil YÜCEL

(IMS-METU) Ahmet E. KIDEYŞ, Süleyman TUĞRUL, Ali C. GÜCÜ, Zahit UYSAL, Barış SALİHOĞLU

(IMSM-IU) Ahsen YÜKSEK,

WP 5.2 & 5.3





Responsible Person: Prof. Ahmet Erkan KIDEYŞ

kideys@ims.metu.edu.tr





113 Stations 18 – 23/June/ 2013



129 Stations 12 – 30/July/ 2013

Collected Parameters

Phys	sica
≻C1	ΓD

>ADCP

- Chemical
 - Dissolved Nutrients
- Particulate Organic M.
- Secchi DD > Total Phosphorus
 - Dissolved Oxygen
 - ≽pH

Sediment

- Metal pollution (M.Sea)
- TPH (M.Sea)
- TOC (M.Sea)

Atmospheric

Atmospheric deposition

Biological

Abundance of picoplankton (synechococcus sp. and heterotrophic bacteria, Nanopankton)

Phytoplankton

- Primary Production
- Chemoautotrophic Production
- Bacterial Carbon Production
- Phytoplankton Pigments (HPLC)
- Chlorophyll a
- Surface in-situ chlorophyll (continiously)
- Zooplankton
- Ichthyoplankton
- ➢Jelly fish
- Macrozoobenthic

Monthly time series station in Bosphorus (surface bio-chemical measurements)

MSFD: 2008/56/EC	(Descriptors & Indicators)	WP5	WP2		MSFD: 2008/56/EC (Descriptors & Indicat	ors) W	WP2
	D1: Biodiversity		*	1	D5: Eutrophication		
1.1.1 Distributional range		5/7			5.1.1 Nutrients concentration in the water column	7/7	x
1.1.2 Distributional pattern		3/7			5.1.2 Nutrient ratios	3/7	Х
1.1.3 Area covered by the species (for sessile/benthic species)		1/7			5.2.1 Chlorophyll concentration in the water column	7/7	Х
1.2.1 Population abundance and/or biomass		6/7			5.2.2 Water transparency related to increase in suspended algae	5/7	х
1.3.1 Population demographic characteristics		5/7		, í	5.2.3 Abundance of opportunistic macroalgae	5/7	
1.3.2 Population genetic structure		2/7			5.2.4 Species shift in floristic composition	5/7	
1.4.1 Distributional range		2/7			5.3.1 Abundance of perennial seaweeds and seagrasses	5/7	
1.4.2 Distributional pattern		2/7			5.3.2 Dissolved oxygen	6/7	Х
1.5.1 Habitat area		4/7			D6: Seafloor integrity		
1.5.2 Habitat volume		-		_	biogenic substrate	2/7	
1.6.1 Condition of the typical species and communities		4/7			6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	3/7	
1.6.2 Relative abundance and/or biomass		3/7			6.2.1 Presence of particularly sensitive and/or tolerant species	5/7	
1.6.3 Physical, hydrological and chemical conditions		3/7			6.2.2 Multi-metric indexes assessing benthic community condition and functionality	5/7	x
1.7.1 Composition and relative proportions of ecosystem components		2/7			6.2.3 Proportion of biomass or number of individuals in the macrobenthos above some specified length/size	1/7	x
	D2: Non-indigenous			1 🔼	6.2.4 Parameters describing the characteristics of the size	1/7	х
2.1.1 Trends in abundance, temporal occurrence and spatial distribution		4/7			D7: Hydrographic conditions	_	
2.2.1 Ratio between invasive non-indigenous spe native species	ecies and	3/7	x		7.1.1 Extent of area affected by permanent alterations	4/7	
2.2.2 Impacts of non-indigenous invasive species	6	1/7	x		7.2.1 Spatial extent of habitats affected by the permanent alteration	2/7	
	D3: Fish populations		ł	1	7.2.2 Changes in habitats, in particular the functions provided	-	
3.1.1 Fishing mortality		7/7		1	D8: Contaminants		
3.1.2 Ratio between catch and biomass index		5/7			8.1.1 Concentration of the contaminants	7/7	
3.2.1 Spawning Stock Biomass		7/7			8.2.1 Levels of pollution effects on the ecosystem components concerned	3/7	
3.2.2 Biomass indices		4/7			8.2.2 Occurrence, origin, extent of significant acute pollution events	2/7	
3.3.1 Proportion of fish larger than the mean size of first sexual maturation		6/7			D9: Contamimants in seafood		
3.3.2 Mean maximum length across all spe research vessel surveys	ecies found in	3/7	X (Black Sea small pelagic and East. Mediterranean demersal)	-	9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels	חד	
3.3.3 95% percentile of the fish length dist in research vessel surveys	ribution observed	6/7]	9.1.2 Frequency of regulatory levels being exceeded	7/7	
3.3.4 Size at first sexual maturation	3/7	(East. Med-Small pelagic and demersal.Totally 10 species	-	D10: Marine litter			
	D4: Food webs				10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines	2/7	
4.1.1 Performance of key predator species using their production per unit biomass		3/7			10.1.2 Trends in the amount of litter in the water column	3/7	
4.2.1 Large fish (by weight)		3/7			10.1.3 Trends in the amount, distribution and composition of micro-particles	1/7	

The Marmara Sea is at "high category" considering the first six criteria of EBSA (Ecologically or Biologically Significant Marine Areas). The Marmara Sea, having a transitional system between two hydrologically different seas (Mediterrenean and Black Seas), is a migration pathway of the protected marine mammals and high economical value fish such as *Swordfish*, *Atlantic Mackerel*, *Atlantic bonito*, *Bluefish*, *European anchovy*

According to the IUCN Red List, the status of native Mediterranean marine fish species (2012) in the Sea of Marmara shows that **4** species are classified **CR (Critically Endangered)** namely (*Squatina squatina, Oxynotus centrina, Rostroraja alba, and Pomatoschistus microps*), a further **4** species are **EN (Endangered)** (*Mustelus mustelus, Mustelus asterias, Squalus acanthias, and Thunnus thynnus*), **6** species are **VU (Vulnerable)** (*Merluccius merluccius, Labrus viridis, Umbrina cirrosa, Sciaena umbra, Dentex dentex, and Pomatoschistus minutus*), **12** species are **NT (Near Threatened)** (*Scyliorhinus stellaris, Dasyatis pastinaca, Raja clavata, Psetta maxima, Pleuronectes platessa, Platichthys flesus, Syngnathus acus, Scomber colias, Hippocampus hippocampus, Syngnathus typhle, Xiphias gladius, and Dicentrarchus labrax*) and **26** species are classified **LC (Least Concern).** In addition, there are **2 protected and 16 important areas** for migrant and water birds according to the RAMSAR Convention. Three major factors affect the biodiversity of the Sea of Marmara;

dissolved oxygen, fishing and antropogenic input.



The Sea of Marmara comprises a two-layered system. The density differences between the upper and lower layers influence the deep dissolved oxygen distribution. The waters of Mediterranean origin flowing from the Dardanelles Strait follow the southern shelf of the Sea of Marmara and spread to the north. For this reason, the lower layer is rich in dissolved oxygen in the southern region of the sea. This feature is an important factor affecting biodiversity. Dissolved oxygen determines the distribution of macrozoobenthic species which are found at the lower levels of the food

web and are important components of the biodiversity. Macrozoobenthic distribution in the Sea of Marmara indicates that their abundance is high but their diversity is low in the northern Marmara shelf. This is a result of the

increase in populations of certain species through their adaptation to hypoxic conditions. Biodiversity is greater in the southern shelf where the deep dissolved oxygen values are higher. Conversely, in the bays of Izmit and Gemlik, where there is both low circulation in deep waters and impacts of human-induced eutrophication, both abundance and biodiversity are very low because of extremely poor dissolved oxygen levels



EQS based on macrozoobenthic species of the sea of Marmara (Van Veen grab samplings were performed)

EQS is considered bad in Izmit Bay and Gemlik Bay due to observed Hypoxia which is also true for the Buyukcekmece which receives effluents directly from the deep discharge.



Total Petrol and Hydrocarbon Contamination in the sea of Marmara

A comparison of pollutants in the sediment will also be made with those results obtained in the past within the Perseus in the basin



Degree of Metal Contamination (Al, Cd, Cu, Hg, Pb ve V) in the sediment

Moderate pollution exist in the entire basin including heavily polluted Izmit bay (through various industrial sources).



Comparison of several quality assessment methods for macro algae in the Marmara Sea (DeKoS, June 2013, *by Ergun Taşkın, unpublished*)





	Stations							
Indeces	Şarköy Armutlu		Silivri	İzmit				
R/C ratio	1,01	0,89	0,16					
R/C status	HIGH	HIGH	BAD					
E-MaQI _{EQR}	1,06	1,05	0,38					
E-MaQI status	HIGH	HIGH	POOR					
EEI _{EQR}	0,78	0,60	0,15	0,02				
EEI Status	HIGH	GOOD	POOR	BAD				

The name of the Project is "Marine and Coastal Waters Quality Status Determination and Classification Project" shortly called DeKoS which is supported by the Ministry of Environment and coordinated by TUBITAK/MRC for the period 2011-2013.





Ecological quality classification of the Coastal Water Bodies of the Marmara Sea for 2011 (Nov)



- WFD complaint one-out-all-out principle applied for coastal waters bodies with three BQEs (phytoplankton, macro zoobenthos and macro algae) and supporting parameters (DIN, TP, SDD).
- High and Good are accepted as EQO and desired status for coastal waters.

• Good/Moderate is commonly accepted as the threshold for GES good/not good. However, the thresholds for the marine waters not known for all BQEs.

Assessment of Eutrophication Status of the Marmara Sea: possible tools, initial thresholds for GES and non-GES _1

(DeKoS, 2013)

Indicators	AU1	AU2	AU3	Possible (optional) GES	Recommendations			
				thresholds / targets		Assessment Units		
511 Nutrient	Data is av research	vailable f and mor	rom nitoring	i) Reference+%50 dev. ii) expert judgement on	 i) Modelling required for the reference values 	1) Marmara Sea	a) Coastal : <30 m	
concentrations	projects	(1986-20)13)	long-term data	ii) Expert judgement on	2) Golden Horn	b) Shelf: 30-200 m	
	More frequently			iii) 90% method(statistics)	long-term data (see Table right below)	3) İzmit Bay	c) Open: >200 m	
	obtained at central and eastern basins		aranu	iv) decreasing trends in the concentrations	iii) Good/Moderate (50%) value of 90 percentile of			
	Time seri available Marmara	ies data i at DB1 (a) & DB 3	s NE		time series (min 5 yrs) or long term (min 15-20 yrs) data can be tested	Parameters	Recommended thresholds (1986-2013 / spring- summer values	
5.1.2. Nutrient	1			Expert judgement on	(See Table right below)		for AU 1)	
ratios				long-term data		Phosphate (PO_4)	<0.15 µM	
522 Light	Data is av	vailahlo f	rom	i) expert judgement on	i) see Table right below	Nitrate (NO ₃)	< 0.5 µM	
transnarency	research	and mor	nitoring	long-term data	ii) Good/Moderate (50%)	Nitrite (NO ₂)	< 0,2 µM	
liansparency	projects	(1986-20)13)	ii) 90% method	value of 90 % of time	Ammonium (NH ₄)	< 0.4 µM	
				(statistics)	series (min 5 vrs) or long	Sili cate(Si)	> 1.0 µM	
					term (min 15-20 yrs) data	Si/(NO ₃)	>3	
						(NO ₃)/PO ₄	>2	
532 Bottom	Data is av	vailahle f	rom	Initially expert judgement	(See Table right below)	Secchi Depth	> 4.0 m	
dissolved	research	and mor	nitoring	on long-term data		Oxygen	% > 20	
oxygen	projects	(1986-20)13)		It is critically important to monitor >30m depths bottom	saturation %	(For >30 m depth)	

Assessment of Eutrophication Status of the Marmara Sea: possible tools, initial thresholds for GES and non-GES _2

(DeKoS, 2013)

Indicators	AU 1	AU 2	AU 3	Possible (optional) GES Recommendations									
				thresholds / targets				Assessment Units					
5.2.1. Chlorophyll concentration	Data is researc monito (1986-2	available h and ring proj 2013)	e from ects	i) Reference+%50 dev. (0.6+0.3= <u>0.9 μg/l</u> for AU 1)	i) see Tab below	le right		1) 2) 3)	Marmara S Golden Ho İzmit Bay	Sea a) Co orn b) Sh c) Oj	a) Coastal : <30 m b) Shelf: 30-200 m c) Open: >200 m		
More frequently obtained at central and eastern basins Time series data is available:		iii) 90% method (statistics)	iii) see Table right			Parameter		Recommended thresholds (1986-2013 / spring- summer values for AU 1)					
	AU1 (N	E Marma	ara:	below for overall data;	below			Klo	orofil-a	< 1.5 µg/l			
	1996-2006) AU3 (2007-2012)		2)	2.3 μg/l for AU1.a (<30m) <u>1.05 μg/l</u> for AU1.b & AU1.c		Reference	e val	alue estimated from St B2 10% (0,62)					
					All data	ню	SH	GOOD	MOD.	POOR	BAD		
					>30m	109	%	25%	50%	75%	90%		
				Finally; <1.5 µg/l (ii) looks as an acceptable initial target especially for >30 m depth			<0,	60	0,61-1,04	1,05 -1,96	1,97- 3,63	>3,63	
						EQR	1,0	0	0,60	0,32	0,17	0,10	
						Reference	e val	alue estimated from St B2 10% (0,62)					
			araes		All data	HIC	ЭH	GOOD	MOD.	POOR	BAD		
						<30m	109	%	25%	50%	75%	90%	
							<1,	66	1,66-2,28	2,28 3,46	3,47- 5,71	>5,71	
						EQR	0,3	7	0,27	0,18	0,11	0,07	

Sediment chemical status for coastal waters -2011 and possible thresholds for GES and non-GES (DeKoS, 2013)





