REPORT ON THE STATE OF MARINE AND COASTAL ENVIRONMENT IN 2009

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ABSTRACT

State and evolution trends of Romanian Black Sea coastal environment continued to be monitored in 2009 from physical, chemical and biological point of view compared with reference periods dating back in early ‘60ies or more recent years depending on parametres.
Coastal processes during the geomorphological cycle 2007-2009 have been dominated by erosion (64%) and accretion (18%) compared to dynamic equilibrium (18%).
Sea level indicated high values compared to reference period 1933-2008, in correlation with precipitations, floods and increased Danube flow (discharge); the annual mean value was +7.2 cm higher than the multiannual value for 1933-2008.
Salinity fluctuated significantly under the influence of the river input depending on

Danube's flow. At Constanta, the minimum monthlz average value reflected the maximum flow, in April 2009. Nutrient (inorganic forms of N, P and Si) concentrations recoreded normal values, easily higher in transitional waters under anthropic influence. Phosphate concentrations with comparable levels to those between 1960 and 1970 are highlighted. Heavy metals varied within values range encountered between 2002 and 2008 with slightly decreasing trends in some cases. Organic pollutants, mainly total petroleum hydrocarbons showed only occasionally higher values than usual. Aromatic polynuclear hydrocarbon and organochlorurated pesticide values ranged within the variation limits for 2004-2008.

Bioaccumulation of contaminants in edible bivalve mollusks did not affect their state of health.

Slight improvement of state of marine ecosystem signaled end 90ies, beginning 2000, continued to be proved by:

- decrease of phytoplankton densities / biomasses and related blooms,
- reinstallment of *Cystoseira barbata* belts off Vama Veche,
- increase of macrozoobenthic specific diversity (up to 60 species compared to fewer number in 90ies till 2004).

Revised Red List of macrophytes, invertebrates, fish and mammals totalized 223 species as in 2008.

Biodiversity and habitats continued to be characterized by specific decision indicators (state, pressure, impact, response).

State of living resources / fish stocks has been surveyed taking into consideration evolution of state, pressure and impact indicators.

New versus historical reference data concerning present state and evolution trends of the Romanian coastal environment do constitute contributions to joint Black Sea Commission's „Report on the state of the Black Sea".

KEY WORDS: Black Sea, Romanian coast, chemistry, eutrophication, contamination, biodiversitz, endangered species, habitats, protected areas, living resources, sustainable development, maritime spatial planning, anthropogenic pressures.

C O N T E N T

C. Ispas, L. Alexandrov)
6.4.5. Anthropic pressures (*R. Mateescu*)

Chapter 4 - WATER

4.3.5. State of Black Sea water
4.3.5.1. Physico-chemical indicators

The analysis of the physico-chemical indicators utilized for the monitoring of Romanian Black Sea transitional, coastal and marine waters quality in 2009 is based on 104 surface samples collected from a 44 stations network located between Sulina and Vama Veche. The network includes monitoring of all water types mentioned in the Water Framework and Marine Strategy Directives as follows: 12 stations - transitional waters (Sulina, Mila9, Sf. Gheorghe, Portita, Gura Buhaz - up to 20m inclusive), coastal waters - 21 stations (Est Constanta, Casino Mamaia, Constanta Nord, Constanta Sud, Eforie, Costinesti, Mangalia and Vama Veche up to 20m inclusive) and marine waters - 11 stations (all stations of the network which lie at 30m and 50m depths). Long term statistical analysis was performed based on historical and daily collected data in 2009 from Casino Mamaia 0m station. General indicators and those characterizing the eutrophication status: transparency, temperature, pH, salinity, dissolved oxygen, inorganic nutrients and chlorophyll_a were analyzed.

4.3.5.1.1. General Indicators

Water **transparency,** measured *in-situ* with Secchi disk, oscillated between 0.6 -10.0m. The maximum was recorded in July, in marine waters, Est Constanta station 5 and the minimum in transitional waters, at Sulina 10m in September (Table 4.3.5.1.1.1). In all water bodies, minimum values are below 2m, allowed for both the environmental status and the impact of anthropogenic activity (Ord. No.161/2006- "Normative on surface water quality classification to determine the environmental status of water bodies").

Table 4.3.5.1.1.1. The main values of seawater transparency along the Romanian shore in 2009

Water body type	No. of samples	Min. (m)	Station	Month	Max. (m)	Station	Month	Average (m)	St. Dev.

Transitional waters	23	**0.6**	Sulina 10m	September	**4.0**	Gura Buhaz 20m	September	2.1	0,813
Coastal waters	35	**0.7**	Constanta South-5m	September	**7.0**	Vama Veche 20m	September	3.2	1,319
Marine waters	28	**1.8**	Portita 30m	May	**10.0**	EC 5	July	4.4	2,303

Transparencies between the three water bodies differ *significantly* (ANOVA, F = 14,072, p <0.0001, F_{cr} = 3106, α = 0.05), the lowest belonging to the transitional waters and the highest to the marine waters (Fig. 4.3.5.1.1.1.).

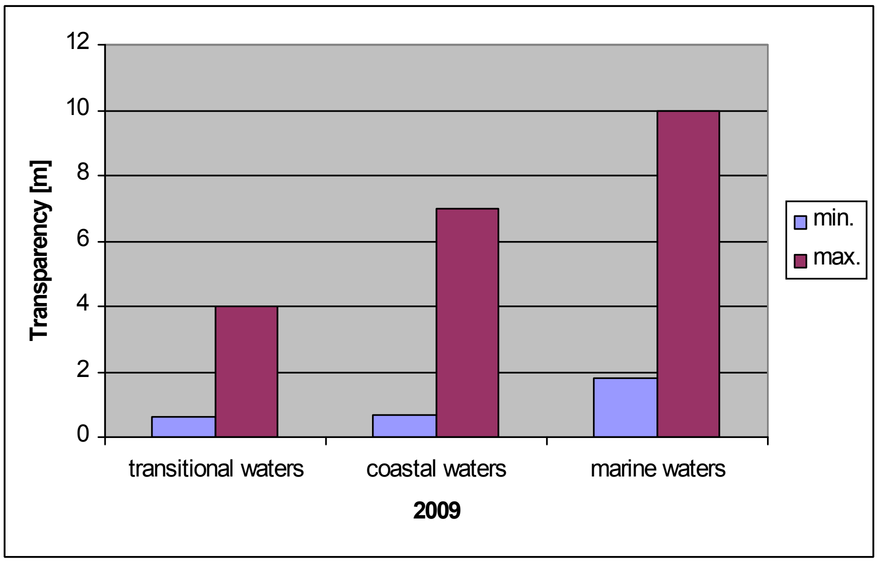


Fig. 4.3.5.1.1.1. Minimum and maximum values of water transparency in Romanian Black Sea water (2009)

From February to September 2009**,** seawater **temperature** recorded values between 3.4^{o} C and 27.6^{o}C, along the entire Romanian coast. The minima were registered in February and maxima in July, regardless of water body type, according to air temperature (Table 4.3.5.1.1.2.), with *insignificant* differences (ANOVA, F = 2091, p = 0.13, F_{cr} = 3086, α = 0.05) between the water bodies.

Table 4.3.5.1.1.2. The main values of seawater temperature along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min (^{O}C)	Station	Month	Max. (^{O}C)	Station	Month	Average (^{O}C)	St. Dev.
Transitional waters	31	**4.0**	Portita 20m	February	**27.6**	Gura Buhaz 5m	July	20.96	5,757
Coastal waters	43	**3.8**	EC 1	February	**26.0**	Casino 0m Vama Veche 0m	July	21.33	5,470
Marine waters	30	**3.4**	Mangalia 30m	February	**26.3**	Portita 30m	July	18.46	7,404

At Constanta, Casino Mamaia 0m station, the seawater temperature was within the limits of natural variation of the area. Between the multiannual monthly averages of 1959-2008 and the monthly average values of 2009 (Fig. 4.3.5.1.1.2.) there are *insignificant* differences (t test, confidence interval 95%, p = 0.7903, t = 0.2691, df = 22, St.Dev. of the difference = 2.911). Absolute minimum measured value was 1.2^{o}C in January and maximum 26^{O}C, in July and August.

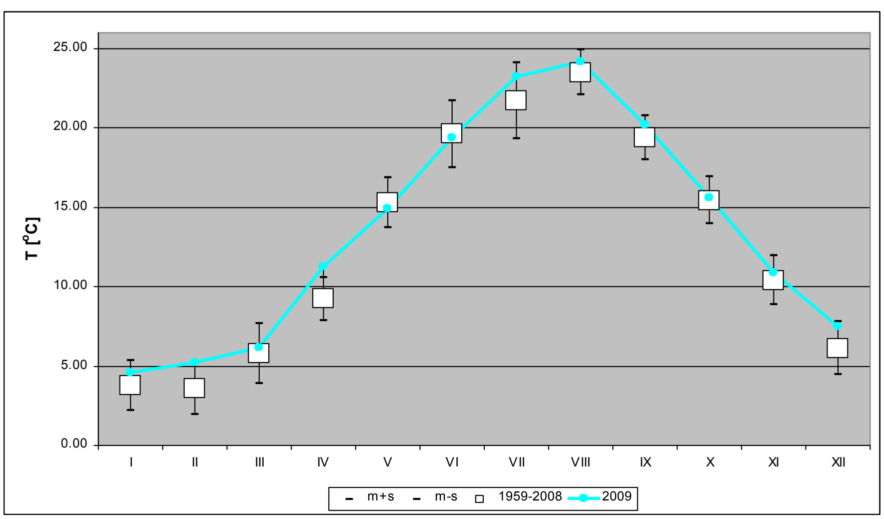


Fig. 4.3.5.1.1.2. Comparative analysis of multiannual monthly averages of seawater temperature (^oC), Constanta, between 1959-2008 and 2009

As in the past years the issue of ocean acidification has become a problem at planetary scale, European directives mentioning the requirement to assess the marine environment status using standards of pH, pCO2 or other equivalent methods for measuring water acidification. In 2009, the **pH** of the coastal waters from Constanta area (Casino Mamaia station 0m) recorded a monthly average between 8.29 and 8.50 pH units with an average of 8.40 and standard deviation s = 0.06. It differs *extremely significant* (t test, confidence interval 95%, p <0.0001, t = 9.5898, df = 22, St.Dev. of the difference = 0.029) by the multiannual monthly average values for 1998-2008 (Fig. 4.3.5.1.1.3.). In 2009, the monthly average values of pH increased and the trend line does not reflect the coastal waters acidification.

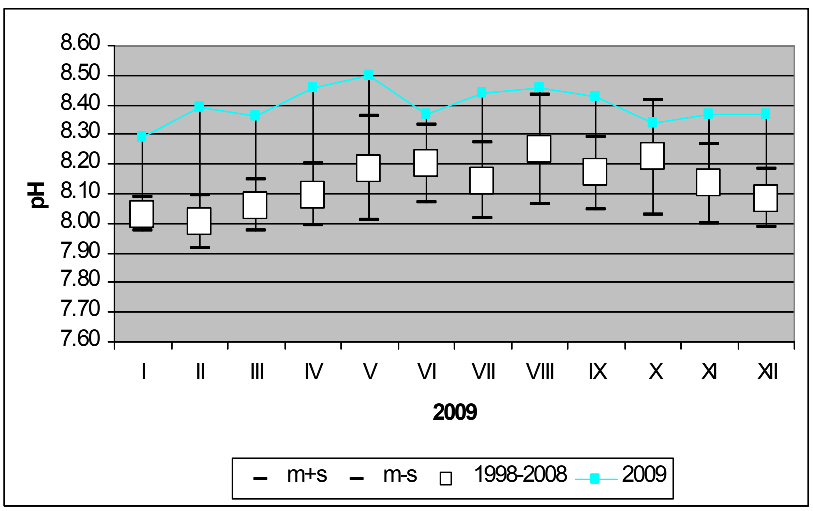


Fig. 4.3.5.1.1.3. Comparative analysis of monthly multiannual seawater pH, Constanta, between 1998-2008 and 2009

The **salinity** of water bodies along the Romanian shore recorded values within 0.12-19.11 ‰.The maximum value is registered in the coastal waters at Costinesti 5m station in September and the minimum one in the transitional waters, Sulina upstream and Sulina downstream stations in July (Table

4.3.5.1.1.3.). Between the salinity values of the three water bodies there are highlightly *significant differences* (ANOVA, $F = 45.13$, $p < 0.0001$, $F_{cr} = 3086$, $\alpha = 0.05$), justifying their classification in the mentioned body types.

Statistical analysis (t test, confidence interval 95%, $p = 0.0694$, $t=1.9093$, $df = 22$, St.dev.of the difference = 0.472) of the long-term data registered for Casino Mamaia 0m station shows a *little significant* difference between 1959-2008 multiannual monthly averages and 2009 monthly average values (Fig. 4.3.5.1.1.4.). The period February to May 2009 when the monthly average values of salinity in the coastal zone, Constanta area, decreased up to the minimum monthly average of April 2009, 11.40 ‰., according to the Danube's flow, has to be noticed.

Tab. 4.3.5.1.1.3 - The main values of seawater salinity along the Romanian shore between February-September 2009

Water body type	No. of samples	Min. (‰)	Station	Month	Max. (‰)	Station	Month	Average	St. Dev.
Transitional waters	31	**0.12**	Sulina amonte Sulina aval	July	**14.89**	Gura Buhaz 30m	September	7.84	4,742
Coastal waters	43	**8.15**	EC 2	May	**19.11**	Costinesti 5m	September	14.81	2,316
Marine waters	30	**7.80**	Portita 30m	May	**17.13**	EC 5	July	13.92	2,471

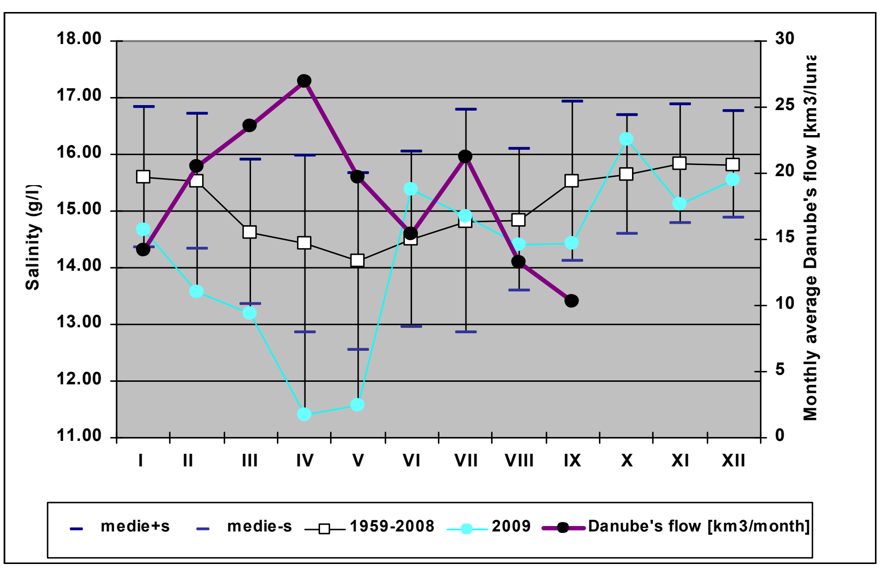


Fig. 4.3.5.1.1.4 - Comparative analysis of salinity multiannual monthly average (g/l), Constanta, between 1959-2008 and 2009

Dissolved oxygen concentrations ranged from 213.0 µM at Constanta Sud 5m in September and 517.2µM at Constanta Sud 20m in July (Table 4.3.5.1.1.4.).

Between the dissolved oxygen concentrations of the water bodies there are *insignificant* differences (ANOVA, $F = 1.632$, $p = 0.20062$, $F_{cr} = 3086$, $\alpha = 0.05$).

Table 4.3.5.1.1.4 - The main values of seawater dissolved oxygen concentrations
along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min. (µM)	Station	Month	Max. (µM)	Station	Month	Average	St. Dev.
Transitional waters	31	**231.3**	Sulina 20m	July	**489.0**	Portita 20m	September	337.0	66.30
Coastal waters	43	**213.0**	Constanta Sud 5m	September	**517.2**	Constanta Sud 20m	July	313.8	62.39
Marine waters	30	**251.4**	Sf.Ghe. 30m	September	**421.1**	Portita 30m	May	332.5	44.24

Although the average value of July 2009, 215.5 µM, is lower than the monthly multiannual range between 1959-2008, its *insignificant* difference (t test, confidence interval 95%, $p = 0.2615$, $t = 1.1525$, $df = 22$, St.Dev. of the di … in the hot se … al zone (F

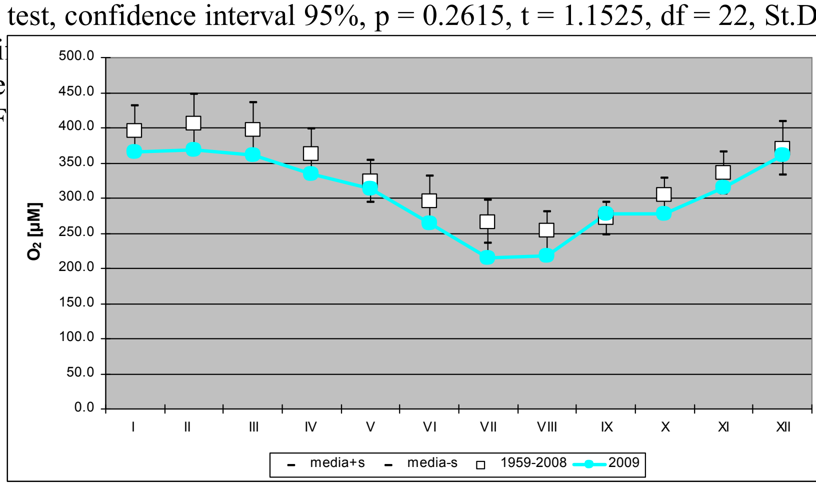


Fig. 4.3.5.1.1.5 - Comparative analysis of multiannual monthly averages of dissolved oxygen concentrations (µM) of the seawater at Constanta, between 1959-2008 and 2009

Oxygen saturation values of transitional, coastal and marine waters from the Romanian littoral ranged between 82.1% -217.3%, both extremes belonging to the coastal zone (Table 4.3.5.1.1.5.). All values determined in 2009 are higher than the permissible limit (80%) for both the environmental status and for the impact of anthropogenic activity (Order No.161/2006 - "Normative on surface water quality classification to determine the environmental status of water bodies"), surface waters in the studied area being well oxygenated.

Table 4.3.5.1.1.5 - The main values of seawater oxygen saturations along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min. (%)	Station	Month	Max. (%)	Station	Month	Average	St. Dev.
Transitional waters	31	**90.8**	Sulina upstream	September	**194.8**	Portita 20m	September	126.6	27.49
Coastal waters	43	**82.1**	Constanta Sud 5m	September	**217.3**	Constanta Sud 20m	July	122.6	26.63
Marine waters	30	**92.9**	EC 4	February	**164.4**	Portita 30m	July	122.8	18.77

As with dissolved oxygen concentrations, the minimum belongs to Constanta Sud 5m station, in September. In the same station, but at 20m distance from the shore, maximum dissolved oxygen saturation was determined in July, which confirms the significant influence of the wastewater treatment plant (WWTP) Constanta Sud on the analyzed area.

Statistical analysis (t test, confidence interval 95%, $p = 0.0892$, $t=1.7783$, $df = 22$, St.Dev. of the difference = 1.795) of the long-term data recorded at Casino Mamaia 0m station shows a *small significant* difference between 1959-2008 multiannual monthly average and 2009 monthly average values (Fig. 4.3.5.1.1.6.) most probably due to the July monthly average, 87.7%.

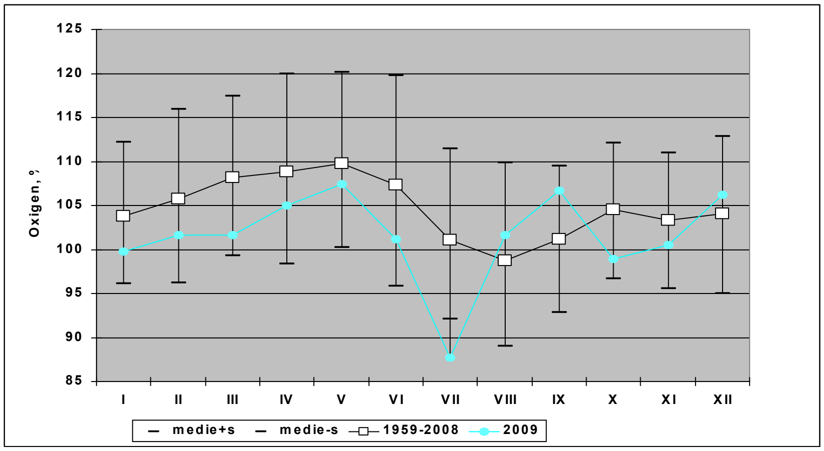


Fig. 4.3.5.1.1.6 - Comparative analysis of multi-annual monthly averages of seawater dissolved oxygen saturation (%) at Constanta, between 1959-2008 and 2009

4.3.5.1.2. Indicators of eutrophication

In 2009**, nitrate** $(NO_3)^-$ concentrations recorded values within the range from 0.37 to 20.92 µM, both extremes belonging to coastal waters (Table 4.3.5.1.2.1.). Statistical analysis ANOVA ($F = 2.00$ $p = 0140$, $F_{cr} = 3086$, $\alpha = 0.05$) underlines the *insignificant* difference between the water bodies, the maximum amount of Constanta Sud Station 5m being an accidental value, due to the presence of Constanta Sud WWTP.

Table 4.3.5.1.2.1 - The main values of nitrate concentrations along the Romanian shore, between February-September 2009

Water	No. of	Mi	Stati	Mon	Ma	Stati	Mont	Avera	St.

body type	sampl es	n. (µ M)	on	th	x. (µ M)	on	h	ge	De v.
Transitio nal waters	31	**1.5 1**	Mila 9	July.	**17. 80**	Portit a 20	Febru ary	5.23	4.8 9
Coastal waters	43	**0.3 7**	EC1	June.	**20. 92**	EC1	Febru ary	3.46	4.0 7
Marine waters	30	**0.5 4**	EC3	June.	**12. 14**	EC3	May	3.47	3.2 7

Insignificant differences are found in long-term data analysis conducted for Casino Mamaia 0m station between 1976-2008 multiannual monthly average concentrations and monthly average values from 2009 (t test, confidence interval 95%, p = 0.4228, t = 0.8167, df = 22, StDev of the difference. = 2.103). Excepting the warm season when the values are decreasing due to the biological uptake and sedimentation, the monthly average concentrations of nitrate are correlated with the average monthly flow of the Danube (km^3/ month) at Isaccea (Fig. 4.3.5.1.2.1.).

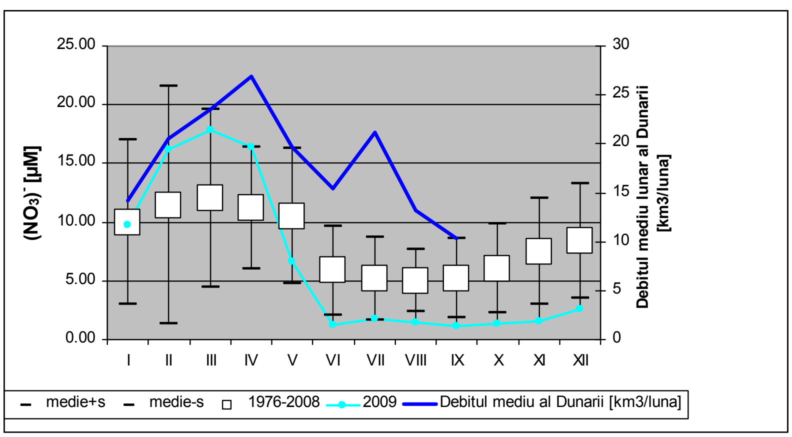


Fig. 4.3.5.1.2.1 - Comparative analysis of monthly multiannual concentration of nitrates (µM), Constanta, between 1976-2008 and 2009

Nitrite $(NO_2)^-$, intermediate forms of redox processes involving inorganic nitrogen species had concentrations in the range of 0.02 µM (the limit of detection) - 2.51 µM (Table 4.3.5.1.2.2.). Due to higher values in the transitional waters, *significant* differences between nitrites concentrations of all water bodies (ANOVA, $F = 12.67$, $p < 0.0001$, $F_{cr} = 3086$, $\alpha = 0.05$) are noticed.

Table 4.3.5.1.2.2 - The main values of nitrites concentrations along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min. (µM)	Station	Month	Max. (µM)	Station	Month	Average	St. Dev.
Transitional waters	31	**0.06**	Sf.Ghe.20m	September	**2.51**	Sulina 20m	September	0.90	0.70
Coastal waters	43	**0.05**	EC1	September	**2.14**	Constanta Sud 5m	September	0.37	0.44
Marine waters	30	**0.02 (<LOD)**	EC3 EC5	September	**1.04**	EC3	May	0.35	0.30

Statistical analysis (t test, confidence interval 95%, $p < 0.0001$, $t = 5.5999$, $df = 22$, St.Dev. of the difference = 0.079) of long-term data (Casino Mamaia station 0m) shows *very significant* differences between 1976-2008 multiannual monthly average and 2009 monthly averages due to the decrease of the latter (Fig. 4.3.5.1.2.2.).

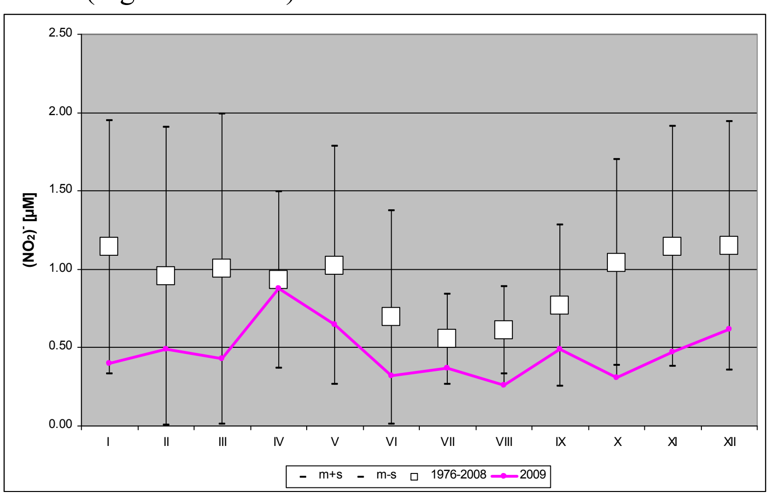


Fig. 4.3.5.1.2.2 - Comparative analysis of monthly multiannual concentration of nitrites (µM), Constanta, between 1976-2008 and 2009

Ammonium $(NH_4)^+$ concentrations registered values within 0,19-27,4 µM excepting Constanta Sud 5m station with very high values both in July (136.08 µM) and September (132, 60 µM) (Table 4.3.5.1.2.3.). Taking into account these values, ANOVA statistical analysis shows *insignificant* difference between the water bodies (F = 1.13, p = 0327, F_{cr} = 3086, α = 0.05).

Table 4.3.5.1.2.3 - The main values of ammonium concentrations along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min. (μM)	Station	Month	Max. (μM)	Station	Month	Media	St. Dev.
Transitional waters	31	**0.35**	Sulina 10m	September	**15.09**	Portita 5m	September	7.58	4.65
Coastal waters	43	**0.74**	Mangalia 20m	July	**136.08**	C-ta Sud 5m	July	12.60	27.68
Marine waters	30	**0.19**	EC4	February	**16.51**	Mangalia 30m	July	5.35	4.10

Although in 2009 ammonium monthly average concentrations fitted with the specific interval of 1980-2008 (Fig. 4.3.5.1.2.3) statistical analysis (t test, confidence interval 95%, p = 0.0187, t = 2.5391, df = 22, St.Dev. of the difference = 0.468) of long-term data (Casino Mamaia 0m station) highlights *significant* difference between 1980-2008 and generally lower concentrations of 2009.

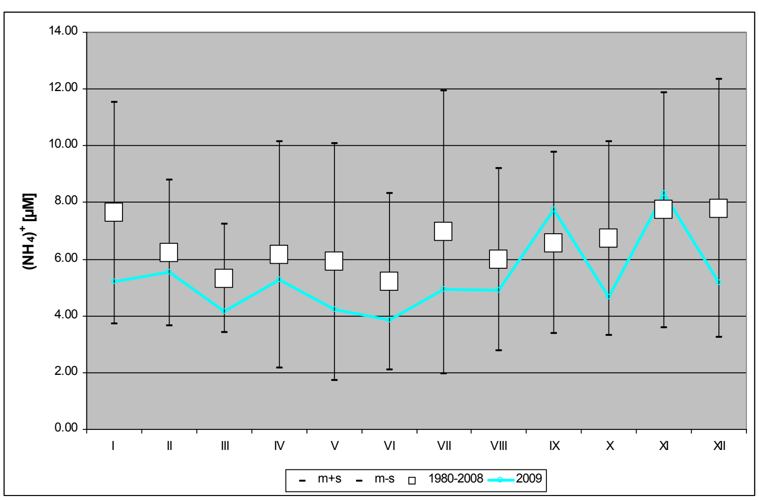


Fig. 4.3.5.1.2.3 - Comparative analysis of monthly multiannual concentration of ammonium (µM), Constanta, between 1980-2008 and 2009

Phosphates **$(PO_4)^{3-}$** recorded in 2009 values within the range *"undetectable"* - 10.44µM, both extremes belonging to coastal waters (Table 4.3.5.1.2.4.). Statistical analysis ANOVA ($F = 0.93$, $p = 0398$, $F_{cr} = 3086$, $\alpha = 0.05$) underlines the *insignificant* difference between all three water bodies concentrations, the maximum amount of Constanta Sud 5m station being accidental due to Constanta Sud WWTP.

Table 4.3.5.1.2.4 - The main values of phosphate concentrations along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min. (µM)	Station	Month	Max. (µM)	Station	Month	Average	St. Dev.
Transitional waters	31	**0.03**	Portita 5m	September	**4.00**	Sulina 10m	July	0.70	0,880
Coastal waters	43	**<LOD**	Casino Mamaia	July	**10.44**	C-ta Sud 5m	September	0.74	2,024
Marine waters	30	**LOD**	EC 5	February	**2.48**	Sf. Ghe 30m	September	0.31	0,445

Statistical analysis (t test, confidence interval 95%, $p < 0.0001$, $t = 9.7791$, $df = 22$, St.Dev. of the difference = 0.259) of long-term data (Casino Mamaia station 0m) shows the v*ery significant difference* between 2009 monthly averages and 1960-2008 multiannual averages (Fig.4.3.5.1.2.4.) due to much lower values recorded in 2009.

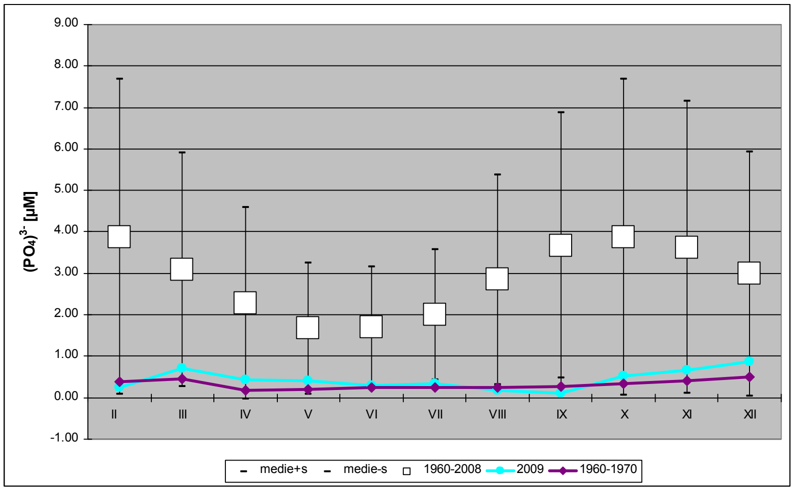


Fig. 4.3.5.1.2.4 – Comparative analysis of monthly multiannual concentration of phosphate (µM) Constanta, between 1960-2008 and 2009

Current levels of phosphate concentrations in coastal waters, Constanta area, are comparable with the range of multiannual average values 1960-1970 (Fig.4.3.5.1.2.4.), a reference period for good seawater quality, with *insignificant* difference (t test, confidence interval 95%, $p = 0.2116$, $t = 1.2867$, $df = 22$, St.Dev. of the difference = 0.074).

Silicates $(SiO_4)^{4--}$ had concentrations within the range 0,4-97,6 µM. Analysis of main values (Table 4.3.5.1.2.5.) highlights the decreasing gradient concentration from north to south, *significant* distinguishing between the three bodies of water, highlighted by statistical analysis (ANOVA, $F = 19.38$, $p < 0.00001$, $F_{cr} = 3086$, $\alpha = 0.05$).

Table 4.3.5.1.2.5 - The main values of silicate concentrations along the Romanian shore, between February-September 2009

Water body type	No. of samples	Min. (µM)	Station	Month	Max. (Mm)	Station	Month	Average	St. Dev.
Transitional waters	31	**0.7**	Gura Buhaz 20m	September	**97.6**	Sulina 10m	July	30.3	29.86
Coastal waters	43	**0.5**	EC2	July	**36.6**	EC1	February	6.2	8.80
Marine waters	30	**0.4**	EC5	July	**28.3**	Mangalia 30m	July	6.1	6.66

Although the monthly average values of silicate concentrations in 2009 fitted with the specific interval 1959-2008 (Fig. 4.3.5.1.2.5.) statistical analysis

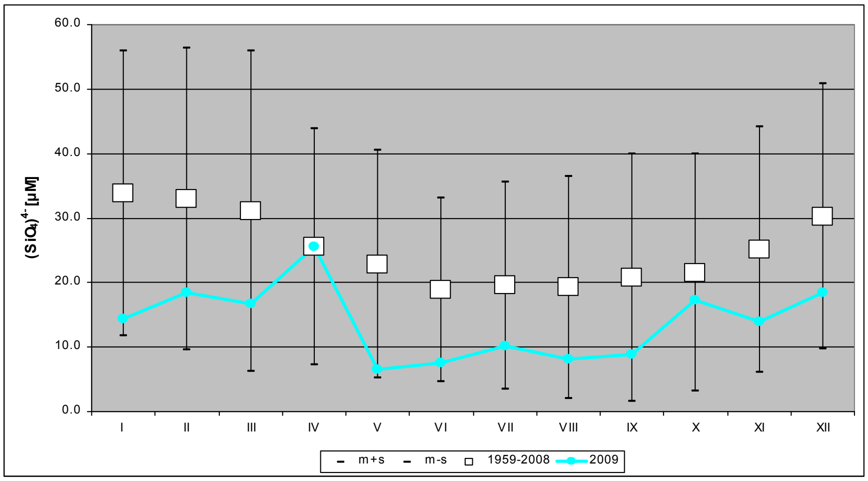


Fig. 4.3.5.1.2.5 - Comparative analysis of monthly multiannual concentration of silicate (µM), Constanta, between 1960-2008 and 2009

(t test, confidence interval 95%, p <0.0001, t = 4.49163, df = 22, St.Dev. of the difference = 2.310) of long-term data (Casino Mamaia station 0m) shows a *very significant* difference between 2009 monthly average values and 1959-2008 multiannual averages of silicate concentration, due to lower values of 2009 (minimum ÷ 6.5 µM in May).

Chlorophyll *a*

Chlorophyll *a* is one of the most common biological parameters determined, as an indicator of phytoplankton biomass and primary productivity. Because of its importance in the marine ecosystems and its easier measuring than phytoplankton biomass, chlorophyll *a* was listed as indicator for the field "Eutrophication" of the EU Water Framework Directive, representing one of the parameters of impact to be monitored.

Chlorophyll *a* concentrations off Constanta, at the coast, ranged from 0.87 to 50.63 µg/l. Mean monthly chlorophyll *a* concentrations ranged from 1.51 to 13.02 µg/l, the highest value was recorded in April, following the maximum value determined earlier this month (50.63 µg/l), probably as a result of an intensive, but very short, algal bloom. Also high values of monthly average concentrations (above annual average - 5.56 µg/l) were determined in February (8.61 µg/l) and May (9.13 µg/l) due to diatom blooms observed in these periods of the year. (Fig. 4.3.5.1.2.6).

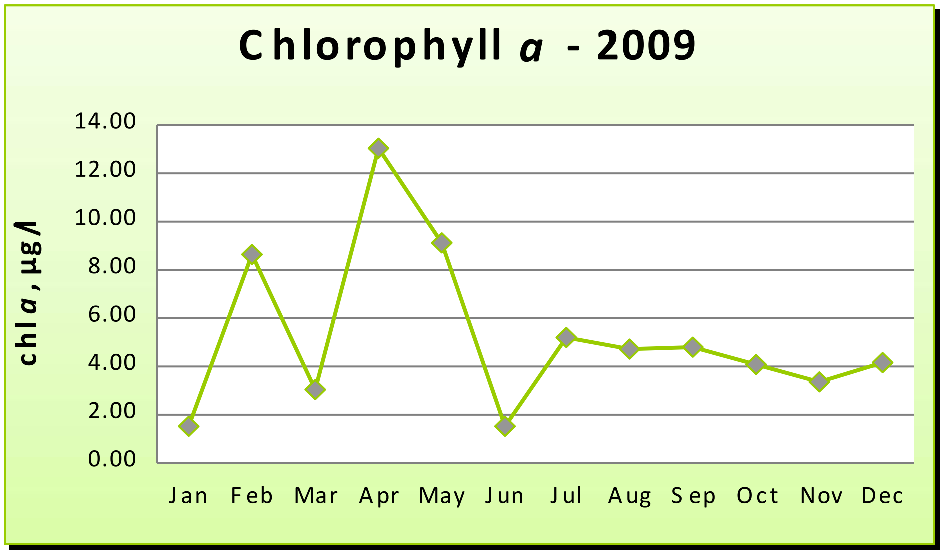


Fig. 4.3.5.1.2.6 - Seasonal variation of monthly average chlorophyll *a* content in coastal waters (Constanta) in 2009

In 2009 the average annual value of chlorophyll *a* content in coastal waters was slightly higher compared to 2008 (5.56 µg/l in 2009, compared to 4.55 µg/l in 2008), but lower than those registered between 2001 and 2009 (5.92 µg/l) (Fig. 4.3.5.1.2.7), confirming the recovery trend of the ecological status of coastal ecosystems in the Romanian Black Sea waters in recent years.

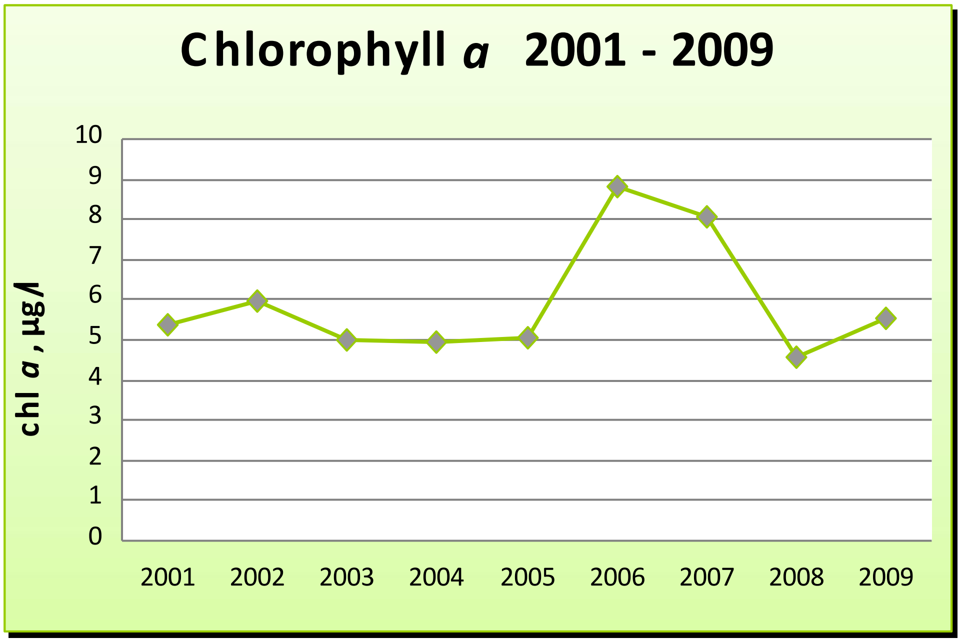


Fig. 4.3.5.1.2.7 - Average annual values of chlorophyll *a* content in coastal waters (Constanta), from 2001 to 2009

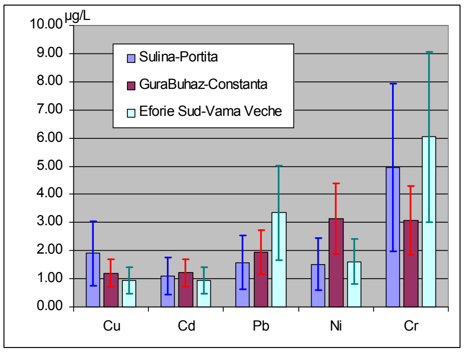
4.3.5.1.3. Indicators of contamination

4.3.5.1.3.1. Heavy metals

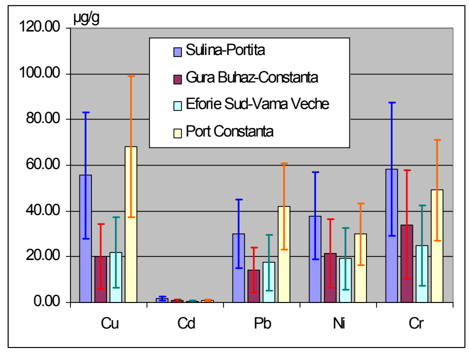
Monitoring of heavy metals in 2009 was made by analyzing samples of water (surface horizon), sediments and molluscs collected in seasons of spring, summer and fall from a network of 44 stations located between the Sulina and Vama Veche, covering the types of water included in Water Framework Directive and Marine Strategy Directive - transitional, coastal and marine.

Average concentrations in water samples were generally moderate and varied between the following limits: 0,94 – 1,91 µg/L Cu; 0,93 – 1,22 µg/L Cd; 1,58 – 3,35 µg/L Pb; 1,52 – 3,13 µg/L Ni; 3,08 – 6,04 µg/L Cr. Distribution of heavy metals showed generally decreasing trend of concentrations along with increasing distance from the coastline, and also some differences between different geographical sectors (Fig. 4.3.5.1.3.1./a).

Average values in sediment were within the following concentration ranges: 20,25 – 68,15 µg/g Cu; 0,39 – 1,61 µg/g Cd; 14,02 – 41,87 µg/g Pb; 19,12 – 37,92 µg/g Ni; 24,86 – 58,19 µg/g Cr. Distribution of metals in sediments from different geographical areas showed increased accumulation in front of the Danube mouths, and in the Port of Constanta, in comparison to central and southern sectors (Fig. 4.3.5.1.3.1./b).



a)



b)

Fig. 4.3.5.1.3.1 - Distribution of heavy metal concentrations in waters (a) and sediments (b) in different sectors of the Romanian littoral in 2009

Trends have shown that the values registered in seawater and sediments were within the variation limits measured during 2002 - 2008, even showing in some cases a slight reduction in the concentrations of heavy metals (Fig. 4.3.5.1.3.2.; Fig. 4.3.5.1.3.3.).

Bioaccumulation of heavy metals in mussels (*Mytilus galloprovincialis*) has not recorded values reflecting a significant impact. Average concentrations of Cu (2.09 µg/g/s.p.), Ni (1,07 µg/g s.p.) şi Cr (1,14 µg/g s.p.) were similar with 2008 data, Cd presented a diminished value (0,32 µg/g s.p.), while the average Pb concentration (1.73 mg / g sp) was slightly increased.

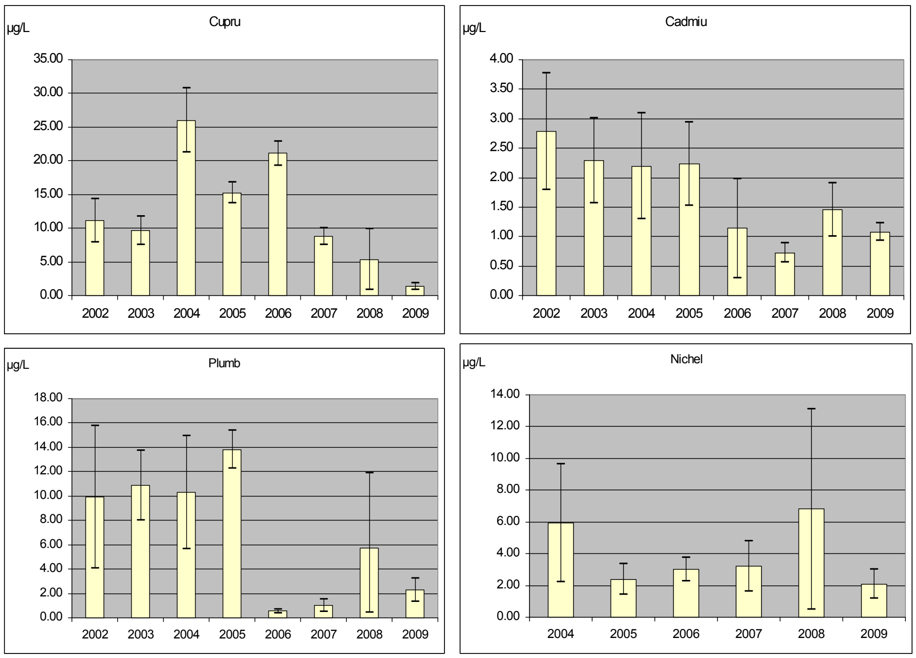
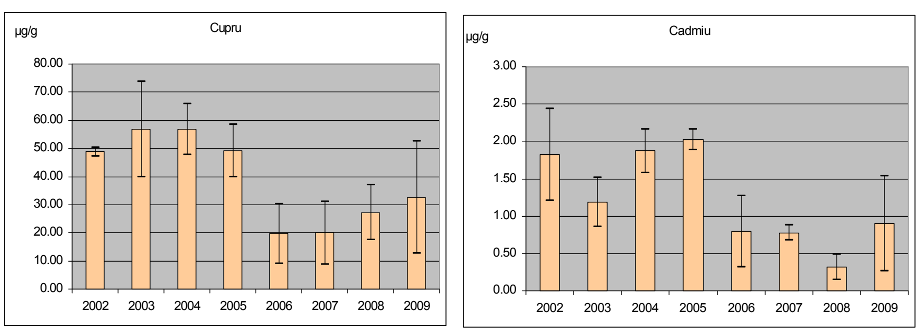
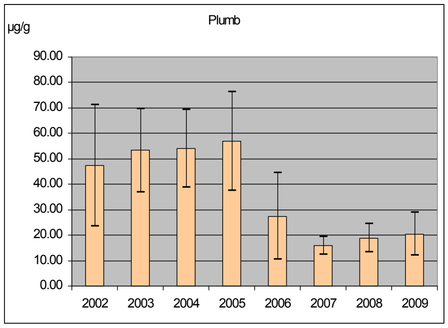


Fig. 4.3.5.1.3.2 - Evolution of annual average concentrations of heavy metals in transitional, coastal and marine waters during 2002-2009





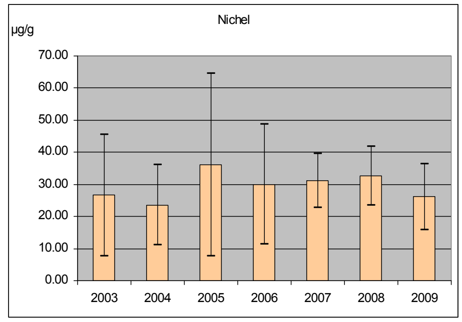


Fig. 4.3.5.1.3.3 - Evolution of annual average concentrations of heavy metals in sediments during 2002-2009

4.3.5.1.3.2. Total petroleum hydrocarbons

Between July and September 2009, the total hydrocarbon concentrations determined in the transitional (Sulina - Gura Buhaz) and coastal waters (Vama Veche - Constanta) showed the presence of the pollutant load. Average value was of 569.9 µg g/l, contained within the limits of variation of 197.0 µg/l (Mangalia - July) and 2.2 mg/l (Sf. Gheorghe - July). Other extreme values were recorded at Gura Buhaz (1.4 mg/l), Mila 9 (1.2 mg/l) and Eforie Sud (1.0 mg/l).

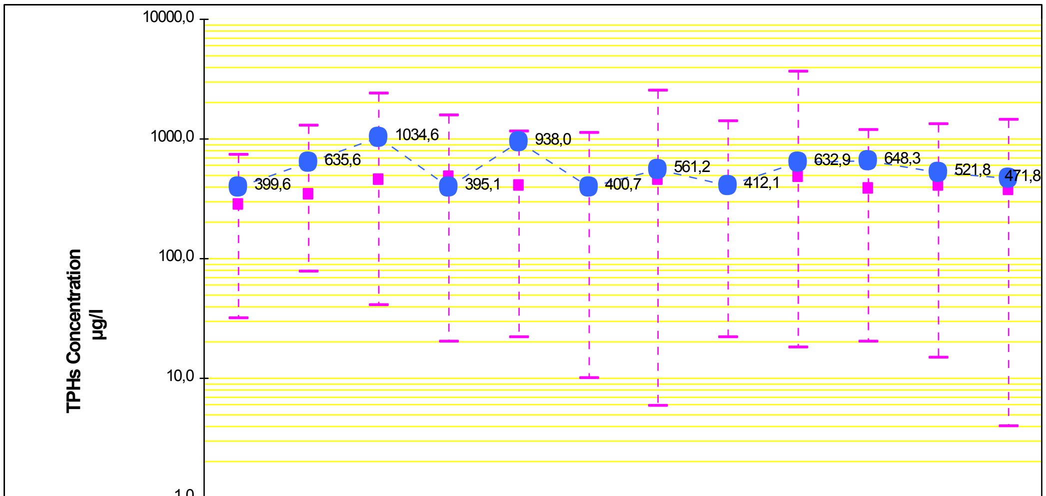
The mean values of total petroleum hydrocarbon (TPHs) content recorded in 2009 (n = 90) were compared with those in 2004-2008 (n = 484). Transitional waters are characterized by a high TPHs content in 2009 - mean value of 601.6 µg /l compared with 2004-2008 - average of 394.8 µg/l. In coastal waters, the average values are within the range of variation for the period 2004-2008 (Fig. 4.3.5.1.3.2.1.). Concentrations of total petroleum hydrocarbons in transitional and coastal waters, recorded in the period 2004-2009, are given in Table 4.3.5.1.3.2.1. Of the 574 samples only 158 showed levels below 200 µg/l - a proposed value for good ecological status by Quality Standard for determination of chemical status of surface water / OMMGA 161/2006.

In 2009, TPHs concentrations in sediment samples ranged from 28.1 to 1282.5µg/g with an average of 238.5 µg/g (n=60 samples). For most stations, average values were within the range of variation from the period 2004-2008 (Fig. 4.3.5.1.3.2.2.). The highest content of TPHs was recorded in sediment samples collected from the northern sector (Sulina- Portita) with an average of 330.2 µg/g, followed by the southern stations Constanta, Mangalia and Vama

Veche –with an average of 260.3 μg/g. The sediments of the central-southern coast (Gura Buhaz-Costinesti) have a lower mean of 116.4 μg/g compared with neighbouring areas. The lowest content in TPHs was determined in sediment from Costinesti (mean of 60.1 μg/g). The downward trend of TPHs content in sediments from Constanta Sud station in 2008-2009 (maximum of 961.0 and 573.7 μg/g) is notable compared with 2004-2007 period when extreme values were recorded up to 11,736.7 μg/g (Fig. 4.3.5.1.3.2.3.).

Thus, it follows that:

- in 2009, mean values of the total petroleum hydrocarbons content in transitional and coastal waters significantly exceeded the concentration of 200 μg/l - proposed value for good ecological status by Quality Standard for determination of chemical status of surface water / OMMGA 161/2006;
- average values of total petroleum hydrocarbon content in sediments are within the range of variation from the period 2004-2008 for most stations; only 43% of sediment samples from Sulina - Vama Veche are characterized by a load in total petroleum hydrocarbons <100 μg/g.

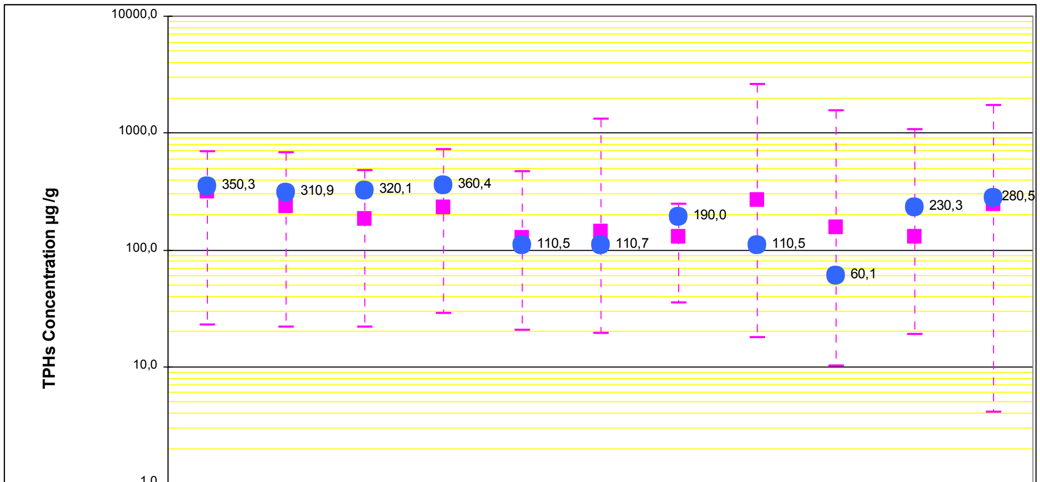


	Sulina	Mila 9	Sf. Gheorghe	Portita	Gura Buhaz	Mamaia	Constanţa Nord	Constanţa Sud	Eforie Sud	Costineşti	Mangalia	Vama Veche
maximum µg/l	729,0	1299,0	2400,0	1559,0	1145,0	1104,0	2558,0	1407,0	3592,0	1171,0	1325,0	1430,0
average 2004-2008, µg/l	284,9	341,4	461,9	486,5	401,5	404,9	458,5	430,0	476,8	389,3	407,9	376,6
minimum µg/l	32,0	77,4	41,0	20,0	22,0	10,0	5,8	22,0	17,8	20,0	15,0	4,0
average 2009, µg/l	399,6	635,6	1034,6	395,1	938,0	400,7	561,2	412,1	632,9	648,3	521,8	471,8

Fig. 4.3.5.1.3.2.1 - The concentration of TPHs (µg/l) in transitional and coastal waters in 2009 compared with 2004-2008

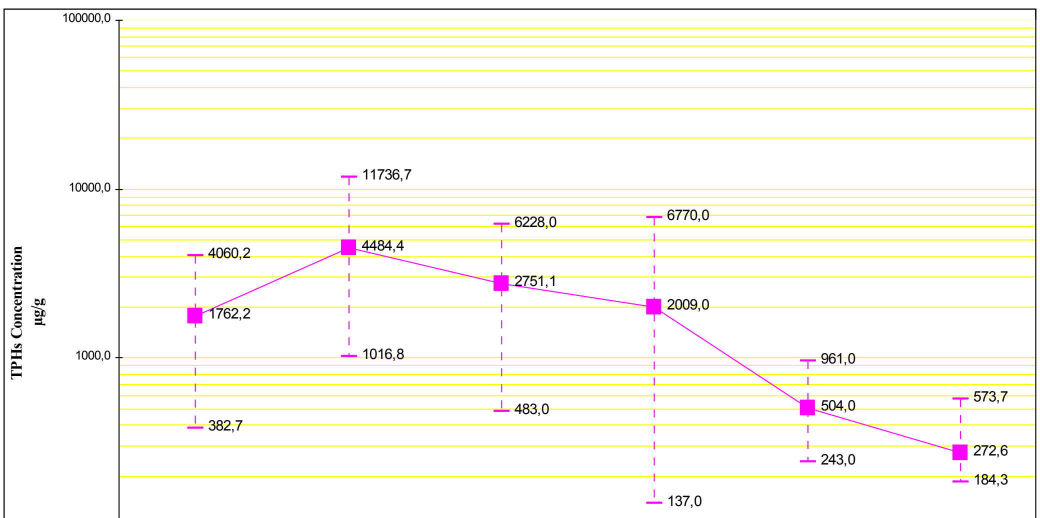
Table 4.3.5.1.3.2.1 - The concentration of TPHs (µg/l) in transitional and coastal waters in 2004-2009

Year	Maximum	Minimum	Average	Mediane	No.of samples
2004	1284,0	4,0	244,4	224,8	102
2005	470,4	34,5	210,7	179,3	73
2006	1145,0	100,0	358,2	229,0	89
2007	1325,0	200,0	653,8	321,0	115
2008	3592,0	15,0	511,5	232,0	105
2009	2188,7	197,0	568,9	481,4	90



	Sulina	Mila 9	Sf.Gheorghe	Portiţa	Gura Buhaz	Cazino Mamaia	Constanţa Nord	Eforie Sud	Costineşti	Mangalia	Vama Veche
maximum µg/g	686,0	672,0	476,9	719,0	468,0	1305,8	247,8	2619,0	1542,0	1075,8	1712,6
average, 2004-2008 µg/g	313,0	234,7	185,0	229,4	126,6	143,1	130,2	267,6	156,4	129,3	244,0
minimum µg/g	23,0	22,0	21,8	28,5	20,6	19,4	35,2	17,8	10,1	19,0	4,1
average, 2009 µg/g	350,3	310,9	320,1	360,4	110,5	110,7	190,0	110,5	60,1	230,3	280,5

Fig. 4.3.5.1.3.2.2 – The concentration of TPHs (µg/g) in sediments of Sulina-Vama Veche in 2009 compared with 2004-2008



	2004	2005	2006	2007	2008	2009
maximum µg/g	4060,2	11736,7	6228,0	6770,0	961,0	573,7
average µg/g	1762,2	4484,4	2751,1	2009,0	504,0	272,6
minimum µg/g	382,7	1016,8	483,0	137,0	243,0	184,3

Fig. 4.3.5.1.3.2.3 – The concentration of TPHs in (µg/g) sediments at Constanta Sud in 2004 - 2009

4.3.5.1.3.2. Polynuclear Aromatic Hydrocarbons (PAHs)

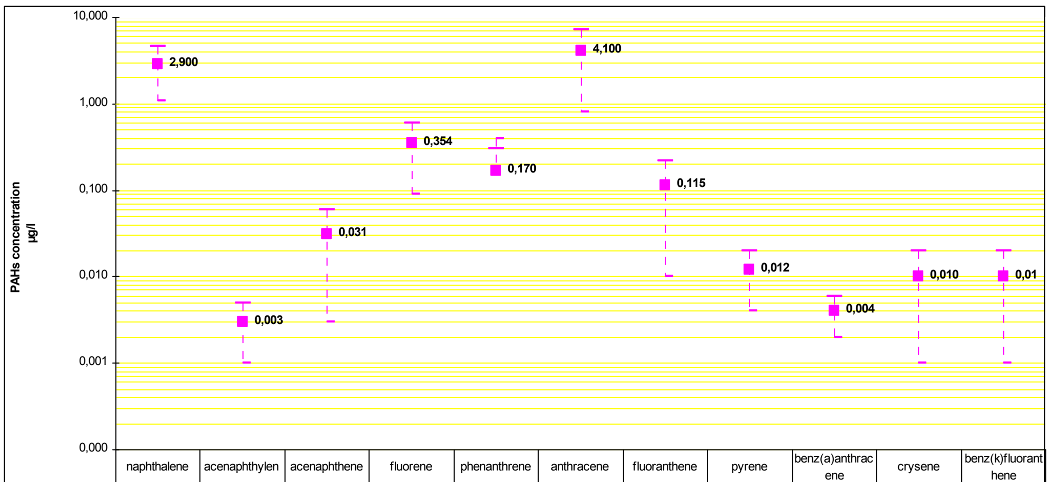
Between July and September 2009, polynucleare aromatic hydrocarbons-PAHs concentration in sediments (n = 45) and water (n = 90) of the Sulina - Vama Veche area were determined. It was intended to identify the 16 priority hazardous organic contaminants, common in the marine environment: naphthalene, acenaphthene, acenaphthylene, anthracene, phenanthrene, fluorene, fluoranthene, pyrene, benzo (a) anthracene, crysene, benzo (b) fluoranthene, benzo (k) fluoranthene, benzo (a) pyrene, benzo (g,h,i) perylene, dibenzo (a,h) anthracene, indeno (1,2,3-c,d) pyrene.

The results indicate a high level of diversity of polynucleare aromatic hydrocarbons in the transitional (Sulina - Gura Buhaz) and coastal waters (Vama Veche-Constanta). The presence of the following individual compounds was identified: naphthalene, acenaphthylene, anthracene, fluorene, fluoranthene, pyrene, chrysene, benzo [a] anthracene, benzo [k] fluoranthene (Fig. 4.3.5.1.3.3.1). The mean concentration of following PAHs (µg/l): anthracene, fluorene, phenanthrene, fluoranthene, naphthalene exceed the limit allowed by Decision No. 351 of April 21, 2005 approving the program to phase out discharges, emissions and losses of priority hazardous substances (Table 4.3.5.1.3.3.1).

Table 4.3.5.1.3.3.1 - The mean PAHs concentration (µg/l) beyond acceptable limits in transitional waters (Sulina - Gura Buhaz) and coastal waters (Constanta - Vama Veche), in 2009

Polynuclear Aromatic Hydrocarbons - PAHs (µg/l)							
	naphthalene	**phenanthrene**	**anthracenene**	**fluoranthene**	**Benzo (b) fluoranthene + benzo (k) fluoranthene**	**benzo (a) pyrene**	**benzo (a) anthracene**
Limits allowed *	1,20	0,03	0,063	0,09	0,03	0,05	0,01
Average	2,90	0,17	4,100	0,11	0,01	-	0.004

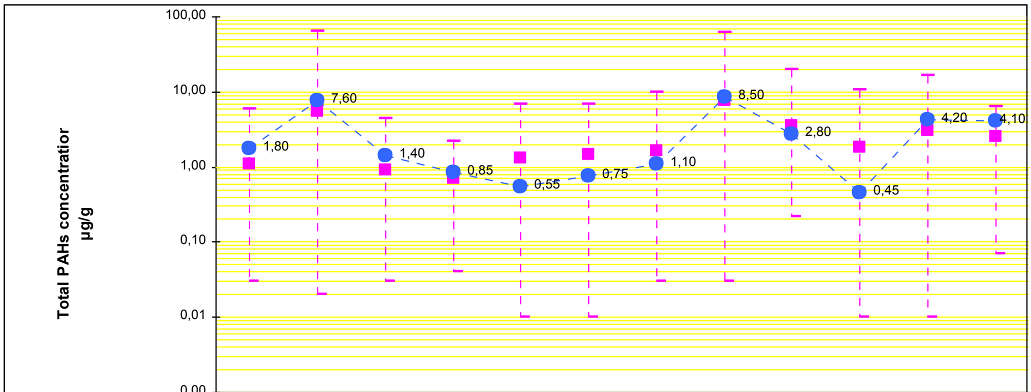
*Quality standards for coastal and territorial waters / Tab.3. / Decision no. 351/21.04.2005



	naphthalene	acenaphthylen	acenaphthene	fluorene	phenanthrene	anthracene	fluoranthene	pyrene	benz(a)anthracene	crysene	benz(k)fluoranthene
maximum µg/l	4,700	0,005	0,060	0,600	0,300	7,200	0,220	0,020	0,006	0,020	0,02
2009,average µg/l	2,900	0,003	0,031	0,354	0,170	4,100	0,115	0,012	0,004	0,010	0,01
minimum µg/l	1,080	0,001	0,003	0,090	0,400	0,820	0,010	0,004	0,002	0,001	0,001

Fig. 4.3.5.1.3.3.1 - The average, maximum and minimum of PAHs (µg/l) for the most representative compounds found in transitional coastal waters, in 2009.

In 2009, mean total content of polynucleare aromatic hydrocarbons - ΣPAHs (µg/g) in sediments was situated in the specific range for the period 2004-2008 for most stations (Fig. 4.3.5.1.3.3.2.).



	Sulina	Mila 9	Sf. Gheorghe	Portiţa	Gura Buhaz	Mamaia	Constanţa Nord	Constanţa Sud	Eforie Sud	Costineşti	Mangalia	Vama Veche
maximum µg/g	5,90	64,80	4,40	2,20	6,89	6,91	9,79	61,26	19,70	10,67	16,43	6,34
2004-2008,average µg/g	1,10	5,50	0,90	0,70	1,31	1,46	1,66	7,68	3,59	1,87	3,08	2,57
minimum µg/g	0,03	0,02	0,03	0,04	0,01	0,01	0,03	0,03	0,22	0,01	0,01	0,07
2009,average µg/g	1,80	7,60	1,40	0,85	0,55	0,75	1,10	8,50	2,80	0,45	4,20	4,10

Fig. 4.3.5.1.3.3.2 - Total polynuclear aromatic hydrocarbons-ΣHAP (µg/g) concentration in sediments from Sulina – Vama Veche in 2009 compared with 2004-2008

Highest ΣPAHs content were determined in samples collected of Mila 9 - average 7.6 µg/g and 8.5 µg/g at Constanta Sud. Higher average values were recorded in the southern coastal stations: Mangalia (4.2 µg/g) and Vama Veche (4.1 µg/g). Lowest ΣPAHs content was determined in the southern sector at Costinesti with an average of 0.45 µg /g.

The level of total PAHs in sediment samples collected in 2009 was compared with that obtained in the period 2004-2008. 50% of samples of marine sediment concentration exceeded 0,8 µg/g and only 17% were below 0,1 µg/g (Fig. 4.3.5.1.3.3.3.).

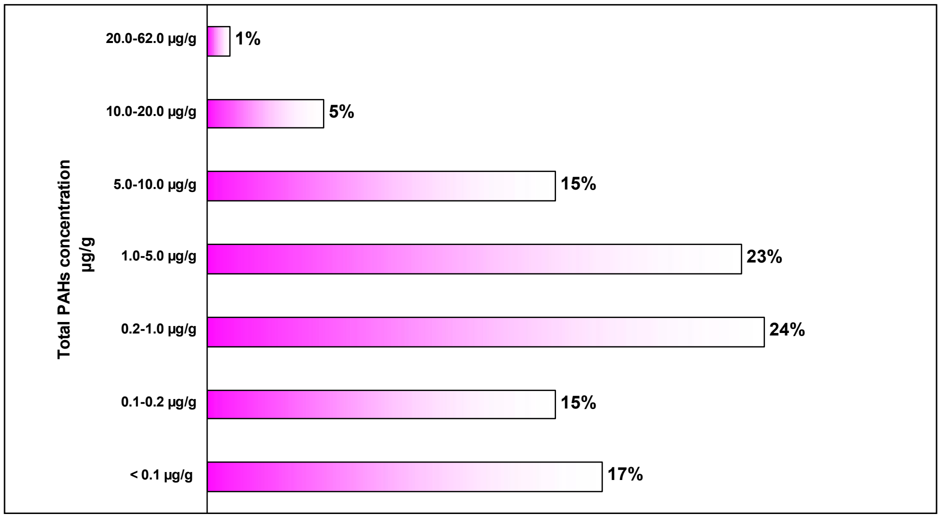


Fig. 4.3.5.1.3.3.3 - Levels of total PAHs (µg/g) in sediments from Sulina – Vama Veche between 2004-2009

For data analysis carried out between the period 2004 and 2009 on the PAH concentrations in marine sediments the presence of the following compounds was found: naphthalene, phenanthrene, anthracene, fluoranthene, pyrene, benzo (a) anthracene, fluorene, chrysene, acenaphthene, acenaphthylene. Naphthalene and anthracene are dominant compounds in sediments collected from stations at Constanta Sud and Eforie Sud. In 20-24% of sediment samples collected in the period 2004-2009 the two organic compounds exceeded the concentration of 1 µg/g (Fig. 4.3.5.1.3.3.4.). Moderate mean values of 0.1-0.3 µg/g were recorded for the remaining aromatic compounds, the level of 1 µg/g was exceeded by 1-6% of the samples.

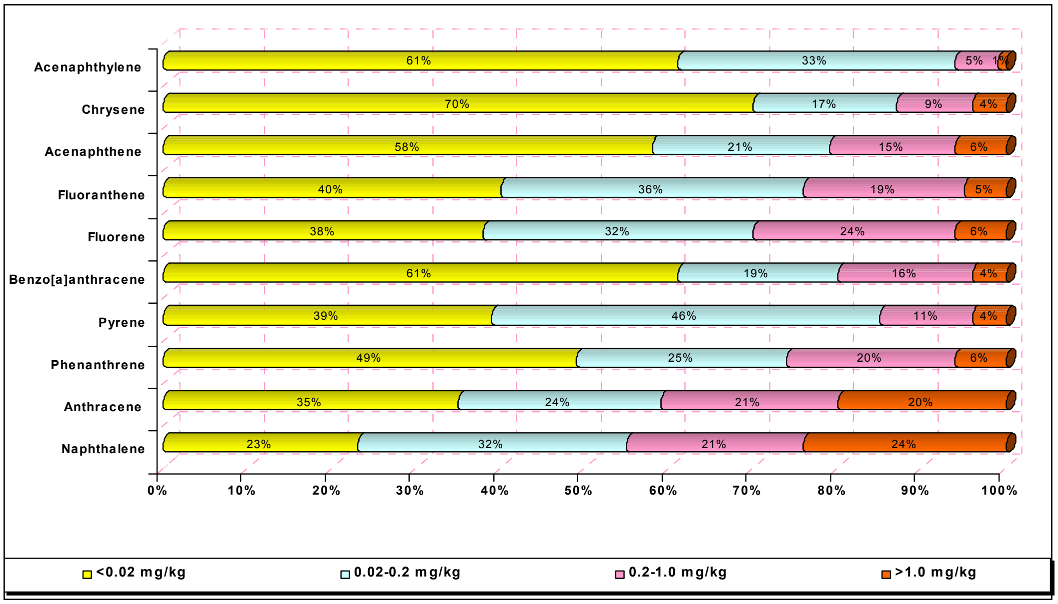


Fig. 4.3.5.1.3.3.4 - The level of PAHs (μg/g) in sediments from Sulina–Vama Veche between 2004-2009

Therefore:

- in 2009, mean levels of PAHs in transitational and coastal waters exceeded permissible limits of Decision No. 351 of April 21, 2005 for the following compounds: anthracene, fluorene, phenantrene, fluoranthene naphthalene;
- naphthalene and anthracene are the dominant organic pollutants in marine sediments collected in the period 2004-2009; in 20-24% of samples collected from Sulina- Vama Veche, concentrations of two compounds exceeded level of 1μg/g;
- in 2009, mean total PAHs concentrations in sediments were situated in the specific range for the period 2004-2008, the highest content was determined in samples from the southern sector.

4.3.5.1.3.4. Organochlorinate pesticides

Organochlorinate pesticide concentrations in sediments, water and organisms are indicators of environmental contamination status. In 2009, organoclhorurate pesticides (HCB, lindane, heptachlor, aldrin, dieldrin, endrin, DDE, DDD, DDT) in seawater varied within comparable limits to transitional waters (Sulina-mouth Buhaz) and coastal waters (Constanta - Vama Veche); the maximum values are below 0.200 µg/l, much lower than those recorded in 2008 (0.185 µg/l in 2009 compared with 0.469 µg/l in 2008 – coastal waters and 0.149 µg/l in 2009 towards 0.324 µg/l in 2008 – transitional waters).

In sediments, a high pesticide level (0.13 µg/g dry weight) was recorded in the southern area (Constanta-Vama Veche). The maximum concentration values measured in 2009 are lower than those recorded in 2008: 0.129 µg/g dry weight in 2009 towards 0.298 µg/g dry weigh in 2008 - southern area and 0.019 µg/g dry weight in 2009 towards 0.184 µg/g dry weight in 2008 - northern area.

Pesticide concentration in organisms is an organoclhorurate impact indicator of environmental contaminants. Analysis of these parameters in bivalves (Fig. 4.3.5.1.3.4.1.) showed a lower maximum extent of concentration in 2009 (0.124 µg/g dry tissue) compared with 2008 (0.21 µg/g dry tissue).

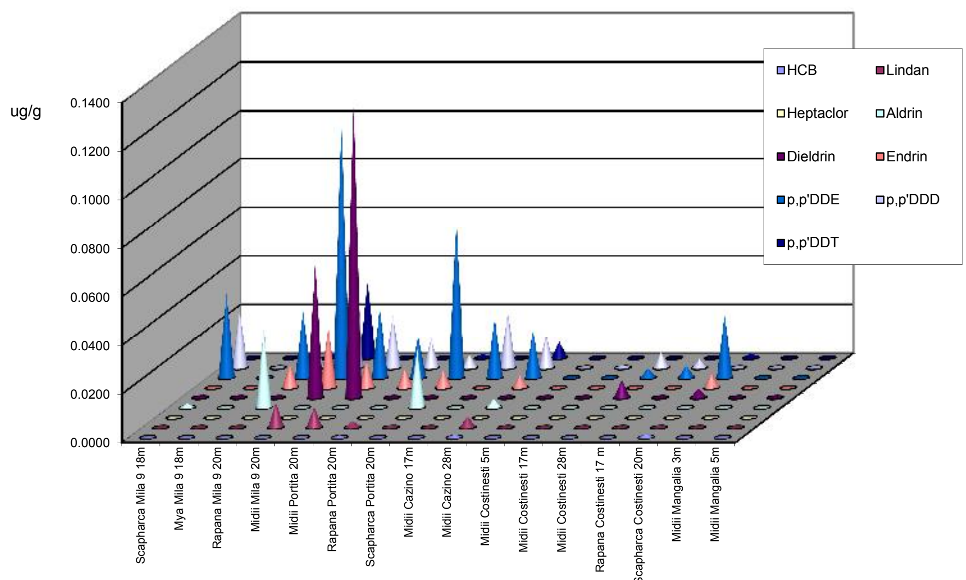


Fig. 4.3.5.1.3.4.1 - Chlorinated pesticide concentrations in bivalve tissue samples from the Romanian Black Sea coast in 2009

The downward trend in the concentrations of chloride pesticides registered in the last period, 2004 to 2008, in all environmental compounds (water, sediment, biota), continued in 2009.

4.3.5.1.3.5 Microbiological charge

Microbiological charge, a state indicator of contaminants in marine environment, was acceptable in the Romanian Black Sea bathing water during 2009; concentrations of enteric bacteria [total coliforms (TC), faecal coliforms (FC), faecal streptococci (FS) have been generally found varying below the limits of National Norms and EC Bathing Water Directive.

The obtained results in August 2009 were in compliance with EC Bathing Water Directive (76/160/EEC). The situation identified for this period (100% compliance with mandatory and guide values for the TC, FC and FS parameters) reflects an improvement of the Romanian Black Sea bathing water in comparison with the last 5 years (2004 – 2008), under the hydro-meteorological conditions (high values of coastal seawater temperatures) specific for the hot summer season of 2009 (Fig. 4.3.5.1.3.5. 1).

The highest values of enteric bacteria TC, FC and FS (> 16 000 germs / 100 ml) were identified as usual in the areas under the influence of sewage discharge, shown a possible negative impact on human and environmental health.

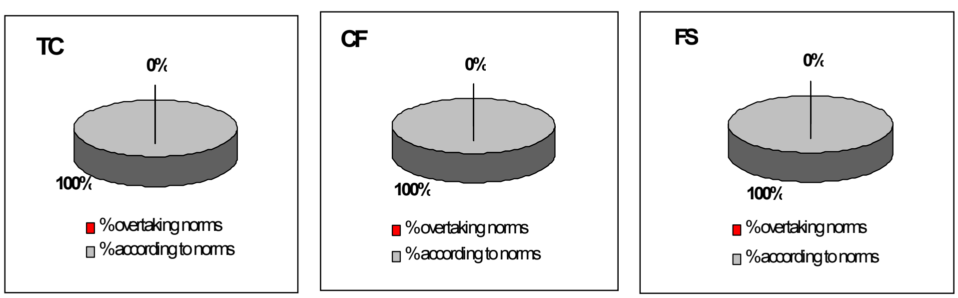


Fig. 4.3.5.1.3.5.1 - The percentage (%) of Romanian coastal bathing waters compliance with mandatory and guide values (95 % < 10000 per 100 ml mandatory value for TC; 95 % < 2000 per 100 ml mandatory value for FC and 100 per 100 ml mandatory value for FS) of National Norms and EC Bathing Water Directive (76/160/CCE), during August 2009

Chapter 6 - NATURE AND BIODIVERSITY CONSERVATION, BIOSECURITY

6.2. Natural habitats. Wild flora and fauna

6.2.5. Marine habitats

The diversity of marine habitats, characterized using the **EUNIS** (**EU**ropean **N**ature **I**nformation **S**ystem of the European Environment Agency) classification system evinced the existence of two habitat types in the water column and of about 150 benthic habitat types. Of these, 5 types are vulnerable: infralittoral hard clay banks with *Pholas dactylus,* infralittoral rock with *Petricola litophaga,* midlittoral sands with *Donacilla cornea, Zostera noltii* meadows and *Cystoseira barbata* belts. All these habitat types are of national and regional (Black Sea) interest. At present the area covered by these habitats of national importance has not been evaluated.

The number of habitats of European (Natura 2000, Habitats Directive 92/43/EEC) interest was evaluated at 8 general types:

1110 - Sandbanks which are slightly covered by seawater all the time
1130 - Estuaries
1140 - Mudflats and sandflats not covered by seawater at low tide
1150 - Coastal lagoons
1160 - Large shallow inlets and bays
1170 - Reefs
1180 - Submarine structures made by leaking gases
8330 - Submerged or partially submerged sea caves

with 28 subtypes. In 2009 no research especially directed at inventorying marine habitats was made; collateral information was obtained from underwater exploration within other projects.

In human-impacted areas of habitat 1130 – Estuaries, 3 non-indigenous species, new for the Black Sea were found: the prawn *Palaemon macrodactylus* Rathbun, 1902 and the crabs *Dyspanopeus sayi* S. I. Smith, 1869 and *Hemigrapsus sanguineus* de Haan, 1835.

Habitat mapping has commenced in two **Natura 2000** marine sites, ROSCI0197 – “Submerged beach from Eforie” and ROSCI0273 – “Cape Tuzla marine area”.

At the site ROSCI0197 - “Submerged beach from Eforie”, 5 elementary subtypes of Natura 2000 habitats are present:

1. 1110-3 Shallow fine sands: Fine sands with shell rests and pebbles at the surface, from the shore to t4-5 m isobaths;
2. 1110-4 Well sorted sands: In continuation of the shallow fine sands, from the 4-5 m isobaths to the eastern border of the site;

3. 1140-1 Supralittoral sands with or without fast-drying drift lines: Occupies the beach strip which gets washed by waves only during storms. The deposits are made of flotsam which can be vegetal (tree trunks, wood pieces, terrestrial and freshwater plants, algae, leaves), animal (corpses) or anthropogenic (litter), but also the dense foam resulted from marine plankton;
4. 1140-3 Midlittoral sands: Occupies the sand strip at the shoremargin, covered by the swash. This strip may be wider or narrower depending on sea state and much less on the tide, which is very small in the Black Sea (0.3m tidal range). The sand is coarser, mixed with shells and gravel.
5. 1170–9 Infralittoral rock with *Mytilus galloprovincialis*: Found in the south – eastern part of the site, at 10 m depths, it has a special ecological role, through mussels' bio-filtration capacity. The fauna is extremely diverse, including numerous sponge, hydrozoan, polichaete, mollusk, crustacean and fish species, characteristic only for this type of habitat, some of them being rare or protected (Photo nr. 6.2.5.1.).

Photo no. 6.2.5.1 – Infralittoral rock with mussels
(August 2009 - photo Dragoş Micu)

In the site ROSCI0273 – "Cape Tuzla marine area", 18 elementary subtypes of Natura 2000 habitats are present:

1. 1110-3 Shallow fine sands;

2. 1110-4 Well sorted sands;
3. 1110-5 Wave-lashed coarse sands and fine gravels: Narrow submerged beaches, not deeper than 1 m, made of gravel and shingle resulted from erosion of natural rocky coasts;
4. 1110-6 Infralittoral cobbles: The habitat consist from submerged beaches made of cobblestones. The lower limit corresponds to the zone where wave strength becomes insufficient to remove the sediment covering the rocks;
5. 1110-9 Sandy mud and muddy sands bioturbated by *Upogebia pusilla*: On sandy mud, the habitat forms a continuous belt along the Romanian coast, at depths of 10-30m. On muddy sands it has a fragmentary distribution, in sheltered areas, at shallow depths;
6. 1140-1 Supralittoral sands with or without fast-drying drift;
7. 1140-2 Supralittoral slow-drying drift lines: Occupies the portion of boulder shores or cobblestone beaches which is covered by waves only during storms. Flotsam and humidity accumulate and persist in the interstices between the rocks, therefore deposits do not dry easily;
8. 1140-3 Midlittoral sands;
9. 1140-4 Midlittoral detritus on shingle and boulders: In the midlittoral of rocky coasts, on boulders or gravel, in continuity with supralittoral slow-drying drift lines;
10. 1170-2 *Mytilus galloprovincialis* biogenic reefs: Through accumulation of mussel shells, in time a hard substratum is formed, taller than the surrounding sediments (mud, sand, mixtures), on which the living mussels are fixed, together with myriad associated species;
11. 1170-4: Boulders and blocks: occur in the midlittoral an infralittoral of rocky shores, at the base of rocky cliffs. These blocks can be rolled or eroded by water loaded with resuspended sand during storms, hence algal cover is ephemeral. The structural complexity and obscurity attract a very diverse fauna for such shallow waters. It offers a mosaic of microhabitats, forming midlittoral enclaves for species that belong to deeper areas;
12. 1170-5: Supralittoral rock: Is situated above the water level and is sprayed by waves of flushed during storms. The vertical extent depends on wave regime, solar exposure and slope. Harsh conditions make this habitat suitable only for a few hardy species: the lichen *Verrucaria*, isopod crustaceans, the crab *Pachygrapsus marmoratus*, etc. In areas with organic pollution it can be covered by a slippery film made of epi- and endolitic cyanophytes;

13. 1170-6 Upper midlittoral rock: Is located in the upper part of the swash zone is not permanently covered by water, being intermittently wetted by taller waves;
14. 1170-7 Lower midlittoral rock: Located in the lower part of the swash zone and covered by water most of the time. Submersion, strong wave action and bright light are the main factors here. Encrusting corallines *Lithophyllum incrustans*, articulated corallines *Corallina officinalis, C. elongata* and ephemeral macrophytes like *Ulva compressa, Enteromorpha sp., Cladophora sp.* and *Ceramium sp*. Algae make up the algal cover. The fauna is characterized by *Balanus improvisus*, *Haliplanella lineata*, *Mytilaster lineatus* and *Mytilus galloprovincialis*, bryozoans, amphipod and isopod crustaceans, the crabs *Pachygrapsus marmoratus* and *Eriphia verrucosa*;
15. 1170-8 Infralittoral rock with photophilic algae: Begins immediately below the lower midlittoral, where emersion is accidental, and extents down to the lower limit of distribution of photophilic algae. This lower limit is conditioned by light penetration and is very variable, depending on the topography and water clarity. Generally in the Romanian Black Sea this limit is around 10 m depth, but high turbidity areas it can be less than 1 m depth. Between these boundaries the rocky substratum is covered with dense and varied of photophilic algal turfs. It comprehends many facies (including the ones with *Cystoseira barbata* and *Corallina officinalis*) and a high algal and faunistic diversity (Photo no. 6);
16. 1170-9 Infralittoral rock with *Mytilus galloprovincialis*: The infralittoral rock with *Mytilus galloprovincialis* stretches down to maximum 28 meters deep, the lower limit of rocky substrata in the Romanian Black Sea. In the photophilic algal zone it overlaps the previous habitat, but continues deeper. The fauna is highly diverse, including numerous sponge, hydrozoan, polychaete, mollusk, crustacean and fish species, characteristic only for this type of habitat, some of them being rare or protected.
17. 1170-10 Infralittoral hard clay banks with *Pholadidae*: Shaped as plateaus or ridges, which can be partially covered by the surrounding sediments. The boreholes of piddocks *Pholas dactylus* and *Barnea candida* provide this habitat a high three-dimensional complexity and lead to the establishment of a specific fauna.
18. 8330 Submerged or partially submerged sea caves: The floor and walls are covered by marine invertebrate communities (sponges, hydrozoans, anthozoans, bryozoans, colonial tunicates) and sciaphilic algae.

The state of the habitats was evaluated through inventorying habitat types (8 Natura 2000, 152 EUNIS) and assessing conservation status.
Pressure on the habitats was expressed by 10 human activities with impact on the conservation state (same as in previous years).

Photo no. 6.2.5.2 – Infralittoral rock with photophilic algae
(July 2009 – photo Dragoş Micu)

Evolution trends of marine habitats accord with the general rehabilitation tendency, due to diminishing anthropogenic pressures.

Response at environment and environmental policies level was quantified as the number of MPAs / total coast length (2 / 245 km for national MPAs network and 6 / 245 km for Natura 2000 ecological network).

6.3. The State of the Marine Protected Areas
6.3.4. Marine Protected Areas

In accordance with the stipulations of Government Ordinance No. 57 from June 20 2007, regarding the regime of protected areas, the preservation of natural habitats, of the wild flora and fauna (Official Monitor No. 442 from June 29 2007), as well as with the 79/409/CEE and 92/43/CEE European Directives, the following natural protected areas were established in the Romanian marine area:

- ROSPA0076 Black Sea: site of communitary importance, according to the 79/409/CEE Birds Directive, directly nominated Special Protected Area – SPA – through GD No. 1284/2007 regarding the declaration of avifaunistic protected areas as an integrating part of the Natura 2000 European ecological network in Romania - 147 242.9 ha;
- ROSCI0094 - The Sulphurous Springs in Mangalia (362 ha), ROSCI0197 - The Submerged Beach in Eforie Nord - Eforie Sud (141 ha), ROSCI0273 - The Cape Tuzla Marine Area (1.738 ha), ROSCI0237 - The Submerged Methanogen Structures in Sfântu Gheorghe (6.122 ha): Sites of Communitary Importance, according to the 92/43/CEE Habitats Directive, adopted through 2009/92/CE Decision;
- ROSCI0269 - Vama Veche - 2 Mai: Site of Communitary Importance, according to the 92/43/CEE Habitats Directive, adopted through 2009/92/CE Decision, which overlaps the 2 Mai - Vama Veche Marine Reserve, natural protected area of national importance - 5.272 ha;
- ROSCI0066 - the Danube Delta Biosphere Reserve – the marine area: Site of Communitary Importance, according to the 92/43/CEE Habitats Directive, adopted through 2009/92/CE Decision, which overlaps the marine area of the Danube Delta Biosphere Reserve – natural protected area of national and international interest - 121.697 ha.

In 2009, NIMRD started, within a project financed through the Nucleu Programme by the Scientific Research Autority, the charting of the habitats of European interest in the marine sites - ROSCI0197 - The Submerged Beach in Eforie Nord - Eforie Sud (Fig. 6.3.4.1) and ROSCI0273 - The Cape Tuzla Marine Area (Fig. 6.3.4.2), with the transposition of the data in GIS format.

The Danube Delta Biosphere Reserve has its own management plan, which stipulates expenses for biodiversity preservation actions, including for the marine area (buffer zone).

The 2 Mai - Vama Veche Marine Reserve has regulations and a management plan, both approved by the Romanian Academy and presently under approval by the Ministry of Environment and Forests.

The custodian of the 2 Mai - Vama Veche Marine reserve, NIMRD, carried out in 2009, until the month of May (when it sent a notification to the responsible authorities stating it renounces the custody), a series of activities which were appointed to it as custodian:

- carrying out activities of forbidding the access in the strictly protected area (together with the Coast Guard Police);
- carrying out the monitoring of the marine protected area;
- continuing the educational and awareness activities, especially with the support of the Junior Ranger students group from the Elementary School with the classes I-VIII from 2 Mai.

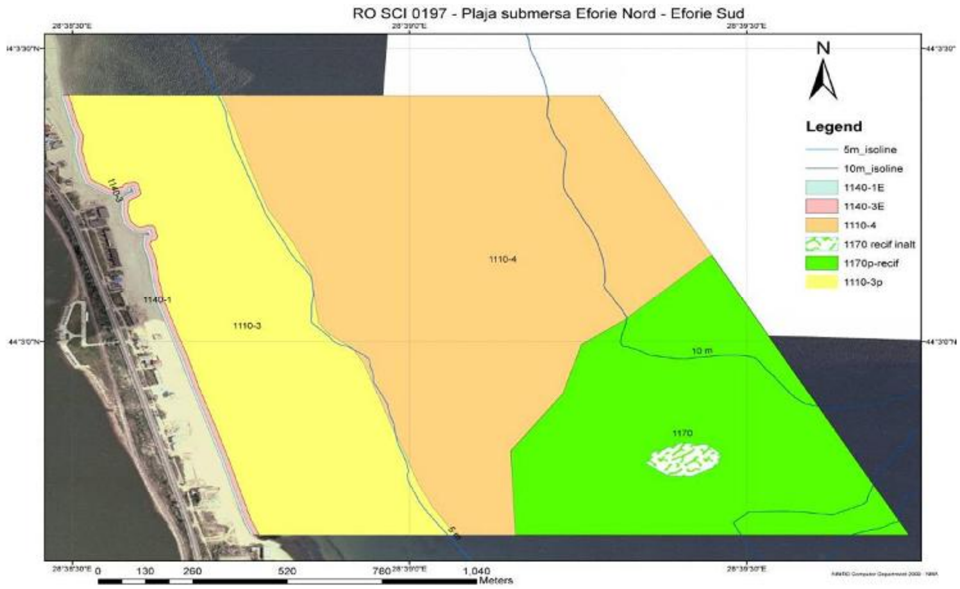


Fig. 6.3.4.1 - Map of the Natura 2000 habitats from ROSCI0197

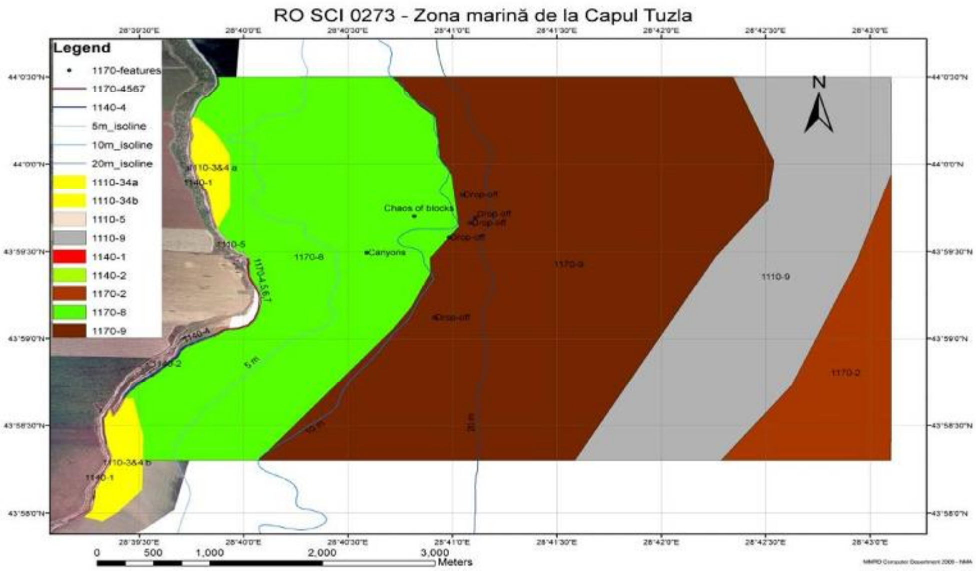


Fig. 6.3.4.2 - Map of the Natura 2000 habitats from ROSCI0273

After renouncing the custody, NIMRD continued the educational and awareness activities in the area, especially together with the Junior Ramgers Club members, through the celebration of the Day of the Reserve and the World Environment's Day (05.06.2009), with the support of the Balkan Environmental Association, which donated bicycles and protection equipment for the patrolling actions in the area.

For the information, education and awareness activities, as well as the monitoring of the reserve (the workforce included, all actions being carried out voluntarily), about 80.000 lei were spent in 2009 by NIMRD.

6.4. Marine and coastal environment

6.4.1. Introduction

World seas and oceans continue to face a strong anthropic pressure amplified recently by the effects of climatic changes with huge long term geopolitical consequences.

The effect of this pressure produces following main threats: pollution, habitat degradation, biodiversity decline, overexploitation of resources, coastal erosion, transfer of species, etc.

The semi - enclosed nature, a big hydrographic basin as well as the unique hydrobiological peculiarities transformed the Black Sea into an extremely sensitive ecosystem exposed to serious threats.

The progressive degradation of the Black Sea ecosystem started in the 60's faced an unusual level compared also with other marine areas between 1980 and 1995.

Not few experts have considered that the continuation of this situation would conduct to an imminent ecological catastrophe.

In the context of some important restructurings of the economic and social systems of the Black Sea coastal states since 1990 dynamic changes have been registered in the components of the marine ecosystem characterized by slight but continuous improvements of the physical and chemical parameters.

Simultaneously the biological indicators have also ameliorated, even if sometimes asymmetrically at structural, functional and productivity level, and trends to new states of equilibrium of biodiversity and living resources are evident.

On that background, a strong increase of the frequency and amplitude of extreme phenomena caused by climatic changes whose effect in many cases is amplified by the impact of human interactions in the marine and coastal environment is acknowledgeable.

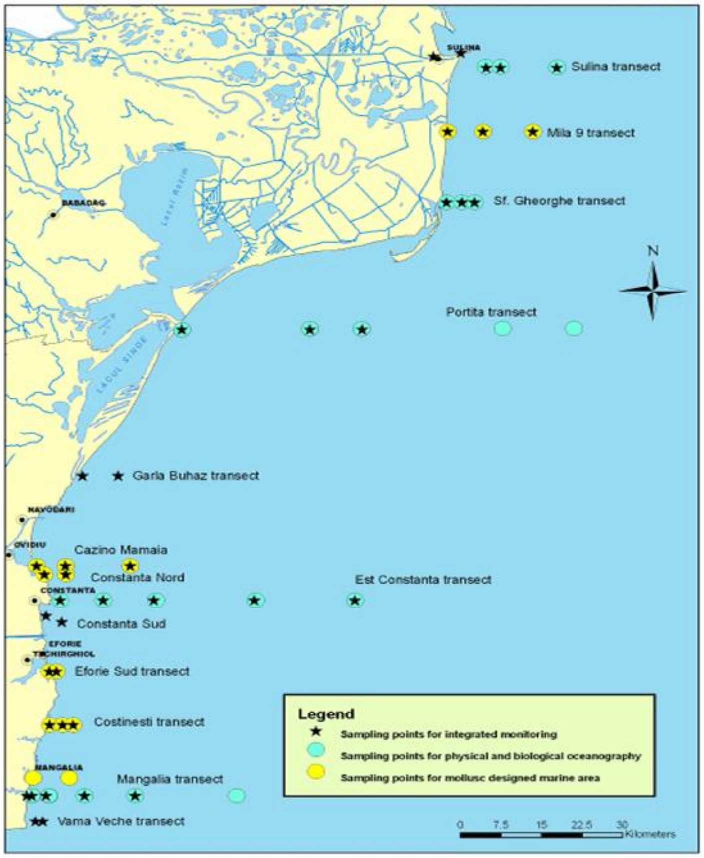
The pressure on land using, natural framework and valuable habitats is confronted with high levels in certain sectors of the Romanian coastal zone.

The present state of the marine ecosystem can be assimilated to a state of *convalescence* with a still fragile equilibrium where any other adverse intervention can induce disastrous effects.

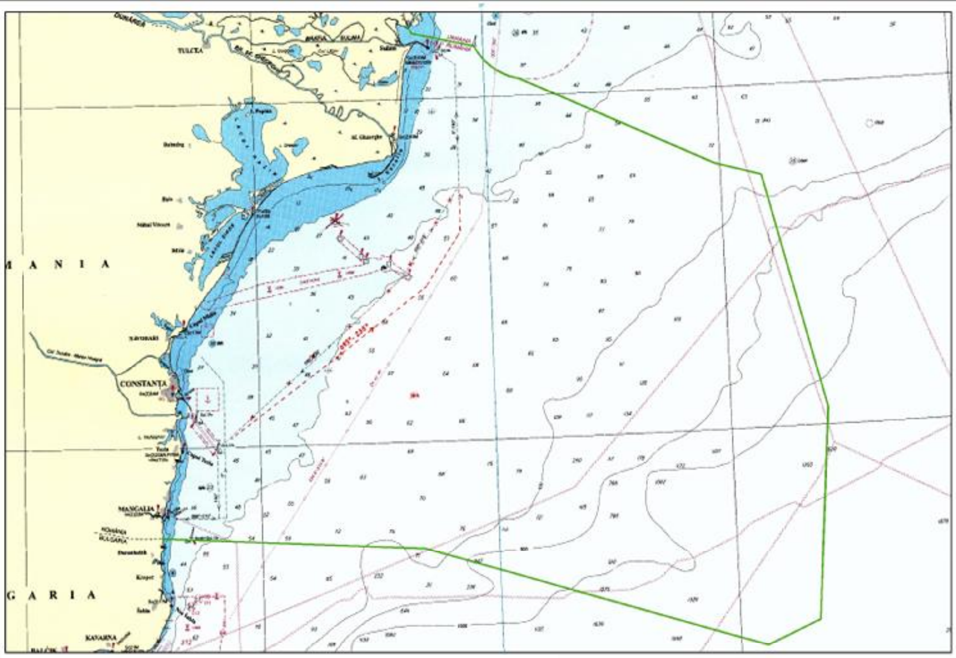
NIMRD contributions to the Report on the marine and coastal environment state derives from the main programmes and research projects (MERI / NUCLEU "CEMAR" RDINA I and II, international), grants (NURC) and studies (ME, NAFA, etc.) conducted in 2009.

The information in this report concerns data collected by the stations network covered both by national monitoring programme and other programs or projects as illustrated (Map no. 1).

We emphasize that on February 9, 2009 the International Court of Justice (The Hague) issued a decision on the division of maritime delineation of the Black Sea. According to border delineation coordinates between Russia and Ukraine in this document, the exclusive economic zone of Romania at Black Sea is about 29,700 km2 (Map no. 2).



Map no. 1 Stations network
National Institute for Marine Research and Development "Grigore Antipa" Constanta



Map no. 2 Romanian exclusive economic zone (2010)

6.4.2. State of marine ecosystem and living resources. Situation of endangered species

6.4.2.1. State of littoral and coastal zone

6.4.2.1.1. Coastal processes

To assess changes in coastal processes of Năvodari-Vama Veche area, the measurements performed in spring 2007 and 2009 were used.

On the basis of determining the rate of changes of coastal processes at sea-land interface, the assessment of magnitude (erosion / dynamic-stabiliy / accretion) to the beach areas by grouping them into 7 classes (class range is 5m) has been achieved, as follows: **EP** - Strong erosion <-12,5 m; **EM** - Average erosion -12.5÷ -7,6m; **ES** - Weak erosion: -7,5 ÷ -2,6m; **SR** - Dynamic Stabilty: -2.5 ÷ 2.5 m; **AS** - Weak accretion 2,6 ÷ 7,5m, **AM** - Average accretion: 7,6 ÷ 12,5m; **AP** - Strong accretion: > 12.5 m.

In the studied sector coastal processes had the following procentage (Fig.6.4.2.1.1.1):

- erosion 64%;
- dynamic stability 18%;
- accretion 18%.

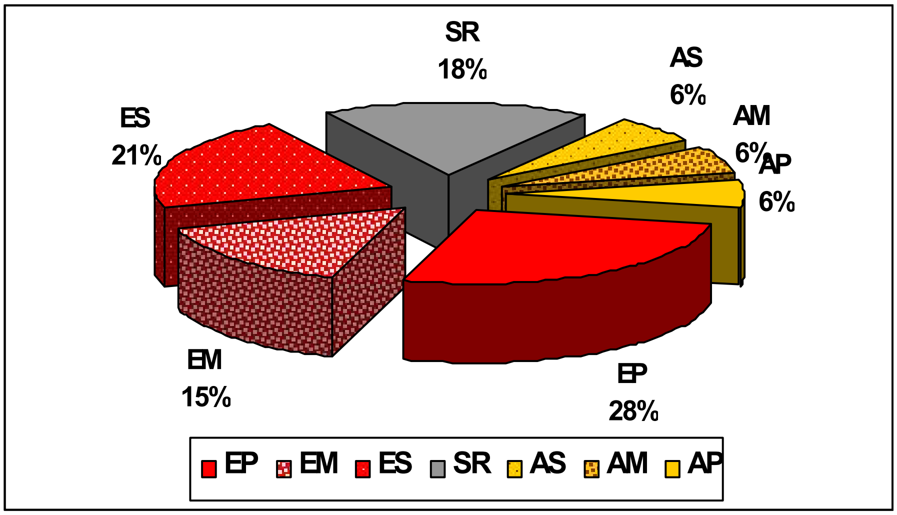


Fig. 6.4.2.1.1.1 - Share of coastal processes (erosion/dynamic-stability/accretion)
of the coastal beaches in Năvodari-Vama Veche area (2007 and 2009)

Geomorphological changes were performed on a length of 11,800m backshore, for which the calculated ratio erosion/accretion was 3.24, as an indicator of environmental state for the beaches alog the southern Romanian coast.

6.4.2.1.2. Sea level

Sea level, as one of the *indicators of coastal zone state,* presented during 2009 a constantly positive deviation from the long term yearly average (Fig. 6.4.2.1.2.1.). Maximum deviation was + 19.1 cm in December, only 4.1 cm below the monthly maximum mean for this month (+36.1 cm in 2002). Annual average was 7,2 cm higher than long term annual average (1933 – 2008).

Division of the yearly mean values in eight statistical intervals (five cm. each) from – 5.0 cm to + 35.0 cm places 2009 year in the VI-th class (21.0 – 25.0 cm), which includes eleven years, when sea level was higher than 21 cm. The most populated interval, the IV-th, includes 24 years. Statistical interval ranges from the I-st class (-5.9 cm to 0 cm) with one value and the interval including values higher than 31 cm with only one value as well (the maximum, 32.5 cm in 2005) (Fig. 6.4.2.1.2.2.).

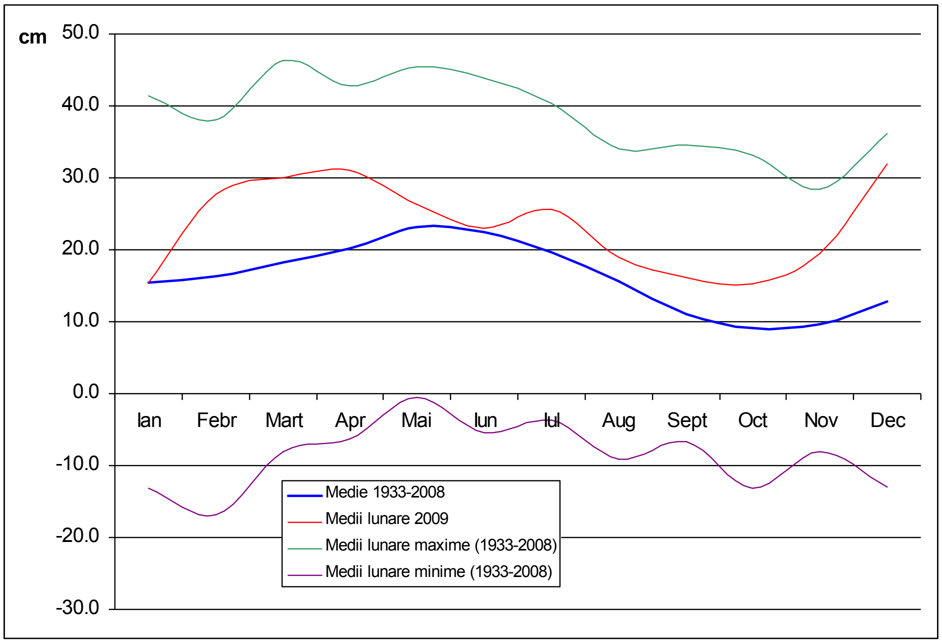


Fig. 6.4.2.1.2.1 - Sea level oscillations at Romanian littoral during 2009

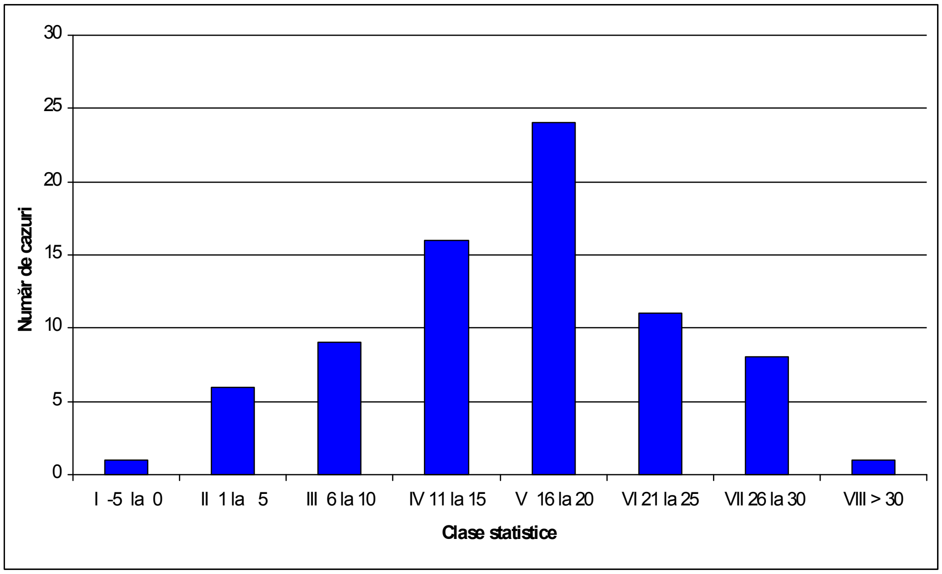


Fig. 6.4.2.1.2.2 - Statistical intervals of the sea level annual means (1933 - 2009)

6.4.2.2. State of marine ecosystem

6.4.2.2.1. Phytoplankton

Identification of the phytoplankton qualitative and quantitative structure, as indicator of state of eutrophication, is based on the sampling carried out on the profiles settled along the whole Romanian littoral, at 5, 20 and 30 m depths, in February, May and July 2009. For the continuity of the results, a set of 77 be-weekly samples, taken at the station Cazino-Mamaia (station for long-term evolution of phytoplankton) was taken into consideration.

133 algal taxa were identified out of the total 99 samples, pertaining to seven taxonomic groups (Bacillariophyta, Dinoflagellata, Chlorophyta, Cyanobacteria, Chrysophyta, Euglenophyta and Cryptophyta). The dominance, in the specific diversity, pertained to Bacillariophyta, with 38% from the total, followed by Dinoflagellata (25%) and Chlorophyta (18%). The marine and marine-brackish water species represented 61% out of the total, while 31% were fresh and fresh-brackish water species. Like in 2008, the number of non-diatoms continued to be higher then diatoms, which represented 38% out of the total.

Multi-yearly evolution of the phytoplankton numerical densities recorded in the Black Sea Romanian sector proved the same general tendency of decrease, evinced at high intensity during the ‘80s (Fig. 6.4.2.1.1.1), as a consequence of mitigation of eutrophication process.

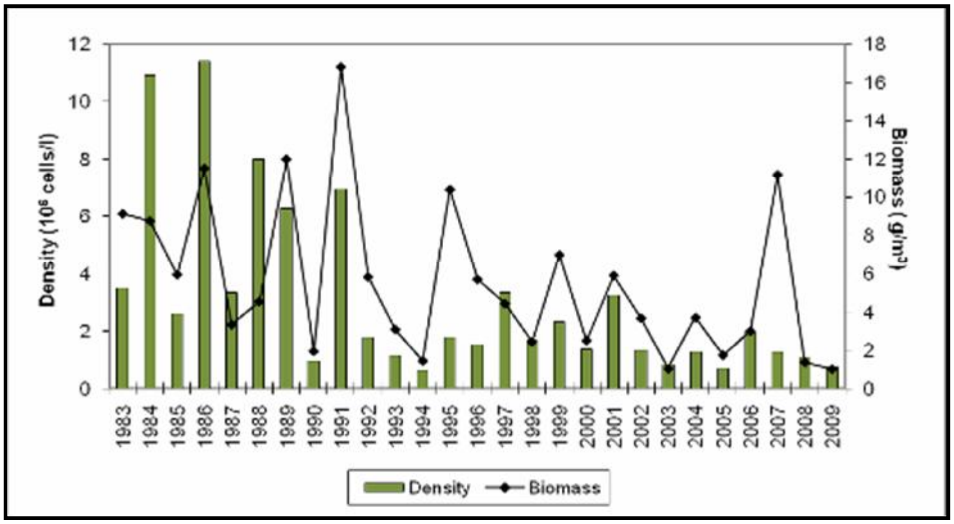


Fig. 6.4.2.2.1.1 - Multi-yearly averages registered for phytoplankton in the marine waters off Constanta between 1983 and 2009

In 2009, the numerical density and biomass values of the phytoplankton registered in the offshore waters (up to 30 m depths) ranged from 0.12 to $16.6 \cdot 10^6$ $cel \cdot l^{-1}$, and 315.87 to 9,186.63 $mg \cdot m^{-3}$, respectively.

The phytoplankton distribution was characterized by a concentration of biomasses in Portita area, in Februry, and on Constanta and Portita profiles in May. In the maximum value of 1,809.98 $mg \cdot m^{-3}$, recorded at Portita, 89% was represented by diatoms (Fig. 6.4.2.2.1.2). In May, biomass maximum value 9,186.63 $mg \cdot m^{-3}$ was five times higher then maximum value registered in February, and was obtained off Constanta; 66% out of this quantity was represented by diatom *Chaetoceros curvisetus*.

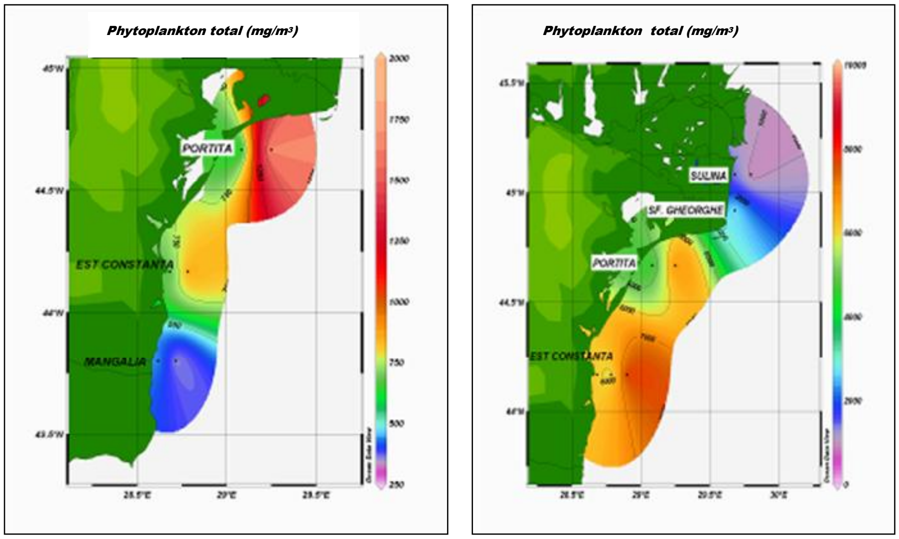


Fig. 6.4.2.2.1.2 - Distribution of total phytoplankton biomasses (mg/m^3) in the Black Sea Romanian sector in February (left) and May (right) 2009

The diatoms prevailed both qualitatively and quantitatively, the main species being *Nitzschia delicatissima, Cerataulina pelagica, Chaetoceros socialis, Skeletonema costatum, Chaetoceros curvisetus, Cyclotella caspia.*

6.4.2.2.2. Algal blooms

The algal blooms, as impact indicator of eutrophication of the marine environment, showed a descendent tendency, both numerically and as amplitude, which has maintained constant during the last years. A number of 6 species registered more then one million cells per liter compared with just 10 species in 2008 (Table 6.4.2.2.1.1).

Table 6.4.2.2.1.1 - Main phytoplankton species identified in the Romanian Black Sea coastal waters with significant densities in 2009

	Species	Coastal waters			Cazino-Mamaia
		February	May	July	
BAC	*Skeletonema costatum*	1814			830
BAC	*Chaetoceros socialis*			4422	1200
BAC	*Chaetoceros curvisetus*		1216		470
BAC	*Cerataulina pelagica*		259		2100
BAC	*Cyclotella caspia*			417	380
BAC	*Nitzschia delicatissima*		15528	604	8690
BAC	*Nitzschia pungens var. atlantica*				720
BAC	*Thallasiosira parva*	544			
DIN	*Prorocentrum minimum*			106	180
EUG	*Eutreptia lanowii*				4320
CRS	*Apedinella spinifera*		101	114	260
CYA	*Aphanizomenon flos-aquae*				490

100-1000 x 10^3 cells/l   1000-10000 x 10^3 cells/l   >10000 x 10^3 cells/l

The diatom *Nitzschia delicatissima* was the first species registering significant quantities, meaning $15{,}528 \cdot 10^3$ cells·l^{-1} in May, off Portita. Early and late May, also *N. delicatissima* registered $8{,}690 \cdot 10^3$ and $2{,}380 \cdot 10^3$ cells·l^{-1}, respectively, in shallow waters off Cazino-Mamaia. During the summer, no significant algal blooms were registered, the only species developing more then millions cells per liter being the diatoms *Chaetoceros socialis* (maximum density - 4,422·103 cells·l^{-1}, in July) and *N. delicatissima* (maximum density – $1{,}750 \cdot 10^3$ cells·l^{-1}, in August).

Comparatively with the previous period, the mean densities of total phytoplankton ($2{,}540 \cdot 10^3$ cells·l^{-1}) were about 3.3 times higher then in 2006 and 2008. As for the mean biomass (1,986.42 mg·m^{-3}), it has the same order of magnitude as the values recorded in 2007 and 2008, namely 2,171.77 mg·m^{-3} and 1,384.24 mg·m^{-3}, respectively.

6.4.2.2.3. Zooplankton

Between February and June 2009, the zooplankton biocoenosis was dominated by the fodder component, the only period with higher values of nonfodder zooplankton being June.

The qualitative structure of zooplankton start to present improvement signs during all the seasons, presenting an uniform abundance distribution of the 24 identified taxa. Maximum values for total zooplankton abundance and biomass have been registered on the Est Constanta profile during June in the station 4, where the abundance reached 37.787 ind/m^{-3} and a biomass of 3.236,19 mg/m^{-3}. The fodder zooplankton registered the maximum values in July in the station 3 of the same profile where the abundance reached 32.346 ind/m^{-3} and a biomass of 1.024,23 mg/m^{-3}.

Rare species during the past decades like the copepod *Centropages ponticus* and cladocerans *Penilia avirostris*, *Evadne spinifera* and *Pseudevadne tergestine* start to register more abundant populations (maximum 19.156 ind/m^3 of *Penilia avirostris* in July). So, during July the dominant group was cladocera, representing up to 70% of the total zooplankton abundance, this situation being similar to the one registered along the Romanian littoral between 1960 and 1970.

From the five zooplanktonic species mentioned in the Black Sea Red Data Book (*Pontella mediterranea, Anomalocera patersoni, Labidocera brunescens, Centropages ponticus* and *Oithona nana),* only two species have been identified in 2009.

The fodder zooplankton abundance registered in 2009 evinced the same positive evolution trend that has been registered during the last years (Fig.6.4.2.2.3.1).

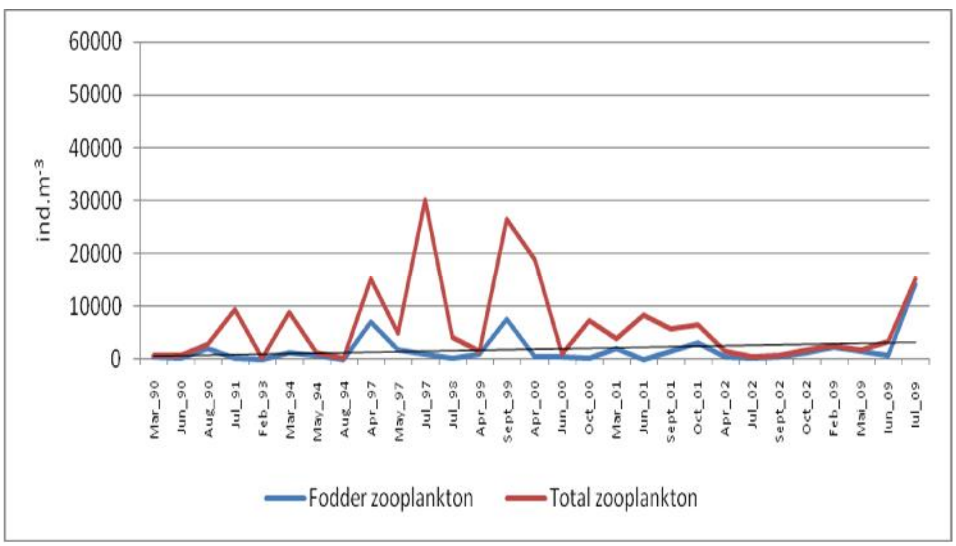


Fig. 6.4.2.2.3.1 - Evolution of the total and fodder zooplankton abundance on the Est Constanta profile

6.4.2.2.4. Phytobenthos

In 2009, the macroalgae sampling took place during July to September in the area between Năvodari and Vama Veche. As result of the qualitative analysis, 12 macroalgal species have been identified along the Romanian seashore: 6 species belonging to phyllum Chlorophyta, one species (*Cystoseira barbata*) to phylum Phaeophyta, 4 species belonging to the phyllum Rhodophyta and one marine eelgrass (*Zostera nana*). Like in the last few years, both qualitative and quantitative dominance of green algae has been noticed, followed by the red algae, by some opportunistic species able to develop noticeable wet biomasses at depths between 0 and 5 meters. Thus, during the summer 2009, the macroalgal flora has been dominated by opportunistic species *Ulva lactuca* (max. 1,537.5 g/m^2 wet weight), *Enteromorpha* sp. (*E. flexuosa* – 1,425 g/m^2 w.w., *E. intestinalis* – 1,040 g/m^2 w.w.) and *Cladophora vagabunda* (approx. 500 g/m^2 w.w.). Among the red algae, *Ceramium elegans* (2,027.5 g/m^2 w.w.), *C. rubrum* and *Callithamnion corymbosum* had a continuous presence during the summer 2009 (Fig. 6.4.2.2.4.1).

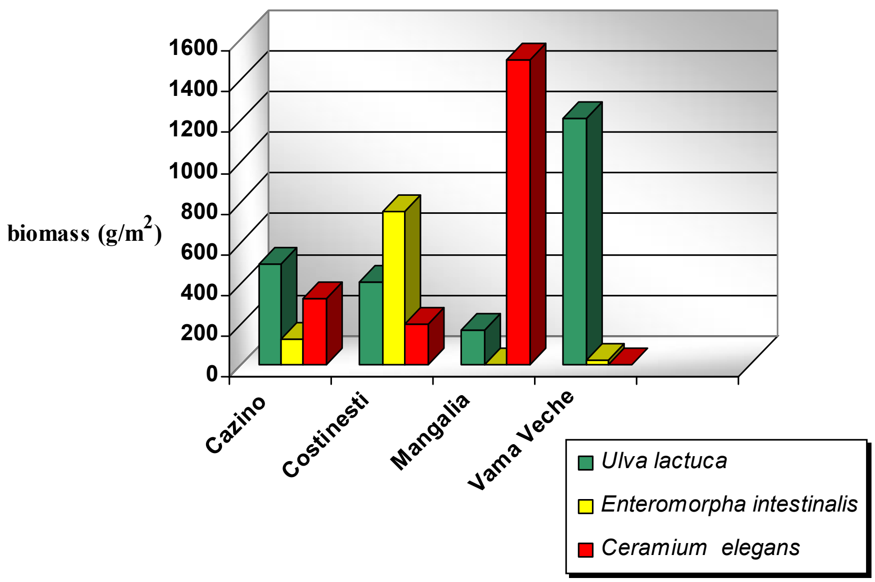


Fig. 6.4.2.2.4.1 - The variation of the average wet biomass for the quantitatively dominant species at the Romanian seashore between July and September 2009

The brown algae are low represented, the only representative found in the mentioned period, belonging to phyllum Phaeophyta, was the perennial species *Cystoseira barbata,* which has been identified in the southern part of the Romanian seashore (along Mangalia to Vama Veche) as thick bunches, able to develop high wet biomasses (3,877.5 g/m^2 w.b., at Mangalia in July; 5,865 g/m^2 w.b. at the same station, in August). *C. barbata* was strongly epiphyted by *Enteromorpha, Cladophora* and *Ceramium*. The marine eelgrass *Zostera nana* was found at Mangalia, in August.

In Mangalia lake, in 2009, as a result of the qualitative and quantitative analysis of samples, 8 macroalgal species have been identified, distributed as follows: 7 green algae (Chlorophyta) and 1 red alga (Rhodophyta). The dominant genera, *Enteromorpha* (487.5 g/m^2 wet weight), *Cladophora* (*C. vagabunda* - 322,5 g/m^2 w.w., *C. sericea* - 270 g/m^2 w.w.) and *Ceramium*, have been represented by eurihaline and cosmopolitans species, that thrives in eutrophic waters, rich in organic matters, as well.

The summer season represents the peak period of macroalgae development. Because of the storms, strong winds and waves, formed along seashore important macroalgal deposits appeared again during the summer 2009, fact also noticed in the last few years. As a result of field observations, in macroalgal deposits the following species were identified: *Ulva lactuca*, *Enteromorpha* sp., *Cladophora* sp., from the green algae and *Ceramium rubrum*, *C. elegans*, *Callithamnion corymbosum,* from the red ones. In macroalgae stocks, *Ulva lactuca* was the dominant species, followed by genera *Ceramium* and *Enteromorpha*. (Fig. 6.4.2.2.4.2)

Fig. 6.4.2.2.4.2 - Macroalgal deposits at Vama Veche in July, 2009

So, during the summer 2009, the macroalgal flora was represented by opportunistic species, with short life cycle, easily adaptable to the present environmental conditions with eutrophic waters. The southern part of the Romanian seashore is characterized by a higher specific biodiversity, compared with the rest of the seashore.

Cystoseira barbata, a very important species for the marine ecosystem, maintains its regeneration, trend also noticed in the last five years.

6.4.2.2.5. Zoobenthos

Zoobenthos, the state indicator of eutrophication in coastal waters still presented signs of revival in terms of species diversity. Qualitative assessment in all monitored areas led to a record of 51 macrozoobenthic species, the faunal composition retaining characteristics of the previous years (Fig. 6.4.2.2.5.1.)

In the current period a slight qualitative equilibrium tendency is observed. The faunal evaluation in coastal waters evinced an improvement in terms of species diversity if the present status is compared with the situation of '90s when benthic fauna was represented by a maximum of 28 species (Fig. 6.4.2.2.5.1.)

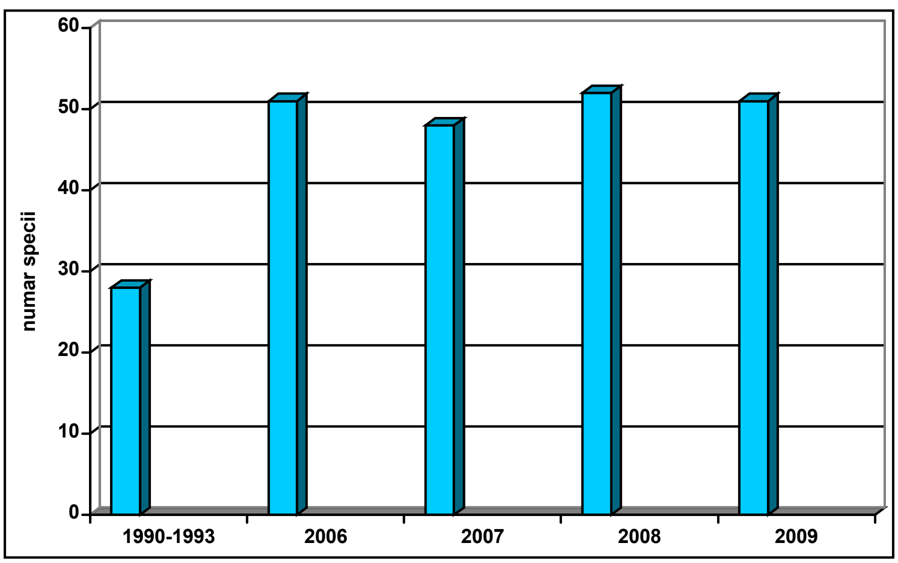


Fig. 6.4.2.2.5.1. Evolution of macrozoobenthic species in coastal waters (Sulina-Vama Veche) between 2006-2009 compared with 1990-1993

Quantitative density indicator increased by over two times higher only in the central zone (Casino - Mamaia) compared with 2007-2008.

In the northern marine sector the estimate of macrozoobenthic biomass of 304 g/m^2 is comparable with the results in 2007 (324 g/m^2) with a slight downward trend as to 2008 (425 g/m^2), 1. 4 times lower, respectively.

In the southern zone, the values of biomass were almost nine times lower than in 2007-2008 when the biomasses were estimated at about 2,052 g/m^2 ; the weighted contribution of mollusks to the biomass increasing was more significant compared with 2009.

In order to annihilate the negative effects on coastal zones, to conserve the coastal ecosystem fragments, a solution to limit the eutrophication by controlling the discharge with fertilizer effect, restrictions on discharge of waste water, especially in summer season is required.

On the other hand, the progressive tendency to increase the number of predacious gastropod *Rapana* on sedimentary bottoms led to the recommendation to temporary suspend the prohibition period for harvesting in order to minimize the negative effect on bivalve mollusks populations (*Mytilus galloprovincialis, Mya arenaria)* which constitute the main food source of this opportunistic species (Micu et *al,* 2008).

6.4.2.2.6. Indicators of biodiversity

Marine biodiversity from the Romanian littoral has been characterized by the specific indicators value.

State of biodiversity has been defined by the number of the total species identified in the Romanian marine waters and the number of threatened species (CR, EN and VU). In the last 15 years, in marine waters approximately 750 species belonging to the main groups (phytoplankton, zooplankton, macrophytobenthos, zoobenthos, fish and mammals) have been identified. In order to have a correct picture of this indicator, the number of species from the main marine biotic components identified every year has been used. The values obtained are rather subjective, varying from a year to another due to the differences between the number of collected samples and the specialists involved in the species identification. Between 1996 and 2008, approximately 200 to 270 species have been identified every year. In 2009, around 300 marine species from the above mentioned groups have been identified. In the Red List, 48 species are categorized as **CR**, **EN**; last year, 26 of them have been identified in Romanian marine waters.

Pressure on biodiversity has been expressed through the occurrence of 28 non-indigenous species (among them 18 are considered in the list of the worst invasive species in Europe elaborated in 2006), 8 species commercially exploited (6 fish and 2 molluscs) and 12 activities with impact on marine biodiversity conservation status.

Impact on marine biodiversity has been estimated through the ratio between the number of threatened species/number of total species identified in 2009, namely 26/300, and through number of disappeared species/number of total species identified in the last 15 years, namely 7/750; the only self-acclimated species is the fish *Mugil soiuyi*. Number of threatened species (48) refers to the species listed as **CR**, **EN** and **VU**, considered as threatened categories by IUCN.

The response at the level of the environment and environmental policy has been assessed through the ratio between number of protected marine species/number of total species, namely 16/750 (without birds), taking into account the species protected by the EGO 57/2007. Concerning human resources acting in the marine biodiversity, in 2009, less than 50 specialists have been active in this field.

6.4.2.3. Situation of endangered species

The **Red List of macrophytes, invertebrates, fish and mammals,** state indicator for marine biodiversity in Romanian waters, has been entirely updated in 2008 and just for fish in 2009. It includes 223 species in 8 IUCN categories (according to IUCN criteria and categories at regional level v. 3.0 2003 and to the guidelines for using Red List criteria and categories v. 2004 and v 6.2 2006) namely: 19 macrophytes and superior plants (8,5%), 58 invertebrates (26%), 142 fish (63,7%), 4 mammals (1,8%) (Fig. 6.4.2.3.1) .

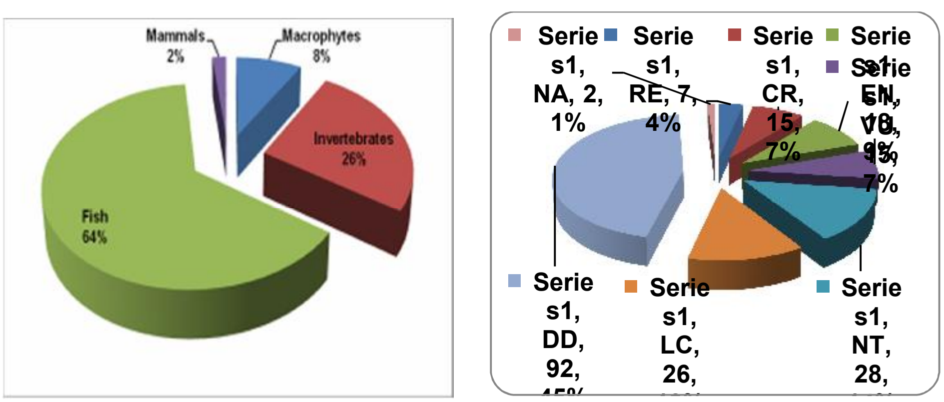


Fig. 6.4.2.3.1 – The main marine groups in the Red List (left hand side) and IUCN categories they belong to (IUCN, v. 3.0, 2003, 2004, v. 6.2, 2006)

Among macrophytes and vascular plants from the red list, in the summer 2009 in the southern part of the Romanian littoral, in the area Mangalia – Vama Veche the brown alga *Cystoseira barbata*, listed as endangered species (**EN**), has occurred. In Mangalia area the *Cystoseira* population is far better represented than in the marine reserve 2 Mai – Vama Veche, and it consists from thick bunches, their thalli being epiphyted by opportunistic species belonging to genera *Enteromorpha*, *Cladophora* and *Ceramium*. In the same area, the phanerogam *Zostera noltii*, having a discontinuous character, has also been identified. The marine plants have been listed into six categories (**RE**, **CR, EN, VU, LC, DD**): 1 species (5 %) as *Regionally Extinct* (**RE**), 3 (16%) – *Critically Endangered* (**CR**), 7 (37%) – *Endangered* (**EN**), 3 (16%) *Vulnerable* (**VU**), 2 (11%) as *Least Concerned* (**LC**) and 3 (16%) as *Data Deficient* (**DD)** (Table 6.4.2.3.1)

Table 6.4.2.3.1 – Conservation status of species included in the Red List of marine species

Group of species	**Conservation status according to IUCN (v.3.1, 2001 & v.3.0, 2003) categories**								
	RE	**CR**	**EN**	**VU**	**NT**	**LC**	**DD**	**NA**	**Total**
Macrophytes	1	3	7	3	0	2	3	0	**19**
Invertebrates	6	12	6	8	1	11	12	2	**58**
Fish	0	0	2	4	27	32	77	0	**142**
Mammals	0	0	3	0	0	1	0	0	**4**
Total	**7**	**15**	**18**	**15**	**28**	**46**	**92**	**2**	**223**

As for invertebrates the 58 species from the red list have been included in 8 categories as follows: **RE** (6 – 10%), **CR** (12 – 21%), **EN** (6 – 10%), **VU** (8 – 14%), **NT** (1 – 2%), **LC** (11 – 19%), **DD** (12 – 21%) and **NA** (2 species – 3%)(Tab. 6.4.2.3.1). Among the four copepods *Anomalocera patersoni, Labidocera brunescens, Pontella mediterranea* and *Centropages ponticus*, in 2009 only two have been identified (*Centropages ponticus* and *Pontella mediterranea*). Among the red listed benthic invertebrates, in 2009 16 have been identified, the most frequent being the following: *Donax trunculus* (**VU**), *Paphia aurea* (**VU**), *Tricolia pullus* (**CR**), *Calyptrea chinensis* (**VU**), *Clibanarius erythropus* (**CR**), *Carcinus aestuarii* (**EN**), *Callianassa truncata* (**VU**), *Eriphia verrucosa* (**NT**) and the polychaet *Arenicola marina* (**VU**).

The fish species categorization has been entirely changed in 2009, taking into account their conservation status at world level elaborated by IUCN. Using the methodology for the conservation status assessment at regional level, at present fish species have been included into five categories only: **EN, VU, NT, LC** and **DD**, most of them being data deficient **DD** (77 – 54%), followed by **LC** (32 – 23%). Species belonging to threatened categories (**EN, VU** and **NT**) represent together less than quarter (23%) of all fish species in the red list (Table 6.4.2.3.1). Among the 41 fish species identified in 2009, 3 are **VU** (*Acipenser stellatus*, *Trachurus mediterraneus ponticus* and *Alosa pontica pontica*), 13 are **NT**, and 6 data deficient (**DD**). In the following years, those considered now as **DD** can be included into a threat category or into the *Least Concerned* category (**LC**).

In 2009, as in 2008, **marine mammals** were not subjected to any monitoring programme; nevertheless groups of 2 to 50 individuals have been observed both in shallow waters and open sea, especially during summer. Also, 18 stranded dolphins have been registered, 13 *Phocoena phocoena* and 5 *Tursiops truncatus*. 90% of stranded dolphins are due to illegally installed turbot nets. The three dolphins (*Delphinus delphis*, *Phocoena phocoena* and *Tursiops truncatus*) are still considered as *Endangered* (**EN**) both at Black Sea and national level, even if in the IUCN red list only *Tursiops truncatus* is considered *Vulnerable* (**VU**); the other two species are assessed *Least Concerned* (**LC**).

6.4.3. State of marine fish stock
6.4.3.1. Indicators for marine living resources

In 2009, as in previous years, the Romanian marine sector fishing industry practiced by fishermen was done in two ways: active fishing gear with coastal trawler vessels, at depths of 20 m, and fixed fishing gear, along the coastline in 28 fishing points, located between Sulina and Vama Veche, in shallow waters (3-11 m); additionally a small-scale coastal fishing, should be mentioned.

In the Romanian marine sector the following trends have been reported:

► **Evolution of the state indicators:**

● **stocks biomass** for the main fish species (Table 6.4.3.1.1.) indicates: the sprat which usually had a natural fluctuation, almost normal and actually a relatively good one in 2009, had a biomass which was estimated as in the past two years at 60,000 tons compared to 45,000 tons befween 2004 and 2005 and 14,750 tons in 2006, when due to the existence of special hydro-climatic conditions, the species was stationed in other areas of the sea. Whiting's biomass was estimated at 10,000 tons, with about 10% more than estimated in 2008, when it varied between 6,000 and 8,500 tons (2004-2008). For turbot, the biomass was estimated at 1,500 tons, less than in 2008 and closer to that of 2007 the shark had a 2,500 tons higher biomass compared to the one in 2008, but lower than in 2007 (4,300 tons);

Table 6.4.3.1.1 - Value stocks (tons) for major fish species in the Romanian Black Sea sector

Species	2004	2005	2006	2007	2008	2009
sprat	45.000	45.000	14.750	60.000	60.000	60.000
whiting	8.000	8.000	7.000	6.000	8.500	10.000
anchovy	19.000	19.000	20.000	20.000	20.000	-
goby	600	600	600	600	500	-
turbot	980	1.080	1.150	1.300	2.356	1.500
dog	1.650	1.650	2.000	4.300	1.450	2.500

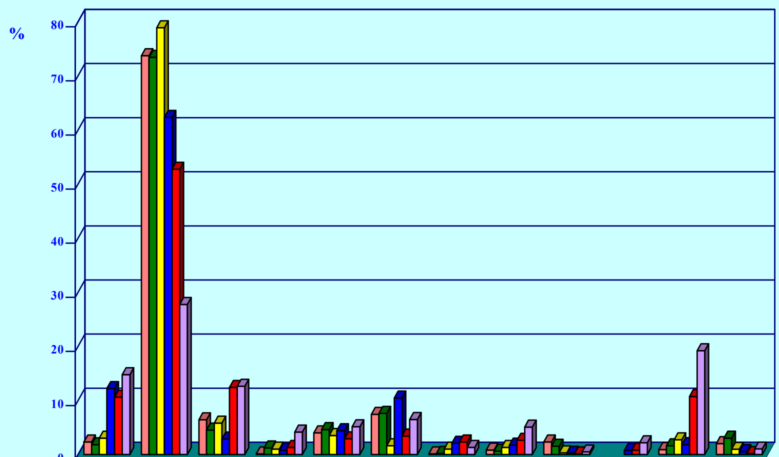
● **population structure** indicates as in previous years the presence in the catch of a higher number of species (over 20), in which the mainstream belonged to small species (sprat, anchovy, whiting, goby) and the higher class (turbot and shad). Notably, as in previous years, the low share of some species, such as: shark, horse mackerel, needlefish, mullet, bluefish, but also the recurrence as isolated specimens of blue mackerel (mackerel) and bonito (Fig. 6.4.3.1.1);

► **Evolution of the pressure indicators:**

● fishing effort continues the trend of reduction reported in 2000. In 2009, in the case of active fishing, specialized for sprat by using the pelagic trawl, two ships activated and for the turbot, four ships, which have used about 650 gillnets. In fishing with fixed gear, practiced along the Romanian coast: 20 trap nets, 1420 turbot gillnets, about 700 shad gillnets, 200 gobies gillnets, 14 beach nets, about 400 long liners and 950 handline, have been used;

● **the total catch** continued the downturn reported since 2000, from over 2000 tons 2001 and 2002, at 1.390-1.940 tons between 2003 and 2006 and 500 tons in the last three years (2007- 2009) respectively 435 t/2007, 444 t/2008 and 331 t/2009 (Fig. 6.4.3.1.2.). The low level of catches in 2009, respectively 331 tons, was due to the effort reduction (decrease of the number of coastal trawlers, the number of trap nets and staff engaged in fishing activities), increasing of the production costs and the influence of hydro-climatic conditions on fish populations;

● the Total Admissible Catch (TAC) of the main fish species caught between 2005 and 2009 remained at the same level (Table 6.4.3.1.2).



	turbot	sprat	whiting	mullet	goby	anchovy	shark	horse makerel	red mullet	caspian shad	pontic shad	other
2004	2,3	73,7	6,4	0,1	4	7,4	0,1	0,8	2,3		0,9	2
2005	1,8	73,4	4,5	1,2	4,6	7,6	0,2	0,6	1,5		1,6	3
2006	3	78,85	5,8	1	3,5	1,6	1	1,3	0,3		2,7	0,95
2007	12,19	62,29	2,86	0,75	4,38	10,42	2,08	1,73	0,22	0,71	1,82	0,55
2008	10,6	52,7	12,4	1,3	2,9	3,4	2,3	2,6	0,1	0,82	10,7	0,18
2009	14,74	27,72	12,6	4,15	5,13	6,46	1,31	5,07	0,46	2,16	19,18	1,01

Fig. 6.4.3.1.1 - The catch structure (tons) of the main fish species in the Romanian marine sector between 2004 and 2009

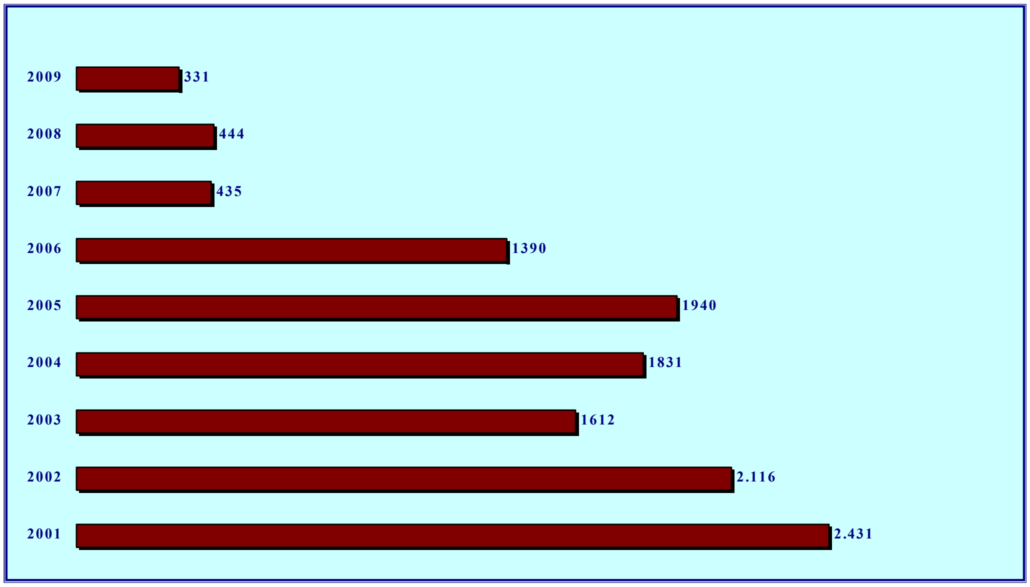


Fig. 6.4.3.1.2 - Total catches (tons) in the Romanian sector of the Black Sea, between 2001 and 2009

Table 6.4.3.1.2. The value of TAC (Total Admissible Catch) for main fish species in the Romanian Black Sea sector

Species	**TAC (tons)**				
	2005	**2006**	**2007**	**2008**	**2009**
sprat	10.000	10.000	10.000	10.000	10.000
whiting	1.000	1.000	500	500	500
anchovy	2.000	-	-	-	-
goby	100	100	200	100	100
turbot	50	50	50	50	50
dog	50	50	50	50	50

► **Evolution of the impact indicators:**

● **the percentage** of species whose stocks are outside safe limits was close to that in previous years, which is nearly 90%. Overcoming the limits of safety is not only the exploitation of the Romanian marine sector, because most fish species have a cross-border distribution, which requires management at regional level;

● **the percentage** of additional species in the Romanian catches continue to be maintained at a similar level to that in recent years, of 25%;

● **changes in the size class structure** (age, length): compared with the period 1990-2008, except sprat which stands a rejuvenation of the herds, due to a very good addition to other unusual catch, were the biological ? remained almost within the same values;

● **CPUE** (catch per unit effort), for fishing with fixed gears, was lower than the one in 2008, being of 4.52 tons/month, respectively 0.075 tons / day, an effort made by 1,200 trap nets and 20 days respectively 23.55 kg/gill, 45.155 kg/day, 3.763 kg/hour, in an effort turbot gillnets in 2070, 1080 days and 12,960 hours. The active fishing gear have been of 44.04 tons/ship, 1.074 tons/day, 0.497 tons/trawl and 0.376 tons/hour, the effort made by 2 ships, 82 days fishing, 177 and 234 trawling hours.

6.4.3.2. Measures for solving critical problems

► **Nationally**:

● **harmonization** of sustainable development strategies in the fisheries sector in the Romanian marine environment by implementing the concept of fisheries management based on ecosystem approach and the Code of Conduct for Responsible Fisheries through:

- avoid creation of excess fishing capacity;
- the practice of responsible fishing;
- conservation of biological diversity of marine ecosystems and protect the species threatened with extinction;
- the development and use of selective fishing gear and techniques: non-destructive, cost effective, environmental friendly and protecting living marine resources;
- the development and diversification of marine aquaculture products.

► **Regionally**:

- regional harmonization of legal and institutional framework for sustainable use of living resources;
- improving the management of fish stocks through exploitation assessment methodology agreed at regional level;
- development programs / projects to assess the status of fish stocks and to monitor the environmental conditions and biological factors that have influences;

- creating partnerships between research institutions, governments and producer organizations to develop joint research programs;
- construction of a regional fishery database;
- addressing stringent action against illegal fishing.

6.4.4. The Black Sea and sustainable development

> "Sustainable development is development which aims to meet the needs of the present without compromising the ability of future generations to meet their needs.
>
> (Bruntland Report)

The concept of sustainable development means all forms and methods of socio-economic foundation of which is to ensure balance between socio-economic and natural potential.

At national level, implementation of sustainable development is achieved by the National Strategy for Sustainable Development of Romania and by the Governance Programme for 2010 whose chapter on "Environmental Protection" provides the government objectives:

1. Raising the quality of life and environment in human communities;
2. Reducing the existing gaps to other EU countries and between development regions on environment infrastructure;
3. Minimize risk to natural disasters and increasing the safety of citizens;
4. Conservation of biodiversity and natural heritage, tourism potential and economic recovery in accordance with appropriate management plans;
5. Applying the principles of sustainable development into sectoral policies;
6. Introducing principles of sustainable development in education and supporting research applied in clean technologies;
7. Increase the transparency of environmental institutions in relation with citizens;
8. Implementation of environmental policies to prevent climate change;
9. Limiting the negative effects of climate change;

10. Stimulating initiatives and investments in environment protection using economic and fiscal instruments, increasing absorption of European funds;
11. Efficient use of natural and mineral resources gradual approximation of the average performance of EU countries;
12. Ensure transparency in implementation of environmental policies; cooperation with civil society;
13. Expanding international cooperation by participating in programmes and cross-border projects, a better presence of Romania within representative bodies at European and international level.

Integrated coastal zone management - the key tool of sustainable development

The integrated coastal zone management is the main instrument for protection and sustainable development of this area.

Integrated coastal zone management at national level

In recent years, Romania has succeeded in implementing the EU environmental acquis for the coastal zone. Also, the entry into force of provisions of new transposed legislation occurred the need to strengthen national and local institutional capacity.

The most important European documents that underpin or facilitate implementation of integrated coastal zone management are:

- ICZM Strategy Directive;
- Water Framework Directive;
- Mollusks Directive;
- Birds and Habitats and NATURA 2000 Directives;
- Integrated Maritime Strategy;
- Directive - Framework Strategy on the marine environment;
- INSPIRE Directive containing the water component of WISE;
- Initiative Global Monitoring for Environment and Security (GMES);
- Community policies on fisheries;
- European maritime policies, including maritime spatial planning.

The Romanian government created the legal basis for integrated coastal zone management by adopting the Emergency Ordinance on the integrated coastal zone management approved by Law No.280/2003, with amendments and completions. The existence of the legal framework supports Romania in meeting the requirements of national and EU law on integrated coastal zone management to sustainable development of Romanian coastal area.

The legislative framework

The main legislative document regulating the coastal zone is the Government Emergency Ordinance No. 202/2002 on coastal zone management, amended by Law No. 280/2003.

A series of laws that contain provisions related to this area have also been promoted:

- Water Law no. 107/1996, with subsequent modifications and additions
- Government Decision No.1015/2004 regarding the approval of the organization and functioning of the National Committee of Coastal Zone;
- Government Decision No. 546/2004 approving the methodology for delineation of public state domain in the coastal zone;
- Joint Order of the Minister of Environment and Water, Minister of Transport, Construction and Tourism and Minister of Health No.38/1044/671/2004 approving the Code of conduct for recreational activities in coastal zone;
- Government Decision No. 898/2004 approving the Instructions on the exploitation of groundwater and interface areas between freshwater and salt;
- Government Decision No. 317/2004 on the use of coastal wetlands as anchorage areas;
- Emergency Ordinance No.196/2005 regarding the Environment Fund;
- Government Decision No.893/2006 amending the Government Decision No. 1593/2002 approving the National Plan for preparedness, response and cooperation in case of marine pollution by oil;
- Joint Order of the Minister of Environment and Water, Minister of Transport, Construction and Tourism and Minister of Administration and Interior No. 1/217/182/2004 for approval and operation of the Operative Commandment against Marine Pollution;
- Order of the Minister of Environment and Water for approval No.374/2004 Action Plan for conservation of cetaceans in the Romanian Black Sea waters;

- Government Decision No. 918/2002 on the establishment of methodology for environmental impact assessment and environmental audit in accordance with EU Directive 85/337/EEC, amended 97/11/EEC, the effects of certain public and private projects on the environment;
- Government Decision No. 459/2002 on technical standards for water quality for bathing in natural areas;
- Government Decision no. 201/2002, as amended by GD 467/2006 on technical standards on water quality for shellfish;
- Government Decision No. 730/1997 on the quality of water (NTPA-001) on setting limits for pollutant load of wastewater discharged into water sources;
- OM No. 1618/2000 approving the representative sections of the national system for monitoring water quality;
- Action Plan for 2002 to implement the Framework Directive of the European Union in the water - OM No. 913/2001;
- MESD Order No. 1888/27.11.2007 approval list of organohalogenated substances and heavy metals and the maximum permissible organohalogenated substances and heavy metals in water and sediment substrate;
- MESD Order No.38/18.01.2008 and the MADR Order No. 1950/12.12.2007 for delimit and cataloging areas suitable for growth and exploitation of marine mollusks.

In 2009, NIMRD "Grigore Antipa", as responsible of the Permanent Technical Secretariat of the National Committee of Coastal Zone, developed at the request of the Ministry of Environment and Forests, a working paper on the National Plan for Integrated Coastal Zone Management.

Institutional Framework

Institutions involved in the Romanian ICZM, as well as their tasks and responsibilities are stipulated by the Government Emergency Ordinance no.202/2002 on coastal zone management, amended by Law No. 280/2003.

The central public authority for environmental protection, represented by the Ministry of Environment and Forests, has the following duties and responsibilities:

a) develop and promote national strategy for integrated management of coastal zone and action plans for implementation;

b) initiating the creation of institutional and administrative framework for the coastal parks and reserves;
c) approve the action plans in order to limit the polluting emissions from diffuse sources;
d) coordinates and controls the activity of integrated management of coastal areas.

The National Committee of Coastal Zone (NCCZ) coordinates national activities on integrated coastal zone management.

The National Committee on Coastal Zone was established under Law No. 280 of June 24, 2003 approving the Emergency Ordinance No. 202/2002 on integrated coastal zone management and operating under the Government Decision No. 1015/25 June 2004 (the approval of the organization and functioning of the National Committee of Coastal Zone). NCCZ ensures besides the Ministry of Environment, the integrated coastal zone management.

NCCZ has the following responsibilities:

- Endorsing the plans regarding integrated coastal zone management and local and regional spatial planning;
- Endorsing the studies regarding environment impact of activities having an important impact in the coastal zone as well as the environment audit for the existing ones;
- Endorsing the projects regarding establishing of natural parks and reserves.
- NCCZ through Permanent Technical Secretariat, is empowered to inform the competent organizations about critical situations in the coastal zone which need rehabilitation actions and initiating of specific projects.

NCCZ shall meet whenever necessary, focusing on consensus between the state institutions with responsibilities in this sector, in resolving the major problems of the coastal zone. President of the National Coastal Zone is the secretary of state for water in the Ministry of Environment. He is assisted by two Vice-presidents.

NCCZ cooperates with central and local public bodies and with government institutions engaged in specific geographical area of the coastal zone and ensures the application of the regulatory acts issued by central government authorities.

Permanent Technical Secretariat

The Permanent Technical Secretariat (PTS) of the coastal zone is the structure for the current activity of the NCCZ. The responsible for PTS activity is the National Institute for Marine Research and Development "Grigore Antipa" - Constanta.

PTS tasks and responsibilities established by the NCCZ:

- Prepare documentation for NCCZ / WG debates;
- Organize NCCZ meetings, public debates and other related activities;
- Prepare correspondence regarding NCCZ current activity, according to adopted decisions;
- Communication issues (responding to interested persons about any problem regarding NCCZ tasks, except the ones upon NCCZ has not adopted any decision yet);
- Prepare reports/ minutes from NCCZ/WG meetings and public debates;
- Drafting the NCCZ yearly working programme.

PTS has necessary logistics and a permanent establishment located at the National Institute of Marine Research and Development "Grigore Antipa" - Constanta.

In fulfilling its mandate, the NCCZ has access to information and resources to any public institution under the law.

Working Groups

Working Groups have been approved by the NCCZ. The objective of the work conducted by the Working Groups is to develop and provide expert advice on subjects relating to the proper implementation of the strategy for coastal zone.

So far, working groups have been established with the following tasks:

WG 1: WG for delineation of the coastal zone, urbanism and spatial planning;

WG 2: WG for prevention of damages of the coastal zone due to coastal erosion, land slides and other accidents;

WG 3: WG for preparing technical and legal documents for the coastal area;

WG 4: WG for establishing policies, strategies and action plans needed for integrated management of the coastal zone;

WG 5: WG for integrated environment monitoring and surveillance of activities in the coastal zone;
WG 6: WG for information and communication.

Issues concerning the functioning of the National Committee of Coastal Zone (NCCZ)

The practical experience shows that there are some gaps in the NCCZ and PTS activity. For these reasons, the PTS proposed to ME a draft for a new Regulation of the NCCZ and some proposals for modifying the ICZM Law:

– Ensure a quorum for decision-making meetings;
– Reducing the number of projects discussed in CNZC by establishing a list of categories of projects to be supported by STP;
– Ensure regularity of meetings and the operability of their CNZC by establishing an assessment procedure;
– Providing financial resources for the operation of PTS as a structure with executive technical role by allocating a budget by the Ministry of Environment.

All these requirements can be placed in a government decision to amend the Regulation on organization and operation of CNZC. Moreover, these elements have been agreed within CNZC meeting in February, 21, 2008.

Regional cooperation

Sustainable development of coastal zone requires cooperation of all countries bordering the Black Sea. In this respect, a Strategic Action Plan for Rehabilitation and Protection of the Black Sea was developed. Its general objectives include providing a healthy environment for the population in the Black Sea region, both in urban and rural areas, obtaining a biologically diverse marine ecosystem, containing variable and viable natural populations and sustainable higher organisms, including marine mammals and sturgeons, and to support sustainable activities such as fishing, aquaculture and tourism in all Black Sea countries.

NIMRD "Grigore Antipa" has 5 national focal points operating within the Black Sea Commission Advisory Groups in the following areas:

- Fisheries management and other living marine resources
- Biodiversity
- Pollution Monitoring and Assessment
- ICZM
- Land – based pollution.

Relevant projects to implement sustainable development in the coastal zone, conducted in 2009

NUCLEU Programme 2009 – 2011

a) dynamic interactions in the abiotic component of the marine ecosystem under the influence of climate and present anthropogenic changes;
b) biotic activity of the marine ecosystem under the influence of increased anthropogenic pressure and climate change;
c) development of methodology for analysis and evaluation in the ICZM process.

International Projects

- EC-FP6: European Coastal-shelf sea operational observing and forecasting system (ECOOP), 2007 to 2010;
- EC / Development and pre-operational validation of marine GMES Services and upgraded capabilities (MyOcean), from 2009 to 2011;
- NATO: Bio-optical characteristies of the Black Sea, 2009 - 2011;
- CE/PC6: Upgrade Black Sea Scene (UBSS), from 2009 to 2011;
- CE/PC7 Scientific and Technological Collaboration for the study of sea-level changes and vertical crustal movements at the Western Black Sea (EMODNet), from 2009 to 2011;
- CE/PC6: Pan - European infrastructure for Ocean & Marine Data Management (SEADATANET), from 2006 to 2011;
- CE/PC6: Southern European Seas: Assessing and modeling ecosystem changes (SESAME), from 2006 to 2010;
- PN I / PDP: Influence of geo-climatic changes on global and regional sustainable development in Dobrogea (GLOBE) / CNMP, from 2007 to 2010;
- PN II, Partnerships' - Evaluation of macrophytes communities from the Romanian coast and possibilities for recovery of deposits on macroalge beaches, 2008 - 2010;
- PN II, Partnerships - Complex system of application of remote sensing and GIS techniques to support quality environmental monitoring and integrated management development activity in the Romanian Black Sea shore, 2008-2010;
- PN II, Partnerships'-Research on factors limiting populations of turbot (Psetta Maeotica Maxima) from the Romanian coast in the assessment, exploitation, conservation and species protection, from 2008 to 2010;

- National Plan for fishery data collection / ANPA-DG Mare, 2009 – 2010.

Maritime Spatial Planning

At the European level, the process of terrestrial planning is imposed in present policy to answer to the global impact of climate changes prevention, development and population mobility, international market standardization and the necessity for boundaries states abolition. The existing territorial planning takes place at the continental national, regional, zonal and local level.

1. In 2009, the main purpose of the activity of maritime spatial planning in Romania has aimed to promote the Integrated Maritime Spatial Planning Manual (PSMI) *Handbook* to streamline the economic potential of coastal and marine areas in a uniform, continuous and sustainable way, avoiding conflicts and creating maximum of understanding and synergy between different stakeholders' interests of maritime space. In this respect has been achieved:

- The terms identification and patterns defining for the *Handbook* of Integrated Maritime Spatial Planning dissemination, public and stakeholder involvement.
- Stakeholders and groups of interest identification among specialists, planners, communities and social groups, policy makers and the general public.

Implementation of the *Handbook* has taken into account the dissemination, the beginning of the results exploitation staring with the identification of transmission and multiplication flow as planned process for individual users/groups convincing, to adopt and/or implement the included recommendations. For the gained and put in practice experience and recommendations elaboration the ICZM Secretariat needs for reactivation is noted, adding its specifically meetings and discussions.

The IMSP *Handbook* **promotion** has be done by NIMRD both at nationally and at the Black Sea basin level in order to extend the scope and gained experience in cross-border and regional context, mainly to Bulgaria and Ukraine, but also to more farer countries as Georgia, Turkey and Russia.

2. An informational support for database creation has developed; the results and practical examples were described regarding the maritime spatial planning, accompanied by graphics and thematic maps. To achieving these goals, were the follows:

- Informational support preparing, highlighting needs, requests and approaches
- Specifical domains, parameters and indicators identifying

- New data collection and practical explanation of the main areas of interest, including terrestrial data, environment protection, including SPA-s, aquatic protected areas, land coast and agriculture surfaces

- Operational GIS system preparing to answer to MSP activities, offering mapping facilities designated to the complex spatial analyses, to the spatial information automatical generation, geographical coordinate processing and cartographical design/projection

- Vulnerable coastal locations identifying as analytic instrument in establishing zones with specifically kind of activities, developing knowledge on the cause-effect relation support for the sectoral plans development preparing in the aim of Integrated Maritime Spatial Planning Strategy elaboration.

Collected data were related to the different aspects, as followed: *Planning Structure, Geographical location, Integrated Monitoring Data, Pollution, Natural and Built Heritage, Energy Resources, Telecommunications, Socio-demographic structures.* The need for the functional space zonation, the emphasizing and avoiding of interdisciplinary conflicts were the main aim of PSMI field. Results obtained in 2009 in INCDM are complex and necessary to support national policy's documentation and decisions for the maritime strategy elaboration. The inventory of impact of cases studies have been realized in the Romanian coastal zones.

Maritime Spatial Planning Fields

Harbor activities   Tourism. Marine Transport. Industry. Energy

Climate and anthropogenic impact

Coastal urban planning

Combined effect of coastal erosion and global warming

Scientific and public participation

Between October 29 – 30, 2009, NIMRD "Grigore Antipa" has organized the International Symposium "Protection and sustainable development of the Black Sea ecosystem, imperative of the Third Millennium", fourth edition, with a ceremony dedicated to the International Black Sea Day, under the auspices of the Romanian National Committee of Oceanography (RNCO).

6.4.5. Anthropic pressures

ANTHROPOGENIC PRESURES (14)

- Accentuated devlopment of different socio-economic activities within natural space of the coastal zone:
  - Agriculture and food industry
  - Marin Fishing
  - Constructions/holiday houses
  - Aerial transport/Airports
  - Ports/Navigation
  - Touristic Ports Extension: dredging
  - Shipyards
  - Manufacture Industry
  - Extractive Industry: sand mining in coastal areas
  - Metallurgic Industry
  - Nuclear Industry
  - Petrochemical Industry /Oil-refineries
  - Tourism and recreation

    - Military and Defence Activities (inland/marine): seaward shuting
- Environmental problems induced by anthropogenic factor, identified in the Romanian coastal zone, are the following:
    - Coastal Erosion/Sediment's dynamic
    - Natural resources extraction/beach sand
    - Water pollution /air (hydrocarbons, greenhouse effect gases, s.a.)
    - Transport
    - Over-Exploitation of fish stocks
    - Habitats losing/Endangered species
    - Sand extraction on beachs in bays area: Eforie Nord
    - Population growth
    - Urban expansion: Mamaia, Eforie, Costinesti and Mangalia touristic resorts
    - Seawater intrusion
    - Uncontrolled development of touristic and recreation activities over the tourism carrying capacity (inefficient solid waste management)

Other activities with coastal and marine ecosystem impact:
- Urban development
- Navigation constructions and submerged construction
- Oil platforms
- Eolian Instalations