United Nations Environment Programme

Distr.
RESTRICTED

UNEP/WG.118/Inf.24
24 May 1985

Original: ENGLISH

Third Meeting of the Working Group for Scientific and Technical Co-operation for MED POL

Athens, 27-31 May 1985

Mediterranean action plan

Long-Term Programme for Pollution Monitoring and Research in the Mediterranean Sea (MED POL - PHASE II)

INFORMATION ON RESEARCH ACTIVITIES RELEVANT TO THE PHYSICAL DYNAMICAL PROCESSES AFFECTING POLLUTANT TRANSPORT IN THE MEDITERRANEAN SEA

(document prepared by the International Oceanographic Commission)

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Third Meeting of the Working Group for
Scientific and Technical Co-operation
for MED POL

Athens, 27-31 May 1985

Long-Term Programme for Pollution Monitoring and Research in the Mediterranean Sea (MED POL - PHASE II)

INFORMATION ON RESEARCH ACTIVITIES RELEVANT TO THE PHYSICAL DYNAMICAL PROCESSES AFFECTING POLLUTANT TRANSPORT IN THE MEDITERRANEAN SEA

Prepared by Dr. M. Gerges, IOC Consultant

INFORMATION ON RESEARCH ACTIVITIES RELEVANT TO THE PHYSICAL DYNAMICAL PROCESSES AFFECTING POLLUTANT TRANSPORT IN THE MEDITERRANEAN SEA

1. INTRODUCTION

Among other activities, the "Long-term Programme for Pollution Monitoring and Research in the Mediterranean Sea", known as "MEDPOL-Phase II" of the Mediterranean Action Plan, includes an activity "F" which deals with "RESEARCH ON OCEANOGRAPHIC PROCESSES". In this context, the term "oceanographic processes" comprises those physical-dynamical processes which affect horizontal circulation and vertical transport of pollutants in the Mediterranean Sea. The research on oceanographic processes under Activity "F" thus aims at the preparation of a scientific review document on the above subject, which should describe the state of knowledge in this field and as a basis for further scientific research and monitoring activities along this line in the Mediterranean Sea.

With the above in view, the present study was prepared to outline the different on-going activities, carried out by the various research laboratories, particularly in the Mediterranean countries, and to provide the basic sources of information relevant to the subject matter of activity "F". The study concludes with a proposed outline for the scientific review document to be prepared under this activity.

In order that the information given here be as complete, comprehensive and up-to-date as possible, a brief questionnaire (Annex I) was sent to 84 research institutions, departments and laboratories in the Mediterranean countries, as well as to many individual scientists, known to be active in the field of physical oceanographic research on the Mediterranean (Annex II). Based on the responses received and on further information gathered through personal contacts with Mediterranean scientists, the present document was compiled. It is intended to further complete and update this information before the preparation of the scientific review document. In this respect, further co-operation with scientists active in this field is solicited.

2. SYNOPSIS OF RESPONSES TO THE QUESTIONNAIRE

In the light of the replies received in response to the IOC questionnaire, and from the discussions held with individual scientists, Table (I) was constructed. The table gives some details of the activities presently carried out by Mediterranean and non-Mediterranean research laboratories and institutes. Table (II) summarizes the work being done in various regions of the Mediterranean basin, and the main scientific research institutions carrying out this work in each of the respective regions. On the basis of Tables (I) and (II) the following remarks may be made.

2.1 A great deal of work has been done on the Strait of Gibraltar and on the Western Alboran Sea. Intensive oceanographic investigations have been carried out in this area by French, Spanish and American Institutions and

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scientists. These investigations ranged from conventional hydrographic observations and current measurements to the use of highly advanced remote sensing and modelling techniques.

Apparently, questions related to the Mediterranean outflow to the Atlantic, although previously studied intensively by French and Spanish scientists, still attract the attention of various investigators. For example, American scientists at Woods Hole Oceanographic Institution (W.H.O.I.) are planning further investigations in this regard, in co-operation with Spanish scientists and, in the meantime, French scientists are still engaged in research on the Gibraltar Strait and the Alboran Sea. A laboratory model has also been constructed at WHOI to study the effect on the Mediterranean outflow of the earth's rotation and of the stratification in the water body.

2.2 In the Western Mediterranean, attention has been given to the study of the Ligurian and Tyrrhenian Seas and the Gulf of Lyon, mainly by Spanish, Italian and French scientists. In this connexion, particular attention has been devoted to the study of circulation and dynamics, both large and mesoscale, and to the questions of deep water formation. Remote sensing techniques have been widely applied in this region. Besides, some theoretical studies have been undertaken aiming at modelling the physical oceanographic processes.

2.3 In the Central Mediterranean, only the Adriatic Sea has been studied by Italian and Yugoslav scientists. General hydrographic information has been collected for many years, and, at the present time, great emphasis is put on the question of dense water formation in the Northern Adriatic and on the mathematical modelling of the general circulation. Remote sensing data are also collected and analyzed, mainly by Italian scientists. Attention is also given to some practical applications such as wave forecasting, pollutant transport and sediment suspension in the Adriatic Sea. Other areas of the Central Mediterranean, particularly its Southern parts are very poorly studied (e.g. Libyan and Tunisian waters).

2.4 The Eastern Mediterranean, including the Aegean, Ionian and Levantine Seas are studied mainly by Greek, Turkish, Israeli and Egyptian scientists. In most cases, these investigations are concentrating on the hydrography of coastal waters of the above countries. However, some open sea studies have been carried out by individual scientists and institutions in the region on an occasional basis to investigate the problem of formation and spreading of the Levantine Intermediate Water (LIW). This question and other related phenomena are, however, still far from being fully understood, and further extensive studies are needed to investigate the driving mechanisms of these processes and many related problems.

2.5 Current measurements, using self-recording current meters from moorings are now performed by many institutions all over the Mediterranean. Most of the institutions are using Aanderaa current meters. In addition, CTD

or STD data and meteorological observations are obtained. However, there are still some institutions, particularly in the Eastern Mediterranean, which are still using conventional hydrographic methods and lack facilities for obtaining current measurements.

3. DATA ACQUISITION, STORAGE AND AVAILABILITY

Through the physical oceanographic activities described above, as well as from previous investigations, a very wide range of oceanographic data has been collected. These data range from simple hydrographic observations to the most advanced satellite imagery obtained by remote sensing techniques. However, from the replies received, it is obvious that in most cases, the data acquired are not systematically deposited in any regional or international data centre. Individual scientists and institutions collecting the data seem to restrict the use of data for their individual scientific and national purposes. The only exception may be the case of French institutions, the majority of which, if not all, systematically deposit the data in the Bureau National des Données Océanographiques (B.N.D.O.), at the "Centre Océanographique de Bretagne" (C.O.B.), Brest. This Centre now acquires all available historical data, evaluates its validity and provides statistical summaries of all data available. Besides, a considerable amount of oceanographic data on the Mediterranean is stored in the World Data Centre (WDC)-B in Moscow-USSR, within the scheme of the International Oceanographic Data Exchange (IODE) system.

The data available at the B.N.D.O. of C.O.B. Brest was the basis for an atlas on the Mediterranean Sea provisionally entitled "Atlas Hydrologique de la Méditerranée", which is now under preparation by the Laboratoire de Océanographie Physique in Paris (Figure 1-5).

A N N E X I

Proposed Outline of the Scientific Review Document

Title : State of knowledge related to oceanographic processes affecting horizontal circulation and vertical transport of pollutants in the Mediterranean Sea

Contents :

1. GENERAL INTRODUCTION

   Objectives of MED POL-VI and MED POL-Phase II, Activ. "F"
   Purpose of the present review
   Presentation of the review contents

2. PHYSICAL PROCESSES AFFECTING POLLUTANT TRANSPORT

3. PHYSICAL OCEANOGRAPHIC KNOWLEDGE OF THE MEDITERRANEAN

   Western Basin
   Eastern Basin

4. WATER MASSES OF THE MEDITERRANEAN

   Identification in Western and Eastern Basins : Atlantic surface water, Levantine Intermediate Water, Deep Water Mass.

   Formation and spreading of water masses
   Associated processes :
   - water sinking
   - mixing - transformation

5. HORIZONTAL CIRCULATION

   Based on hydrography and water mass distribution
   Dynamical computations
   Numerical modelling
   Current measurements

6. VERTICAL WATER MOVEMENTS

   Methods of observation
   Available information

7. HORIZONTAL AND VERTICAL POLLUTANT TRANSPORT

   Source-sink system
   Possible mechanisms and pathways

8. SUMMARY AND CONCLUSIONS

ANNEX II

Distribution List of the Questionnaire by Country+ and Indication of Response

A. Mediterranean countries

	Name and Institution	Response
CYPRUS	1. A. Demetropoulos Fisheries Dept. Nicosia	
EGYPT	2. N. Dowidar Oceanography Dept. Alexandria Univ.	**
	3. A. El-Gindy " " " "	*
	4. S. El-Sharkawy Inst.Oceanog. and Fisheries, Alexandria	
	5. Y. Halim, Oceanography Dept. Alexandria Univ.	**
	6. A. Karam, Institute Oceanog.and Fisheries, Alexandria	**
	7. M. Osman Oceanography Dept, Alexandria Univ.	**
FRANCE	8. D. Chabert Mont Bennot, Saint Ismier	
	9. M. Crepon Lab. Oceanographic Physique (L.O.P.), Paris	
	10. M. Fieux L.O.P., Paris	**
	11. J.C. Gascard L.O.P. Paris	**
	12. J. Gonella L.O.P.	**
	13. A. Ivanoff, Lab. Physique et Chimie Marines, Paris	
	14. H. Lacombe L.O.P., Paris	**
	15. C. Millot, Antenne L.O.P., La Seyne sur Mer	**
	16. A. Morel, Lab. Physique et Chimie Marines, Villefranche	
	17. J. Peres Station Marine d'Endoume, Marseille	
	18. C. Richez L.O.P., Paris	**
	19. B. Saint-Guily Laboratoire Arago, Banyuls sur Mer	**
	20. J. Soyer " " "	**
	21. L. Wald Centre de Télédétection, S. Antipolis, Valbonne	
	22. Director/STARESO, Station Res.Sous Marine et Océanographie, Calvi	

+ in alphabetical order
* response by correspondance
** contacted personally

A N N E X II (contin.)

Country	Name and Institution	Response
GREECE	23. Baloupoulos Inst.Oceanog. and Fisheries Res. (IOKAE) Athens	**
	24. A. Lascaratos Dept. App. Phys. Univ. of Athens	**
	25. Papaliou Univ. of Patras	
	26. A. Theocharis IOKAE, Athens	**
	27. C. Vasilikiotis, Fac.Phys. and Math. Univ. Thessaloniki	
	28. Director, IOKAE, Athens	
ISRAEL	29. A. Hecht Oceanog. and Limnological Res. Ltd.Haifa	*
ITALY	30. Astraldi Centro Ricercha Energ. Ambiente (ENEA) Santa Teresa	
	31. V. BARALI Inst. Studio Dinamica Grandi Masse (ISDGM), Venezia	
	32. A. Bergamasco I.S.D.G.M. Venezia	
	33. D. Bergant C.N.R. Instituto Talassografico, Trieste	
	34. M. Bernhard ENEA, Santa Tereza	
	35. L. Bertotti I.S.D.G.M., Venezia	
	36. Bohn Instituto di Fisica, Univ. diRoma, Rome	
	37. G. Buffoni ENEA, Santa Tereza	
	38. L. Cavaleri I.S.D.G.M., Venezia	*
	39. Colacino Instituto di Fisica dell 'Atmosphera (I.F.A.) Roma	
	40. P. Franco Instituto di Biologia del Mare, Venezia	*
	41. R. Frassetto I.S.D.G.M., Venezia	
	42. G. Gasparini C.N.R. Santa Tereza	
	43. G. Grancini Osserv.Geofisica Sperimentale (S.G.S.), Trieste	
	44. T. Hopkins Saclant ASW Research Centre, La Spezia	*

ANNEX II (contin.)

YUGOSLAVIA	65. M. Gacic Inst. of Oceanography and Fisheries, Split	**
	66. M. Kuzmic Rudjer Boskovic Inst., Zagreb	
	67. T. Legovic Rudjer Boskovic Inst. Zagreb	
	68 J. Ljubomir Dept. of Planning and Env., Zagreb	
	69. P. Tusnik Marine Research and Training Centre, Piran	*
	70. M. Zore-Armanda Inst. Oceanog. and Fisheries, Split	*

B. NON-MEDITERRANEAN COUNTRIES

FEDERAL REPUBLIC of GERMANY	71. W. Krauss IFML, Kiel	
	72. W. Roether Inst. fur Umweltphysik, Heidelberg	
U.K.	73. T. Allan Institute of Oceanographic Sciences (IOS) Wormley	
	74. H. Cattle Meteorological Office, Bracknell Berks	
	75. H. Charnock Dept. of Oceanog. Univ. of Southampton	
	76. Elliot I.O.S. Wormley	
	77. Guymer I.O.S. Wormley	
U.S.A.	78. T. Kinder Woods Hole Oceanog.Institution (WHOI) Woods Hole	*
	79. U. Kourafalo University of Miami, Florida	
	80. P. la Violette Norda, St.Louis, Mississippii	**
	81. S. Murray Coastal Studies Inst. Louisiane State Univ.	*
	82. N. Pinardy Harvard Univ. Boston	
	83. D. Stanley Smithonian Institution, Washington	**
	84. J. Whitehead W.H.O.I. Woods Hole	*

TABLE (I)

ON-GOING RESEARCH ACTIVITIES IN THE MEDITERRANEAN SEA CARRIED OUT BY DIFFERENT INSTITUTIONS *

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main Fields of Research	Type of Data Obtained
1. Instituto Espanol de Oceanografia Madrid - Spain	Strait of Gibraltar and Alboran Sea	- Alboran sea dynamics and water mass distribution - Strait of Gibraltar (sea level, Atlantic-Mediterranean water exchange, internal waves)	-Current measurements: Aanderaa C.M.; shelf waters, duration 1 - 2 months. -Temp., Sal., Oxygen, Nutrients, -Meteorological data (wind, atmospheric pressure, air temp) Data partially deposited.
2. Woods Hole Oceanographic Institution Woods Hole, U.S.A.	Strait of Gibraltar and Alboran Sea	- Laboratory Model of : 1. Effects of earth's rotation and stratification on the flow out through the Strait of Gibraltar. 2. Effect of coastal slope on coastal jet.	-Relevant laboratory data
3. Stazione Oceanografica (C.N.R.) Santa Tereza, Italy	Archipelago of la Maddalena (Sardinia); East Ligurian Sea, Central Tyrrhenian Sea	- Hydrodynamic characteristics of the Gulf of Taranto - Study of coastal circulation in relation to the present forcing mechanisms	-Current measurements (Aanderaa, NBA, Neil Brown, General Oceanic; Moorings, 1-8 months duration). -Temp., salinity (CTD), Sea Level -Meteor.data:wind and atmos. pressure (Aanderaa Meteo. Station). Deposited in COB, Brest

* Based on information received in response to the questionnaire up till 30 November 1984

TABLE (I) continued

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main Fields of Research	Type of Data Obtained
4. Inst. Studio Dinamica Grandi Masse (CNR) Venezia, Italy	Adriatic Sea Mediterranean Sea	- Mathematical models of the general circulation - Models for wave forecast - Remote sensing of pollutants - Sediment suspension in polluted areas	-wave measurements -remote sensing data -mete.data from oceanographic tower -pollution data on rivers discharging in Venice Lagoon
5. Marine Research Centre Beirout, Lebanon	Coastal waters of Lebanon	- Basic hydrography - Study of coastal currents	-current measurements(Aanderaa) -temp., salinity, oxygen -STD (Inter Ocean probe). -Meteo data (Air temp., humidity, atm. press.).
6. Inst. Fisica dell'Atmosfera (CNR) Roma, Italy	?	- Theoretical studies on : 1.The physics of air-sea interaction, 2.The baroclinic instability problem in ocean models - Experimental work on air-sea interaction and the analogic simulation in a rotating tank - Study of large scale dynamics of marine systems	-current measurements(Aanderaa) -temperature (Aanderaa thermistor -meteo data: wind profile with the remote sensing technique (SODAR); wind components; air temp.; at.pressure; humidity, all at different levels. Deposited in N.O.D.C.

TABLE (I) continued

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main Fields of Research	Type of Data Obtained
7. Institute ofMarine Science (METU) Erdemli - Içel - Turkey	NE Levantine Basin	- Investigation of meso-scale dynamics - Base-line study of hydrographic conditions - Modelling of physical processes in the seas around Turkey (particular attention to LIW formation) - Structure of semi-permanent circulation features and mixing in straits	-current measurements(Aanderaa RCM-4),EG&G CT/3; at depth ranging from 5 to 45 m, duration from 1 month to 1 yr) -temp., salinity, oxygen -pH, suspended sediment total dissolved material, nutrients -meteo data, air temp. atm. pressure, relative humidity
8. Department of Physics, University La Sapienza, Roma, Italy	Adriatic Sea Strait of Messina	- Dense water formation in the Adriatic - Tides - Turbulence - Fronts at the Strait of Messina	-CTD casts -satellite imegeries Deposited at Brest
9. Instituto Biologia del Mare Venezia - Italy	Northern Adriatic	Multi annual cruises to study : - Oceanographic properties related to circulation and transport of nutrients, suspended matter and phytoplanktonic biomass in different conditions of vertical stability	-temp., salinity -irradiance in PAR range -bean transmittance -diss.oxygen,pH, nutrients, -suspended matter -chlorophylls -phytoplankton biomass -meteo data:wet-dry temp., pressure, wind

T A B L E (I) continued

Research Institutions/Laboratories	on-going (or recently completed activities		
	Area covered	Main Fields of Research	Type of Data Obtained
10. Coastal Studies Institute Lousiana State Univ. Baton Route, USA	Along the Nile Delta, Egypt	- Physical oceanographic studies - Coastal boundary layer dynamics	-temp., salinity, turbidity -current measurements: Endeco 174 and 1174 -entensive meteo observations Data not deposited
11. Woods Hole Oceanographic Institution Woods Hole, USA	Gibraltar Strait, Western Alboran Sea, Gulf of Cadiz (the area of the Atlantic Ocean just west of the Strait). (Donde Va? project)	- Dynamics and variability of the Alboran anticyclonic gyre using: field measurements, remote sensing and numerical modelling - Structure of the intermediate and deep water flows and the contribution of these waters to the Mediterranean out-flow - Biological and chemical influence on the gyre's strong ocean color signal in relation to the physical structure of the gyre - Influence of atmospheric forcing on the gyre, both directly and through changes in the Atlantic in flow	-satellite monitoring data -hydrographic data obtained at the grid points -current meter moorings -AXBT flights -shore-based current measuring radar (CODAR) -meteo and aerosal data -NOAA 7 and NIMBUS 7 images

T A B L E (I) continued

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main Fields of Research	Type of Data Obtained
12. Institute of Oceanography and Fisheries - Mediterranean Branch and 13. Oceanography Dept., Alexandria, University, Egypt	Egyptian Mediterranean coastal waters	- Study of hydrographic conditions along the Egyptian coast - Study of coastal currents - Study of the Mediterranean-Suez Canal Region - Hydrographic studies of the coastal lakes - Physical studies related to coastal erosion and pollution problems - Study of dynamical and hydrographic conditions and its seasonal variations in the Eastern Mediterranean	- temperature, salinity - current measurements: surface drifters; Aanderaa C.M. moorings: 25 m.depth-10 days - instantaneous measurements - sea level data - meteo data : wind, atmospheric pressure, air temperature

T A B L E (I) - continued

Research Institutions/Laboratories	on-going (or recently completed activities		
	Area covered	Main fields of research	Data obtained
14. Laboratoire d'Océanographie Physique, Paris, France and other French institutions e.g. : -Centre National de la Recherche Scientifique CNRS (Programme Inter-disciplinaire de Recherche Océanographique PIRO) - Centre National d'Etudes Spatiales (Toulouse) - Centre National de Recherche Météorologique CNRM (Lannion) - Centre National pour l'Exploration des Océans (CNEXO)	Western Mediterranean: Gibraltar Strait and Alboran Sea	- Remote sensing studies of the Alboran Sea	-remote sensing data
	North Western Mediterranean	- Study of frontal structure close to sea surface - Study of Ligurian current (PROLIG) - Mesoscale ocean dynamics (DYOME)	-current measurements: deep moorings :1 year duration -CTD data -meteo observations
	Gulf of Lyon, South of Marseille	- Interdisciplinary programme for the study of coastal shelf dynamics - Study of turbulence and abyssal circulation - Geological/sedimentological studies with physical oceanographic component to study near bottom currents (Project ECO-MARGE) - Physical-chemical-biological studies (Project MEDIPROD, completed in 1981)	# all French data are deposited in Brest Data Centre (B.N.D.O.)
	The area between Toulouse (France) and the Eastern Mediter-ranean	- Project VICOMED to study the stable isotopes composition of sea water in relation to hydrography and chemistry (large scale survey planned for fall 1985/winter 1986)	

TABLE (I) continued

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main Fields of Research	Type of Data Obtained
15. Institute of Oceancgraphic and Fisheries Research (IOKAE) Athens, and 16. The Hellenic Hydrographic Oceanographic Service, Athens, Greece, and 17. Dept.of Applied Physics, Univ. ofAthens	Aegean and Ionian Seas Coastal waters of the Greed (mainland and islands)	- Surface and deep currents - Water masses and dynamics - Base-line studies for applied research such as underwater construction, installation of sewage outfalls, pollution studies, etc ...	-temp., salinity, diss.Oxygen, pH, nutrients, trace elements -tidal observations -current measurements (surface by drift cards and deep by Aanderaa current meters) -meteo observations and sea-state -data to be deposited in N.O.D.C.
18. Institute of Biology-Univ. of Ljubljana, Marine Research and Training Centre, Piran, Yugoslavia	Adriatic Sea	- Hydrography within yugoslav-Italian bilateral research project	-hydrographic data: temp., salinity, BT, secchi disc, water color -meteo observations: sea state, air temp., atmospheric pressure, wind, cloud, visibility, -data deposited in N.O.D.C.
19. SACLANT ASW Research Centre La Spezia, Italy	Alboran Sea Tyrrhenian Sea	- Large scale circulation in the Alboran Sea - Fire scale vertical structure in the Central Tyrrhenian - Hydrography of the Tyrrhenian and Alboran Seas - Study of density field and circulation patterns	-hydrographic data: temp., salinity and oxygen -current measurements:Aanderaa, NBIS, Weller, VACM, subsurface moorings down to 2000 m., one to two months duration -meteo observations -remote sensing data -no data deposited

T A B L E (I) - continued

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main fields of research	Data obtained
20. Israel Oceanographic and Limnological Research Ltd., Haifa, Israel	South Eastern Levantine 32°N to 43°30'N and 32°30'E to 34° 30'E	- Study of hydrographic conditions - Dynamics of the region - Formation and spreading of Levantine Intermediate Water - Atlantic water penetration	-Hydrographic data: four cruises/ year; 30 stations/cruise: CTD data; dissolved oxygen -standard meteo observations -some data deposited in WDC
21. Institute of Oceanography and Fisheries, Split, Yugoslavia	North Adriatic Sea	- Study of frontal zones in the N.Adriatic (in MEDALPEX) - Long-term changes of Oceanographic parameters - Influence of wind on surface waves and currents - Field experiments on water exchange of semi-closed bays and adjacent basins, synoptical time-scale variability - Investigation of near-shore dynamics and current driving forces	-hydrographic data : temp., salinity, nutrients, turbidity plus plankton -current measurements: Aanderaa (RCM4), time-series longer than one month -meteo observations: air and SS temp., humidity, rainfall, wind -tidal observations since 1952 -data deposited partially in WDC, but mainly in NODC in Split

T A B L E (I) - continued

Research Institutions/Laboratories	on-going (or recently completed) activities		
	Area covered	Main fields of research	Data obtained
22. Instituto de Investigacionas Pesqueras, Barcelona, Spain	Catalan Sea, Spanish continental shelf waters	- Oceanographic study of the Catalan Sea and Spanish continental shelf water - Deep water formation in the Catalan Sea - Study of currents, thermochimie structure, winter convection and wind-driven circulation in shallow waters - Oceanographic conditions in relation to productivity	-hydrographic data: CTD, turbidity, penetration of light, dissolved oxygen -current measurements: Aanderaa (multi level:8,50, 100 m depth; duration 2-3 yrs); Electromagnetic C.M. mooring at 4 levels to near bottom, duration 2 months -meteo observations: wind, air temp., atmosph.pressure, solar radiation, ..., other data: nutrients, chlorophille, suspended matter, sediments -data deposited in local data bank, some are deposited in MEDALPEX Data Bank (Brest)

TABLE (2)

SUMMARY OF SOME ON-GOING ACTIVITIES IN THE VARIOUS REGIONS OF THE MEDITERRANEAN*

Region	On-going research activities and studies	Main Institutions working in the region
1. Strait of Gibraltar and Alboran Sea	i. Strait of Gibraltar : Sea level, Atlantic-Mediterranean water exchange, internal waves, laboratory models to study effect of Earth's rotation, stratification on the flow. ii. Alboran Sea : Dynamics and water mass distribution; Dynamics and variability of the Alboran anticyclonic gyre using remote sensing, numerical modelling and field measurements; Structure of Intermediate and Deep Water flows and their contribution to the Mediterranean out flow; Influence of atmospheric forcing on the gyre, both directly and through changes in the Atlantic in flow; Large-scale circulation studies.	1. Instituto Espanol de Oceanografia, Madrid, Spain 2. Woods Hole Oceanographic Institution, Woods Hole, USA 3. Laboratoire d'Océanographie Physique, Paris, France 4. SACLANT ASW Research Centre, La Spezia, Italy
2. Western Mediterranean (Ligurian and Tyrrhenian Seas)	i. Hydrodynamic characteristics of the Gulf of Taranto ii. Study of coastal circulation in relation to the present forcing mechanisms iii. Study of frontal structure close to the sea surface iv. Study of Ligurian current (PROLIG) v. Mesoscale ocean dynamics in the North Western Mediterranean (DYOME) vi. Interdisciplinary studies of the Gulf of Lyon vii. Geological/sedimentological studies including physical oceanog. (ECO-MARGE) viii. Physical-chemical-biological studies(MEDIPROD Project) ix. Mesoscale flow structure in the Tyrrhenian x. Fine scale vertical structure in the Central Tyrrhenian xi. Study of the density field and circulation pattern xii. Deep water formation, currents and thermocline structure in the Catalan Sea	1. Stazione Oceanografica (C.N.R.), Santa Tereza, Italy 2. French Institutions (See Table 1, N°14) 3. SACLANT ASW Research Centre, La Spezia, Italy 4. Instituto de Investigacionas Pesqueras, Barcelona, Spain

* Based on information received on response to the questionnaire and through personal communication with individual scientists

TABLE (2) - continued

Region	On-going research activities and studies	Main Institutions working in the region
3. Eastern Mediterranean (including Adriatic, Ionian, Aegean and Levantine Seas; Strait of Messina)	i. Adriatic Sea : Formation of dense water in the Adriatic; Tides in the Adriatic, Turbulence; Oceanographic properties related to circulation and transport of nutrients, suspended matter and phytoplanktonic biomass in different conditions of vertical stability; Study of frontal zones in the North Adriatic; Long-term changes of oceanographic parameters; Influence of wind on surface waves and currents; Water exchange between semi-closed bays and the adjacent basins; Near-shore dynamics and current driving forces; Mathematical modelling of the general circulation; Models for wave forecasting; Remote sensing of pollutant transport; Sediment suspension in polluted areas; Fronts at the Strait of Messina	1. Instituto Studio Dinamica di Grandi Masse (C.N.R.), Venezia, Italy 2. Department of Physics, University La Sapienza, Roma, Italy 3. Instituto Biologia del Mare, Venezia, Italy 4. Institute of Oceanography and Fisheries, Split, Yugoslavia 5. Institute of Biology, University of Ljubljana, Marine Research and Training Centre, Piran, Yugoslavia
	ii. Ionian and Aegean : Surface and deep currents; water masses and dynamics; Base-line studies for applied research; hydrography of coastal waters of the Greek mainland and islands	1. Institute of Oceanographic and Fisheries Research (IOKAE), Athens, Greece 2. The Hellenic Hydrographic-Oceanographic Service, Athens, Greece 3. Department of Applied Physics, University of Athens, Greece

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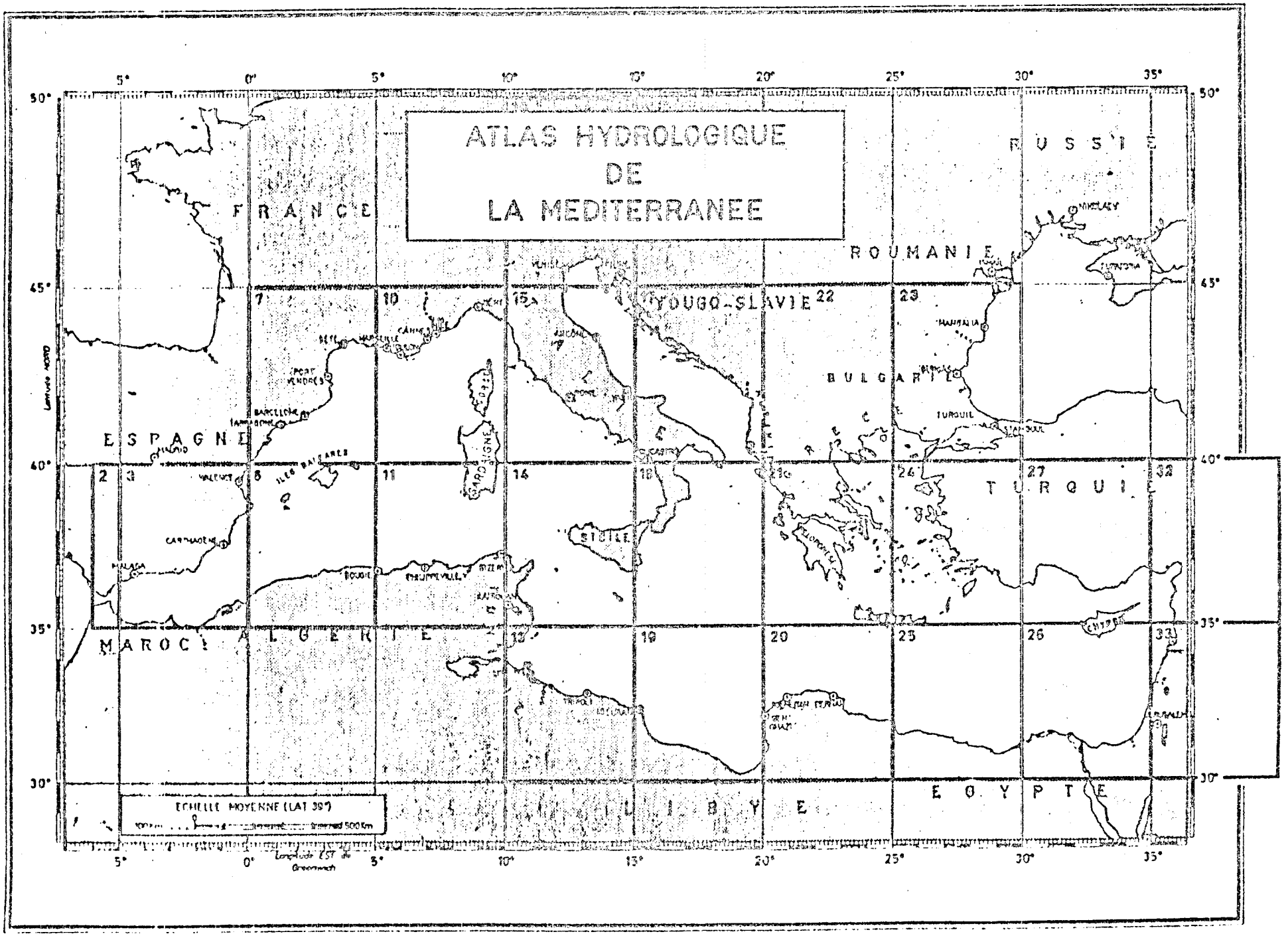
TABLE (2) - continued

Region	On-going research activities and studies	Main Institutions working in the region
	iii. Levantine: Investigation of meso-scale dynamics in NE Levantine basin; Base-line studies of hydrographic conditions; Modelling of physical processes in the seas around Turkey; LIW Formation; Structure of semi-permanent circulation features in mixing in straits; Basic hydrographic observations in the coastal waters of Lebanon; Study of hydrography and coastal currents along the Egyptian coast; Exchange with the Suez Canal and coastal lakes of Egypt; Study of dynamical and hydrographic conditions and their seasonal variation in the Eastern Mediterranean.	1. Institute of Marine Science, Erdemli, Turkey 2. Marine Research Centre, Beirout, Lebanon 3. Institute of Oceanography and Fisheries, Alexandria, Egypt 4. Dept. of Oceanography, Alexandria Univ., Egypt 5. Israel Oceanographic and Limnological Research Ltd., Haifa, Israel 6. Coastal studies Inst. Louisiana State University, USA.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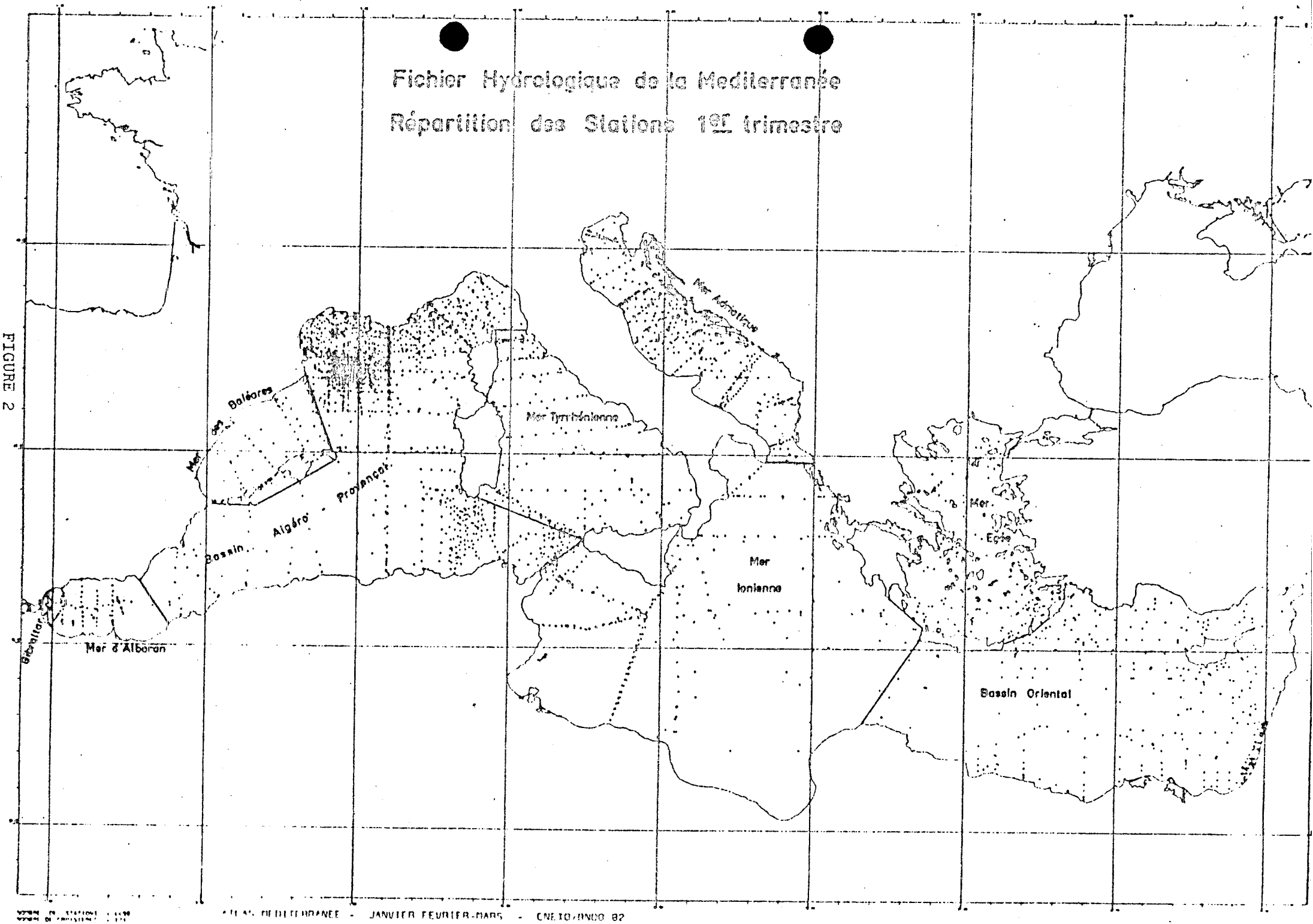
RUSSIE
YOUGO-SLAVIE
SICILE
CORSE
ILES BALEARES
ECHELLE MOYENNE (LAT 39°)

FIGURE 1

FIGURE 2



ATLAS MEDITERRANEE - JANVIER FEVRIER-MARS - CNEXO/INOC 82

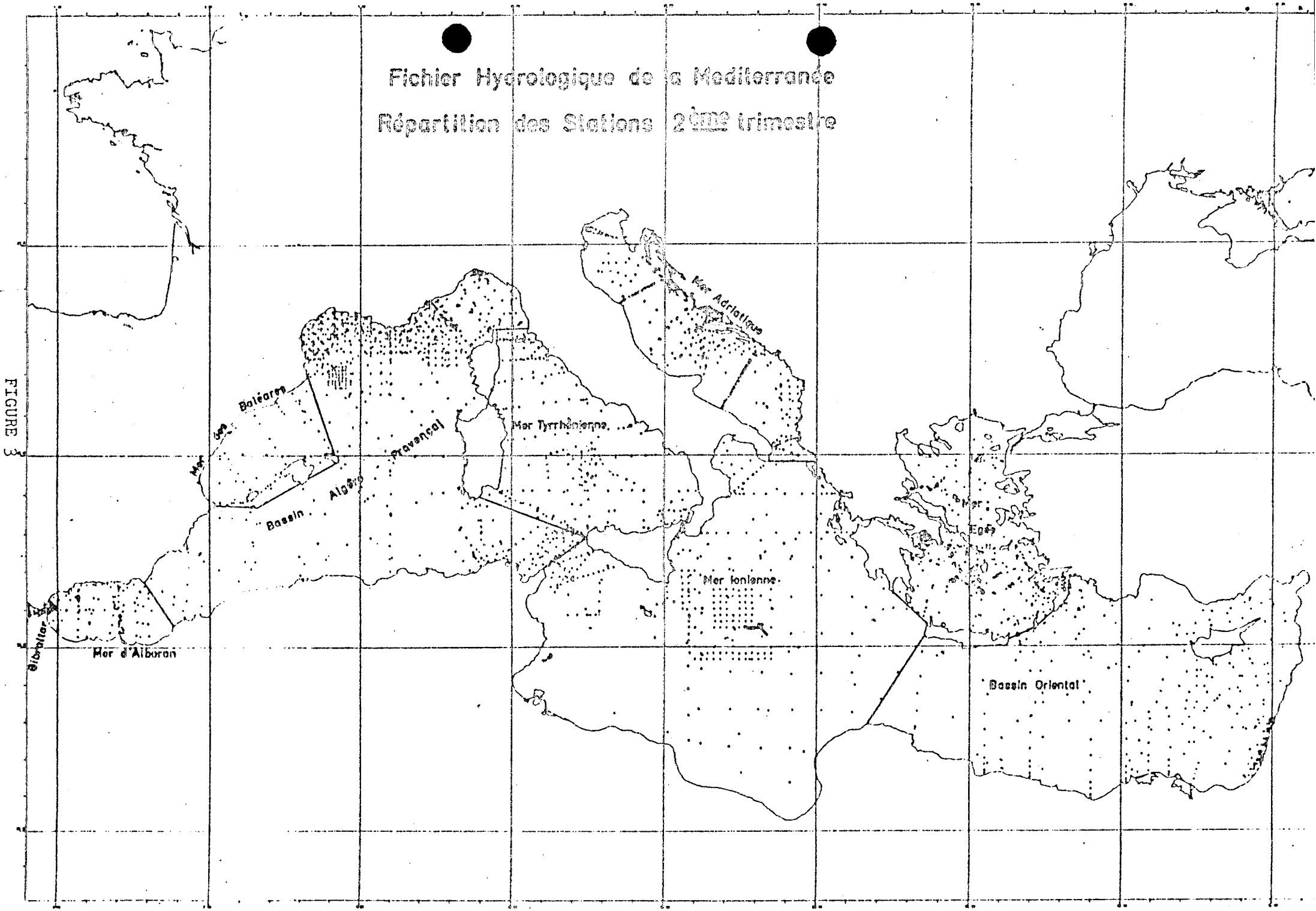


FIGURE 3

ATLAS MEDITERRANEE - AVRIL-MAI-JUIN - CNEXO/ORSTOM 82

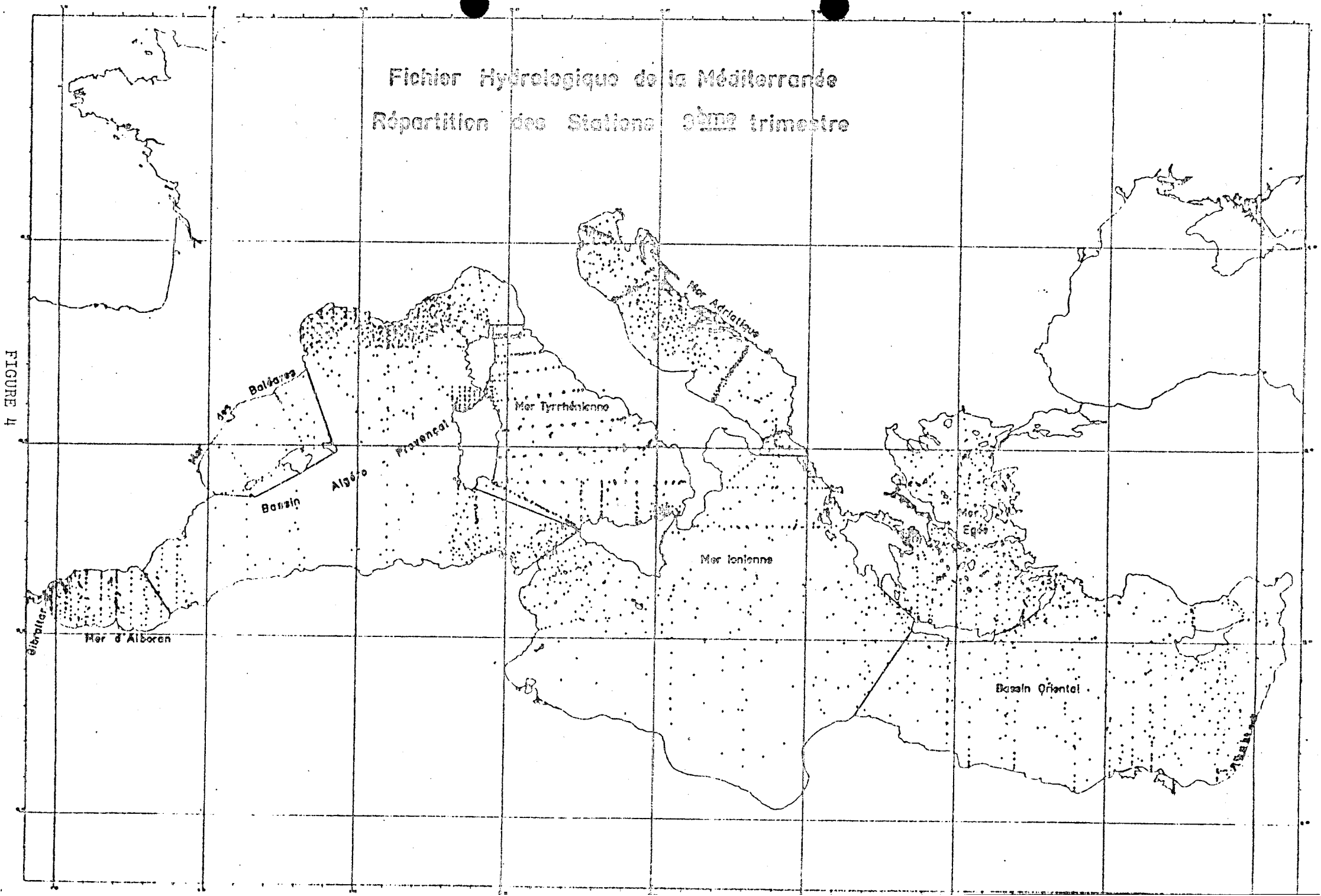

Fichier Hydrologique de la Méditerranée
Répartition des Stations 3ème trimestre
Mer Adriatique
Mer Tyrrhénienne
Mer Ionienne
Mer Egée
Bassin Oriental
Mer d'Alboran
Gibraltar
Mer Baléares
Bassin Algéro Provençal

FIGURE 4

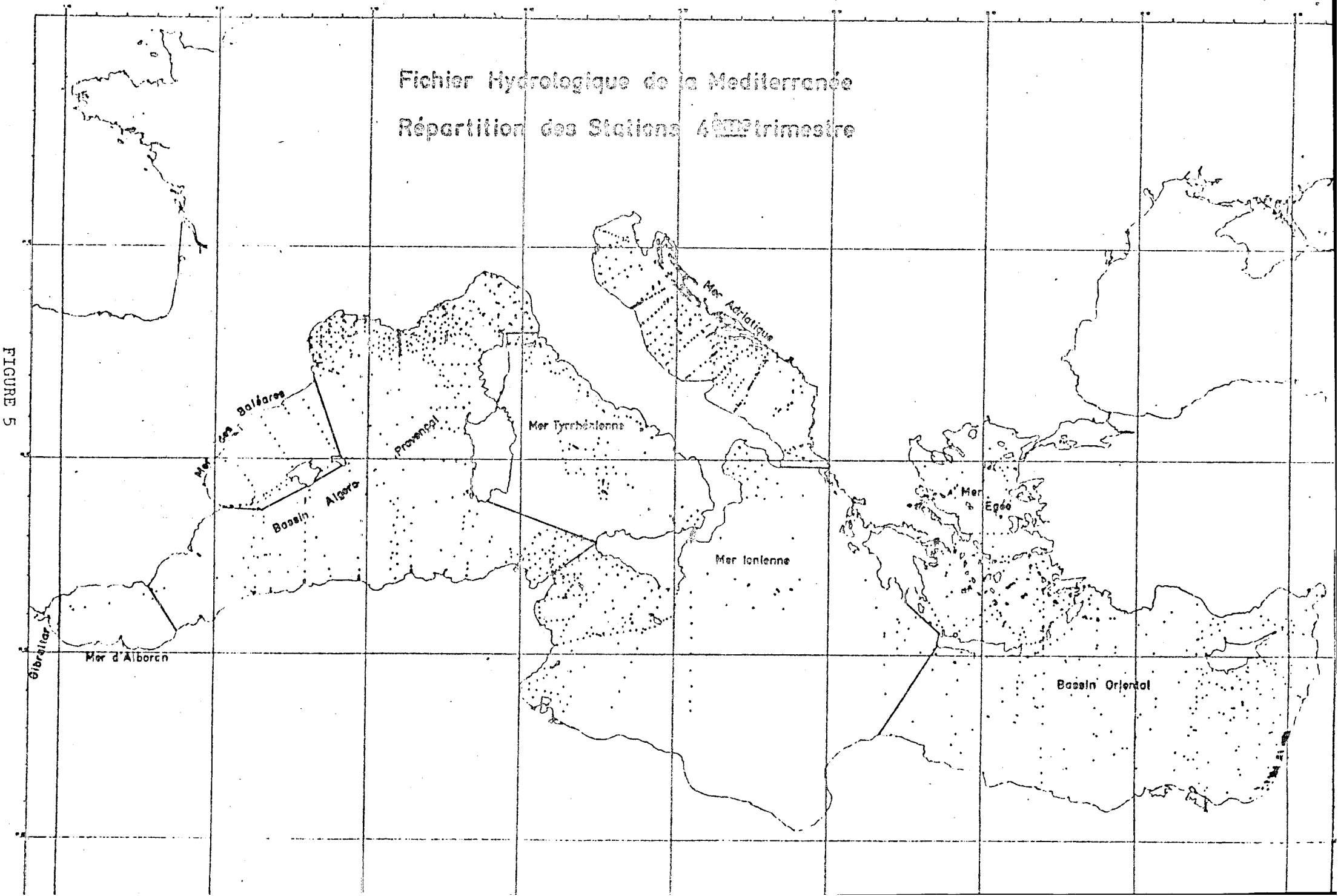

Fichier Hydrologique de la Mediterranée
Répartition des Stations 4ème trimestre
Mer Adriatique
Mer Tyrrhénienne
Mer Ionienne
Mer Egée
Bassin Oriental
Mer des Baléares
Bassin Algero Provençal
Mer d'Alboran
Gibraltar

FIGURE 5