Cruise Report

POS 363
RV "Poseidon"

March 7 to 25 2008, Varna/Varna

Chief scientist
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1 Participants and tasks during the cruise

Name	Function on board	Institute
Aleynik, Dmitry	Hydrophysical measurements, CTD and FRRF operation	UoP-MI
Becke, Ronny	Sediment sampling, box corer operation	AWI
Eulenburg, Antje	Water column chemistry	AWI
Friedrich, Jana	Chief Scientist, benthic nutrient fluxes, lander operation	AWI
Kusch, Stephanie	Sediment sampling, Multicorer operation	AWI
Mee, Laurence	Water column chemistry, FRRF operation	UoP-MI
Minicheva, Galina	Macrophytobenthos analysis	IBSS-Odessa
Shapiro, Grigory	Hydrophysical measurements, CTD operation	UoP-MI
Soloviev, Dmitry	Hydrophysical measurements, CTD operation, satellite imagery	MHI
Stevens, Tim	Benthic imagery, benthic camera operation	UoP-MI
Teaca, Adrian	Zoobenthos analysis, van Veen grab operation	GeoEcoMar

AWI – Alfred Wegener Institute for Polar and Marine Research in Bremerhaven and Potsdam, Germany
GeoEcoMar – National Institute of Marine Geology and Geo-Ecology, Constanta branch in Romania
IBSS-Odessa – Institute for Biology of the Southern Seas, Odessa branch in Ukraine
MHI – Marine Hydrophysical Institute, Sevastopol branch in Ukraine
UoP-MI – University of Plymouth, Marine Institute, United Kingdom

2 Objectives of the cruise POS 363

Since the changes in the economies in the Black Sea countries in the 1990's, the associated decrease in anthropogenic pressures has put the ecosystem of Black Sea western shelf on a trajectory to recovery. However, the suspected non-linearity of recovery and the ecological instability of the benthic shelf ecosystem in particular, became evident in the field surveys in 2003, 2004, 2005 and 2006, e.g. in the spread of opportunistic species taking new niches and the re-occurrence of large-scale bottom water hypoxia like in 2001. The temporal dynamics of the recovery (as well as of the decline) may also be tied to climatic effects. The Black Sea is known to respond to north Atlantic oscillation (NAO) forcing and decadal climate changes.

The target of the 363th cruise of R/V Poseidon in March 2008 was to study the current state of the pelagic system and of the benthic ecosystem in a quasi-winter situation. We assessed:

a) the current state of the benthic ecosystem on the north-western shelf; to what degree it recovered during the past decade from its collapse in the 1980's. In this respect, we investigated the role of the seabed as storage media of nutrients from past eutrophication, and the role of the sediments as internal source of nutrients to the pelagic system. We focused on zoo- and phytobenthos distribution, the interaction of benthic biota with the sediment, accumulation of nutrients in the sediment, and the flux of nutrients from the sediments to the water.
b) The benthic-pelagic coupling, i.e. how the nutrients nitrogen, phosphorus and silica for algal growth are transported from the seafloor to the sea surface and thus fuel biologic productivity.
c) The exchange of water between the shelf and the open Black Sea, and hence the transport of nutrients, i.e. the fertilization of the open Black Sea with nutrients from the shelf.

Ship time had been provided by the German Commission for medium-sized Research Vessels, which included funding from the Alfred Wegener Institute. Additional funding from the Royal Society International Joint project Grant 2006/R4-IJP is acknowledged. Our winter survey is complementary to a set of earlier surveys in 2003, 2005 and 2006 during autumns and summer. Those earlier cruises had been funded by the UNDP-GEF Black Sea Ecosystem Recovery Project. The results from this whole set of surveys will allow a more thorough assessment of the current state of the ecosystem of the western Black Sea shelf.

We hope that our findings may help to identify locations crucial for the functioning for the benthic shelf ecosystem, to define "Good Environmental Status" and help to provide recommendations for Marine protected areas on the western Black Sea shelf. We hope that the data will make an important contribution to the information base underpinning the new European Marine Strategy Directive and the Bucharest Convention for the Protection of the Black Sea.

3 Study area

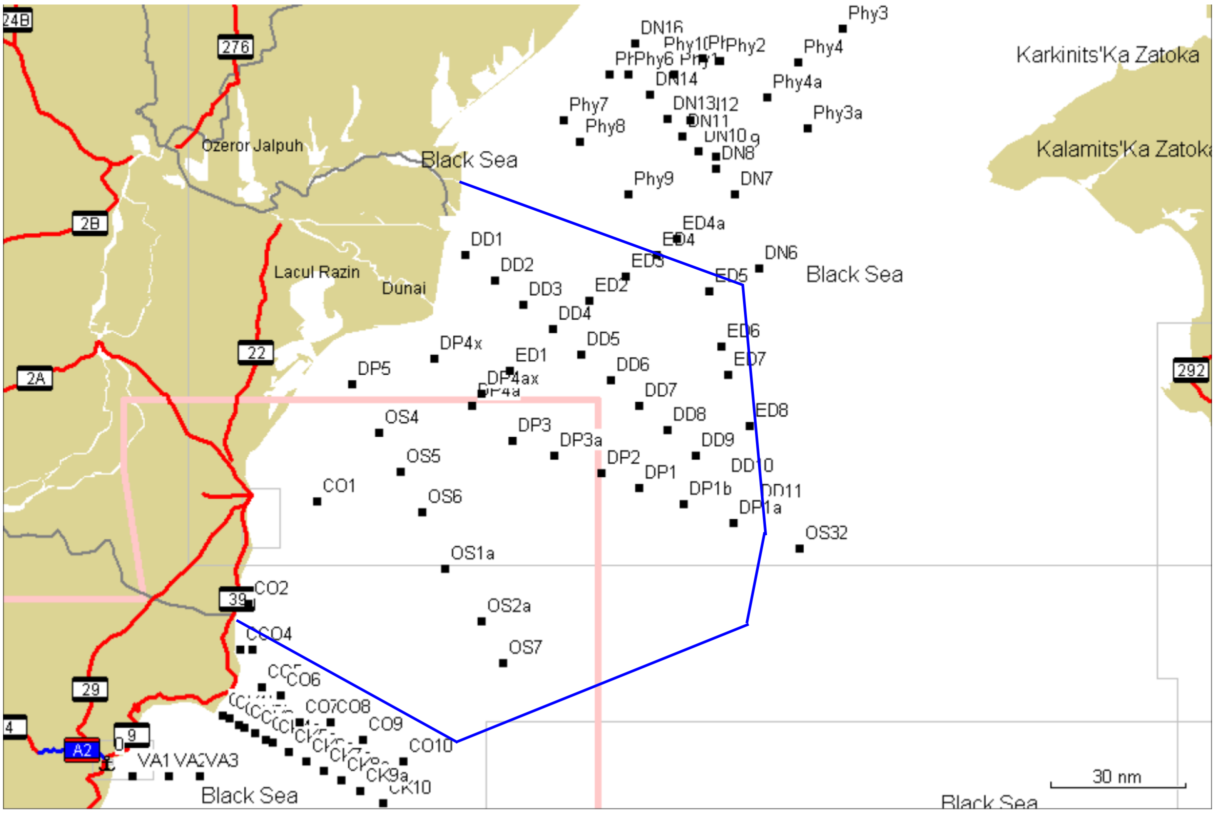

Figure 1. Map of the western Black Sea shelf showing the stations sampled during cruise POS363. The stations within Romanian territorial waters are located within the blue frame.

4 Sampling strategy

We choose a sampling strategy that accommodated both the requirements for the hydrographical survey and the survey for typical benthic assemblages. For the hydrographical survey we did transects perpendicular to the isobaths across the shelf edge. To assess the current state of key benthic ecosystems on the shelf in a winter situation, we choose a grid survey, revisiting most of the locations that were sampled in summer 2006, and did observations along a depth transect from the coast to the shelf edge to get information the current depth distribution of typical assemblages. For benthic flux measurements, we revisited the stations that were sampled in previous years. The stations are indicated in Figure 1 and the GPS positions are given in Table 1.

Description of transects and bottom characteristics

BG – Burgas (clay-like mud with sand, deeper parts consist of muddy bottom)

VA – Varna (shallow areas consisting of muddy sand hollowed by *Upogebia*, deeper parts with deep *Mytilus* assemblages on muddy bottom)

CK – Cape Kaliakra (muddy substrate with deep *Mytilus* assemblage, and *Modiolus* assemblages)

CO – Coast (muddy substrate with deep *Mytilus* assemblage)

OS – Open shelf (substrate consisting of *Phaseolina* shells and whitish mud)

DP – Danube Prodelta (prodeltaic area with alluvial muds, shallow parts with *Mya* and *Melinna* assemblages, deeper parts characterized by *Mytilus, Modiolus* assamblages and *Phaseolina* muds, affected by hypoxia in the past)

DD – Danube Delta Front (alluvial muds within the Danube River mixing area, strong salinity gradients between fresher surface water and salty bottom water, soft bottom communities, affected by hypoxia in the past)

DN – Dniestro (Dniestro river influence, partly covering the former *Phyllophora* field, shallow parts affected by hypoxia in the past, muddy-silty-shelly substrate)

Phy – Phyllophora (the former Zernov *Phyllophora* field, characterized shelly substrate and by macroalgal communities)

Table 1. Station log of POS363.

Cruise	Station [POS no_ name]	date [mon/day/yr]	Longitude [°E]	Latitude [°N]	Bottom Depth [m]
POS363	101_CK1	03.08.2008	28.517	43.360	35.0
POS363	102_CK2	03.08.2008	28.519	43.328	63.0
POS363	103_CK3	03.08.2008	28.686	43.295	79.0
POS363	104_CK4	03.08.2008	28.775	43.293	89.0
POS363	105_CK5	03.08.2008	28.863	43.227	137.0
POS363	106_CK6	03.08.2008	28.952	43.194	767.0
POS363	107_CK7	03.08.2008	29.042	43.157	1044.0
POS363	108_CK8	03.08.2008	29.131	43.123	1464.0
POS363	109_CK9	03.08.2008	29.283	43.084	1806.0
POS363	110_OS2	03.09.2008	29.861	43.710	81.0
POS363	111_OS1	03.09.2008	29.676	43.906	65.0
POS363	112_OS3	03.10.2008	31.513	43.982	1336.0
POS363	113_DD11	03.10.2008	31.282	44.132	849.0
POS363	114_DP1a	03.10.2008	31.174	44.074	894.0
POS363	115_DD10	03.11.2008	31.131	44.227	555.0
POS363	116_DP1b	03.11.2008	30.910	44.146	352.0
POS363	117_DP1	03.11.2008	30.681	44.207	118.0
POS363	118_DD9	03.11.2008	30.974	44.326	201.0
POS363	119_DD8	03.11.2008	30.827	44.420	114.0
POS363	120_DD7	03.11.2008	30.682	44.511	92.0
POS363	121_DP2	03.11.2008	30.487	44.259	96.0
POS363	122_DP3a	03.11.2008	30.239	44.323	82.0
POS363	123_DP3	03.12.2008	30.021	44.377	64.0
POS363	124_DD6	03.12.2008	30.533	44.604	75.0
POS363	125_DD5	03.12.2008	30.378	44.700	59.0
POS363	126_DD3	03.12.2008	30.080	44.884	42.0

POS363	127_DD2	03.12.2008	29.930	44.975	37.0
POS363	128_DD1	03.12.2008	29.775	45.070	18.0
POS363	129_DP4	03.13.2008	29.666	44.682	45.6
POS363	130_DP4a	03.13.2008	29.887	44.550	57.0
POS363	131_ED1	03.13.2008	30.011	44.637	57.0
POS363	132_DD4	03.13.2008	30.229	44.792	53.0
POS363	133_ED2	03.13.2008	30.406	44.927	49.0
POS363	134_ED3	03.13.2008	30.552	45.040	47.0
POS363	135_ED4	03.13.2008	30.716	45.164	40.0
POS363	136_DN7	03.14.2008	31.180	45.291	48.0
POS363	137_Phy3a	03.14.2008	31.554	45.539	44.5
POS363	138_Phy3	03.14.2008	31.736	45.905	20.9
POS363	139_Phy4	03.14.2008	31.510	45.781	26.7
POS363	140_Phy4a	03.15.2008	31.347	45.652	41.3
POS363	141_Phy2	03.15.2008	31.100	45.785	22.7
POS363	142_Phy1	03.15.2008	30.863	45.734	29.3
POS363	143_DN12	03.15.2008	30.948	45.568	33.0
POS363	144_DN8	03.15.2008	31.081	45.387	44.4
POS363	145_DN10	03.15.2008	31.000	45.450	41.0
POS363	146_DN11	03.15.2008	30.906	45.507	36.1
POS363	147_DN13	03.15.2008	30.829	45.573	34.3
POS363	148_DN14	03.16.2008	30.734	45.661	32.5
POS363	149_Phy10	03.16.2008	30.777	45.791	24.2
POS363	150_DN16	03.16.2008	30.658	45.851	19.6
POS363	151_Phy5	03.16.2008	30.527	45.739	26.1
POS363	152_Phy6	03.16.2008	30.628	45.737	25.1
POS363	153_DN14	03.16.2008	30.735	45.661	32.2
POS363	154_DN13	03.16.2008	30.829	45.572	34.7
POS363	155_DN11	03.17.2008	30.905	45.507	37.0
POS363	156_DN10	03.17.2008	30.989	45.449	41.5
POS363	157_DN8	03.17.2008	31.080	45.446	45.1
POS363	158_DN6	03.17.2008	31.301	45.017	57.0
POS363	159_Phy7	03.18.2008	30.290	45.569	19.0
POS363	160_Phy8	03.18.2008	30.371	45.486	19.3
POS363	161_Phy9	03.18.2008	30.624	45.292	31.4
POS363	162_ED4a	03.18.2008	30.716	45.164	40.0
POS363	163_ED5	03.18.2008	31.046	44.931	62.0
POS363	164_ED6	03.18.2008	31.107	44.731	88.0
POS363	165_ED7	03.18.2008	31.140	44.625	284.0
POS363	166_ED8	03.18.2008	31.251	44.434	605.0
POS363	167_DD12	03.19.2008	31.514	43.982	1339.0
POS363	168_DP1	03.19.2008	30.682	44.206	118.0
POS363	169_DP2	03.19.2008	30.486	44.258	95.0
POS363	170_DD7a	03.19.2008	30.682	44.511	91.0
POS363	171_DD6a	03.19.2008	30.535	44.603	75.0
POS363	172_DD5a	03.19.2008	30.379	44.699	59.0
POS363	173_DD4a	03.19.2008	30.230	44.793	52.0
POS363	174_DD3a	03.19.2008	30.082	44.884	41.0
POS363	175_DP3	03.20.2008	30.021	44.376	64.0
POS363	176_DP4	03.20.2008	29.616	44.684	43.9
POS363	177_DP5	03.20.2008	29.190	44.588	23.1
POS363	178_OS4	03.21.2008	29.328	44.407	44.5
POS363	179_OS5	03.21.2008	29.439	44.263	52.0
POS363	180_OS6	03.21.2008	29.551	44.114	56.0
POS363	181_OS1a	03.21.2008	29.676	43.906	65.0

POS363	182_OS2a	03.21.2008	29.861	43.710	82.0
POS363	183_OS7	03.22.2008	29.973	43.556	687.0
POS363	184_CO1	03.22.2008	29.007	44.153	39.2
POS363	185_CO2	03.22.2008	28.650	43.776	28.8
POS363	186_CO3	03.22.2008	28.608	43.605	15.1
POS363	187_CO4	03.22.2008	28.674	43.604	47.5
POS363	188_BG1	03.23.2008	28.228	42.798	75.0
POS363	189_BG2	03.23.2008	28.017	42.792	32.3
POS363	190_VA1	03.23.2008	28.051	43.136	17.0
POS363	191_VA2	03.23.2008	28.240	43.138	29.0
POS363	192_VA3	03.23.2008	28.398	43.137	57.0
POS363	193_CK1a	03.23.2008	28.517	43.360	35.5
POS363	194_CK1b	03.23.2008	28.550	43.351	45.6
POS363	195_CK2a	03.23.2008	28.599	43.326	63.0
POS363	196_CK2b	03.23.2008	28.629	43.314	72.0
POS363	197_CK3a	03.23.2008	28.687	43.295	80.0
POS363	198_CK3b	03.23.2008	28.742	43.271	87.0
POS363	199_CK4a	03.23.2008	28.775	43.261	90.0
POS363	200_CK5a	03.23.2008	28.864	43.227	136.0
POS363	201_CK6a	03.23.2008	28.951	43.193	775.0
POS363	202_CK7a	03.24.2008	29.043	43.157	1040.0
POS363	203_CK8a	03.24.2008	29.132	43.123	1466.0
POS363	204_CK9a	03.24.2008	29.233	43.082	1796.0
POS363	205_CK10	03.24.2008	29.354	43.037	1922.0
POS363	206_CO10	03.24.2008	29.458	43.193	1710.0
POS363	207_CO9	03.24.2008	29.249	43.270	1208.0
POS363	208_CO8	03.24.2008	29.078	43.336	104.0
POS363	209_CO7	03.24.2008	28.915	43.398	80.0
POS363	210_CO6	03.24.2008	28.816	43.434	73.0
POS363	211_CO5	03.24.2008	28.719	43.466	64.0

4.1 Parameters measured on board

At all stations - temperature, salinity, pressure, oxygen, fluorescence in water column

At selected stations - ammonia, dissolved inorganic phosphorus, dissolved silica, pH in the water column, secchi depth
- ammonia, pH and dissolved inorganic phosphorus in in-situ benthic flux chamber and ex-situ sediment core incubations
- ammonia, pH, CO2 in sediment porewater
- macrobenthic survey

5 Reports by the participating teams

5.1 Water chemistry, benthic flux studies and sediment studies (J. Friedrich)

Tasks on board	*Team members*
Lander operation, incubation/ denitrification experiments, pore water and sediment sampling	Jana Friedrich, Stephanie Kusch, Ronny Becke (Alfred Wegener Institute for Polar and Marine Research, Germany)
water sampling and filtration ammonia and pH measurements	Antje Eulenburg, Alfred Wegener Institute for Polar and Marine Research, Germany
water sampling, phosphate & silicate measurements	Laurence Mee, University of Plymouth, UK L.Mee@plymouth.ac.uk

Sampling

On the nearshore and offshore shelf key locations were chosen for benthic flux and sediment geochemistry studies. Some of those stations overlap with locations that have been investigated during previous benthic flux surveys in 1995, 1997, 1998 and 2006.
Referring to the benthic flux studies, station OS1 (69m) on transect OS represents the offshore shelf beyond direct river influence having muddy sediment covered with *Modiolus* shells. Unfortunately, on this station no benthic flux data were obtained due to failure of both the in-situ flux chamber and the box corer. DD1 (21m) on transect DD south of the *Danube's Sulina branch* represents the Danube plume. The sediment consisted of alluvial grey-brownish silty mud with *Mya arenaria*, *Neanthes succinea,* Scapharca and polychaeta. DP5 (26m) on transect DP has been choosen to be representative for the Danube Prodelta area south of the three Danube branches. The alluvial sediment was densely covered by polychaeta tubes accompanied by *Mya arenaria* and *Melinna palmata*. Sediment porewater has been sampled on the locations of benthic flux studies. DP2 (99m) on the same transect is located close to the shelf edge. The deep bottom is characterised by phaseolina muds clogged by detritus. The *Modiolus* population has a lower abundance. Despite of bottom water hypoxia, the bottom was populated by polychates, sponges and few tunicates. The occurrence of benthic life may be seen as an indication that bottom water hypoxia is not a permanent feature but caused by occasional shoaling of anoxic water from the deep Black Sea.
Water samples have been taken at selected stations along the CTD transects across the shelf with 5-L Niskin bottles attached on a rosette + CTD system. The water has been filtered through pre-combusted GFF filters (1µm) for POC, PN and PP. For dissolved nutrients, the water has been filtered through 0.45µM polycarbonate filters. Dissolved inorganic phosphorus, dissolved silica and ammonia have been measured on board. For nitrogen compounds and dissolved organic nutrient forms sample aliquots have been poisoned with $HgCl_2$ and taken to the home laboratory for further analysis.

Methods

Samples for benthic nutrient fluxes have been taken in-situ with a benthic flux chamber Lander on stations OS1 (failed), DD1 and DP5. On each station the Lander was moored on the seafloor for 24 hours. The functioning of the benthic Lander is described in detail in (Tengberg et al., 1995) and (Friedrich et al., 2002). The same Lander has been used in the previous benthic flux studies in 1995, 1997 and 1998. In parallel to the lander moorings, deck incubation microcosm experiments where carried out, simulating in-situ conditions. For each microcosm experiment, three sediment subcores (10 cm in diameter) from the box corer where taken, carefully filled with bottom water, sealed gastight with rubber stoppers and stored in a fridge at in-situ temperatures of 5°C. The microcosms where left 12 hours for adjustment. Daylight penetrating to the seafloor has been simulated by dimmed blue light. Sample aliquots have been taken, as in the Lander experiments, in two-hour intervals with syringes without opening the cores, avoiding oxygen penetration. Bottom water currents have been simulated by gently moving the microcosms prior to sampling. The deck incubation microcosm experiments have been run for 24 hours, the Lander in-situ experiments have been run for 20 hours.

Porewater has been sampled from sediment subcores taken from the box corer immediately after coring. Rhizones placed in 1 cm intervals down the core have been used to extract 5 to 10 ml of porewater per sample. The functioning of rhizones is described in detail in (Seeberg-Elverfeldt et al., 2005). All water samples are stored for further analysis in cleaned PE bottles and poisoned at 4°C until nutrient analysis at AWI.

Nutrient analysis

Ammonia ($N\text{-}NH_4^+$) has been measured on board by flow-injection analysis (Hall and Aller, 1992). HPO_4^{2-} and $Si\text{-}SiO_2$ has been measured on board photometrically with the ammonium-molybdate method (Murphy and Riley, 1962) and the molybdenum blue method (Strickland and Parsons, 1972), respectively, on a Spectroquant Nova 60 spectrophotometer (MERCK). Oxygen in the in-situ and the deck incubation experiments has been measured with a modified Winkler method (EN 25813) on a Spectroquant Nova 60 spectrophotometer (MERCK). Oxygen oxidizes Mn2+ to Mn3+. In acidic solution after adding a Titriplex II solution, red coloured permanganate is formed.

Denitrification experiments

Denitrification experiments have been carried out at stations DD1, DP5 and DN11. These microcosm experiments were done the same way as the deck incubation experiments described above, plus adding a ^{15}N tracer as nitrate (15 ml of 3.5 mM NO_3) to the water of two parallel microcosms, while running a reference microcosm without nitrate addition. In two-hour intervals, 10 ml water samples have been filled into exetainers and poisoned with $HgCl_2$. $^{15}N^{14}N{:}^{14}N^{14}N$ and $^{15}N^{15}N{:}^{14}N^{14}N$ ratios in the dinitrogen gas will be determined by gas chromatography isotope ratio mass spectrometry after the cruise.

First Results

The water column on the shelf was well oxygenated. As a result, ammonia was mostly undetectable in the water column. The Danube Rivers represents a source for NOx and silica in the shelf waters (Figure 2 and 3). In contrast, the Dniestro and Dniepro Rivers do not seem to be a source of NOx, phosphate and dissolved silica at that time of the year. The Danube does not seem to serve as source for phosphate (Figure 2). The phosphate concentration ranged below 0.1 µM in the photic zone, even in the vicinity of the Danube plume. With increasing water depth, the phosphate increased slightly which is a result of a combination of phosphate recycling from the sediment and low uptake below the photic zone. We observed more rapid increase in larger depth below 50m with deceasing oxygen at the shelf break. This is seen as a result of the influence of the deep Black Sea anoxic water body.

Due to gradual decomposition of organic matter deposited at the seafloor and the complete consumption of oxygen in the upper few cm of the sediment, the dissolved nitrogen pool in the sediment occurs in the form of ammonia. The concentrations increase rapidly with increasing sediment depth. The ammonia concentrations in sediment pore water are related to the pelagic and benthic biological productivity and hence the sedimentation rate on the shelf. The highest ammonia pore water concentrations were found within the Danube River plume (station DD1). On the Danube Prodelta (station DP5), the ammonia concentration in the deepest part of the core were only about 1/3 compared to the Danube plume location. The lowest porewater ammonia (one order of magnitude lower than at DD1) has been detected on the deep offshore shelf near the shelf edge were productivity and sedimentation is presumably much lower than within the Danube influence.

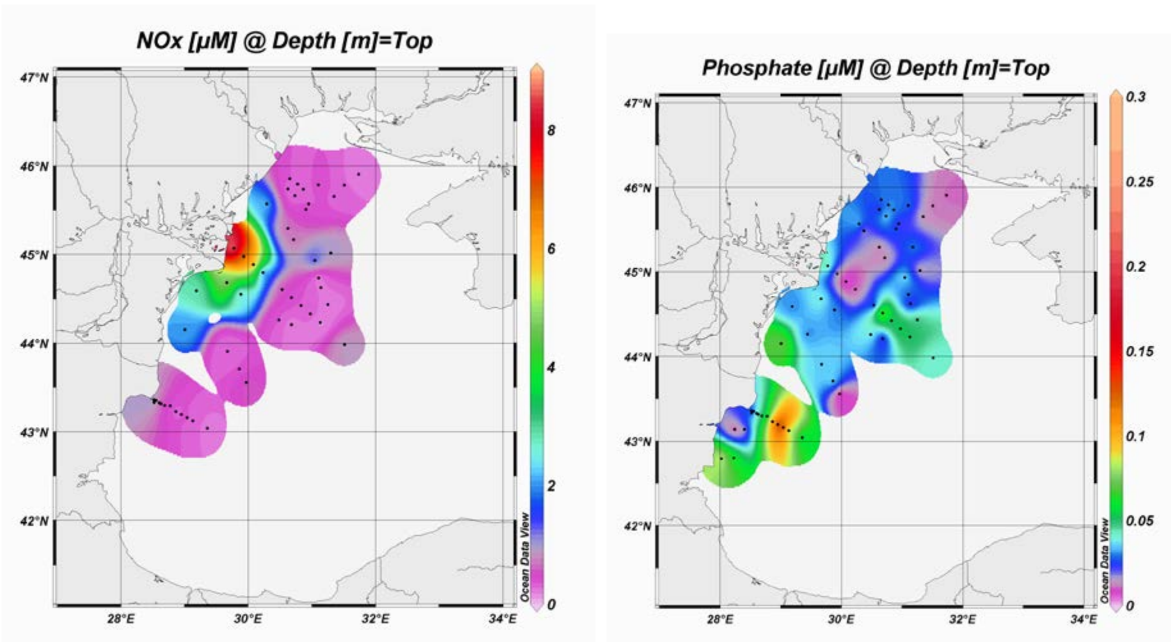

Figure 2. NOx and phosphate in the surface water in March 2008, measured during the RV Poseidon cruise POS363

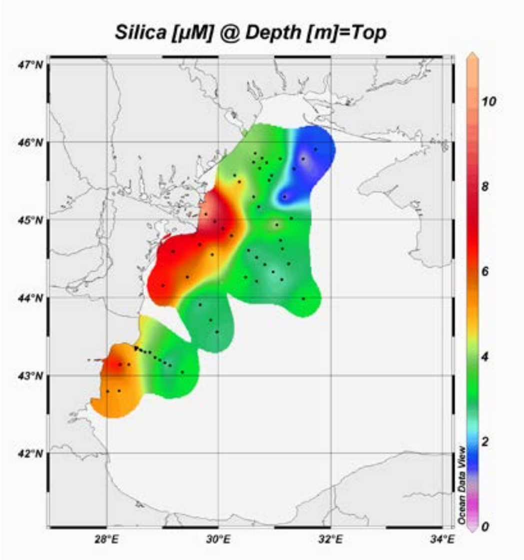

Figure 3. Dissolved silica in the surface water in March 2008, measured during the RV Poseidon cruise POS363.

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5.2 Distribution and carbon isotopic composition of lipid biomarkers (St. Kusch)

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Introduction

Paleoenvironmental studies are often based on the analysis of source-specific organic compounds, so-called biomarkers, e.g. the reconstruction of sea surface temperatures (SST) via long-chain, unsaturated alkenones (UK'37) derived from marine coccolithophorids. A prerequisite for such studies is the identical age of all compounds deposited within the same sediment layer. Postdepositional processes as well as the contribution of terrigenous organic matter however, can significantly affect the reliability of the sediment record.

The Black Sea being the world's largest basin with both well-oxygenated and permanently oxygen-deficient conditions provides ideal conditions for investigating the effect of the contribution of terrestrial organic matter to Black Sea surface sediments delivered from nearby rivers.

The objective of our research is to study the timescales of organic matter transport from the rivers to the shelf areas and finally into the deep ocean. Additionally possible lateral sediment transport processes occurring on the shelf are to be identified. These processes shall be investigated along transects in front of different river mouths which represent diverse hinterland regimes. According to the different hinterland regimes we want to investigate possible soil reservoir ages from the certain areas the rivers are draining.

The tool to differentiate between recently produced marine and pre-aged terrestrial organic compounds and to estimate the timescales of organic carbon transport from the continent to the ocean as well as intermediate storage of the organic matter is compound-specific ^{14}C analysis. The compounds to be investigated are mainly land plant derived like long chain n-alkanes, long-chain n-fatty acids or porphyrins. For the terrigenous fraction we will further use isoprenoid tetraether lipids derived from soil bacteria. In comparison marine phytoplankton derived biomarkers (alkenones and porphyrins) as well as glycerol dialkyl glycerol tetraethers (GDGTs) produced by marine Crenarchaeota will be investigated.

In addition, we will use the new branched versus isoprenoid tetraether lipid (BIT) index as an indicator for the relative fluvial contribution of terrigenous organic matter to marine sediments (Hopmans et al., 2004).

A special emphasis will be set on the isotopic investigation of porphyrins (Bidigare et al., 1991; Kashiyama et al., 2007). These are descendents of tetrapyrrols like chlorophylls and bacteriochlorophylls which themselves are produced in the biosynthetic pathways of plants. A second source, hemes occurring in animal blood, contributes only negligible amounts to the total porphyrins in marine sediments. Especially the differentiation of marine and terrigenous porphyrin-$\Delta^{14}C$-ages will provide important knowledge about the timescales of transport processes from continent to the ocean. By the investigation of same compounds with identical chemical and physical properties but deriving from different sources, the effect of reservoir ages and transport duration times should clearly be shown.

Samples

During cruise P363, near-surface sediments from 13 different sites along transport trajectories from river mouths to the open ocean, were sampled with a multicorer or a boxcorer (Table 2). The multicorer was equipped with 12 large tubes (6.7cm diameter) each of it 60 cm long.

Cores P110 and P111 were recovered from water depths of 82m and 68m, respectively. They complete a transect of cores which were taken on Meteor cruise M51/4 to investigate selective degradation of organic compounds in marine sediments that seems mainly dependent on biomarker exposure to oxygen.

For the study of terrigenous organic matter input and their transport duration across the shelf to the deep sea, two transects were run. The Danube river transect consists of 6 multicorer/boxcorer-stations from water depths ranging from 16.9m to 1336m, located in oxic as well as anoxic waters. Cores P128, P125 and P120 with water depths of 16.9m, 60m and 91m are located within the oxygenated zone, whereas core P167 in a water depth of 1336m was retrieved from anoxic waters. The cores P168 and P169 from water depths of 118m and 96m were recovered from the transition zone. Here, the CTD data taken ob board RV Poseidon immediately before deployment of the multicorer, clearly indicated anoxic conditions in the bottom waters, but the core-top sediments consist of mussel layers, like the oxic stations do. Core P177 (21.9m water depth) was sampled south of the Danube river delta to investigate transport processes of the terrigenous material from the Danube river hinterland along the shoreline in a southward direction.
The second transect for the investigation of the timescales of terrigenous organic matter transport across the shelf to the deep ocean was taken in front of the Dniester river mouth. This transect consists of 4 cores from oxic water conditions. Cores P153, P155, P157 and P158 compile this transect. They were retrieved from water depths of 32.6m, 36.1m, 44.1m and 56m. Unfortunately it was not possible to obtain further cores from anoxic waters due to restrictions by military areas along the cruise track.

At each station three cores were used for the sedimentological description during immediate sampling of the cores after recovery. Sediment cores were pushed carefully out of the tubes using a piston. In case the upper 2cm to 4cm consisted of unconsolidated, fluffy material, these were sampled with a spoon. Downcore, the sediment was cut into 1cm segments for high resolution analysis. The uppermost 4cm to 6cm were stored in pre-combusted glass jars and the remaining downcore part of the cores was stored in petri dishes. Until further processing in the laboratory, samples were kept frozen at -18°C and carried frozen by air to Bremen.

Table 2: Samples taken for lipid analysis (MUC = multicorer, BC = boxcorer).

Core No. POS 363-	**Devic e**	**Lat. N°**	**Long. E°**	**Water depth [m]**	**Sampled core length [cm]**	**No of sub-samples**
P110	MUC	43:42.61	29:51.67	82	24	24
P111	MUC	43:53.78	29:40.55	68	18	18
P120	MUC	44:30.66	30:40.93	91	20	20
P125	BC	44:42.01	30:22.65	60	14	24
P128	BC	45:04.67	29:46.67	18	35	35
P128b	MUC	45:04.69	29:46.64	16.9	36	4
P153	MUC	45:39.69	30:44.01	32.6	17	17
P155	MUC	45:30.41	30:54.26	36.1	16	16
P157	MUC	45:23.22	31:04.85	44.1	25	25
P158	MUC	45:01.05	31:18.02	56	25	25
P167	MUC	43:58.88	31:30.83	1336	55	55
P168	MUC	44:12.36	30:40.89	118	28	28
P169	MUC	44:15.48	30:29.19	96	29	29
P177	MUC	44:35.76	29:11.43	21.9	25	25

The sediment samples will be freeze-dried for further processing. Aliquots of these samples will be analyzed for bulk parameters such as total organic carbon content (TOC), C/N-ratio, water content, etc. The freeze-dried sediment samples will then be extracted with organic solvents by means of a Soxhlet apparatus to recover total extractable lipids. The total lipid extract will be separated into different compound classes such as alkanes, ketones, alcohols, fatty acids, GDGTs using standard methods (Fig 4; GDGTs missing). For the analysis of the geoporphyrins the methods need to be developed. Individual compounds will subsequently be isolated by preparative capillary gas-chromatography (PCGC) and high performance liquid-chromatography (HPLC/MS). Suitable compounds derived from terrigenous sources (e.g., long-chain n-fatty acids, long-chain n-alkanes or BIT-GDGTs) that occur in sufficient quantities for radiocarbon analysis (>100 µg C of each individual compound), will be finally purified for radiocarbon analyses using accelerator mass spectrometry.

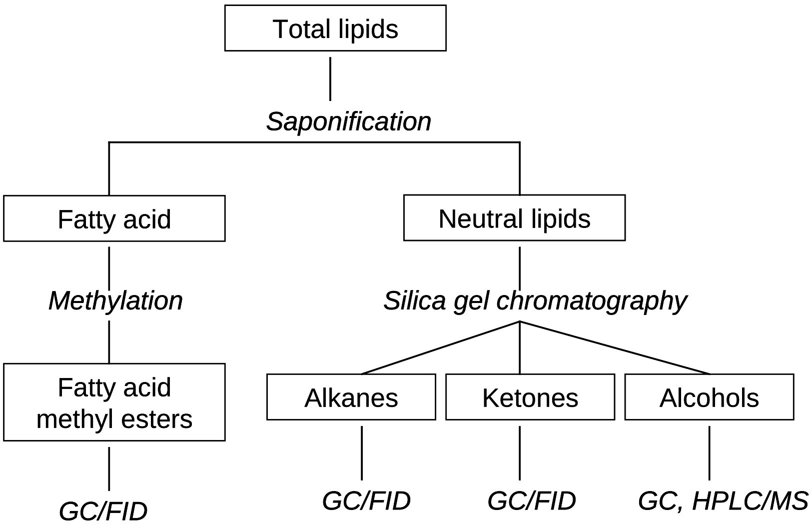

Fig. 4: Lipid extraction scheme. GC = capillary gas chromatography, FID = flame ionization detector, HPLC/MS = high performance liquid chromatography mass spectrometry.

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5.3 Phytobenthos studies (G. Minicheva)

Macrophytobenthos, pigments, transparency

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Work tasks:
Estimation of a condition of communities macrophytobentos in the Zernov Phyllophora Field (north-western shelf).
Sampling sediments for analyses of the contents of pigments and organic substance.
Measuring of transparency.

Field methods:
Sampling macroalgae from Van Veen grab, dredge and Box corer to identify floristic composition, gravimetric and morphological parameters.
Vision over the screen of benthic camera system for identified distribution and cover bottom of macrophytes community.
Sampling sediments from Box corer for analyses content pigments and organic substance.
Use of the secchi disk for measure transparency.

Laboratory methods:
Identified of macroalgae floristic composition with use determinant: *Zinova A.D*. Identification keys of green, brown and red seaweeds of the southern seas of the USSR // Moscow, Leningrad: Nauka, 1967, 397 p.
Calculated the gravimetric parameters with use geobotanic method: - *Gromov V.V*. Technique of underwater phytocenosis researches. In: Hydrobiological investigation of the northeastern part of the Black Sea // Rostov University, 1973, P. 69–72; - *Kalugina-Gutnik A.A.* Phytobenthos of the Black Sea // Kiev: Naukova Dumka, 1975, 245 p.).
Calculated the morpho-functional parameters of macroalgae : - *Minicheva G.G., Zotov A.B., Kosenko M.N.* Methodical recommendations on the morpho-functional indexes define for unicellular and multicellular forms of aquatic vegetation // GEF UNDP Black Sea Ecosystems Recovery Project. – Odessa, 2003, 32 p; - *Minicheva G.G.* Structural and functional peculiarities of formation of benthic algae marine communities // Algologia, 1993.-V.3,N1.- P.3-12.
Analyses the content pigments in the samples sediment: SCOR-UNESCO Working group № 17. Determination of photosynthetic pigments in seawater // Monographs on Oceanologic Methodology. UNESCO. – Paris. – 1966. – P 9–18; - *Lorenzen C. J.* // Limnol. Oceanogr. – 1967. – Vol 12. – P. 343–346. (Executers: Rusnak E.M., Mikulich D.V., OB IBSS).

Results:

Table 3. Secchi depth and value of benthic samples (cruise RV “Poseidon -363”, 5-25 March)

Date	Time	POS 363-	Station	Depth, m	Secchi depth (m)	Van Veen	Dredge	Pigment sample sediment	Camera track (m)
08.03.08	7.00	101	CK1	35	9	+	-	+	200
08.03.08	12.05	102	CK2	64	11	-	-	-	-
08.03.08	13.10	103	CK3	79	12	+	-	-	230
08.03.08	15.35	104	CK4	81	11	-	-	-	-
08.03.08	16.55	105	CK5	136	13	+	-	+	130
08.03.08		109	CK9	-	-	-	-	-	-
09.03.08	8.00	110	OS2	83	-	-	-	-	-
09.03.08	10.30	111	OS1	65	16	+	-	+	157
09.03.08	18.00	111	OS1-02	68	14	-	-	-	-
10.03.08	8.00	111	OS1-06	69	14	+	-	-	-
10.03.08	10.00	111	OS1-07	67	13	-	-	-	-
11.03.08	7.00	117	DP1	122	13	+	-	+	340
11.03.08	10.55	118	DD9	206	14	+	-	+	-
11.03.08	15.20	119	DD8	118	11	+	-	-	
11.03.08	17.55	120	DD7	94	10	-	-	-	170
12.03.08	7.00	125	DD5	64	10	+	-	+	270
12.03.08	11.25	126	DD3	44	5	+	-	+	180
12.03.08	15.00	127	DD2	37	4	-	-	-	-
12.03.08	16.15	128	DD1	22	4	+	-	+	
13.03.08	8.00-16.00	132	DD4	21	5 (8.00) 5(12.00) 4,5(16.00)	-	-	-	-
14.03.08	1.15	132	DD4	55	-	-	-	-	-
14.03.08	8.45	136	DN7	52	14	+	-	+	240
14.03.08	12.35	137	Phy3a	48	17	+	+	+	160
14.03.08	16.30	138	Phy3	25	17	+	-	+	165
15.03.08	7.00	139	Phy4	31	14	+	+	-	300
15.03.08	10.45	140	Phy4a	45	16	+	+	-	240
15.03.08	14.25	141	Phy 2	27	15	+	+	+	160
15.03.08	17.15	142	Phy 1	34	11	+	-	-	210
16.03.08	2.00	148	DN14		-	-	-	-	-
16.03.08	6.0	149	Phy 10	27	10	+	-	-	250
16.03.08	9.35	150	DN 16	24	10	+	-	-	200
16.03.08	11.00	151	Phy 5	30	8	-	-	-	270

Date	Time	POS 363-	Station	Depth, m	Secchi depth (m)	Van Veen	Dredge	Pigment s. sediment	Camera track (m)
16.03.08	12.05	152	Phy 6	29	10	+	-	+	110
16.03.08	13.45	153	DN 14	37	15	+	-	-	170
16.03.08	15.30	154	DN 13	39	13	+	+	-	230
17.03.08	6.30	155	DN 11	41	13	+	-	-	280
17.03.08	9.40	156	DN 10	45	15	+	-	-	280
17.03.08	11.25	157	DN8	49	16	+	+	-	170
17.03.08	16.25	158	DN6	60	10	+	-	+	160
18.03.08	5.30	159	PHy7	24	3	+	-	-	220
18.03.08	10.05	160	Phy8	23	5	+	+	-	260
18.03.08	13.10	161	Phy9	36	10	+	+	-	230
19.03.08	5.45	167	DD12	1393	-	-	-	+	-
19.03.08	7.00	168	DP1	1341	12	-	-	-	-
19.03.08	16.30	169	DP2	100	9	+	-	-	215
20.03.08	6.30	175	DP3	68	9	+	-	-	240
20.03.08	11.05	176	DP4	48	4	+	-	+	120
20.03.08	15.15	177	DP5	27	7	-	-	-	-
21.03.08	8.00 12.00 16.00	177	DP5	27	7 7,5 7	+	-	+	-
22.03.08	9.30	184	CO1	43	9	+	-	-	180
22.03.08	14.20	185	CO2	32	12	+	-	+	180
22.03.08	16.15	186	CO3	21	17	-	-	-	77
22.03.08	18.00	187	CO4	51	12	+	-	-	200
23.03.08	6.30	188	BG1	78	10	+	-	-	140
23.03.08	8.45	189	BG2	36	11	+	-	-	-
23.03.08	12.15	190	VA1	21	8	+	-	-	150
23.03.08	14.15	191	VA2	33	8	+	-	-	136
23.03.08	15.15	192	VA3	61	8	+	-	-	130
24.03.08	8.00	205	CK10	1926	12	-	-	-	-
24.03.08	10.00	206	CO10	1714	16	-	-	-	-
24.03.08	12.00	207	CO9	1218	12	-	-	-	-
24.03.08	13.30	208	CO8	104	10	-	-	-	-
24.03.08	14.30	209	CO7	84	9	-	-	-	-
24.03.08	15.30	210	CO6	77	10	-	-	-	-
Period	**8-24.0308**		**65 stations**		**64 meas.**	**42samples**	**8 samples**	**18 samples**	**track7750 m**

Table 4. Algae information (cruise RV “Poseidon-363”, 5-25 March 2008)

Date	**Station**	**Bottom covering by phyto-bentos,** %	**Dominant seaweed species**	**Full floristic composition specific surface (S/W), $m^2.kg^{-1}$**	**Size population stature, x (max), cm**	**Gravimetric descriptions** VanVeen (30x45)cm Boxcorer (50x50) cm Dredge (70x40)cm, long way ≈ 100m
14.03.08	DN7	0,1	Ph. truncata	1. Ph. truncata 2. Peyssonnelia rubra 3. Pneophyllum fragile 4. Cladophora sp. (103,2±12)	-	-
14.03.08	Phy3a	0,1	Ph. truncata Ph. crispa	1. Ph. truncata 2. Ph. crispa 3. Acrochaetium savianum 4. Sphacelaria cirrhosa 5. Peyssonnelia rubra 6. Pneophyllum fragile 7. Cladophora sp.	Ph. truncata -13,5 (17)	About 20 tallus of phyllophora by the 160 m of the video way. Dredge: Ph. truncata (6-7 tallus) ≈ 25g. <u>Average biomasses</u>: ≈ 0,35 $g.m^{-2}$
14.03.08	Phy3	15-20	Polysiphonia sanguinea	1. Ph. truncata (Cover: 0,1%) 2. Polysiphonia sanguinea, S/W - 61,05±2,67 3. Polysiphonia denudata, S/W - 72,12±2,20 4.Ceramium tenuissimum, S/W - 50,7±0,8 5. Ulva rigida 6. Pneophyllum fragile 7. Peyssonnelia rubra 8. Ectocarpus siliculosus 9. Sphacelaria cirrhosa 10. Stigeoclonium tenue S/W - 192,32±8,52	-	2 -3- tallus of phyllophora on the 165 m video way.

15.03.08	Phy4	5-7	Ph. truncata Ph. crispa	1. Ph. truncata S/W - 9,52±0,26 2. Ph. crispa S/W - 7,95±0,52 3. Polysiphonia sanguinea, S/W - 55,53±2,25 4. Polysiphonia denudata, S/W - 66,82±2,61 5. Lomentaria clavelosa S/W -11,72±0,52 6. Sphacelaria cirrhosa, S/W – 209,8±8,5 7. Acrochaetum savianum 8. Stigeoclonium tenue, S/W- 254,0±17,6 9. Rhodochorton purpureum 10. Pneophyllum fragile 11. Peyssonnelia rubra 12. Ectocarpus siliculosus	Ph. truncata -8,1 (18) Ph. Crispa -8,5 (15)	VanVeen: Ph. truncata ≈ 3-5g. Dredge: ≈ 100-200 g. Ratio Ph. truncata to Ph. crispa, as: 97-98% to 2-3%. Biomasses on cover: ≈30 $g.m^{-2}$ Average biomasses: ≈ 2,0 $g.m^{-2}$
15.03.08	Phy4a	0,1	Ph. crispa	1. Ph. crispa S/W - 6,31±0,46 2. Ph. truncata S/W - 11,67±0,25 3. Pneophyllum fragile 4. Peyssonnelia rubra	Ph. truncata -6,9 (8,5) Ph. Crispa 5,7 (9,5)	VanVeen: ≈ 0,5-1 g Ph. crispa Dredge: ≈ 20-50 g dominate the Ph. crispa Biomasses on cover: ≈ 5 $g.m^{-2}$ Average biomasses: from 0,005 to 0,5 $g.m^{-2}$
15.03.08	Phy 2	15-20 (30)	Polysiphonia sanguinea	1.Polysiphonia sanguinea, S/W – 59,00±1,85 2. Ph. truncata(Cover: 0,1%) S/W – 10,21±0,32 3. Ph. crispa S/W - 6,30±0,48 4. Lomentaria clavelosa 5. Acrochaetum savianum 6. Pneophyllum fragile 7. Peyssonnelia rubra	Ph. Truncata - 9,02 (20)	Dredge: Ph. truncata ≈ 20-50 g Average biomass: ≈ 0,5 $g.m^{-2}$

				8. Cladophora sp. 9. Ectocarpus siliculosus 10. Sphacelaria cirrhosa Lot of Diatom algae		
15.03.08	Phy 1	5-10 (20)	Ph. truncata	1. Ph. truncata S/W – 10,16±0,32 2. Ph. crispa 3. Pneophyllum fragile 4. Peyssonnelia rubra 5. Polysiphonia sanguinea 6. Ectocarpus fasciculatus 7. Ulothrix implexa	-	VanVeen: Ph. truncata ≈ 5 g. Biomasses on cover: ≈ 37,5 $g.m^{-2}$ Average biomasses: ≈ 3,7 $g.m^{-2}$
16.03.08	Phy 10	10-15	Polysiponia sanguinea	1. Polysiponia sanguinea, S/W – 70,16±3,50 2. Ph. truncata (Cover: 0,01%) 3. Acrochaetum savianum S/W – 454,7±17,04 4. Pneophyllum fragile 5. Peyssonnelia rubra 6. Ectocarpus siliculosus 7. Sphacelaria cirrhosa Lot of Diatom algae	-	
16.03.08	DN 16	0,5-1	Ectocarpus siliculosus	1. Ectocarpus siliculosus, S/W – 148,2±9,5 2. Ph. truncata (Cover: 0,001%) 3. Sphacelaria cirrhosa 4. Pneophyllum fragile 5. Peyssonnelia rubra 6. Polysiponia sanguinea	-	
16.03.08	Phy 5	0,1	Ph. truncata	1. Ph. truncata 2. Pneophyllum fragile 3. Ph. crispa	-	About 20-25 tallus of phyllophora by the 270 m of the video way.
16.03.08	Phy 6 (B5)	0,5-1	Ph. truncata	1. Ph. truncata 2. Polysiponia sanguinea S/W – 64,64±3,68 3. Polysiphonia denudata, S/W – 68,56±3,52	-	VanVeen: Ph. truncata ≈ 1,0 g. Biomasses on cover: ≈ 7,5 $g.m^{-2}$ Average biomasses: ≈ 0,8

				4. Pneophyllum fragile 5. Peyssonnelia rubra 6. Acrochaetum savianum		g.m^{-2}
16.03.08	DN 14	1-3	Ph. crispa	1. Ph. crispa 2. Ph. truncata 3. Pneophyllum fragile 4. Peyssonnelia rubra 5. Polysiponia sanguinea	-	Ph. crispa to form the islands size ≈ (1,5 x 0,3)m, between distance ≈ 30-50 m.
16.03.08	DN 13	5-8 (10)	Ph. truncata	1. Ph. truncata S/W – 9,30±0,29 2. Ph. crispa S/W – 8,53±0,433 3. Polysiponia sanguinea, S/W – 88,1±7,3 4. Pneophyllum fragile 5. Peyssonnelia rubra	Ph. truncata-11,3 (22) Ph. Crispa 9,9 (14)	Dredge: Ph. truncata- 1200 g , Ph. crispa-45 g. Ratio Ph. truncata to Ph. crispa, as: 95-97% to 3-5%. Average biomasses: Ph. truncata- 17,0 g.m^{-2}; Ph. crispa – 0,5 g.m^{-2}
17.03.08	DN 11	10 (15)	Ph. truncata	1. Ph. truncata 2. Ph. crispa 3. Pneophyllum fragile 4. Peyssonnelia rubra 5. Sphacelaria cirrhosa	Ph. truncata-8,5 (14)	1 Van Veen and 4 Boxcore: the average weight of phyllophra from 1 simples - 3,5 ±1,5 g. Ratio Ph. truncata to Ph. crispa, as: 99,5% to 0,5%. Biomasses on cover: ≈ 26,3 g.m^{-2} Average biomasses: ≈ 2,6 g.m^{-2}
17.03.08	DN 10	5-7	Ph. truncata	1. Ph. truncata 2. Ph. crispa 3. Pneophyllum fragile 4. Peyssonnelia rubra	-	In Van Veen -Ph. truncata – 1,5 g Biomasses on cover: ≈ 1,25 g.m^{-2} Average biomasses: 0,08 g.m^{-2}
17.03.08	DN8	5-10	Ph. truncata	1. Ph. truncata S/W – 8,51±0,34 2. Pneophyllum fragile 3. Ph. crispa	Ph. truncata – 12,6 (22)	Vanveen: Ph. truncata – 0,5 g. Dredge: Ph. truncata - 350 g. Biomasses on cover: ≈ 3,7 g.m^{-2}

						Average biomasses: from 0,185 to 5,0 $g.m^{-2}$
18.03.08	Phy8 (D7)	0,01	Ph. truncata	1. Ph. truncata	-	2-3 tallus of phyllophora by the 260 m of the video way.
18.03.08	Phy9	0,1	Ph. truncate Ph. crispa	1. Ph. truncata S/W – 9,91±0,27 2. Ph. crispa S/W – 7,01±0,53 3. Pneophyllum fragile 4. Peyssonnelia rubra	Ph. truncata – 10,96 (18) Ph.crispa – 11,6 (16).	VanVeen: Ph. truncata and Ph crispa – 0,5 g. 1-2 tallus of phyllophora by the 230 m of the video way. Dredge: Ph. truncata – 22 g, Ph. crispa -18 g. Ratio Ph. truncata to Ph. crispa, as: 50% to 50%. Biomasses on cover: ≈ 3,7 $g.m^{-2}$ Average biomasses: Ph. truncata- 0,30 $g.m^{-2}$; Ph. crispa – 0,25 $g.m^{-2}$

Table 5. Content pigments and organic substance (cruise RV “Poseidon-363”, 5-25 March 2008)

POS 363-	Station	Depth, m	Dry substance, %	Organic substance in dry masse, %	Content in dry substance, µg g^{-1}		Phaeopig-ments from general chlorophyll, %
					Carotenoids	Chl.”a”	
128	DD1	21	57.2	13.4	15.4	37.4	37
126	DD3	44	78.8	11	6.34	20.2	47
125	DD5	64	58.8	29.3	20.4	21.1	53
118	DD9	206	57.4	26.4	407	79.6	89
167	DD12	1393	38.5	33.4	1231.1	252.4	97
141	Phy2	27	72.1	10.6	4.1	13.8	43
138	Phy3	25	77.7	22.2	0.9	22.6	45
152	Phy6	29	69.9	27.1	2.8	16.7	57
117	DP1	122	70	23	21.4	5.6	73
129	DP4	48	51.7	18.6	27.7	7.5	67
125	DP5	27	59.2	12.7	76	41.4	77
101	CK1	35	67.9	10.6	0.3	30.8	54
105	CK5	136	52.1	28.4	69.1	16.3	82
158	DN6	60	52.3	35.5	38.2	25.2	87
136	DN7	52	55.9	27.9	57.2	28.6	46
185	CO2	32	78.7	7.8	1.3	10.9	39
111	OS1	65	54.2	24.8	7.4	15.7	25

5.4 Oceanography report. Part: Romanian Waters (G. Shapiro)

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Aims and objectives.

The aims of the group were:

- Collect oceanographic water column data (temperature, salinity, oxygen, current velocities) and remotely sensed data (Sea Surface Temperature and Chlorophyll- a concentration) for the study of the water column processes on the western and north-western shelves of the Black Sea.
- Collect water samples for the geochemistry and biochemistry group and for the Institute of Oceanology (Varna).
- Operate Fast Rate Repetition Fluorometer (FRRF) and pass the data to the biochemistry group

Constitution and duties.

The group consisted of Prof Georgy Shapiro (group leader, University of Plymouth, UK), Dr Dmitry Aleynik (University of Plymouth, UK), Mr Dmitry Soloviev (Marine Hydrophysical Institute, Ukraine). The duties were shared as follows

- G.Shapiro – group supervision, night time watch sampling (from 20:00 to 8:00), operational data analysis and interpretation, communication with IFMGEOMAR, safety and risk assessment within the group.
- D.Aleynik – day time watch sampling (from 8:00 to 20:00), provisional data processing, setting up and maintenance of FRRF.
- D.Soloviev – receiving and full processing of the remotely sensed satellite information (SST and Chl-a), night time watch sampling (together with G.Shapiro, from 20:00 to 8:00), assistance in measuring water transparency conducted by Odessa Branch of the Institute of Biology of Southern Seas group.

Equipment and data collection methodology.

The hydrographic data were collected using a rosette-CTD package equipped with 11 Hydro-Bios (Apparategebau, Germany) type bottles. The rosette also contained a Fast Rate Repetition Fluorometer mounted in place of the 12th bottle. The pressure, temperature and conductivity data were acquired using a Seabird SBE-9/11plus CTD profiler. The current velocity was measured by a ship mounted Acoustic Doppler Current Profiler (ADCP) model RDI WH600. ADCP acquisition kit was configured to receive data from the ADCP and the ship navigation system NMEA. The ship velocity data (VTG signal) was not transmitted to the ADCP kit via NMEA, so the ADCP recorded uncorrected velocities (a combination of the ship and water current velocities). The actual current velocities will be obtained through further processing of the recorded acoustic signal in the home institution (University of Plymouth). Both ADCP and CTD devices were kindly provided by the IFM-GEOMAR (Kiel, Germany), and were calibrated following IFM-GEOMAR protocol before the cruise. The high resolution (1.1x 1.1 km pixel size) satellite imagery of sea surface temperature and Chl-a was provided by the support team from the Marine Hydrophysical Institute (MHI, Ukraine) using the level-2 data from MODIS AQUA satellite distributed by Oceancolor, NASA. These data were transmitted to the ship as raw binary data via mobile INTERNET from the MHI server when working close to the coastal mobile transmitting stations. When the ship was further off-shore, the raw satellite images were transmitted from MHI via the ship's email system. Weather data were obtained from the standard ship weather station.

Data collection was carried out on a 24 hours/ 7 days a week basis. The details of the stations taken by the oceanography group are shown in the Table 6 below.

Table 6. List of CTD stations

Hydrology group log book
POSEIDON 363
March 2008

Station no	Station name	cast no	Date	Start time GMT	CO-ORDINATES Latitude, deg.mins.decimals	Longitude, deg.mins.decimals	Depth of sea m	Depth of sounding m	METEO/ SHIP data wind speed m/s	wind direction, deg	T-air, deg C	T-water, surf, degC	S, surf ppt	NAV HDT, after station	CHEMISTRY Bottle depths, m (NO;D)
101	CK1	1	8-3-2008	05:00	43.21.588	28.31.031	33.6		4.8	200	7.3	6.9	17.100		
101	CK1	2	8-3-2008	06:42	43.21.588	28.31.031	36		8.3	210	6.6	6.8	17.036		30;10;0
102	CK2	1	8-3-2008	10:06	43.19.647	28.35.94	67.3	62	5.1	203	7.7	7.1	17.085		62;40;20;5;0
103	CK3-1	1	8-3-2008	11:07	43.17.74	28.41.08	84.3	78	7.8	199	8.4	7.7	17.360		
103	CK3-2	2	8-3-2008	11:31	43.17.70	28.41.19	83.3	79	7.3	205	8.9	7.8	17.370		70;40;20;5
104	CK4	1	8-3-2008	13:38	43.15.66	28.46.50	93.3	87	5.8	204	9.3	7.9	17.413		86;60;40;20;5
105	CK5	1	8-3-2008	14:57	43.13.63	28.51.79	140.3		6.1	214	10.0	8.0	17.516		132;100;75;50;25;5
106	CK6	1	8-3-2008	18:09	43.11.50	28.57.10	773	500	6.1	214	10.0	8.0	17.500		150;110;80;50;25;5
107	CK7	1	8-3-2008	19:43	43.09.40	29.02.50	1047	500	6.1	214	10.0	8.1	17.510		80;45;5
108	CK8	1	8-3-2008	21:13	43.07.39	29.07.88	1465	500	8.1	170	6.7	8.0	17.448		156
109	CK9	1	8-3-2008	22:45	43.05.02	29.16.96	1806	500	5.1	166	6.7	7.8	17.630		5
110	OS1	1	9-3-2008	06:05	43.42.59	29.51.70	82		2.7	137	5.4	7.7	17.519		
111	OS2-1	1	9-3-2008	08:32	43.54.34	29.40.56	69.3		5.0	174	6.6	8.0	17.550		65;60;40;20;5
111	OS2-2	2	9-3-2008	15:30	43.53.78	29.40.58	69		4.1	196	8.4	8.0	17.525		0
111	OS2-3	3	9-3-2008	17:03	43.53.77	29.40.57	68	66	4.7	192	8.2	8.1	17.520		
111	OS2-4	4	9-3-2008	19:02	43.53.77	29.40.57	68		4.2	221	8.4	8.0	17.524		
111	OS2-5	5	9-3-2008	21:00	43.53.77	29.40.56	72.3		5.7	224	8.5	8.1	17.530		
111	OS2-6	6	10-3-2008	06:01	43.53.76	29.40.57	68		6.9	328	9.3	8.1	17.550		
111	OS2-7	7	10-3-2008	08:03	43.53.77	29.40.56	68		7.3	217	10.0	8.1	17.550		
112	OS3	1	10-3-2008	19:20	43.58.90	31.30.19	1340	500	5.5	259	9.0	8.3	17.550		
113	DD11	1	10-3-2008	21:24	44.07.94	31.16.90	853	500	5.2	222	8.6	8.1	17.588		
114	DP1a	1	10-3-2008	22:39	44.04.43	31.10.46	898	500	5.1	217	8.5	8.1	17.530		
115	DD10	1	11-3-2008	00:30	44.13.63	31.07.91	559	500	5.0	207	8.3	8.0	17.584		80;52;45;25;5
116	DP1b	1	11-3-2008	02:43	44.08.73	30.54.71	362	345	6.9	192	8.3	7.9	17.440		
117	DP1	1	11-3-2008	05:10	44.12.37	30.40.91	122	115	5.6	187	8.5	7.8	17.510		5
118	DD9	1	11-3-2008	08:52	44.19.54	30.58.49	201	197	6.9	193	8.4	8.2	17.480	316	197;150;125;92;75; 55;45;35;20;5
119	DD8	1	11-3-2008	13:38	44.25.20	30.49.62	117		10.1	196	8.8	8.1	17.460	113	115;90;80;68;40;30 ;20;05
120	DD7	1	11-3-2008	16:06	44.30.60	30.40.90	90	88	0.0	177	9.0	8.1	17.450	163	88;68;40;5

121	DP2	1	11-3-2008	20:42	44.15.54	30.29.24	99		9.6	171	9.5	8.0	17.380	289	
122	DP3a	1	11-3-2008	22:33	44.19.39	30.14.30	87		0.0	167	9.5	7.9	17.293	289	
123	DP3	1	12-3-2008	00:03	44.22.60	30.01.44	68	63	8.5	169	9.0	7.8	17.160	55	
124	DD6	1	12-3-2008	03:22	44.36.15	30.32.08	79	72	8.8	165	8.9	7.6	17.350	308	73;42;37;5
125	DD5	1	12-3-2008	05:04	44.42.01	30.22.62	63	56	7.9	162	8.8	7.4	16.950		
126	DD3	1	12-3-2008	09:30	44.53.02	30.04.81	46	41.6	7.3	171	8.3	6.8	14.530		40;20;13;5
127	DD2	1	12-3-2008	12:38	44.58.51	29.55.81	37		7.5	177	8.4	7.5	13.760	151	36;19;10;5
128	DD1-1	1	12-3-2008	15:00	45.04.18	29.46.50	18		0.0	178	8.2	7.3	15.680		15;15;5;0
128	DD1-2	2	13-3-2008	06:00	45.04.70	29.46.65	21.1		7.0	207	7.8	6.3	16.071		
128	DD1-3	3	13-3-2008	10:00	45.04.69	29.46.64	17.1		6.8	225	10.5	6.6	16.110		
128	DD1-4	4	13-3-2008	13:30	45.04.64	29.46.65	17.1		5.9	16	11.2	6.9	16.170		
129	DP4	1	13-3-2008	18:20	44.40.91	29.39.98	50.1		4.3	324	9.4	6.9	15.513		43.5;25;8
130	DP4a	1	13-3-2008	20:11	44.32.99	29.53.19	61	55	4.4	295	7.9	7.5	16.460		50;24;5
131	ED1	1	13-3-2008	21:27	44.38.22	30.00.64	61.3	56	6.1	323	8.7	7.4	16.025	44	
132	DD4	1	13-3-2008	23:15	44.47.54	30.13.74	57	51	7.7	325	7.9	7.2	15.650	44	51;20;4
133	ED2	1	14-3-2008	00:54	44.55.58	30.24.30	52	47	8.2	333	7.8	6.9	15.770		
134	ED3	1	14-3-2008	02:15	45.02.43	30.33.19	51	45	8.6	342	8.6	6.4	15.830	44	
135	ED4	1	14-3-2008	03:47	45.09.82	30.42.99	44	38	8.4	338	6.6	6.7	16.958		
136	DN7	1	14-3-2008	06:41	45.17.47	31.10.78	48	47	11.3	343	6.3	6.7	17.570	341	38;5
137	Phy3a	1	14-3-2008	10:40	45.32.33	31.33.27	43	42	8.7	312	6.0	5.9	17.602	307	5
138	Phy3	1	14-3-2008	14:35	45.54.28	31.44.15	21	20	5.3	307	6.3	5.2	17.080	307	20;10;05
139	Phy4	1	14-3-2008	17:01	45.46.86	31.30.61	27	26	5.2	305	7.4	5.5	17.510	311	26;15;05
139	Phy4	2	15-3-2008	06:01	45.46.81	31.30.29	31	24	8.4	188	6.8	5.5	17.540	199	
140	Phy4a	1	15-3-2008	08:50	45.39.10	31.20.78	41	40	8.3	219	7.2	5.7	17.520	223	40;5
141	Phy2	1	15-3-2008	12:27	45.47.13	31.05.97	22.2	22	8.4	294	5.9	4.7	17.136	258	22;5
142	Phy1	1	15-3-2008	15:24	45.44.04	30.51.78	29	27	12.8	320	7.0	5.0	17.190	258	27;26;5
143	DN12	1	15-3-2008	18:26	45.34.06	30.56.88	37	30	11.0	317	5.8	5.0	17.266	155.0	30;5
144	DN8	1	15-3-2008	20:19	45.23.17	31.04.84	46.1	41	10.8	326	6.1	6.0	17.485	315.0	41;5
145	DN10	1	15-3-2008	21:59	45.27.00	31.00.00	45	38	8.7	334	5.7	5.7	17.465	305.0	
146	DN11	1	15-3-2008	23:00	45.30.39	30.54.33	40.9	33	8.4	303	5.6	5.4	17.354	326.0	33;4
147	DN13	1	16-3-2008	00:14	45.34.38	30.49.70	39.4	32	11.7	180	5.1	5.2	17.261	324.0	
148	DN14	1	16-3-2008	01:27	45.39.67	30.44.03	37.1	29	7.2	323	4.7	5.0	17.046	10.0	29;15;5
149	Phy10	1	16-3-2008	04:00	45.47.48	30.46.59	29	23	6.2	287	4.3	4.7	17.450	0.0	23;5
150	DN16	1	16-3-2008	06:34	45.51.04	30.39.46	24	19	0.0	0	0.0	0.0	0.000	0.0	19;5
151	Phy5	0	16-3-2008	08:53	45.44.31	30.31.65	26	0	0.0	0	0.0	0.0	0.000	0.0	
152	Phy6	1	16-3-2008	10:02	45.44.22	30.37.70	25	23	0.0	0	0.0	0.0	0.000	0.0	22;13;5
153	Phy6	1	16-3-2008	12:20	45.39.67	30.44.02	33	31	0.0	0	0.0	0.0	0.000	0.0	
154	DN13	0	16-3-2008	13:00	45.34.37	30.49.69	35	0	0.0	0	0.0	0.0	0.000	0.0	
155	DN11	1	17-3-2008	04:28	45.30.41	30.54.30	39.5	35	8.0	221	7.7	7.6	17.210	0.0	35;35.5
156	DN10	1	17-3-2008	08:20	45.26.78	30.59.08	41	39	7.4	228	8.0	5.9	17.397	219.0	
158	DN6	1	17-3-2008	14:20	45.01.00	31.17.55	58	56	10.1	205	9.1	7.8	17.250	152.0	56;28;5
159	Phy7	1	18-3-2008	04:56	45.34.13	30.17.39	23	19	4.3	280	8.7	6.1	16.120	0.0	19;5
159	Phy7	2	18-3-2008	06:53	45.34.10	30.17.37	23	18	4.5	297	8.3	6.3	16.090	0.0	18;10;5
160	Phy8	1	18-3-2008	08:08	45.29.13	30.22.28	24	19	3.4	275	7.7	8.4	15.470	178.0	2;
161	Phy9	1	18-3-2008	10:56	45.17.50	30.37.50	32	32	4.4	214	7.7	6.5	16.390	204.0	26;5
162	ED4a	1	18-3-2008	13:20	45.09.81	30.42.95	40	38	5.8	183	8.2	6.8	17.040	161.0	
163	ED5	1	18-3-2008	16:43	44.55.83	31.02.75	62	60	5.2	215	8.1	7.7	16.660	234.0	60;35;5

164	ED6	1	18-3-2008	19:04	44.43.87	31.06.44	92	86	5.8	211	8.6	8.2	17.483	165.0	86;65;50;20;5
165	ED7	1	18-3-2008	21:15	44.37.49	31.08.42	288	280	6.3	217	8.6	8.0	17.449	160.0	170;100;50;22;5
166	ED8	1	18-3-2008	23:20	44.26.00	31.15.07	605	500	7.4	209	8.8	8.0	17.462	155.0	200;100;70;50;25;5 500;100;125;?;90;2
167	DD12	1	19-3-2008	03:41	43.58.90	31.30.86	1339	500	7.6	244	9.3	8.1	17.530	0.0	5;?
167	DD12	2	19-3-2008	05:48	43.58.90	31.30.88	1339	150	7.4	306	8.9	8.1	17.550	0.0	150;70;52;25
168	DP1	1	19-3-2008	12:01	44.12.33	30.40.89	117	112	10.2	338	5.3	8.2	17.430	0.3	112;72;43;5
169	DP2	1	19-3-2008	13:52	44.15.50	30.29.14	95	92	1.4	285	4.9	8.1	17.140	89.0	92;75;5
170	DD7a	1	19-3-2008	17:59	44.30.66	30.40.90	94	88	2.5	248	5.6	7.9	17.171	287.0	
171	DD6a	1	19-3-2008	19:22	44.36.16	30.32.10	79	75	11.5	238	5.7	7.6	16.250	304.0	
172	DD5a	1	19-3-2008	20:59	44.41.97	30.22.80	63	57	6.1	239	5.1	7.6	16.040	302.0	
173	DD4a	1	19-3-2008	22:19	44.47.54	30.13.79	56.3	49	6.1	257	5.5	7.3	15.231	304.0	
174	DD3a	1	19-3-2008	23:42	44.53.03	30.04.90	45.7	38	7.1	261	5.7	7.3	14.604	187.0	
175	DP3a	1	20-3-2008	04:20	44.22.60	30.01.30	68	63	4.8	246	5.5	7.6	16.470	0.0	
176	DP4	1	20-3-2008	09:03	44.41.03	29.36.92	48	44	6.4	220	5.2	7.1	13.670	216.0	5;
177	DP5	1	20-3-2008	12:58	44.35.28	29.11.43	24	22	6.7	189	6.3	6.9	16.220	211.0	5;
177	DP5	2	21-3-2008	06:00	44.35.76	29.11.43	26.2	20	1.3	41	4.8	6.6	16.195	0.0	20;10;4
177	DP5	3	21-3-2008	10:00	44.35.75	29.11.43	26.2	20	1.7	257	5.2	7.0	16.196	0.0	
177	DP5	4	21-3-2008	12:27	44.35.75	29.11.44	26.2	20	3.7	340	6.0	6.9	16.160	204.0	
178	OS4	1	21-3-2008	16:03	44.24.43	29.19.67	49	43	6.4	191	6.5	6.9	16.300	213.0	
179	OS5	1	21-3-2008	18:05	44.15.74	29.26.39	55	50	9.2	208	6.8	7.7	16.567	155.0	50;5
180	OS6	1	21-3-20008	19:37	44.07.01	29.33.05	61	54	9.4	209	6.9	7.8	16.760	159.0	
181	OS1a	1	21-3-2008	21:33	43.54.34	29.40.57	70	64	9.6	214	7.1	8.1	17.170	159.0	3;
182	OS2a	1	21-3-2008	23:32	43.42.63	29.51.67	65.3	60	7.4	201	7.1	8.1	17.308	152.0	
183	OS7	1	22-3-2008	01:00	43.33.37	29.58.33	700	500	7.0	195	7.1	8.0	17.431	308.0	200;150;125;106;8 3;70;60;50;40;24;5
184	CO1	1	22-3-2008	07:44	44.09.16	29.00.42	44	39	8.0	185	7.9	7.3	16.320	185.0	39;5
185	CO2	1	22-3-2008	12:10	44.46.52	28.39.01	33	27	8.3	185	8.3	7.8	17.370	174.0	
186	CO3	1	22-3-2008	14:35	43.36.29	28.36.45	19	15	5.8	180	9.7	7.9	17.500	153.0	
187	CO4	1	22-3-2008	15:53	43.36.21	28.40.43	50	46	2.9	171	9.3	8.1	17.310	153.0	
188	BG1	1	23-3-2008	04:31	42.41.88	28.13.68	79	72	7.5	199	10.0	8.1	16.770		73;30;5
189	BG2	1	23-3-2008	06:43	42.47.49	28.01.00	36	31	2.7	163	11.9	7.7	16.730	177.0	31;5
190	VA1	1	23-3-2008	10:12	43.08.16	28.03.01	17	15	10.7	178	10.5	7.9	16.770	154.0	
191	VA2	1	23-3-2008	11:45	43.08.28	28.14.46	33	28	7.4	160	10.1	8.0	16.770	166.0	28;5
192	VA3	1	23-3-2008	13:11	43.08.24	28.23.88	63	54	10.5	163	10.0	7.9	16.800	168.0	54;20;5
193	CK1a	1	23-3-2008	16:09	43.21.60	28.31.03	39	34	3.8	259	10.5	7.8	16.898	200.0	29;5
194	CK1b	1	23-3-2008	16:55	43.21.05	28.33.01	49	44	3.7	253	10.4	7.9	17.088	200.0	44;30;5
195	CK2a	1	23-3-2008	17:30	43.19.56	28.35.95	67	67	6.0	202	10.2	8.0	17.290	213.0	62;28;5
196	CK2b	1	23-3-2008	18:05	43.18.85	28.37.71	75.3	69	2.5	240	9.9	7.9	17.272	116.0	69;41;31;5
197	CK3a	1	23-3-2008	18:52	43.17.75	28.41.22	84	77	8.0	191	10.6	8.1	17.010	118.0	77;56;31;5
198	CK3b	1	23-3-2008	19:38	43.16.25	28.44.50	91.3	84	6.5	187	10.5	8.4	17.197	108.0	
199	CK4a	1	23-3-2008	20:15	43.15.70	28.46.52	94	87	8.2	185	11.3	8.3	17.400	115.0	
200	CK5a	1	23-3-2008	21:18	43.13.62	28.51.85	140	132	3.2	149	9.7	8.1	17.435	115.0	132;100;63;40;5
201	CK6a	1	23-3-2008	22:46	43.11.58	28.57.08	782	500	4.4	179	12.7	8.1	17.424	116.0	
202	CK7a	1	24-3-2008	00:00	43.09.41	29.02.55	1055	500	2.0	188	11.0	8.1	17.441	116.0	
203	CK8a	1	24-3-2008	01:12	43.07.40	29.07.88	1463	500	10.5	193	12.1	8.0	17.436	116.0	100;80;60;35;5
204	CK9a	1	24-3-2008	02:47	43.04.93	29.13.99	1798	500	9.8	195	11.5	8.2	17.460	119.0	
205	CK10	1	24-3-2008	04:13	43.02.18	29.21.19	1925	500	10.6	206	10.7	8.3	17.560		300;250;225;200;1 80;160;140;120;10 0;75;64
205	CK10	2	24-3-2008	06:01	43.02.18	29.21.10	1926	500	12.0	219	11.6	8.3	17.540		50;47;42;30;5
206	CO11	1	24-3-2008	07:46	43.11.54	29.27.47	1713	500	8.4	219	11.4	8.4	17.580	184.0	
207	CO9	1	24-3-2008	09:59	43.10.24	29.14.95	1198	500	5.8	247	11.2	8.2	17.394	170.0	
208	CO8	1	24-3-2008	11:36	43.20.19	29.04.67	109	103	8.3	209	12.6	8.6	17.380	176.0	30;20;5
209	CO7	1	24-3-2008	12:59	43.23.89	28.54.93	84	81	7.5	178	11.3	8.7	17.360	208.0	
210	CO6	1	24-3-2008	14:11	43.26.03	28.48.98	77	70	7.9	163	11.5	8.4	17.180	163.0	
211	CO6	1	24-3-2008	15:08	43.27.98	28.43.20	67	62	11.2	174	11.7	8.3	17.140	183.0	

Provisional results.

Figure 1 shows a map with the location of the CTD stations. The North-western shelf of the Black Sea experiences thermal heating and freshwater input from rivers during the spring months. The latter affects the salinity distribution and can be detected far offshore (up to 100 km from the coast). The temperature, salinity and density distribution over the whole study region were comparable with the typical early-spring values. Preliminary analysis shows a strong cold coastal jet flowing southward along the western coast of Romania and Bulgaria (Fig.5 and Fig 6). The jet was evolving during the cruise and generated a multi-frontal structure of coastal and shelf water masses. Stratification in the area was variable, from well-mixed waters on some stations to well stratified and dynamically active waters further off-shore. The ADCP data acquisition system was configured to record uncorrected speed of water relative to the moving vessel, so that actual current velocities will be obtained after in-lab processing using the software scripts developed in UoP.

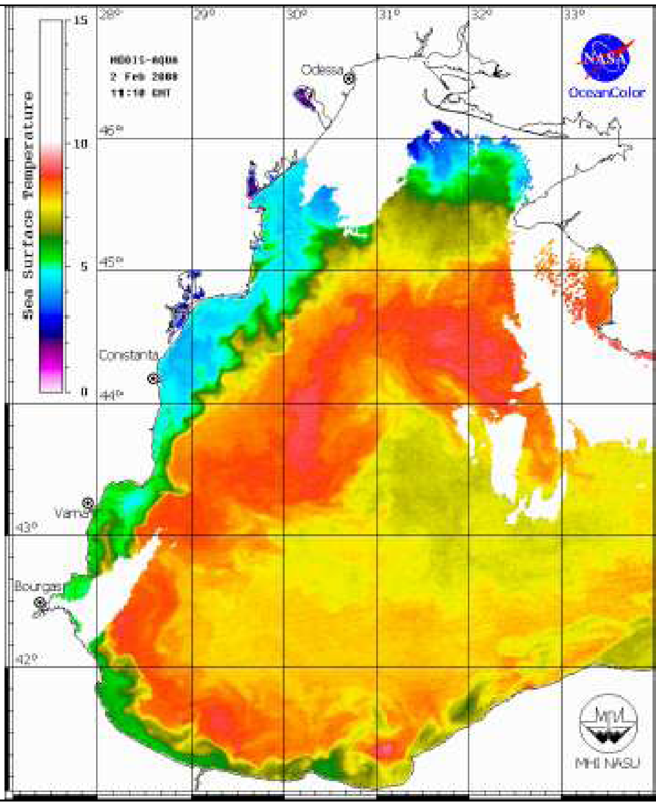

Fig.1. Sea Surface Temperature Distribution before the cruise (02 February 2008)

Figure 5.

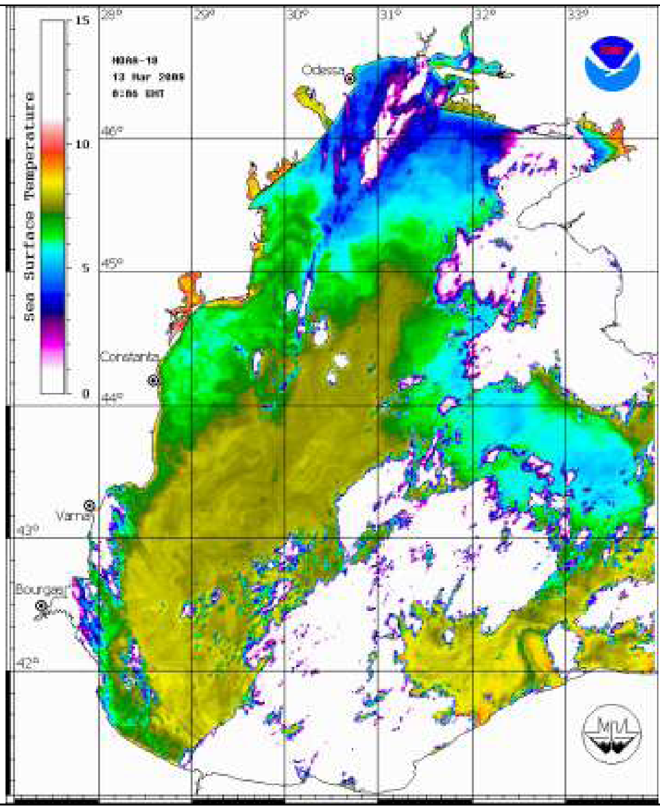

Fig.2. Sea Surface Temperature Distribution in the middle of the cruise (13 March 2008)

Figure 6.

5.5 Benthic Image Analysis, Romanian territorial waters (T. Stevens)

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The benthic imaging sled was deployed at 41 stations throughout the cruise (Table7 and Figure 7). For this cruise, the sled was equipped with a Kongsberg Simrad 14-208 camera, which allows for real-time capture of video at VGA resolution, plus high-resolution still images at 5 Mpixels. Lighting was provided by 2 OM1000 250w underwater floodlights. This system provided extremely detailed images, allowing identification of a greater range of taxa, and with much improved confidence.

The field of view of the camera was fixed and calibrated at the beginning, middle and end of the cruise. Calibrated area was 0.29 m^2 and did not vary between these times. Target imaging transect length was 200m or 10minutes, with 10 high resolution stills per transect. Video was recorded on an ARCHOS AV700 digital video recorder as .avi files, using a DivX codec.

Quantitative data will be extracted from the high resolution still images by manual counts of solitary organisms (e.g. *Ciona intestinalis*) or indicators (e.g. number of burrows), or estimates of percent cover for colonial or cover-forming organisms (e.g. *Phyllophora spp.*). For extremely numerous taxa, images were subsampled and counts extrapolated to the full image size. The video recordings were used to provide context for the still image analysis, and to weight cover estimates and counts.

A total of approximately 8 km of transects, representing an area of about 4500 m^2, was sampled by the imaging sled. Quantitative data on the abundance of 25 taxa and 3 indicators of bioturbation was collected from 476 still images at 36 of the 41 transects. One transect was aborted because of unsuitable terrain, and the final 4 transects were conducted using only a backup video sensor because of a communications failure.

Preliminary analyses for this report have concentrated on illustrating distribution patterns of key elements of the benthos (Figure 8) and an initial multivariate analysis of patterns of biodiversity (Figure 9). Future analyses will concentrate on testing hypotheses about ecosystem drivers for these distribution patterns, and the probable trajectory over the next decade. Sample images from representative habitat types are provided in Figure 10.

Table 7. Summary of benthic imaging sled deployments during POS 363.

Station	Date	Depth (m)	Video file name	Duration (minutes)	Distance (m)	No. of stills	Centroid Latitude	Centroid Longitude
CK1	8/3/2008	40	VID0000	0:12	200	11	43°21.570'	28°31.131'
CK3	8/3/2008	84	VID0001	0:11	230	12	43°17.673'	28°41.520'
CK5	8/3/2008	140	VID0002	0:11	130	9	43°13.588'	28°51.983'
OS1	9/3/2008	70	VID0003	0:15	160	10	43°53.713'	29°40.573'
DP1	11/3/2008	122	VID0004	0:17	340	11	44°12.276'	30°40.933'
DD7	11/3/2008	94	VID0005	0:13	170	19	44°30.640'	30°40.754'
DD5	12/3/2008	63	VID0006	0:16	270	14	44°41.845'	30°22.670'
DD3	12/3/2008	44	VID0007	0:16	180	20	44°52.992'	30°04.846'
DD1	13/3/2008	23	VID0008	0:09	150	7	45°04.714'	29°46.606'
DN7	14/3/2008	52	VID0009	0:13	240	18	45°17.649'	31°10.627'
PHY3A	14/3/2008	48	VID0011	0:12	170	18	45°32.381'	31°33.165'
PHY3	14/3/2008	24	VID0012	0:10	160	8	45°54.331'	31°44.060'
PHY4	15/3/2008	31	VID0014	0:16	300	6	45°46.741'	31°30.422'
PHY4A	15/3/2008	46	VID0015	0:13	240	10	45°39.062'	31°20.635'
PHY2	15/3/2008	27	VID0016	0:12	170	19	45°47.231'	31°05.566'
PHY1	15/3/2008	34	VID0017	0:13	210	20	45°44.017'	30°51.696'
PHY10	16/3/2008	29	VID0018	0:13	260	11	45°47.521'	30°46.400'
DN16	16/3/2008	24	VID0019	0:11	200	8	45°51.014'	30°39.297'
PHY5	16/3/2008	30	VID0020	0:12	270	11	45°44.285'	30°31.496'
PHY6	16/3/2008	30	VID0021	0:14	110	18	45°44.262'	30°37.664'
DN14	16/3/2008	37	VID0022	0:10	170	8	45°39.729'	30°43.969'
DN13	16/3/2008	39	VID0023	0:11	220	12	45°34.422'	30°49.608'
DN11	17/3/2008	41	VID0024	0:13	240	21	45°30.334'	30°54.238'
DN10	17/3/2008	44	VID0025	0:13	280	18	45°26.865'	30°59.199'
DN8	17/3/2008	48	VID0026	0:11	130	14	45°23.154'	31°04.837'
DN6	17/3/2008	60	VID0027	0:11	170	15	45°01.013'	31°17.986'
PHY7	18/3/2008	23	VID0029	0:11	220	11	45°34.222'	30°17.541'
PHY8	18/3/2008	24	VID0030	0:15	260	20	45°29.191'	30°22.220'

PHY9	18/3/2008	36	VID0031	0:13	230	22	45°17.468'	30°37.370'
DP2	19/3/2008	99	VID0032	0:10	240	8	44°15.538'	30°29.348'
DP3	20/3/2008	68	VID0033	0:10	240	9	44°22.625'	30°01.339'
DP4	20/3/2008	48	VID0034	0:10	120	7	44°40.987'	29°36.869'
DP5	21/3/2008	26	VID0036	0:16	140	10	44°35.717'	29°11.401'
CO1	22/3/2008	43	VID0037	0:15	180	14	44°09.062'	29°00.344'
CO2	22/3/2008	33	VID0038	0:15	180	16	43°46.457'	28°39.006'
CO3*	22/3/2008	19	VID0039	0:03	80	3	43°36.251'	28°36.446'
CO4	22/3/2008	52	VID0040	0:13	202	10	43°36.107'	28°40.459'
BG1**	23/3/2008	79	VID0041	0:10	200	0	42°47.789'	28°13.661'
VA1**	23/3/2008	21	VID0042	0:10	190	0	43°08.158'	28°02.957'
VA2**	23/3/2008	33	VID0043	0:11	136	0	43°08.228'	28°14.407'
VA3**	23/3/2008	60	VID0044	0:01	136	0	43°08.200'	28°23.906'
* Aborted - in boulder field			**Total**	**8:11**	**8,124**	**478**		
** Video only			**Mean**	**0:11**	**198**	**12**		

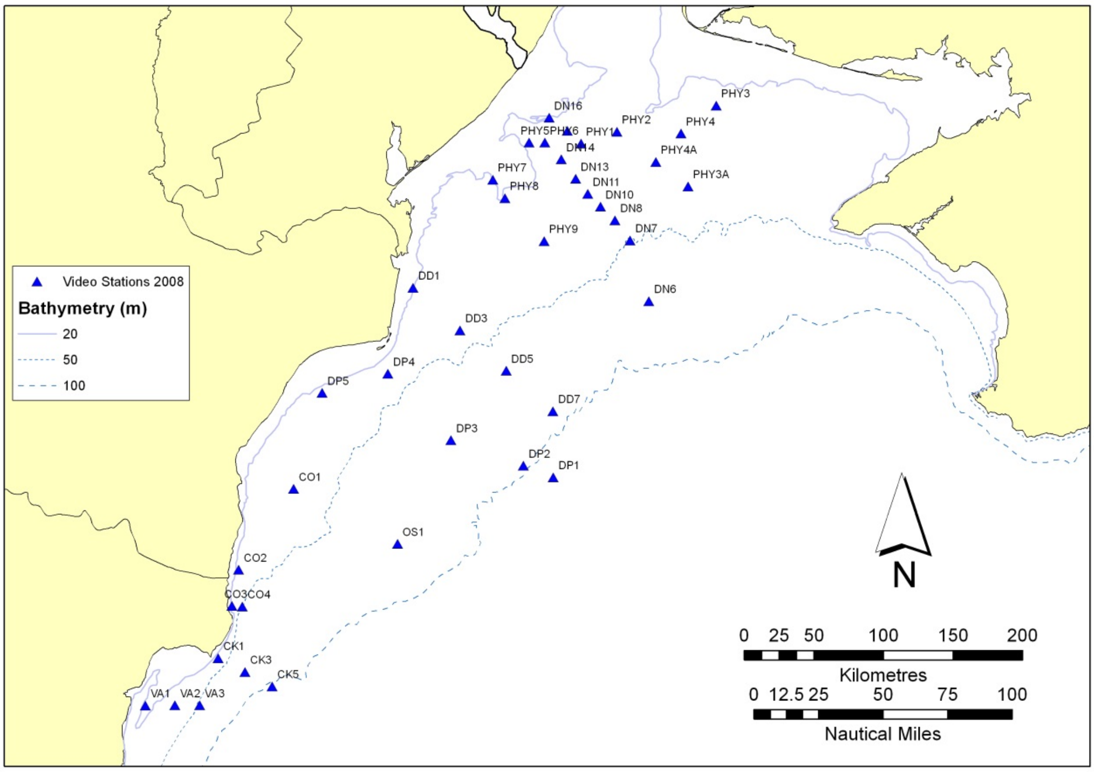

Figure 7. Benthic imaging sled stations undertaken during POS 363

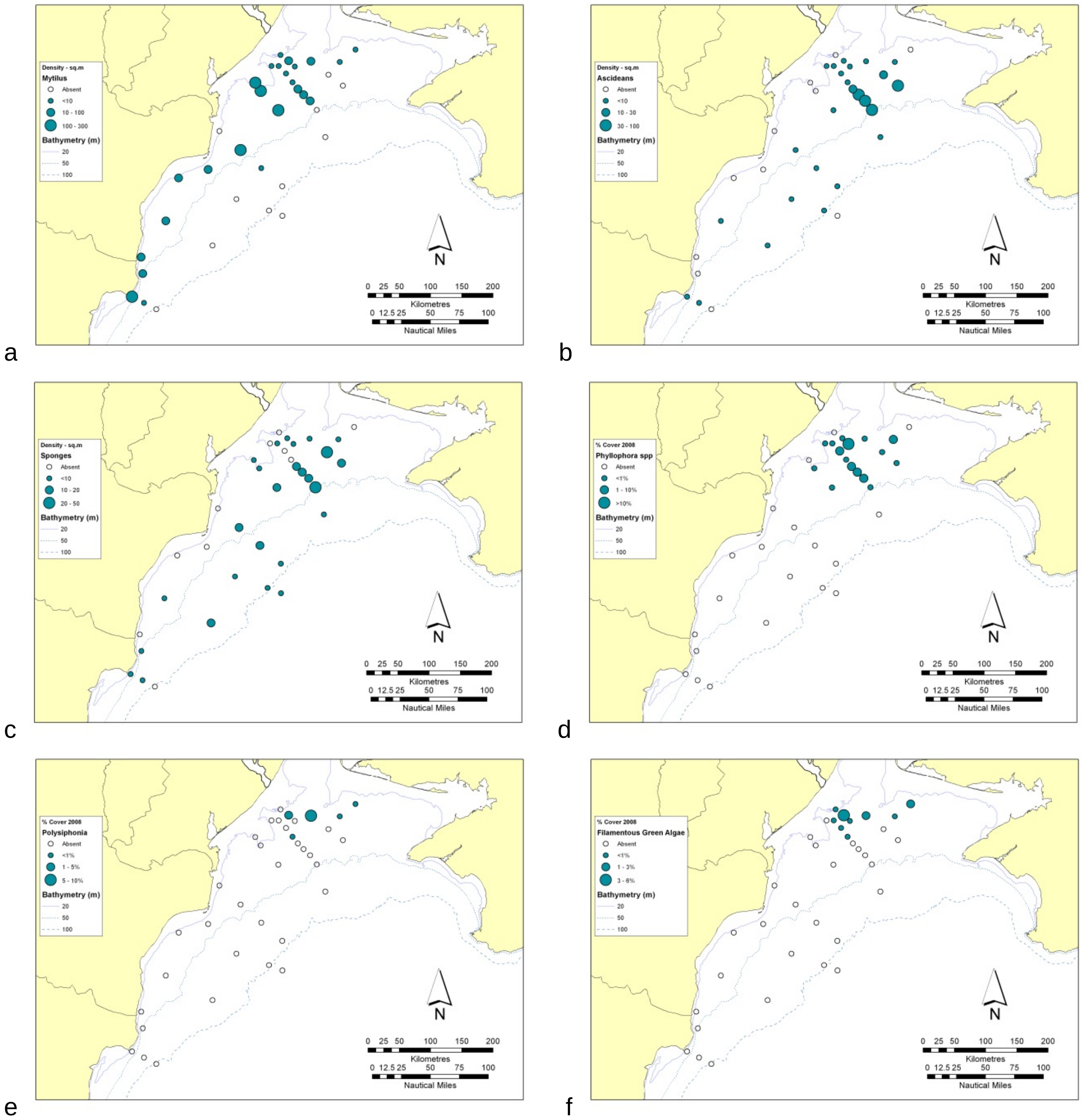

Figure 8. Distribution patterns of major benthic components. a – *Mytilus edulis*; b – combined ascideans (3 spp); c – combined sponges (5 spp); d – *Phyllophora spp*; e – *Polysiphonia saguinea*; f – green filamentous algae complex

Initial multivariate analyses were carried out using PRIMER v.6 to determine patterns of biodiversity. Because the data matrix contained a mixture of % cover and density values, the individual components were standardised before analysis using the procedure outlined by Stevens (2004), and evaluated for bias. The matrix was found to be relatively insensitive to weightings of up to 2 orders of magnitude between % cover and density data types.

Ordination analyses (Cluster, nMDS) were performed using a range of transformations, with reasonable agreement in results; 4th root-based analyses are illustrated here (Figure 9) as those with the lowest stress values. It is apparent that there are statistically distinct groups in epibenthic communities of the northwest shelf (ANOSIM Global R=0.93, p<0.001). Preliminary analyses suggest that these are strongly depth stratified, but also driven by availability of biogenic substrates and nutrients.

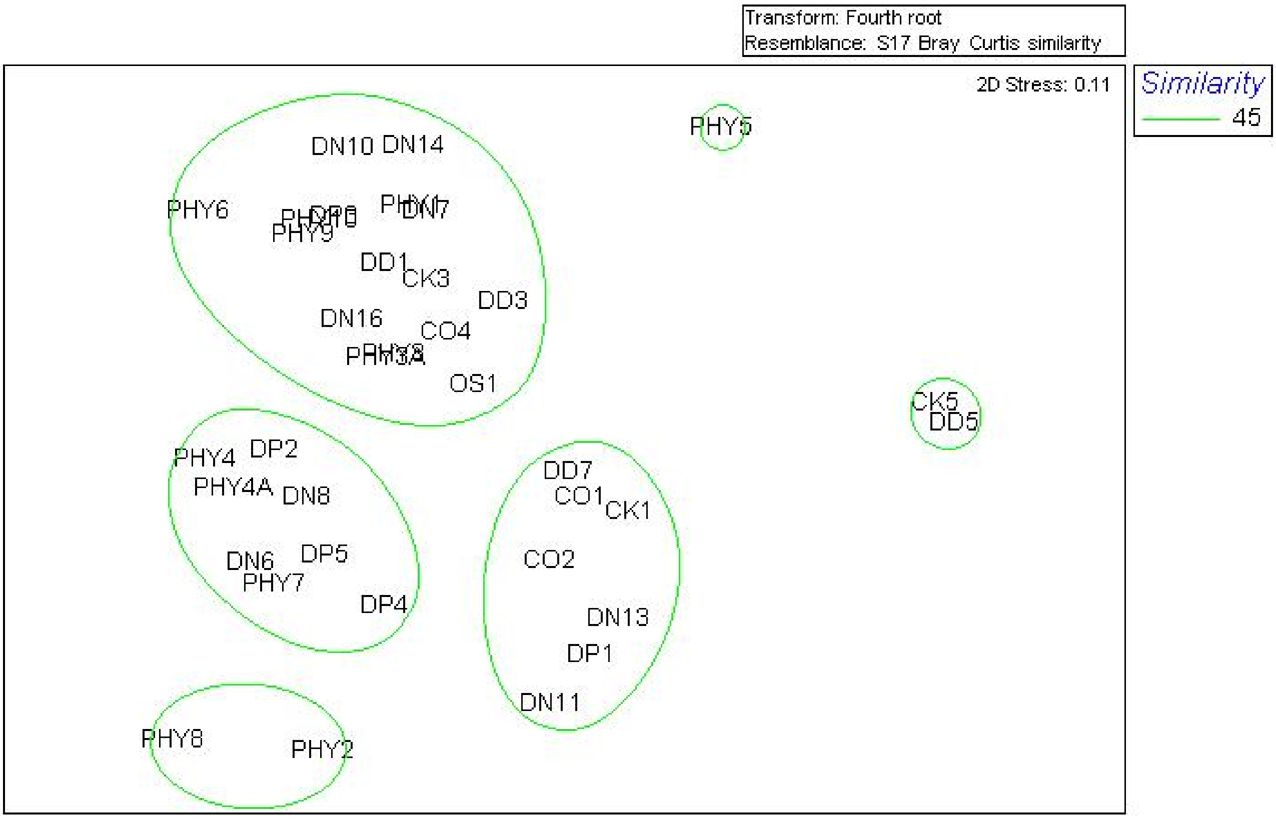

Figure 9. nMDS of 4th-root transformed abundance data

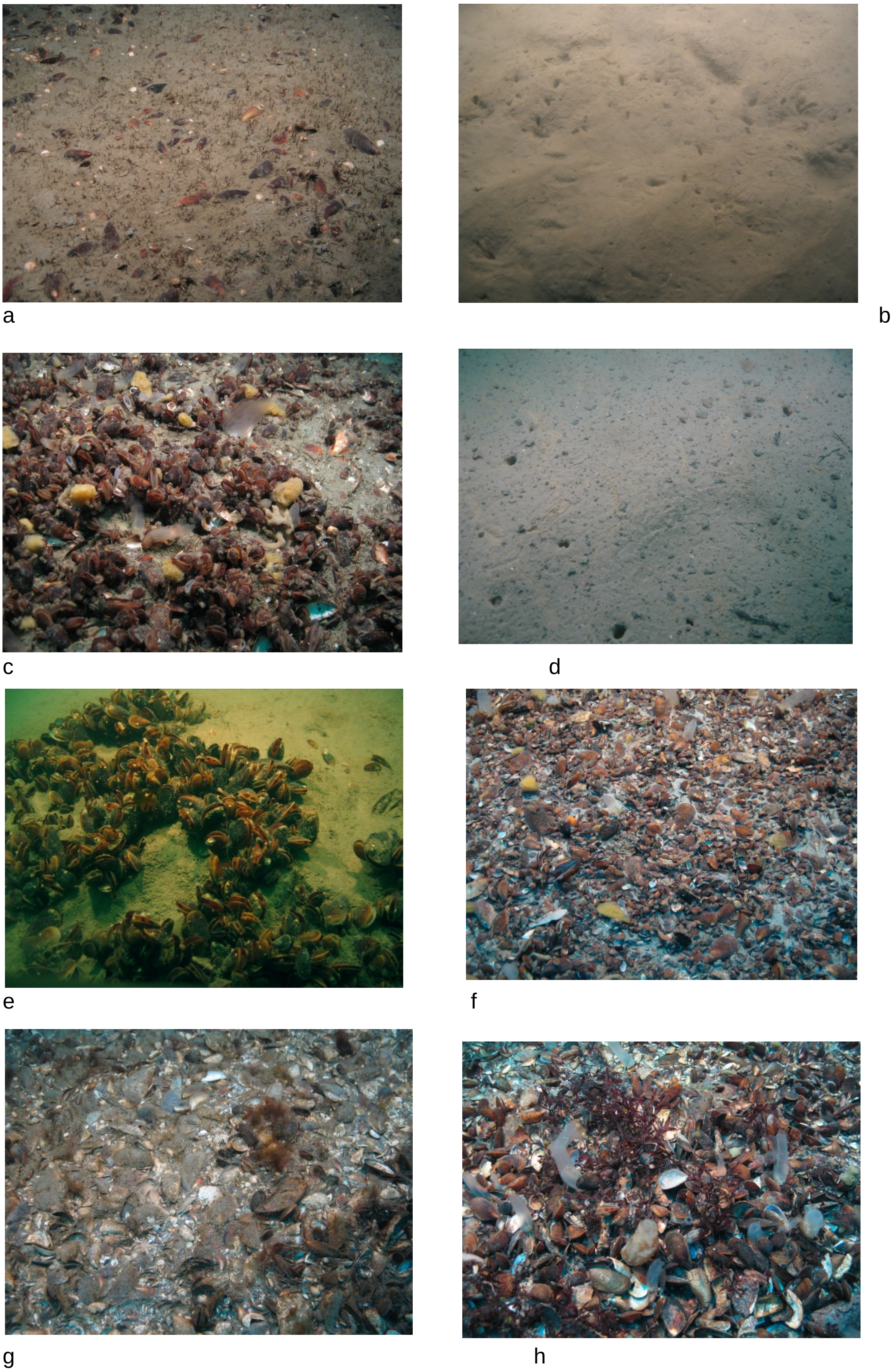

Figure 10. Representative images of habitat types. a – CO1: Deep *Mytilus* community with tubes on muddy sediment, b- DD1:Littoral biocoenosis *Mya-Neanthe*s on muddy sediment, c- DD3: Deep *Mytilus* community with tunicates and polychaetes on sandy mud, d- DP5: *Melinna* and *Mya* communities on muddy sediment, e – CK1: *Mytilus edulis* beds on fine mud, f- DN7: *Modiolus* shell bed with ascideans and sponges, fg– PHY2: Mixed shell bed with filamentous algae, h – DN11:*Phyllophora truncata* and *Ciona intestinalis* on mixed shell bed.

5.6 Observations of zoobenthos in Romanian territorial waters (A. Teaca)

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R/V Poseidon, March 2008

METODOLOGY

Samples from benthic stations have been taken at depths of 21,3 – 205,3 m (average – XX m) during the cruise of the R/V "Poseidon" (05.03 – 25.03.2008) in the northwestern part of Black Sea. Generally, the methodology used in the present cruise follows the common protocols adopted by different specialists involved the Black Sea studies (Băcescu, Muller & Gomoiu, 1971; Gomoiu & Ţigănuş, 1977; Wijsman, Herman, Gomoiu, 1999; Mee, Friedrich and Gomoiu, 2005; Begun, 2006; Teacă, 2006).

Macrobenthos samples were taken with a Van Veen grab (0,14 m^{-2} area). The macrobenthos samples were partly processed on-board (washing using 1 mm and 0,5 mm mesh sieves), preserved and stored for subsequent laboratory analyses. A microscopic screening of the samples for the general characterization of the benthos and sediments is recommended. Meiobenthos samples were taken with a plastic tube from a box-corer of 200 cm^2 (1/50 m^2) surface was used.
The material (sediments and living organisms) was preserved with 4% formaldehyde and stored in plastic bags doubled by cloth bags. Fixation and processing were done according to standard methods (Bubnova, Kholikova, 1980; Volodkovich, 1980).

This is why *“in situ”* underwater observations during the Poseidon 2008 cruise using in all stations a towed high resolution video camera array helped considerably the efforts in assessing the state of benthic communities and produced new important information in addition to that obtained by conventional methods.

Table 8. Sampling stations of the Romanian benthos team during the cruise and first results

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
23.03.08	188-4	BG1	42.47.69	28.13.62	80.3	1	-	-	140	Isolated *Mytilus* clumps on the muddy bottom, sparsely distributed as about 3-5 individuals in clump compounded. There is an individual of *Merlangus merlangus* and 4 individuals of *Corymorpha nutans.* A lot of jelly suspensions in water column.
23.03.08	189-3	BG2	42.47.46	28.00.94	36.5	1	-	-	-	Black, sandy and yellowish claylike mud covered by a mix fauna for deeply bottom characteristic (*Amphiura*, *Terebellides*) and also for shallow waters (*Spisula*, *Cardium paucicostatum*).
23.03.08	190-4	VA1	43.08.08	28.02.89	21.8	1	-	-	150	Muddy sand hollowed out by *Upogebia*. The bottom looks like a Swiss cheese; more than 35 holes of different diameters are displayed on a surface of 0,28 m^2 area. There were founded 3 large clumps of *Mytilus* almost cloggy and 2 *Rapana.* A constant presence has the decapod *Portunus holsatus.* A lot of jelly suspensions in water column.
23.03.08	191-4	VA2	43.08.17	28.14.41	33.7	1	-	-	136	Deep *Mytilus* biocoenosis. Muddy bottom traced by: *Hinia*, *Diogenes* and *Rapana*, appearing as Nazca drawings. Mussel's colonies are large, cloggy, covering about 20-25% of bottom surface. A constant presence in our surveyed area had *Hinia*, *Rapana* individuals (5-6 specimens), *Diogenes*, Hydrozoa (great abundance in mussel's colonies overlaid in proportion of 80% by it), *Corymorpha nutans*, (very frequent), *Portunus holsatus*, cumaceans, Gobius genus specimens. A lot of jelly suspensions in water column.
23.03.08	192-4	VA3	43.08.14	28.23.93	61.3	1	-	-	130	Mussel's biocoenosis edge. Muddy shells form the substratum. There are 3 large mussels' clumps along with smaller ones. There are frequent solitary mussels "garnished" with hydroids. Weak animation on the bottom, excepting the presence of cumaceans, solitary hydroids and one specimen of fish (*Merlangus merlangus*).
08.03.08	101-4	CK1	43.21.59	28.31.05	38.9	1	1	-	200	Deep *Mytilus* biocoenosis. Muddy grey-yellowish bottom with

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										Melinna palmata and *Mya arenaria*. Mussels' clumps are well shaped (elongated) ranging between 70cm - 1m in length. It consists of hundreds of individuals of big size (40-50 mm). Mostly of them are alive. Young specimens are settled beneath adults. Very few shells are founded in the neighbor of the clumps. The distance between nests reaches up to few meters. Those are not clogged and are higher in position relatively to the ground with 26-30 cm. Hydroids and *Actinothoe clavata* represents the constant faunistic elements that were encountered. The surface of the substratum was marked by numerous "footprints" of gastropods *(Hinia)* and bivalves. There have been identified some fragmented parts of *Porphyra*.
08.03.08	103-4	CK3	43.17.70	28.41.18	83.3	1	1	-	230	*Modiolus phaseolinus* biocoenosis. *Modiolus'* field distribution is disparate, patched with narrow bands of whitish mud. With low frequency appear small clumps (consists of 2-3 individuals) of mussels *(Mytilus)*. Constant and dominant (most abundant) faunistic components are: the tunicate *Ciona intestinalis* (11 indv.m^{-2}), the sponges: *Sycon ciliatum* and *Mycale syrinx*, hydroids *Obelia* (solitary strong bushes, settled on the mussels' shell) and *Corymorpha nutans. Tunicates* are jointed together as a grape in 8-9 specimens.
08.03.08	105-3	CK5	43.13.63	28.51.80	139.3	1	1	-	130	The bottom has moon like aspect, no life trace at (first) sight. It stands allover a geomorphologic homogeneity. Grey-yellowish mud covers the *Modiolus* shells. Near the bottom persists a body of water with low oxygen concentration (almost anoxic medium).
09.03.08	111-3	OS1	43.54.34	29.40.56	69.3	1	1	-	157	Typical substratum made up of phaseolin shells, well compressed, spotted with whitish muddy lens of substratum, without mollusks. There is a mosaic distribution of *Modiolus* field as such stripes interrupted by narrow places of mud with few mollusk shells. The constant and most abundant species are the tunicate *Ciona* (10 indiv.m^{-2}), the sponges *Haliclona* sp. and Mycale *syrinx*, the tunicate *Ascidiella aspersa* (sparsely) and the

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										hydroid *Corymorpha*.
10.03.08	111-15	OS1 (2)	43.53.77	29.40.56	73.3	1	1	-	-	-
22.03.08	184-3	CO1	44.09.15	29.00.41	42.5	1	1	-	180	Deep *Mytilus* biocoenosis. Spatial gaps of insular distribution of mussels are filled up with muddy substratum overlaid by tubes of polychaeta. Mussels' clumps are steady, long shaped, ranging to 1,5-2 m in length and 25-30 cm above the bottom, in high. The overlaying is approximately 15-20%. The colonies are quite clogged. Sedimentary substratum looks like a "forest" of tubes of sedentary polychaeta, most of them being empty (only 50% being occupied). The bottom is marked by numerous traces of gastropods and/or bivalves. Mussels' shells are seeing everywhere. The dominant faunistic elements are: *Ascidiella* and the sponge *Mycale* (mostly of them living in association with large clumps of mussels). *Ciona* is less frequent.
22.03.08	185-3	CO2	43.46.50	28.39.02	32.1	1	1	-	180	Littoral characteristic benthic associations with *Mya* mixed with mussels pertaining to deep bottom biocoenosis. The substratum consists of fine, clay like mud, with sandy fraction within it. Mussels' clumps are sparsely. Medium size colonies (50cm-1m length) alternate in distribution with small isolated ones. All are clogged with fine sedimentary material. In majority, the mussels are alive. There are overspread on 10-15% of bottom's surface. Crawling traces made by mollusks *Hinia*, *Cardium paucicostatum* or decapods *Diogenes pugilator* and *Portunus holsatus* (identified in Van Veen or Box) forms a very compact array. The dominant elements are: *Mya*, *Spisula*, *Abra fragilis* and hydroids, which populate in great, number the mussels and other species of mollusks (*Spisula*).
22.03.08	187-5	CO4	43.36.01	28.40.55	51.9	1	-	-	200	Deep *Mytilus* biocoenosis. The nests are frequent, unclogged; comprised of big mussels, distanced one from another. These are not choked by young specimens, which are very rare. Most of the mussels are colonized with hydroids and *Actinothoe clavata* (very abundant, about 18 individuals onto one mussel colony).

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										The sponges have the highest frequency while tunicates are founded in little number. On the sedimentary substratum the dominant forms are tubes polychaeta like *Terebellides* and *Melinna*.
11.03.08	117-3	DP1	44.12.36	30.40.90	122.3	1	1	-	340	Substratum formed by shells accumulation covered by a sub superficial matrix with shells of *Mytilus*, which has a pregnant smell of H_2S. A brownish layer of detritus as appear the snow deposited upon the mussels' shells coats the bottom. Homogeneity and poorness of life forms aspects characterize the landscape. Albeit, there were founded constantly sponges, deep bottom hydroids *Cerianthus solitarius* and *Corymorpha nutans*.
19.03.08	169-3	DP2	44.15.50	30.29.13	99.3	1	1	-	215	Deep bottom characteristic phaseolin are strongly clogged by detritus. The *Modiolus* population has a uniform distribution but very depress as abundance. In spite of almost entirely disappearance of O_2 near the bottom (CTD results), faunistic associations are diverse and constant. The dominant elements are *Cerianthus solitarius* (9 indv.m^{-2}), *Terebellides* (37 indv.m^{-2}), Ciona (8 indv.m^{-2}) and the spongies (6 indv.m^{-2})
20.03.08	175-3	DP3	44.22.59	30.01.18	68.3	1	1	-	240	The mud with Phaseolin. Insular distribution with mosaic aspect stretches on 95% of bottom surface. Distinct visible populations. The characteristic faunistic elements are *Ciona* and *Ascidiella* (report 1:1), *Mycale*, *Amphiura* (15 indv.m^{-2}), *Terebellides*, *Apseudopsis*.
20.03.08	176-3	DP4	44.41.04	29.36.91	48.1	1	1	-	120	Muddy biocoenosis of *Mellina* and *Mya*. Mussels' clumps are dispersed being assemblage of 3-5 big sized (30-40mm) individuals in each clump, which extends up to 5-10% over the bottom. The hydroids (*Obelia*) are present fixed on the mussels. Littoral biocoenosis in exclusivity dominated by *Melina palmata* and *Mya arenaria* (30 indv.m^{2}), without being able to equalize the abundance of the same populations situated at depth of 25-30m.
21.03.08	177-8	DP5	44.35.76	29.11.43	26.2	1	1	-	+	Typical biocoenosis of *Melinna* and *Mya*. The populations which dominate from quantitative and qualitative point of view

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										form great densities as is the case of polychaeta with hundreds of individuals per square meter and *Mya arenaria* of which densities reach about 70-80 indiv.m^{-2}. The mussels are omnipresent forming small clumps (very cloggy and quite sparsely) composed of 50-60 big sized individuals. Besides them, dominate in the same biocoenosis the bivalves *Abra fragilis* (95 indv.m^{-2}) and *Scapharca inaequivalvis.*
12.03.08	128-4	DD1	45.04.68	29.46.67	21.3	1	1	-	+	Littoral biocoenosis *Mya-Neanthes.* The substratum is represented through very fine, grey-brownish siltic mud. The bottom's surface is crossed by crawling marks made up by mollusks and polychaeta. The density of dominant species reaches 30 indv. m^{-2} of *Mya arenaria* and 74 indv.m^{-2} of *Neanthes succinea.* Scapharca represents the codominant species with an estimative density of 15 indv.m^{-2}. The water column is heavily loaded with mineral and organic suspensions.
12.03.08	126-3	DD3	44.53.03	30.04.83	46.3	1	1	-	180	Deep *Mytilus* biocoenosis. The colonies of mussels cover only 15-20% of bottom, having a characteristic insular distribution. The mussels' size goes from small to medium – 30-40 mm. The substratum consists of mud associated with sand. The fauna is mixed due to accentuate influence of the deep biocoenosis of *Modiolus.* Mussels' clumps are rounded shaped or little elongated, uniform settled or more often randomly displayed, comprising only few specimens. There is little of about 10-20 cm diameter. Big colonies (over 1m diameter) are rare and quite choked up. The dominant faunistic elements are represented by tunicates (app. 9 indv. m^{-2}, especially *Ciona)* and sponges (26 indiv. m^{-2}), especially *Mycale syrinx,* which are very abundant on the big clumps of Mytilus. The deep fauna represented are *Modiolus* and Terebellides and also *Molgula* genus. Sedimentary silty substratum is filled with polychaeta tubes (probably *Heteromastus*) appearing like a "forest" of tubes intercepted of mussels' enclave. Excepting the mussels, the bottom could be considered as a monospecific coenosis formed by tubes

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										polychaeta with densities that reach 10.000-15.000 indv.m^{-2}. About half of seen tubes contain the organism inside.
12.03.08	125-3	DD5	44.42.00	30.22.69	64.3	1	1	-	170	The transgressing zone of deep mussels' biocoenosis upon phaseolin biocoenosis. There is the inferior limit of mussels' distribution albeit they are still abundant (124 indv.m^{-2} – Box results). The shells and bivalve populations remain unclogged, insular distributed (as spots on leopard fur), covering 80-85 % of the surface. Dominant faunistic elements (Tunicata, Spongia) build compact colonies of tens of individuals. An average estimation of abundance shows that *Mycale syrinx* develops about 50 indv.m^{-2}, *Ascidiella aspersa* - 20 indv.m^{-2}, *Ciona intestinalis* – 4 indv.m^{-2}. Each colony has an extent over 1 m, while the space between them is about 2,5-3,5m pretty like the distance between colonies and muddy barren spaces. Other identified species with important densities are *Apseudopsis ostroumovi*, *Amphiura stepanovi* and *Synisoma capito*.
11.03.08	120-3	DD7	44.30.67	30.40.90	94.3	1	-	-	170	There is the lower distribution limit of *Modiolus* populations. The colonies are distributed in patches and shells accumulations are clogged of detritus. Be given that, the distribution of associated fauna is more abundant in those places with clogged shells. *Terebellides* – 50 indv.m^{-2}, *Ctenicella* – 14 indv.m^{-2}, *Ciona* – 8 indv.m^{-2}, *Cerianthus* and Spongia – 3 indv.m^{-2} has the most numerous populations.
11.03.08	119-3	DD8	44.25.19	30.49.62	117.3	1	1	-	-	Grey, clay like mud with shell accumulations of *Modiolus* coated on surface of fine, brownish detritic material. The fauna is extremely poor, only few *Modiolus* 7 indv.m^{-2} and polychaeta.
11.03.08	118-4	DD9	44.19.54	30.58.48	205.3	-	1	-	-	Whitish, jelly like consistence mud covered by brown detritic material. Macrobenthic fauna has not been found.
17.03.08	158-3	DN6	45.01.02	31.18.04	61.3	1	1	-	160	Typical mud with phaseolin. The clumps distributions are heterogeneous, forming great and compact assembles, and brownish-grey, cut by barren muddy zones. The fauna is abundant in muddy zones dominated by the tunicates *Ascidiella* (14 indv.m^{-2}), *Ciona* (8 indv.m^{-2}), spongies *Sycon* (14 indv.m^{-2}),

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										Mycale (11indv.m^{-2}) and tubes polychaeta (*Terebellides stroemi)*
14.03.08	136-4	DN7	45.17.48	31.10.81	51.4	1	1	-	240	The lower limit of *Phyllophora* Field. The substratum is made up of mussels and Modiolus shells. The little *Phyllophora* are settled on *Mytilus* shells, encrusted with red calcareous algae *(Melobesia),* with densities of 20 plantlets x m^{-2}. Big associations of populations are compactly crowded. *Ciona* (22 indv.m^{-2}) and *Mycale* (32 indv.m^{-2}) dominate as abundance. *Ascidiella* (10 indv.m^{-2}) accompanies these along with other deep characteristic species: *Amphiura stepanovi*, *Apseudopsis ostroumovi*, *Terebellides.* The transition coenosis *Modiolus-Mytilus* is uniformly distributed. Mussels' clumps, free of detritus, house on the shells tens of tunicates. On hard bottom (mussels' shells encrusted with algae), *Modiolus* form aggregates, as the *Mytilus* do in littoral coenosis.
17.03.08	157-2	DN8	45.23.24	31.04.77	48.1	1	1	+	170	Deep *Mytilus* biocoenosis with *Phyllophora*. Insular distribution of "healthy", unclogged mussels' populations. Muddy and shells built-up sediments are "sown" with tubes of *Heteromastus* (probably), in majority being empty inside. *Phyllophora* bushes have 15-20 cm length and reach densities of 20 indv.m^{-2}. Partially, these are covered by massive colonies of sponges and bryozoans (*Callopora aurita*). *Ciona* (40 indv.m^{-2}) and *Mycale* (30 indv.m^{-2}) dominate by far. Depth characteristic species (*Modiolus*, *Terebellides*) are still abundant.
17.03.08	156-2	DN10	45.26.95	30.59.28	45.5	1	-	-	280	Deep *Mytilus* biocoenosis with *Phyllophora*. Semi fluidic silt fractions mixed with conchiferous sand form the substratum. Conchiferous substratum is scarce. *Heteromastus* dwells on sedimentary portions. *Phyllophora* extend barely on 2-3% of the bottom. The thalli are small and scattered. As density and biomass, dominate (excepting mollusks) tunicates, as *Ciona*, forming crowded associations of 60 indv.m^{-2}, but *Ascidiella* with only 8 indv.m^{-2}. The sponges like *Mycale syrinx* are lots on every hard support (18 indv.m^{-2} in this example).
17.03.08	155-3	DN11	45.30.45	30.54.26	41.3	1	1	-	250	Deep *Mytilus* biocoenosis with *Phyllophora*. They are insular,

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										mosaic displayed. The clumps are not clogged, 40-50 cm in diameter, garnished with *Ciona* (20 indv.m^{-2}) and *Phyllophora* bushes. *Ascidiella* is weakly present with only 5 individuals per m^{2}. *Phyllophora* has a frequent and constant presence, being disposed in “packets” of 1,5 m length and 30-40 cm width, spread on 10% of the bottom. Conchiferous fine sand (calcite and pearls fragments) and shells form the substratum. The mussels are big sized (40-50 mm) scattered on the bottom with an estimate density of 290 indv.m^{-2}. The images are very suggestive and beautiful for illustrating the insular distribution of “healthy” mussels, *Phyllophora* and tunicates. The bottom is paved of thousands of shells.
16.03.08	154-2	DN13	45.34.36	30.49.68	39.1	1	1	+	230	Deep benthic communities with big sized mussels regularly distributed. The shell build-up sediment is moderately clogged as was founded in previous stations. *Ascidiella* with it density of 12 indv.m^{-2} governs beyond the macrobenthic populations, unlike *Ciona* (5 indv.m^{-2}), even lessen than in previous stations. They are associated with mussels’ clumps, too. Other associated fauna is characteristic for littoral zone (*Pectinaria*, *Mytilaster* and *Balanus*). The sponges are weakly represented because of detritic deposits, probably. *Phyllophora* are constant, consisting of big, aggregated bushes, but scattered. The plantlets predominate. The bottom is almost overlain by shells coated with a brownish layer of detritus.
16.03.08	153-2	DN14	45.39.68	30.44.02	36.9	1	-	-	170	As depth decrease the quantity of siltic material deposited on the mussels shells increase. The mussel’s shells are strongly clogged, composed of small and medium sized exemplars, covering 7-10% of the bottom. Neither the tunicates are as exuberant in abundance (3-5 indv.m^{-2}) as were in precedent stations, nor as dense. Fixed thalli of *Phyllophora* are clogged while those that are not fixed form clusters of 1,5 m length and 30-40 cm width. The range between them is about 20-25 cm. The proportion of covering with *Phyllophora* is very little – 2%.

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
16.03.08	150-4	DN16	45.51.02	30.39.43	24.2	1	-	-	200	Compact conchiferous sand with big granulation. Associated fauna is profoundly influenced by the type of substratum being formed of littoral species as polychaeta *Pectinaria koreni*, bivalves *Cardium edule*, *Pitar rudis* (7 indv.m^{-2}), *Spisula subtruncata* (7 indv.m^{-2}). Very abundant are the amphipods (probably *Ampelisca*). Mussels' clumps are dispersed, comprising up to 2-3 individuals, covering the bottom in proportion of 5%. The faunistic element, which is constant in this biotope, is the hydroid *Obelia*, with sedentary way of life. Its "branches" are either fixed on shells and substratum, in proportion of 5 individuals per square meter.
15.03.08	142-3	Phy1	45.44.04	30.51.80	33.8	1	1	-	210	Massive shells deposits intercalated with big-grained sand (conchiferous origin). Small mussels don't form distinct clumps, being settled anywhere exists hard substratum (shells). The bottom is moderately choked of detritus. Tunicates are little represented (5-7 indv.m^{-2}), both *Ascidiella* and *Ciona*. The sponges are not present. There are only founded on *Phyllophora* bush in association with other epibiontic organisms like bryozoans, for example. *Phyllophora* populations are well represented, especially *Phyllophora truncata*, which form important bunches (70 cm in length) displayed at 3-4,5 m distance of each other's. Otherwise, the bottom is little animated.
15.03.08	141-3	Phy2	45.47.13	31.05.99	26.6	1	1	+	160	Typical biocoenosis of deep mussels and massive deposits of shells. The proportion of overlaying with mussels range to 60-70%. The clumps are heterogenic disposed, especially formed of small and medium individuals (20-30 mm). Epibiontic elements that dominate are red filamentous alga (*Polysiphonia sanguinea)*, which covers about 10-15% of the bottom populated with mussels. *Phyllophora* is almost absent (excepting some seldom plantlets). Under superficial sediments exists newly shells deposits much oxidized, black, fragile, and with nasty smell.
14.03.08	138-3	Phy3	45.54.29	31.44.15	25.4	1	1	-	165	*Mytilus* shells deposits overlaid on shells bed intercalated with

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										blackish mud that smell disgustfully (H_2S). There is the most disastrous benthic system encountered, strongly clogged with detritus. It is only governed by red filamentous alga (*Polysiphonia sanguinea)*, which covers in proportion of 7-10 % the bottom. The mussels form small clumps scattered all over composed of 2-3 individuals of 20-30 mm in size or just solitary individuals. Constant appearances have the colonial hydroids (*Obelia*). The smell and the color of sub superficial sediments exhibit prolonged anoxic phenomena ended with mass mortalities of mitilide mussels and predominance of species of annual filamentous alga. This reality is demonstrated both through the presence in structure of mussels' populations of the young individuals hatched this year and the multitude of closed shells, empty inside, although apparently alive (similar with the situation founded in precedent station, Phy2)
14.03.08	137-3	Phy3a	45.32.30	31.33.23	48.4	1	-	+	160	Typical biocoenosis of deep mussels. The substratum is an amalgam of mitilide shells, recent and fossils, covered with a fine stratum of mineral and detritic sediment. The nests are irregularly distributed on the bottom, with large spaces of conchiferous sediment, lighter colored, between them. The mussels' size is reduced (30 mm). The dominant species, which confer a specific aspect to biocoenosis, is *Ciona intestinalis*. A real forest of translucent tunicates covers the bottom with the most abundant density – 100 indv.m^2 seen until now. The co-dominant species that break the monotony is *Mycale syrinx*. The sponge takes any opportunity offered by a hard support to develop its yellow globular colonies composed of over 50 indv.m^{-2}. *Ascidiella* presents constant populations, with smaller effectives than 17 indv.m^{-2}. Excepting the dominant species, in association appear influences of deep characteristic species pertaining to phaseolin biocoenosis. Among them, we mention *Terebellides*, *Modiolus* and *Amphiura*. *Phyllophora* is absent, except of some insignificant plantlets.

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
15.03.08	139-5	Phy4	45.46.87	31.30.59	31.3	1	1	+	300	Conchiferous sediment strongly clogged populated with distinct mussels' clumps and *Phyllophora* bushes. The shells of which sediment is made-up pertaining to following species: *Pitar*, *Polititapes*, *Chione*, *Ostrea*, *Pecten* and *Modiolus adriaticus.* Delicate branches of hydroids cover the mussels of medium size. The tunicates *(Ascidiella)* are seldom. The superior crustaceans are represented by two species: *Pisidia longicornis* and *Liocarcinus holsatus. Phyllophora* appears fixed as free as well, covering in proportion of 4-5% the bottom. The free specimens (*Phyllophora truncata)* form aggregations of almost 50 cm in length.
15.03.08	140-3	Phy4a	45.39.11	31.20.78	46.1	1	-	+	240	Typical landscape with deep mussels and *Ciona* fields. The mussels are abundant forming large clumps distanced between, unclogged. In majority, they are small in size (30 mm). *Phyllophora* are weakly represented, spread on less than 1% of bottom's surface. The plantlets are rare and reduced in size (barely visible). By far, the tunicate *Ciona* (30 indv.m^{-2}) and the sponge *Mycale* (50 indv.m^{-2}) dominate as density and biomass as well. The deep elements are present with populations of transition quite frequent, as *Terebellides*, *Modiolus*, and *Amphiura*. Modiolus is fixed with predilection on fossil shells of mussels plenty encrusted with *Melobesia.*
16.03.08	152-3	Phy6	45.44.21	30.37.70	29.5	1	-	-	110	Shells strongly clogged. It's a benthic system affected as much as those from station Phy 3. The similarity between these stations is obviously. The single turn consists in absence of filamentous red alga and predominance of colonial hydroids (*Obelia). The bottom looks like is coated with a dirty blanket weaved of organic and mineral detritus. The hydroids have a frequency of 100% and a full covering to any hard substratum, including thalli of *Phyllophora*. These are constant in presence (about 12 indv.m^{-2}) with little and scattered plantlets strongly clogged. Muddy subsuperficial sediment exhales a noxious smell of H_2S. The living mussels are small, rare and chaotic displayed

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										on the bed of shells, covering less than 10%. The tunicates appear rarely, being represented only by *Ascidiella*. The vagile fauna is dominated exclusively by amphipods.
18.03.08	159-4	Phy7	45.34.13	30.17.38	23.4	1	1	-	220	Shells accumulations with compact, large clumps (70-100 cm) of living mussels, covers 30-40% of bottom's surface. The colony are partially clean, others are clogged, composed of small and medium (20-30 mm) sized mussels. The "islands" of mussels and shells are above the bottom with 30-35 cm, being separated of large spaces of muddy conchiferous sand. The dominant elements, which populate the clumps, are the hydroids *(Obelia)*. In vicinity, on the sedimentary bottom, dominate the amphipods (probably *Ampelisca*), along with other constant species, as *Spisula* (7 indv.m^{-2}) and *Pectinaria* (7 indv.m^{-2}). *Phyllophora* and tunicates are absent. The dominance of hydroids in this station as in the previous could be explained by the thermal regime of depth waters. Like in littoral zones with rocky substratum, the maxim abundance of them coincides with the moment when water is cold, as we can see in this situation when the temperature of water at the bottom is 3,8^{o}C. So, this represents a normal situation in life cycle of hydroids, which register big densities in cold season.
18.03.08	160-3	Phy8	45.29.10	30.22.26	23	1	-	-	260	Similar landscape with precedent station. The sedimentary substratum is vastly and consists of harsh littoral sand. The mussels form abundant populations, healthy, displayed in large clumps, unclog. They have a chaotic disposal on the bottom with broad sedimentary spaces between. The clumps are higher in position than the bottom, 20-25 cm above, and consist of crowds of recent shells, which bear living mussels. The covering proportion with mussels is 25-30%. In fewer stations, the rapture gastropod *Rapana venosa* can be founded in such great abundance. The dominant epibiotic elements are the hydroids, which cover the mytilide with a fine delicate layer. It could be distinguished several species, through them: genus *Obelia*, on

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										the sedimentary substratum, *Clytia* and *Gonothyraea* from the hard support. Additionally, in mollusks' colonies, is frequent the barnacle *Balanus improvisus* and the bivalve *Mytilaster lineatus. Obelia* individuals of big size (10-12 cm) record densities 9 indv.m^{-2} on the sedimentary substratum. Psamic associated fauna is formed of tubes polychaeta (*Pectinaria* - 11 indv.m^{-2}) or free-living (*Harmothoe* – 7 indv.m^{-2}) and molluscs (*Spisula* – 3 indv.m^{-2}). But, as numeric as biomasses dominate the juveniles of *Scapharca* (*Anadara*) – 140 indv.m^{-2} and free-living amphipods (probably *Ampelisca*). Shells deposits are founded in huge amounts constituted of mitilide shells and others pertaining to the species associated with sedimentary substratum as *Chione*, *Polititatpes*, *Cardium*, *Scapharca* and *Spisula*. *Phyllophora* populations is insignificant, being founded only one exemplar. The sedimentary bottom is marked by ripples, which indicate ample processes of agitation or a mixture of waters driven by the currents, wind and waves.
18.03.08	161-3	Phy9	45.17.52	30.37.44	35.9	1	1	+	230	Deposits of mytilide shells with little sedimentary material. The mussels' clumps are well represented, large with compact populations in which dominate the juveniles of 10-15 mm in size. The clumps are separated of spaces with fragmented shells, partially muddy, where the tubes polychaeta *Heteromastus* is abundant. The colonies are displayed in mosaic, covering 50-60%. Associated fauna is dominated of deep elements. Numerical dominant are the sponges of different sizes and forms, especially *Mycale* with 28 indv.m^{-2}, then *Ciona* with 13 indv.m^{-2}. The mytilide (*Modiolus phaseolinus*, *M. adriaticus*) forms important populations in zone (very abundant in Van Veen). In general, the mollusc's population are spectacular, healthy, in spite of their little size (schools of hundreds of juveniles). The clumps with bigger sized *Mytilus* are rare but compact formed of hundreds of exemplars. Otherwise, the bottom is covered with an amalgam of recent mytilide shells.

Date	Station Nr.	Station	Coordinate		Depth, m	Samples for GeoEcoMar			Video Sled, m	Observations
			Latitude	Longitude		Van Veen	Box Corer	Dredge		
										Phyllophora is present, covering 1%. The thalli are small and rare divided between *P. truncata* and *P. crispa* in 1:1 rapport.
16.03.08	149-3	Phy10	45.47.52	30.46.58	28.2	1	-	-	250	Massive deposits of mytilide shells strongly clogged and covered by *Polysiphonia sanguinea*. The mussel's clumps are barely visible garnished with filamentous alga and few tunicates (*Ascidiella*), covering 15-20% of substratum. The sponges and *Phyllophora* are absent because of great quantities of suspensions and lack of clean substratum (especially for sponges). Filamentous alga dominates, covering 30% and even 60% of bottom in some shells accumulations.
Total number of samples collected in the 43 Stations						**42**	**28**	**7**		

Table 9. Synopsis of the samples collected by GeoEcoMar at the R/V Poseidon Cruise 2008

Shelf	Depth, m									Total
	21-30	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**>101**	
Ukrainian (UA)	7	5	5	1	1					**19**
Romanian (RO)	2	1	3		3	1		2	3	**15**
Bulgarian (BG)	1	3		1	1	1	1		1	**9**
Total	**10**	**9**	**8**	**2**	**5**	**2**	**1**	**2**	**4**	**43**

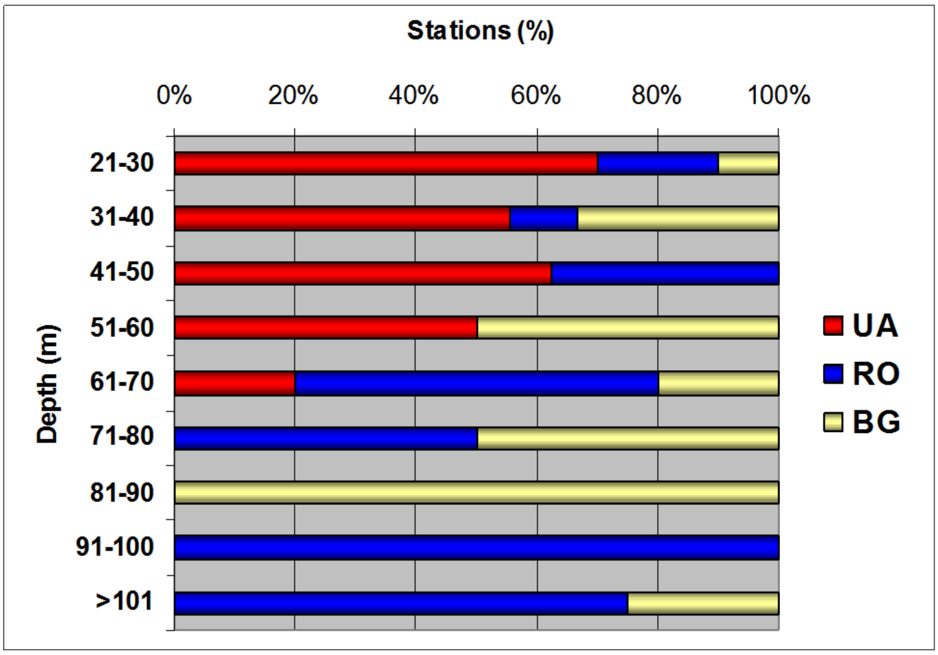

Figure 11. Distribution of stations per EEZ at different seafloor depth.

Table 10. Qualitative compositions of macrobenthos in grab samples of the NW Black Sea shelf (Southern area). R/V Poseidon, March 2008

Nr.	Group	Taxa / Station ID	Bulgarian Shelf									Romanian shelf				F%
			BG1	BG2	VA1	VA2	VA3	CK1	CK3	CK5	CO 4	OS1	OS1 (2)	CO 1	CO 2	
1	POR	*Mycale syrinx*									+		1	1		23,1
2	POR	*Sycon ciliatum*							1		+++		2			23,1
3	HYD	Hydrozoa varia					++	++								15,2
4	ANT	*Actinia equina*						+								7,7
5	ANT	*Actinithoe clavata*						1	1		+					23,1
6	POL	*Harmothoe sp.*										1				7,7
7	POL	*Melinna palmata*						+++++			+++				++++	23,1
8	POL	*Nephthys sp.*										1	1			15,2
9	POL	*Pectinaria koreni*				++									4	15,2
10	POL	*Terebellides stroemii*	12	5					+		+++	6	1	11		53,8
11	POL	Polychaeta varia	++	++	++	++	++	+	+		++	+	+	+++	++++	92,3
12	GAS	*Hinia reticulata*			4											7,7
13	BIV	*Abra fragilis*		2				3							3	23,1
14	BIV	*Cardium paucicostatum*		3				2							3	23,1
15	BIV	*Modiolus phaseolinus*					+		++++			++++	++++			30,8
16	BIV	*Mya arenaria*						2							4	15,2
17	BIV	*Mytilus galloprovincialis*					++	5	2		+++	3		10	4	53,8
18	BIV	*Pitar rudis*													1	7,7
19	BIV	*Scapharca inaequivalvis*						1								7,7
20	BIV	*Spisula subtruncata*		5				4							9	23,1
21	BIV	*Venus gallina*			12											7,7
22	PHO	*Phoronis euxinicola*							+							7,7
23	CIR	*Balanus improvisus*						++++								7,7
24	AMP	*Ampelisca sarsi*							++				1			15,2
25	AMP	*Phtisica marina*											1			7,7
26	AMP	Amphipoda varia			++	+	+				++					30,8
27	ISO	*Synisoma capito*										2	1			15,2
28	DEC	*Upogebia pusilla*			7											7,7

Nr.	Group	Taxa / Station ID	Bulgarian Shelf									Romanian shelf				F%
			BG1	BG2	VA1	VA2	VA3	CK1	CK3	CK5	CO 4	OS1	OS1 (2)	CO 1	CO 2	
29	ECH	*Amphiura stepanovi*	14	1				2	2			1		5		46,2
30	ECH	*Leptosynapta inchaerens*											2			7,7
31	TUN	*Ascidiella aspersa*							3							7,7
32	TUN	*Ciona intestinalis*							1				1			15,2
33	TUN	*Ctenicella appendiculata*	2								1					15,2
		TOTAL	**4**	**6**	**5**	**3**	**5**	**13**	**11**	**0**	**9**	**8**	**11**	**5**	**9**	

Table 11. Qualitative compositions of macrobenthos in grab samples of the NW Black Sea shelf (Danube Delta area). R/V Poseidon, March 2008

Nr.	**Group**	**Taxa / Station ID**	**Romanian shelf (Danube Delta area)**											**F %**
			DD 1	**DD 3**	**DD 5**	**DD 7**	**DD 8**	**DD 9**	**DP 1**	**DP 2**	**DP 3**	**DP 4**	**DP 5**	
1	POR	*Haliclona sp.*		2										9,1
2	POR	*Mycale syrinx*			3									9,1
3	POR	*Sycon ciliatum*			1									9,1
4	POR	Spongia varia		+	+									18,2
5	HYD	*Podocoryne carnea*											+++	9,1
6	ANT	*Actinothoe clavata*											1	9,1
7	ANT	*Pachycerianthus solitarius*							+	2				18,2
8	NMT	*Micrura sp.*		1										9,1
9	NMT	Nemerini varia			+									9,1
10	POL	*Heteromastus filiformis*		+++++										9,1
11	POL	*Melinna palmata*										++++	+++	18,2
12	POL	*Neanthes succinea*	10	+										18,2
13	POL	*Terebellides stroemii*		++	+	7				5	++			45,5
14	POL	Polychaeta varia		+++	+		+			+	++			45,5
15	GAS	*Hinia reticulata*											1	9,1
16	BIV	*Abra fragilis*											14	9,1
17	BIV	*Modiolus phaseolinus*		+++	+++		1			6	+++			45,5
18	BIV	*Mya arenaria*	4									4	12	27,3
19	BIV	*Mytilus galloprovincialis*		++++	+++							3	2	36,4
20	BIV	*Pitar rudis*											1	9,1
21	BIV	*Scapharca inaequivalvis*	2										1	18,2
22	BRY	Bryozoa varia			++									9,1
23	MYS	Mysida varia											+++	9,1
24	ISO	*Synisoma capito*			+									9,1
25	TAN	*Apseudopsis ostroumovi*			+++									9,1
26	ECH	*Amphiura stepanovi*			1						+++			18,2
27	TUN	*Ascidiella aspersa*		1	3									18,2
28	TUN	*Ctenicella appendiculata*		1		2								18,2
		TOTAL	**3**	**11**	**13**	**2**	**2**	**0**	**1**	**4**	**4**	**3**	**10**	

Table 12. Qualitative compositions of macrobenthos in grab samples of the NW Black Sea shelf (Dniester area). R/V Poseidon, March 2008

Nr.	**Group**	**Taxa / Station ID**	**Ukrainian shelf (Dniester area)**								**F %**
			DN 6	**DN 7**	**DN 8**	**DN 10**	**DN 11**	**DN13**	**DN 14**	**DN 16**	
1	POR	*Haliclona sp.*		++							12,5
2	POR	*Sycon ciliatum*	+								12,5
3	POR	Spongia varia		++			2				25,0
4	HYD	Hydrozoa varia						++	++	+++	37,5
5	POL	*Pectinaria koreni*						++	++	++	37,5
6	POL	*Pomatoceros triqueter*				++		+			25,0
7	POL	*Terebellides stroemii*	+	++	++						37,5
8	POL	Polychaeta varia	++	+++	++	+++	+++	++	++	++	100
9	BIV	*Cardium edule*								++	12,5
10	BIV	*Modiolus phaseolinus*	++	++++	++	++		+			62,5
11	BIV	*Mytilaster lineatus*						++	++	++	37,5
12	BIV	*Mytilus galloprovincialis*		++++	++	+++	40	+++	++	+++	87,5
13	BIV	*Pitar rudis*								1	12,5
14	BIV	*Spisula subtruncata*								1	12,5
15	BRY	Bryozoa varia			++	+++	++		++		50,0
16	CIR	*Balanus improvisus*						+		++	25,0
17	AMP	*Caprella acanthifera ferox*					++				12,5
18	AMP	Amphipoda varia								+++	12,5
19	ISO	*Synisoma capito*						++			12,5
20	TAN	*Apseudopsis ostroumovi*		+							12,5
21	ECH	*Amphiura stepanovi*	+	+++							25,0
22	TUN	*Ascidiella aspersa*		++				++			25,0
23	TUN	*Ciona intestinalis*		+++		++	++	+			50,0
		TOTAL	**5**	**10**	**5**	**6**	**6**	**11**	**6**	**10**	

Table 13. Qualitative compositions of macrobenthos in grab samples of the NW Black Sea shelf (*Phyllophora* field). R/V Poseidon, March 2008

Nr.	Group	Taxa / Station ID	Ukrainian shelf (*Phyllophora* field)											F%
			Phy 1	Phy 2	Phy 3	Phy 3a	Phy 4	Phy 4a	Phy 6	Phy 7	Phy 8	Phy 9	Phy 10	
1	POR	Spongia varia	+		++	++	++							36,4
2	HYD	Hydrozoa varia						++		1	++	++		36,4
3	NMT	Nemerini varia			+									9,1
4	POL	*Harmothoe sp.*									++			9,1
5	POL	*Neanthes succinea*		+										9,1
6	POL	*Pectinaria koreni*								1	3	+		27,3
7	POL	*Terebellides stroemii*	++	++		+++	++	++						45.5
8	POL	Polychaeta varia		++	+	+++	++	++	++	++	++	++	+++	90,9
9	BIV	*Modiolus adriaticus*					++	1				++		27,3
10	BIV	*Modiolus phaseolinus*	+			++		++				+++		36,4
11	BIV	*Mytilaster lineatus*	+								++			18,2
12	BIV	*Mytilus galloprovincialis*	+++	+++	3	++++	++++	+++	+++	+++	+++	+++	++++	100
13	BIV	*Scapharca inaequivalvis*									40			9,1
14	BIV	*Spisula subtruncata*								1	1			18,2
15	BRY	Bryozoa varia		+++										9,1
16	AMP	Amphipoda varia	+++						+++	+++++	++++			36,4
17	DEC	*Pisidia longimana*					1							9,1
18	ECH	*Amphiura stepanovi*				++	+++	++						27,3
19	TUN	*Ascidiella aspersa*				++		1						18,2
20	TUN	*Ciona intestinalis*	+			++		1						27,3
		TOTAL	**7**	**5**	**4**	**8**	**7**	**9**	**3**	**6**	**9**	**6**	**2**	

Only in Van Veen:
+ - rare
++ - low abundance
+++ - medium abundance
++++ - high abundance
+++++ - very high abundance

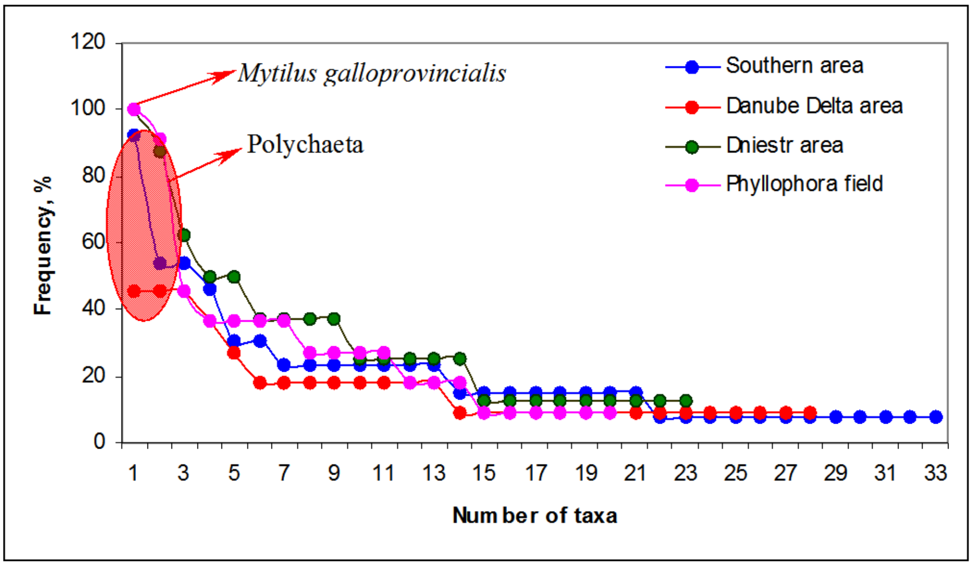

Figure 12. Macrobenthic organisms frequency on the NW Black Sea Continental Shelf in 2008

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