POSEIDON-363

7-25 March 2008

Oceanography group cruise report

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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 IFM-GEOMAR, 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 1 below.

Hydrology group log book
POSEIDON 363
March 2008

Station no	Station name	cast no	Date	Start time GMT	CO-ORDINATES Latitude, deg.mins.decimals	Longtude, 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	1808	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	29.40.56	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	186	6.6	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	45.26.76	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	6.4	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
167	DD12	1	19-3-2008	03:41	43.58.90	31.30.88	1339	500	7.6	244	9.3	8.1	17.530	0.0	500;100;125;7;90;2 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	85.3	80	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	43.19.58	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;180;160;140;120;100;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.

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.1 and Fig2.). 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.

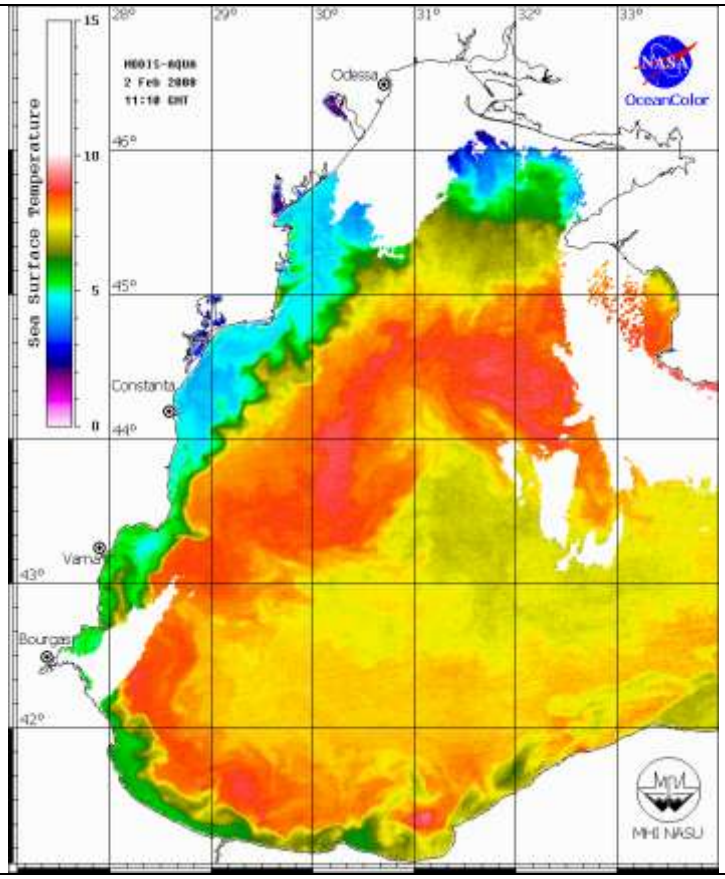

Fig.1. Sea Surface Temperature Distribution before the cruise (02 February 2008)

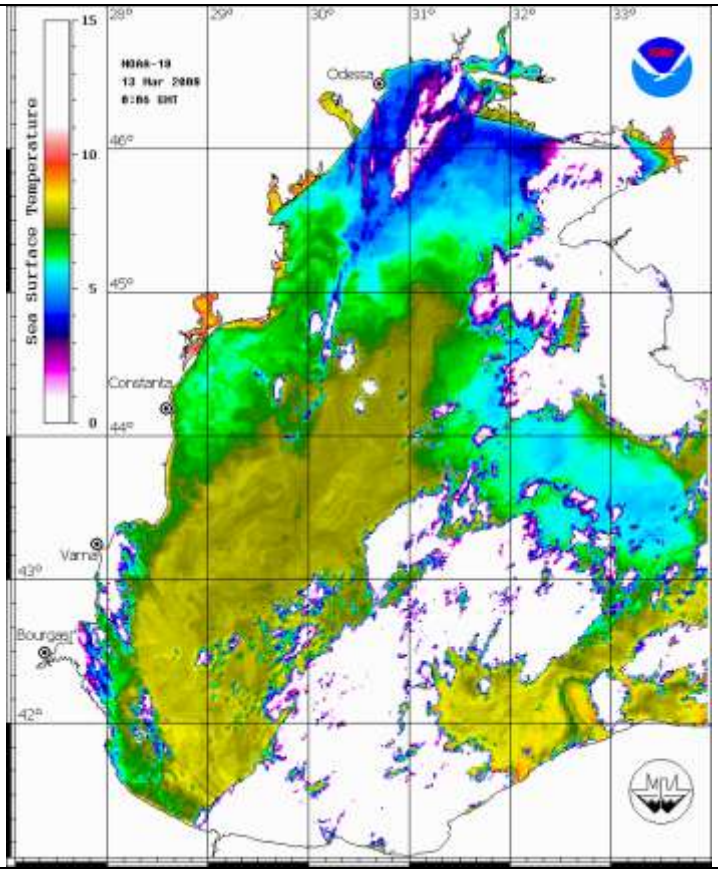

Fig.2. Sea Surface Temperature Distribution in the middle of the cruise (13 March 2008)

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.

On the *first survey* off Cape Kaliakra carried out in early March, the surface temperature was 6.83°C and salinity 17.49 psu.at the coastal station (28°31.03'E 43°21.59'N, st. 101_2) There was a smooth thermocline and the temperature difference between the surface and the near bottom layer was 0.4°C. On the off- shore side of the area (st. 109, 29° 16.96'E 43° 5.02 'N) the surface temperature increased to 7.75°C. We clearly see that the temperature stratifications have increased. The minimal temperature in the Cold Intermediate Layer (CIL) was observed there at depth 64 m (6.78°C). See Figs.3,4

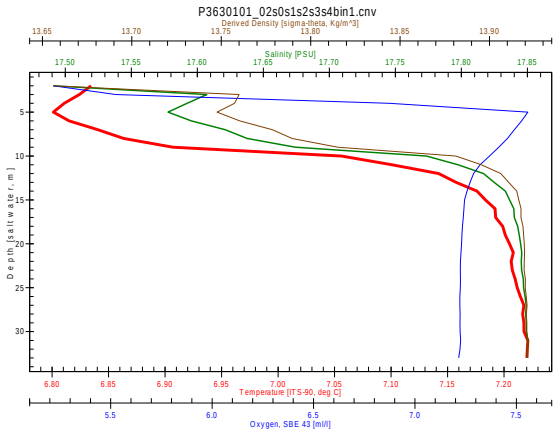

Fig.3.

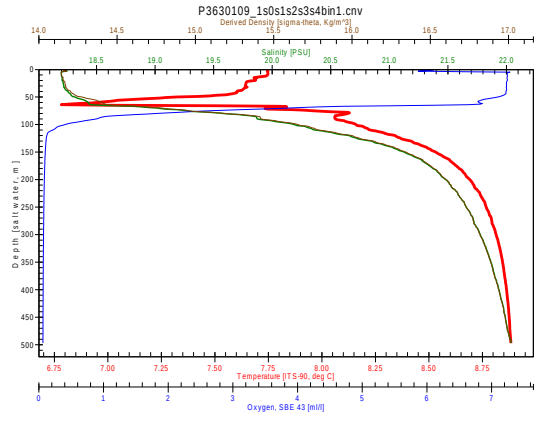

Fig.4

The *second* survey near *Kaliakra* was made on 23-24 March 2008. At the coastal station (28° 31.03'E 43° 21.60'N, st. 193) the surface temperature was 7.95°C and salinity 17.80 psu. The thermocline had two inversion layers at 15 and 25 m with T=8.05 and 7.97 °C and the temperature difference between the surface and the near bottom layer was 0.15°C. On the off-shore side of the section (29° 21.19'E 43° 2.18 'N, st. 205_1) the surface temperature increased to 8.25°C. The temperature stratifications have increased. The minimal temperature in the CIL was observed there at depth 49 m (7.68°C). See Figs 5,6.

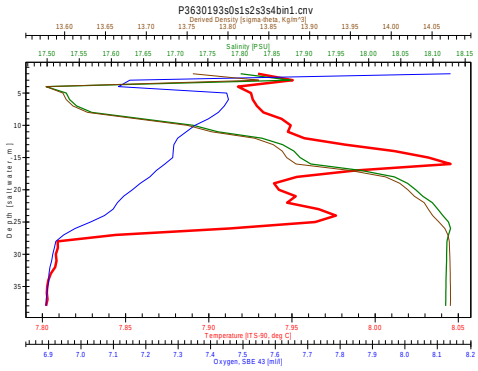

Fig.5

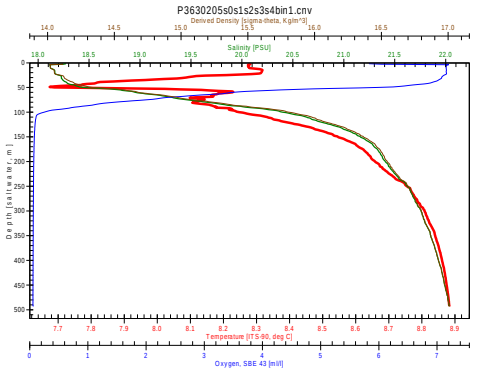

Fig.6

The *third Kaliakra* section was in 15-20 miles to north off the position of the 1st and the 2nd surveys in 24 March. At the coastal station (28° 43.20'E 43° 27.98'N st. 211) the surface temperature was 8.32°C and salinity 17.78 psu. The thermocline had only one inversion layer at 20 m with T=8.27. The temperature difference between the surface and the near bottom layer was 0.37°C. The CIL was located at depths 30-35 m with 7.90 °C. On the off- shore side of the section (29° 27.47'E 43° 11.54'N, st. 206) the surface temperature increased to 8.40°C. The minimal temperature in the CIL was observed there at depth 49 m (7.59°C).See Figs 7, 8.

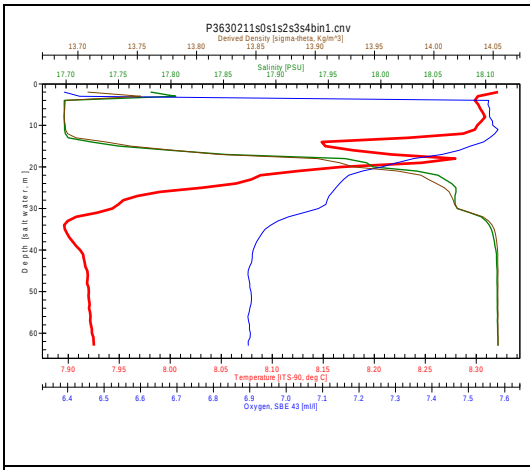

Fig.7.

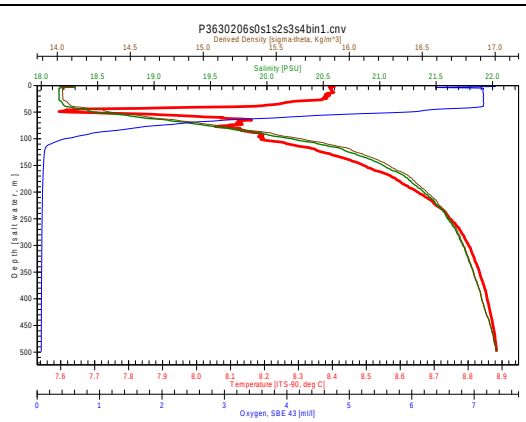

Fig.8.

The vertical structure of temperature at the area of Zernov's *Phyllophora Field* (Polygon Phy) was characterised with the very deep development of the upper homogenous layer. It varies from 12 m to 23 m at a number of stations. The temperature at the surface and in this layer was very low: 5.2°C at st.138 (31° 44.15'E 45° 54.28'N) and 5.02 at st. 142 (30° 51.78'E 45° 44.04'N). The temperature difference between the surface and the near bottom layer was 0.6-0.8°C. The salinity of the surface and subsurface layers decreased toward the coast from 17.85 psu at st. 138 to 16.25 psu at st 142, which were close to Dnistro Lyman. See Figs 9,10

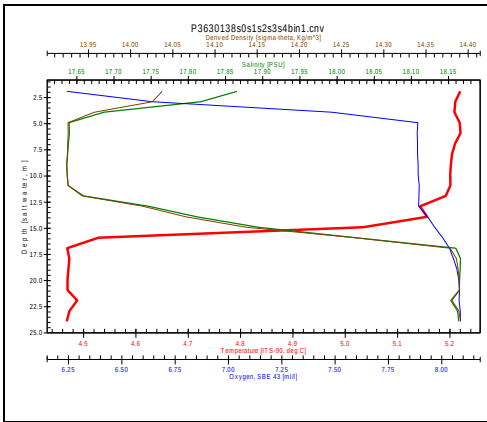

Fig.9

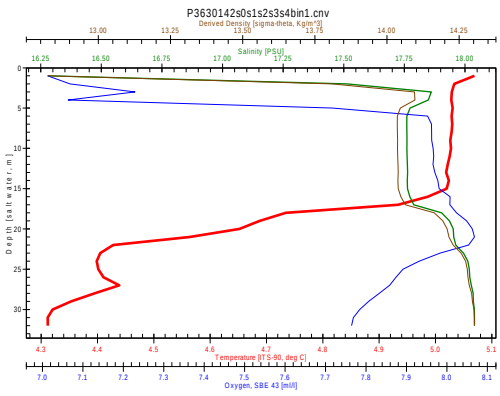

Fig.10

Two cross-sections from *Dnistro river Lyman* shows the step-like structure in the vertical temperature profiles in its upper parts both on off-shore and in-shore stations. At the coastal station (30° 39.46'E 45° 51.04'N, st. 150) the surface temperature was 5.1°C and salinity 15.96 psu. The thermocline has one inversion layer at 12 m with T=4.96°C. The temperature difference between the surface and the near bottom layer was 0.5°C. The minimal temperature was observed at depths 16 m with 4.48°C. On the off-shore side of the section (31° 17.55'E 45° 1.00 'N, st. 158) the surface temperature increased to 7.8°C, salinity – to 17.75 psu. The minimal temperature (in the CIL) was observed near sea bottom at depths 58 m (6.76°C). See Figs 11,12

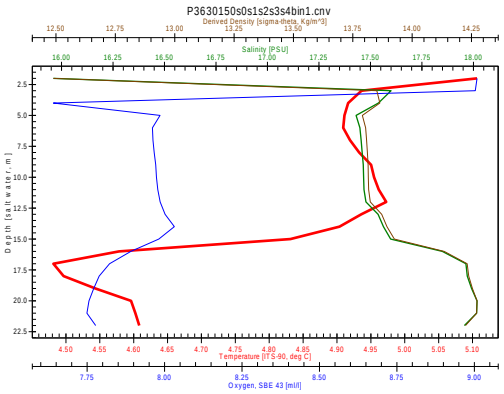

Fig.11

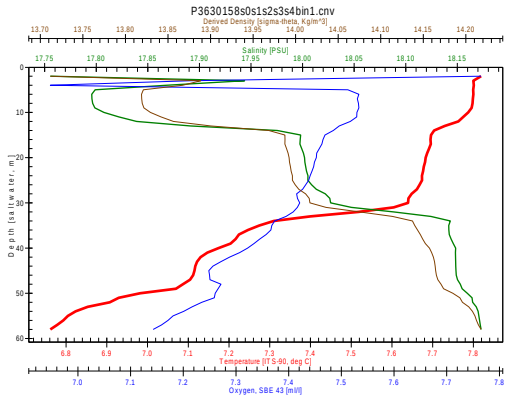

Fig.12

More developed profiles of temperature were observed at stations in Bulgarian waters. On *VA3* (28° 23.88'E 43° 8.24 'N, st. 192) the surface temperature increased to 7.9°C, salinity – to 17.75 psu. Ta depts. 12-30 m there was positive inversion of temperature 8.07°C. The minimum temperature was 7.83°C at depths 33 m. The temperature difference between the surface and the near bottom layer (58 m, 7.86°C) was 0.04°C. The low saline (17.6 psu) sub-surface layer was observed at depths 5-11 m., see Fig 13.

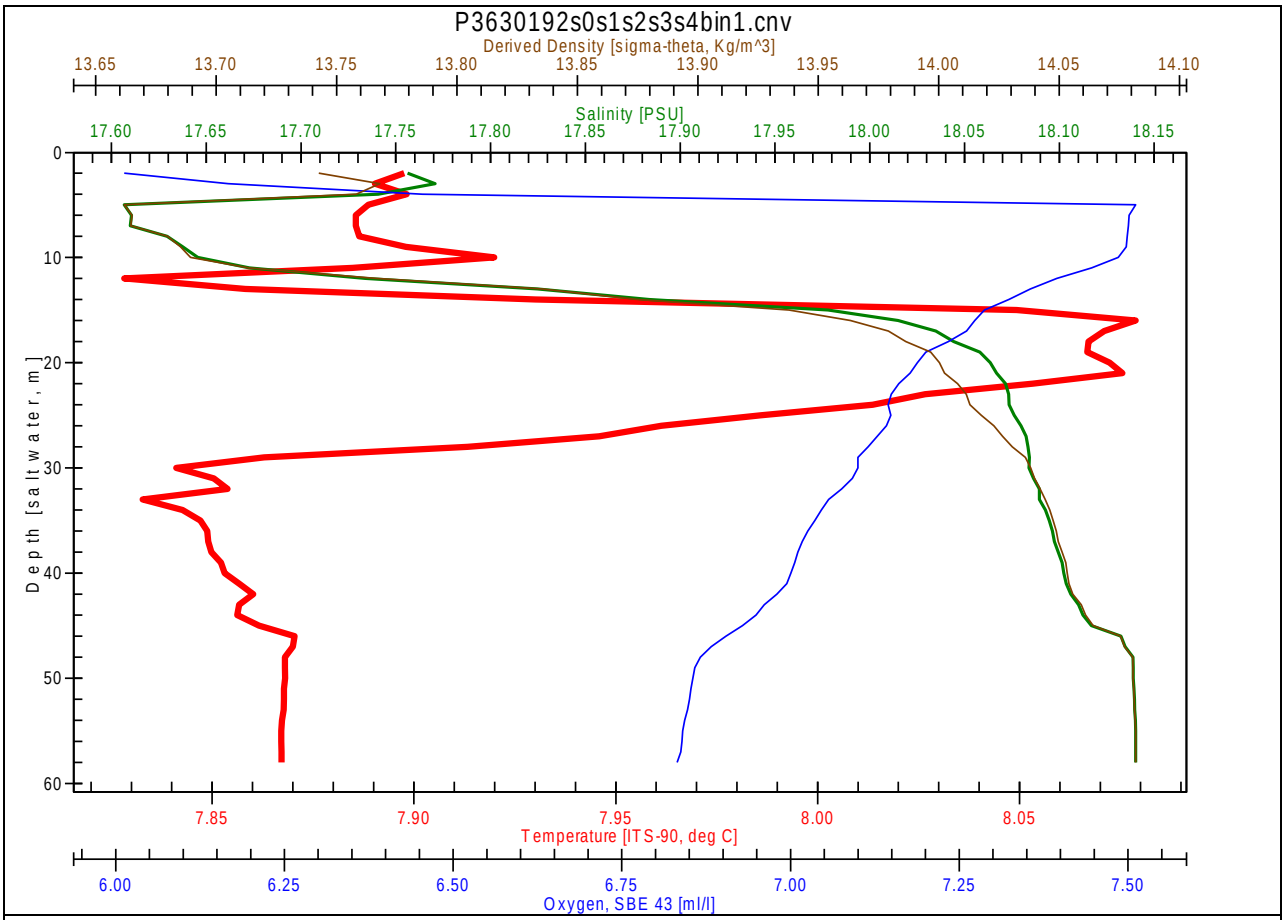

Fig.13

The stability of the water mass and its dynamics can be inferred indirectly from comparing the downcasts (which are normally used to describe the water column properties) and the upcast , which was conducted immediately after the downcast. Examples of stable und evolving situations are shown in Figs.14, 15 for stations No 120 and 183. Further analysis of the hydrophysical situation is being carried out at the University of Plymouth.

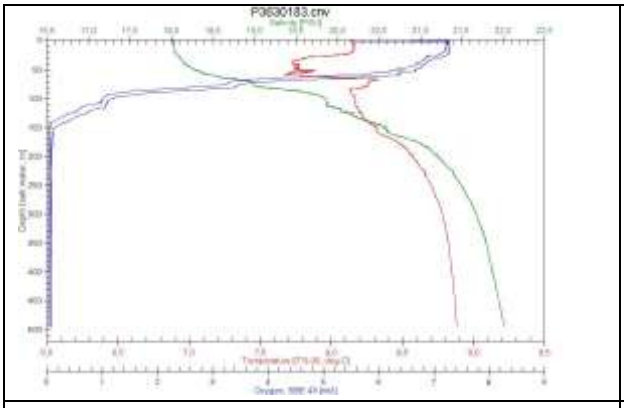

Fig.14

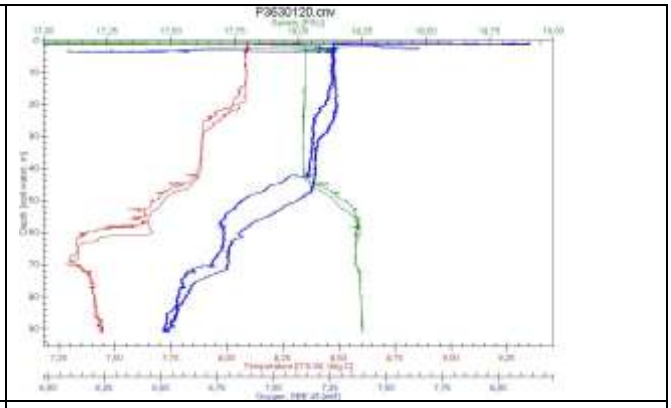

Fig.15