The Eastern Mediterranean as a Laboratory Basin for the Assessment of Contrasting Ecosystems

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OCEANOGRAPHIC DATA HOLDINGS IN THE UKRAINIAN MARINE CENTERS FOR THE MEDITERRANEAN SEA

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Abstract. This paper provides a survey of the oceanographic data holdings in the Ukrainian institutions for the Mediterranean Sea. So, the Ukrainian marine centers hold hydrological, hydrophisical, hydrochemical, hydrobiological, hydrometeorological, and other Mediterranean data collected for more then 40 years from about 500 cruises and 17.000 oceanographic station.

1. Introduction

In Ukraine, activities aimed at the establishment of a national system for compiling, transfer, storage, analysis and dissemination of oceanologic data and information are being conducted in the framework of the project "National Bank of Oceanologic Data". This project is one of several specific research projects of the National program for the study and use of resources of the Azov Sea - Black Sea basin and other World Ocean regions. Financial support is provided by the Ministry of Science and Technologies of the Ukraine (fig. 1).

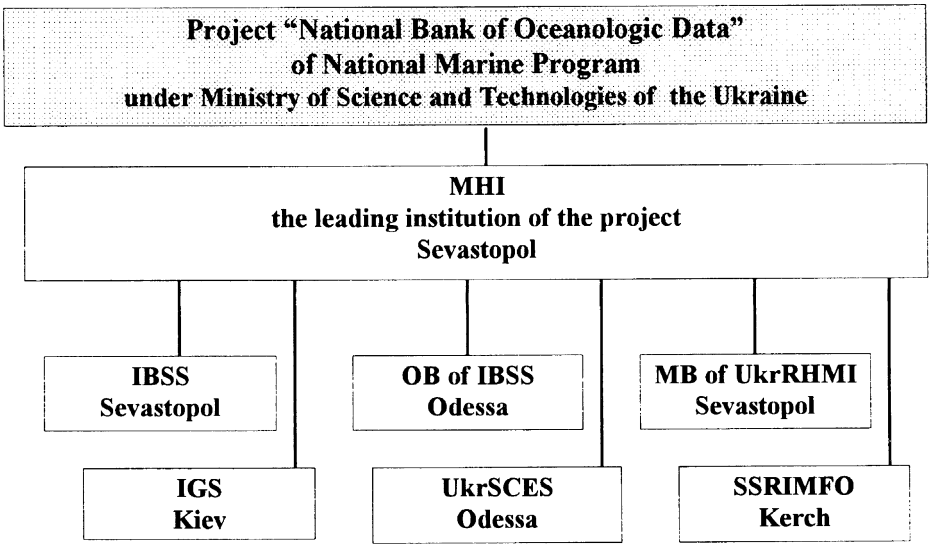


Figure 1. Participants of the project "National Bank of Oceanologic Data"

The leading institution of the project is

- Marine Hydrophysical Institute (MHI) of the Ukrainian National Academy of Sciences (Sevastopol).

Other participants of the project are:

- Institute of Biology of Southern Seas (IBSS) of the Ukrainian National Academy of Sciences (Sevastopol);
- Institute of Geological Sciences (IGS) of the Ukrainian National Academy of Sciences (Kiev);
- Ukrainian Scientific Center of the Ecology of Sea (UkrSCES) of the Ministry of Nuclear Safety and Environment of the Ukraine (Odessa);
- Southern Scientific Research Institute of Marine Fisheries and Oceanography (SSRIMFO) of the State Committee of Fisheries of the Ukraine (Kerch);
- Marine Branch of Ukrainian Research Hydrometeorological Institute (MB of UkrRHMI) of the State Committee of Hydrometeorology of the Ukraine (Sevastopol);
- Odessa Branch of the Institute of Biology of Southern Seas (OB of IBSS) of the Ukrainian National Academy of Sciences (Odessa).

The conception and principles of constructing a national distributed oceanologic information system have been developed, which included the foundation of four oceanologic data centers:

- oceanographic and satellite data at MHI;
- nonliving marine resources at IGS;
- living marine resources at SSRIMFO;
- marine environment pollution at Ukr SCES.

In framework of abovementioned project the first version of the data catalogue on sea environment and resources was developed in the Ukraine on the basis of data provided by all marine institutions referred to above. To date, the catalogue comprises information about 550 data sets: 45 sets pertaining to marine geology and geophysics, 75 to marine biology and living resources, and 15 to marine environmental pollution. The rest of the sets contain hydrophysical, chemical and meteorological data.

The oceanologic data for the Mediterranean Sea are being stored in the archives of the following Ukrainian institutions.

2. Marine Hydrophysical Institute (MHI)

MHI research vessels accomplished measurements in the Mediterranean Sea during 48 cruises (in total, there were 176 MHI cruises in all the regions of the World Ocean). Most of the stations were located in the Eastern part of the sea (the Aegean and Levant Seas), in the Alboran Sea and in the Gulf of Lions. It was made about 1600 stations. The measurements were conducted from 1968 till 1994 during all seasons (fig. 2). The following parameters were measured:

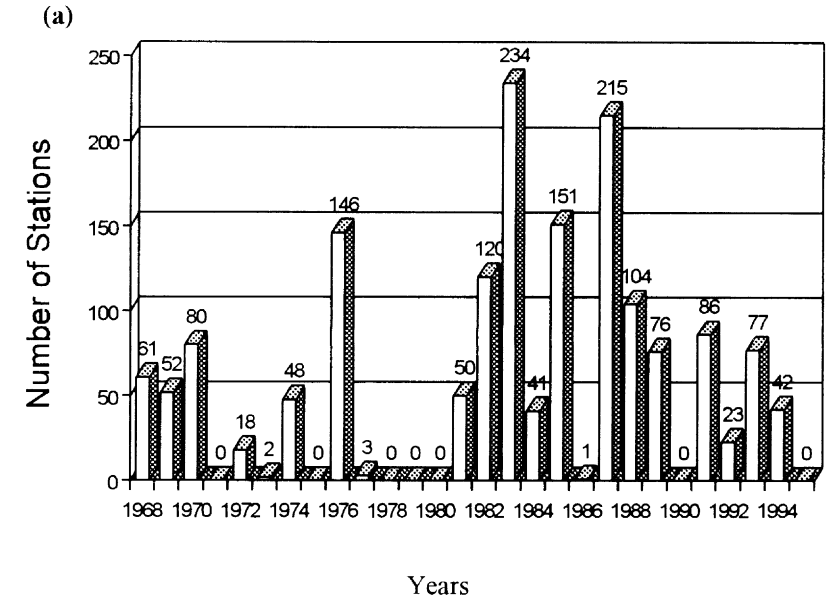
- temperature and salinity (Nansen bottles, MBT, CTD);
- currents (moorings);
- meteorological data:
- actinometric data;
- chemical parameters (dissolved oxygen, pH, alkalinity, phosphate, nitrate, nitrite, ammonium, silicate);
- hydrooptical parameters (Secchi disk depth, vertical profiles of spectral transparency, color index, scattering function, radiance index spectra, bioluminescence);
- radioactivity (Sr-90, Cs-134, Cs-137, Ce-144, Rn-222);
- biological data (chlorophyll, primary production, phyto-, zoo-, and ichthyoplankton, squid, etc.).

Biological data were obtained by scientists of the Institute of the Biology of Southern Seas and were kept there. Additional measurements were made in some cruises, for example, continuous measurements of the fine structure of temperature in the surface layer.

MHI has a special reference database including all information about R/V cruises (time, scientific staff, types of measurements, used instruments, coordinates of stations).

Brief information about cruises and measurements in the Mediterranean Sea is shown in Table 1. Cruises of R/V "Mikhail Lomonosov" (ML), R/V "Academic Vernadsky" (AV) and R/V "Professor Kolesnikov" (PK) are listed in the table. During these cruises the measurements were done in the basins of the Black Sea (BS), the Mediterranean Sea (MS) and the Atlantic Ocean (AO). The main types of the performed researches are indicated in the table: M - Meteorology, A - Actinometry, C - Chemistry, B - Biology, O - Optics, CTD - CTD-casts, MBT - Mechanical Bathytermographs, OSD - Nansen's bottles. The total number of stations in the Mediterranean Sea is shown in the last column.

Regretfully, only a part of the data collected by the research vessels after 1983 is stored in a computer readable form. The data from the previous years are being kept in the form of tables, punched cards, reports, etc. For the present moment, only about 20% of the data have been transferred onto modern data carriers.



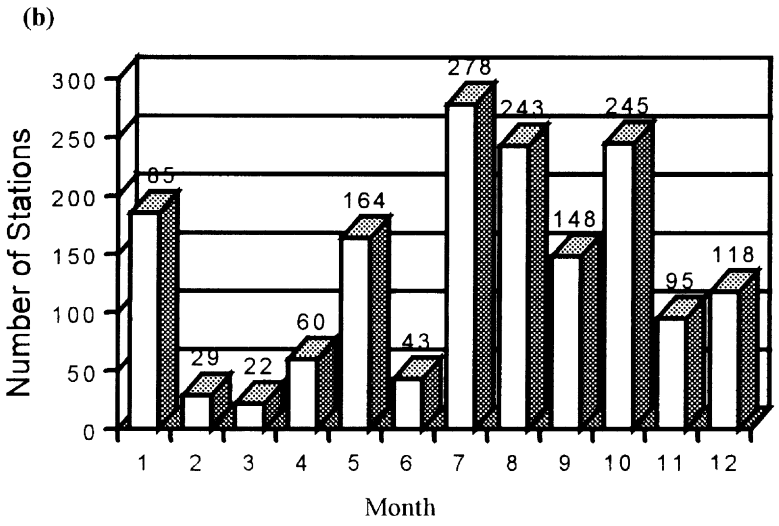


Figure 2 . Distribution of the MHI's oceanographic stations on years (a) and months (b)

TABLE 1. Cruises of the MHI's Research Vessels in the Mediterranean Sea

RV/ Cruise	Cruise Time Start-Finish	Regions			Parameters					T,S Measure.			Stat. Number
		BS	MS	AO	M	A	B	C	O	CTD	MBT	OSD	
ML/21	28.04.68-24.08.68		*	*	*		*	*	*	0	0	192	58
ML/22	25.12.68-24.04.69	*	*	*	*	*		*	*	160	0	73	14
AV/1-1	11.02.69-15.04.69		*	*			*	*	*	0	11	11	6
AV/1-2	08.06.69-04.07.69		*	*						0	10	10	1
ML/23	24.06.69-28.08.69		*		*	*		*	*	0	0	27	29
ML/24	11.12.70-10.04.71		*	*		*	*	*	*	0	37	41	14
AV/2-1	16.02.70-27.04.70		*	*			*		*	0	29	40	11
AV/2-2	04.06.70-03.09.70		*	*	*	*	*	*	*	0	85	67	2
ML/25	29.07.70-27.10.70		*	*	*	*		*	*	0	0	40	39
AV/3-2	01.03.71-21.03.71		*	*		*	*	*		0	0	0	0
ML/26-1	09.03.72-24.06.72		*	*		*	*	*	*	0	91	56	1
ML/27	14.12.72-24.04.73	*	*	*		*	*	*	*	0	158	66	9
ML/28	22.01.74-05.05.74	*	*	*		*	*	*	*	190	45	45	8
AV/9	09.10.74-30.11.74		*	*	*		*	*	*	458	54	53	37
ML/30	17.04.76-28.08.76	*	*	*	*		*	*	*	86	168	57	7
AV/13	18.06.76-12.08.76		*		*	*		*	*	330	64	70	138
ML/32	04.06.77-30.09.77	*	*	*	*		*	*	*	216	54	119	3
ML/42	04.07.81-16.09.81		*	*	*	*	*		*	125	0	24	50
PK/3-1	21.03.82-09.06.82	*	*					*	*	174	0	92	74
PK/4	02.07.82-10.08.82	*	*				*		*	114	0	0	20
PK/5-1	01.09.82-12.11.82	*	*		*				*	124	0	0	26
PK/5-2	29.12.82-04.03.83	*	*			*				108	0	0	30
PK/6-1	30.03.83-31.05.83	*	*	*	*				*	147	0	0	11
PK/6-2	24.06.83-25.08.83	*	*							146	0	0	69
PK/7	20.09.83-14.11.83	*	*		*	*	*		*	180	0	0	124
AV28	30.12.83-13.05.84	*	*	*	*	*				235	0	43	3
PK/9	20.06.84-23.09.84	*	*		*	*		*	*	650	0	0	38
PK/10	06.11.84-09.02.85	*	*	*						283	0	0	114
PK/11	06.03.85-09.06.85	*	*	*	*		*	*	*	269	0	0	1
PK/12-1	26.07.85-28.08.85	*	*			*	*		*	131	0	0	33
ML/45	14.11.85-25.01.86		*	*	*		*	*		137	0	0	3
AV/33	18.02.86-03.06.86		*	*	*	*	*	*		230	0	0	1
PK/14-1	07.08.86-06.11.86	*	*	*						385	0	0	103
PK/16	17.06.87-10.09.87	*	*			*			*	52	0	0	51
PK/17-1	01.10.87-06.11.87	*	*							165	0	0	8
ML/49	16.10.87-19.02.88		*	*	*			*	*	193	0	0	14
PK/17-2	12.11.87.-20.12.87	*	*				*		*	160	0	0	39
PK/18	10.04.88-30.05.88	*	*				*	*		220	0	0	26
PK/19	02.08.88-06.10.88	*	*		*	*				195	0	0	27
AV/38	28.10.88-23.02.89		*	*			*	*		180	0	0	51
PK/20	16.11.88.-06.03.89	*	*	*				*		480	0	0	10
PK/21	31.03.89-15.05.89	*	*		*	*		*	*	340	0	0	24
PK/23	04.08.89-03.10.89	*	*			*	*		*	184	0	0	42
ML/52-a	04.05.90-30.05.90	*	*		*	*			*	0	0	0	0
PK/27	20.07.90-25/08.91	*	*					*		117	0	0	86
ML-55	30.09.92-02.11.92	*	*					*		21	0	0	23
PK/31	16.11.93-14.01.94	*	*		*		*	*	*	108	0	0	119

3. Institute of Biology of Southern Seas (IBSS)

Research vessels of IBSS carried out measurements in the Mediterranean Sea during 63 cruises. The measurements were made by research vessels " Akademik Kovalevsky" (1958-1990) and "Professor Vodyanitsky" (1977-1989) at approximately 1000 stations in the Aegean, Ionic, Adriatic, Tyrrhenian and Ligurian seas. The following parameters were measured:

- temperature and salinity (Nansen bottles, MBT, CTD);
- currents;
- chemical parameters;
- hydroacoustics;
- bioluminescence;
- primary production;
- phyto-, zoo-. bacterio- and ichtiyoplankton;
- ichthyology;
- phyto- ,and zoobenthos;
- sanitary hydrobiology;
- radioactive and chemical hydrobiology.

Brief information about cruises and measurements in the Mediterranean Sea is shown in Table 2. Cruises of R/V " Akademic Kovalevsky " (AK), and R/V "Professor Vodyanitsky " (PV) are listed in the table. The main types of the performed researches are indicated in the table: H-Hydrology, C- Currents, Hc - Hydrochemistry, Ha - Hydroacoustics, Bl - Bioluminescence, P - Primary production, Ph - Phytoplankton, Bp - bacterioplankton, Zp - zooplankton , Ip - ichtiyoplankton, I - ichthyology, Pb - phytobenthos, Zb - zoobenthos, S - sanitary hydrobiology, R- radioactive and chemical hydrobiology.

TABLE 2 . Cruises of the IBSS's Research Vessels in the Mediterranean Sea

RV/ Cruise	Cruise Time Start-Finish	Parameters														
		H	C	Hc	Ha	Bl	P	Ph	Bp	Zp	Ip	I	Pb	Zb	S	R
AK/1	25.08.58 - 24.10.58	*									*	*				
AK/2	12.07.59 - 24.10.59	*	*								*	*				
AK/3	28.05.60 - 13.08.60	*	*					*		*	*	*				
AK/4	11.10.60 - 23.02.61	*	*				*	*		*	*	*	*			
AK/5	03.12.61 - 03.03.62	*	*					*		*		*	*			
AK/6	29.09.63. - 12.12.63	*	*				*	*		*	*	*	*			
AK/8	08.66 - 10.66										*					
AK61	27.09.67 - 11.12.67	*	*													*
AK/62	30.04.68 - 02.07.68	*	*				*	*	*	*	*	*				*
AK/63	14.09.68 - 05.11.68															*
AK/64	15.08.69 - 29.10.69										*	*				
AK/65	28.12.69 - 13.03.70	*	*				*	*		*						
AK/66	19.05.70 - 29.07.70										*		*			
AK/67	25.09.70 - 28.10.70	*		*			*	*		*						
AK/68	23.06.71 - 07.09.71										*	*				

TABLE 2 (cont.)

RV/ Cruise	Cruise Time Start-Finish	Parameters														
		H	C	Hc	Ha	Bl	P	Ph	Dp	Zp	Jp	L	Pb	Zb	S	R
AK/69	02.11.71 - 25.01.72	*		*					*							
AK/70	07.05.72 - 16.07.72							*		*		*				*
AK/71	28.08.72 - 29.09. 72	*		*			*	*		*						
AK/72	17.07.73 - 05.10.73										*	*				
AK/74	21.04.74 - 29.06.74							*	*		*	*		*		
AK/75	23.08.74 - 28.10.74	*			*	*		*		*						
AK/76	07.06.75 - 04.08.75	*						*		*						
AK/78	07.09.75 - 20.11.75								*							
AK/82	06.09.77 - 05.11.77										*	*				
AK/83	18.03.78 - 17.05.78										*	*				
AK/87	18.08.79 - 17.10.79									*	*	*		*		*
AK/89	20.03.80 - 03.06.80									*	*	*	*	*		
AK/90	12.08.80 - 26.10.80									*			*	*		
AK/95	08.09.83 - 28.10.83	*		*						*		*	*			
AK/96	10.11.83 - 30.12.83	*			*	*		*	*	*			*	*	*	
AK/97	11.05.84 - 23.07.84	*			*	*		*		*						
AK/98	24.08.84 - 13.10.84							*					*			
AK/100	25.06.85 - 24.08.85	*								*		*	*			
AK/101	11.09.85 - 10.11.85	*		*						*						
AK/102	12.04.86. - 27.05.86	*		*									*			
AK/103	25.07.86 - 08.09.86	*		*									*			
AK/104	11.10.86 - 28.11.86	*		*									*		*	
AK/105	03.06.87 - 18.07.87										*	*				
AK/107	29.08.87 - 13.10.87			*				*		*						*
AK/109	03.11.87 - 18.12.87	*			*	*		*								
AK/111	22.07.88 - 05.09.88										*	*				*
AK/112	22.09.88 - 05.11.88			*												*
AK/114	28.04.89 - 12.06.89	*									*	*			*	
AK/115	29.06.89 - 18.08.89	*		*									*			
AK/116	08.09.89 - 28.10.89	*			*	*		*		*						
AK/118	25.06.90 - 09.08.90	*									*	*	*			
AK/119	31.08.90 - 20.10.90	*		*									*	*		
PV/1	18.12.76 - 04.03.77										*	*			*	
PV/3	14.10.77 - 28.11.77											*			*	
PV/6	27.07.79 - 30.10.79	*	*	*								*			*	
PV/7	23.11.79 - 06.02.80	*					*	*		*						
PV/9	16.08.80 - 09.10.80	*	*	*				*		*					*	
PV/11	15.11.81 - 15.02.82	*			*	*			*	*		*				
PV/12	26.06.82 - 01.06.82	*		*					*	*					*	
PV/15	31.05.83 - 14.08.83	*		*			*			*						
PV/7	05.06.84 - 13.09.89	*	*				*		*						*	
PV/19	15.05.85 - 29.07.85	*	*					*		*						
PV/22	07.12.86 - 27.12.86	*		*												*
PV/27	15.07.88 - 13.09.88	*		*			*			*	*	*		*		
PV/28-1	27.04.89 - 21.06.89	*		*			*			*				*	*	*
PV/28-2	08.07.89 -31.08.89	*		*				*		*		*			*	

Only 10% of data are kept in the institute archives, other data are kept by the principal investigators. An inventory of data is currently being prepared. All data are still stored in form of tables and reports. For loading in a database the data have to be checked and transferred onto modern computer carriers .

4. Institute of Geological Sciences (IGS)

IGS (Department of Modern Marine Sediments Genesis) has the following materials on Geology and Geochemistry of the Eastern Mediterranean Sea:

1) Experimental data from
cruise r/v "Faras el Bahr" (1969);
cruise 19 r/v "Akademic Vernadsky" (1978-1979);
cruise r/v "Gidrolog" (1981);
cruise 24 r/v "Professor Kolesnikov" (1989-1990)
cruise 31 r/v "Professor Kolesnikov" (1993-1994),
represented with columns of:

- bottom sediments;
- bottom surface samples;
- Aeolian and water suspension;
- porous waters.

2) Analytical materials:
represented with the results of granulemetrical analysis, mineralogical analysis, chemical analysis for determination of $CaCO_3$, SiO_2, C_{org} and Fe, Mn, Ti, Na, K, Cr, Cu, Zn, Ni, Cd, Zr, Co, V, Mo mikroelements, as well as emission spectral, atomic absorption, Roentgen fluorescent, neutron activation, chromatographic and other kinds of physical analysis.

The analytical base includes about 500 analyses.

3) IGS possesses materials on bottom sediments from the Nile Estuary, the Abu-Kyr Bay, the Levant Sea, the Aegean Sea and Izmir Bay.

4) On the base of the data obtained, a monograph and about 10 articles were published, lithological (on sediments types), geochemical (on elements), geoecological (landscape-geochemical) maps, as well as sections and profiles were constructed.

A part of the obtained materials is not brought into concrete data bases, nor systematized, nor digitized. Including into the National data bank on Marine Geology and Geophysics in a state ready for application by users needs additional financing and serious development.

5. Ukrainian Scientific Center of the Ecology of Sea (UkrSCES)

Research vessels of UkrSCES carried out measurements in the Mediterranean Sea during 334 cruises:

◊ 310 cruises of R/V type "Passat";
◊ 24 cruises of R/V "J. Gakkel" and "V. Parshin" .

For R/V type "Passat" the measurements were performed from 1968 up to 1992 during all seasons. 8000 stations had been made. The following parameters were measured:

- temperature and salinity (Nansen battles, MBT, CTD);
- currents;
- meteorological data;
- aerological data;
- chemical parameters (dissolved oxygen, pH, alkalinity, phosphates, nitrates, ammonium, silicates);
- pollution data;
- MARPOLMON pollution data (oil slicks, tar bulls, dissolved oil);
- microlayer data (chemistry, pollution);
- hydrooptical parameters (Secchi disk, depth);
- radioactivity (Sr-90, Cs-134, Cs-137, Ce-144, Rn-222) in the atmosphere.

For R/V "J. Gakkel" and "V. Parshin" the measurements were performed from 1978 till 1992 in 24 cruises. More than 3400 station had been made.
The following parameters were measured:

- temperature and salinity;
- currents;
- meteorological data;
- chemical parameters;
- pollution data;
- MARPOLMON pollution data;
- hydrooptical parameters;
- radioactivity in the atmosphere.

Additional special measurements were made in cruises, for example, continuous measurements of the fine structure of temperature in the surface layer. UkrSCES has a database including information of R/V cruises (time, types of measurements, used instruments). Only part of the data collected by research vessels after 1976 is stored in a computer readable form. The data are being kept in the form of tables, cards, reports, etc. Only 15% of the data up today have been transferred onto modern carriers.

6. Southern Scientific Research Institute of Marine Fisheries and Oceanography (SSRIMFO)

Research vessels of SSRIMFO carried out measurements in the Mediterranean Sea from 1959 till 1984 during 8 cruises. The following parameters were measured:

- temperature - 339 stations;
- salinity - 325 stations;
- dissolved oxygen - 286 stations;
- phosphates - 228 stations;
- silicates - 230 stations.

The Mediterranean Sea was not of the main scientific interest for SSRIMFO and all the data are still stored in the form of tables. For loading into a database these data have to be checked and transferred onto modern computer data carriers.

7. Marine Branch of Ukrainian Research Hydrometeorological Institute (MB of UkrRHMI)

In 1973-1990 research vessels of State Oceanographic Institute (SOI) conducted investigations in the Aegean Sea and Eastern part of Mediterranean (table 3).

The main goals were to explore exchange of pollutants between the Black Sea and Mediterranean Sea and to specify balance of contamination substances. Staff from Marine Branch of Ukrainian Research Hydrometeorological Institute (former Sevastopol Branch SOI) took part in 16 cruises mentioned above. Nowdays these data of amount about 1200 stations are stored in an archive of Marine Branch. List of variables includes:

- temperature;
- salinity;
- currents;
- O_2, pH, PO_4, P, NO_2, NO_3, Si, As, Cu, Hg, Cd, Ag, Hg, Pb, Cr, Co, Zn, Se, Au, Sb, Cs, Ba;
- oil hydrocarbons and detergents.

TABLE 3. Research cruises carried out in the Aegean Sea and Eastern Part of Mediterranean

R/V	Cruise No	Period
Mgla	1 Med	May-August 1973
Mgla	2 Med	August-October 1974
Mgla	3 Med	March-April 1975
Mgla	4 Med	July-August 1975
Yakov Gakkel	2	August-October 1976
Yakov Gakkel	3	February-April 1977
Yakov Gakkel	5	May-July 1978
Yakov Gakkel	9	August-September 1979
Yakov Gakkel	10	October-December 1980
Yakov Gakkel	11	February-April 1981
Yakov Gakkel	28	March-May 1987
Yakov Gakkel	29	August-October 1987
Yakov Gakkel	31	February-April 1988
Yakov Gakkel	33	February-April 1989
V.Parshin	1	June-July 1989
V.Parshin	4	March-April 1990

8. Odessa Branch of the Institute of Biology of Southern Seas (OB of IBSS)

Research vessels of the OB of IBSS carried out measurements in the Mediterranean Sea during 65 cruises. Most measurements were made in the Aegean Sea from 1972 up to 1990. The following parameters were measured:

- temperature and salinity:
- currents:
- waves;
- Secchi disk and Forel Ule color scale;
- chemical parameters (dissolved oxygen, pH, alkalinity, phosphates, nitrates, organic nitrogen, ammonium, silicates, organic carbon);
- pollutants in particulate and dissolved forms;
- primary production, phytoplankton pigments;
- benthic organisms;
- phyto-, zoo-, and ichtyoplankton;
- microbiological parameters;
- biochemical parameters.

Only 10% of the data have been transferred onto modern carriers, the other data are being kept in the form of tables and reports.

9. Conclusions and recommendations

The Ukrainian marine centers (MHI, IBSS, IGS, UkrSCES, SSRIMFO, MB of UkrRHMI, OB of IBSS) hold hydrological, hydrophysical, hydrochemical, hydrobiological, hydrometeorological, and other Mediterranean data collected for more than 40 years from about 530 cruises and 17 040 oceanographic stations (table 4).

TABLE 4 . Number of oceanographic cruises and stations of the Ukrainian marine centers

Institute	Number of cruises	Number of stations
MHI	48	1600
IBSS	65	1000
SSRIMFO	8	340
UkrSCES	334	11400
MB of UkrRHMI	16	1200
OB of IBSS	60	1000
IGS	5	500
	Total:	17 040

Unfortunately, only a part of these data (about 15-20%) is now presented in a computer readable form, the other data are kept in a form of tables, reports, punched cards, etc. The great part of these data is at risk of being lost to future because of media degradation. The sole copies of manuscript data could be easily lost affected by the environment conditions or accidents, for instance, by fires. Additionally, manuscript data are hardly used by researchers who require data in

digital form with all pertinent meta-data in order to perform the most comprehensive studies possible. To meet the requests, it is necessary to make the Mediterranean data available both for the national and international scientific communities in a common exchange format, on modern computer data carriers, as well as to prevent any obstacles for further using of the data.

Creation of the more precise and full Mediterranean data catalogue is planned in Ukraine for the current year in the frames of "National bank of Oceanologic data" project mentioned above. But to convert analog and tabular Mediterranean data into modern digital forms, to carry out the quality control of these data, to merge them into national and international databases, the Ukrainian marine centers need financial and technical support.

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