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MC Report 103

MEDITERRANEAN ENVIRONMENTAL ACOUSTIC DATA CATALOG (U)

May 1975

LONG RANGE ACOUSTIC PROPAGATION PROJECT

OCEAN SCIENCE PROGRAM
MAURY CENTER FOR OCEAN SCIENCE
Department of the Navy
Washington, D.C.

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This report contains a description of the environmental and acoustic data that are available for interpreting and predicting the performance of acoustic ASW sensors in the Mediterranean Sea. It is a companion to three other reports, namely: "Mediterranean ASW Bibliography — Volume I", MC Report 101 (Unclassified); "Mediterranean ASW Bibliography — Volume II", MC Report 102 (Secret). The purpose of this report is to provide a tabulation of the kinds and quantities of observations and measurements which have been made and where they were made.

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The text or references at the end of each section then provide a guide to where the actual data can be found. No data are given here, but can be found in summary form in MC Report 104.

FOREWORD (U)

(U) In 1969 the Maury Center for Ocean Sciences issued a publication entitled "Mediterranean Sea Environmental Atlas for ITASS (U)". It was stated in the Foreword to this document that the presentation of the environmental and acoustic data was tailored solely to support a specific equipment system. Furthermore, the Atlas was considered as an interim document, anticipating that it would be updated in the future.

(U) Since 1969, there has been considerable measurement activity in the Mediterranean Sea. The Long Range Acoustic Propagation Project (LRAPP) itself participated in or sponsored three such efforts (IMP, IOMEDEX, and TASSRAP/DECKPLATE). These measurements have contributed significantly to our knowledge and understanding of sound transmission and ambient noise in the Mediterranean. This fact, coupled with the continued operational interest there, makes the issuance of an up-date to the Atlas at this time a worthwhile event.

(U) In order to serve the variety of different needs of the operating Fleet as well as those of the scientific and planning community, while at the same time providing volumes which are convenient to use and easy to handle, the Atlas up-date has been issued as four separate companion reports, namely: "Mediterranean ASW Bibliography - Volume I", MC Report 101 (Unclassified); "Mediterranean ASW Bibliography - Volume II, (U)", MC Report 102 (Secret); "Mediterranean Environmental Acoustic Data Catalog (U)", MC Report 103 (Confidential); and "Mediterranean Environmental Acoustic Summary (U)', MC Report 104 (Secret). These four volumes cover the many different aspects of environmental acoustics and include information reflecting the total oceanographic discipline as it supports the study of antisubmarine warfare. The information they contain was drawn from a broad spectrum of sources that originated in this country and elsewhere.

J B Hersey

J.B. Hersey
Deputy Assistant Oceanographer
for Ocean Science

PREFACE AND ACKNOWLEDGEMENTS (U)

(U) This catalog of environmental and acoustic data for the Mediterranean Sea contains a tabulation of the kinds of measurements and observations which have been carried out and their location. Its primary purpose is to provide a convenient source for determining to what extent each of the subjects covered here has been studied and, through the references given, provide a guide to the literature and the actual data. No data are provided here.

(U) The catalog was derived from material supplied by a large number of people. The environmental and sound velocity structure data and references were compiled by the Undersea Surveillance Oceanographic Center of the U.S. Naval Oceanographic Office. The overall coordinator of this effort was CDR W. B. Matthews. The principal investigator for sound velocity, temperature, salinity and water masses was Mr. Don F. Fenner, with assistance from Messrs. Paul J. Bucca, William J. Cronin, Jr., Terry L. Kelley and William C. Lippert. Ocean fronts and internal waves was compiled by Mr. Alvin Fisher, sea and swell by Mr. Richard H. Holcombe, tides and currents by Mr. Theodore Frontenac, bathymetry and province charts by Mr. Reuben J. Busch, physiography by Mr. Robert N. Bergantino, geophysics and sediments by Mr. Patrick T. Taylor.

(U) Volume scattering was compiled by Mr. Richard H. Love and Mr. Wayne E. Renshaw, false targets and bioluminescence by Mr. William T. Leapley, bottom reverberation by Mr. Jonathan M. Berkson, bottom loss by Mr. Robert E. Christensen. Ms. Joanne V. Lackie and Mr. Douglas Koik prepared the illustrations for the temperature, salinity and sound velocity sections.

(U) The compilations of ambient noise and propagation loss were made by Dr. William M. Carey, MAR, Inc. Shipping distributions were supplied by Dr. Lou P. Solomon, PSI and Mr. Paul Wolff, Ocean Data Systems, Inc. The project was under the direction of LCDR T. J. McCloskey, Long Range Acoustic Propagation Project. The overall coordination for the preparation of this document was Mr. Jimmy T. Gottwald, Tracor, Inc., with assistance from Dr. August F. Wittenborn and Mr. A. N. Glennon, Tracor, Inc.

R. D. Gaul
Manager, Long Range Acoustic
Propagation Project

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1.0(U) INTRODUCTION (U)

1.1(U) General Description (U)

(U) This report contains a description of the environmental and acoustic data that are available for interpreting and predicting the performance of acoustic ASW sensors in the Mediterranean Sea. It is a companion to three other reports, namely: "Mediterranean ASW Bibliography - Volume I", MC Report 101 (Unclassified); "Mediterranean ASW Bibliography - Volume II", MC Report 102 (Secret); and "Mediterranean Environmental Acoustic Summary", MC Report 104, (Secret). The purpose of this report is to provide a tabulation of the kinds and quantities of observations and measurements which have been made and where they were made. The text or references at the end of each section then provide a guide to where the actual data can be found. No data are given here, but can be found in summary form in MC Report 104.

1.2(U) Data Sources (U)

(U) Fundamentally, the data sources for this catalog are the contents of the reports listed in MC Report 101 and MC Report 102. Many of these reports, however, have been summarized in subsequent reports or automated data bases, some have lost their significance due to the passage of time and some have been superseded by subsequent events. The sources considered of prime significance at this time are listed as references in this catalog under the heading or topic to which they correspond.

2.0(U) MARINE CLIMATOLOGY, INCLUDING WIND, SEA AND SWELL (U)

(U) Data on marine climatology have been derived from synoptic meteorological observations made from ships, including, in particular, voluntary observations from merchantmen along primary shipping lanes. These observations are accumulated and combined into climatological data files at national and international repositories.

(U) Surveys of the observations for representative ocean areas indicate that each observation contains wind force and direction, nearly all of them contain air temperature, 95% contain total cloud amount, about 70% contain present weather, about 50% contain visibility information, 35% to 40% contain sea state information, and less than 35% contain swell information.

(U) The major data repository for Navy use is the National Weather Records Center, Asheville, N.C. The total count of surface marine observations available there for each one-degree square in the Mediterranean Sea, as of June, 1974, summarized on an annual basis and identified as Tape Data Family-11, are shown in figure 2-1. Except for a few areas which are not of significant operational interest, the number of observations is reasonably uniformly distributed by month or season.

(U) The data represented by these observations are summarized in a number of different ways. One common way is in the form of wind, sea and swell roses, giving magnitude and direction as a percentage of time. Another is in the form of isolines representing the percentage of observations which equal to or exceed (or are less than) a given magnitude. Extensive summaries of this type are given in reference 2 and in the Additional Sources listed below.

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1. Weather Bureau, National Weather Records Center, Asheville, N.C. Wind sea, and swell data tabulated from marine punched card decks. Unpublished

2. Naval Weather Service Command 1970. Summary of synoptic meteorological observations. Mediterranean Marine Areas, Vol. 1-9

ADDITIONAL SOURCES

1. Central Intelligence Agency 1960. National Intelligence Survey, Atlantic Basin, Part IX--Mediterranean and Black Seas, Section 1. Marine Climate, Washington, D.C., CONFIDENTIAL

2. Central Intelligence Agency 1963. National Intelligence Survey, Atlantic Basin, Part IX—Mediterranean and Black Seas, Section 2, Oceanography. Washington, D.C., SECRET

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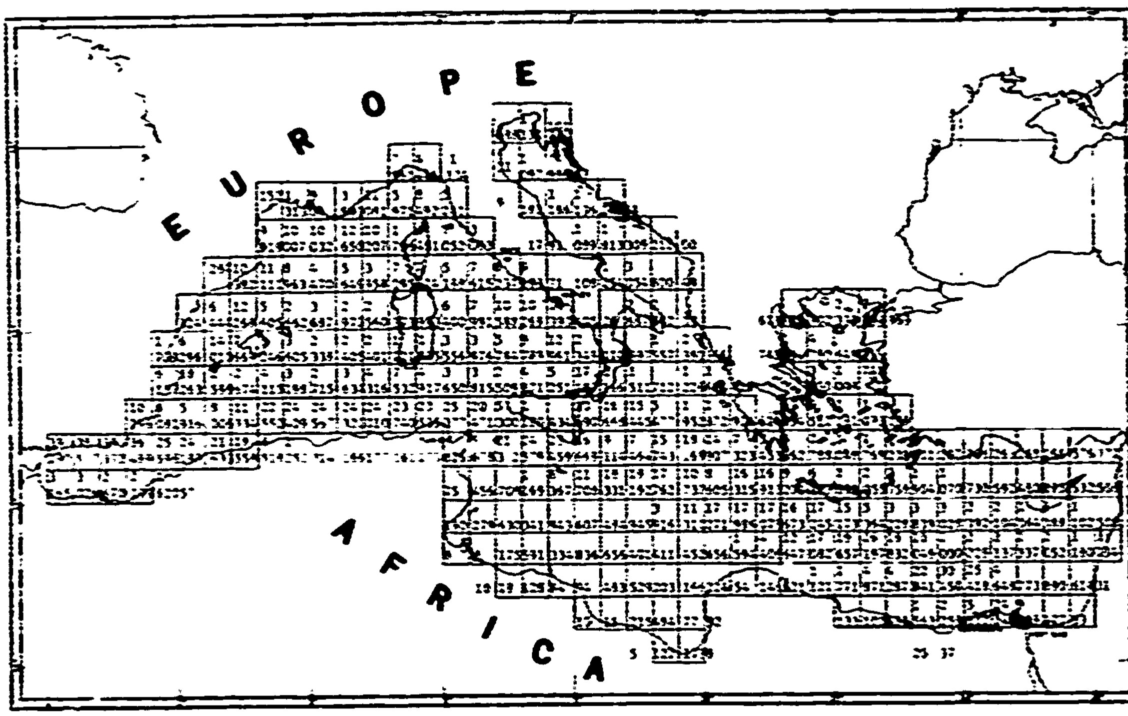
11. U.S. Naval Oceanographic Office 1971. Sailing directions (planning guide) for the Mediterranean. Publication No. 130, First Edition

12. U.S. Naval Oceanographic Office 1962. Operational oceanography of the Eastern Mediterranean Sea for submariners. Special Publication No. 50, Washington, D.C., CONFIDENTIAL

13 U.S. Navy Hydrographic Office 1962. Operational oceanography of the Western Mediterranean for submariners. Special Publication No. 49, Washington, D.C., CONFIDENTIAL



Legend:

xx	Thousands
yyy	Hundreds

Figure 2-1(U). Number of Surface Marine Climatology Observations Available from Tape Data Family-11 as of June 1974

3.0(U) CURRENT MEASUREMENTS (U)

3.1(U) Surface Currents (U)

(U) Data on surface currents have been derived from ship drift reports and by direct measurement. These observations are accumulated and combined into surface current data files at various national and international repositories.

(U) Figures 3-1 through 3-12 show the number of observations per one-degree square, on a monthly basis, contained in the data base of the U.S. Naval Oceanographic Office, Ocean Analysis Division, Code 3320. These data are compiled and summarized in the form of current roses, giving magnitude and direction as a percentage of time, and in a form giving mean speeds, prevailing directions and persistence. Extensive summaries of this type can be found in the references given below.

3.2(U) Subsurface Currents (U)

(U) Subsurface current observations in the Mediterranean are shown in figures 3-13 through 3-16 on a seasonal basis. The observations shown as closed circles generally go to a depth of 250 meters. The two open circles (winter) extend to a depth of nearly 3000 meters.

(U) As can be seen from the figures, the number of observations is small, so that no adequate summaries can be prepared. It is not clear at this time as to what a suitable format for summarizing subsurface current data should be, if and when such data become available.

REFERENCES

1. Central Intelligence Agency 1963. National Intelligence Survey, Atlantic Basin, Part IX—Mediterranean and Black Seas, Section 2, Oceanography. Washington, D.C., SECRET

2. Gottwald, J.T. 1974. LRAPP Mediterranean data catalog. Tracor Document No. T-74-RV-5044-C, CONFIDENTIAL

3. Great Britain, Hydrographer of the Navy 1970. Mediterranean Pilot. Volumes I-IV, N.P. 45-48, Ninth Edition, London

4. Royal Netherlands Meteorological Institue 1957. The Mediterranean, oceanographic and meteorological data. 'S-Gravenhage

5. U.S. Naval Oceanographic Office 1963. Oceanographic atlas of the North Atlantic Ocean, Section I, tides and currents. Publication No. 700, Washington, D.C.

6. U.S. Naval Oceanographic Office 1971. Sailing directions (planning guide) for the Mediterranean. Publication No. 130, First Edition

7. U.S. Naval Oceanographic Office 1962. Operational oceanography of the Eastern Mediterranean Sea for submariners. Special Publication No. 50, Washington, D.C., CONFIDENTIAL

8. U.S. Navy Hydrographic Office 1962. Operational oceanography of the Western Mediterranean for submariners. Special Publication No. 49, Washington, D.C., CONFIDENTIAL

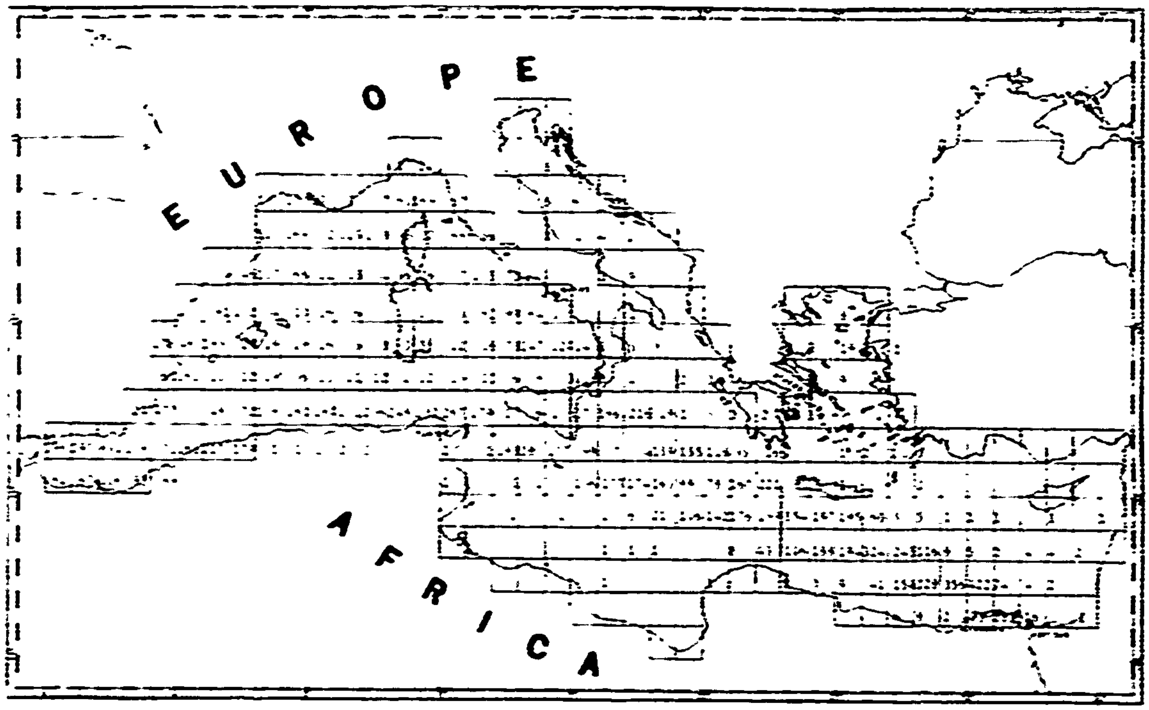


Figure 3-1(U). Number of Surface Current Observations per 1^{o} Square, NAVOCEANO Data Base for January (U)

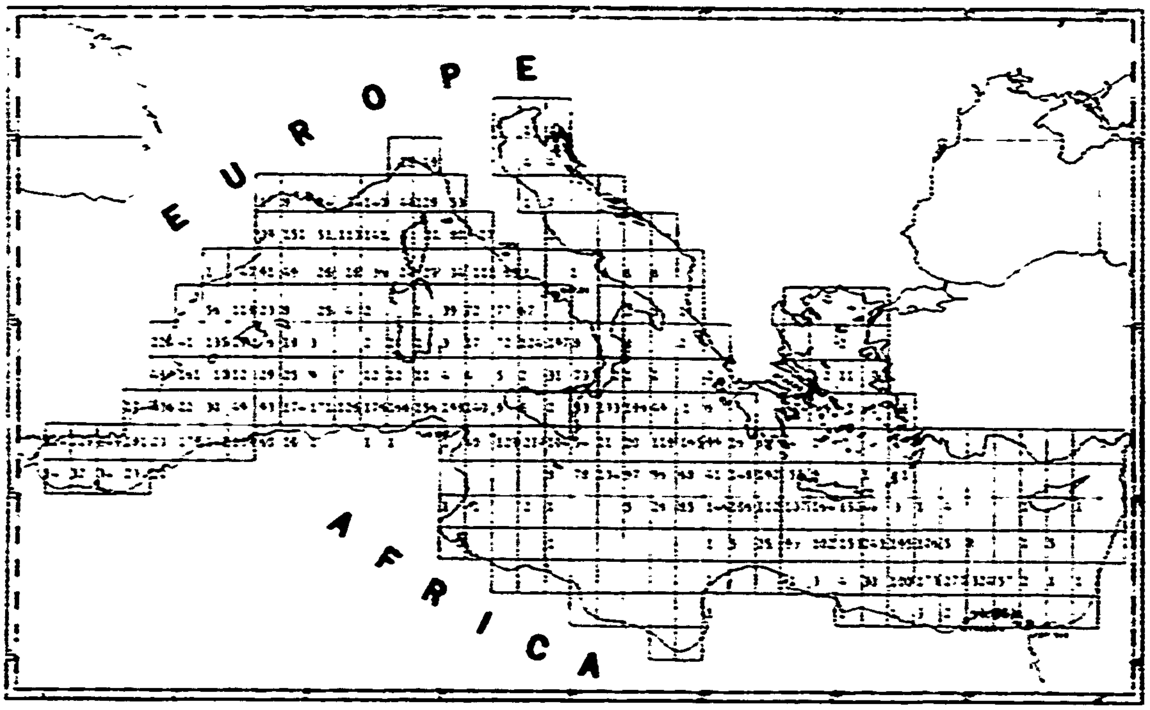


Figure 3-2(U). Number of Surface Current Observations per 1^{o} Square, NAVOCEANO Data Base for February (U)

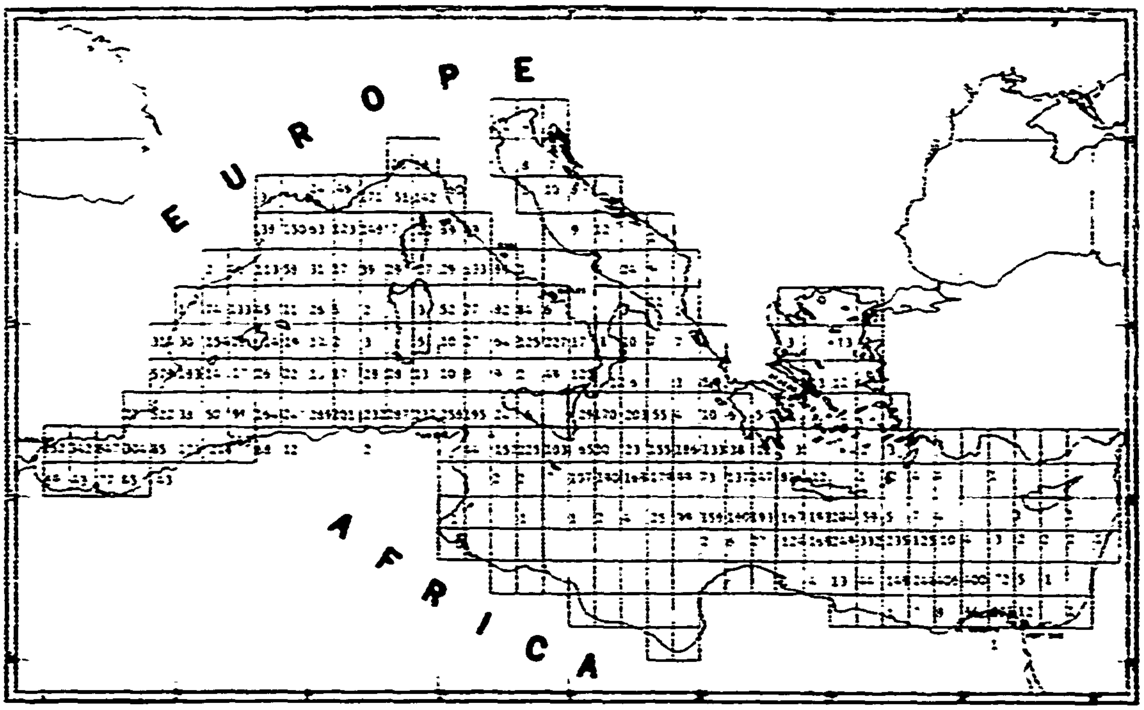


Figure 3-3(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for March (U)

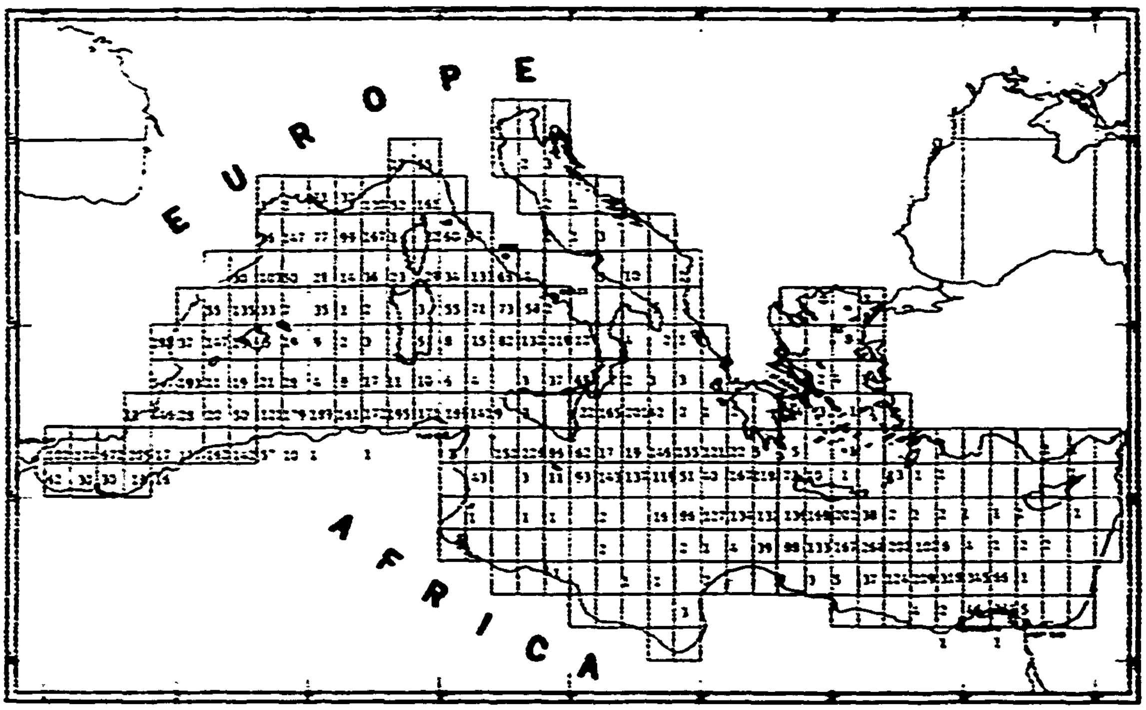


Figure 3-4(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for April (U)

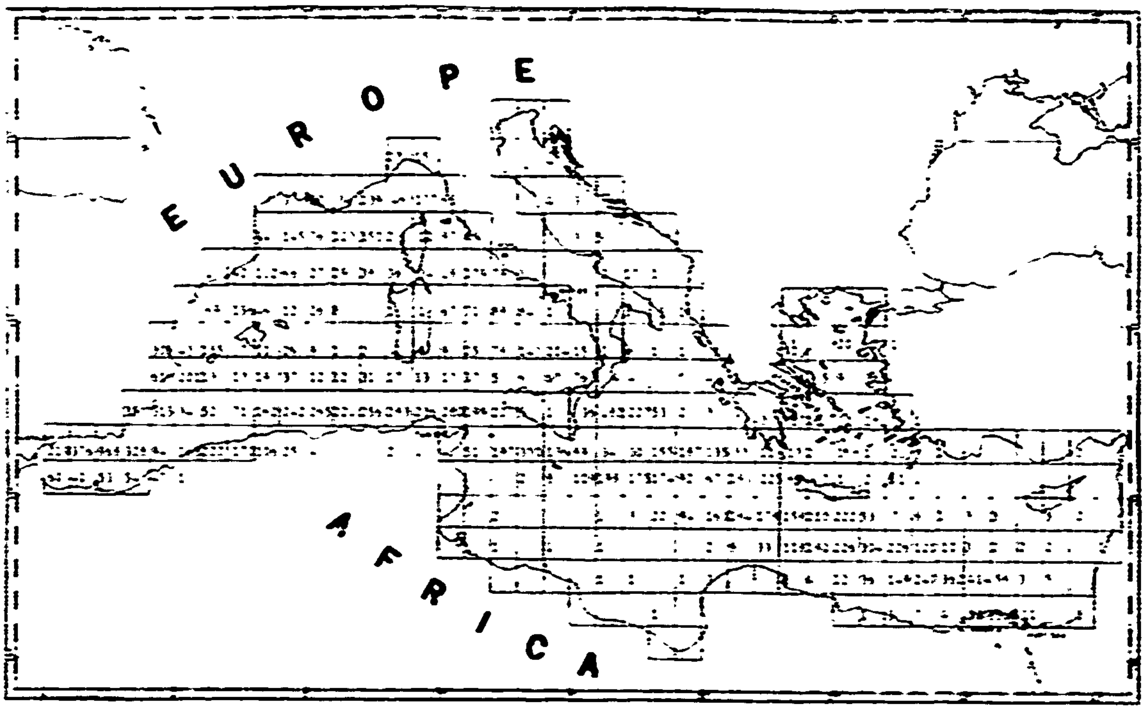


Figure 3-5(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for May (U)

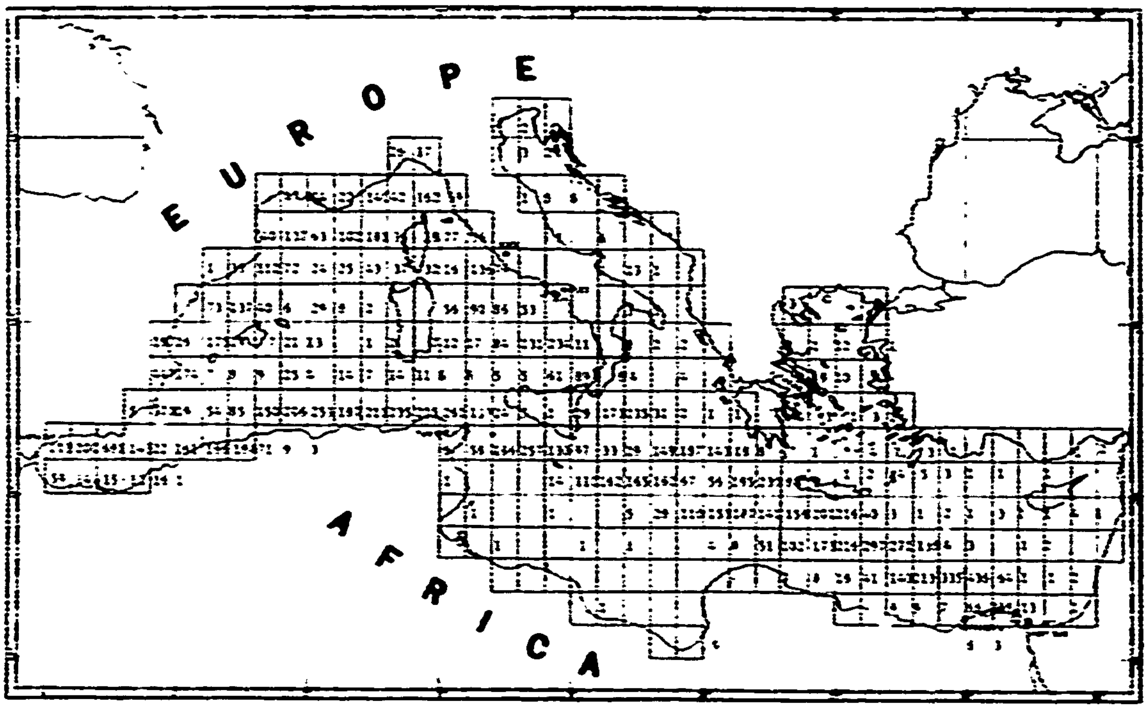


Figure 3-6(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for June (U)

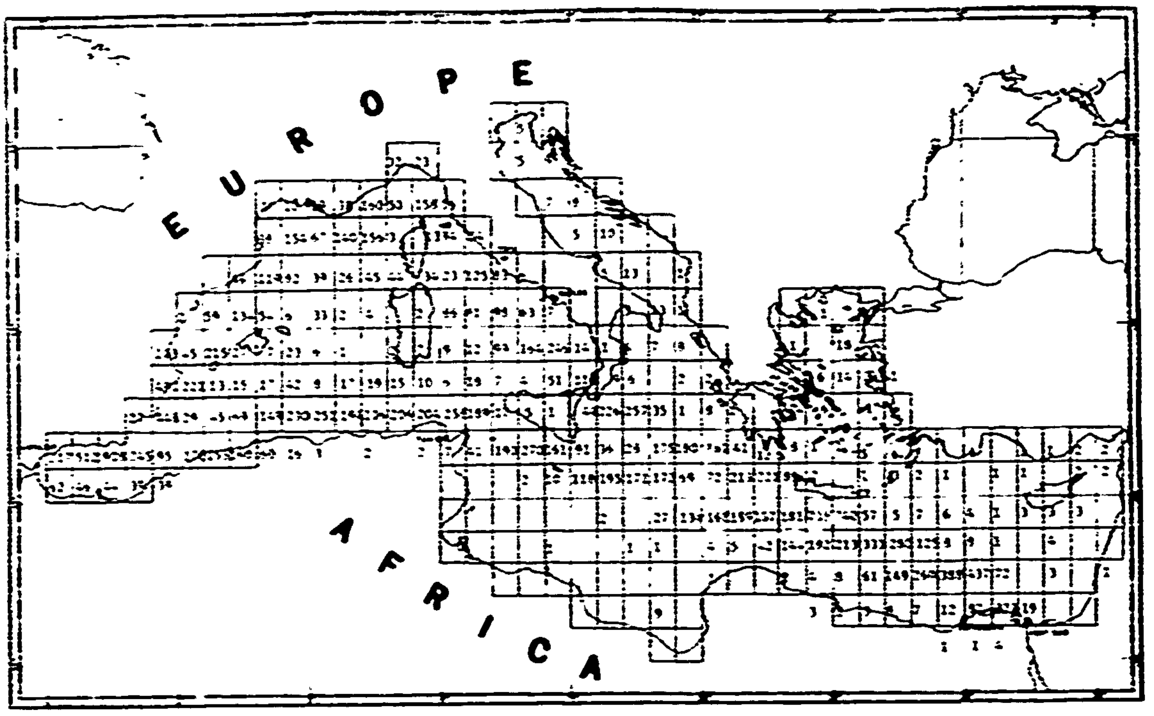


Figure 3-7(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for July (U)

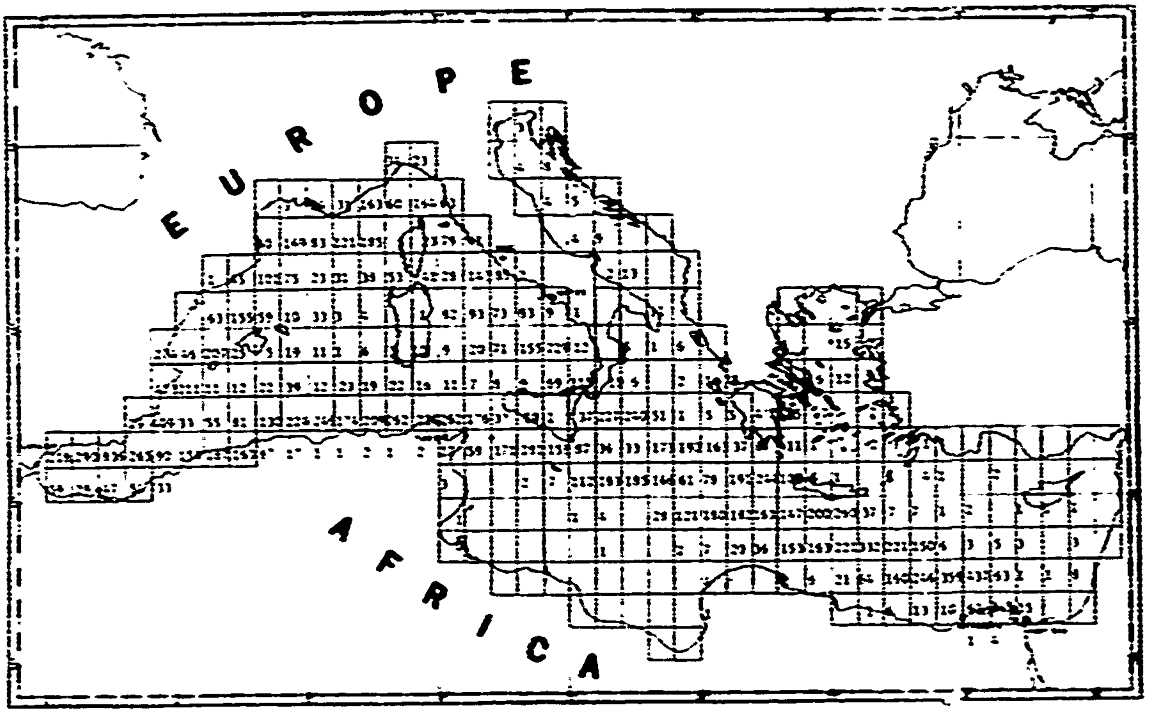


Figure 3-8(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for August (U)

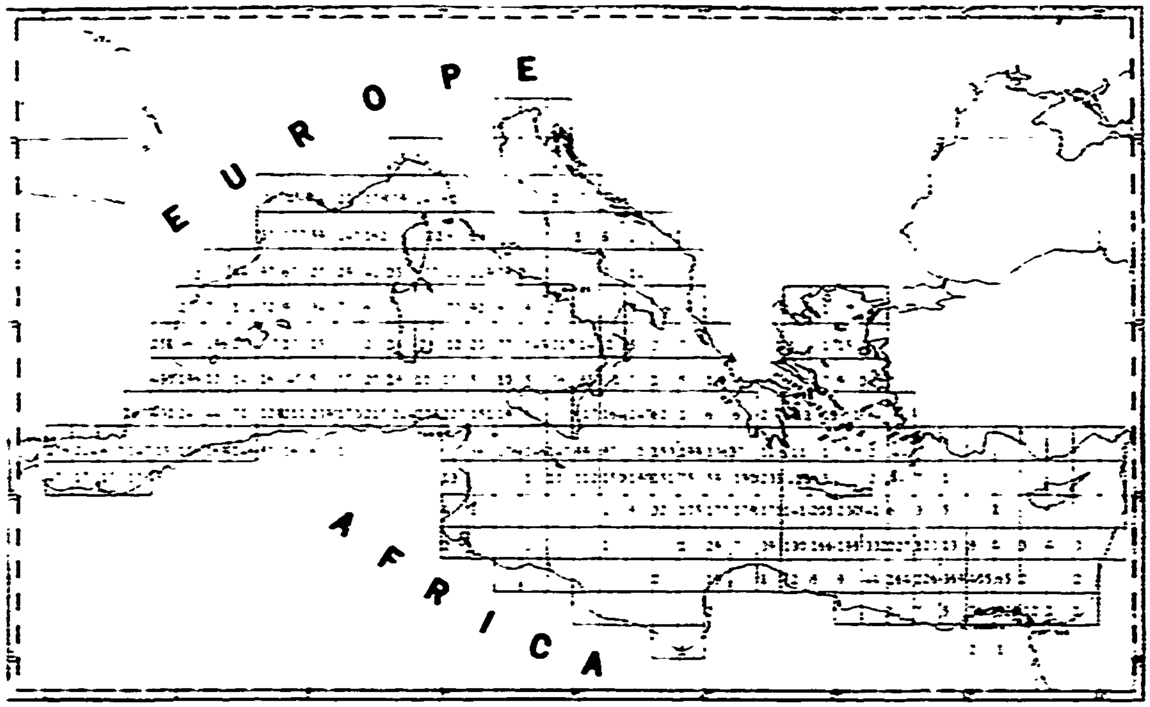


Figure 3-9(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for September (U)

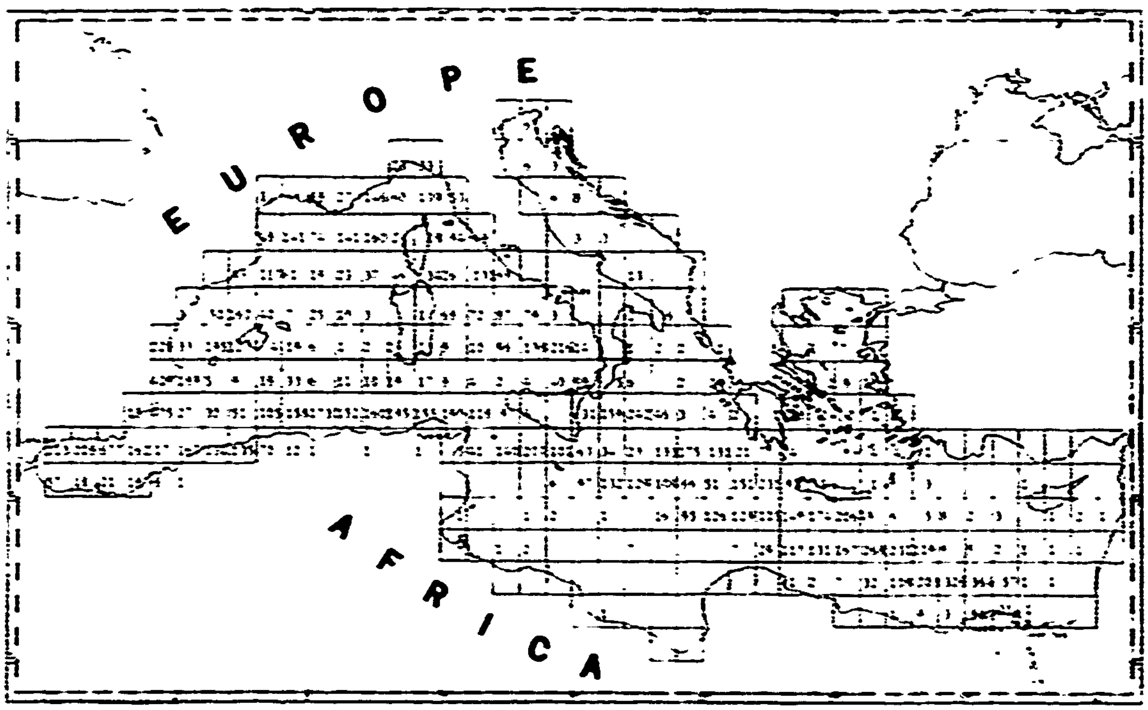


Figure 3-10(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for October (U)

UNCLASSIFIED

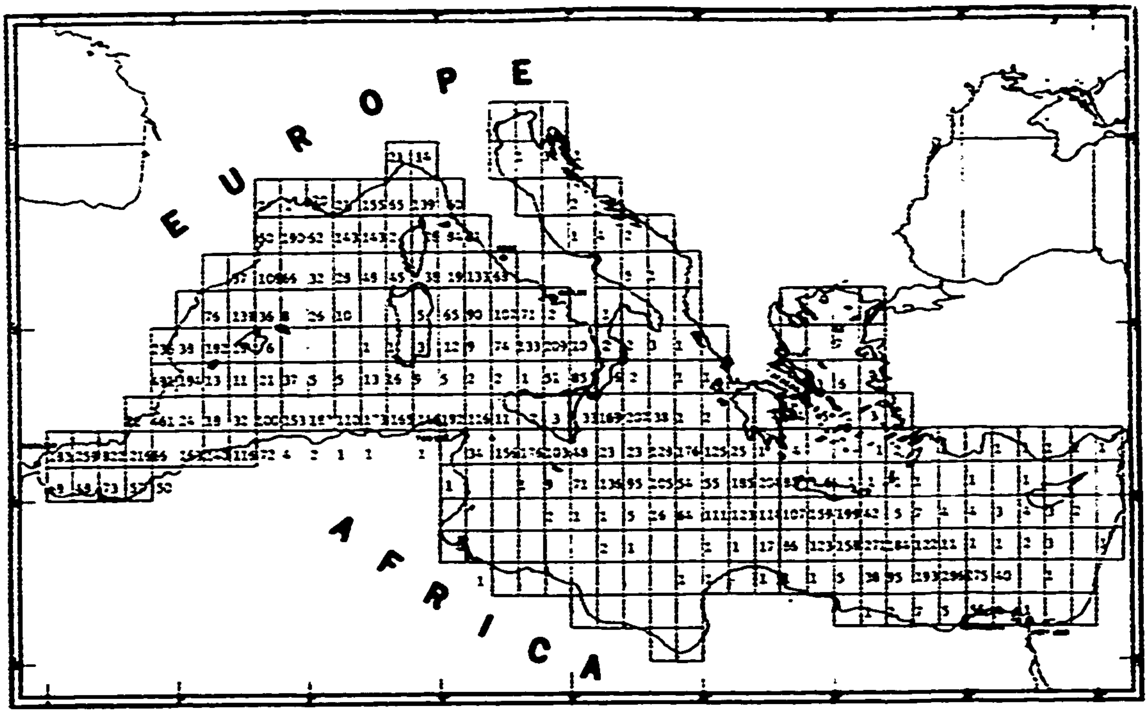


Figure 3-11(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for November (U)

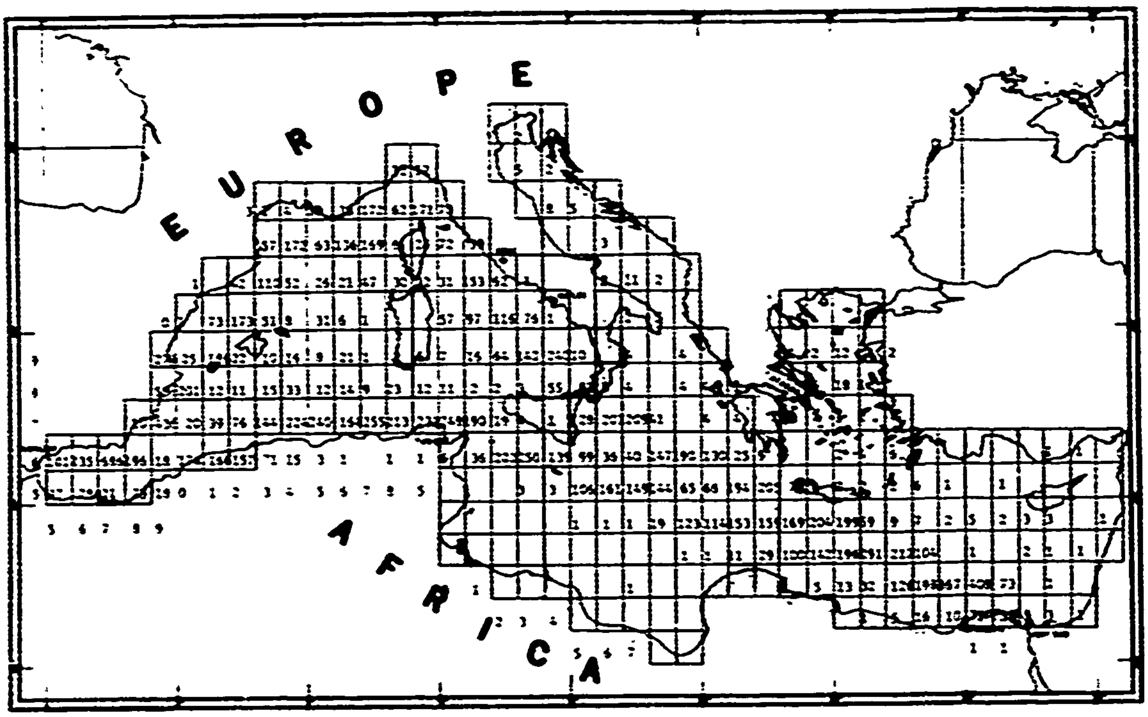


Figure 3-12(U). Number of Surface Current Observations per 1° Square, NAVOCEANO Data Base for December (U)

UNCLASSIFIED

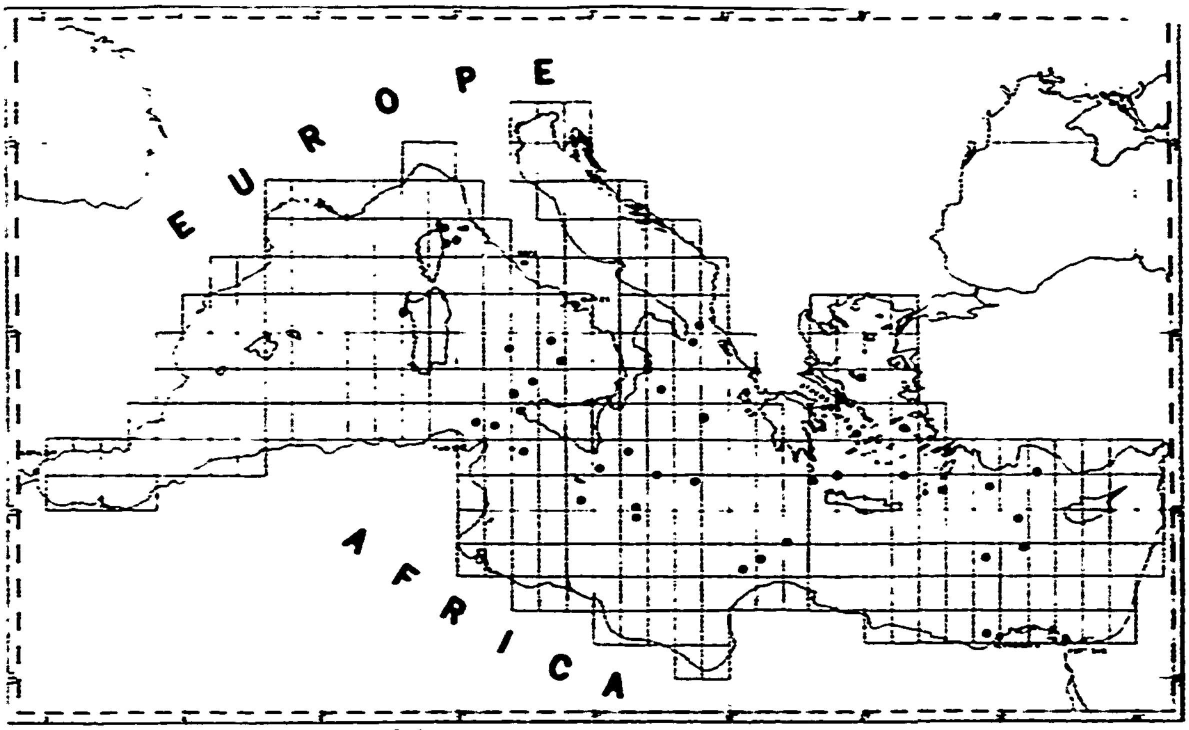


Figure 3-13(U). Subsurface Current Observations in the Mediterranean Sea, Summer (U)

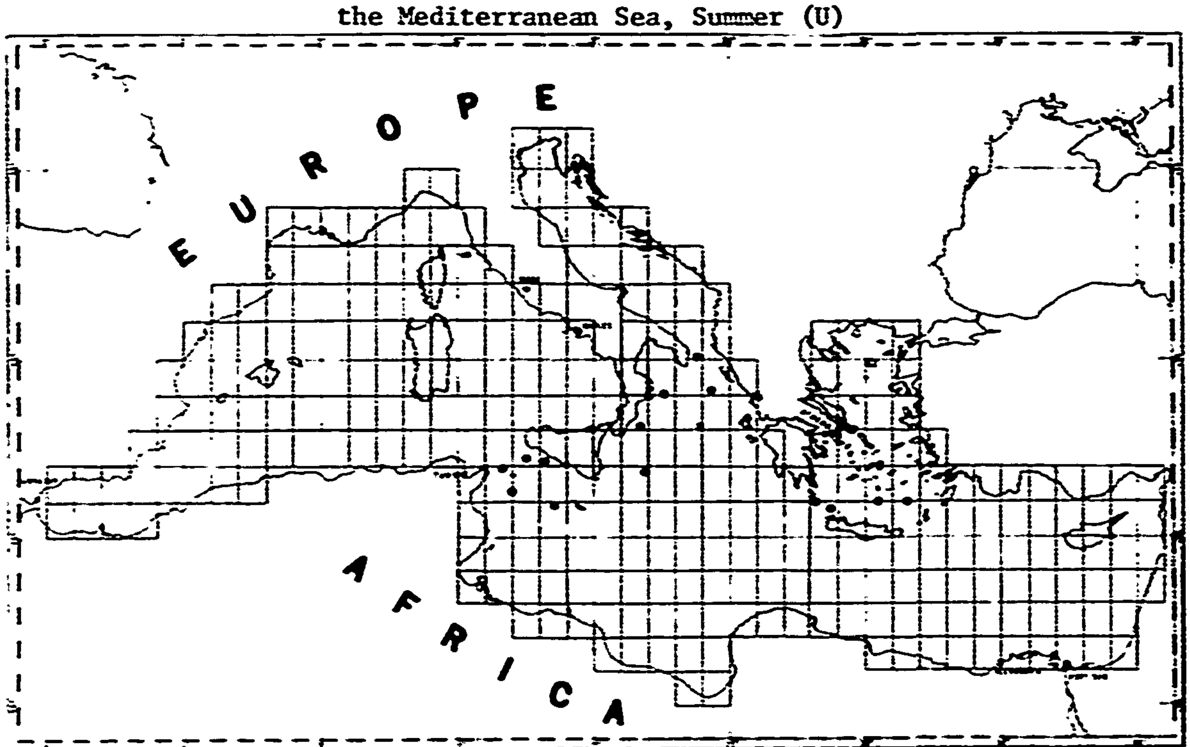


Figure 3-14(U). Subsurface Current Observations in the Mediterranean Sea, Fall (U)

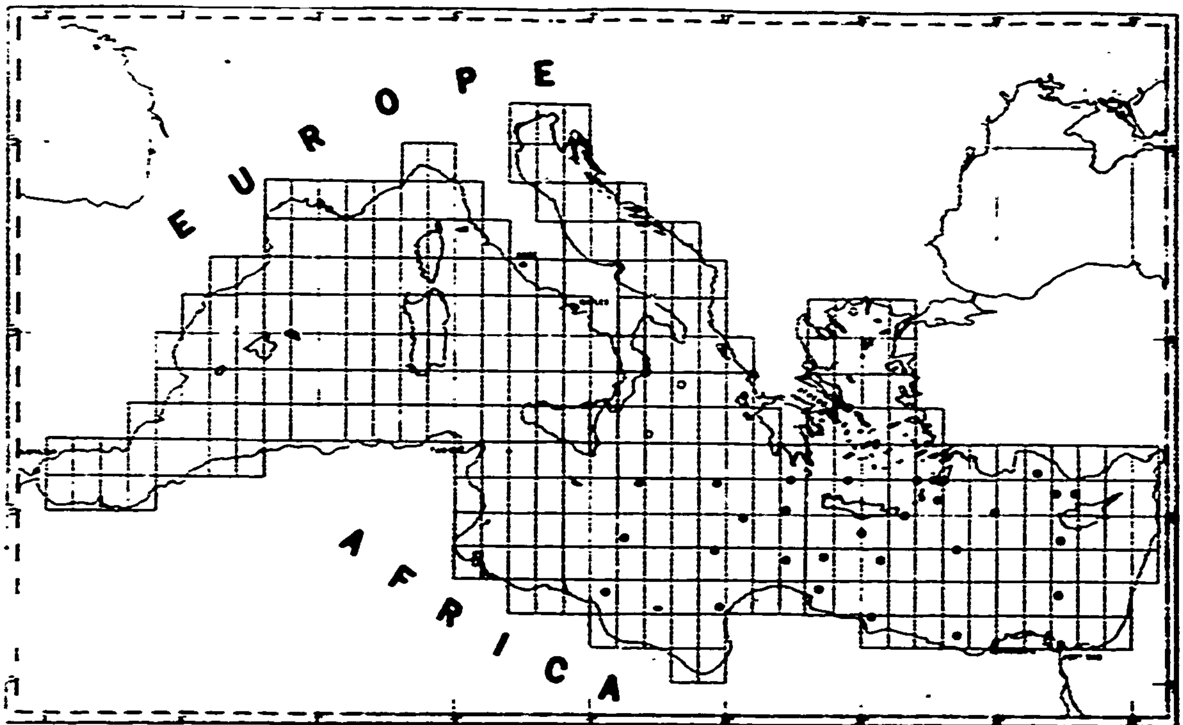


Figure 3-15(U). Subsurface Current Observations in the Mediterranean Sea, Winter (U)

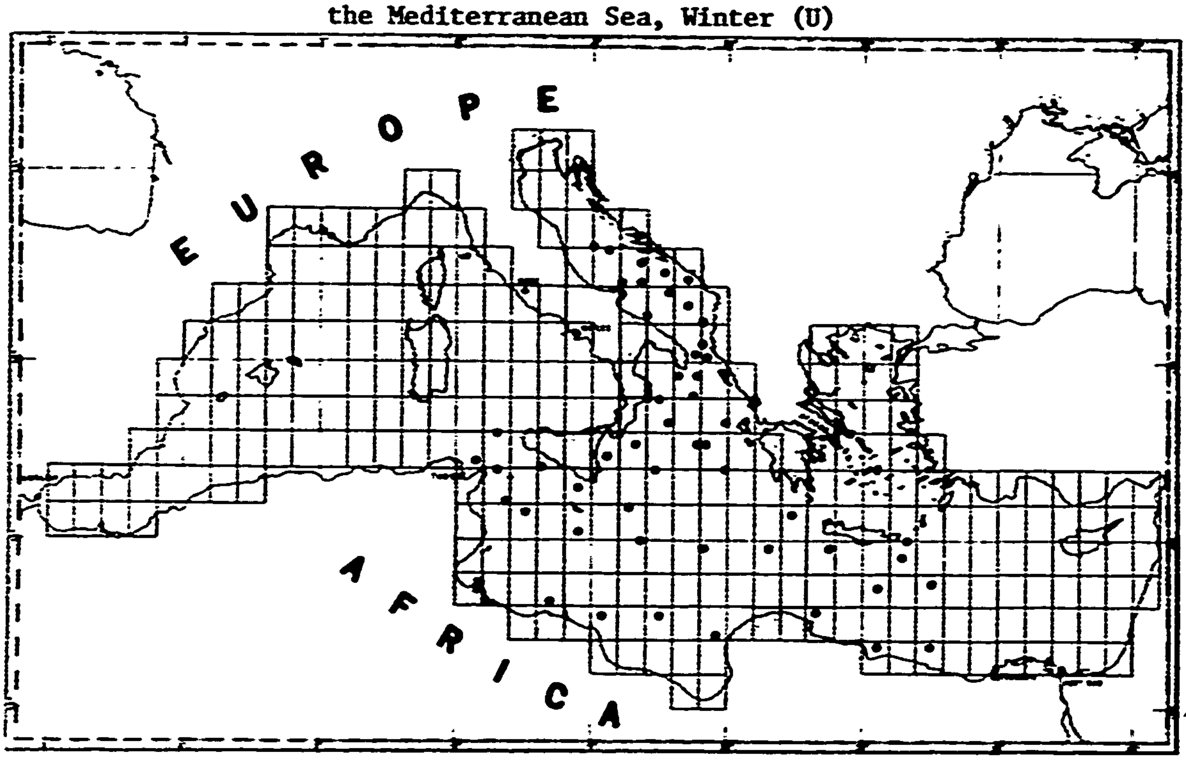


Figure 3-16(U). Subsurface Current Observations in the Mediterranean Sea, Spring (U)

4.0(U) FRONTS AND INTERNAL WAVES (U)

(U) During several cruises covering many of the basins or smaller seas throughout the Mediterranean, a number of thermal fronts or frontal zones have been encountered. In the eastern Mediterranean, 20 frontal zone crossings have been recorded at various locations (Levine and White, 1972). The positions of documented frontal crossings in the Mediterranean are shown in figure 4-1.

(U) A number of studies of internal waves have been made for the Strait of Gibraltar (references 1-5). Reports of internal waves in other Mediterranean areas are meager. One would normally expect to encounter internal waves in an enclosed area where two water masses are in proximity, such as in the Strait of Sicily, but available observations have failed to record their presence (reference 6). However, internal waves with characteristics similar to those reported in the Strait of Gibraltar have been observed in the Ionian Sea (references 7, 8).

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14. Ziegenbein, J. 1969. Short internal waves in the Strait of Gibraltar. Deep-Sea Res., 16, p. 479

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19. Lee, O.S. 1961. Effect of an internal wave on sound in the ocean. J. Acous. Soc. Amer., 33, p. 677

Figure 4-1(U). Locations of Documented Frontal Crossings in the Mediterranean Sea (U)

5.0(U) TEMPERATURE, SALINITY, AND SOUND VELOCITY DATA (U)

(U) Figures 5-1 through 5-12 show the location of historical temperature, salinity, and sound velocity data collected in the Mediterranean Sea during the months of January through December. The data shown in these figures include the following:

- Nansen Cast (NC), salinity-temperature-depth (STD) and sound velocity-salinity-temperature-depth (SV/STD) data contained in the Acoustic and Environmental Support Detachment (AESD) data bank,
- Expendable bathythermograph (XBT) and aircraft expendable bathythermograph (AXBT) data contained in the Fleet Numerical Weather Central (FNWC) XBT data bank.
- Additional data of all types described in table 5-1.

(U) The historical temperature, salinity, and calculated sound velocity data (Wilson, 1960) contained in the AESD data bank include that processed by National Oceanographic Data Center (NODC) as of December 1972. The December 1972 cutoff date can be interpreted to mean data collected prior to about 1970 that was forwarded to NODC for processing. However, much data collected prior to 1970 obviously has not been included or was not forwarded by the various collecting organizations. For example, only a very small percentage of data collected on NATO sponsored cruises or by some foreign oceanographic institutions ever finds its way into the NODC data bank.

(U) The historical temperature data contained in the FNWC XBT data bank include that collected using Sippican Model T-4 probes (460-m), T-7 probes (760-m) and T-5 probes (1830-m) plus data collected using 330-m AN/SSQ-36 AXBTs. FNWC XBT and AXBT data shown on figures 5-1 through 5-12 includes that processed as of October 1973. Data from the LRAPP-sponsored IOMED, TASSRAP, and DECKPLATE Exercises had not been received by FNWC prior to October 1973 and hence were not included in the October 1973 FNWC XBT tape. However, these data have been added to figures 5-8, 5-9, 5-10, and 5-11 (see items 19, 20, and 21 in table 5-1).

(U) The additional data sources enumerated in table 5-1 include those either retained in USOC or readily available in various publications held by the Maury Center for Ocean Science, NAVOCEANO, or NRL libraries. The additional data given in table 5-1 is not totally inclusive. Important data sources not included in the tabulation are as follows:

- NATO data such as:
  - Data collected in the eastern Mediterranean Sea during August-September 1967 and during September 1968,
  - MEDOC-70 data collected in the northern Balearic Basin during February-March 1970,
  - MILOCMED-71 (MAY FROST) data collected in the Ionian Sea and Straits of Sicily during May 1971,
  - MEDOC-72 data collected in the northern Balearic Basin during February-March 1972;
- Israeli data holdings in the eastern Mediterranean Sea, including data from CYPRUS cruises 5, 6, 7, and 8;
- Data holdings of the Istituto Sperimentale Tallassografico, Trieste in the Adriatic Sea, Ionian Sea, and eastern Mediterranean Sea; and
- Data holdings of France, Russia, Egypt, Yugoslavia, and Greece throughout the Mediterranean Sea.

Many of the above data sources might be available through an extensive data search of the Library of Congress or the Mediterranean Sea data holdings of A. R. Miller, WHOI. However, much of this data probably would be in regions of already dense data coverage, and would not significantly add to the accuracy of sound velocity predictions for ASW purposes.

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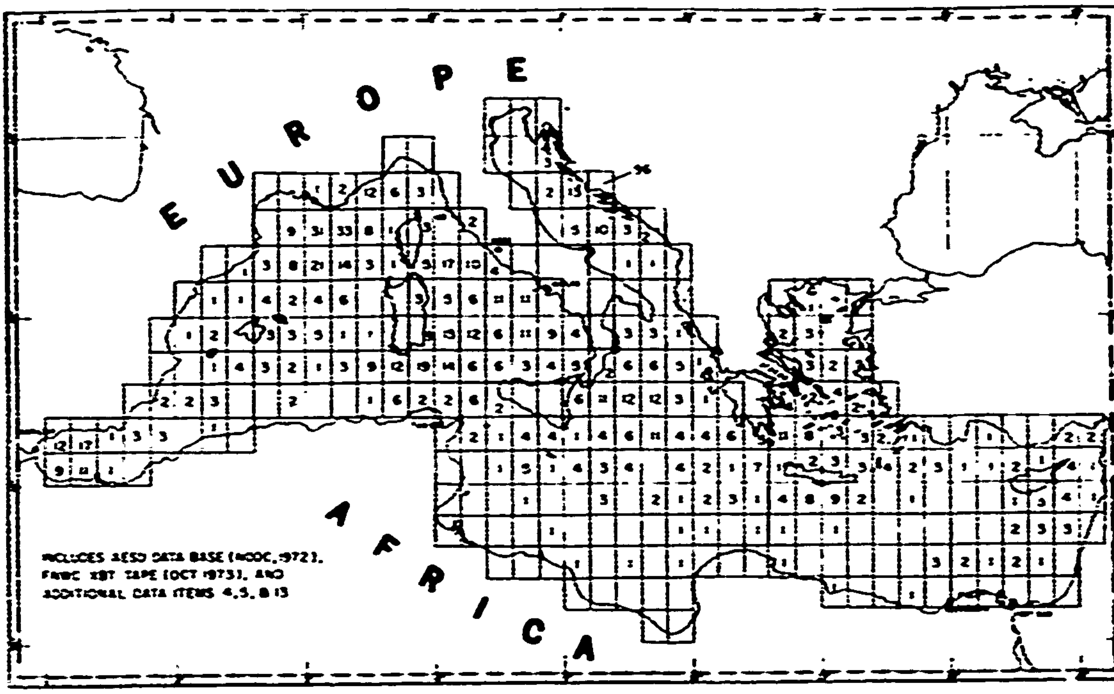

Figure 5-1(U). January Temperature, Salinity, and Sound Velocity Observations (U)

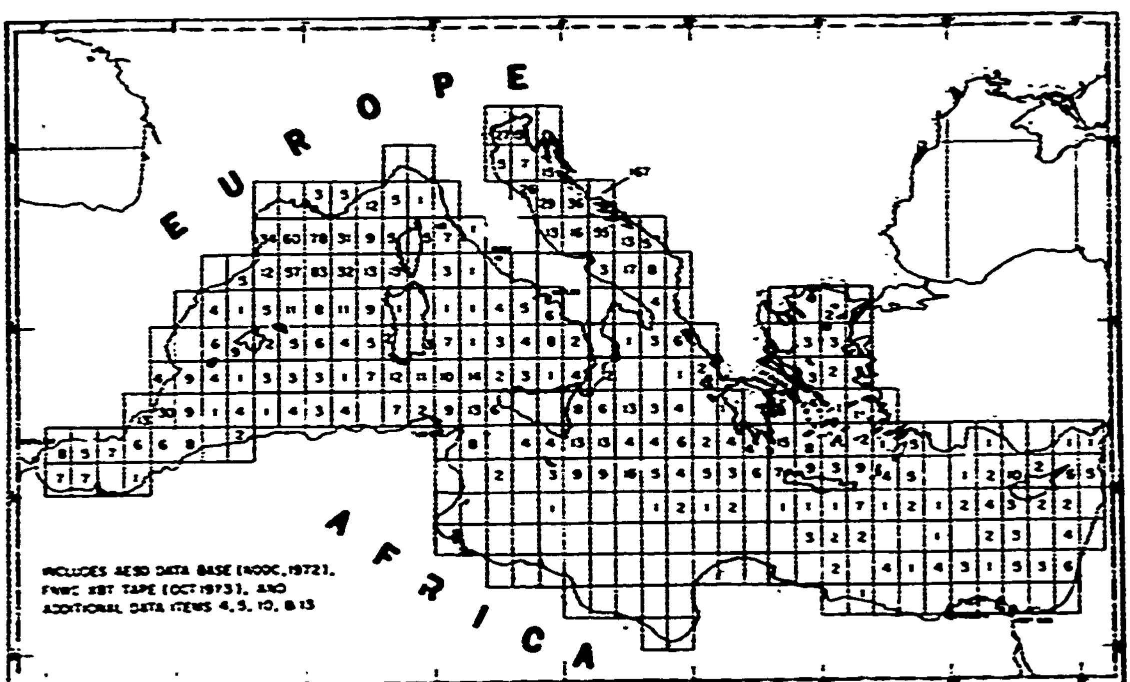

Figure 5-2(U). February Temperature, Salinity, and Sound Velocity Observations (U)

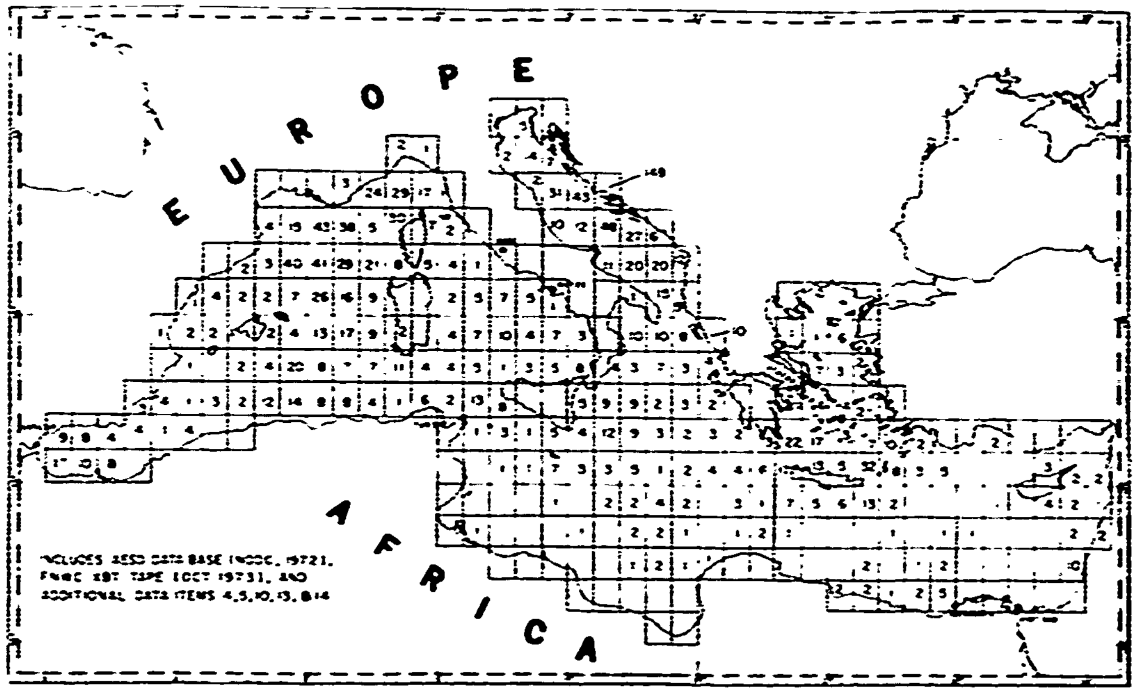

Figure 5-3(U). March Temperature, Salinity, and Sound Velocity Observations (U)

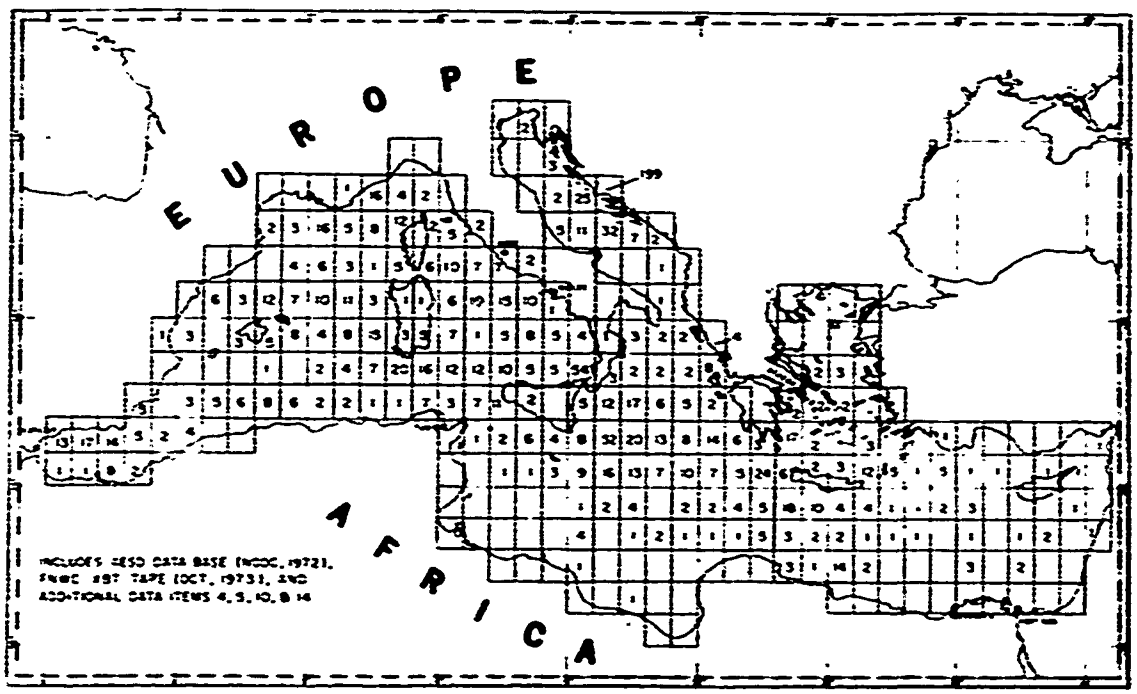

Figure 5-4(U). April Temperature, Salinity, and Sound Velocity Observations (U)

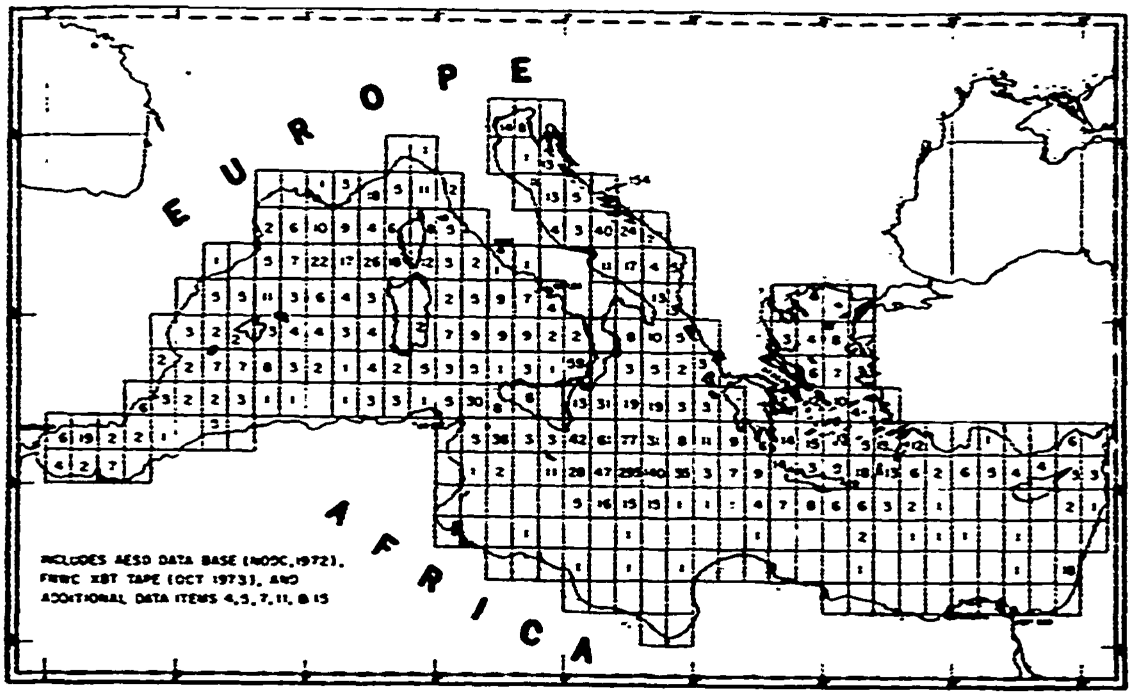

Figure 5-5(U). May Temperature, Salinity, and Sound Velocity Observations (U)

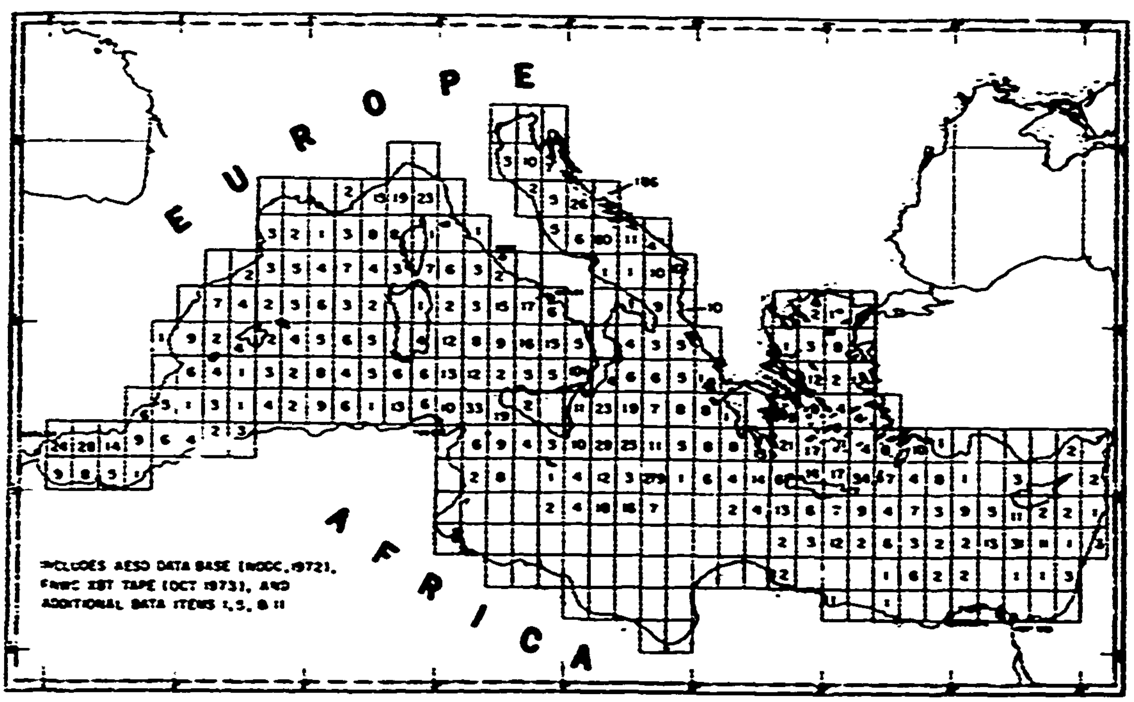

Figure 5-6(U). June Temperature, Salinity, and Sound Velocity Observations (U)

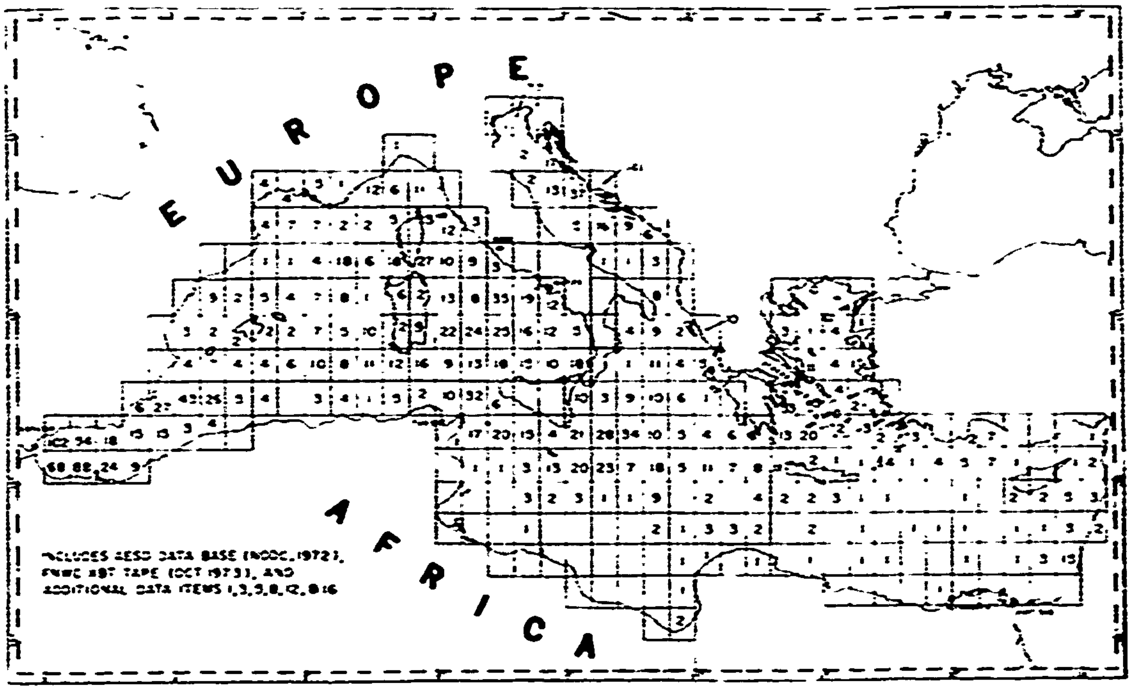

Figure 5-7(U). July Temperature, Salinity, and Sound Velocity Observations (U)

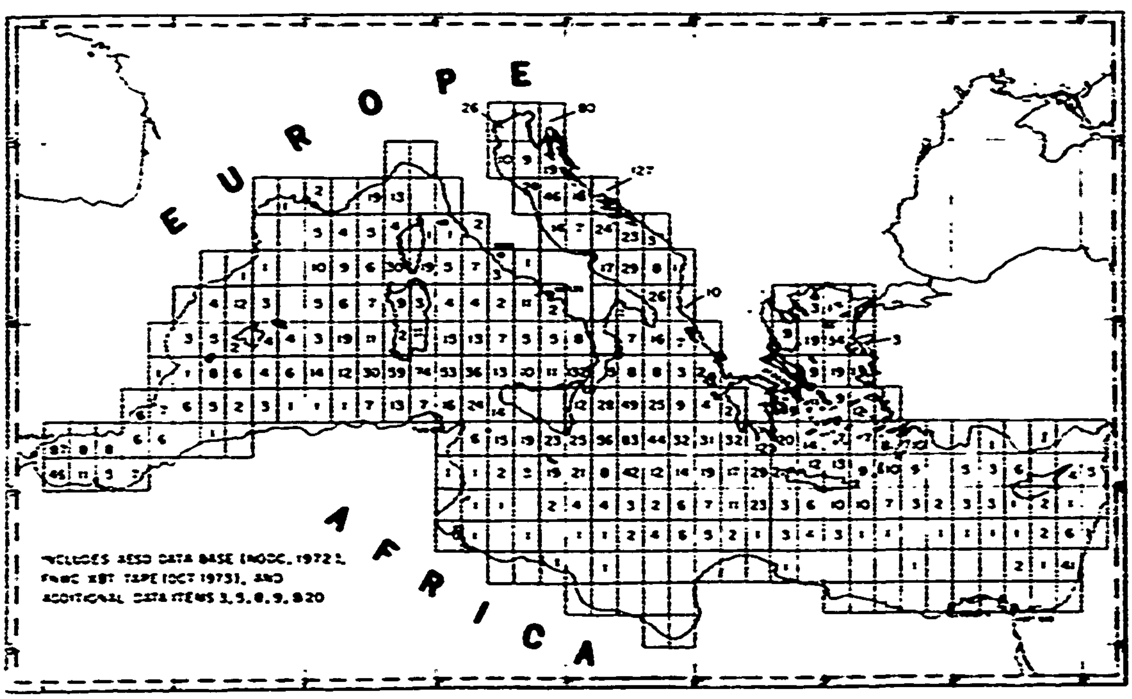

Figure 5-8(U). August Temperature, Salinity, and Sound Velocity Observations (U)

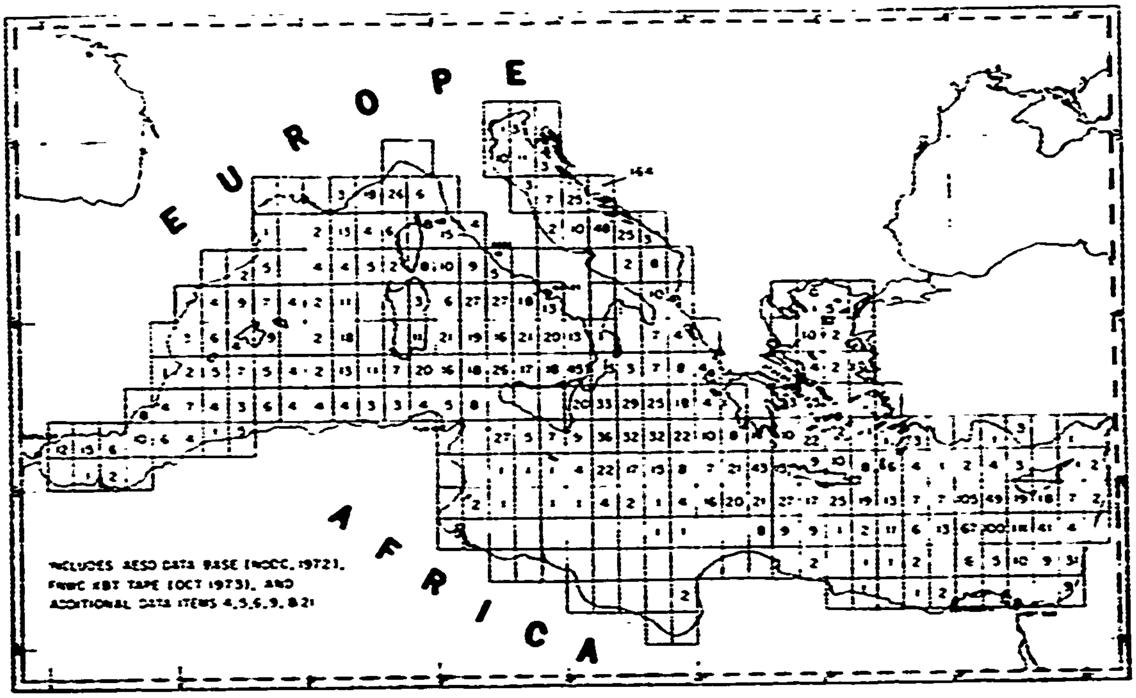

Figure 5-9(U). September Temperature, Salinity, and Sound Velocity Observations (U)

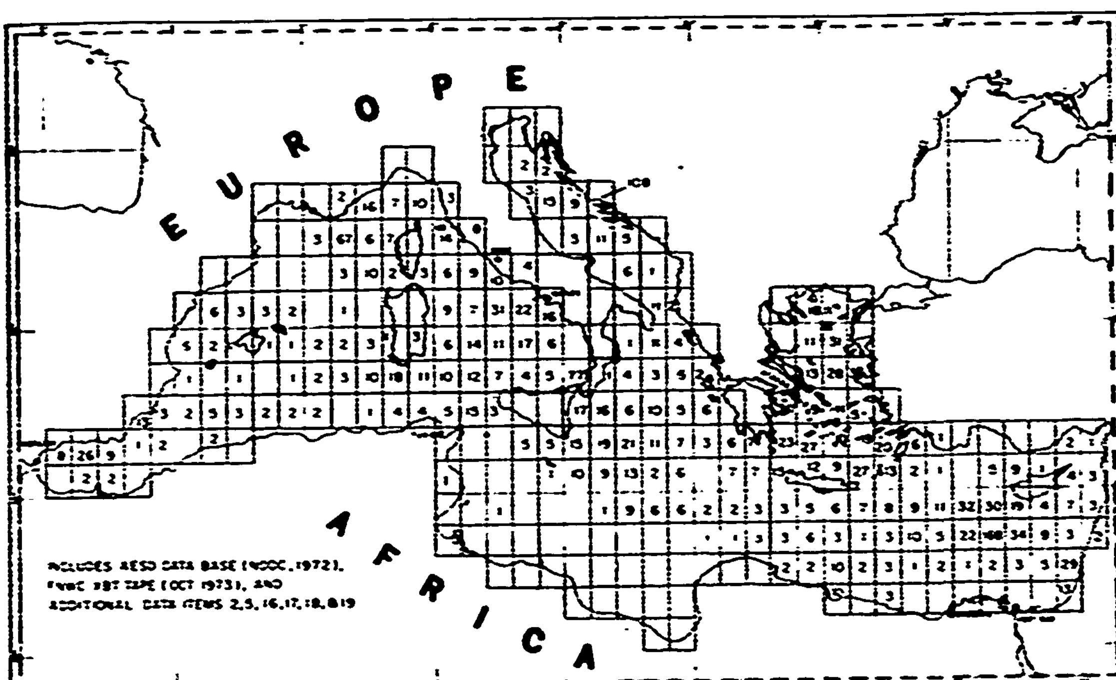

Figure 5-10(U). October Temperature, Salinity, and Sound Velocity Observations (U)

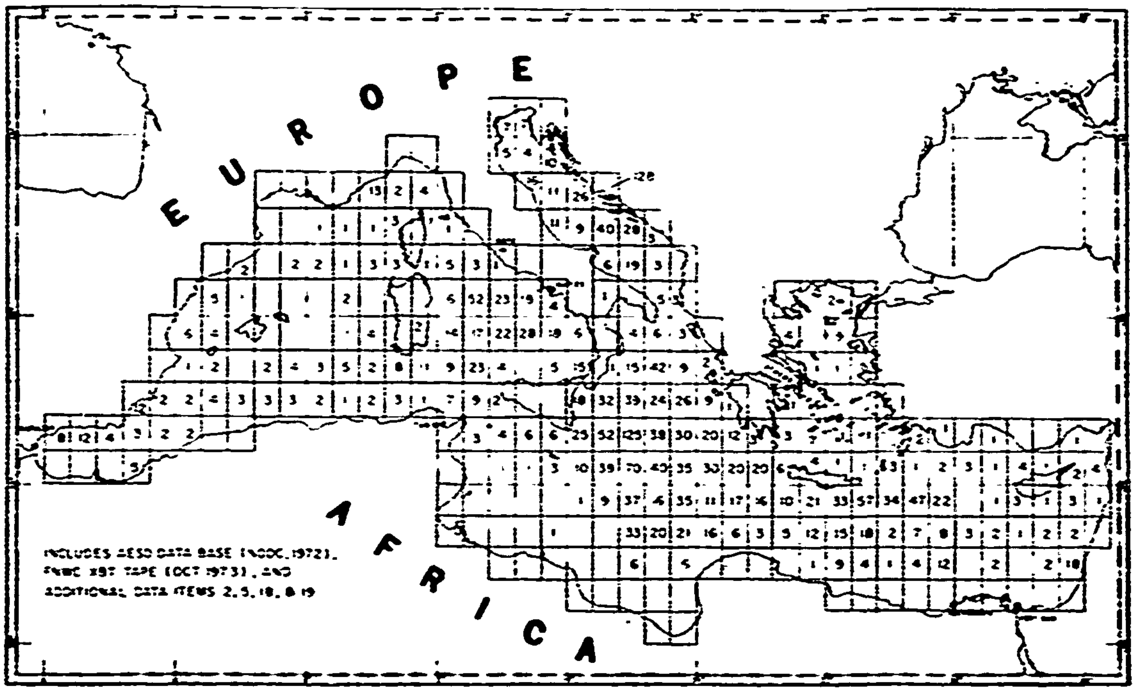

Figure 5-11(U). November Temperature, Salinity, and Sound Velocity Observations (U)

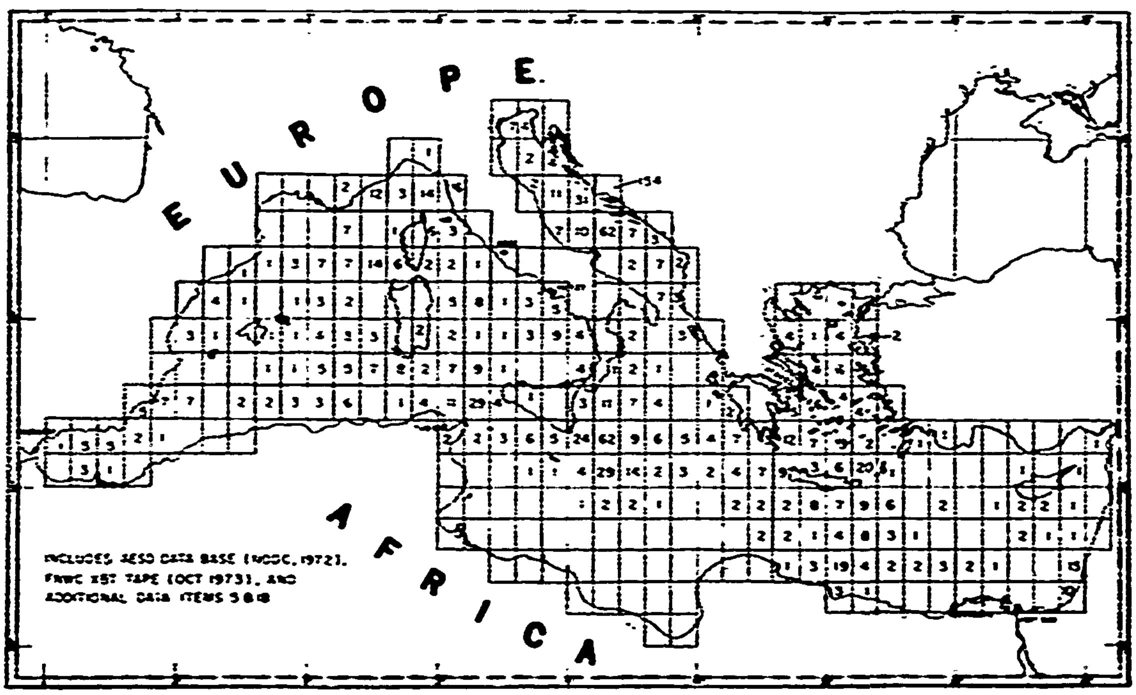

Figure 5-12(U). December Temperature, Salinity, and Sound Velocity Observations (U)

TABLE 5-1 (U)
MEDITERRANEAN SEA TEMPERATURE, SALINITY, AND SOUND VELOCITY DATA NOT CONTAINED IN DATA BANKS (U)

Item No.	Data Description and Data Type	No. of Obs.	Geographic Area	Data Availability and Remarks
1	CHAIN Cruise 7, Jun-Jul 1959, SVD Data	15	Balearic Basin, Tyrrhenian and Ionian Seas	USOC, WHOI; Additional to CHAIN 7 NC Data
2	CHAIN Cruise 21, Oct-Nov 1961, SVD Data	11	Same as Item 1	USOC, WHOI; Additional to CHAIN 21 NC Data
3	Alboran Sea Expedition, Jul-Aug 1962, NC Data		Alboran Sea (Gibraltar to 1°W)	Published in Cah. Oceanogr., 17, Supl. 1 and 2, 1965
	EUPEN	27		
	ORIGNY	56		
	SEGURA	84		
	XAUEN	32		
4	ORIGNY, Sep 1962-May 1963, NC Data	79	N.W. Balearic Basin (Approx. 42°N, 6°E)	Published in Cah. Oceanogr., 19, Supl. 1, 1967
5	WINNARETTA-SINGER, Aug 1962-Jul 1964, NC Data	106	Ligurian Sea	Published in Cah. Oceanogr., 19, Supl. 1, 1967
6	NATO Tyrrhenian Sea Cruise, Sep-Oct 1963, NC Data		Tyrrhenian Sea	Published in Cah. Oceanogr., 20, Supl. 1, 1968
	BANNOCK	95		
	ORIGNY	57		
7	CALYPSO, May 1965, NC Data	19	Straits of Sicily	Published in Cah. Oceanogr., 21, Supl. 2, 1969
8	CALYPSO, Jul-Aug 1966, NC Data	42	Ligurian Sea and Straits of Sicily	Same as Item 8

TABLE 5-1 (U) (Continued)
MEDITERRANEAN SEA TEMPERATURE, SALINITY, AND SOUND VELOCITY DATA NOT CONTAINED IN DATA BANKS (U)

Item No.	Data Description and Data Type	No. of Obs.	Geographic Area	Data Availability and Remarks
9	CHAIN Cruise 61, Aug-Sep 1966, TSVD Data	32	Icnian Sea, Eastern Mediterranean, Sea of Crete	Published in WHOI Ref. No. 68-17, 1968
10	Marine Geophysical Survey, Texas Instruments Area 6, Feb-Apr 1967, TSVD Data	53	Throughout Mediterranean Sea	Published in NUC Tech. Pub. No. 289, 1972 (CONFIDENTIAL)
11	NATO MILOCMED-68 Exercise, May 1968, NC and STD Data		Central Ionian Sea	
	PLANET	149		Published in WHOI Ref. No. 72-5, 1972
	BANNOCK	90		
	MARIA PAOLINA G.	276		SACLANT ASW Res. Cen Positions in SACLANT ASW Res. Cen. Tech. Rep. No. 173, 1970 (CONFIDENTIAL)
12	CHAIN Cruise 82, Jul 1968, SVD Data	30	West of Corsica, Tyrrhenian Sea, East of Sicily	USOC, WHOI; Additional to CHAIN 82 STD Data
13	NATO MEDOC-69 Exercise, Jan-Mar 1969, NC and STD Data		Northern Balearic Basin	
	ATLANTIS II	157		WHOI; Positions in WHOI Ref. No. 69-24, 1969
	HYDRA	56		NIO; Positions in WHOI Ref. No. 69-24, 1969

TABLE 5-1 (U) (Continued)
MEDITERRANEAN SEA TEMPERATURE, SALINITY, AND SOUND VELOCITY DATA NOT CONTAINED IN DATA BANKS (U)

Item No.	Data Description and Data Type	No. of Obs.	Geographic Area	Data Availability and Remarks
	DISCOVERY	120		NIO; Positions in NIO Cruise Rep. No. 25, 1969
	JEAN CHARCOT (See Note)	126		Published in Cah. Oceanogr., 23, Supl. 1, 1969
14	JEAN CHARCOT MEDIPROD I Cruises, Mar-Apr 1969, NC and STD Data	82	Ligurian Sea	Published in Cah. Oceanogr., 23, Supl. 1, 1971
15	NATO MILOCMED-70 Exercise, May 1970, Nc and STD Data from MARIA PAOLINA G., BANNOCK, and ORIGNY	60	Straits of Sicily	SACLANT ASW Res. Cen.; Partially Published in SACLANT ASW Res. Cen. Tech. Memo No. 168, 1970
16	ATLANTIS II Cruise 59, Jul 1970, STD Data	20	Alboran Sea, Southern Balearic Basin, Southern Tyrrhenian Sea	USOC, WHOI (E.J. Katz); Part of WHOI IMP Contribution
17	METEOR, Oct 1970, STD Data	65	Northern Balearic Basin	Inst. fur Meerskunde, Univ. Kiel: Positions given by Mittelsteadt and Huber, 1973
18	LEE IMP Cruises, Oct-Dec 1970, SV/STD Data	93	Tyrrhenian Sea, Ionian Sea, Eastern Mediterranean, Straits of Sicily, Southern Balearic Basin	Published in NUC Tech. Pub. No. 289, 1972 (CONFIDENTIAL)

NOTE: Other MEDOC-69 data from ORIGNY, BANNOCK, and MARIA PAOLINA G. not available at this time.

TABLE 5-1 (U) (Continued)
MEDITERRANEAN SEA TEMPERATURE, SALINITY, AND SOUND VELOCITY DATA NOT CONTAINED IN DATA BANKS (U)

Item No.	Data Description and Data Type	No. of Obs.	Geographic Area	Data Availability and Remarks
19	IOMED Exercise, Oct-Nov 1971		Ionian Sea	TRACOR, USOC
	SANDS SVD Data	18		
	SANDS, KNORR, NORTH SEAL, HAMMERBURG, COURTNEY, and LESTER XBT Data	388		
	VP-16 AXBT Data	160		
20	TASSRAP Exercise, Aug 1972		Ionian Sea	USOC, FNWC
	NORTH SEAL SVD Data	6		SVD Data of Doubtful Quality
	NORTH SEAL, DEARBORN, LESTER, and COURTNEY XBT Data	103		
	VP-26 and VXN-8 AXBT Data	132		
21	DECKPLATE Exercise, Sep 1972		Central Ionian Sea	USOC, FNWC
	NORTH SEAL SVD Data	4		SVD Data of Doubtful Quality
	NORTH SEAL, DEARBORN, LESTER, and COURTNEY XBT Data	143		
	VXN-8 AXBT Data	54		

6.0(U) BATHYMETRY (U)

(U) The ten individual bathymetric charts covering the Mediterranean Sea, BC 3306, 3307, 3406, 3407, 3506, 3507, 3508, 3607, and 0107, were up-dated in the last quarter of 1970 by Code 3310, Bathymetric Analysis Division, USNOO. The charts are drawn on Mercator projection on a scale of 1° longitude = 4 inches, with a contour interval of 200 meters based on uncorrected soundings with an assumed velocity of 1500 meters per second. The updating of the bathymetry of the Mediterranean was based primarily on the systematic surveys completed by USNS SHOUP in 1966-1968. About 90% of the tracks shown on the accompanying track chart (figure 6-1) are SHOUP tracklines. This excludes the Adriatic Sea where the tracklines are primarily those of the R/V BANNOCK Survey of 1965-1967. Large-scale trackline charts (scale 1° longitude = 4 inches) with USNS SHOUP tracks identified are available from USOC. The SHOUP soundings are available from the bathymetric archives of Defense Mapping Agency, (DMA), Hydrographic Center, in Suitland, Md. The BC scale bathymetric charts with or without names of undersea features are available from USOC. These large-scale charts have been incorporated into a regional bathymetric chart of the Mediterranean on a scale of 1:2,849,300 (or 1° longitude - about 1.18 inch). The chart was published by DMA in July, 1972 as N.O. 310, 17th edition. This edition is now out of print, having been superseded by the 18th edition in June, 1973. The latter edition is inferior to the 17th edition bathymetrically because some changes in contour interval resulted in a loss of topographic detail. A mylar copy of the bathymetric manuscript for the 17th edition is retained by USOC and ozalid copies of this chart are available.

(U) Another series of 6 charts was developed by U.S. Naval Oceanographic Office in September, 1971. The charts are on a scale of 1:1,100,000 (or 1° longitude = 3.15 inches) and a contour interval of 100 fathoms, uncorrected. The charts are in color and available from DMAHC as N.O. 5620 through 5625.

(U) The ten Mediterranean BC charts will appear in the North Atlantic bathymetric atlas scheduled to be published in July, 1974. The atlas charts will be available in two scales: 1° longitude = 2 inches and 1° longitude = 1 inch.

(U) A substantial part of the western Mediterranean Sea floor has been charted by close control survey methods. The positional accuracy of these surveys is within 500 yards.

(U) A series of 9 bathymetric charts for the Mediterranean was developed by SACLANT ASW Research Center, La Spezia. These charts are based primarily on bathymetric and geophysical data gathered by research vessels Aragonese, Maria Paolina G. (SACLANTCEN) and Bannock (C.N.R.)

whose survey tracklines of 1961 to 1966 are overprinted on the charts. The charts are on Mercator projection with a scale of 1:750,000 (or 1° longitude =4-1/2 inches). The contour interval is 100 fathoms with all soundings corrected to appropriate sound velocities by use of Mathews' Tables. The charts were issued in 1970 under the auspices of Istituto Idrografico della Marina, Genova-Maggio.

(U) None of the above charts are recommended for use in navigation. An excellent set of bathymetric charts suitable for navigation is available from DMAHC, Suitland. The coverage of this series of eleven overlapping charts is illustrated in figure 6-2. The chart numbers are N.O. 52000, 52010, 52020, 53000, 53020, 54000, 54010, 54020, 54030, 56000, and 56020. The charts are on Mercator projection on a scale of 1° longitude = 4-1/2 inches. The contour interval is 100 fathoms, uncorrected for variations in the speed of sound in sea water from an assumed rate of 4800 feet per second. Bathymetric data to January, 1971 was used in compiling most of the charts and a sounding line diagram is included on each chart.

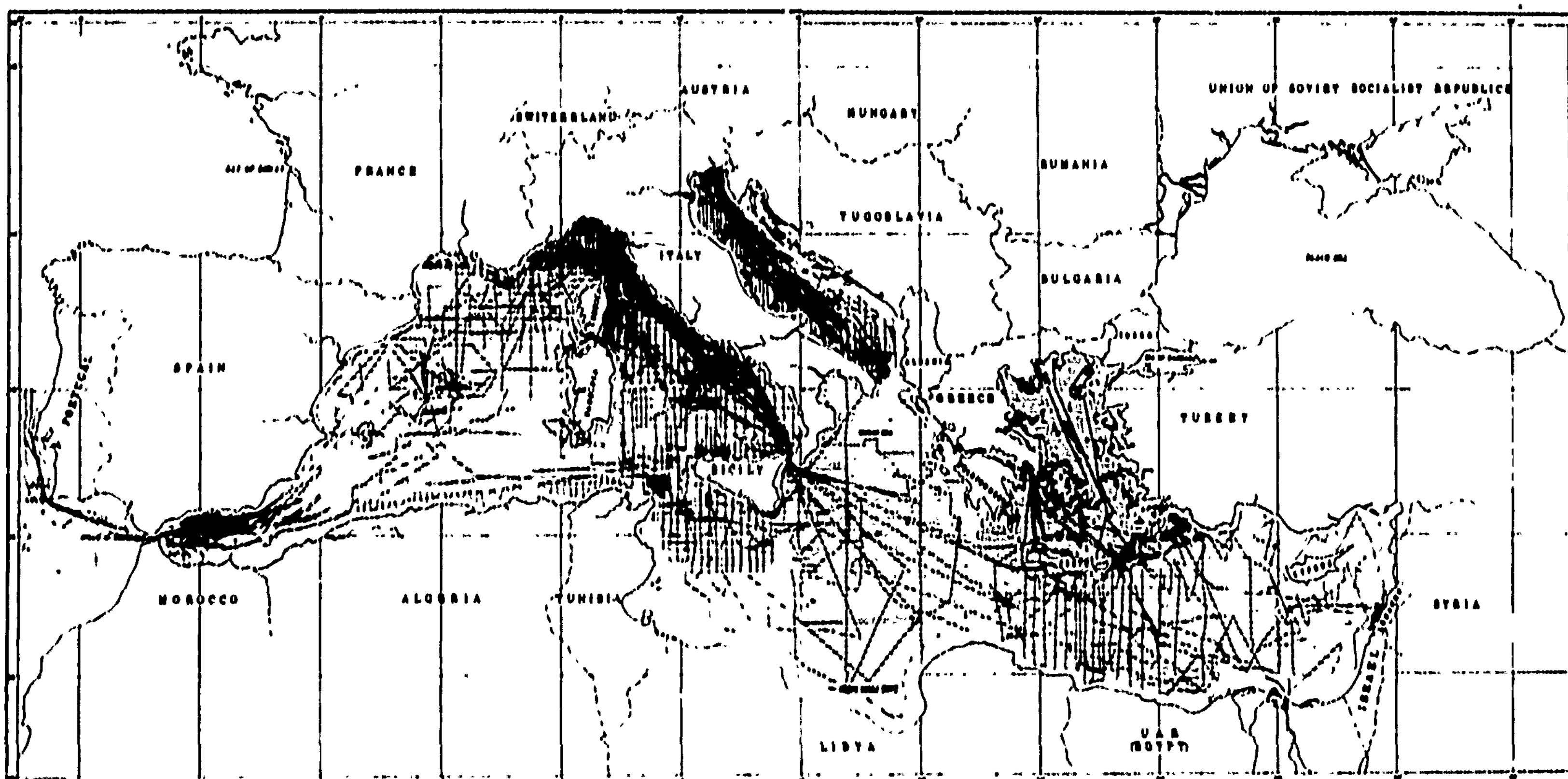

Figure 6-1(U). Track Chart of Precision Sounding Data in the Mediterranean Sea. Sources of Tracks Shown: U.S. Naval Oceanographic Office, Woods Hole Oceanographic Institution, and SACLANT ASW Research Center, La Spezia, Italy (U).

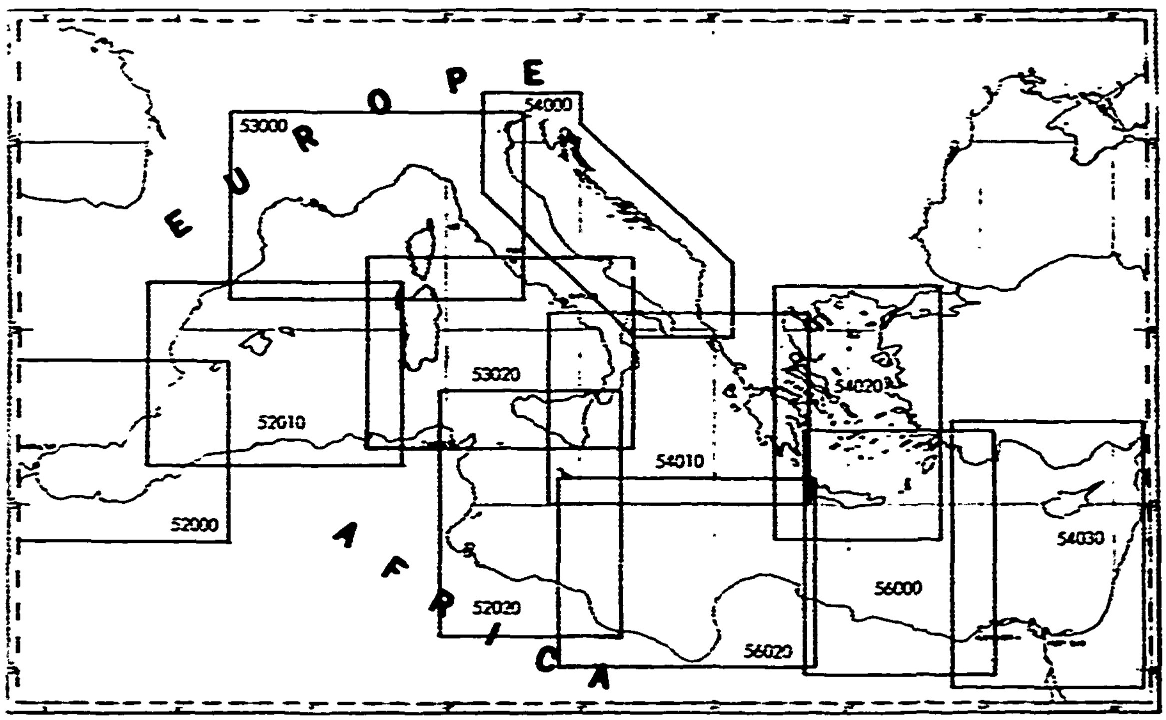

Figure 6-2(U). Bathymetric Charts Suitable for Navigation, Available from DMAHC, Suitland (U)

7.0(U) PHYSIOGRAPHY (U)

(U) The physiographic province chart in the Mediterranean ITASS Atlas was derived from the larger scale chart in the Marine Geophysical Survey (MGS) report (Texas Instruments, 1967). The physiographic province chart in the MGS report is in two sheets covering the eastern and western portions and is constructed on a scale of 1° longitude equals 1.25 inches. This chart shows more detail than the ITASS chart because the seamounts, knolls and banks were not included in the latter chart. Another small-scale physiographic province chart derived from the MGS report appears in the International Hydrographic Review of January, 1969.

(U) A new set of physiographic maps was produced by the U.S. Naval Oceanographic Office, Bathymetric Analysis Division in 1971. These are small-scale charts constructed on a regional basis for inclusion in the volume "The Mediterranean Sea: A Natural Sedimentation Laboratory". In general, the physiography is shown in greater detail and some re-interpretations of physiographic provinces afford improved validity over the MGS chart. The MGS chart was redrawn and updated with this new material on the NAR-8 base by Mr. Reuben J. Busch, in 1974; it is included in the data summary report (MC Report 104).

(U) Mr. Robert N. Bergantino of the Oceanographic Analysis Division, U.S. Naval Oceanographic Office has just completed an up-to-date physiographic relief chart on the NAR-8 base. This chart is given in the data summary report (MC Report 104).

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8.0(U) SEDIMENTS AND SUB-BOTTOM STRUCTURE (U)

(U) A great number of bottom samples has been collected from the Mediterranean Sea using a variety of collecting techniques (cores, grabs, dredges). Descriptions of these samples vary considerably in sophistication; some entail detailed laboratory examination while others represent a single word in a ships log. A recent summary of Mediterranean sedimentation has been given in reference 1. These data, of varying credibility, have been plotted, evaluated and ultimately used to compile a sediment map.

(U) There are six published references available with respect to observations of Mediterranean sub-bottom structure. These publications are given as references 2-7. No effort has been made to obtain unpublished data from either research institutions or petroleum companies.

(U) Figure 8-1 shows the location of 49 refraction stations. This listing was prepared and is retained by the U.S. Naval Oceanographic Office, Code 6120, from whom all information pertinent to the original data can be obtained. The stations are also described in the references as follows:

Station	Reference
1-5	2
6-12	3
13-19	4
20-46	5
47	6
48-49	7

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Figure 8-1(U). Locations of Refraction Stations (U)

9.0(C) BOTTOM LOSS AND BOTTOM BACKSCATTERING (U)

(U) Bottom reflection loss measurements have been reported for more than 125 sites in various areas of the Mediterranean Sea since 1960. These data were used in the development and/or validation of nine classification curves (labeled 1 through 9) for categorizing bottom reflection loss as a function of grazing angle as a function of area. These curves have been fitted to fourth degree polynomials. The locations of the measurement stations are shown in figure 9-1.

(C) Texas Instruments reported bottom reflection loss measurements for 45 Mediterranean stations occupied in the period from February to April 1967 as part of the MGS program for NAVOCEANO. A shooting ship detonated approximately two pound TNT sound sources at shallow depths on a schedule of ranges spanning the grazing angles from approximately 3 to 90 degrees and measured the source levels for each shot for the frequency range 0.5 to 12.0 kHz. A receiving ship, dead in the water, measured the received levels of each shot for each frequency of interest. Bottom reflection loss and total loss were reported for each shot for this frequency set. These stations were included in the more than 1300 employed in developing the 9 classification curves, as well as a similar set of curves developed by the Fleet Numerical Weather Center (FNWC) which are applicable to frequencies below 1.0 kHz.

(C) SACLANT ASW Centre returned to the Tyrrhenian Sea to an area previously reported by Hastrup and Lallement to conduct extended tests which were reported in 1962 by Hastrup. In these tests both explosive charges and an AN/SQS-26 sonar were used as sources, with a shallow suspended hydrophone as the receiver. The shooting and receiving ships were both repositioned simultaneously over a schedule of ranges to keep the area of bottom reflection constant at the midpoint of the intervening ranges for each set of measurements, thus minimizing any variability in the characteristics of the bottom at the point of reflection. The measured bottom reflection loss values in these tests agreed with the previously reported tests (Hastrup and Lallement, 1969) in which a near-bottom hydrophone has been employed as a receiver.

(C) The Bottom Reflection Active Sonar System (BRASS) program of the Naval Underwater Systems Center (NUSC) conducted ten bottom reflection loss runs at five stations in the Mediterranean using two submarines during March and April 1961. Measurements made at 4.5 and 2.15 kHz were reported in 1968 by Weaver, Geary, et. al. A single bottom reflection loss value is reported for each run, usually with a single sonar beam depression angle.

(C) The Joint Oceanographic Acoustic and System Test (JOAST) program of NUSC reported bottom reflection loss for one test area south of the Balearic Islands collected during August 1970 and reported by Hanrahan. An AN/SQS-26 (AXR) sonar was used as both source and receiver, and a submarine was employed as the target. Data were reported for various grazing angles from 12 to 45 degrees.

(C) NUSC conducted additional bottom bounce echo ranging trials at 17 stations in the Eastern Mediterranean during September 1971 which were reported in 1973 by Hanrahan, Podeszwa, Rembetski, and Fries. Again an AN/SQS-26 (AXR) sonar was used as the source and receiver with a submarine as the target. Received levels were measured by both ships.

(C) The Admiralty Underwater Weapons Establishment (AUWE) collected ten bottom reflection loss stations in three areas of the Mediterranean during the fall of 1960 which were reported by Reynolds and Pryce in 1961. Both explosives and a 3.25 kHz sonar were employed as sources. The bottom reflection loss data were averaged for each test area, rather than being reported as separate loss curves for each station.

(C) NAVOCEANO collected six bottom reflection loss stations in the Western Mediterranean during May 1972 which were reported in 1973 by Davis and O'Neill. A P-3 Orion aircraft was used to drop specially modified AN/SSQ-57 sonobuoys to receive and retransmit signals generated by SUS charges dropped to detonate at 60 or 800 feet along a schedule of ranges.

(C) The Naval Undersea Center (NUC) as part of the Integrated Mediterranean Program (IMP-70) occupied seven stations in the Mediterranean during 1970 to measure bottom reflection loss at low frequencies (100 to 500 Hz). These data were reported by Keir, and these stations are plotted on the Station Location Chart; however, they were not used in determining the bottom loss provinces for the Mediterranean for the 1.0 to 3.5 kHz range.

(C) SACLANT ASW Centre at La Spezia collected 28 stations from 1960 to 1967 using explosive sources for which Hastrup and Lallement reported bottom reflection loss measurements in 1969.

(C) Bottom backscattering has been measured at 44 stations for grazing angles ranging from 20° to 65° at 3.5 kHz. The locations of these stations are shown in figure 9-2. The data have been put into four groups (labeled A, B, C, and D) having similar backscattering strength vs grazing angle characteristics (reference 15).

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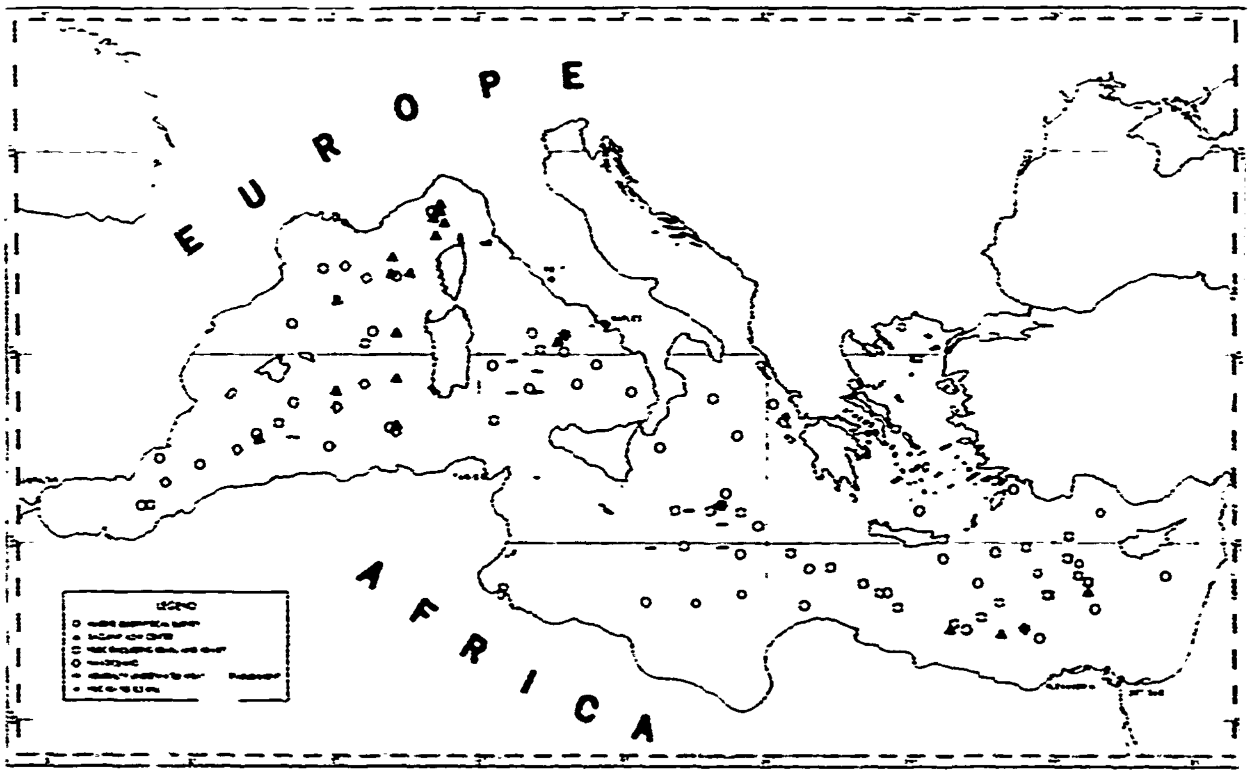

Figure 9-1(U). Major Bottom Loss Measurement Stations in the Mediterranean (U)

Figure 9-2(C). 44 Bottom Backscattering Stations (U)

10.0(U) BIOLOGICAL (U)

(U) As is well known, the effect of marine life on antisubmarine warfare is manifested in four different ways, namely: (1) as false targets; (2) as interfering biological sound producers; (3) as sound scatters and (4) as bioluminescent emitters.

(U) Potential submarine-like contacts in the Mediterranean have been identified in the form of several cetaceans and a number of schooling fishes. The characteristics of the larger marine animals capable of producing echoes individually, such as their size, grouping habits and swimming characteristics are known and have been tabulated. The locations of their occurrence and seasonal distribution are also known. Additionally, the identity, abundance and seasonal distribution of schooling fishes is also reasonably well known (References 1, 9, 10, 12 and 14). A summary of these facts is given in MC Report 104.

(U) The bioacoustic characteristics of the cetaceans, fishes and crustaceans in the Mediterranean have been tabulated in terms of frequency range, principal frequencies and source level or peak pressure. The distribution of these marine animals as a function of season has been tabulated. (References 1, 2, 4, 8, 9, 10 and 11). A summary of these facts is given in MC Report 104.

(U) Volume scattering or reverberation, which is primarily a biological pehnomenon, has two measures, namely:

1. the scattering strength S_c of a cubic yard of water, in dB; and

2. the scattering strength S_v of a column of water from the surface to the bottom of cross-section one square yard, in dB.

In the Mediterranean, the results of scattering strength measurements show that values are similar in the region 6-10 kHz and 12-20 kHz. Data are, therefore, generally summarized in four frequency bands of 3.5 kHz, 5 kHz, 6-10 kHz and 12-20 kHz.

(U) Measurements of S_c have not been made in all of the standard ASW prediction areas of the Mediterranean. However, extrapolation from an area with data to adjacent areas without data is considered reliable. Values of S_c have been tabulated for the winter and summer seasons, both for day and for night (Reference 3).

(U) On the other hand, few measurements of S_v have been made in the Mediterranean Sea, and extrapolation is not considered reliable. Scattering strength as a function of depth has been measured as shown in Table 10-1 (Reference 3).

(U) Bioluminescence in the Mediterranean is attributed to protozoa, crustaceans and jellyfish. Their seasonal distribution and abundance is known (References 5, 6, 7, 12, 13 and 15).

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TABLE 10-1(C)

Available Data, Indicated by X, for Scattering
Layer Depth and Strength (U)

Prediction Area**	3.5 kHz D*	3.5 kHz N	5 kHz D	5 kHz N	6-10 kHz D	6-10 kHz N	12-20 kHz D	12-20 kHz N
Winter								
B138		X		X		X		X
B142							X	X
B144	X	X	X	X	X	X	X	X
B158	X	X	X	X	X	X	X	X
B163	X	X	X	X	X	X	X	X
B173	X	X	X	X	X	X	X	X
Summer								
B138							X	X
B140		X						X
B141		X						X
B142							X	X
B144		X					X	X
B158		X						
B163		X						
B166		X						
B173		X						

* D - Day
N - Night

** Refers to NOVOCEANO Chart NA 8 p. 2401

11.0(U) SHIPPING DENSITY (U)

(U) A major effort was made in 1967 to obtain a complete picture of all ship positions in the Mediterranean on a single date, to coincide with a NATO worldwide analysis of shipping. While this effort was successful, the subsequent closing of the Suez Canal has caused modifications to the traffic patterns and shipping density in the Mediterranean. The data have been published by Keller and Weinstein (1971), who have also estimated the shipping density to reflect the change created by the closing of the Suez.

(U) Using data from the NATO study, as well as data from the World Meteorological Organization (WMO) and from Automated Marine International (AMI), Wolff (1974) has constructed tables of shipping density for use in the Fleet ASW acoustic prediction models. These tables give, for each month of the year, the average number of ships that would be expected in each one degree square. These data are included in MC Report 104.

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12.0(U) AMBIENT NOISE MEASUREMENTS (U)

(U) The measurement sites for the major ambient noise experiments conducted since 1960 are shown in figure 12-1. The characteristics of these measurements are summarized in table 12-1.

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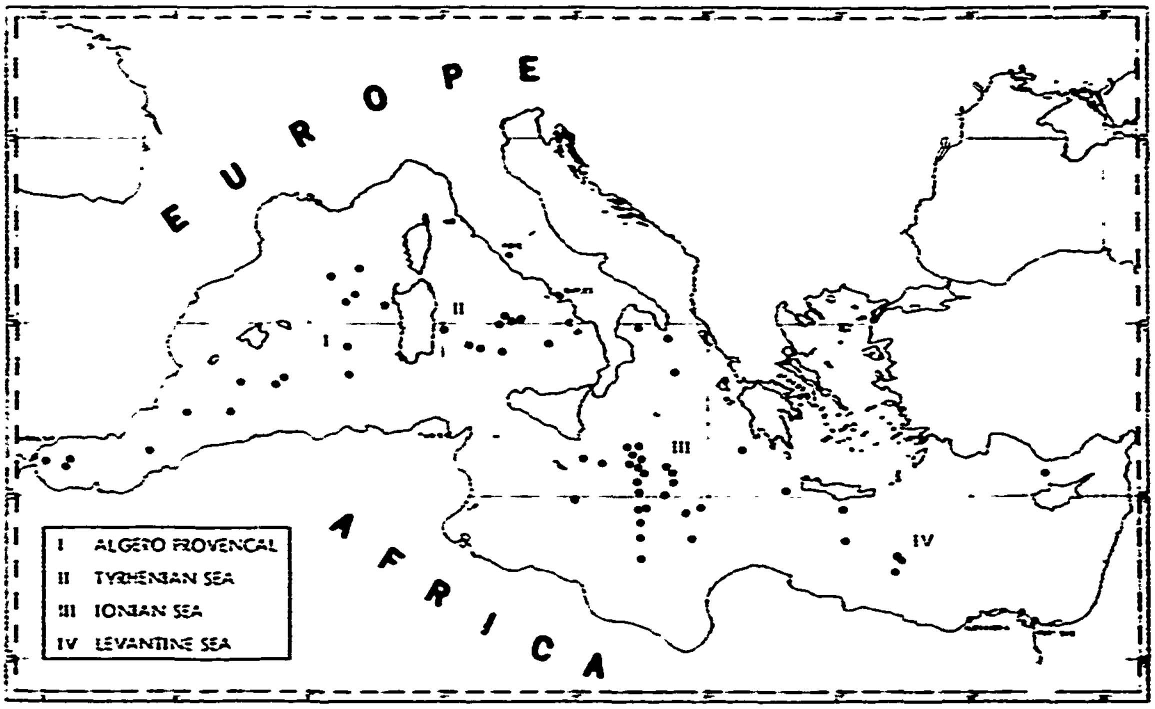

Figure 12-1(U). Ambient Noise Studies in the Mediterranean, 1960 to 1973 (U)

TABLE 12-1 (C)

A SUMMARY OF AMBIENT NOISE MEASUREMENTS IN THE MEDITERRANEAN SEA (U)

Reference	Meas. Date	Latitude	Longitude	Basin	No. of Meas.	Frequency Range	Meas. Depth(m)
Lomask, Frassetto (1960)	7/60 - 10/60	40°N 40°N	15°E 15°E	II	2	20-200 Hz	183
Arase, Arase (1968)	6/68	40°10'N 39°10'N 36°40'N 36°10'N 33°40'N	12°58'E 6°30'E 17°40'E 17°35'E 25°10'E	II I III III IV	4	20-500 Hz	29
Hays, Murphy (1969)	7/68	38°17'N	3°53'E	I	12	50-2000 Hz	107, 137 305
		40°33'N	7°53'E	I			92, 183 276
	6/68	39°55'N	10°00'E	II			
Hersey (1969)				I, II III, IV	4	20-900 Hz	92, 183 297, 29
White, Horton (1969)	12/68 11/68 11/68 11/68	Note: Data Averaged from Individual Sonobuoy Drops		I II III IV	23 8 5 15	20-2000 Hz	28 shallow 92 deep
Sanders Assoc. (1969)	14-20 11/68	34°40'N 34°50'N 34°50'N 34°41'N	19°40'E 17°27'E 17°27'E 25°13'E	III III III	12	20-2000 Hz	31 and 92
Sanders Assoc. (1969)	4/14/69 4/16/69 4/17/69 4/19/69 4/20/69 4/20/69 4/22/69 4/23/69 4/24/69	40°10'N 40°05'N 33°07'N 32°55'N 38°20'N 35°30'N 41°20'N 35°55'N 35°55'N	12°20'E 12°08'E 27°17'E 27°07'E 02°30'E 02°00'W 05°45'E 18°30'E 18°30'E	II II IV IV I I I III III	54	20-2000 Hz	28 and 92
Gerrebout, Leroy (1968)	Var.	36°64'N	05°17'W	I	2 avg. plots	100-2000 Hz	1281
Sanders Assoc. (1970)	18-29 1/70			I, II, III, IV		20-2000 Hz	28 92
Morey, Macphee, (1970)	1/70	35°55'N	18°30'E	III	4 avg. plots		92 to 3K
Baxter (1971)	7/70	40°30'N 40°30'N 37°46'N 37°21'N 36°07'N 35°41'N 35°35'N 40°00'N	6°45'E 6°57'E 6°25'E 11°28'E 16°55'E 17°52'E 17°57'E 13°03'E	I I I III III III III II	210 spectra	20-500 Hz	18, 92, 458

TABLE 12-1 (C) (Continued)

A SUMMARY OF AMBIENT NOISE MEASUREMENTS IN
THE MEDITERRANEAN SEA (U)

Reference	Meas. Date	Latitude	Longitude	Basin	No. of Meas	Frequency Range	Meas. Depth(m)
Murphy (1971)	7/70	36°00'N	17°00'E	III	13 spectra		18 92 458
Weigle, Watt (1971)	11/70	38°30'N 37°30'N 37°30'N 36°30'N 36°00'N	04°00'E 02°00'E 05°00'E 01°00'W 04°00'W	I I I I I	22	10-4000 Hz	170 to 2477
Kingsbury, Owisey (1972)	7/71	39°30'N 39°30'N 35°00'N 36°30'N	14°00'E 11°00'E 15°00'E 17°00'E	II II III	11	(Ambient Noise Vertical Directionally No Omnispectra)	92-1830 34 458-920
Hasse (1971)	10/71		Reference IOMEDEX Summary				
IOMEDEX Summary (1973)	11/71	36°18'N 33°00'N 38°40'N 36°15'N 36°30'N 39°50'N 36°00'N 33°40'N 34°15'N	17°12'E 17°30'E 18°40'E 15°20'E 21°20'E 18°32'E 16°00'E 17°30'E 17°30'E	I	72	10-5000 Hz Spectra presented. Continuous data available at various depths. Detail wind and depth correlations also appears in supporting reports. Data available in IOMEDEX library.	30 2652
IOMEDEX (1973) (Cont.)		35°25'N 36°00'N 37°35'N	17°30'E 17°30'E 18°05'E			10-5000 Hz	
Martin, Perrone (1973)			Reference IOMEDEX Summary				
Marshall (1973)			Reference IOMEDEX Summary				
Frish (1972)			Reference IOMEDEX Summary				
Gaul, et al. (1972)			Reference IOMEDEX Summary				
McCloskey, Gottwald (1972)	8-9/72	36°20'N 36°20'N	17°37'E 17°28'E	III	9	10-500 Hz Spectral plots and continuous measurements over 11-day period at various depths available.	301 333 944 1556 2167 2779

13.0(U) PROPAGATION LOSS MEASUREMENTS (U)

(U) A review of the literature on measured sound propagation loss in the Mediterranean Sea has been made to identify those experiments whose results have been reported in sufficient detail for interpretation or analysis through modelling techniques and that have direct applicability to sensor system performance evaluation experiment planning. From this review, 11 reports, which are results of nine major experiments, are considered to contain adequately documented data. These are identified and their major characteristics are summarized in table 13-1. The entry under the column labeled basin in table 13-1 corresponds to the basin numbering appearing on figure 13-1.

(U) A summary of the results of these experiments is given in MC Report 104.

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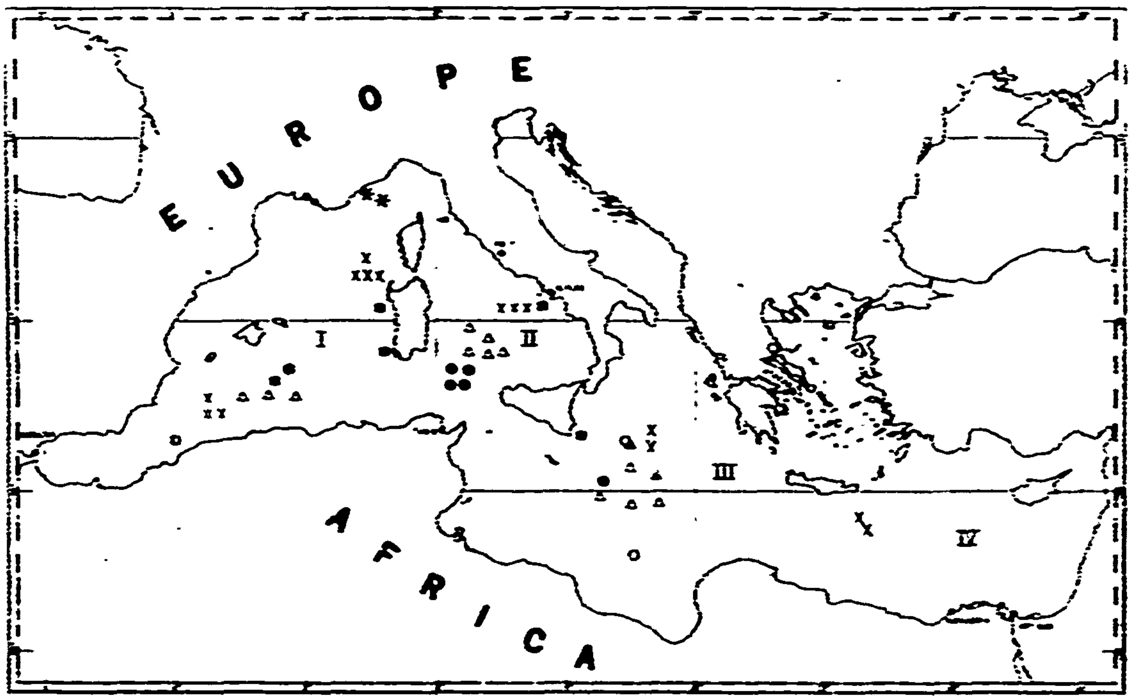

LEGEND

REFERENCE	SYMBOL	SOURCE
38	◻	WESTON (1964)
30	▲	REYNOLDS (1960)
13	■	HAYES (1968)
9	x	COLE (1971)
3	✱	ALLAN (1970)
31	●	SCHUMACHER (1972)
24, 25, 26	○	IOMEDEX (1971)
33	▲	TASSRAP (1972)

NOTE: MGS STATIONS (REFERENCE 34) ARE SHOWN IN FIGURE 9-1.

Figure 13-1(C). Location of Receivers in Propagation Loss Experiments Since 1960 (U)

TABLE 13-1 (C)

A SUMMARY OF PROPAGATION LOSS MEASUREMENTS IN THE MEDITERRANEAN SEA (U)

Ref.	Date of Meas.	Basin	Frequency Range	Source Type/ Depth	Receiver Depth	Max. Range	No. of PL
38	July 1960	I	25 Hz to 6.4 kHz	Explosive 24' to 360'	24' to 360'	40 nm	8
30	Dec 1960	I, II, III	2.4 to 4.8 kHz	Pulsed CW Explosive 100'/300'	100'/300'	50 nm	95
34	Feb March April 1967	I, II, III, IV	0.5, 1.0, 2.0, 3.5, 8.0, 12.0 Hz	Explosive Nominal 100-150 m	Nominal 150 m	30 kyd	≈ 300
13	July 1968	I, II, III, IV	35/100 Hz	Explosive 60'/800'	Various 200-2600 ft.	Various 80-500 nm	50
3	Feb 1970	I	1/4 kHz	30/200 m	20, 50, 100 200, 500 m	30 km	10
9	Sept 1970	I, II, III, IV	3.5 kHz	Active Sonar Shallow	25, 50, 150, 200, 500, 1000 ft.	55 kyd	84
31	Oct 1970	I, II, III,	Bands 25/50/80/100/ 200/400/500/ 1000 Hz	Explosive 300'/800'	60, 350, 800 ft.	190 nm	129
25	Oct/Nov 1970	III	125 Hz	CW 500'	270, 490, 1050 1550, 2010 ft	200 nm	5
24	Oct/Nov 1970	III	125 Hz	CW 137 m	135, 615, 1115, 2375, 2650 m	140 nm	12
26	Oct/Nov 1970	III	125 Hz	CW 152 m	135, 615, 1115 2375, 2650 m	200 nm	27
33	Aug/Sept 1972	III	130 Hz	CW 410 ft.	80' to 9118'	55 nm	2

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Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
HLR167; CU-195-69-ONR-266-PHYS	Hardy, W. A.	PROJECT APTERYX: FINAL REPORT (U) (HUDSON LABORATORIES OPERATION 245)	Columbia Univ./ Hudson Labs	690301	NS; ND	C
MCR002	Unavailable	MEDITERRANEAN SEA ENVIRONMENTAL ATLAS FOR ITASS (U)	Maury Center for Ocean Science	691001	NS; ND	C
NUSCNL3018	Unavailable	TECHNICAL PLAN FOR IMPLANTMENT OF THE TEST BED ARRAY FOR THE LONG RANGE ACOUSTIC PROPAGATION PROGRAM (LRAPP) (U)	Naval Underwater Systems Center	700810	NS; ND	C
Project469 149429855R700	Balaban, M. M.	LRAPP TEST BED ARRAY CABLE FAILURE ANALYSIS (U)	TRW Systems Group	710730	AD0516710; NS; ND	C
BKDCN667	Bernard, P. G., et al.	TECHNICAL DIAGNOSTIC ANALYSIS OF LRAPP TEST BED PROGRAM FAILURE (U)	B-K Dynamics, Inc.	710802	AD0516656; NS; ND	C
NUSCPUB6002	Unavailable	IOMED EXPERIMENT. PRELIMINARY DATA REPORT (U)	Naval Underwater Systems Center	711206	NS; ND	C
ADL ED 15316; ADL-116-672	Unavailable	SQUARE DEAL EXERCISE PLAN (U)	Arthur D. Little, Inc.	720301	ND	C
ADLR4560372	Sullivan, D. L., et al.	PRELIMINARY ANALYSIS OF ACODAC MEASUREMENTS NEAR MADEIRA ON 13-16 OCTOBER 1971 (U)	Arthur D. Little, Inc.	720331	AD0595812; NS; ND	C
MCR07	Gaul, R. D., et al.	IOMEDEX SYNOPSIS ON ENVIRONMENTAL ACOUSTIC EXERCISE IN THE IONIAN BASIN OF THE MEDITERRANEAN SEA NOVEMBER 1971.	Maury Center for Ocean Science	720401	NS; ND	C
P1243	Unavailable	FINAL REPORT ACOUSTIC TEST ARRAY (U)	Raytheon Co.	720831	AD0522104; NS; ND	C
Unavailable	Unavailable	CHART-BATHYMETRIC-SQUARE DEAL EXERCISE (U)	Naval Oceanographic Office	730601	AU	C
TM SA23-C275-73	Wilcox, J. D.	A DESCRIPTION OF THE LRAPP ATLANTIC TEST BED ARRAY FOR MOTION PREDICTION STUDIES (U)	Naval Underwater Systems Center	731212	ND	C
Unavailable	Unavailable	CHURCH ANCHOR AMBIENT NOISE REPORT (U)	Texas Instruments, Inc.	740501	AU	C
Unavailable	Hoffman, J., et al.	CHURCH ANCHOR CW PROPAGATION LOSS AND SIGNAL EXCESS REPORT(U)	Texas Instruments, Inc.	740701	AU; ND	C
MCR104	Unavailable	MEDITERRANEAN ENVIRONMENTAL ACOUSTIC SUMMARY (U)	Maury Center for Ocean Science	740701	NS; ND	C
OSTP-39	Romain, N. E.	OSTP-39 NER: ANALYSIS OF DATA FROM A FIELD TRIAL OF THE LAMBDA ARRAY (U)	Westinghouse Electric Corp. and Bell Laboratories	740930	ND	C
MC-103	Unavailable	MEDITERRANEAN ENVIRONMENTAL ACOUSTIC DATA CATALOG (U)	Office of Naval Research	750501	ND	C
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