



IOC Consultative Group on Ocean Mapping

Seventh Session

International Hydrographic Bureau, Monaco
12–14 April 1999

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC Consultative Group on Ocean Mapping

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UNESCO

IOC/CGOM-VII/3
Paris, February 2000
English only

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1. OPENING OF THE SESSION

The Chairman, Dr. Günter Giermann, opened the Seventh Session of the IOC Consultative Group on Ocean Mapping (CGOM), on Monday, 12 April 1999, at 09.30 at the International Hydrographic Bureau in Monaco.

In the name of the IOC Executive Secretary, Dr. Patricio Bernal, he welcomed the Members of the CGOM and the representatives of the International Hydrographic Organization (IHO) and International Arctic Science Committee (IASC).

He thanked the President of the International Hydrographic Organization, Rear Admiral Giuseppe Angrisano for having invited them to hold the meeting in the new offices in Monaco. He also thanked the Secretary of the CGOM, Dr. Dmitri Travin, for the excellent work he had done in the two years since the last session.

He expressed a particularly warm welcome to Mr. Desmond Scott, Past Chairman CGOM, and Professor Carlo Morelli the Vice-Chairman.

Rear Admiral Giuseppe Angrisano welcomed the participants on behalf of the IHO. He wished the meeting success and continued by saying that the day was coming when bathymetric mapping would operate under the same standards as Hydrographic charting with the two disciplines drawing on a unified database.

Apologies were received from Dr. Hou Wenfeng, Chief Editor IBCWP, and Professor Gleb Udintsev, Vice-Chairman GAPPA, for not being able to attend. Rear Admiral Neil Guy, Director of the IHO, also apologised for being unable to attend until the last day of the meeting. A full list of participants is given in Annex II.

The Chairman welcomed Mr. Ron Macnab, as the Chief Editor of the new International Bathymetric Chart of the Arctic Ocean (IBCAO).

2. ADOPTION OF THE AGENDA

The agenda was adopted (See Annex I).

3. CONDUCT OF THE SESSION

The Chairman and Dr. Travin announced the arrangements for the session and presented the general documentation.

Mr. Peter Hunter was appointed Rapporteur for the session.

4. PROGRESS AND PLANNED FUTURE DEVELOPMENTS IN OCEAN MAPPING

4.1 GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

(See assembly diagram Annex III.).

Mr. Brian Harper, Permanent Secretary of the Joint IOC-IHO Guiding Committee for GEBCO, presented the following report.

4.1.1 Meetings of the Joint IOC-IHO Guiding Committee for GEBCO

The 16th Session of the Guiding Committee was held at the Southampton Oceanography Centre (SOC), UK, 23-25 June 1997 (doc. IOC-IHO/GEBCO XVI/3 of 22 September 1997).

The 17th Session of the Guiding Committee will be held at the Bedford Institute, Halifax, Nova Scotia, Canada, 28-30 June 1999.

A meeting of interim GEBCO Officers combined with a meeting of the GEBCO Sub-Committee on Digital Bathymetry (SCDB) was held at two venues in Wellington, New Zealand: the Institute of Geophysical and Nuclear Sciences Ltd. and the National Institute of Water and Atmospheric Research, 12-17 March 1998 (doc. IOC-IHO/GEBCO Officers XI/3 of 20 June 1998).

4.1.2 GDA Report

By March 1998, 885 copies of the GDA had been sold/distributed to 500 organizations and individuals in 78 countries.

4.1.3 Report to CGOM on GEBCO Intersessional Activities

The Second Release of the GDA, in February 1997, was made free on condition that an accompanying questionnaire is completed.

The questions were arranged under six headings:

- | | |
|-----------------------------|----------------------|
| A. Gridded Bathymetry | D. Suggestions |
| B. Shallow Water Bathymetry | E. User Profile |
| C. Paper Charts | F. Mailing Addresses |

Replies were received from 385 of the 636 holders of the 1st edition. Questions were not sent to the GEBCO Community.

Answers confirmed what the GEBCO Community had expected. Firstly, there was an overriding demand for some form of latitude/longitude gridded product, with global coverage, nested/variable grids were requested by 68% of the respondents. Secondly, there was a strong demand (74%) for the inclusion of shallow water bathymetry with some calling for contours at 10m intervals, and thirdly, a small demand (13%) for a paper product.

Numerous ideas were received under Section D. Suggestions. These included: closed polygons for coastlines and contours, provision of a Windows version and addition of polar projections.

The analysis of the User Profile (Section E) revealed some interesting statistics. Chief among these were that 89% of respondents are using the GDA on PCs, and for these, 80% export data from the GDA for use with other software packages. The most popular destination packages for exported data were ArcView/ArcInfo (22%), Surfer (21%) and GMT (17%). Apart from homegrown software, a further 41 proprietary packages were listed.

4.1.4 Towards Third Release of GDA

This is planned for late 1999 and will include the following elements:

4.1.4.1 Bathymetric Data from New Maps in the following areas:

- Indian Ocean;
- Ross Sea;
- New Zealand Waters;
- Canadian Waters, including Hudson Bay;
- US East Coast;
- Caribbean and Gulf of Mexico (US area of responsibility);
- Hawaiian Waters;
- North Atlantic Ocean;
- South-Central Pacific Ocean.

Additionally, the Chief Editors of the IBC Regional Mapping Projects have been asked to deliver validated maps to the GEBCO Bathymetric Editor.

4.1.4.2 Gridded Versions of GDA

Following the lengthy discussion in Wellington, and considering matters raised during the Intersessional Period since March 1998, it is evident that the GEBCO Grid Task Group is facing some difficult problems. These are related to numerous issues, *inter alia*, the quality of contour data, lack of data on the continental shelves, incorporation (or otherwise) of satellite predicted bathymetry, and general strategies about updating and release procedures. There are no easy solutions or clear courses of actions that can be seen at present. Considerable debate is expected at the GEBCO Guiding Committee and SCDB in Halifax, June 1999.

4.1.4.3 Obtaining Data on the Continental Margins

Results from the GDA questionnaire demonstrated that the scientific community required the proposed grid to cover the continental margins. Following a recommendation made at Wellington, the IHO sent a Circular Letter to Member States asking them if they were prepared to release data for use by GEBCO in the continental margins.

The response to the letter was generally favourable but some hydrographic offices raised concerns. GEBCO recognises the need to press this matter further.

4.1.5 **GEBCO Web Site**

The recommendation to create a GEBCO Web Site was carried out in October 1998. The site includes a short history of GEBCO hyperlinks to IOC, IHB, BODC, IBCWIO and IHO-DCDB. More links to IBC sites will be added later.

Discussions about the further development of this site will take place in Halifax.

4.1.6 **GEBCO Guidelines, Part 4 - Multibeam Echo Sounders**

Despite the upbeat statements at the 1997 CGOM, there is still some small tidying up required to complete this Guideline. Rear Admiral Guy hopes to have this completed by June 1999.

4.1.7 **Generic Names Review**

The list of generic names, agreed at the 1997 SCUFN Meeting was presented to the GEBCO Guiding Committee for approval. The list generated considerable debate. The Chairman ruled that although the bulk of the descriptions was acceptable, agreement on several difficult interpretations would have to be resolved through correspondence. It is hoped to have an agreed list of generic names for formal acceptance by the GEBCO Guiding Committee at the Halifax meeting in June 1999.

4.1.8 **SCOR WG 107**

The SCOR Working Group (WG-107) "Improved Global Bathymetry", under the chairmanship of Dr. Colin Summerhayes, IOC, met at the Southampton Oceanography Centre, UK, in November 1996 and at Johns Hopkins University, Baltimore, USA in October 1997.

The Terms of Reference for WG-107 are:

- (i) To establish the scientific needs for improved ocean bathymetry;
- (ii) To determine the specifications for accuracy and resolution in different areas; and
- (iii) To recommend actions and priorities.

The final report is being prepared and will be published soon.

4.1.9 GEBCO Centenary

Mr. Desmond Scott reported that it had now been decided to celebrate the Centenary of GEBCO during the year 2003. The Group had already been informed (IOC/CGOM-VI/3, item 4.1.1) about the plans for two publications, an edited volume (ref: IOC-IHO/GEBCO-XVI/3, item 14 and Annex VIII) and a well-written book directed towards the general public. Work on the former was well in hand. It has now been decided to hold a short two-day conference in Monaco during 2003 and preliminary plans for this were now being prepared for submission to the forthcoming session of the GEBCO Guiding Committee (GEBCO-XVII) in June. This would almost certainly be hosted with the Monegasque Government and with the collaboration of the International Geographical Union (IGU). Other non-governmental bodies which had supported GEBCO over the years, i.e. the Scientific Committee on Oceanic Research (SCOR) and its Working Group 107: "Improved Global Bathymetry"; the International Association for the Physical Sciences of the Ocean (IAPSO); and the Commission for Marine Geology (CMG) were also invited to collaborate and an approach would be made to the International Cartographic Association (ICA).

Ing. Général Roubertou suggested that an invitation also be sent to the Fédération Internationale des Géomètres (FIG) - this was agreed.

4.2 INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)

(See assembly diagram Annex III)

Professor Carlo Morelli, the Chief Editor of the IBCM, presented the following report.

4.2.1 Meetings of the Editorial Board for IBCM

An Informal Consultation took place on board R/V *Sibiryakov* in Monaco Harbour, 19-20 April 1997, together with the 6th Session of CGOM (doc. IOC/INF-1070 of 15 April 1998).

The 7th Session of the Editorial Board was held in Cavtat near Dubrovnik, Croatia, 2-4 June 1998 (doc. IOC/EB-IBCM-VIII/3).

Dr. John K. Hall was elected Vice-Chairman.

4.2.2 Bathymetric Series and Geological-Geophysical Series

Professor Morelli looked back over the early history of bathymetric mapping in the Mediterranean.

IBCM originated from the necessity of bathymetric knowledge offshore the Mediterranean, at a time (1960-62) when, as for most of the oceans, only sparse data often existed.

The initiative started from CIESM, IOC and FAO, with the aim of offering to the scientific community the basic data for the basic study and exploitation of the sea bottom and the Earth's interior.

The physiographic results were so outstanding that the initiative was extended to the connected geophysical and geological studies. The data were published in the 1:1M IBCM (1981) and its Geological/Geophysical Charts series (1989-1999), each with an illustrated pamphlet.

From the 80's, the improvements in positioning (satellites), surveying (multibeam) and processing (computers) as well as the availability in digital form of enormous quantities of new data – such as the Mediterranean area – suggested to begin the collection and preparation of the new available data in a form suitable for any purpose.

The purposes of this work could be:

- The exploration and exploitation for any scientific, industrial or economic research or project;
- The constitution of a database for coastal management, margin risks.

The availability of the data in digital form will permit the maximum possible flexibility for their use, including the cartographic representation in any projection, format and scale, in 3D, etc.

4.2.3 The second Edition of the IBCM

Dr. Hall continued the report.

He reviewed the philosophy behind the preparation of the Second Edition of the IBCM, which will be a gridded digital terrain model for the land and sea with nodes every 0.1', on the WGS-84 horizontal datum. This density was chosen not because sufficient data is available every ~ 185m, but rather to give a nearby location to the existing data, and to accurately portray areas surveyed by swath on grids of ~ 100m.

A more detailed discussion is given in the Report of IBCM Seventh Session, in June 1998, Cavtat, Croatia. In brief, most efforts will be directed towards building a coastal-basin marginal grid between the deep basins, which are being scientifically investigated by swath, and the land which is presently gridded at ~ 1km and which will be gridded at better than 100m by spaceborne interferometric radar.

The product of this effort will be a single CD-ROM with the 0.1' grid data for all the Mediterranean and Black Sea areas in the original IBCM, plus files with a redigitized WGS-84 coastline from the best available sources.

4.3 INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND THE GULF OF MEXICO (IBCCA)

(See assembly diagram Annex III.)

Mr. José Luis Frias Salazar, Vice-Chairman of IBCCA, presented the following report.

4.3.1 Meetings of the Editorial Board for IBCCA

The Seventh Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) was hosted by the Instituto Nacional de Estadística, Geografía e Informática (INEGI) in Aguascalientes, Ags., Mexico, 9-11 November 1998.

4.3.2 Progress in Editing and Printing of IBCCA Sheets

Compilation of each sheet is done in the country having responsibility for that sheet. Then the sheet is digitized or scanned and vectorized by a combination of the country concerned and the Chief Editor's office, the Directorate of Geography of INEGI in Mexico. When a sheet is completed in digital form, its automatic editing can be undertaken at INEGI prior to printing.

Sheets 1.04 and 1.09 have been printed. Copies are available from INEGI at a price of US\$ 10 plus postage (Fax: +52 5 5639932, E-mail: Jfrias@mdf.inegi.gob.mx, Attn. Mr. José Luis Frias Salazar) or from: Ocean Mapping (IOC), Cumbers, Mill Lane, Sidlesham, Chichester P020 7LX, United Kingdom (Fax: +44 1243 641222).

Sheets 1.01, 1.02, 1.03, 1.05 and 1.06 have been fully digitized and incorporated into the digital database.

Sheets 1.07 and 1.08 have been digitized. Following their review, the bathymetric contours have been sent to Cuba to incorporate new bathymetry.

Sheets 1.11 and 1.15 have been digitized and are being reviewed. Their general editing is in progress at INEGI.

Printing of the IBCCA Sheets has been delayed due to internal printing problems at INEGI. Mr. Frías Salazar explained the problem of being unable to print the full-sized map sheets on the old main press at the INEGI. A possible solution is to print each map in two parts on a smaller press.

In the meantime, the Chief Editor plans to print colour proofs of sheets 1.01, 1.02, 1.03, 1.05, 1.06, 1.07 and 1.08 by the end of 1999.

Considering that much information is now in digital form, the Editorial Board has expressed its interest in producing a CD-ROM for IBCCA, including all data currently available in digital form. After his report, Mr. Frías demonstrated a CD-ROM based viewer of the vector files for the Gulf of Mexico areas 1.01, 1.02, 1.05, and 1.06 compiled by USA and Mexico.

Financial support has been requested from IOC, for continuing the printing programme for IBCCA and for the production of CD-ROMs.

4.3.3 IBCCA Geophysical/Geological Series

The IBCCA Editorial Board has agreed that, as a first step, the following three series of geophysical maps at scale 1:1 000.000 should be produced: magnetic anomalies, gravity anomalies and seismicity.

They will be based on the bathymetric series, as was done with the IBCM. Noting that general geophysical maps for the IBCCA area had already been published, it was further agreed that the initial work will consist in digitizing those maps, with the permission of the authors/publishers and sending them to the members of the Editorial Board according to their area of responsibility.

Cuba suggested that the IHO Transfer Standard S-57 be used for the exchange of IBCCA digital data. The IHB was asked to assess this proposal and to act as co-ordinators for this matter.

4.3.4 List of Agreements

To produce the first version of the CD-ROM for IBCCA assembled with all IBCCA data currently available in digital form until end of March 1999, which will be presented to the next meeting of the IOC (CGOM) Consultative Group on Ocean Mapping, to be held in April 1999.

Price of US\$10 assigned to sheets 1.04 and 1.09, which have been printed.

The US NGDC (National Geophysical Data Center) will prepare, jointly with the INEGI (Instituto Nacional de Estadística, Geografía e Informática), Mexico, a Web page for the IBCCA Regional Project, to promote the project *via* the Internet. In addition, if possible, they will edit a brochure for IBCCA by April 1999.

Cuba, Colombia and Costa Rica agreed to fulfil the compilations of their corresponding areas of responsibility and will deliver them to the Chief Editor at INEGI in digital form, in order to be incorporated in the automatic editing programme for IBCCA.

Mexico will continue with the digitization of the sheets they have been receiving from compilers and will prepare a colour proofing of each one.

The Chief Editor will send the proposal of the list of undersea feature names by the Compilers to the Sub-Committee on Undersea Feature Names (SCUFN) for its examination.

Ms. Guadalupe López Chávez, General Director of Geography at INEGI, has been elected as Chairperson of the Editorial Board and Mr. José Luis Frías as Vice-Chairman.

The 8th Session of IBCCA has been tentatively planned for September 2000 at the IHO Data Centre for Digital Bathymetry (DCDB), US National Geophysical Data Center (NGDC), Boulder, Colorado, USA.

4.4 INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)

(See assembly diagram Annex III.)

Ing. Général André Roubertou, Chairman of the IBCEA, presented the following report.

4.4.1 Amendments to the minutes of CGOM-VI

A few items of the record of the last meeting (CGOM-VI, para. 5.3) require updating as follows:

All difficulties in collecting data from French sources such as IFREMER and ORSTOM, have now been overcome. Moreover, an informal agreement has been reached between SHOM and the French Oil Company ELF, which has been and will be very active in the area, to make sure that no significant data is missing. Unfortunately, it has not been possible to recover data from CERESCOR (Guinea).

It should be made clear that as regards sheets No. 1.04 and 1.05, Mr. Peter Hunter has undertaken only the compilation of the charts, the printing and distribution having been accepted by France (SHOM).

It was erroneously stated that Morocco and Ivory Coast were willing to participate in IBCEA. Indeed the Editorial Board indicated such a wish, but these countries had not at that time been approached.

4.4.2 Meetings of the Editorial Board for the IBCEA

The Third Session of the Editorial Board is tentatively planned in October 2000, Dakar, Senegal.

4.4.3 Progress with compilation and production of IBCEA

4.4.3.1 Sheets 6 and 8 to 12 (France)

Sheet 6 is almost ready to be circulated for reviewing by the members of the Editorial Board in May 1999.

Sheet 8 is about to be printed. The first proof copy shows that the adopted process of Quadrichromy gives satisfactory results. Proof copies should be available within five to six weeks.

Sheet 9 will be ready shortly, probably in June 1999. At the same time, a file of the geographical names for each sheet will be transmitted to SCUFN for review purposes.

Sheets 8 and 9 should be ready for printing before the end of 1999.

Sheets 10, 11 and 12 are in the process of compilation. According to the present time schedule, they should be ready for printing before the end of 2000. The end of the compilation phase of these three sheets will enable SHOM to undertake compilation of sheets 10 and 16 of the IBCCA project.

4.4.3.2 Sheets 1, 2, 3 and 7 (Portugal)

According to last minute information received during the Session, sheet 1 should be published within a few months and sheet 3 shortly afterwards. The delay was caused by some technical difficulties with the cartographic software.

4.4.3.3 Sheets 4 and 5 (formerly Spain - now UK to compile & France to print).

Sheet 4 has been compiled. Sheet 5 is almost ready. They will be shortly transmitted to SHOM and inserted into the publication schedule, after reviewing by the Editorial Board.

4.4.4 Inclusion of the IBCEA in the GDA

According to the decision taken during the Second Session of the IBCEA Editorial Board (Paris, October 1996), every publication of the project will be followed by the transmission of the associated digital data to the GDA editors.

4.5 INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)

(See assembly diagram, Annex III.)

Dr. Werner Bettac, Chairman and Chief Editor of the IBCWIO, presented the following report.

4.5.1 Meetings of the Editorial Board for the IBCWIO

The 4th Session of the Editorial Board was held in Cape Town, South Africa, 6-10 October 1997.

4.5.2 Progress with Compilation and Production of IBCWIO

Sheet 1.04 is ready to print at the end of April. A full colour computer print was shown to the meeting of CGOM-VII.

Sheet 1.07 is at the digitizing stage.

Sheet 1.16 is at the drafting stage. South Africa will be sending the final draft soon.

South Africa announced that they have an experienced scientist at the University of Cape Town who will act as Scientific Reviewer for sheets 1.16 to 1.21.

Dr. Bettac asked the meeting for guidance on using data derived from satellite altimetry. They considered that in the case of a lack of bathymetric data, these data could be used, but that it should be done with care. In particular, it should be noted that the results are good in the areas of mid-ocean ridges but poor where there are great thickness of sediments, which may have buried the feature that is giving the gravity reading.

4.6 INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)

(See assembly diagram, Annex III.)

Dr. Hou Wenfeng, Chief Editor of the IBCWP, was unable to attend the meeting. The following report was received during the meeting.

4.6.1 Meetings of the Editorial Board for the IBCWP

It is planned to hold the next Session of the Editorial Board in Tianjin, China, September 2000.

4.6.2 IBCWP Work in Recent Years

The IBCWP project has progressed slowly in recent years (see later discussion in this report).

4.6.2.1 Sub-Region 1 (Russia)

Ten plotting sheets at a scale of 1:500,000 have been compiled. Two more plotting sheets, in addition to sheets 1-12, 1-13 and 1-14 at a scale of 1:1,000,000 are under compilation.

4.6.2.2 Sub-Region 2 (Japan)

No information has been provided.

4.6.2.3 Sub-Region 3 (China)

Collection and Sorting out of Current Bathymetric Data.

In recent years, China has conducted dense bathymetric surveys in its inshore areas. The bathymetric data from the surveys have been used in the nautical charts at a variety of scales. In offshore areas, China has also conducted several marine scientific surveys using improved positioning and more accurate sounding techniques. A large number of valuable bathymetric data have been obtained from the surveys. The data catalogue and dataset are being set up.

1:500,000 Bathymetric Charts of Chinese Inshore and Adjacent Sea Areas.

Since 1996, 43 sheets of the bathymetric charts of the Bohai Sea, Yellow Sea, East China Sea and South China Sea have been compiled and published. They are based on current national and foreign bathymetric data and will provide the basic contour data for parts of sheets of the Sub-Region 3 of the IBCWP. Complying with the IBCWP Specifications, China has compiled five sheets (3-2, 3-6, 3-7, 3-11 and 3-12). Besides intervals of 200 m, the contour lines of 500 m, 1500 m, 2500 m, 3500 m and 4500 m etc. have been expressed by a thin green line on the charts, in accordance with the UNCLOS and at the request of Mr. Scott.

Research on Computer-aided compilation of Bathymetric Chart.

After the integration and optimisation of computer hardware and software, a computer-aided mapping system has been established, including data input, data processing, chart compilation and output. This system is suitable for the compilation of marine charts. It provides advanced, standard, precise and quick techniques for the compilation and production of digital, electronic and multi-media bathymetric charts. Usage shows that the system functions well, the interface is friendly, and operation and maintenance are easy. The basic configuration of the system is : 2 SUN Workstations and 1 PC acting as server and six PCs acting as image workstations. They comprise the local network. One large-scale scanner and one plotter are the input and output devices. The integrated software consists of Microstation, CorelDraw and Arc/Info.

Implementation of Surveying and Mapping Plan of Inshore and Adjacent Sea Areas (1998-2001).

The development and application of Multibeam Echo Sounders and Side Scan Sonar permit seabed surveys. A contour chart of a surveyed sea area is produced quickly and automatically because of the improvement of high resolution and multibeam formulation technology, generation of shallow-water working system, enhancement of data, and image processing storage and displaying abilities and the application of GPS. Using the above technologies, China has begun to implement the precise surveying and mapping plan for its Continental Shelf and EEZ. Work has been carried out at marine test sites. The duration of the plan is five years. It will provide precise bathymetric data and image information for the IBCWP.

4.6.2.4 Sub-Region 4 (Australia)

Although little direct progress has been made during the past year, specifically towards the implementation of IBCWP, considerable progress has been made by the Australian Geological Survey Organization (AGSO) in seabed mapping in the Australian region, including the Western Pacific area adjacent to Australia. No information is available from Australia on the combination of the IBCWP and these domestic programmes.

4.6.2.5 Sub-Region 6

SOPAC confirmed that they were willing to join EB-IBCWP and, in principle, to act as the responsible organisation for Sub-Region 6.

4.6.2.6 Other national activities.

Malaysia has been taking an active part in the IBCWP. Data are being gathered for sheets 3-12, 3-16 and 3-17. Actual data collecting cruises are also carried out from time to time. Compilation of sheets for 3-16 and 3-17 at a scale of 1:1,000,000 has started in accordance to the work plan as agreed at the Second Session of the EB-IBCWP and the specifications for the IBCWP.

The Philippines are slowly building up a digital hydrographic database with existing paper charts and recent surveys as primary data sources. It is expected that data collection will be accelerated with the commissioning of their two new hydrographic/oceanographic vessels.

The Republic of Korea will complete the bathymetric survey in the west Coast of Korea in 2002 and the establishment of its database is in progress.

There is no information from New Zealand and Vietnam.

4.6.3 Existing problems

Concerning the compilation of the unified catalogue of bathymetric data for the IBCWP, which was proposed by China, the Member States have not submitted their respective data catalogues, thus preventing implementation. Thus the EB-IBCWP cannot give precise statistics on the quantity and the distribution of the data.

There exists great difficulty in bathymetric data exchange among the Member States. The data held by the Member States cannot be shared. It will influence the quality and precision of charts, and evaluation of the EB-IBCWP on the charts will also be influenced by it.

The plans decided at the Second Session of the EB-IBCWP have not been implemented. For example, up to now the Third Session and the technological training programme have not been held yet. It is hoped that IOC, NOAA and NGDC will provide support for them.

UNCLOS is important to the interests and rights of all the marine countries in the world. This makes the situation in the South-Eastern Asia and Eastern China Seas both subtle and complex, which

possibly has some impact on the data exchange among the Member States and also on the whole progress of the IBCWP project.

4.7 INTERNATIONAL BATHYMETRIC CHART OF THE ARCTIC OCEAN (IBCAO) Jointly sponsored by IOC, IASC and IHO

Assembly diagram not yet available (see Annex III for a provisional map).

Mr. Ron Macnab, Chairman of the IBCAO, presented the following report.

4.7.1 Meetings of the Editorial Board for the IBCAO

The inaugural Session of the Joint Editorial Board took place in the premises of the Royal Danish Administration for Navigation and Hydrography in Copenhagen, Denmark, 19-20 October 1998.

Mr. Ron Macnab of the Geological Survey of Canada, and Mr. Arne Nielsen of RDANH acted as Chairmen.

4.7.2 Introduction

IBCAO has two primary objectives: (1) to construct a modern digital database of all available bathymetric observations north of 64°N; and (2) to use this database for the preparation of an accurate regional map.

The project was launched in an effort to rectify serious shortcomings in existing regional charts of the Arctic, and to do so by capitalizing upon significant new opportunities which began to materialise in the mid-1990's, i.e. improved access to historic data sets which had been collected over previous decades by agencies of the USA and the former Soviet Union; modern sounding programmes executed for scientific purposes by German and Swedish icebreakers; and unclassified under-ice mapping missions undertaken by submarines of the US Navy.

4.7.3 Developments to date

The project had its genesis during an Informal Workshop held in October 1996 at the Polar Marine Geosurvey Expedition (PMGE) in St. Petersburg - Lomonosov, Russia, when specialists from the five coastal States that border upon the Arctic Ocean met to discuss scientific and technical issues relating to the preparation of continental shelf claims beyond 200 nautical miles, according to the provisions of Article 76 of the Law of the Sea. In anticipation of potential contentions arising from overlapping continental shelf claims, Workshop attendees recommended that coastal States around the Arctic Ocean consider a joint action to consolidate their data holdings in the region, for the purpose of developing a common understanding of the bathymetric and geologic conditions which affect the implementation of Article 76.

Under the auspices of the International Arctic Science Committee (IASC), an Arctic Bathymetry Workshop was next convened at the Research Institute for Geology and Mineral Resources of the World Ocean (VNIIOkeangeologia) in St. Petersburg in September 1997, to review the status and availability of bathymetric data holdings, and nominate members of a working group. Subsequently, a formal affiliation with IOC was established, and endorsement for the undertaking was obtained from the GEBCO organization of IHO.

The first formal meeting of the Editorial Board took place in Copenhagen in October 1998, where tasks and responsibilities were assigned according to a general plan for assembling and consolidating data sets. It was agreed that the represented agencies from each coastal State would assume responsibility for assembling and treating proprietary and public data within their own EEZ's, and that they would work with their neighbours to ensure continuity of data across bilateral boundaries. The High Seas would be treated on a collective basis, using public data only. Issues related to presentation standards and to the distribution of final products were deferred for consideration and discussion in the months leading up to the next formal meeting.

In February 1999, US and Swedish members of the Editorial Board met at Stockholm University to merge data sets from several sources: existing public-domain observations; soundings extracted from published and proof maps prepared by the Head Department of Navigation and Oceanography of the Russian Federation Navy; historic and modern measurements by submarines of the US Navy; and recent measurements collected by Swedish and German icebreakers

4.7.4 Future activities

Three complementary posters describing different aspects of the project will be presented at the General Session on Ocean Sciences of the Spring Meeting of the American Geophysical Union (AGU) in Boston, May 31 to June 4, 1999. The primary purpose of these presentations is to acquaint members of the broader geoscientific community with the objectives of IBCAO, and with its potential research benefits.

A special session to review the status of the project is scheduled to occur during the GEBCO Meetings in Halifax, June 23-30. The primary focus of this session will be to describe the procedures employed by US and Swedish members of the Editorial Board for merging and reconciling depths extracted from Russian charts with observations collected by submarines of the US Navy, and to present the preliminary results of this work.

The second formal meeting of EB-IBCAO is scheduled to take place in Monaco in November 1999, when participants will: (a) report on the results of bilateral and multilateral collaborations since October 1998; (b) identify data issues that remain to be resolved; and (c) start considering techniques for presentation and distribution of assembled data sets.

Barring unforeseen problems, completion of the project is anticipated by late in the Year 2000, at which point maps and grids will be released into the public domain, and a procedural framework will be in place to facilitate future upgrades.

4.7.5 Complementary maps

A number of maps that display geological and geophysical parameters for the same region have been produced, or are in planning stages. In the late 1980's and early 1990's, a collaboration with Russian investigators yielded separate maps of Quaternary and Bedrock Geology. In the mid 1990's, researchers of the Geological Survey of Canada working under the auspices of the International Association for Aeronomy and Geomagnetism (IAGA) assembled and rationalised a large quantity of magnetic data sets obtained from numerous international partners; in 1998, a co-operation with the Cambridge Arctic Shelf Programme (CASP) led to the construction of a combined Tectonic and Magnetic Map of the Arctic.

Also in 1998, a new international initiative was launched under the auspices of IASC and the International Association for Geodesy (IAG), to construct a gravity map of the Arctic. In the meantime, exploratory discussions have been initiated with Russian investigators to assess prospects for international collaboration in the preparation of a circumpolar map of sediment thickness.

4.8 INTERNATIONAL GEOLOGICAL-GEOPHYSICAL ATLASES OF THE ATLANTIC AND PACIFIC OCEANS (GAPA)

Mr. Desmond Scott, Deputy Editor GAPA, presented the following report.

The compilation of the International Geological/Geophysical Atlas of the Pacific Ocean, which is the final atlas of the GAPA project, is about 70% complete but, owing to financial difficulties, work has now virtually ceased. This is most unfortunate in view of the large amount of work already carried out and, in addition, the longer the delay the more out of date the maps become.

Every effort is being made to find a new source of funds so that the atlas can be completed and published. If this is unsuccessful, action will be taken to publish certain new maps separately, for example, and in particular the Thickness of Sediments section of the atlas.

5. DIGITIZATION OF IBCs AND INCLUSION IN THE GEBCO DIGITAL ATLAS (GDA)

Aspects of this item were covered during the reports on the mapping projects (see above, in particular items 4.3 and 4.4).

6. A CONCEPT FOR SELECTED LOCAL CHARTS FOR THE EXPLORATION OF THE EEZ

The Chairman reported that he had been invited by the Executive Secretary IOC to represent IOC at the Thirteenth Meeting of the Standing Committee of IOMAC, The Indian Ocean Marine Affairs Co-operation, in Colombo, Sri Lanka, 27-30 May 1998. He was named Chairman of its Technical Co-operation Group (TCG). The meeting had expressed at several occasions an urgent need for large scale mapping of coastal and shelf areas for the exploration and exploitation of the resources of the EEZ, for archaeological investigations, and the determination of the outer limit of the EEZ and Continental Shelf.

Dr. Ragoonaden, Chairman of IOCINCWIO at its 4th Session, had raised the same matter by letter of 2 September 1998 and stressed "*the urgent need to initiate the preparation of large scale bathymetric charts of near-shore areas to enable countries in the IOCINCWIO region to start the exploration of the wealth of their EEZs*".

After a discussion centered around the resources needed to produce such maps and the obvious requirement in other parts of the world, the CGOM meeting agreed that a small working group should develop a short resolution for the IOC stating that, in principle, Member States would get support.

7. SALES AND PUBLICITY

At present Mr. Scott, is acting as official agent for sales of the GEBCO maps under the authority of the Canadian Hydrographic Service, Ottawa. The North American orders are re-directed to the CHS. He passes on orders for the CD-based GEBCO Digital Atlas to Dr. Meirion Jones at BODC, Bidston, UK.

There is an agreement with the HDNO, Russia, regarding the map sheets of the IBCM. At present, he is in correspondence with Captain Popov, HDNO, regarding the arrangements for the IBCM as there is a problem to forward stocks of the maps to the United Kingdom. They have agreed that Mr. Scott will take orders for the IBCM and pass them on to HDNO by fax; HDNO will then send the charts out from St Petersburg. The payment procedure still needs to be sorted out.

A trial run has been agreed on. Mr. Scott emphasised that his supplies were running low and that a quick response from the HDNO was needed in order to ensure the success of the trial. Orders should be dispatched within one week of receipt.

With respect to the other chart projects, Mr. Scott is willing to act as an agent. He will purchase the charts at the wholesale price and then sell at the usual marked-up price.

The meeting commented on the success of the postcard versions of the IBCM and thought that it would be worthwhile repeating that sort of venture with the other chart series.

8. TEMA AND CAPACITY BUILDING

The Group discussed the necessity to increase training activities in bathymetry in developing countries using research vessels and land facilities, following the example of Germany which had offered two two-week cruises in 1987 and 1995 on board R/V *Meteor* and on land in Madagascar and

South Africa, as well as individual training in Kenya, Tanzania and Mauritius by the Chief Editor, Dr. Bettac.

One proposal was to use the Floating University courses offered by the IOC on board Russian research vessels in the Baltic and Mediterranean Seas.

It may also be possible to approach the University of Malmö with a view to giving hydrographic courses.

9. REPORT OF THE CHAIRMAN OF CGOM TO THE TWENTIETH SESSION OF THE IOC ASSEMBLY

The Chairman submitted a draft of the report. After discussion, amendments were made to parts of the main body of the report and also to the memberships of all the groups responsible for supervising Ocean Mapping Projects sponsored (or co-sponsored) by the IOC.

The Group approved the report.

10. OTHER MATTERS

10.1 GLOBAL SPATIAL DATA INFRASTRUCTURE (GSDI)

Ing. en Chef Michel Huet informed the meeting of developments at international level regarding GSDI.

A Global Spatial Data Infrastructure is one that encompasses the policies, organizational remits, data, technologies, standards, delivery mechanisms as well as financial and human resources necessary to ensure that those working at the global or regional scale are not impeded in meeting their directives.

Its goals are ensuring access to appropriate information and delivering data to users fit for their purpose without undue impediment.

The meeting, noting the key role played by the IOC in the collection, management and provision of scientific geographical data for the Oceans, felt that the IOC should look into the matter with a view to ascertaining that the marine side of GSDI is adequately addressed.

10.2 WEB SITES

The Group recommended that, as already developed by IBCCA and IBCWIO, the remainder of the regional IBCs set up separate Websites, with hyperlinks to the GEBCO Website, in close consultation with Dr. Carla Moore at the NGDC, Boulder, USA, in order to ensure standardization of presentation.

10.3 INTERNATIONAL WORLD OCEAN ATLAS

Captain Sobolev reported that the Russian Hydrographic Service (HDNO) and scientific organizations in Russia have continued in accordance with the FAO proposal the work on creation of the international "World Ocean" atlas as a component of the UN Atlas of the Oceans.

By now, the new bathymetric chart of the Arctic Ocean at scale 1:5,000,000 has been compiled and will be incorporated in the first volume of the "World Ocean" atlas.

Ocean bottom features on the chart have been specified and the colour scheme for the chart has been carefully designed for a pleasing appearance.

A scheme of bathymetric charts for the remaining areas of the World Ocean has been developed as well as the selection of scales and projections for thematic charts for other Atlas volumes.

11. DATE AND PLACE OF THE NEXT SESSION

The Eighth Session of the IOC Consultative Group on Ocean Mapping, should be held in two years time, funds permitting. It should take place well before the biennial IOC Assembly.

The Chairman asked for suggestions for a venue. Captain Sobolev offered to investigate the possibility of an invitation to St Petersburg during 2001. The Chairman thanked him and the discussion turned to possible dates.

The most likely date for the meeting would be during the second half of April or the first half of May 2001. An objection to a later date would be a conflict with the annual GEBCO meetings which tend to take place during May or June.

12. ADOPTION OF THE SUMMARY REPORT

The Group agreed that the first draft of the Summary Report would be prepared after the Session and distributed to the participants.

13. CLOSURE OF THE SESSION

The Chairman thanked the President of the IHO, Rear Admiral Angrisano for hosting the meeting and the Directors and Staff for their help. Rear Admiral Guy responded on behalf of the IHO; he thanked the Group and offered the Bureau as a possible venue for future meetings.

Dr. Giermann expressed his gratitude to the Group for their supportive participation in his first meeting as chairman.

The Session closed at 12.50 on Wednesday, 14 April 1999.

ANNEX I

AGENDA

- 1. OPENING OF THE SESSION**
- 2. ADOPTION OF THE AGENDA**
- 3. CONDUCT OF THE SESSION & DOCUMENTATION**
- 4. PROGRESS AND PLANNED FUTURE DEVELOPMENTS IN OCEAN MAPPING**
 - 4.1 GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)
 - 4.2 INTERNATIONAL BATHYMETRIC CHART OF THE MEDITERRANEAN AND ITS GEOLOGICAL/GEOPHYSICAL SERIES (IBCM)
 - 4.3 INTERNATIONAL BATHYMETRIC CHART OF THE CARIBBEAN SEA AND THE GULF OF MEXICO (IBCCA)
 - 4.4 INTERNATIONAL BATHYMETRIC CHART OF THE CENTRAL EASTERN ATLANTIC (IBCEA)
 - 4.5 INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN INDIAN OCEAN (IBCWIO)
 - 4.6 INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC (IBCWP)
 - 4.7 INTERNATIONAL BATHYMETRIC CHART OF THE ARCTIC OCEAN (IBCAO)
 - 4.8 INTERNATIONAL GEOLOGICAL-GEOPHYSICAL ATLASES OF THE ATLANTIC AND PACIFIC OCEANS (GAPA)
- 5. DIGITIZATION OF IBCs AND INCLUSION IN THE GEBCO DIGITAL ATLAS (GDA)**
- 6. A CONCEPT FOR SELECTED LOCAL CHARTS FOR THE EXPLORATION OF THE EEZ**
- 7. SALES AND PUBLICITY**
- 8. TEMA AND CAPACITY BUILDING**
- 9. REPORT OF THE CHAIRMAN OF CGOM TO THE TWENTIETH SESSION OF THE IOC ASSEMBLY**
- 10. OTHER MATTERS**
 - 10.1 GLOBAL SPATIAL DATA INFRASTRUCTURE (GSDI)
 - 10.2 WEBSITES
 - 10.3 INTERNATIONAL WORLD OCEAN ATLAS
- 11. DATE AND PLACE OF THE NEXT SESSION**
- 12. ADOPTION OF THE SUMMARY REPORT**
- 13. CLOSURE OF THE SESSION**

ANNEX II

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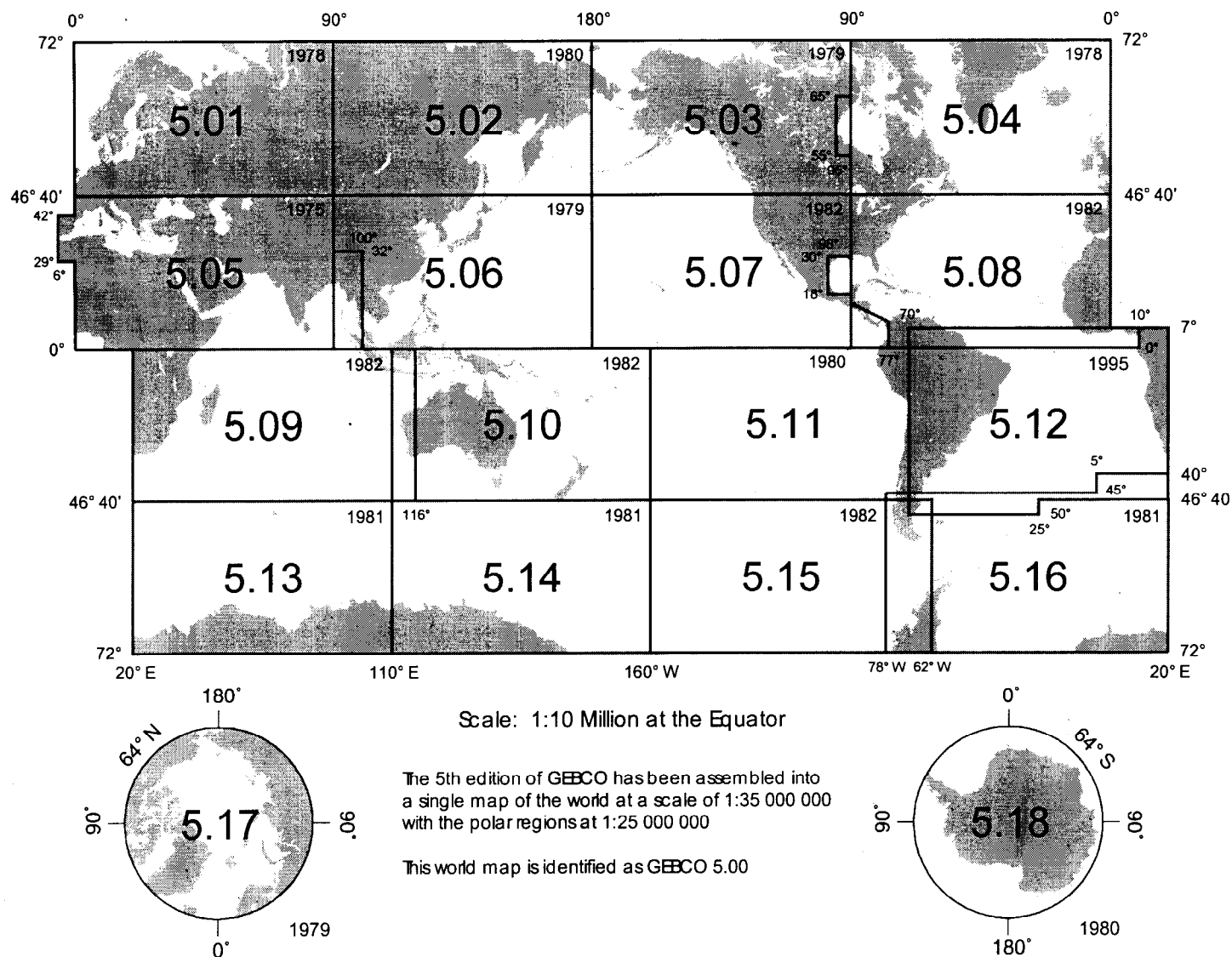
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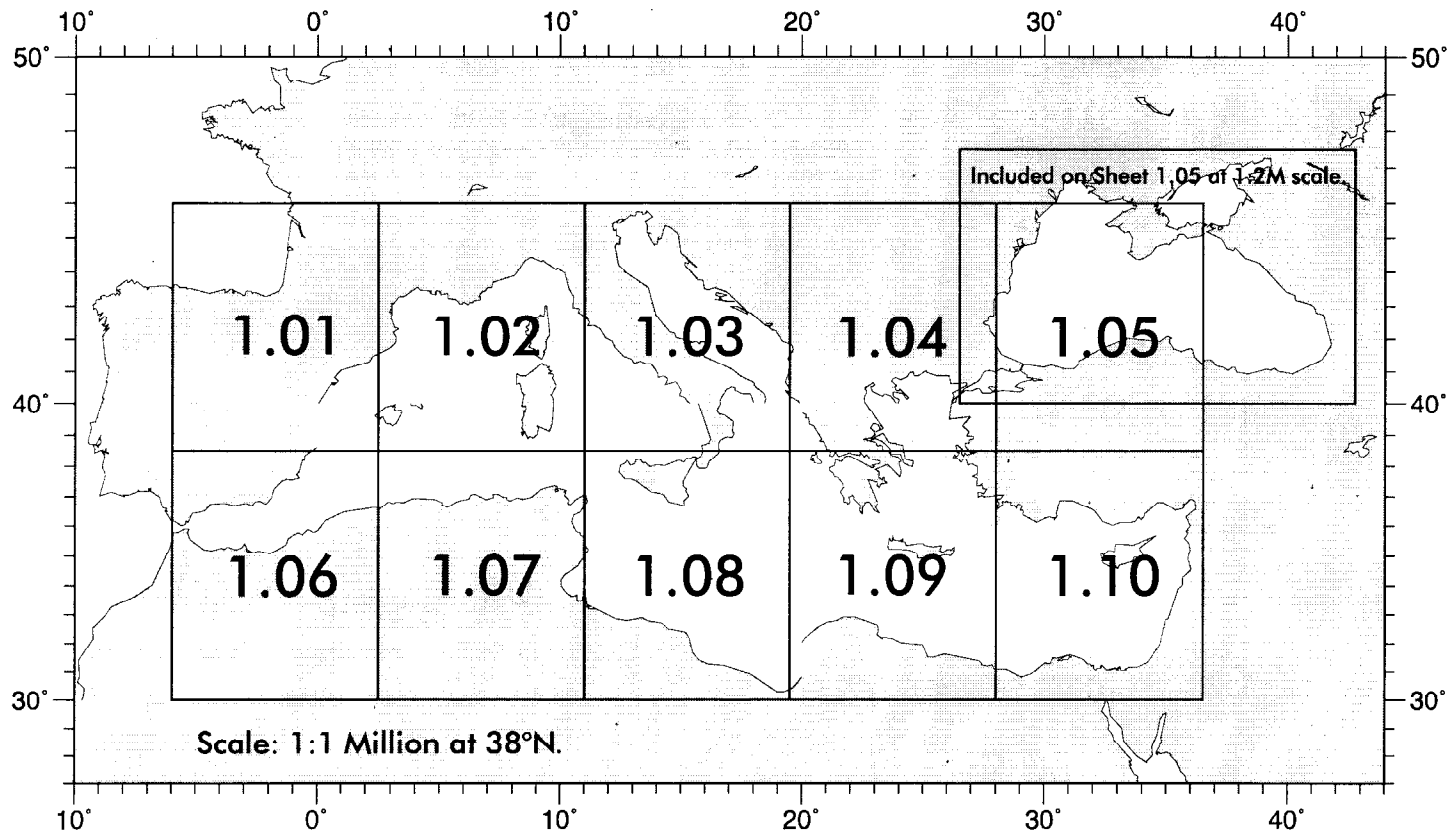
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ANNEX III

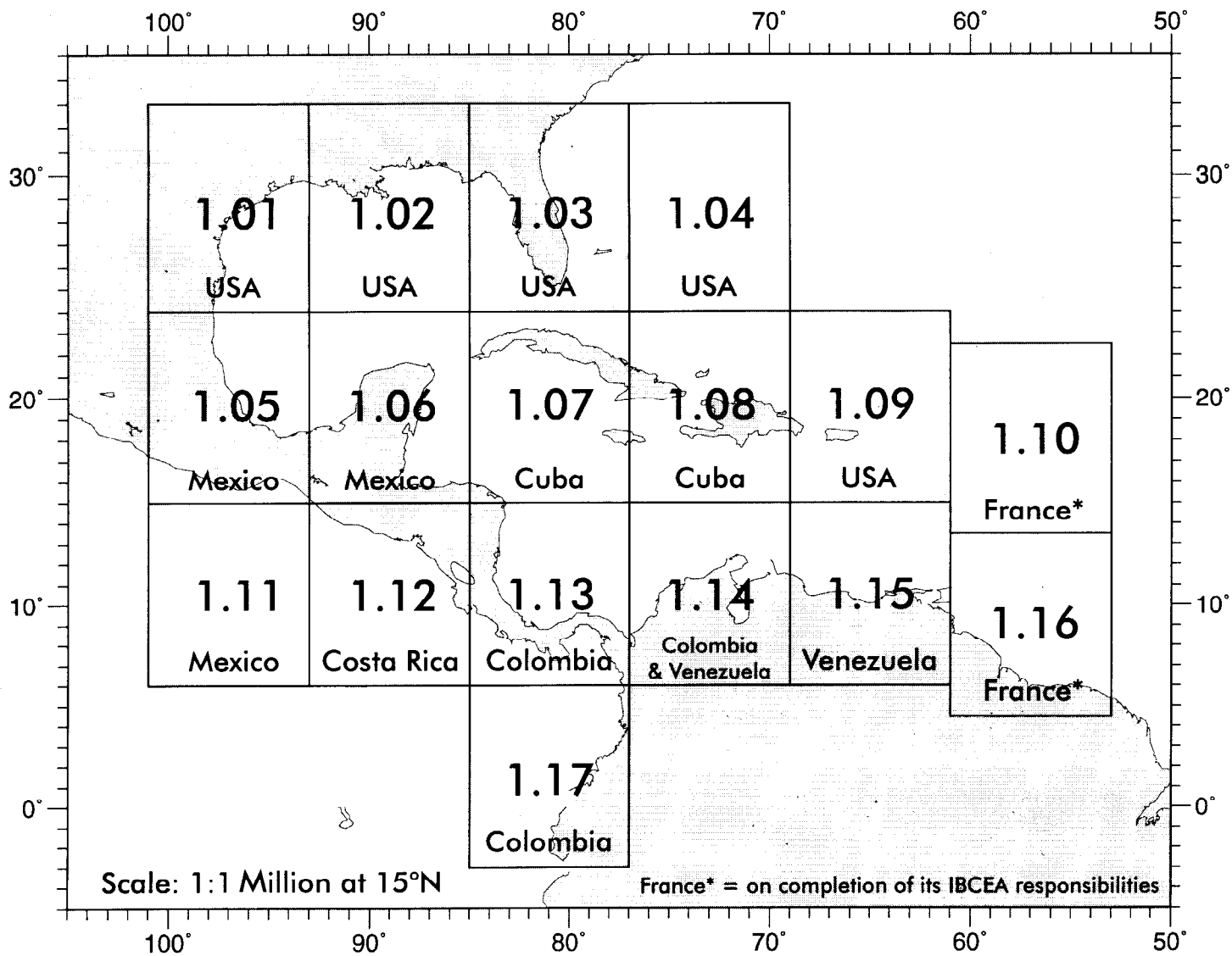
ASSEMBLY DIAGRAM OF THE GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO) Scale: 1:10 Million at the Equator



**ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART
OF THE MEDITERRANEAN (IBC-M)**
Scale 1:1 Million at 38°N

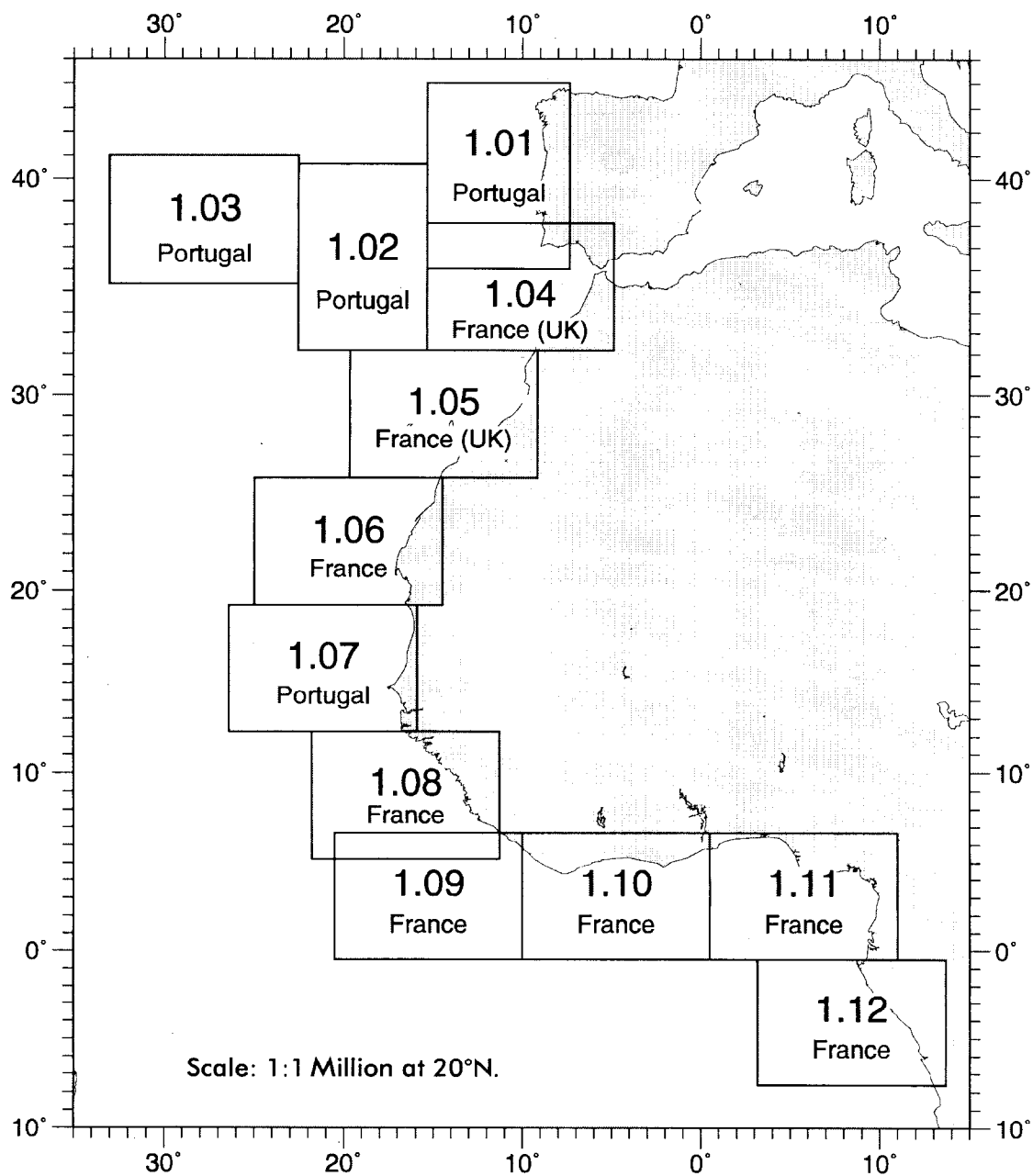


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OF THE CARIBBEAN & GULF OF MEXICO (IBCCA)
Scale 1:1 Million at 15°N

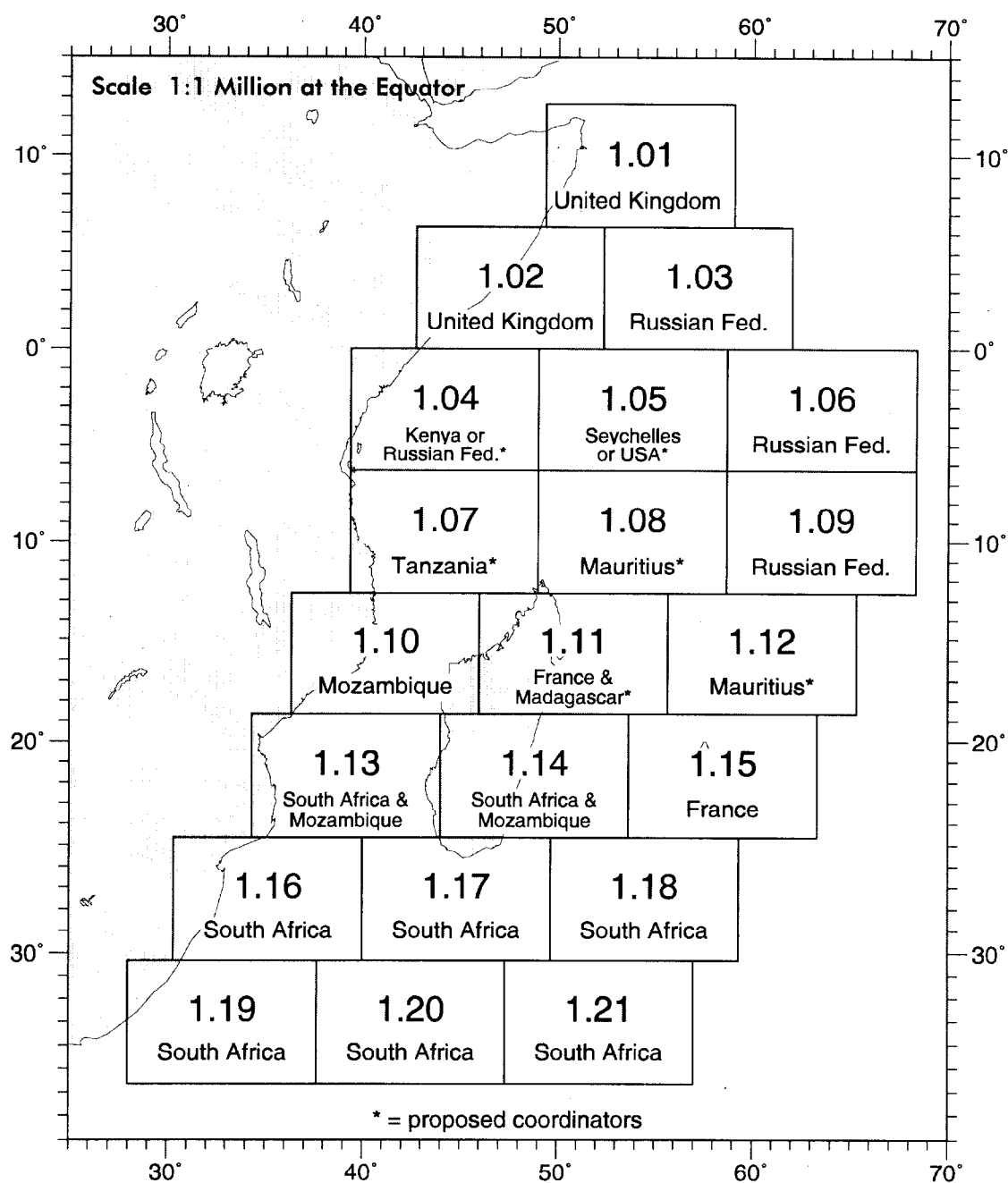


**ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART
OF THE CENTRAL EASTERN ATLANTIC (IBCEA)**

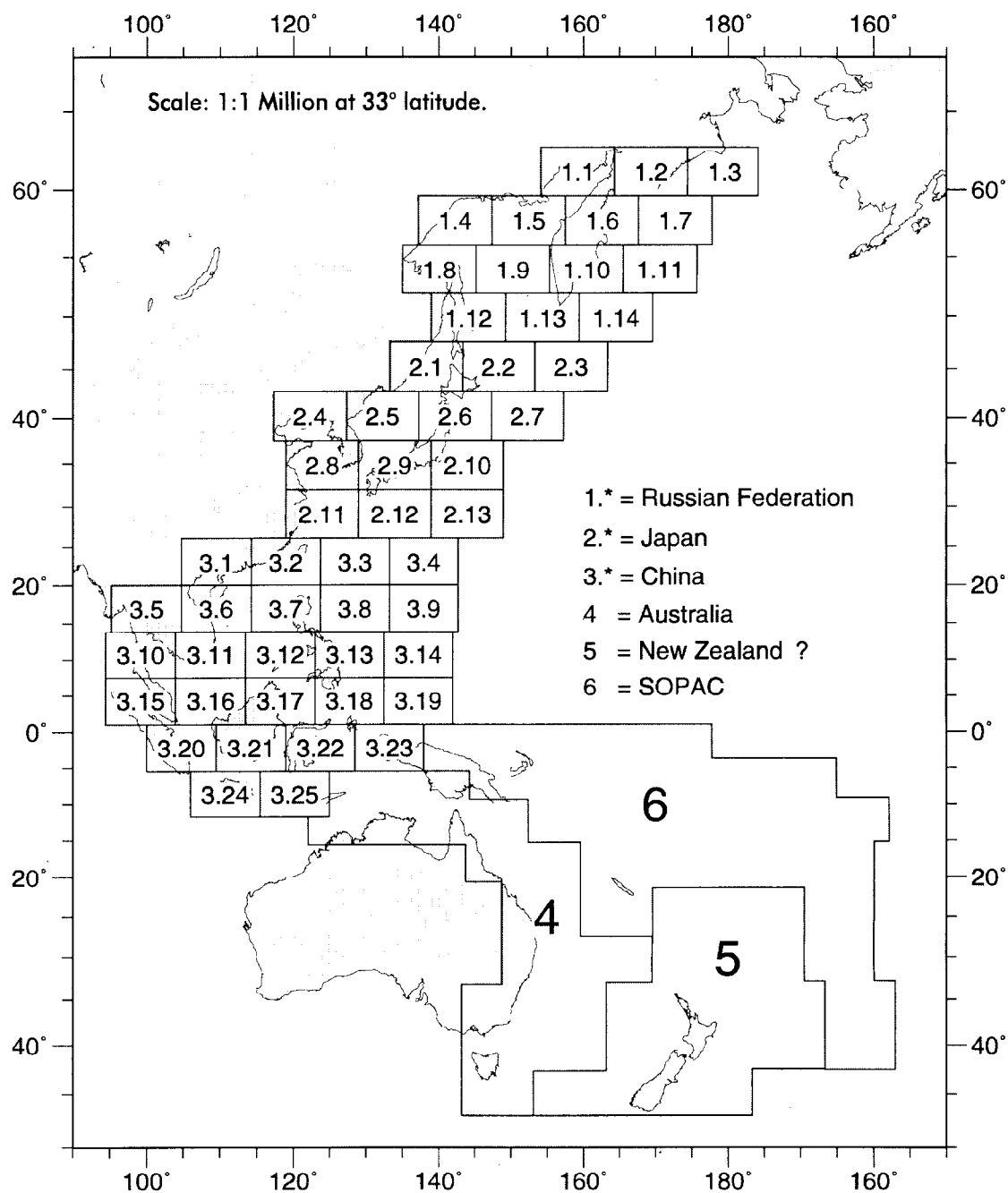
Scale 1:1 Million at 20°N



**ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART
OF THE WESTERN INDIAN OCEAN**
Scale 1:1 Million at the Equator

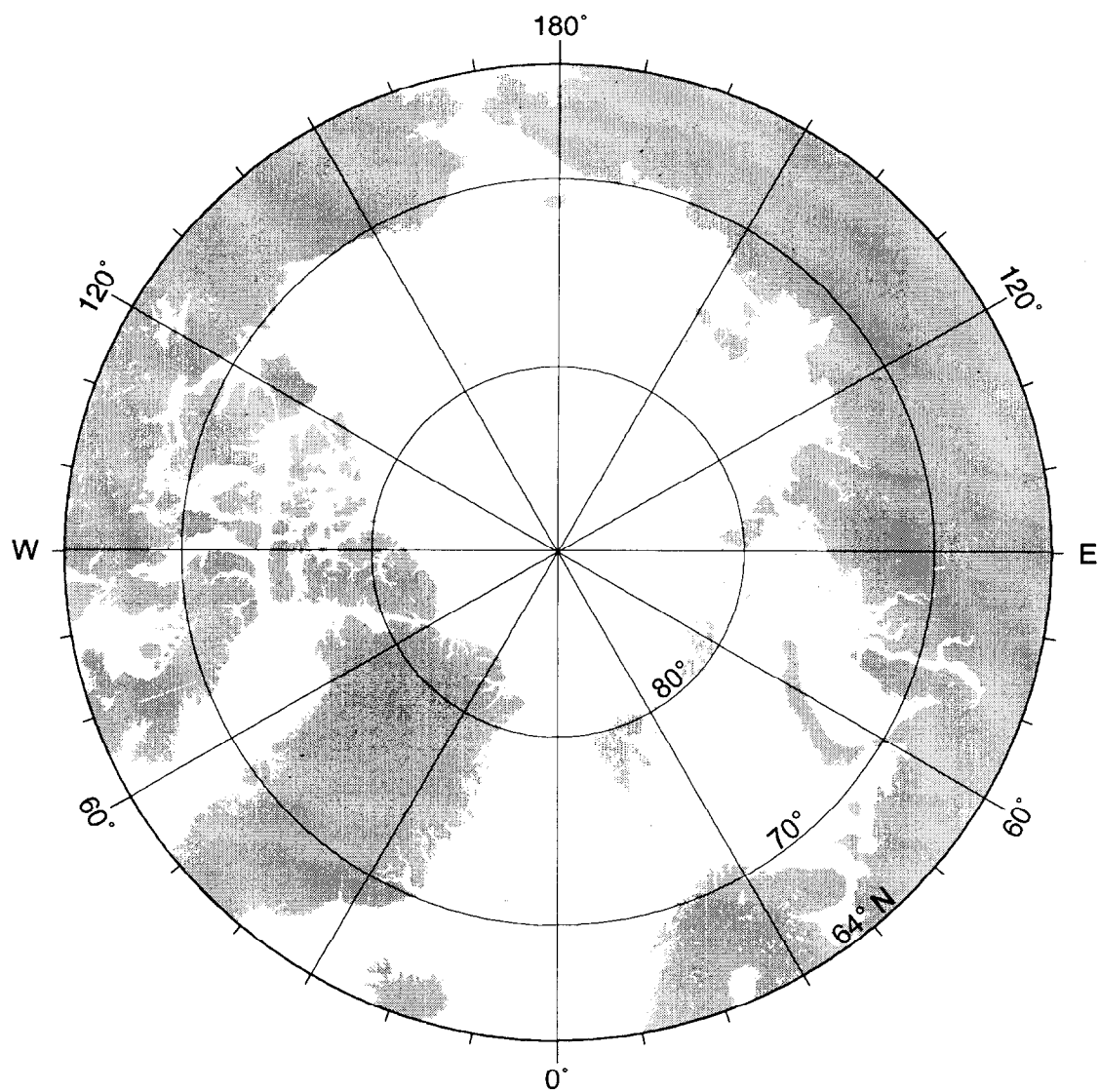


ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART OF THE WESTERN PACIFIC Scale 1:1 Million at 33° latitude



**ASSEMBLY DIAGRAM OF THE INTERNATIONAL BATHYMETRIC CHART
OF THE ARCTIC OCEAN**

(Provisional)



ANNEX IV

DRAFT RESOLUTION ON OCEAN MAPPING

Adopted by 7th Session of the CGOM at 14 April 1999 in Monaco

To: 20th Session of the IOC Assembly, Paris, 29 June-9 July 1999

The Intergovernmental Oceanographic Commission,

Recalling that since the 17th Session of the Assembly in 1993, Ocean Mapping has been a priority action of the Commission,

Noting with appreciation that in accordance with Resolution XIX.3, the Joint IOC-IASC-IHO Editorial Board for the International Bathymetric Chart of the Arctic Ocean (IBCAO) has been established and held its inaugural meeting in the Royal Danish Administration of Navigation and Hydrography in Copenhagen, Denmark, 19-20 October 1998,

Noting with satisfaction the close co-operation in Ocean Mapping with the International Hydrographic Organization (IHO); and the progress made in Ocean Mapping due to the efficient co-operation of the IOC Consultative Group on Ocean Mapping (CGOM) with the Editorial Boards for the International Bathymetric Charts for six selected areas of the World Ocean, of which the Arctic Ocean is the most recent,

Accepts the Report of the 7th Session of the Consultative Group on Ocean Mapping (CGOM), which met in the International Hydrographic Bureau in Monaco, 12-14 April 1999;

Further accepts the comprehensive Report of the Consultative Group on Ocean Mapping (CGOM) which was submitted to the 20th Session of the Assembly in accordance with Clause 1 of its Terms of Reference;

Thanks the Russian Federation for continuing to provide an expert to the IOC Secretariat for Ocean Mapping;

Requests the Executive Secretary to continue to support the Technical Secretary for Ocean Mapping;

Invites Member States to provide assistance to the Centenary Conference for the General Bathymetric Chart of the Ocean (GEBCO) to be held in Monaco in the year 2003;

Also Invites Member States to assist developing countries in the exploration, but also protection, of their Exclusive Economic Zones (EEZs) in providing, or assisting in the production of, large-scale bathymetric charts for areas of particular interest such as coastal zones and nearshore shelf areas;

Further Invites Member States to give increased support to TEMA and Capacity Building in Ocean Mapping, for instance by offering shipborne and land-based courses for professional and student trainees of developing countries; and

Considering the international co-operative aims of Agenda 21 and in recognition of the demands of the Ocean Scientific Community for seamless gridded data sets embracing deep ocean and continental margin data;

Recommends that the IOC encourages active dialogue with data holders to permit the selective use of their data, especially on the continental margin, but ensuring acquisition of such data for use by the scientific community is accompanied by adequate protection of the data contributors' commercial or security interests;

Requests the Executive Secretary to support the United Nations' initiative to publish the International World Ocean Atlas jointly with FAO and WMO.

ANNEX V

LIST OF ACRONYMS

ACUF	Advisory Committee on Undersea Features (SCUFN)
AGSO	Australian Geological Survey Organization
AGU	American Geophysical Union
BODC	British Oceanographic Data Centre
CASP	Cambridge Arctic Shelf Programme
CERESOR	Centre de Recherche Scientifique de Conakry (Guinée)
CGOM	IOC Consultative Group on Ocean Mapping
CHS	Canadian Hydrographic Service
CMG	Commission for Marine Geology
DCDB	Data Center on Digital Bathymetry
DTM	Digital Terrain Model
EB	Editorial Board
EEZ	Exclusive Economic Zone
FIG	Fédération Internationale des Géomètres
GAPA	International Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
GDA	GEBCO Digital Atlas (GEBCO Data base)
GEBCO	General Bathymetric Chart of the Oceans (IOC/IHO)
GSDI	Global Spatial Data Infrastructure
HDNO	Head Department of Navigation and Oceanography (Russian Federation)
IAG	International Association for Geodesy
IAGA	International Association for Aeronomy and Geomagnetism
IAPSO	International Association for Physical Sciences of the Ocean
IASC	International Arctic Science Committee (Norway)
IBCAO	International Bathymetric Chart of the Arctic Ocean
ICBCCA	International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic
IBC	International Bathymetric Chart

IBCM	International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IBCWP	International Bathymetric Chart of the Western Pacific
ICA	International Cartographic Association
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
IHB	International Hydrographic Bureau (Monaco)
IHO	International Hydrographic Organization (Monaco)
INEGI	Instituto Nacional de Estadística, Geografía e Informática (México)
IOC	Intergovernmental Oceanographic Commission
IOCINCWIO	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean
ISM	International Sea Mapping
NOAA	National Oceanic and Atmospheric Administration (USA)
NGDC	National Geophysical Data Centre (USA)
ODINEA	Ocean Data and Information Network for Eastern Africa (IODE)
ORSTOM	Institut français de recherche scientifique pour le développement en coopération (France)
PMGE	Polar Marine Geosurvey Expedition
SCDB	Sub-Committee on Digital Bathymetry (GEBCO)
SCUFN	Sub-Committee on Undersea Feature Names (GEBCO)
SHOM	Service Hydrographique et Océanographique de la Marine (France)
SOC	Southampton Oceanographic Centre (UK)
SOPAC	South Pacific Applied Geoscience Commission (Fiji)
UNCLOS	United Nations Conference on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization

In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' (*Also printed in Spanish*)
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping (*Also printed in French and Spanish*)
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration, Monaco, 1985
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica, Aguascalientes, 1986 (*Spanish only*)
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management, Moscow, 1986
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources, Paris, 1987 (*Also printed in French and Spanish*)
25. Third Session of the IOC Group of Experts on Effects of Pollutants, Oslo, 1986
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration, Paris, 1987
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans, Paris, 1987 (*Also printed in French*)
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources, Rome, 1987
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials, Paris, 1987
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities, Cartagena de Indias, 1987 (*Also printed in Spanish*)
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources, Bangkok, 1987
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets, Paris, 1987
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants, Paris, 1987
36. First Consultative Meeting on RNOs and Climate Data Services, Wormley, 1988
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow, Ottawa, 1988
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources, Suva, 1988
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange, Ottawa, 1988
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources, Baguio City, 1988
41. Third Session of the IOC Consultative Group on Ocean Mapping, Bremerhaven, 1988
42. Sixth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Viña del Mar, 1988 (*Also printed in Spanish*)
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN(OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources, Bordeaux, 1989
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration, Villefranche-sur-Mer, 1988
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. Cancelled
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans, Boulder, CO, 1989
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources, Bangkok, 1989
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes, Hamburg, 1989
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System, Bidston, 1989
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean, Paris, 1989
53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic, Lagos, 1989 (*Also printed in French*)
54. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico, Caracas, 1990 (*Also printed in Spanish*)
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants, London
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping
59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-Level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Intercalibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
66. Fifth Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series
67. Thirteenth Session of the IOC-IHO Joint Guiding Committee for the General Bathymetric Chart of the Oceans (*Also printed in French*)
68. International Meeting of Scientific and Technical Experts on Climate Change and Oceans
69. UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System
70. Fourth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
71. ROPME-IOC Meeting of the Steering Committee on Oceanographic Co-operation in the ROPME Sea Area
72. Seventh Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' (*Spanish only*)
73. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (*Also printed in Spanish*)
74. UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
75. Third Session of the IODE Group of Experts on Marine Information Management
76. Fifth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
77. ROPME-IOC Meeting of the Steering Committee for the Integrated Project Plan for the Coastal and Marine Environment of the ROPME Sea Area
78. Third Session of the IOC Group of Experts on the Global Sea-level Observing System
79. Third Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials

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80. Fourteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
81. Fifth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
82. Second Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of climate Change on Coral Reefs, Miami, FL, 1993
83. Seventh Session of the JSC Ocean Observing System Development Panel, Lisbon, 1993
84. Fourth Session of the IODE Group of Experts on Marine Information Management, Washington, D.C., 1993
85. Sixth Session of the IOC Editorial Board for the International Bathymetric chart of the Mediterranean and its Geological/Geophysical Series, Jerusalem, 1993
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide, Plymouth, 1993
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific, Tianjin, 1993
88. Eighth Session of the JSC Ocean Observing System Development Panel, Dartmouth, NS, 1993
89. Ninth Session of the JSC Ocean Observing System Development Panel, Melbourne, 1994
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange, Geneva, 1994
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region, Mombasa, 1994
92. Fifth Session of the Joint IOC-JGOFS CO₂ Advisory Panel Meeting
93. Tenth Session of the JSC Ocean Observing System Development Panel, Paradise, TX, 1994
94. First Session of the Joint CMM-IGOSS-IODE Sub-group on Ocean Satellites and Remote Sensing, Paris, 1994
95. Third Session of the IOC Editorial Board for the International Chart of the Western Indian Ocean, Zanzibar, 1994
96. Fourth Session of the IOC Group of Experts on the Global Sea Level Observing System, Bordeaux, 1995
97. Joint Meeting of GEMSI and GEEP Core Groups, Bermuda, 1993
98. First Session of the Joint Scientific and Technical Committee for Global Ocean Observing System, Nantes, 1994
99. Second International Meeting of Scientific and Technical Experts on Climate Change and the Oceans, Valletta, 1994
100. First Meeting of the Officers of the Editorial Board for the International Bathymetric Chart of the Western Pacific, Bali, 1994
101. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico, San José, 1994
102. Second Session of the Joint Scientific and Technical Committee for Global Ocean Observing System, Paris, 1995
103. Fifteenth Session of the Joint IOC-IHO Committee for the General Bathymetric Chart of the Oceans, Monaco, 1995
104. Fifth Session of the IOC Consultative Group on Ocean Mapping, Bremerhaven, 1995
105. Fifth Session of the IODE Group of Experts on Marine Information Management, Athens, 1996
106. IOC-NOAA *Ad hoc* Consultation on Marine Biodiversity, Paris, 1995
107. Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes, Ottawa, 1995
108. Third Session of the Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GOOS, Bangkok, 1995
109. Second Session of the Strategy Subcommittee (SSC) of the IOC-WMO-UNEP Intergovernmental Committee for the Global Ocean Observing System
110. Third Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
111. First Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate, Baltimore, Md, 1997
112. Sixth Session of the Joint IOC-JGOFS CO₂ Advisory Panel Meeting, Mayaguez, 1996
113. First Meeting of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS)
114. Eighth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño", Concepción, 1996 (*Spanish only*)
115. Second Session of the IOC Editorial Board of the International Bathymetric Chart of the Central Eastern Atlantic, Paris, 1996 (*Also printed in French*)
116. Tenth Session of the Offices Committee for the Joint IOC-IHO General Bathymetric Chart of the Oceans (GEBCO), USA, 1996
117. IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Fifth Session, USA, 1997
118. Joint Scientific Technical Committee for Global Ocean Observing System (J-GOOS), Fourth Session, USA, 1997
119. First Session of the Joint IOC-WMO IGOSS Ship-of-Opportunity Programme Implementation Panel, South Africa, 1997
120. Report of Ocean Climate Time-Series Workshop, Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate, USA, 1997
121. IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS), Second Session, Thailand, 1997
122. First Session of the IOC-IUCN-NOAA *Ad hoc* Consultative Meeting on Large Marine Ecosystems (LME), France, 1997
123. Second Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), South Africa, 1997
124. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico, Colombia, 1996 (*Also printed in Spanish*)
125. Seventh Session of the IODE Group of Experts on Technical Aspects of Data Exchange, Ireland, 1997
126. IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), First Session, France, 1997
127. Second Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 1998
128. Sixth Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1997
129. Sixth Session of the Tropical Atmosphere - Ocean Array (TAO) Implementation Panel, United Kingdom, 1997
130. First Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 1998
131. Fourth Session of the Health of the Oceans (HOTO) Panel of the Global Ocean Observing System (GOOS), Singapore, 1997
132. Sixteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), United Kingdom, 1997
133. First Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1998
134. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IOC/EB-IBCWIO-IV/3), South Africa, 1997
135. Third Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), France, 1998
136. Seventh Session of the Joint IOC-JGOFS CO₂ Advisory Panel Meeting, Germany, 1997
137. Implementation of Global Ocean Observations for GOOS/GCOS, First Session, Australia, 1998
138. Implementation of Global Ocean Observations for GOOS/GCOS, Second Session, France, 1998
139. Second Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Brazil, 1998
140. Third Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), China, 1998
141. Ninth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Ecuador, 1998 (*Spanish only*)
142. Seventh Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Croatia, 1998
143. Seventh Session of the Tropical Atmosphere-Ocean Array (TAO) Implementation Panel, Abidjan, Côte d'Ivoire, 1998
144. Sixth Session of the IODE Group of Experts on Marine Information Management (GEMIM), USA, 1999
145. Second Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), China, 1999
146. Third Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Ghana, 1999
147. Fourth Session of the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC); Fourth Session of the WCRP CLIVAR Upper Ocean Panel (UOP); Special Joint Session of OOPC and UOP, USA, 1999
148. Second Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1999
149. Eighth Session of the Joint IOC-JGOFS CO₂ Advisory Panel Meeting, Japan, 1999
150. Fourth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), Japan, 1999
151. Seventh Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1999