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The Mediterranean Sea

DIRECTORATE GENERAL OF ENVIRONMENTAL IMPACT ASSESSMENT,
PERMIT AND INSPECTION

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1 INTRODUCTION

Ministry of Environment and Urbanization has been conducting pollution and quality monitoring studies in all seas of Turkey -the Black Sea, the Marmara Sea and Straits, the Mediterranean Sea and the Aegean Sea- since the 2000s under the Regional Sea Conventions signed by Turkey (Barcelona and Bucharest Conventions) and national and international legislation. Since 2011, the marine monitoring studies have been carried out on the basis of ecosystem-based management approach under the "Integrated Marine Pollution Monitoring Program". Through the monitoring program, it is aimed to establish a scientific background for the determination of national marine and coastal management policies and strategies for the Turkish seas; where comprehensive assessment reports are prepared about the findings based on the historical and up-to-date data.

The "Integrated Marine Pollution Monitoring Program" conducted by the Ministry has been operated in 3-year periods since 2014 under the coordination of TÜBİTAK-Marmara Research Center with the cooperation and contributions of many acknowledged specialists and scientists from the universities and research institutions.

In the framework of the monitoring program; the physicochemical properties of the water column, ecological status indicators, state of pollution, radioactivity levels, marine litter accumulated at the coasts and the seas, the seafloor and water column biodiversity/habitats, contaminant levels in the target species of economic value are monitored. With these results, quality classifications have been made for assessing the status of coastal water bodies and marine areas. Also, multi-variable data sets have been created to determine and follow up the definitions and targets of "good environmental status" for our seas. The monitoring activities in all Turkish seas -Black Sea, Marmara Sea and the Straits, Mediterranean Sea and Aegean Sea- consist of the following components.

- Monitoring of biodiversity and ecological quality (including alien species),
- Monitoring of eutrophication,
- Monitoring of pollutant levels and their trends as well as in terms of human consumption,
- Monitoring of marine litter in sediments, water and at the coasts.

The Mediterranean Sea - Marine Quality Bulletin-2017 contains the eutrophication component assessments for the 2014-2017 period and ecological quality status assessments for the year 2016.

2 DEFINITIONS

CTD: Conductivity and **T**emperature measurements of sea water relative to **D**epth (In situ measurements).

Ecological Status: The structural and functional quality of aquatic ecosystems. According to the Water Framework Directive, coastal waters are assessed with 3 biological quality elements (phytoplankton, zoobenthos and macro algae) and in 5 quality classes (high/good/moderate/poor/bad).

Monitoring of Eutrophication: Relevant indicators like nutrient levels and their temporal changes, dissolved oxygen levels at the bottom and/or intermediate layer depths and their temporal changes, chlorophyll-a levels in euphotic water column, light penetration, prevalence and distribution of opportunistic macroalgae are monitored at the seafloor and in the water column. The assessments are made with integrated data on pressures and impacts.

Secchi Disk Depth (SDD): It is an indicator of light transmittance in the environment which is commonly used in eutrophication assessments owing to both the ease of measurement and the possibility of comparison with historical data. The Secchi disk depth decreases when the particulate matter in water column increases, however, it increases when the light transmittance increases.

Water Management Unit (Coastal Water Body, CWB): Identifies a surface water part characterized by significant physical, hydro-morphological, ecological properties and by pressure analyses. It is the smallest management unit handled by the Water Framework Directive (2000/60/EC).

Marine Assessment Unit (MAU): Marine areas defined for monitoring as specified in the Marine Strategy Framework Directive (2008/56/EC); and initially was set with DeKoS Project which are still subject to official confirmation.

TRIX Index: Trophic Index (TRIX) is a scale for the trophic status (eutrophication) classification of coastal surface waters. It is a logarithmic calculation method including such parameters as the Total Phosphorus (TP) and Dissolved Inorganic Nitrogen (DIN) which are among nutrients; Chlorophyll-a (Chl-a) which is a quantitative indicator of planktonic biomass; and aDO% (oxygen saturation deviation from 100%DO) which is an indicator of photosynthesis intensity.

TRIX index (Vollenweider *et al*. 1998; Bendoricchio *et al*. 2005) is calculated with the following formula;

$$TRIX = (Log_{10}[Chl\text{-}a \times aDO\% \times TIN \times TP] + k) / m$$

Chl-a: Chlorophyll-a concentration (µg/L),
aDO%: Absolute deviation from the oxygen saturation value: I 100-DO% I

DIN: Dissolved inorganic nitrogen: (NO_3+NO_2+NH_4)-N (µg/L)

TP: Total phosphorus (µg/L)

k: Equation constant; 1.5

m: Equation constant; 1.2

Classification ranges according to this index are given in the Table below.

Table 2.1 TRIX Values and Class Definitions

TRIX Value	Class Definition
< 4	No Risk of Eutrophication (High quality)
4 - 5	Less risk of eutrophication (Good quality)
5 – 6	High Risk of eutrophication (Moderate quality)
>6	Eutrophic (Bad quality)

Supplementary information about the sampling, measurement and analysis methods can be found in the Appendices.

3 GENERAL INFORMATION

This section includes general information about the monitoring stations and campaigns in the Mediterranean Sea.

The monitoring studies between 2014 and 2017 were conducted with R/V BİLİM-2. The information about the monitoring stations in the 2014-2017 period is given in Table 3.1. Also, the detailed information about the stations monitored in 2017 is available in Appendix-1.

Table 3.1 Information about the Monitoring Stations in the Mediterranean Sea

Monitoring Components	2014	2015		2016		2017
	Summer	Winter	Summer	Winter	Summer	Summer
Water Column	66	62	64	66	68	88

3.1 The Mediterranean Coastal Water Bodies (Water Management Units)

There are 22 Coastal Water Bodies (CWBs) in the Mediterranean Sea, listed in Table 3.2 and shown in Figure 3.1.

Table 3.2 The Mediterranean Coastal Water Bodies (Water Management Units)

Coastal Water Bodies (Water Management Units)
AKD01: Yayladağ - Samandağ
AKD02: Inner Gulf of İskenderun
AKD03: Outer Gulf of İskenderun
AKD04: Karataş
AKD05: Inner Gulf of Mersin
AKD06: Outer Gulf of Mersin
AKD07: Erdemli
AKD08: Silifke
AKD09: Taşucu
AKD10: Gülnar - Anamur
AKD11: Gazipaşa - Antalya
AKD12: Kemer
AKD13: Kumluca-Finike
AKD14: Kaş Kekova SPA
AKD15: West of Kekova SPA - East of Patara SPA
AKD16: Patara SPA
AKD17: Off the coast of Fethiye Göcek SPA
AKD18: Fethiye Göcek SPA
AKD19: Dalaman – Ortaca
AKD20: Protected Areas of Köycegiz
AKD21: Off the coasts of Köycegiz- Marmaris
AKD22: Gulf of Marmaris

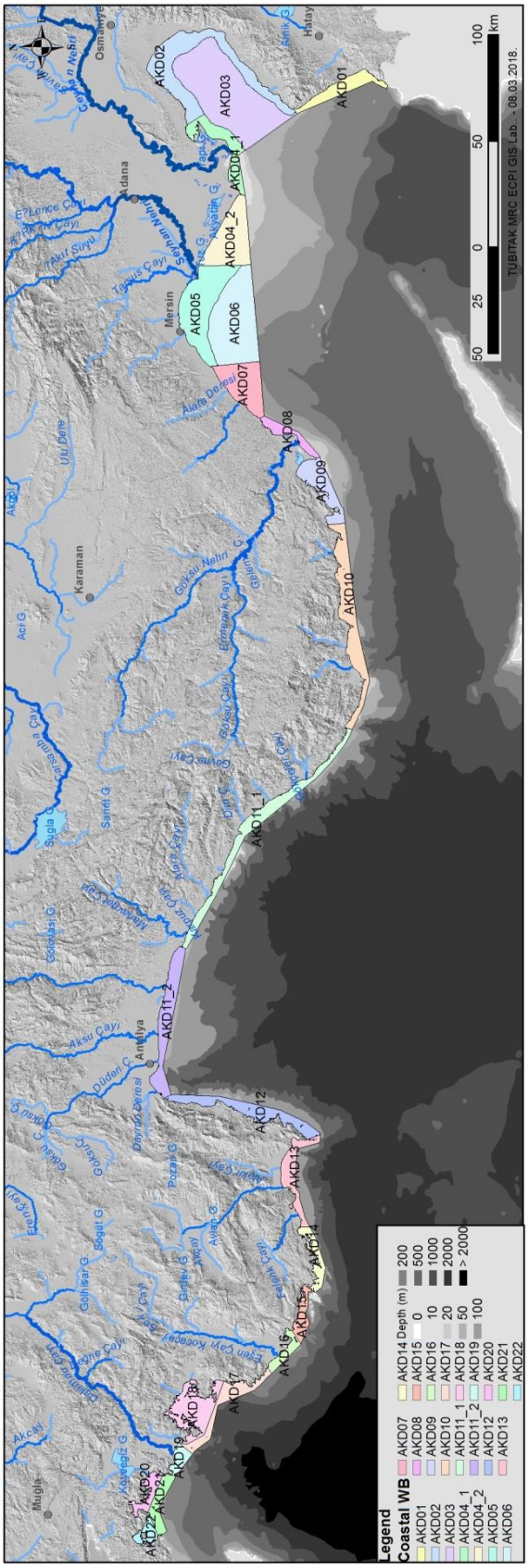

Figure 3.1 The Mediterranean Sea Coastal Water Bodies (Water Management Units) (DEKOS, 2014)

3.2 Information on the monitoring stations and campaigns in the Mediterranean Sea

Information about the monitoring stations (codes/location, coordinates, depths, etc.) studied in the Mediterranean in the summer of 2017 are given in Appendix-1. Under the “Integrated Marine Pollution Monitoring Program”, the summer term sampling activities in the Mediterranean Region were performed in August 2017 via *in situ* measurements and samplings at 88 stations.

In the summer period, seawater physicochemical variables (CTD including in-situ fluorescence and radiation, dissolved oxygen, pH, nutrients, Secchi depths) and chlorophyll-a were measured. 15 stations were selected to represent 4 marine assessment units, were measured.

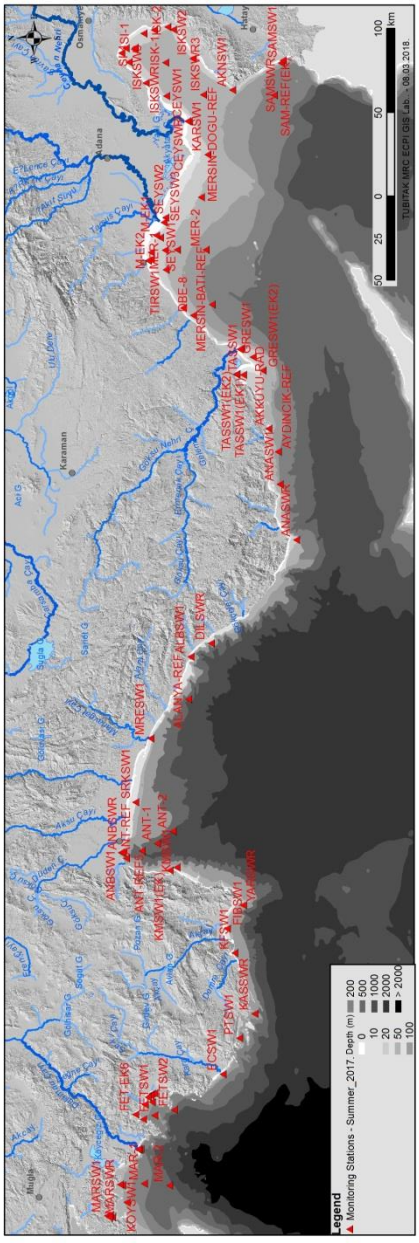

Figure 3.2 Map of Mediterranean monitoring stations in 2017

4 EUTROPHICATION STATUS of THE MEDITERRANEAN SEA

As part of the eutrophication assessment of the Mediterranean Sea, the following variables were also assessed together with Physical Variables (salinity, temperature, pH, density changes, etc.).

- Nutrient levels
- Chlorophyll-a levels
- Dissolved Oxygen levels
- Secchi Disc Depths

This section includes the assessment results of the above mentioned variables in the Mediterranean coastal water bodies.

4.1 Variability of Nutrients

For surface distributions of nutrients; the surface dissolved inorganic nitrogen (DIN), silicate (Si), nitrite-nitrate nitrogen (Nox) and total phosphorus (TP) concentrations were assessed. 2014-2017 data from the Mediterranean CWBs on the surface layer (0-10m average) nutrients (NO3+ NO2 –N [Nox], NH4, PO4-3, TP ve Si), their ratios (N:P, Si:N) and comparisons of salinity-temperature properties are given in Figure 4.1 and Figure 4.2

TP values obtained in the Mediterranean coastal waters in 2017 summer have reflected the river/urban influences and also the “oligotrophic” (TP <0.5 µM) properties of the salty and clear waters not affected such pressures. In some occasions, TP values of stations under the river influence were even lower than 0.5 µM which is accepted as the threshold for eutrophication (KAAY Tebliğ, 2009) and where relatively higher values would indicate a tendency towards eutrophic status. In addition, the values of total dissolved inorganic nitrogen (DIN) reached the highest levels (>3.0 µM) at the low salty surface waters of coastal regions (AKD02 and AKD05) affected by terrestrial inputs; while they are in the range from 0.1 to 0.5 µM at the surface waters of the open marine waters; which is quite low and close to the oligotrophic eastern Mediterranean surface water values. The DIN values of bottom waters whose large percentage was composed of nitrate ions resulted from organic matter degradation.

The DIN (nitrate+nitrite+ammonia) and chlorophyll-a concentrations were quite high in the 2005-2009 in the eastern part of the Gulf of Mersin (Tuğrul et al., 2009); however, after the commissioning of urban wastewater treatment system to control the load of pollution on river waters, the TP and DIN (nitrate+nitrite+ammonia) loads flowing into the sea were observed to decrease, hence the concentration levels in sea water (ÇŞB-ÇEDİDGM, TÜBİTAK-MAM , 2017 a). The molar (N/P) ratio of DIN/PO4 in terrestrial inputs was high (>25) (Koçak et al., 2010); also, it was verified, with recent C-14 isotope-added bio-experiments, that the lack of phosphorus in coastal waters affect plankton production speed, biomass production and accordingly water quality changes and phosphate concentration in the environment (Tüfekçi et al., 2013).

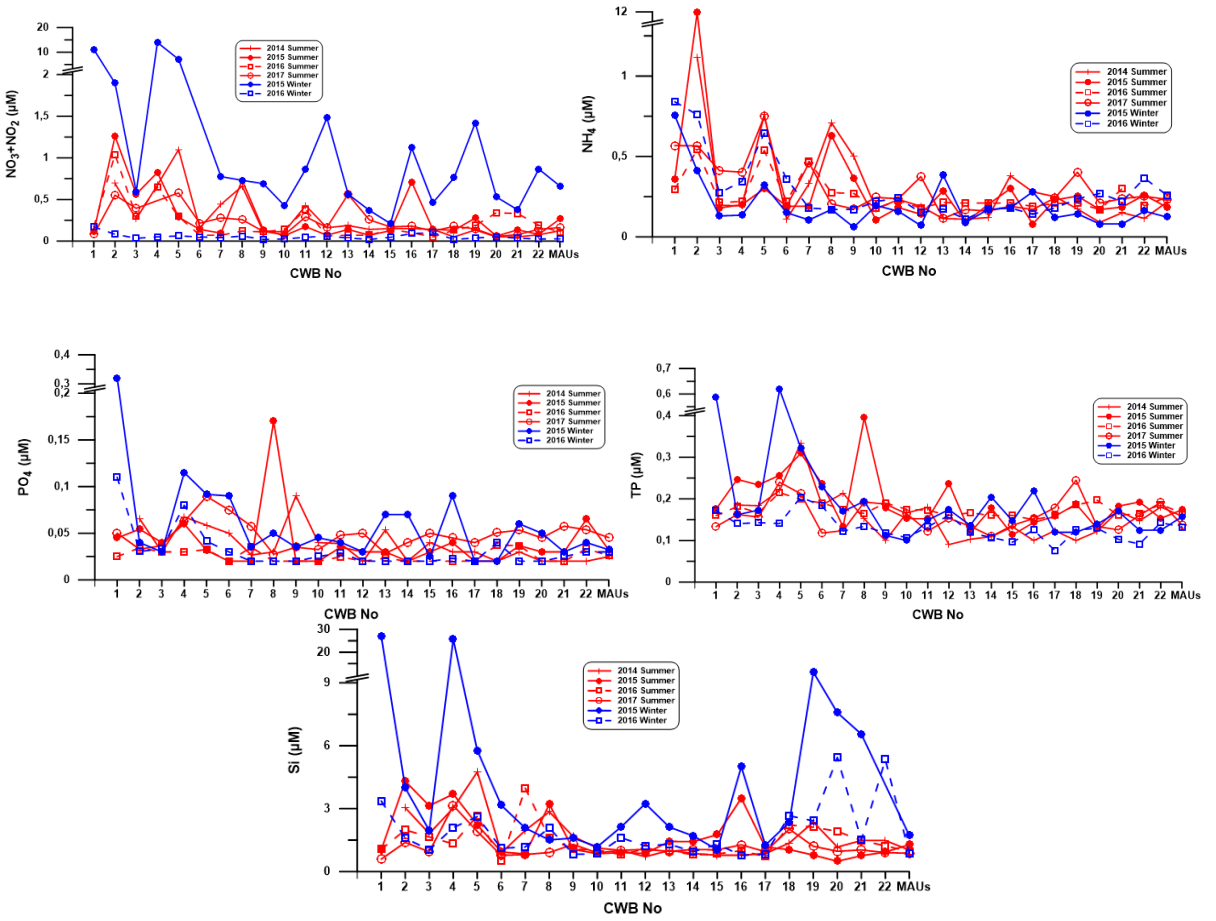

Figure 4.1 Comparison of 2014-2017 nutrients data in the surface layer (0-10m average) of the Mediterranean CWBs

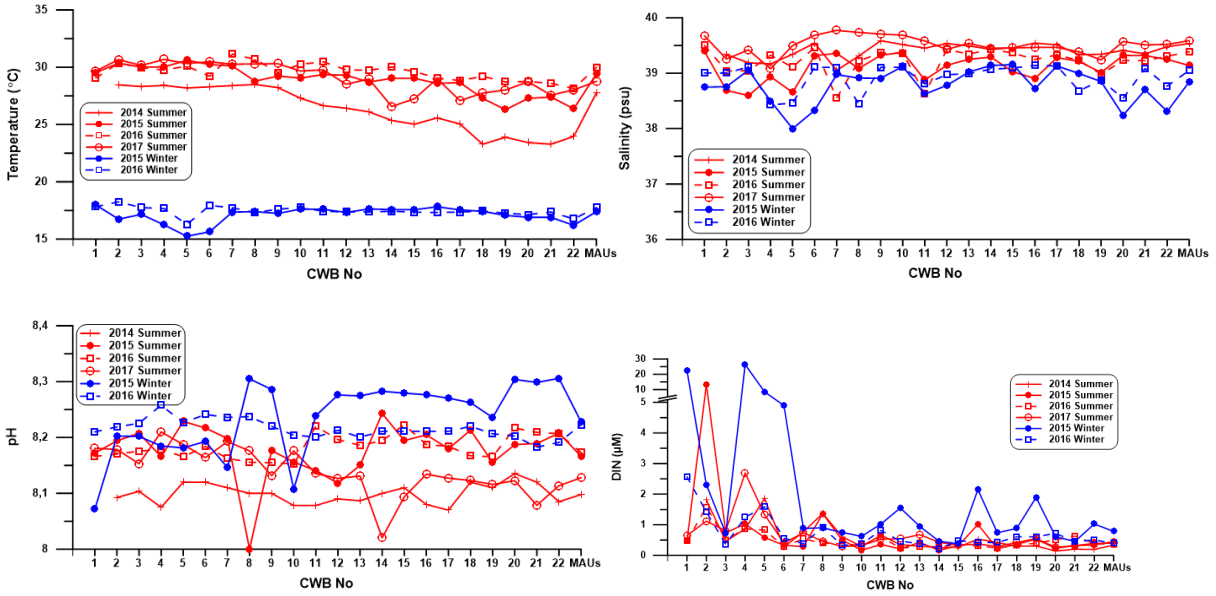

Figure 4.2 Comparison of 2014-2016 physical properties and DIN data in the surface layer (0-10m average) of the Mediterranean CWBs

4.2 Chlorophyll-a levels

Figure 4.3 includes the comparison of the 2014-2017 data from the Mediterranean CWBs on surface layer (0-10m average) chlorophyll-a concentrations. All measurements of chlorophyll-a at all stations in summer period was performed through the euphotic zone (upper 60-100 m); and no chlorophyll-a measurement was made at over 200-250m depth because chlorophyll was not detected below this depth.

In general, relatively higher chlorophyll-a values were observed in shallow and less salty coastal areas under the effects of rivers and other terrestrial inputs like urban wastewaters (AKD01: Asi River, AKD04: Ceyhan River, AKD05: Seyhan River) where almost all winter concentrations were higher than the summer values. Chlorophyll-a was observed to decrease to its natural level at 0.03-0.24 µg/L in open sea surface waters where the effects of land-based inputs diminish and in clean coastal areas (the area between Anamur and Marmaris). The inputs were more effective in the upper 5-10 meters of the water column. The changes in the 2017 summer values with depth revealed a similar distribution to the oxygen profiles. While the coastal areas of Mersin and İskenderun gulfs fed by rivers with less salty waters and low SDD values were observed to have high levels of Chl-a; the surface waters of coastal areas where the effect of land-based inputs diminished and the reference conditions were observed to have the natural open sea levels of Chl-a, displaying typical eastern Mediterranean properties.

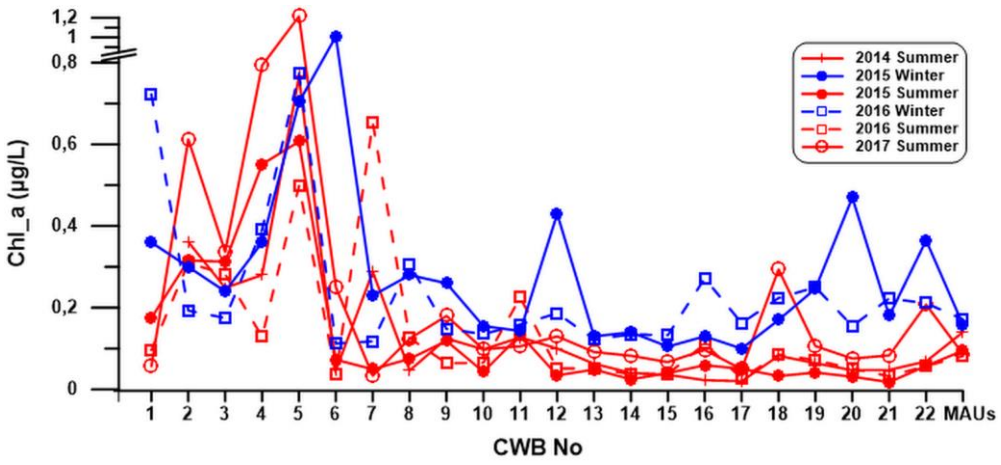

Figure 4.3 Comparison of 2014-2016 chlorophyll-a data in the surface layer (0-10m average) of the Mediterranean CWBs

4.3 Dissolved Oxygen Levels

Dissolved oxygen concentration and saturation percentages in the Mediterranean region during 2017 summer sampling periods are presented in Figure 4.4 for the surface water as 0-10 m averages. In the summer term, the surface water oxygen saturation levels were around 97-112%; while the concentration values ranged from 5.74 to 6.7 mg/L, owing the lowest values to the summer periods. The dissolved oxygen profiles of all the stations in the Mediterranean Sea are given below.

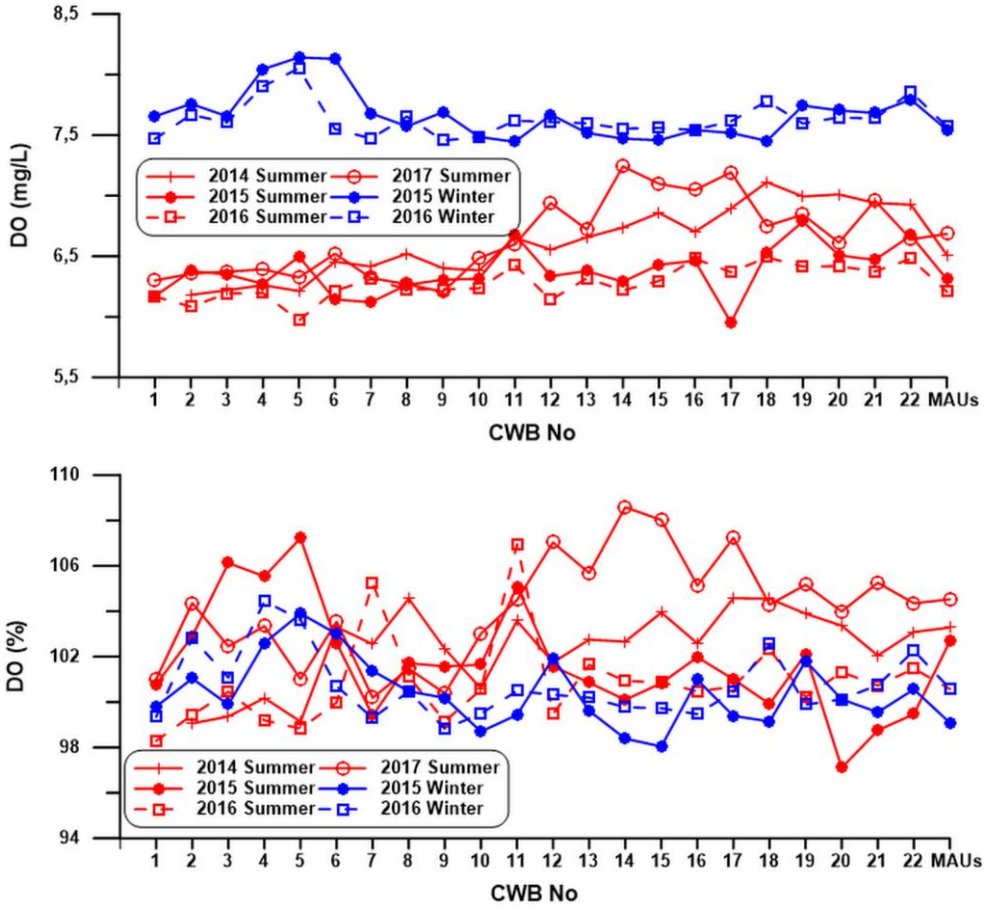

Figure 4.4 Dissolved oxygen values and percentages of the Mediterranean CWBs from 2014 to 2017 for the surface layer (0-10 m average)

4.4 Secchi Disk Depth

Secchi Disc Depths were found to range between 3 and 39 m in the 2017 summer sampling in the Mediterranean Sea (Figure 4.5). As long as moved from east to west along the coastal areas of the Mediterranean Sea (from the Gulf of İskenderun to Marmaris), it was observed that the SSD values increased remarkably relating to the decreased land-based pressures.

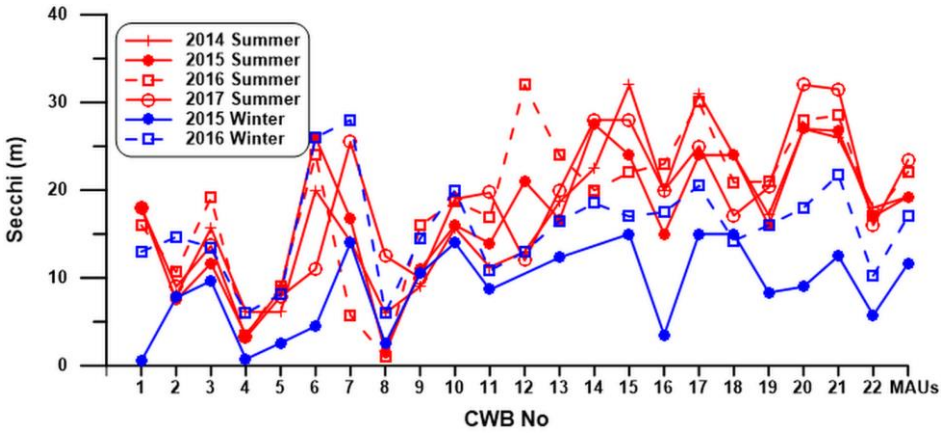

Figure 4.5 Comparison of the 2014-2017 Secchi Disk Depth data of the Mediterranean CWBs

5 TRIX INDEX ASSESSMENT

Considering the fact that river influence on water column is limited to the upper 5-10 m depths, a 0-10 m average TRIX index values distribution is presented in Figure 5.1. The results indicated that the TRIX values of surface waters ranged from 0.65 to 5.20 as per station. The lowest TRIX values (<1.0) calculated were found at open waters and some coastal areas that were not affected by rivers and wastewaters. These low results reflected the typically oligotrophic summer term TRIX level of the Eastern Mediterranean surface water. The decrease in the effects of terrestrial inputs in the first 5-10 m depths caused a decrease in the 0-10 m average TRIX values calculated. The highest TRIX values were calculated at the CWBs having locations with high terrestrial inputs like the coastal waters in the east of Mersin Gulf (the area between the Port of Mersin and Seyhan River estuary), the area between the estuaries of the River Ceyhan and River Asi, and the inner Gulf of İskenderun.

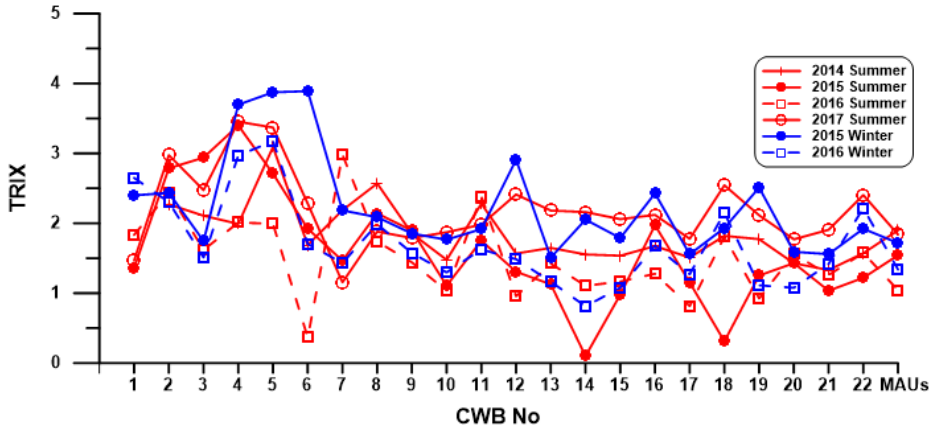

Figure 5.1 Comparison of the Mediterranean surface layer TRIX values between 2014 and 2017

6 GENERAL ASSESSMENT

Ecological Quality Status of Coastal Water Bodies

This section includes quality status assessments for the 2014-2016 period on the basis of the findings of CWBs according to Water Framework Directive by biological quality elements (phytoplankton, macroalgae and benthic invertebrates) as well as supporting parameters (TP, Nox, SDD). Figure 6.1 shows the ecological quality status assessments of the Mediterranean by WFD 5-classification classes.

The ecological status of Mediterranean coastal waters have been set for 2014-2016 in each annual report and the assessment for 2016 is given in Figure 6.1. Accordingly, in the CWBs which are under the influence of pressures of Ceyhan, Seyhan rivers and the Mersin Bay, the ecological quality was determined as "moderate /poor" and in other CWBs it was "good/very good" and "poor" quality was not observed in any of the monitoring periods.

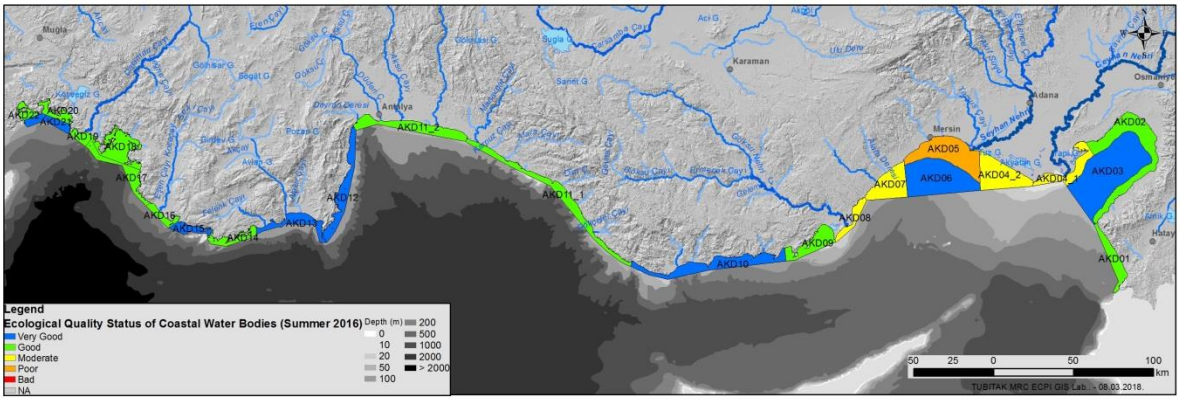

Figure 6.1 Coastal water bodies ecological quality status in 2016 summer

7 APPENDICES

7.1 Appendix-1: Information on the stations and samplings in 2017

Station number	Station location	CWB_/MAU No *	Co-ordinates		Depth (m)	Distance from coast (km)
			Latitude	Longitude		
1	Samandağ	AKD01	36 02.9651N	35 56.0867E	75	2.20
2	Samandağ	AKD01	36 02.4080N	35 57.0354E	17	1.30
3	Cape Akıncı	AKD02	36 18.7747N	35 45.7584E	67	1.80
4	Gulf of İskenderun	AKD02	36 31.3127N	35 58.5455E	40	3.90
5	Gulf of İskenderun	AKD02	36 46.8580N	36 09.0297E	23	4.40
6	Gulf of İskenderun	AKD02	36 39.1427N	36 11.4397E	35	2.00
7	Gulf of İskenderun	AKD02	36 37.3422N	36 10.2920E	42	2.40
8	Gulf of İskenderun	AKD02	36 43.5270N	36 10.2961E	24	2.40
9	Gulf of İskenderun	AKD02	36 52.6874N	36 03.3201E	18	3.40
10	BOTAŞ/BTC	AKD02	36 51.8318N	35 57.7458E	32	2.80
11	Yumurtalık	AKD02	36 46.4655N	35 49.2010E	9	0.93
12	Gulf of İskenderun	AKD02	36 54.1060N	36 01.3828E	13	2.60
13	Gulf of İskenderun	AKD02	36 50.0511N	36 02.8276E	46	8.00
14	Gulf of İskenderun	AKD02	36 49.6981N	36 03.3473E	46	8.00
15	Gulf of İskenderun	AKD03	36 28.2548N	35 44.1633E	83	14.20
16	Gulf of İskenderun	AKD03	36 40.1482N	35 57.2474E	65	17.20
17	Gulf of İskenderun	AKD03	36 40.0128N	35 43.9056E	51	4.30
18	Ceyhan River Mouth	AKD04	36 32.9348N	35 33.5387E	9	0.96
19	Ceyhan River Mouth	AKD04	36 33.3529N	35 33.6848E	8	1.70
20	Tırtar	AKD05	36 41.0055N	34 34.6821E	49	7.10
21	Seyhan River Mouth	AKD05	36 41.0054N	34 55.4490E	17	4.70
22	Seyhan River Mouth	AKD05	36 41.4787N	34 53.5401E	17	3.70
23	Seyhan River Mouth	AKD05	36 42.7296N	34 47.4948E	25	9.30
24	Gulf of Mersin	AKD05	36 45.6211N	34 38.8696E	18	3.60
25	Gulf of Mersin	AKD05	36 46.6039N	34 38.2590E	12	1.70
26	Gulf of Mersin	AKD05	36 43.9796N	34 48.3367E	15	6.80
27	Gulf of Mersin	AKD05	36 45.6904N	34 41.6340E	16	4.70
28	Off the coast of Mersin Gulf	AKD05	36 41.2186N	34 42.4689E	45	13.50
29	Gulf of Mersin	AKD06	36 37.2254N	34 42.5750E	70	21.10
30	Erdemli	AKD07	36 32.2019N	34 16.4568E	73	3.40
31	Erdemli	AKD07	36 35.3706N	34 19.3150E	31	1.50
32	Göksu River Mouth	AKD08	36 16.8499N	34 03.3274E	31	1.90
33	Göksu River Mouth	AKD08	36 17.3204N	34 02.9581E	14	0.93
34	Taşucu	AKD09	36 16.1761N	33 52.7904E	35	3.40
35	Taşucu	AKD09	36 18.5955N	33 52.9861E	14	0.52
36	Taşucu	AKD09	36 18.2495N	33 53.1525E	22	1.20
37	Akkuyu	AKD10	36 08.1339N	33 31.5111E	32	0.66
38	CWB 10 - New Station	AKD10	36 04.2498N	33 09.5691E	190	5.80
39	Cape Dildare	AKD11	36 25.5739N	32 06.1889E	58	3.20
40	Alanya	AKD11	36 31.9820N	32 00.5343E	19	0.81
41	Manavgat River Mouth	AKD11	36 44.1715N	31 27.5986E	19	1.20
42	CWB 11 - New Station	AKD11	36 48.2800N	31 01.9777E	50	5.40
43	Gulf of Antalya - offshore	AKD11	36 50.6144N	30 39.3959E	320	2.60
44	Gulf of Antalya	AKD11	36 51.7459N	30 41.5196E	47	2.00
45	Gulf of Antalya	AKD11	36 52.3210N	30 41.5475E	40	1.30
46	CWB 12 - Additional station	AKD12	36 34.3080N	30 36.6615E	78	1.80
47	CWB 12 - Additional station	AKD12	36 36.5123N	30 35.2841E	45	1.50
48	Cape Yarımcı	AKD13	36 12.4879N	30 22.7342E	129	2.20
49	Gulf of Finike	AKD13	36 17.2731	30 13.1471E	56	2.90
50	CWB 13 - New Station	AKD13	36 14.5578N	30 03.5977E	19	1.60
51	Kaş	AKD14	36 07.2742N	29 40.0216E	300	1.90
52	CWB 15 - Additional station	AKD15	36 11.6798N	29 30.1337E	191	1.60
53	CWB 16 - New Station	AKD16	36 16.4443N	29 15.4047E	73	1.80
54	CWB 17 - New Station	AKD17	36 31.3917N	29 00.1788E	465	2.40
55	Gulf of Fethiye	AKD18	36 37.4892N	28 57.4850E	320	4.96
56	Gulf of Fethiye	AKD18	36 40.9856N	28 55.6375E	128	2.99
57	Gulf of Fethiye	AKD18	36 38.5343N	29 02.8726E	145	2.40
58	Gulf of Fethiye	AKD18	36 43.6902N	28 57.3950E	66	0.540
59	Gulf of Fethiye	AKD18	36 38.6939N	29 06.1376E	21	0.44
60	Gulf of Fethiye	AKD18	36 37.9408N	29 06.3700E	14	0.66

Station number	Station location	CWB_/MAU No *	Co-ordinates		Depth (m)	Distance from coast (km)
			Latitude	Longitude		
61	Gulf of Fethiye	AKD18	36 39.0742N	29 05.3141E	43	0.88
62	Gulf of Fethiye	AKD18	36 39.9870N	29 04.5563E	38	1.30
63	Gulf of Fethiye	AKD18	36 40.7736N	29 01.7102E	54	2.00
64	Dalaman River Mouth	AKD19	36 41.2619N	28 43.6394E	300	1.79
65	Dalaman River Mouth	AKD19	36 41.9130N	28 43.5709E	70	0.66
66	Dalaman River Mouth	AKD19	36 42.1094N	28 43.6526E	30	0.30
67	CWB 20 - New additional station	AKD20	36 47.0901N	28 29.1823E	100	1.58
68	CWB 21 - New additional station	AKD21	36 44.6388N	28 22.1993E	130	5.00
69	CWB 21 - New additional station	AKD21	36 46.4726N	28 28.9504E	110	2.57
70	For Akd CWB 22 from Aegean Sea	AKD22	36 50.6591N	28 16.3044E	21	0.60
71	For Akd CWB 22 from Aegean Sea	AKD22	36 48.9997N	28 15.8402E	37	0.60
72	For Akd CWB 22 from Aegean Sea	AKD22	36 49.6774N	28 16.8649E	34	1.48
73	For Akd CWB 22 from Aegean Sea	AKD22	36 49.8770N	28 15.8360E	30	1.35
74	Samandağ - offshore	MAU4	36 05.4700N	35 43.4369E	225	18.40
75	Karataş	MAU4	36 27.1664N	35 20.2952E	38	9.70
76	Gulf of Mersin - offshore	MAU3	36 29.4292N	35 03.4462E	55	18.70
77	Gulf of Mersin - offshore	MAU3	36 26.2698N	34 20.7318E	212	14.30
78	Göksu - offshore	MAU3	36 13.1253N	33 59.8132E	32	3.40
79	Göksu - offshore	MAU3	36 09.9234N	33 54.5005E	74	8.70
80	Aydıncık-Akkuyu - offshore	MAU3	36 04.9607N	33 22.4372E	129	5.10
81	Anamur - offshore	MAU3	35 58.7629N	32 47.7078E	45	4.30
82	Off the coast of Mersin Gulf	MAU3	36 28.0703N	34 42.4579E	159	33.60
83	Alanya - offshore	MAU2	36 32.3090N	31 43.5879E	900	8.60
84	Antalya - offshore	MAU2	36 45.7092N	30 42.6115E	500	10.40
85	Gulf of Antalya - offshore	MAU2	36 40.8523N	30 45.7506E	900	16.90
86	Gulf of Antalya - offshore	MAU2	36 35.9962N	30 50.8325E	1000	22.80
87	Off the coast of Marmaris	MAU1	36 39.4861N	28 30.1153E	380	11.60
88	Off the coast of Marmaris	MAU1	36 31.3988N	28 30.1281E	860	22.50

* As named with the DEKOS Project (2014)

7.2 Appendix-2: Sampling Methods

MATRIX	PARAMETER	SAMPLING METHOD	STORAGE METHOD	REFERENCE
SEA WATER	T,S,D	*In-situ* measurement	-	CTD Manual –Software Sea Monitoring Guidelines (2017)
	DO	*In-situ* measurement / Reagent must be added from rosette to bottle without contacting with air.		Winkler CTD Manual -Software / MTS 163 Sea Monitoring Guidelines (2017)
	SD Depth	*In-situ* measurement: with a 30cm diameter white disk	-	Sea Monitoring Guidelines (2017)
	Chl-a	Roset sampling, filtering with GF/F filters	-20 ^{0}C in deep freezer	Water Pollution Control Regulation Sampling and Analysis Methods Communiqué
	PO_4^+	From rosette to bottle	In HDPE bottles in deep freezer at -20 ^{0}C or immediate measurement	UNEP/MAP, 2005. Sampling and Analysis techniques for the Eutrophication Monitoring Strategy of MED POL. Technical Reports Series No: 163 Sea Monitoring Guidelines (2017)
	TP			
	SiO_2			
	NO_3+NO_2-N			
	NH_4-N			

7.3 Appendix-3: Measurement and Analysis Methods

MATRIX	PARAMETER	METHOD	INSTRUMENT	REFERENCE	LOD/LOQ	Unit	Measurement-Analysis Laboratory
SEA WATER	T,S,D	*In-situ* measurement	CTD prop	CTD Manual –Software Sea Monitoring Guidelines (2017)	-	-	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	DO	Iodometric Method (Winkler Method)	Titrator	S.M. 4500 B:2005 Sea Monitoring Guidelines (2017)	-	mg/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	SD Depth	*In-situ* measurement	Secchi Disk	Sea Monitoring Guidelines (2017)	-	m	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	Chl-a	Spectrophotometric Method-Extraction With Aceton	Spectrophotometer	S.M 10200 H. Sea Monitoring Guidelines (2017)	0,05	µg/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	PO_4^+	Method of Determination of Orthophosphate	Autoanalyzer	S.M. 4500-P : 2005 G Sea Monitoring Guidelines (2017)	0,02/ 0,07	µmol/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	TP	Persulfate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus	Autoanalyzer, Autoclave	S.M. 4500- P J. Sea Monitoring Guidelines (2017)	0,055 / 0,183	µmol/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	SiO_2	Colorimetric method	Autoanalyzer	SM 4500-SiO2- :2005 F Sea Monitoring Guidelines (2017)	0,06 /0,19	µmol/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	NO_3+NO_2-N	Cadmium Reduction Method	Autoanalyzer	S.M. 4500-NO3-I:2005 Sea Monitoring Guidelines (2017)	0,05 / 0,17	µmol/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences
	NH_4-N	Flow Injection Method	Autoanalyzer	S.M. 4500-NH3 H:2005 Sea Monitoring Guidelines (2017)	0,041 / 0,14	µmol/L	R/V BİLİM-2 Research Vessel, METU Institute of Marine Sciences

8 REFERENCES

- ÇŞB-ÇEDİDGM and TÜBİTAK-MAM (2018). Integrated Pollution Monitoring Project (2017-2019). ÇTÜE 5178702, Report No. ÇTÜE.17.2111 (Mediterranean Final Report, 2017), February 2018, Gebze-Kocaeli.

- ÇŞB-ÇEDİDGM, TÜBİTAK-MAM (2017 a) Integrated Pollution Monitoring Project 2014-2016 Akdeniz Summary Report, ISBN:978-605-5294-68-7, TÜBİTAK MAM Publication, Gebze/Kocaeli, 61 sy., ANKARA-2017 (In Tr and Eng).

- ÇŞB-ÇEDİDGM and TÜBİTAK-MAM (2017 b). Integrated Pollution Monitoring Project (2014-2016). ÇTÜE 5148704, Report No. ÇTÜE.16.332 (Mediterranean Final Report, 2016), May 2017, Gebze-Kocaeli.

- ÇŞB-ÇEDİDGM and TÜBİTAK-MAM (2016). Integrated Pollution Monitoring Project (2014-2016). ÇTÜE 5148704, Report No. ÇTÜE.15.262 (Mediterranean Final Report, 2015), April 2016, Gebze-Kocaeli.

- ÇŞB-ÇEDİDGM and TÜBİTAK-MAM (2015). Integrated Pollution Monitoring Project (2014-2016). ÇTÜE 5148704, Report No. ÇTÜE.14.204 (Mediterranean Final Report, 2014), April 2015, Gebze-Kocaeli.

- ÇŞB-ÇEDİDGM and TÜBİTAK-MAM (2017) Sea Monitoring Guidelines, Gebze-Kocaeli.

- DEKOS Project: TUBITAK-MRC and MoEU-GDEM (2014). Marine and Coastal Waters Quality Determination and Classification Project (DeKoS). ÇTÜE 5118703, Report No. ÇTÜE.13.155 (Final Report), February 2014, Gebze-Kocaeli, Turkey.

- Koçak, M., Kubilay, N., Tuğrul, S., Mihalopoulos, N., 2010. Atmospheric nutrient inputs to the northern levantine basin from a long-term observation: sources and comparison with riverine inputs. Biogeosciences, 7, 12, 4037-4050.

- Tüfekçi, V., Kuzyaka, E., Tüfekçi, H., Avaz, G., Günay, A.S., Tuğrul, S., 2013. Determination of limited nutrients in the Turkish coastal waters of the Mediterranean and Aegean Seas. J. Black Sea/Mediterranean Environment Vol. 19, No. 3: 299-311.

- Tuğrul, S., Küçüksezgin, F., Yemenicioğlu, S. Uysal, Z., 2009: Kuzeydoğu Akdeniz ve Ege Denizi ve Kıyı Alanlarında Uzun Süreli Biyolojik İzleme, Değişim ve Uyum İzleme, Mersin Körfezi Ötrofikasyon İzleme Programı (MEDPOL Faz IV). Çevre ve Orman Bakanlığı, Ankara.

- Vollenweider, R.A., Giovanardi, F., Montanari, G. and Rinaldi, A. 1998. Characteriztion of the trophic conditions of marine coastal waters with specific reference to the NW Adriatic Sea: proposal for a trophic scale, turbidity and generalized water quality index. Environmetrics, 9: 329-357.

- UNEP/MAP, 2005. Sampling and Analysis techniques for the Eutrophication Monitoring Strategy of MED POL. Technical Reports Series No: 163