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PHYSICAL, CHEMICAL AND BIOLOGICAL DATA SETS OF THE TU BLACK SEA DATA BASE: DESCRIPTION AND EVALUATION.

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Abstract. The data set of the TU Black Sea Data Base consists of the individual cruise data sets of the Data Contributing Partner Institutions and of several 'external' cruises which data are freely accessible (available) from other sources (databases). Basically, the paper constitutes a brief description of the data of the TU Black Sea Data Base (physical, biogeochemical and biological), and covers the issues of data quality and coverage as well as of sampling techniques and methods of samples treatment.

1. Hydrographic data of the TU Black Sea Data Base.

1.1 GENERAL INFORMATION.

L.I. Ivanov and T. Oguz (eds.), Ecosystem Modeling as a Management Tool for the Black Sea, Vol. 1, 11-37.

Following the decision of the TU Black Sea Project Data Base Executive Committee an expert group has been organized with the objective to fulfill quality control of the hydrographic data coming from different institutions. The expert group was formed by physical oceanographers from the Data Contributing Partner Institutions (DCPI): L.Ivanov (MHI, Ukraine), head of the expert group, and S.Besiktepe (IMS/METU, Turkey); V.Belokopytov (MB UHMI, Ukraine), V.Diakonu (RMRI, Romania), V.Yakubenko (SB SIO, Russia), expert group members.

Quality check has been applied to all hydrographic data sets before they were loaded into the final version of the Data Base and quality flags have been assigned to all temperature and salinity values. Thus, the objective of the expert group work has been attained.

The complete hydrographic data set consists of 186 data sets of individual cruises of the Data Contributing Partner Institutions and 'external', such as R/Vs Atlantis II-69, Knorr -88 and Pektaş-57 cruises. The total number of stations is about 18000. The data cover the period from 1910 to present but more than 98% of the total data are for the last 20 years of observations. Figure 1 shows distribution of data among DCPI.

Quality control of all hydrographic data included (1) simplified visual control of temperature, salinity and density vertical profiles and T,S diagrams as a check for obvious errors; (2) calculation of mean values as well as of their root mean squares (r.m.s.) for temperature and salinity at 300, 500, 1000, 1500 and 2000 m depth levels, where natural variability is known to be small, for those cruises where the data for this depths were available (an examples of such calculations are shown in table 1); (3) assessment of the accuracy of the specific cruise data sets. Finally, after checking against the results of visual control and averaged T,S values for deep layers, quality flags have been assigned to all the data. When the entire data set showed a permanent/quasi-permanent appreciable (exceeding typical r.m.s.) shift off the climatic values (benchmarks) for the deep layers, then all the values for the parameter have been altered.

The benchmarks for T,S values for deep layers were set in accordance with the results of recent experiments [1] that provided hydrographic measurements in the Black Sea of unprecedented accuracy (within ±0.005 for both temperature and salinity individual measurements). The conclusion was based on the knowledge that the T,S indices of the Black Sea intermediate and deep water masses didn't change (within the accuracy of the measurements) during the last 5-10 years. At the same time the following procedure has been applied to provide a proof that these T,S indices, virtually, didn't change (also within the accuracy of the estimate) within the last 20-30 years, so, that the same benchmarks may be applied for earlier data. For that purpose the earlier data have been checked against mean temperature and salinity values for 1955 to 1960 calculated from the climatic data set from MHI. For 500 m depth, such averages are 8.86 ± 0.01°C and 22.01 ± 0.01 ppt (136 stations). The last estimates show that no noticeable shift in temperature / salinity values for 500 m depth can be revealed for the past 40 years. Indeed, an average for the same values but for 1975-85 period is 8.88 ± 0.006 for temperature and 22.03 ± 0.01 for salinity, and for the recent measurements (1991 to present) it is 8.879 ± 0.001 for temperature and 22.045 ± 0.003 for salinity.

Results of the quality control revealed that, generally, all the cruises can be sorted out in three groups in accordance with the r.m.s. values for temperature and salinity for the deep layers.

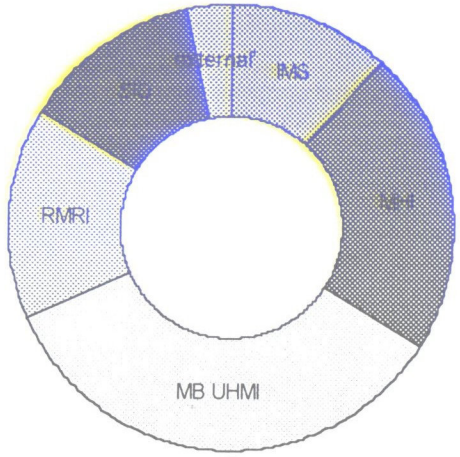

Figure 1. Data input (number of stations) from Data Contributing partner institutions.

Group 1 (*lowest accuracy*) includes cruises with Nansen casts measurements and early cruises where data were collected by means of obsolete CTD probes (ISTOK-3, HYDROZOND). For all the cruises in which data were collected by means of Nansen bottles, any individual values can be trusted only to some extent. In particular, r.m.s. for 500 m depth revealing mostly stochastic errors appear to be on the order of 0.05 for temperature and 0.1 for salinity. Interestingly, the r.m.s. values for cruise average values are of the same order of magnitude as for the individual measurements. In particular for 1975-85 period, r.m.s. for cruise averages are 0.05 for salinity and 0.03 for temperature. Hence, the above mentioned stochastic errors may be considered as typical 'accuracy' for individual temperature and salinity measurements and for cruise averages.

That is why it is strongly recommended not to use historical data for any analysis of space-time thermohaline variability below 300 meters, and, for some cruises, even below 200 meters. Indeed, recent high quality measurements reveal r.m.s. values for spatial variability at 300 m about 0.02°C for temperature and 0.08 for salinity, i.e. on the order of random mistakes for measurements of this group.

Some speculations are possible that for the upper layers (layers where natural variability is significant) such errors might be not as big as for the deep measurements but that is only partially true because, for the deep layers, r.m.s. values were calculated after filtering of apparently wrong data but, for the data collected in the upper layers, there is no possibility to determine and filter the flaws unless these are obvious slips.

Group 2 (*medium accuracy*) includes data collected by means of a developed probes (compared to early examples) that were produced in the Former USSR (basically, MHI production): ISTOK -5, OLT, SHIK and KATRAN probes.

Group 3 (*high accuracy*) includes the data from recent cruises collected by means of the SBE and ISTOK-7 probes. Below 1000 m, typical ratio for the r.m.s. values for these three Groups is on the order of 15/5/1 for the random noise (mistake) range for both temperature and salinity. Unfortunately, the amount of data that may be attributed to this particular group is rather small. Figure 2 shows total number of cruise data sets of each DCPI and relative number of data sets with data belonging to the third group.

TABLE 1. Examples of the assessment of hydrographic data 'accuracy'.

Year	Cruise	depth	points	mean T	r m s T	mean S	r m s S
1957	Pektas	500	48	8.96	0.11	21.56	0.14
1964	16 ML	300	6	8.75	0.05	21.61	0.12
		500	19	8.83	0.04	22.00	0.11
		1000	21	8.93	0.01	22.25	0.11
1984	29 AV	500	19	8.817	0.035	21.975	0.11
		1000	16	8.891	0.030	22.262	0.017
1985	44.4 ML	300	20	8.814	0.022	21.759	0.045
Oct		500	19	8.868	0.015	22.053	0.019
		1000	19	8.937	0.015	22.292	0.10
		1500	17	9.016	0.015	22.332	0.013
		2000	12	9.085	0.013	22.340	0.012
1990	53A ML	300	193	8.821	0.018	21.788	0.014
Oct		500	177	8.884	0.016	22.081	0.026
		1000	137	8.955	0.014	22.318	0.016
		1500	84	9.032	0.012	22.351	0.011
1993	30 PK	300	117	8.809	0.025	21.740	0.09
Apr		500	111	8.880	0.005	22.045	0.030
		1000	50	8.953	0.003	22.289	0.005

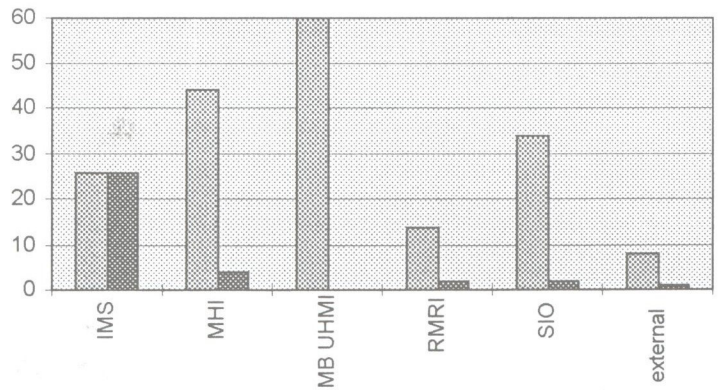

Figure 2. Total number of cruise data sets from all DCPI and number of high quality data sets.

1.2 QUALITY CONTROL OF SPECIFIC DATA SETS.

1.2.1 Hydrographic data sets of MHI.

The data sets from MHI span the period from 1964 to 1995. Most of the data are of low and medium quality (fig. 2). The major flaws found in the process of data quality control are listed below:

- *cruise 44.1 of the R/V Mikhail Lomonosov*: wrong data for the st.4448 and for all deep part of all the stations starting from st.4451;
- *cruise 53 of the R/V Mikhail Lomonosov*: all salinities were found to be wrong since an error is not additive but multiplicative (inverse increase of the error magnitude with decreasing depth), simple correction of the data is impossible, and all salinity from that cruise data were discarded;
- *cruises 37.3 of the R/V Academic Vernadsky:* the data appeared to be noisy, starting from st. 6438, all salinity values were found to be wrong;
- *cruises 37.4 of the R/V Academic Vernadsky:* the data appeared to be noisy, salinity values were found to be wrong, and were corrected;
- *cruises 17.1 and 17.2 of the R/V Professor Kolesnikov*: salinities were found to be wrong, and were corrected;
- *cruise 31 of the R/V Academic Vernadsky*: about 30 per cent of the stations have wrong salinity values, that needed correction;
- *cruise 32 of the R/V Professor Kolesnikov*: several stations had spikes in salinity which were removed, st.5849 had absolutely wrong temperatures and salinities and had been excluded from the data set;
- *cruise 15- of the R/V 'Trepang':* The data are of low quality when compared with other recent CTD data because of appreciable time drift in both temperatures and salinities.

1.2.2 Hydrographic data sets of IMS/METU.

All these data were collected by means of modern CTD probes (SBE). The data are of high quality (fig.2) showing no time drift or permanent shift from the climatology. Yet, spikes in salinity are a persistent feature for salinity distribution within the layer of seasonal thermocline (appreciable vertical temperature gradients). The spikes have the form of sharp increase in salinity and, thus, they have been manually filtered to provide data for further analysis. Where possible, the spikes were removed using the procedure of linear interpolation. Otherwise, quality codes 3 or 4 for temperature and salinity were used.

1.2.3 Hydrographic data sets of MB UHMI.

Quality control of these data, which basically belong to groups 1 and 2 as regards their quality, included simple visual control of temperature, salinity and density vertical profiles; calculations of mean values as well as their root mean squares for temperature and salinity at 300, 500 and 1000 m depth levels for those cruises where the data for this interfaces were available; assessment of the accuracy of the specific cruise data sets. Finally, after checking against the results of visual control and averaged T,S values for deep layers, quality flags have been assigned to all the data.

1.2.4 Hydrographic data sets of SIO.

Quality check of the original data sets of SIO revealed the following flaws. Part of them were corrected but some small part of the data were discarded:

- Cruise *Akvanavt 2*: for all the data of the third phase of the cruise (late April) salinities are high and temperatures are low when compared with the benchmarks.
- Cruise *Akvanavt 5*: there are considerable differences in salinity (about 0.15 compared to benchmarks). For the second phase of the cruise salinities were recalibrated.
- Cruise *Shtokman 5*: for some stations (639, 672, etc.) the salinities are unbelievably low when compared with the benchmarks. At this stations salinity values were corrected.
- Cruise *Vitiaz 21*: accuracy for salinity values is low; therefore QC 3 has been assigned to all salinity values.
- Cruise *Vitiaz 26*: All the salinity values for the upper layer were found to be artificial (unknown reason), and QC 4 has been assigned to all these values.
- Cruise *Yu96*: for some stations (2,22,25,33,37,38,40,41,42,44,45), but for the first soundings only, temperature values appear to be higher than typical (0.15°C). T is time dependent during each station. Caution: temperatures has not been altered.

1.2.5 Hydrographic data sets of RMRI.

The quality check of the RMRI data has been carried out using the CRBCTRL program provided by the data base team. As a rule, the expert group (A. Cociasu and V. Diaconu) agreed that, due to the fact that the Oceanographic Yearbooks, as well as the original data sheets and the cruise logs were available in the laboratory archive, the typing errors and omissions should be corrected both in the log and data files, either prior or during the quality check, without setting the QC flag to 5.

First, the physical parameters (temperature and salinity) have been checked for consistency. Due to repetitive character of almost all of the cruises (except for those of the last decade), the tests have been usually made for each station of a given network, or, when the entire shelf was covered, for a group of stations located relatively close to each other in some specific sectors: near the shore or the Danube delta, on the outer shelf, etc. The choice was made as to reduce the variability among the selected stations and allow an easy inspection of the vertical distributions. Every value leading to a distorted profile was checked against the original data and then either corrected (if a mistyping) and flag set to 1, or flagged as doubtful (flag value 3). The reason for not using the 'bad value' flag 4 was the idea that, owing to the lack of information on the dynamics, some small 'inversions' are not necessarily measurement errors, but rather a possible result of the mesoscale dynamic processes near the Danube plume fronts, on the shallow inner shelf, and/or at the shelf edge.

1.2.6 Data sets from international (external) cruises:

- R/V *'Thorp' 1910* cruise. Only few samples were collected in the Black Sea. The data were checked only for apparent mistakes.
- R/V *'Calipso' 1955* cruise. Only few stations from the near Bosporus region are available. Deep samples show appreciable differences from climatic estimates (0.05 for temperature and 0.03 for salinity).

- R/V *'Chain' 1961* cruise. Only few stations from the near Bosporus region are available.
- R/V *'Pillsbury' 1965* cruise. The cruise had basin wide coverage and deep stations are available. Data are of relatively good quality when compared to other cruises where samples were collected by means of Nansen bottles. Averaged temperatures and salinities for 500 m depth were calculated showing no permanent shift against climatic means (T = 8.88, S = 22.05).
- R/V *'Atlantis' 1969* cruise. The cruise had basin wide coverage and deep stations are available. Some portion of data were considered as erroneous. After filtering that erroneous values, mean temperatures and salinities for 500 m depth were calculated. Both mean temperature and mean salinity did not show appreciable difference compared to climatic data (T = 8.87, S = 22.03).
- R/V *'Thompson' 1970* cruise. Data were collected in the near Bosporus region. The cruise had only one deep station.
- R/V *'Knorr' 1988* cruise. The data were checked and spikes as well as several obviously erroneous values both in temperature and salinity were removed.
- R/V *'Pektaş' 1957* cruise. The cruise had basin wide coverage. Most of the stations were deep making the comparison with climatic data and, thus, an assessment of the accuracy of the data possible. After filtering an apparent flaws, mean temperatures and salinities were calculated for 300, 400, and 500 m depths. That yield the following results:

depth, m	mean T	r.m.s. T	mean S	r.m.s. S	Numb. of st.
300	8.88	0.10	21.25	0.16	49
400	8.91	0.12	21.42	0.13	48
500	8.96	0.11	21.56	0.14	48

The results show some shift in temperature (towards high temperatures) and appreciable shift in salinity (towards lower salinities). Since the cruise was held in 1957, the data have been checked against mean temperature and salinity values for 1955 to 1960 calculated from the climatic data set from MHI. Accordingly, all temperature and salinity data of that cruise were altered : temperatures were decreased by 0.10, and salinities were increased by 0.45.

2. Hydrochemical data of the TU Black Sea Data Base.

Chemical data of Romania, Ukraine, Russia, Turkey, and United States of America (data sets of cruises R/V ATLANTIS, 1969, and R/V KNORR, 1988) have been included into joint data base of the TU-Black Sea Project. This data set includes information for the period from 1964 to 1995. Total number of measurements is about 218,000 (without CTD/O2 data).

Joint data base, basically, contains information on Dissolved oxygen, Hydrogen sulfide, Silicic acid, Inorganic phosphate, Nitrate, Nitrite, Ammonia, Total alkalinity, and pH in the Black Sea. Also, the data base contains some information on other

chemical or relative properties of water such as particulate organic matter, total suspended matter, humic substances, different forms of sulfur, mercury, etc.

The number of data for different years varies from hundreds to tens thousand. More than 80% of the total amount of data is for the period 1985 to 1995. Relevant amount of data contributed by individual countries varies for different years. Thus, Romania has supplied up to 90% of data for the period from 1960 to 1985. At the same time, Ukraine and Turkey, as the most active participants of international programmes (CoMSBlack and TU-Black Sea), have contributed more than 70% of data for the period 1985 to 1995 and 55% of the total amount of data.

The following figures reveal detailed structure of the joint chemical data set. The number of data on nutrients (phosphate, silicic acid, nitrate, nitrite, and ammonia) distribution in the Black Sea is about twice as much as that for dissolved oxygen and hydrogen sulfide. The reason is not only higher number of substances summarized in definition of "nutrients", but very small amount of hydrogen sulfide data for deep layer of water. Marine Hydrophysical Institute (MHI) has been carrying out special program on the monitoring of the sulfide onset for the last 10 years. As the result, the volume of oxygen and hydrogen sulfide data contributed by MHI is the largest among other participants. The same is true for data on nutrients contributed by Romanian Marine Research Institute: large volume of data is the result of long-term monitoring program. Increased number of chemical data obtained in 90's results from several international programmes, where multi-ship basin-wide cruises were organised. So, one of the most important conclusions at this stage is that monitoring is the only way to provide sufficient amount of data. And international program is the only basis for basin-wide monitoring at present time.

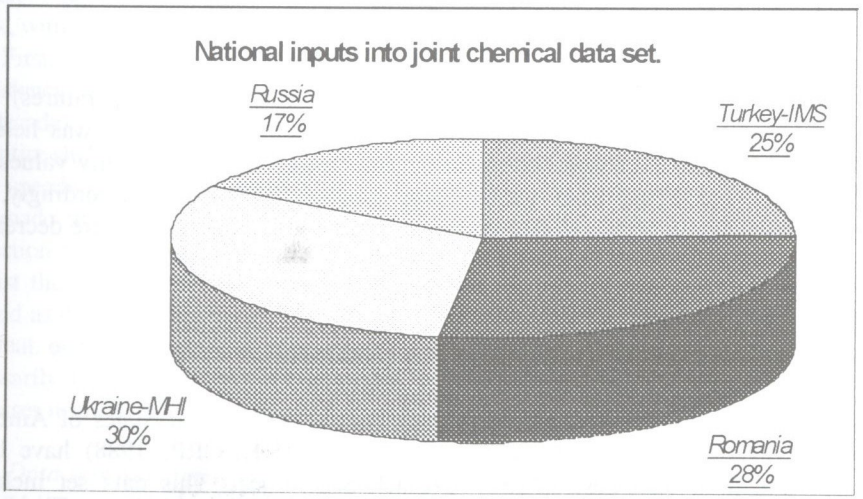

Figure 3. National inputs into joint TU Black Sea chemical data set.

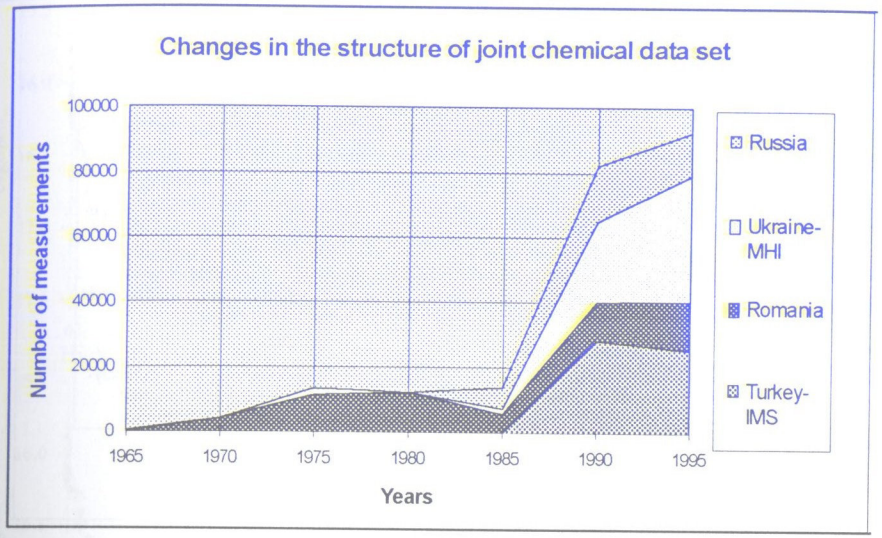

Figure 4. Structure of the joint chemical data set.

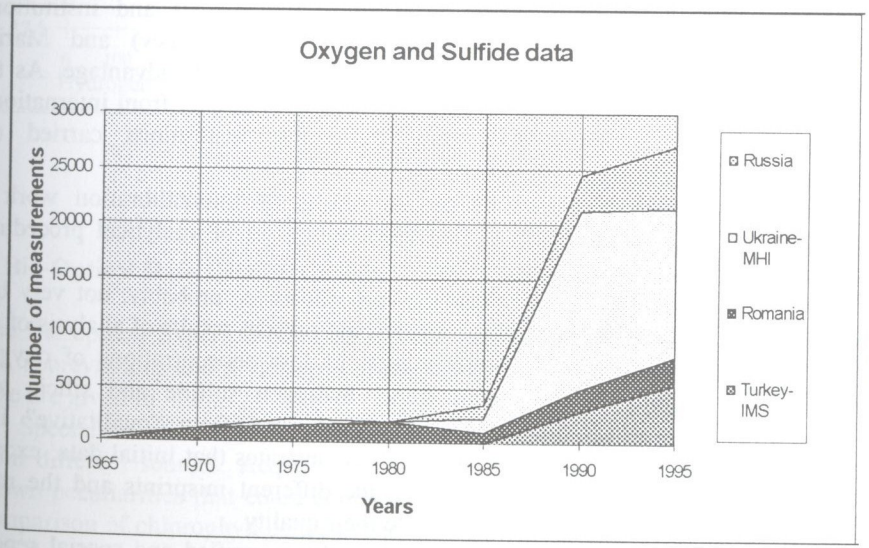

Figure 5. Amount of data on the dissolved oxygen and hydrogen sulfide from different DCPI.

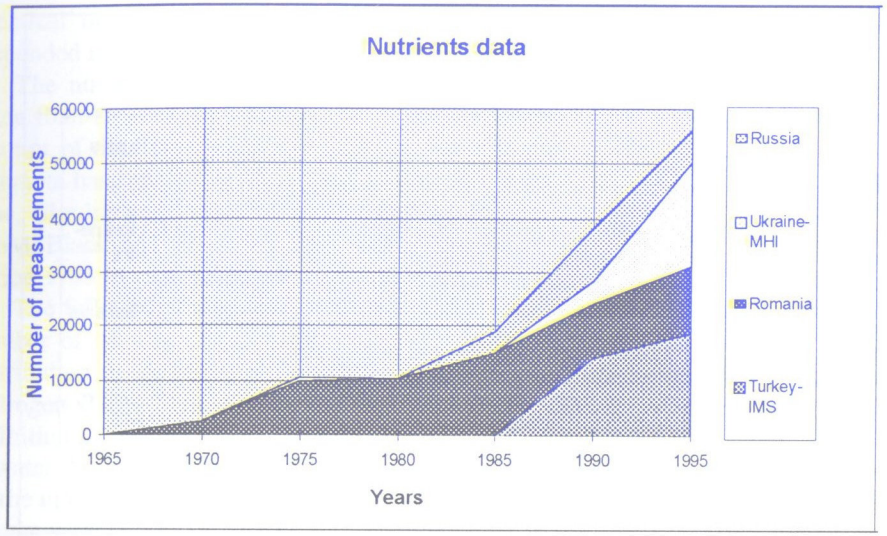

Figure 6. Amount of data on the nutrients from different DCPI.

Another advantage of any international program, that helps to improve joint data base, is cooperative work of scientists from different countries and institutions. Cooperative work of the Institute of Marine Sciences (Turkey) and Marine Hydrophysical institute (Ukraine) is an excellent example of this advantage. As the result, these two institutions have provided more than 80% of data from international multi-ship cruise programmes. And only these two institutions carried out intercalibration of their results.

Detailed information and analysis of the results of intercalibration work is available from [2]. The main result of that work is the set of analytical procedures modified for analysis of the Black Sea waters.

Difference between "new" and "standard" procedures is, probably, not very big, but the difference in the quality between previous and present results of analysis of sea water is clear (fig. 7). Results of determination of low concentrations of oxygen, phosphate concentrations in the anoxic zone, hydrogen sulfide and silicic acid concentrations in the Black Sea have been transformed from "qualitative" into "quantitative" grade. At the same time figure 7 demonstrates that initial data, except, probably, the latest, had to be verified to exclude different misprints and the most obvious errors and to mark the data according to their quality.

All the data included into joint data base have been verified and special reports had to be prepared for data set of every country participating in this Project. These reports containing detailed information for every cruise data set included into joint data base are now available for data of Ukraine and Turkey.

Countries have contributed different amount of data of different quality, but in any case this is the first successful attempt to produce joint data base for the Black Sea and in this way to provide possibility to analyze data of different countries as a joint data set.

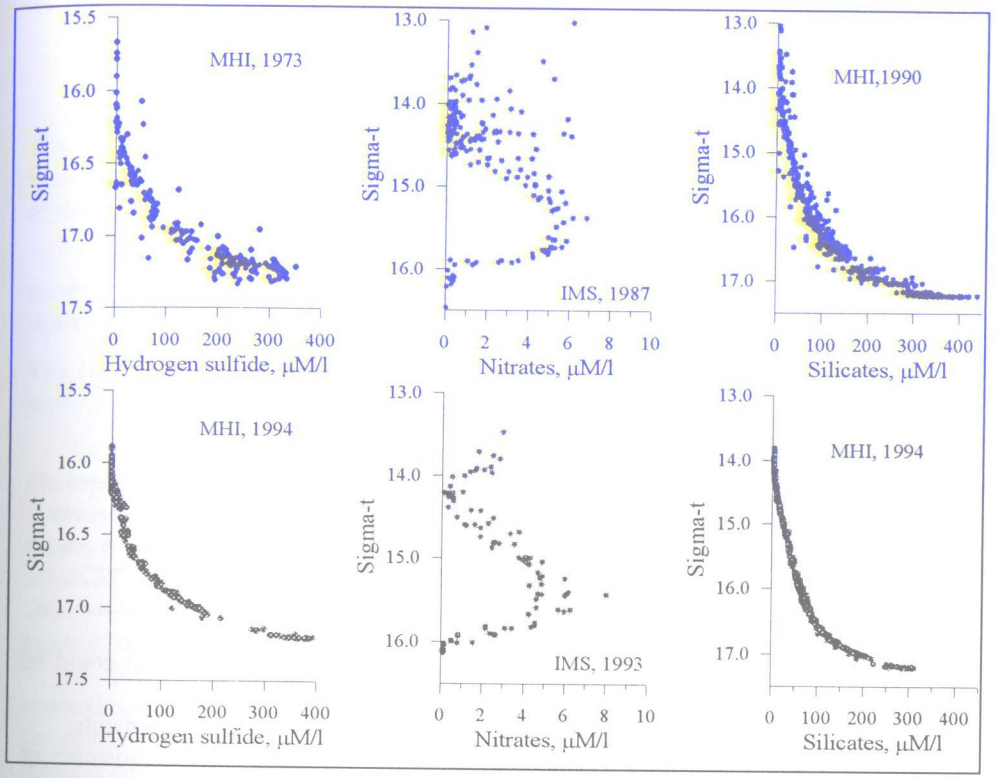

Figure 7. Data 'scattering' for earlier and recent cruises.

3. Bio-Optical Data Quality Control.

The Bio-optical Expert Group checked the relevant data delivered by DCPI. The full list, abbreviations and dimensions of the bio-optical parameters included into the data base are given in Table 2.

Special attention has been paid to methodological issues of how to combine data from different sources. Acquaintance with the methods, used in each country, has shown peculiarities that could complicate the analysis of the joint data set. However, comparison of chlorophyll concentrations measured with different methods has shown that the data are compatible. Further, in addition to comparison of the field data, certain experiments were planned and carried out to find possibility to combine data obtained by different methods. The results were used for evaluation of data quality and assignment of quality flags (QF).

TABLE 2. Abbreviations and Dimensions of Bio-optical Parameters.

1	Chlorophyll-a (Spectrophotometric method)	CHL-S	mg m^{-3}
2	Chlorophyll-a (Fluorometric method)	CHL-F	mg m^{-3}
3	Phaeopigments-a	PHAEO	mg m^{-3}
4	Primary Production at selected depth	PRP	mgC $m^{-3}day^{-1}$
5	Primary Production at surface	PRPS	mgC $m^{-3}day^{-1}$
6	Primary Production in the water column	PRPI	mgC $m^{-2}day^{-1}$
7	Bacterial Production in the water column	BPI	mgC $m^{-2}day^{-1}$
8	Bacterial Biomass at surface	BBS	mg m^{-3} (wet-w.)
9	Secchi Disc Depth	SD	m
10	Beam Attenuation Coefficient at wavelength λ (Source: Artificial Light)	c (λ)	m^{-1}
11	Light Transmission at wavelength λ nm (Light transmission by the water path according to the instrumental optical base)	T (λ)	%
12	Photosynthetically Active Radiation	PAR	μEm^{-2}sec^{-1} (Wm^{-2})

The experts identified the following five groups of possible errors, that could be significant in checking bio-optical parameters before data quality control:

1. Methodological, instrumental errors and accidental mistakes of measurements.
2. A notable gap between estimated and usually observed values as an incosistency of vertical or horizontal distribution.
3. An inconsistency between estimated and usually observed data in a particular region during definite season or month.
4. Apparent disagreement between unusual value of a measured characteristic and the values of other ecosystem parameters.
5. If the data appear to be assigned to a wrong depth.

The first group includes particular cruises, stations and depths that are characterized by:

a) zero Chlorophyll concentrations at definite depths within the euphotic zone;
b) determination of CHL-F concentration without acidification or the lack of information about phaeopigments-a data;
c) a uniform vertical distribution of Primary Production;
d) possible overestimation of CHL-S concentration at lower depths of the euphotic zone;
e) accidental mistakes of measurements of vertical distribution of the Beam Attenuation Coefficient and of Light Transmission.

The errors of the second group are:

a) inexplicable maxima and minima in the vertical profiles and spatial distributions of Primary Production and Chlorophyll concentration;

b) abnormal decrease with depth or abnormal high or low values of spectral characteristics and vertical distribution of the Beam Attenuation Coefficient, which do not coincide with climatic data, or with the measurement of Secchi Disk Depth or with the declared accuracy of measurements.

The third group involves all the values of Primary Production and Chlorophyll concentrations which are unusual for the particular data set and all unusual high value of the Light Transmission that exceed the value for optical clear water.

The fourth group is comprised of stations having a notable disagreement between measured Chlorophyll concentrations in the upper layers of the euphotic zone and the observed Secchi Disc Depth.

The fifth group of stations (which rarely appear) has inverted (increase with depth) profiles of Primary Production.

Each country provided large sets of data including Chlorophyll-a and Phaeopigments-a concentrations. Two standard methods, spectrophotometric and fluorometric, were used for the determination of pigment concentrations. Based on the results of the working group for Aquatic Primary Productivity [3], good correlation was achieved between results of pigment determination by high-performance liquid chromatography (HPLC), the method which is most suitable for this purpose, and the pigment data collected in 21 cruises, between 1986 and 1995, IBSS (Ukraine).

In the latter institute, 3500 measurements were carried out in all seasons at approximately 800 stations in all regions of the Black Sea. In all these cruises, a fluorometric method has been used. The fluorometer was of IBSS production. The method completely corresponds to an up-to-date version of the JGOFS Protocols of June 1994 [4]. The use of this method in its modern and standard form assumes the obligatory separatation of measurements of the concentrations of Chlorophyll-a and Phaeopigment-a. Therefore, in the submitted Ukrainian data when Phaeopigments-a were absent or their concentrations were equal to zero at all depth levels (about 20% of IBSS data), these data were considered as doubtful and marked with QF=3.

Problems pertinent to Phaeopigment-a determinations with the fluorometric method were also characteristic for Turkish data submitted by IMS-METU. In the same period (1986-1995), 330 stations were visited and 2160 pigment measurements were performed. Turkish CHL-F data was essentially obtained by standard procedure with some deviations. The major discrepancy lies in the calibration curves which were drawn using pure chlorophyll-a for pigment analysis in natural samples containing practically both Chlorophyll-a and Phaeopigments-a. It should be mentioned that the specific fluorescence of Chlorophyll-a is nearly twice that for Phaeopigments-a or less. As a consequence, all CHL-F data obtained with Turner fluorometer from January 1986 to April 1990 (30 % of all IMS data) were found to be doubtful (QF=3).

Special experiments were carried out to evaluate the consistency of earlier data with Turkish data measured by means of the Hitachi F- 3000 Model Spectrofluorometer in the period from September 1991 to June 1996. The purpose of these experiments was to compare two fluorometric methods (with acidification of extracts and without acidification). Results of nearly 100 parallel measurements

allowed to determine the correction factor (0.74 ± 0.07) for conversion of the measured values to the real sum of Chlorophyll-a and Phaeopigments-a. This correction was applied to the original CHL-F data and the corrected data were loaded into the data base with QF=1.

Most of the Romanian CHL-S data were found to be correct. Only 19 CHL-S data (3 %) were found to be wrong (QF = 4) on account of zero concentrations of Chlorophyll within the euphotic zone.

All Russian CHL-S data (9 cruises from 1978 to 1992, about 200 stations and 1700 measurements) and PPI data (12 cruises and time series for the same period, about 230 measurements) were checked by the author, namely Vladimir Vedernikov, before the quality control procedure and, thus, all these data were found to be correct.

The quality of a smaller number of PRP data was proved to be better than the quality of CHL data (see Table 3). Practically all Ukranian PRP data were found to be correct. Most of the Romanian PRP data (65 %) is included in the group of correct data. However, 11 Romanian PRP values (5 %) have been altered at stations with inverted vertical profiles, 40 PRP values (18 %) were found to be assigned to wrong depth and, finally, 5 PRP values (2 %) were found to be wrong. As a rule, last two groups of stations were connected with inverted or uniform vertical distribution of primary production.

TABLE 3. Quality flags in all determinations of Chlorophyll-a &Phaeopigments-a and Primary Production.

Country	Index	Number of measurements	Number of determinations						
			QF=0*	QF=1	QF=2	QF=3	QF=4	QF=5	QF=6
UKRAINE	CHL-F	3565	0	2704	20	841	0	0	0
	PRP-S	208	0	207	1	0	0	0	0
	PRPI	120	0	117	3	0	0	0	0
TURKEY	CHL-F	2019	5	1335	18	655	6	0	0
	CHL-S	141	0	138	3	0	0	0	0
RUSSIA	CHL-S	1698	0	1698	0	0	0	0	0
	PRPI	227	0	227	0	0	0	0	0
ROMANIA	CHL-S	760	0	735	3	1	19	2	0
	PRP	221	0	144	15	6	5	11	40

*) Interpretation of QF: 0 = data are not checked, 1 = data are checked and appear correct,
2 = data are checked and appear inconsistent but correct, 3 = data are checked and appear doubtful,
4 = data are checked and appear to be wrong, 5 = data are checked and the value has been altered,
6 = data are checked and appear to be assigned to the wrong depth.

The vertical distribution of the Beam Attenuation Coefficient in the cruises of MHI and its spectral distribution in cruises of SB-SIO RAS, were considered as doubtful or wrong if:

a) an abnormal decrease of this factor was observed with increasing depth in the anoxic zone at some stations, whereas it should increase according to climatic data;

b) an abnormally high values were observed within the cold intermediate layer, that also does not match with the climatic data and the measurements of Secchi Disk Depth;
c) very small values were observed in the cold intermediate layer and below this layer which do not agree with the climatic data;
d) data were characterised by an abnormal decrease of the Beam Attenuation Coefficient within the spectral range from 502 to 460 nm in turbid waters which contained much of the yellow substance and an abnormally weak rise within the spectral band from 630 up to 670 nm in clear waters.

In all these cases, spectra were very noisy and the accuracy of measurement was lower than 5 %, which was indicated in the description file. All such data were considered as doubtful (Table 4).

TABLE 4. Distribution of quality flags for optical stations with determinations of Beam Attenuation Coefficient, Light Transmission and Photosynthetically Active Radiation values from different data sets.

Country	Index	Total number of stations	Number of stations				
			QF=0	QF=1	QF=2	QF=3	QF=4
UKRAINE	c(λ), vertical distrbution	1107	0	1012	0	93	2
	c(λ), spectral distrbution	50	0	46	0	4	0
TURKEY	T (λ)	706	55	421	0	27	251
	PAR		0	23	0	0	0
RUSSIA	c(λ), spectral distrbution	1807	0	1257	0	550	0

The vertical distribution of the Light Transmission in Turkish cruises was characterized by presence of accidental mistakes on 27 stations of R/V Bilim. In all these cases T (λ) were found to be doubtful (QF=3) or to be wrong (QF=4). The vertical distribution of the Photosynthetically Active Radiation at all stations of Turkish cruises were found to be correct (QF=1).

At all stations of the R/V *Knorr*, cruise of Apr-July 1988, approximately at the depths of the cold intermediate layer and sometimes from the surface, T (λ) exceed 91,3% and reached 95%, i.e., showing better transparency than in optically clear water used for calibration of the Sea Tech Trasmissometer. Thus, this data cannot be considered as correct. However, the data may be used to study vertical optical structure of the Black Sea waters using relative values.

4. Phytoplankton database

The phytoplankton database comprises data collected by 5 Institutes from 4 riparian countries:

RMHI - Rumanian Marine Research Institute, ROMANIA
SIO - P.P. Shirshov Institute of Oceanology, RUSSIA
IMS - Institute of Marine Sciences, TURKEY

IBSS - Institute of Biology of the Southern Seas, UKRAINE
OB-IBSS - Odessa Branch of the Institute of Biology of the Southern Seas.

Data were collected over a 29 year period from 1968 to 1996. Samples were taken from the shelf area as well as open waters. The data include time series (in shelf waters), surface samples, vertical profiles and average characteristics for a water column. The total number of sampling sites is 2203, the total number of samples is 6284.

TABLE 5. Phytoplankton parameters incorporated in the database.

parameters	unit
1. Phytoplankton total wet biomass	mg/m^2
2. Dinoflagellates wet biomass	mg/m^2
3. Diatoms wet biomass	mg/m^2
4. Others groups of phytoplankton wet biomass	mg/m^2
5. Microphytoplankton (>15 microns cell length) wet biomass	mg/m^2
6. Nanophytoplankton (2 - 15 microns cell length) wet biomass	mg/m^2
7. Picophytoplankton (<2 microns cell length) wet biomass	mg/m^2
8. Microphytoplankton (>15 microns) average cell density in water column	cells/liter
9. Nanophytoplankton (2 - 15 microns) average cell density in water column	cells/liter
10. Picophytoplankton (<2 micron) average cell density in water column	cells/liter
11. Total phytoplankton average cell density in water column	cells/liter
12. Microphytoplankton (>15 microns) average wet biomass in water column	mg/m^3
13. Nanophytoplankton (2-15 microns) average wet biomass in water column	mg/m^3
14. Picophytoplankton (<2 microns) average wet biomass in water column	mg/m^3
15. Total phytoplankton average wet biomass in water column	mg/m^3
16. Microphytoplankton (>15 microns) carbon biomass	mg C/m^3
17. Nanophytoplankton (2 - 15 microns) carbon biomass	mg C/m^3
18. Picophytoplankton (<2 microns) carbon biomass	mg C/m^3
19. Total phytoplankton carbon biomass	mg C/m^3
20. Total phytoplankton carbon biomass	mg C/m^2
21. Microphytoplankton (over 15 microns) cell density	cells/liter
22. Nanophytoplankton (2 - 15 microns) cell density	cells/liter
23. Picophytoplankton (<2 microns) cell density	cells/liter
24. Total phytoplankton cell density	cells/liter
25. Microphytoplankton (>15 microns cell length) wet biomass	mg/m^3
26. Nanophytoplankton (2 - 15 microns cell length) wet biomass	mg/m^3
27. Picophytoplankton (<2 microns cell length) wet biomass	mg/m^3
28. Total phytoplankton wet biomass	mg/m^3
29. Total cyanobacteria cell density	cells/ml
30. Depth of sampling	in meters

The phytoplankton database includes cell density and biomass for total phytoplankton as well as for 3 size groups:

- microphytoplankton - cell size over 15 μm (or over 1800 μm^3, Ukraine data)
- nanophytoplankton - cell size 2 to 15 μm (or 4-1800 μm^3, Ukraine data)

- picophytoplankton - cell size under < 2 μm.

A list of the phytoplankton parameters and units of measurements is given in Table 5. All assembled data include information about total phytoplankton biomass of which more than 95% is given as total phytoplankton wet biomass (mg/m^3). Where such parameters were not available, data on carbon biomass, average or total biomass in the water column were entered. Cell densities are available for 37% of stations. Data on size composition (micro- and nanophytoplankton) are presented in 36.2% of stations. Data on picophytoplankton are presented for 7.2% of stations.

Over the last 30 years the methods of phytoplankton collection and sample processing have significantly changed. Due to this the comparison of old and more recent data is not easy even when using data from only one institute. When analysing multi-institutional data there exists many differences in methods used to collect and process the samples. Therefore it is often impossible to recommend the use of correction factors. Nevertheless, for the general evaluation of inter-annual and seasonal changes or spatial distribution the same parameters could be compared. For more detailed investigations, it becomes necessary to use specific correction factors adapted for the various methods of collection and treatment of the phytoplankton samples. A general description of methods used by the various institutes is given below.

4.1 DATA OF RMHI.

Samples were collected with Nansen bottles. Subsamples of 0.5-1.0 liter volume were usually treated after sedimentation for 10 days (modified Utermohl method acc. to Morozova-Vodyanitskaya [5]). The biomass (mg/m^3) was calculated by multiplying the number of each species with the standard average cell weight. The standard average cell weights were estimated during long term inter-annual observations.

4.2 DATA OF IBSS.

Samples were collected with Nansen bottles. From 1970 to 1979 the subsamples of 0.5-1.0 liter volume were with fixed formaldehyde to obtain a final concentration of 4%. Samples were treated after sedimentation for 1 month [5]. The biomass (mg/m^3) was calculated by multiplying the number of each species with the cell weight, which was calculated based on cell measurements using approximate dimensions from geometric formulae.

From 1979 to 1995 phytoplankton cells from 4-5 l samples were concentrated over 1.0 μm Nucleopore filters. The concentrates obtained (30-40 ml) were kept in a refrigerator at +5° C before cell counting. These concentrates were not fixed and but were processed in the ship's laboratory on the day of sampling.

Identification and counting was carried out using a light microscope. Microphytoplankton (over 1800 μm^3) were counted in chambers of 0.4-1.0 ml volume. For counting of nanoplankton (cell volume from 4 to 1800 μm^3) aliquots of 0.01-0.02 ml were pipetted onto a small chamber and examined under the microscope. Cell

volumes were calculated based on cell measurements using approximate dimensions from geometric formulae.

4.3 DATA OF OB-IBSS

Samples for the quantitative analysis of phytoplankton were taken with a Moltchanov sampler from 2-4 depths. Samples of 0.5-2.0 l volume (depending on the cells density) were concentrated over 1.0 μm Nucleopore filters (inverse filtration). The concentrates were fixed with Lugol's solution. The cell numbers and estimated cell volumes were used for biomass calculations.

4.4 DATA OF SIO.

In all cruises sample collections were carried out using either a 150 liters sampler or by 30 liter sampler. 4-5 liter subsamples were then taken. In all cruises a combination of two methods were employed to estimate the size and taxonomic composition of phytoplankton: Method 1 was used to count microphytoplankton, method 2 for the small phytoplankton.

Method 1:

Cells of microphytoplankton (>15 μm in length) held in 4-5 l samples were concentrated over 1.0 μm Nucleopore filters. The concentrates obtained (30-40 ml) were kept in a refrigerator at +5° C before cell counting. These concentrates were not fixed if the samples were processed in the ship's laboratory. In cases where concentrates were stored before treatment for 2 days or more they were fixed with formaldehyde or glutaraldehyde to obtain a final concentration of 2-3%.

Cells were examined and enumerated under a light microscope. Counting was performed using the entire volume of the counting chamber (0.4 ml) except when cell abundance was high, in which case only a section of the chamber was counted.

Method 2:

From 1978 to 1981 the small phytoplankton were counted without first concentrating the subsamples. Small flagellates were counted using the light microscope in the entire volume of the counting chambers (0.4 ml). Usually the size of cells varied from 4 to 10 μm.

From 1982 to 1995 phytoplankton of sizes <15 μm were enumerated using epifluorescent microscopy. Aliquots (25 to 50 ml) from collected samples were fixed with glutaraldehyde up to 1% of final concentration. After 20 minutes the aliquots were filtered through 0.2 μm Nucleopore filters, which had been stained previously with Sudan Black, in order to prevent autofluorescence of the filter. Following filtering, algae cells were stained with primulin [6].

Slides containing the filters were examined microscopically using blue excitation. Whilst eukaryotes fluoresced red, those of cyanobacterial cells were yellow-orange. Primulin staining permits the identification of some of the higher taxa. Within the nanophytoplankton (2-15 μm) the following groups were enumerated: diatoms, dinoflagellates, coccolithophorides, cryptophytes. Non-identified cells were labelled as a general group named "flagellates". Within the picophytoplankton (<2 μm)

cyanobacteria and eukaryotic algae were categorized. During the cell counts either by transects or fields of vision, only part of the total filter area was investigated. In the case of nanophytoplankton this amount corresponded to 0.1-1 ml of the filtered water. In the case of picophytoplankton this value varied from 0.001 to 1 ml.

The total phytoplankton biomass was calculated as a sum of large and small cells.

Cell volumes were calculated based on cell measurements using approximate dimensions from geometric formulae. The wet biomass was assumed to be equal to cell volume (1 μm^3 = 1 pg). For microphytoplankton, the cell carbon was estimated using conversions from cell volume [7]. On account of overestimation of the cell carbon content in small algae using these equations [8], the percentage of carbon with respect to total cell volume was assumed to be 15% for nanophytoplankton. For picophytoplankton, it was estimated to be 20% [9].

4.5 DATA OF IMS/METU

The sampling depths were decided after taking the vertical zonation structure of the Black Sea according to density into account. At all stations, surface sampling was also performed in the uppermost layer (0.5 m) using a hand bucket. At selected stations a rosette sampler was used to obtain samples from the lower layers (i.e. the homogeneous layer, the thermocline, the cold intermediate layer and the halocline). One liter seawater samples were fixed in 4% neutralised formaldehyde solution. Samples were stored during 1 month in the laboratory for sedimentation in the land laboratory. The volume of final concentrates varied from 5 to 12 ml.

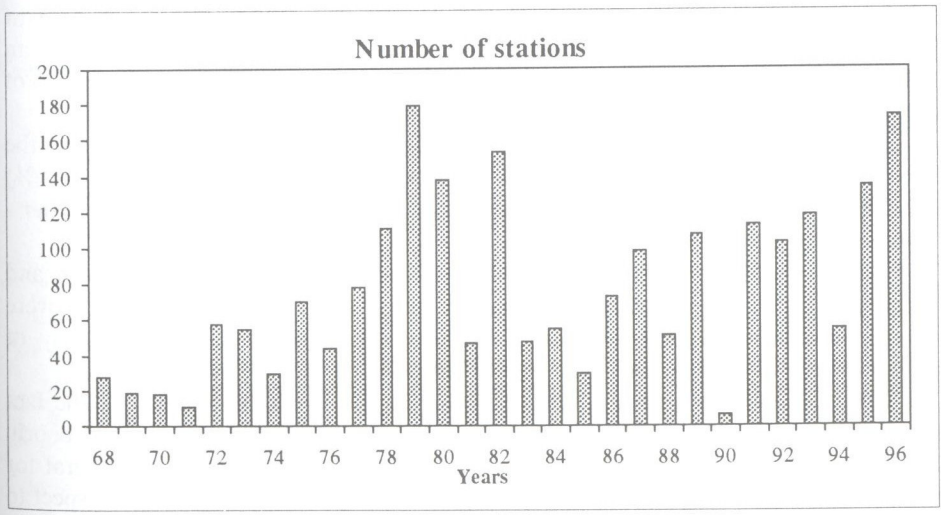

Figure 8. Distribution of number of stations between the years.

Identification and counting was carried out using a light microscope. Microphytoplankton were counted in chambers of volume 0.4-1.0 ml. For counting of nanoplankton cells aliquots of 0.01-0.02 ml were pipetted onto a small chamber and

examined under a microscope. Cell volumes were calculated based on cell measurements using approximate dimensions from geometric formulae. In each subsample a minimum of 400 cells were counted as recommended by Lund et al. [10].

4.6 ADDITIONAL DATA

Data from the Institute of Oceanology, Varna, Bulgaria were computerised in the same format, but were not included in the database. These data may be obtained from Dr. S. Moncheva.

Samples were collected with a rosette sampler cpoupled with a CTD. Samples 0.5 liter volume were treated after sedimentation usually for 10 days. Cell counts were performed by light microscopy (inverted microscope) in counting chambers.

The biomass (mg/m^3) was calculated by multiplying the number of each species with the average cell weight. The standard average cell weights were estimated during the long term inter-annual observations.

Data covered the periods from 1961 to 1970 and from 1983 to 1995 with a total of 275 stations and 902 samples. Almost all data were collected in the Bulgarian shelf area. The total phytoplankton density and biomass were entered. Data include 4 long-time series.

4.7 GENERAL FEATURES

Analysis of the database showed that the main bulk of data covers the period from 1977 to 1996 (Fig. 1). 85% of data were collected after 1977. The distribution of stations according to depth of the sampling site is presented in Figure 2. More than 55% of stations situated on the continental shelf down to depths of 50 m. Only 11% of data were obtained from open waters of over 500 m.

The least studied season was winter. Only 12% of data were collected during the months of December, January and February. A relatively low number of stations (19%) cover the autumn period. The most intensely studied seasons are spring and summer - 33 and 36% respectively.

Table 6 presents the long-term time and seasonal series for Romanian and Bulgarian data. During 5 years the seasonal series (10-12 stations per year) were collected on the Romanian shelf at 5 sampling sites. Only one seasonal study of phytoplankton was carried out in the eastern Black Sea.

The creation of a phytoplankton database for the Black Sea underlines the fact that there is a lack of knowledge about phytoplankton in certain areas. The most poorly studied regions are open waters and the eastern and the southern shelf. In general for the whole Black Sea there is a severe lack of data for the winter season. With respect to phytoplankton the most poorly studied group is the picophytoplankton.

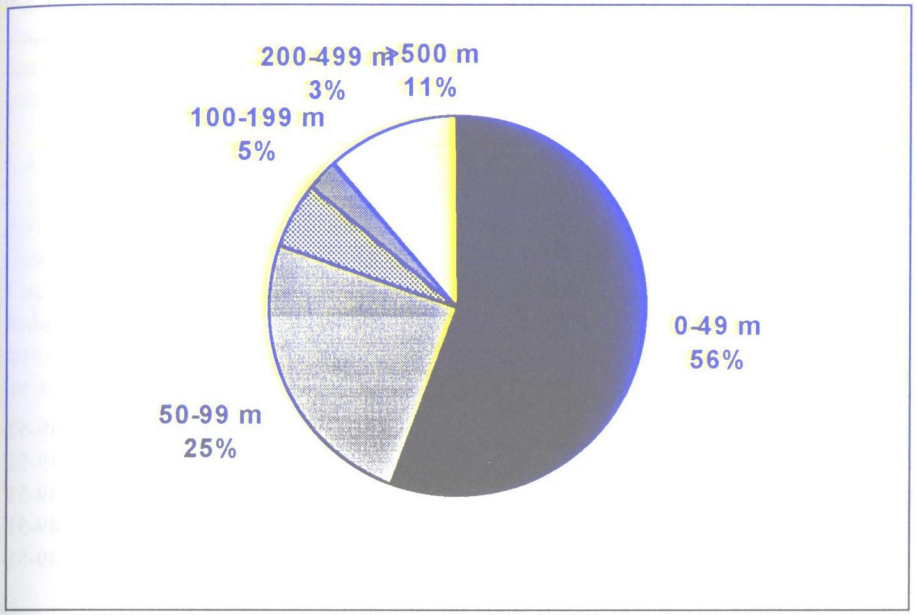

Figure 9. Percentage distribution of number of stations in relation to depths of sampling sites

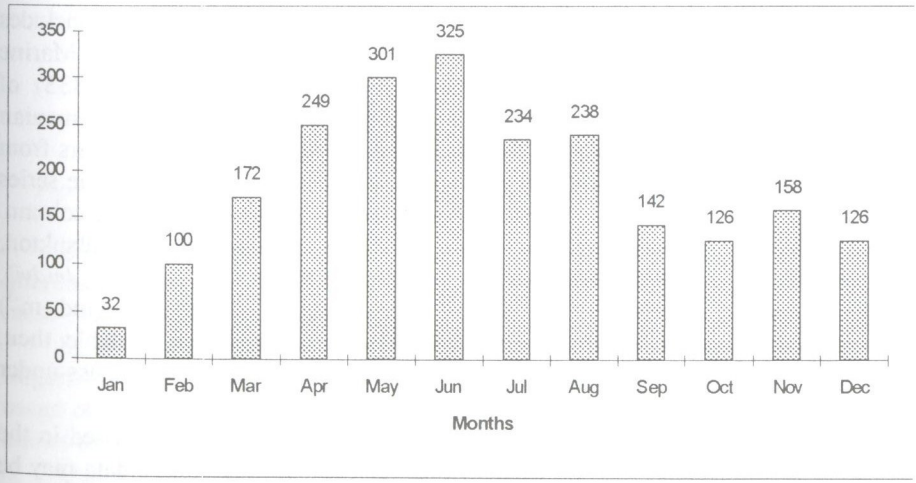

Figure 10. Seasonal distribution of number of stations.

TABLE 6. Long-term time and seasonal series.

Country	Years	N° of stations	Depths of sampling (m)
Long-time Series			
Romania	1972-1994	106	14-20
Romania	1972-1994	120	25-35
Romania	1972-1994	116	40-42
Romania	1972-1994	120	42-47
Bulgaria*	1961-1992	46	22-46
Bulgaria*	1961-1992	50	27-100
Bulgaria*	1961-1992	38	60
Bulgaria*	1961-1970	29	210
Seasonal Series			
Romania	1972	60	5 sites: 14-20; 25-35; 42-40; 42-47;49-51
Romania	1977	53	5 sites: 14-20; 25-35; 42-40; 42-47;49-51
Romania	1978	59	5 sites: 14-20; 25-35; 42-40; 42-47;49-51
Romania	1979	55	5 sites: 14-20; 25-35; 42-40; 42-47;49-51
Romania	1980	55	5 sites: 14-20; 25-35; 42-40; 42-47;49-51
Russia	1978	24	300

* not included in the database.

5. The Black Sea zooplankton and zoobenthos database.

TU Black Sea Project Zooplankton and zoobenthos database of the Black Sea includes data collected by four institutes from four riparian countries: Institute of Marine Sciences (IMS) of Turkey , Institute of Biology of the Southern Seas (IBSS) of Ukraine, Shirshov Institute of Oceanology (SIO-RAS) of Russia, and Rumanian Marine Research Institute (RMRI) of Romania. Data cover a period of 41 years from 1954 to 1995 both from the shelf area and open waters. The data include time series (in shelf waters), surface samples, vertical profiles and averages for the water column. In the database there are data for four groups of animals: mesozooplankton, macrozooplankton (*Pleurobrachia pileus, Aurelia aurita and Mnemiopsis leidyi*), ichthyoplankton and zoobenthos. The bulk of data is present as abundance (ind. m^{-3}) and wet biomass (mg m^{-3}). Sometimes neither of these parameters were available, then, the data on carbon biomass, average biomass in water volume or total biomass under water column were included in the database.

Data from the Institute of Oceanology, Varna, Bulgaria were computerised in the same format, but were not included in the TU Black Sea database. These data may be obtained from Dr. L. Kamburska.

The history of the Black Sea zoological studies dates back to 19th century. However, the routine quantitative zoological researches in the Black Sea have begun only after the World War II. Because of the political and economic reasons and also because of absence of international coordination, the investigations differed in methods of sampling, taxonomy and data processing. The synthesis of zoological data has become possible only recently. Within the framework of NATO TU - Black-Sea Project, a synthesis of data on fauna obtained by the riparian countries was made. This may be considered as an unprecedented action in the history of Black Sea zoological science.

5.1. SAMPLING TECHNIQUES AND TREATMENT OF SAMPLES

5.1.1. Zooplankton.

Distribution of zooplankton stations delivered from all institutes is shown on Fig. 1. The main part of zooplankton data of IBSS, IO-BAS and RMRI which was taken by Juday net (with mesh size 120 microns) are comparable. This sampler has been a standard device in investigations of quantitative distribution of Black Sea zooplankton for more than 50 years.

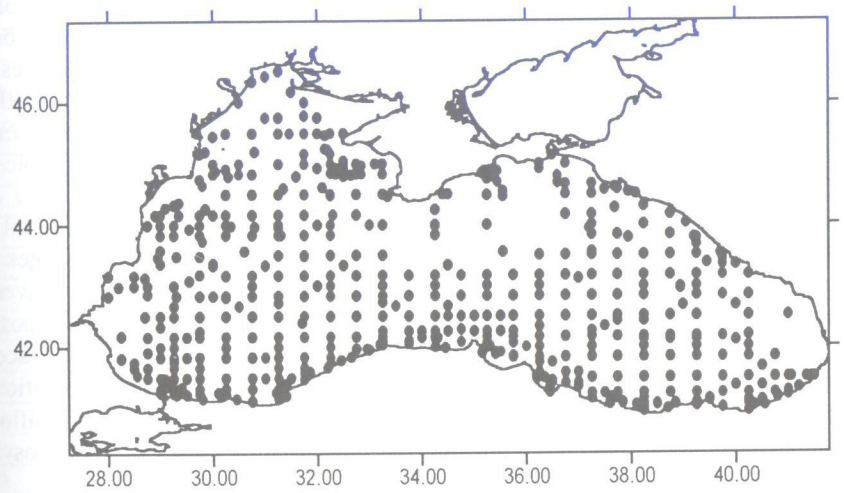

Figure 11. Distribution of zooplankton stations in the Black Sea (IMS, IBSS, IO BAS, RMRI, SIO RAS)

Zooplankton data of IMS was obtained by Hensen net with a mesh size of 300 microns. This sampler has also been used in joint studies of quantitative distribution of meso-, ichthyo- and macrozooplankton.

Samples of SIO-RAS were collected mainly by 150 liters water bottles or by nets: Bogorov-Rass (500 micron) and sometimes by JOM net (120 micron). Simultaneous usage of different samplers such as bottles and plankton nets (120 and 500 micron) allows to compare the catchability for different samplers.

Qualitative and quantitative analyses of zooplankton samples in IBSS, IMS, and RMRI have been based on the morphological characters where, besides species identification, sex, stage of development and average size are also determined. This methodology was accepted as standard for research of the Black Sea mesozooplankton for several decades. This methodology allows to receive information about sex,

generative structure and productivity of different populations of pelagic animals [11, 12, 13, 14].

Species level data of IBSS consist of information which was taken by Juday net (about 40%) and Greze sampler (about 60%). Lattter device was operated with a flowmeter and can be comparable with the contents of Juday net. Coefficient factors were already published for comparison of 1 liter bottles, Juday and Greze net samplers for dominant Black Sea zooplankton species [15]. Species level data of IMS were calculated with IBSS size-weight coefficients and it will be possible to compare this data with IBSS data (for biomass estimations of large species).

Treatment of zooplankton samples by the SIO-RAS is based on measurements of lengths of animals without determining sex and development structure of a population. Determination of biomass (as wet weight or carbon weight of animals) by the SIO-RAS are performed using established formulas. This methodology was developed for problems of mathematical modeling and consequently is limited by a simplified analysis of a biological variety. Submitted materials allow to study trophic relations of the pelagic ecosystem (small euryphagous, large euryphagous, small carnivores and large carnivores). The list of zooplankton data of the SIO-RAS is presented with the coefficient for the biomass and calorimetric estimations. Thus, the linkage between the raw field data and the processed data for the modelling purpose is provided (Table 7).

The list of the SIO-RAS data includes some taxa of the superspecific level (molluscs, larvae, etc.) that are impossible to identify *in situ*. Some dominant and important species (*Calanus euxinus*) are represented with their several life stages (e.g. each copepodite stage). The coefficient allowing the biomass calculations are given for all species and stages of dominant species. Calorimetric coefficients that make possible to find energy equivalent for the wet biomasses of various animals (crustaceans, gelatinous, etc.) are presented. These data were obtained from numerous expeditions in the Black Sea. All animals were combined into size and trophic groups, that allow to combine ecologically similar species within few elements for the purpose of ecosystem modelling.

5.1.2. Ichthyoplankton.

The ichthyoplankton was collected by vertical hauls with the Hensen net (IMS), and Bogorov Rass net (SIO-RAS) and the Juday net (IBSS- IO-BAS and RMRI). Additional horizontal tows were performed in the north by the IBSS with the Melnikov's trawl [16]. The bulk of ichthyoplankton data was delivered by IMS. The main part of ichthyoplankton data comprised of IMS and IBSS data and were considered as compatible.

For preparation of data for the data base, only files containing information about total abundance and biomass of ichthyoplankton were used. Therefore, large part of files containing information on the species characteristics of ichthyoplankton has been archived as Excel files.

5.1.3. Zoobenthos

Sampling for zoobenthos data of IBSS was done by divers in the coastal expeditions in areas of Laspy and Yalta Bays, Cape Lucul and from R/V Professor Vodjanitsky (cruise number 32) at Cape Meganom.

TABLE 7. List of the Black Sea plankton groups, respective calorimetrical (k, cal/mg of wet weight) and weight (a) coefficients. Exponent in weight calculations is equal to 2.22 for *Mnemiopsis leidyi*, and to 3.00 for all other species. Nanophages: 1-8; small evryphages (< 3 mm): 9-23; large carnivores (> 3 mm): 24-31.

	Plankton groups	**k**	**a**
1	*Oikopleura dioica*	0.7	0.125
2	Mollusca larvae	0.5	0.15
3	Polychaeta larvae	0.5	0.12
4	Rotatoria	0.5	0.12
5	Copepoda nauplii	0.5	0.115
6	*Acartia clausi*, copepodite	0.7	0.036
7	*Paracalanus parvus*	0.7	0.057
8	Cladocera	0.5	0.06
9	*Noctiluca miliaris*	0.05	0.5
10	*Acartia clausi*, mature	0.7	0.03
11	*Pseudocalanus elongatus*	0.7	0.032
12	*Calanus euxinus*, copepodites I-II	0.5	0.025
13	*Calanus euxinus*, copepodite III	0.6	0.025
14	*Calanus euxinus*, copepodite IV	0.7	0.035
15	*Calanus euxinus*, copepodite V	0.8	0.035
16	*Calanus euxinus*, copepodite V with oil sac	0.9	0.035
17	*Calanus euxinus*, mature	0.8	0.035
18	Ostracoda	0.7	0.047
19	*Oithona nana*	0.7	0.033
20	*Oithona similis*	0.7	0.009
21	Decapoda larvae	0.7	0.013
22	Polychaeta, slender	0.5	0.0005
23	Polychaeta, usual	0.5	0.016
24	*Sagitta setosa*, slender	0.7	0.00075
25	*Sagitta setosa*, usual	0.5	0.015
26	*Aurelia aurita*	0.03	0.03
27	*Pleurobrachia pileus*	0.05	0.25
28	*Mnemiopsis leidyi*, length < 10 mm	0.015	3.1
29	*Mnemiopsis leidyi*, length 10-45 mm	0.01	3.1
30	*Mnemiopsis leidyi*, length > 45 mm	0.006	3.8
31	Pisces larvae	1.0	0.013
32	Radiolaria	0.5	0.5
33	Eggs	1.0	0.5

Three grab (0.1 m^2 area) samples were taken at each station. The samples were sieved through 1 mm mesh size and were preserved in 40% alcohol, for subsequent sorting and identification in the laboratory. The averages for total abundance ($ind.m^{-2}$)

and total biomass (g m^{-2}) were calculated after identification and after calculation of biomass and abundance for each of benthos species. A total of 217 samples were analysed.

Zoobenthos samples of the RMRI were collected from the ships Gilortul, Palamida, Steaua de Mare, Marea (RMRI, Constantza) and Emil Racovita, Gr. Antipa, NH 112, NH , NDD (Military Navy, Constantza). The samples were taken with Van Veen grab (1/20 m^2) and were preserved in 4% formaldehyde. In laboratory, each sample was sieved through 1 mm, 0.25 mm, 0.10 mm mesh screen; animals were removed under a microscope, identified to species and counted. The biomass of the organisms smaller than 2 mm were calculated using tables of weights and of those larger than 2 mm by weighing. Total biomass (g m^{-2}) and total density (ind.m^{-2}) parameters were calculated for each station.

5.2. DATA SETS.

Part of zooplankton, ichthyoplankton and zoobenthos data (about 1 Mb) consists of basic zoological parameters, such as total density and biomass as data of IMS, IBSS, RMRI and SIO-RAS . For general evaluation of inter-annual and seasonal changes or spatial distribution, the major part of this parameters can be used. But it is necessary to note that for more detail investigations every scientist have to use the specific correction factors.

Another part of data (about 16 Mb in archives) can be used for more detailed species level investigations. These data consist of historical information about species, morphological stages of development, size and sex structure (more than 300 groups), abundance and biomass (ind m^{-3}, mg m^{-3}).

5.3. CONCLUSIONS.

In the conclusion it would be necessary to pay attention to the basic problems, which appeared in the process preparation of zoological data sets. These problems are related to complex nature of zoological objects. For example, in Black Sea ecosystem studies, it is possible to use old classical methods which are based on the morphological characteristics (species, sex or stage of development, size and the weight). However, a similar study may be undertaken with new methods; such as system analysis, considering only large ecological blocks, not paying attention on the taxonomy.

The decision on creation of an international database at a species level was accepted on a session by expert group of zoologists within the NATO TU-Black Sea Project. As a first step, it was suggested to combine the data which have similar structure. Thus IBSS and IMS data were combined forming a species level data base. For future it is important to digitise the IO-BAS data (18 years), RMRI (18 years) and especially YuGNIRO data (50 years). YuGNIRO was not included in the program NATO TU Black Sea, however this institute conducted the most detailed long-term zooplankton investigations over a half of century.

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