

Distribution: limited

IOC-IHO/GEBCO Officers-XI/3

English only

20 June 1998

INTERGOVERNMENTAL OCEANOGRAPHIC
COMMISSION
(of Unesco)



INTERNATIONAL HYDROGRAPHIC
ORGANIZATION



Eleventh Meeting of the GEBCO Officers

covering also

the Fifteenth Meeting of the Sub-Committee on Digital Bathymetry

**Institute of Geological and Nuclear Sciences Ltd.
and
National Institute of Water and Atmospheric Research Ltd.**

12-17 March 1998

SUMMARY REPORT

In addition to recording the business of GEBCO Officers XI, these minutes also contain a précis of the substantive discussions and decisions which arose during the preceding meeting of the GEBCO Sub-Committee on Digital Bathymetry (SCDB). For recording purposes, some of the content of the two meetings are woven together.

1 OPENING OF THE SESSIONS

- 1 The Eleventh Meeting of the joint IOC-IHO General Bathymetric Chart of the Oceans (GEBCO) Officers and the Fifteenth Meeting of the Sub-Committee on Digital Bathymetry (SCDB) were each held at two venues in Wellington, New Zealand: The Institute of Geological and Nuclear Sciences Ltd. (IGNS), and the National Institute of Water and Atmospheric Research Ltd. (NIWA), 12-17 March 1998.
- 2 The opening address to the GEBCO Officers and SCDB was given by the Chief Executive Officer at IGNS, Dr. Andrew West. He explained that IGNS and NIWA were two of nine national Crown Research Institutes, and that IGNS was the smallest of these organisations. On behalf of IGNS, NIWA and the other Institutes, he bade a special welcome to GEBCO for its work in seeking to provide authoritative bathymetry of the ocean floor - a vital component in the constant search to discover the nature of the interactions between the oceans and the weather, and particularly at the present time, when so much effort is being spent trying to predict the effects of El Niño.
- 3 In his response, the Chairman, Sir Anthony Laughton, said that the GEBCO community were very honoured to be invited to meet in New Zealand. He explained the dual policy of introducing GEBCO activities; firstly, to inform a wide selection of global institutions about GEBCO activities, and secondly, to allow participants to learn at first hand about the detailed work of other scientists engaged in similar studies.
- 4 Dr. Meirion Jones, Chairman, SCDB, added his thanks to Dr. West. In remarking on the excellent attendance, he welcomed participants old and new, adding special greetings for those from IGNS, LINZ, NIWA, and the New Zealand Hydrographic Office.
- 5 A full List of Participants is given in Annex X
- 6 Apologies for absence had been received from:

RAdm Christian Andreasen	Dr. Andrey Popov
Dr. Robin Falconer (for 12 & 13 March)	Dr. Hans-Werner Schenke
Mr. Alexis Hadjiantoniou	Dr. Walter Smith
Mr. David Monahan	Dr. Kunio Yashima

2. CONDUCT OF THE MEETINGS

2.1 Adoption of the Agenda

- 7 The Chairman, said that although noting that many of the subjects on the agendas of the GEBCO Officers and SCDB meetings seemed to cover the same subject matter, it was the business of the Officers' meeting to bring together the threads of conclusions reached after detailed discussion at the Sub-Committee meeting, and from these to create the policy to guide GEBCO (See Annex 1).

8 He explained that in future, no minutes of the SCDB meetings would be drafted. Instead, the major elements of the business of the SCDB will be recorded in the minutes of the Guiding Committee or GEBSCO Officers' meetings.

9 He saluted the previous extensive SCDB minutes, prepared by Dr. Jones, but added that it was no longer possible for Dr. Jones to continue to produce similar thorough minutes while also devoting increasing amounts of time to the updating and development of the GDA.

2.2 Documentation, Administrative Arrangements, etc.

10 Mr. Brian Harper, Permanent Secretary GEBSCO, introduced the documentation - see Annex II.

11 Other papers, maps and diagrams were submitted to the meetings for consideration. These are also listed at Annex II.

3. COMPOSITION OF THE GUIDING COMMITTEE AND ITS SUB-COMMITTEES

3.1 Guiding Committee

12 Following the resignations from the Guiding Committee, in 1997, of Capitán de Navío J. M. Fernández de la Puente (Spain) and Capitão-de-Fragata Lucas de Campos Costa (Brazil), the IHO invited the Member States to put forward proposed replacements.

13 The following officers received the majority of votes and were duly appointed by the IHO.

- Dr. Michael Loughridge (USA)
- Ingénieur général de l'armement Patrick Souquière (France)

14 The Chairman reminded the meeting of the composition rules for membership of the Guiding Committee whereby not more than one person from any one country can be appointed.

3.2 Sub-Committee on Digital Bathymetry (SCDB)

15 There were no suggested changes in membership.

3.3 Sub-Committee on Undersea Feature Names (SCUFN)

16 There were no suggested changes in membership.

3.4 Scientific Advisers

17 The position of Dr. Yuri Kiselev at VNIIOkeangeologia was raised for the second time. It was noted that no word had been heard from him for several years. At the 1997 meeting of the Guiding Committee, Dr. Gleb Udintsev said he would make enquiries about Dr. Kiselev's intentions as far as GEBSCO was concerned. No response had been received.

- 18 It was agreed that the Permanent Secretary should write to the Director, VNIIOkeangeologia, Academician Igor Gramberg, explaining the position regarding Dr. Kiselev and to tell him that if no word is heard from Dr. Kiselev, it will be assumed that he no longer wishes to participate in GEBCO activities, and that his name will be removed from the list of Scientific Advisers.

3.5 GEBCO Reviewers

- 19 A letter had been received from Admiral Komaritsyn announcing the retirement of Dr. Evgeniy Shchaulov who was not able to continue in his role as a joint GEBCO Reviewer for the Arctic Ocean. Admiral Komaritsyn proposed Dr Valeriy Fomchenko as a replacement to fill this vacancy. After some discussion this appointment was agreed.
- 20 The Chairman said that some further consideration should be given to the other Reviewer of the Arctic Ocean, Mr.Dave Monahan, CHS. He added that since his duties with the CHS were very heavy, perhaps this may be an opportune time to add Mr. Ron Macnab, GSC, to the Arctic Ocean team of reviewers. He agreed to write to Dr. Richard Haworth at the Geological Survey of Canada, to ask if Mr. Macnab could undertake the work.
- 21 A letter had also been received from Lt. Patricio Carrasco Hellwig announcing that due to a change in his employment he was unable to continue in his post as a GEBCO Reviewer for the South-East Pacific. In January 1998, a letter was sent to Captain Rafael Mac-Kay, Director of the Chilean Hydrographic Office, inviting him to propose a replacement. To date, no response had been received.
- 22 In the event that Chile are unable to find a suitable replacement, it was agreed that the Permanent Secretary should approach Dr. Steve Cande, Scripps Institution of Oceanography, with a copy of the Terms of Reference for GEBCO Reviewers, asking him if he would consider accepting the appointment of GEBCO Reviewer for the South-East Pacific.
- 23 After considering the remaining list, it was agreed that for the area of the South Atlantic, an additional Reviewer, to share the task with Mr. Norman Cherkis, NRL, should be sought. Mr. Harper was asked to invite the Brazilian HO asking them to propose a suitable officer.

3.6 General Review of the GEBCO Personality List

- 24 Mr Philip Woodward, SOPAC, was added to the list of Other Personalities.

4 MATTERS ARISING FROM REPORTS OF PREVIOUS MEETING

4.1 Summary Report of the Sixteenth Session of the Joint IOC-IHO Guiding Committee for the GEBCO (Doc. IOC-IHO/GEBCO-XVI/3)

- 25 Referring to the presence of Dr. Robert Fisher, Chairman SCUFN (who had attended the Antarctic Hydrographic Committee meeting 9-11 March in Christchurch), Sir Anthony Laughton explained that as SCUFN was not normally represented at the GEBCO Officers meeting. He said that there was some business concerning Undersea Feature Names and Definitions, left over from the 1997 meeting at Southampton, which did not appear on the agenda. He said he would draft changes to the original document submitted at GEBCO XVI and send them to Dr. Fisher, and to IHB. In acknowledging the need to reconcile definitions with other publications, he said he expected a lengthy iterative process before agreement was reached.

- 26 All other matters arising from this report are covered by agenda items.

5 GEBCO ACTIVITIES

5.1 Review of Bathymetric Mapping Activities World Wide

27 Dr. Jones said that it was the aim of the SCDB to develop the GDA as an up-to-date and authoritative source of bathymetry for the world's oceans - no longer constrained by scale. He gave a brief summary of worldwide mapping activities.

Arctic Ocean

28 Dr. Jones said that the most significant point of note for this region was the work of the Arctic Bathymetry Workshop (see Item 7). Mr. Macnab responded by saying that one of the major goals of this initiative is to produce a new version of GEBCO Sheet 5.17 as a contribution to GEBCO.

29 Mr. Cherkis reported that the Arctic region continues to be examined. NRL will be conducting a joint programme with Russia, Norway and Germany aboard *RV Mstishv Keldysh* in June or July 1998, using the MIR submersibles on the Barents Sea shelf. Bathymetry will be collected prior to the dives on a previously located mud volcano and a landslide region. Studies of the Knipovich Ridge studies will be conducted if time permits.

30 He added that he had received the US Arctic Submarine Laboratory data sets in September 1997. He expected to complete cleaning these by March 1998 before passing them via NIMA back to the Submarine Laboratory for final release to NGDC. Although 120,000 track miles were sailed only about 50,000 miles of track contain bathymetric data.

31 He concluded by noting that the SCICEX bathymetric data will not be passed to NGDC until the entire programme is completed in 1999 - however, there are discussions on extending the programme into the next millennium.

32 Mr. Macnab displayed overheads of the SCICEX operations areas and US Navy tracks. He added that following the confirmation of the release of the US Navy data, further meetings are planned with Russian counterparts to persuade them to also release their high-latitude Arctic bathymetric data.

33 On the question of release of three under-ice UK Navy tracks, it was suggested that these might now reside with the Scott Polar Research Institute and may be released under the same mechanism as that used for the release of US submarine data. Mr. Cherkis said he would supply Mr. Harper with details of the release mechanism. The GEBCO Chairman said he would write to the Scott Polar Research Institute asking for this data to be released to NGDC.

34 A number of participants noted that the WVS was inadequate in parts of the Arctic Ocean, e.g. northern Greenland. Dr. Jones recalled that the original specification for MWS was that '90% of all identifiable shoreline features should be located within 500 metres of their true geographic position with respect to the WGS-84 datum. Unfortunately, information was not available to identify the location of the remaining 10%. The SCDB had already identified shortcomings in WVS in Antarctica and had assumed that the area of the 10% probably referred to the two polar regions. Participants underlined the fact that WVS is not designed to support hydrographic mapping, particularly at scales larger than 1: 250,000. Questions also arose about coastline definition and assessment. In noting that NIMA are currently building a new shoreline, it was suggested that Dr. Jones might approach them about low tide/high tide problems, which beset the compilers of large scale bathymetric maps.

Atlantic Ocean

- 35 Mr. Peter Hunter, SOC, displayed an index of the East Atlantic area showing where he had worked using contours at 100m intervals, and where he had completed gaps in the contouring not covered by Jean-Claude Sibuet. Most of this work is earmarked for inclusion into the IBCEA project.
- 36 Speaking for the IBCEA project, Ing. En Chef Gilles Bessero said that SHOM had not been able to obtain data from the Russian Federation or Guinea, and had decided to go ahead without it. He added that nine maps are in various stages of production , but none are printed.
- 37 Mr. Macnab exhibited map and grid assemblies in the NW Atlantic, combining US and Canadian data. He said that he was still seeking ways to obtain data held in classified files of the US Navy World Wide Survey Operations. He added that much of the current Canadian interest was in the transition from land to shore where the coastline is an important contour linking land and sub sea morphology, and topographic information, old and new, can supply insight to explain the structure of bathymetric features.

Caribbean Sea and Gulf of Mexico

- 38 A report from Dr. Troy Holcombe, NGDC, indicated that of the 17 sheets of the IBCCA project, the USA have almost completed their production responsibility for five of these. Sheets 1.04 and 1.09 have been printed; 1.01, 1.02 and 1.03 are expected to follow shortly. Work on the three Mexican sheets is also well advanced, and printed versions are expected within the next few months. Although progress in other areas is not progressing so fast, the pattern of production reflects the Chief Editor's policy to concentrate initially on the northern areas.
- 39 NGDC will make a CD-ROM of four raster files of the areas covered by sheets 1.01-1.04. This will be available shortly. It is expected that the Mexicans will do the same for their area.

Mediterranean and Red Seas

- 40 Dr. John Hall, speaking for IBCM, described the project briefly saying that 700 extra bathymetric charts and fair sheets have been used to extract data and fill in many otherwise blank areas. Italy will produce a one tenth of a minute grid for the region.
- 41 He said that, once the decision has been given to proceed, a new version of Sheet 9 or 10 should be completed in 1999.
- 42 He added that for the Red Sea, data from every available chart (including historic versions) have been captured. The data base includes 140,000 soundings. Dr. Hall said he hoped to have the Red Sea map finished by 1999.
- 43 Dr. Loughridge advised that some swath mapping, carried out by NAVOCEANO, is not included in Dr. Hall's data base.

Pacific Ocean

- 44 Speaking as the Chief Editor of the IBCWP, Dr. Hou Wenfeng gave an informative presentation on the progress of the project. Originally, the IBCWP was divided into six Sub-Regions in the hope that responsibility for the work in each of these regions would be undertaken by a particular

country or agency. At present, only four Sub-Regions are operating as planned. He said he was hopeful that New Zealand, in addition to participating in the project, would take responsibility for Sub-Region 5 and similarly, SOPAC for Sub-Region 6.

45 What was becoming clear was the need for more participation by other countries and for specific training for those employed on the compilation of maps. Recognizing the different levels of technical ability in the countries involved, he expressed his thanks for the offer by NGDC to examine the possibility of providing a suitable training course for selected officers.

46 Progress in the production of maps was listed:

Sub-Region 1: (Russia) 10 sounding sheets compiled @ 1:500,000

Sub-Region 2: (Japan) No progress -awaiting the completion of digital bathymetric charts.

Sub-Region 3: (China) 27 sounding sheets compiled @ 1:500,000

Sub-Region 4: (Australia) compilations in progress - first two sheets scheduled for 1998

Sub-Region 5: No progress

Sub-Region 6: No progress

47 Dr. Hou added that a problem with geographic names was emerging whereby some geographic features were given separate names by different charting or mapping authorities.

48 Well aware of this situation, Dr. Fisher said he was anxious that all Chief Editors of IOC Regional Ocean Mapping Projects be informed specifically that names of seafloor topographic features should first be sent to SCUFN or BGN's ACUF for review and verification before the initial printing of each chart. Editorial boards' Terms of Reference should include such a reminder.

49 Mr. Shin Tani, JODC, reported that Japan has been somewhat inactive as far as IBCWP is concerned. He introduced a new 6300 and 6700 series of maps at 1:1,000,000. These received a number of compliments for their technical production and content.

50 Mr. Hunter added that Dr. Luis Delgado, Mexico, had informed him that they were compiling a series of 1: 250,000 maps covering the northern part of the Gulf of California.

51 Dr. Stuart Henrys, LINZ, said that there was some new mapping in small areas of the Pacific. Many of these small areas fell within the limits of the Bathymetry of the South central Pacific @ 1:6,442,194 compiled by Dr. Jacqueline Mammerickx in 1992. Dr. Ian Wright, NIWA, said that although some of the area of the general bathymetric map of New Zealand fell within that map, it had not been used for comparison during the compilation process.

52 Mr. Hunter said he was also aware of mapping and grids around Hawaii, but despite frequent overtures had been unable to obtain these.

53 Mr. Philip Woodward reported that Dr. Alf Simpson had been appointed as the new Director of SOPAC. He said that this had given SOPAC a new impetus; they were now hopeful of filling the post of Offshore Co-ordinator. All recent work had focussed on near shore data - future activities will be directed to the coastal zone and EEZ.

New Zealand Waters

54 Dr. Wright, explained that there were four agencies in NZ who had interests in bathymetric mapping:

- Institute of Geological and Nuclear Sciences Ltd. (IGNS)
- Land Information New Zealand (LINZ),
- National Institute of Water and Atmospheric Research Ltd. (NIWA)
- Royal New Zealand Navy Hydrographic Office

- 55 He said that NZ had a commitment to ocean mapping that dated back sixty years. At present, there were two series of maps: 1:1,000,000 Oceanic series - using GEBCO plotting sheet limits - with 250m contour intervals, and another larger scale Coastal series at 1:200,000 with 50m contour intervals. Additionally, there was a miscellaneous series of maps which importantly, included a small scale regional chart of the waters around New Zealand at 1:4,000,000. This was produced in two forms; as a DTM and as a contour map. He added that he did not see this map being superseded for the next five years.
- 56 He showed an overhead illustrating the 1:1,000,000 GEBCO Plotting Sheets which have been contoured and which may be made available to GDA.
- 57 Dr. Wright said work was underway to define UNCLOS boundaries. In some areas only old *RV Eltanin* data was currently available. In a separate undertaking, NIWA and IGNS were collaborating on a project to invert satellite altimetry data to derive predicted seafloor topography using regional shipborne data as model parameters. Dr. Guillaume Ramillen from Toulouse university is working at NIWA on this project.

Indian Ocean

- 58 Dr. Fisher reported briefly that the Indian Ocean mapping project was on course, in close collaboration with Pauline Weatherall and associates at BODC to digitize his contouring. He hoped to complete the Northern Indian Ocean into the Bay of Bengal and across to 170°E by mid-1999; an initial version already has been digitized. He added that it was also his intention to revise, refine and extend the contouring in areas south of 31°S previously incorporated into the GDA as *GEBCO 97. 1*. He stated his belief that the contoured version for the Red Sea prepared by Dr. John Hall would serve excellently to extend comparable coverage there.
- 59 A report sent by Dr. Holcombe, said that the Fourth Editorial Board Meeting of the IBCWIO project, was held in October 1997 in Cape Town, South Africa, hosted by the Hydrographic Office of the South African Navy. It added that although a large data gathering exercise was now almost complete, no map compilations had begun. It concluded by saying that Mr Sidney Osborne, Superintendent Chart Production, South African Hydrographic Office, had joined the Editorial Board.
- 60 At the Cape Town meeting Dr. Holcombe had made a presentation on how a small and budget-limited organization can accomplish compiling, raster scanning, vectorizing, creation of grid files, creation of image files, and printing of bathymetry, using mapping/GIS software such as GMT and Arc-Info. He also teamed up with Mr. Hunter to explain how to use NGDC's global trackline geophysical data base (GEODAS) on CD-ROM to view and extract bathymetric data.
- 61 At the request of the Editorial Board, a Web Site for the IBCWIO project has been prepared. A provisional version of these web pages can be viewed at:
- <http://www.ngdc.noaa.gov/mgg/ibcwio.html>
- 62 Dr. Fisher reported that in January he had received a letter from Ing. Hartmut Klüger, Bundesamt für Seeschifffahrt und Hydrographie, which included a copy of a CD-ROM "IBCWIO 1997". This was the first direct word he had received on the progress of this project in eight years. The point of the letter was to enquire what help Dr. Fisher may be able to offer IBCWIO as a result of his own work in the Indian Ocean.

- 63 Dr. Fisher explained how he had plotted out 3 of the 32 IBCWIO sheets of tracks and soundings, made examinations of these against his own compilations, and wrote a detailed critique of his findings. He discovered that IBCWIO lacked a large quantity of track data, much of which Fisher had been given to use for GEBCO 6 but not to distribute. He concluded his reply to Ing. Klüger by saying that he did not have the facilities, financial resources nor inclination to prepare complete digital files of his own bathymetric holdings; however, he added that insofar as it would help IBCWIO he would hope the Editorial Board would feel free to include in *its* ultimate product as much of his contour interpretations as its members find acceptable.
- 64 Dr. Fisher added that in the past year he had been given exemplary cooperation and access to recent digital data by the Japanese Geological Survey (Southwest and Southeast Indian Ocean) and the Australian Antarctic Division (South-Central and Southeast Indian Ocean); the latter collaboration was re-affirmed at the just-concluded Hydrographic Committee meeting in Christchurch.

Southern Oceans

- 65 Mr. Cherkis reported that from mid Nov. '97 - mid Jan. '98, *RV Polarstern* had collected 11,000 miles of Hydrosweep multibeam bathymetry - an index of tracklines was displayed. An examination in the South Shetland Trench revealed major submarine canyon systems running downslope from King George Island.
- 66 Dr. Stuart Henrys reported that LINZ have a new Bathymetric map "Ross Sea Area to Marie Byrd Land" - it is available on CD-ROM.
- 67 Mr. Bruce Wallen, LINZ, said that the recent Antarctic Hydrographic Commission meeting in Christchurch, NZ, had very little to contribute to GEBCO. A poll of Member States is to be held on the use of the term 'Southern Oceans'.
- 68 Commodore Neil Guy, IHO, said that South Africa will shortly send data to NGDC.

Great Lakes

- 69 Dr. Loughridge reported that preparation of new bathymetry for the Great Lakes is a co-operative effort between NOAA National Geophysical Data Center, NOAA Great Lakes Environmental Research Laboratory, and the Canadian Hydrographic Service. New bathymetry for Lake Erie and Lake Saint Clair is complete and is now available in digital form. In preparation is a Lake Erie and Lake Saint Clair bathymetry CD-ROM containing the digital bathymetry in vector and raster grid form (grid resolutions of 3, 9, and 30 arc-seconds), and including explanatory text as well as image files for browsing. Compilation of new bathymetry for Lake Ontario is complete, and digital scanning and editing is now in progress. New bathymetry is almost complete for Lakes Huron and Superior. Lake Michigan bathymetry, completed several years ago, is currently being distributed by NGDC as a poster, and as digital data on CD-ROM.

5.1.2 Other Related Activities

- 70 Mr. Cherkis reported that US NRL were currently devoting their resources to shallow water studies; deep water studies have taken second place. Work in the Sea of Japan, Persian (Arabian) Gulf and South China Sea have been suspended

5.2 THE GEBCO DIGITAL ATLAS (GDA)

5.2.1 GEBCO Digital Atlas Questionnaire - Review and Analysis

- 71 Dr. Meirion T. Jones, Chairman SCDB, explained that completion of the GDA Questionnaire, by holders of the First Edition of GDA, was a condition of receipt of a free upgrade for the 1997 Edition. The purpose of the Questionnaire was to solicit ideas on how the GDA could be improved in future releases. It was deliberately not sent to members of the GEBCO community.
- 72 Dr. Jones explained that the Questionnaire was a two-page document with questions arranged under six headings (see Annex VIII, pages 1-2).
- | | |
|-----------------------------|--------------------|
| A. Gridded Bathymetry | D. Suggestions |
| B. Shallow Water Bathymetry | E. User Profile |
| C. Paper Charts | F. Mailing Address |
- 73 Turning to the analysis of the Questionnaire (see Annex VIII - Pages 3-6), Dr. Jones said that he had received returns from 385 of the 636 holders of the First Edition of the GDA. He added that these returns, from respondents in 43 countries, represented a wide range of users and probably covered the requirements of about 80% of the research user community.
- 74 Generally, the answers to the Questionnaire 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 responders; 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.
- 75 Numerous ideas were received under Section D: Suggestions. These included: Closed polygons for coastlines and contours (topological discrepancies now being cleaned by Pauline Weatherall); provision of a Windows version (currently under consideration); addition of polar projections (to be included in the Third Release in 1999).
- 76 The analysis of the User Profile (Section E) revealed some interesting statistics. Chief among these were that 89% of responders are using the GDA on PCs, and of 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 home-grown software, another 41 proprietary packages were listed.
- 77 Dr. Jones concluded by saying that it was clear that the user community are frustrated by the lack of a gridded version of the GDA, omission of most of the available shallow water bathymetry and the content and speed of the updating procedures. Notwithstanding the international scientific demands for the GDA and its planned improvements, he observed that virtually all progress on the product was by way of the voluntary contributions of those who attended GEBCO meetings. It was essential, therefore, that these meetings should continue to focus activity on the regular delivery of enhanced versions of the GDA for the benefit of the worldwide user community.
- 78 Recalling IOC Resolution XVIII-10 (June 1995) "Support for the Joint IOC-IHO Ocean Mapping Programme" and the debates which took place at GEBCO XVI in Southampton in June 1997, Dr. Jones asked what support had materialised at the XIX Session of the IOC Assembly, July 1997. (see Item 9.1 for discussion)

5.2.2 The GEBCO Bathymetric Editor - Annual Report

- 79 Mr. Hunter submitted a report on his activities: Report of the GEBCO Bathymetric Editor, July 1997- February 1998 (see Annex IV). During the intersessional period, he attended the second

meeting of SCOR WG 107 in Baltimore, USA, (see Item 8), and the fourth session of the IBCWIO Editorial Board in Cape Town. One outcome of this latter meeting was a promise by Mr Sidney Osborne, Superintendent Chart Production, South African Hydrographic Office, to visit the GBE and Dr. Jones at BODC, with the aim of increasing South Africa's bathymetric mapping abilities.

80 Mr. Hunter then went on to describe his progress with a number of bathymetric compilations, mainly in the North-east Atlantic Ocean.

81 He also drew attention to an invitation he had received (as GBE) to attend an international workshop on "Bathymetry and Coastal Topography Data Management" arranged by a group undertaking tsunami research in the North Pacific Ocean. The meeting to be held in Washington University, Seattle, was scheduled to follow directly after the GEBCO meetings in Wellington. It was agreed that a report of that meeting should be included in the minutes. (see Annex XII).

82 Finally, whilst discussing the topic of "useful contacts" it was suggested that there was a real benefit in developing a GEBCO Web Site. (see Item 5.3.4.)

5.2.3 The GEBCO Digital Atlas Manager - Annual Report

83 Ms. Pauline Weatherall, BODC, submitted a report on her activities: Report of the GEBCO Digital Atlas Manager, June 1997- March 1998 (see Annex VI). Once again, her main activity during the intersessional period had been the continuing co-operation with Dr. Fisher over the long term task of digitizing the hand-drawn contour sheets and tracklines of his major work in the greater Indian Ocean.

84 Work has also been carried out digitizing contours and trackline control data in the Arctic region. (see Annex VI Page 1, and Item 7)

5.2.4 GEBCO Reviewing System

85 The Chairman reminded the meeting that the problems of inadequate contact with the GEBCO Reviewers and how that might be improved, had been discussed at length during the last two meetings. He enquired how Mr. Hunter's proposal to send Reviewers A4 sized index diagrams of their area of interest, had worked out. (See Annex III for List of Reviewers)

86 In reply, Mr. Hunter said that the introduction of the new system (1997) had proved a great success, he reported a marked improvement in the quantity and quality of responses. He planned to send out such diagrams twice a year.

5.2.5 New Mapping and Technical Changes identified for inclusion in the Third Release

87 In summarising the discussions of the SCDB, the Chairman identified four new elements planned for inclusion in the Third Release of the GDA in 1999:

- Polar Projection capability
- Gridded Data Base of contours
- Gridded Data Base of Predicted Satellite Bathymetry (or Sea Surface Gravity)
- Updated Bathymetry, including Coastal Margin Data (when available)

- 88 Recognizing that the additional elements may prove too much for a single CD-ROM, Dr. Mike Carron, USNOO, said he would discuss the matter of possible overload with Dr. Walter Smith. He expected an answer by May 1998. A two-disc option was generally thought to be necessary with grids being held separately on one of these.
- 89 A long examination was carried out for each ocean area to determine which map/data/grids could be incorporated into the 1999 Release. In areas of data complexity, such as the North Atlantic, it was agreed that an exact definition of data limits for inclusion would have to await discussions between other parties.
- 90 Concerning overlaps with the eastern limits of Dr. Fisher's Indian Ocean maps, two points were raised. Firstly; in respect of the overlaps with IBCWP maps in the China Sea, it was agreed to accept Dr. Fisher's work in this area for the 3rd Release of the GDA and consider the inclusion of IBCWP mapping for the 4th Release, when a decision will have to be made on whether to replace or retain Dr. Fisher's contours. Secondly; in the area of overlap with the 1:4,000,000 Bathymetric Chart of New Zealand waters, Dr. Fisher said he was quite content to restrict his overlap to a narrow band of 3° of longitude along the eastern border of his map - subject to successfully importing the NZ map - this was agreed.
- 91 After concluding his consultations about available mapping, Mr. Hunter said he would provide index diagrams and inventory lists for The World and the Arctic Region as follows: (see Annex IV, Pages 1-8).
- Maps: Included in 2nd Release, 1997 Edition
 - Maps: Category Priority 1 to be included in 3rd Release, 1999 Edition
 - Maps: Category Priority 2 (reserves for 3rd Release) and others for consideration after 1999
- 92 The following actions were identified to seek the release of specific maps for the 1999 Edition of GDA. (See Annex V)
- *Ross Sea.* This sheet was not available for examination at the GEBCO Officers' meeting. If required for release by GBE, Dr. Falconer, will advise on approach to LINZ and IGNS.
 - *New Zealand.* Bathymetric Maps. Dr. Meirion Jones to draft letters for Chairman asking NIWA and LINZ for formal release. Request to include coarse grid option.
 - *Canadian Waters, including Hudson Bay.* Dr. Jones to draft letter for Chairman seeking formal release of data from GSC and CHS.
 - *US East Coast.* Dr. Loughridge to initiate request to Dr. Holcombe, NGDC, asking for data.
 - *Caribbean and Gulf of Mexico - US area of responsibility.* Request to Dr. Holcombe, NGDC, asking for data - Dr. Loughridge to initiate.

- *Hawaiian Waters.* Mr. Woodward to contact Dr. Barbara Keating, HIG, to supply data to GBE.
- *North Atlantic Ocean.* Mr. Hunter and Mr. Macnab to resolve limits of area to link work on east and west portions.
- *South-Central Pacific Ocean.* Chairman to reconsider approach to Dr. Mammerickx, SIO, to obtain permission to incorporate her 1992 bathymetric map of this region into GDA.
- *World Vector Shoreline.* Dr. Jones to write to R. Adm. Christian Andreasen, NIMA, to enquire whether the WVS had been updated and whether improved data were available for the Arctic Area.

93 The Chairman said it was essential that all Priority 1 maps were digitized and ready for presentation by the 1999 meeting, where a quality review of each sheet would be undertaken. Subsequent incorporation and edge matching would be followed by gridding routines. He acknowledged the strain that such a programme would have on Ms. Weatherall in particular, and urged data providers to send Priority 1 data to BODC as soon as possible.

5.2.6. Sales and Distribution

94 Dr. Jones presented details of the Distribution/Sales of GEBCO Digital Atlas (1 March 1998) and a Summary of Statistics - see Annex VII. He said that, to date, 885 copies of the GDA had been distributed to more than 500 organisations in 78 countries - of these 660 had been sold. He added that current sales of the 2nd Release were running at 5-6 per week. Most of these orders came from Web advertising and from an article he wrote for "Hydro International". This volume of sales presented no problem. Income from sales covered costs of publishing, distribution, promotion, raster scanning and digitising facilities at BODC but not the salaries of BODC staff.

5.3 Future Development of GEBCO Products

5.3.1. Update on the work of the GEBCO Gridded Data Set Group.

95 Dr. Jones said the scientific community were looking to GEBCO to provide a gridded version of the GDA and he added that this product must be included in the 3rd Release planned for 1999. Recognising the short time scale and technical difficulties ahead, he said that idealism should be tempered with pragmatism.

96 In making his presentation, Dr. Carron paid tribute to Dr. Smith's work, and others, during the past 5-6 years. He said two main points had emerged from the Group's work during the past nine months:

- There is an overwhelming need to produce something better than any of the grids currently available.
- The GDA grids are mathematical models derived from the contours. They will give a very close match to the GDA contours in most cases, but should not be expected to replicate them at all locations.

- 97 In respect of the first point, he said that although, in some areas, it may not be possible to improve on DBDB5, the GDA would be a cohesive data set. He added that DBDB5 data should not be included in the GDA, and should be considered as entirely superseded by the GDA.
- 98 He recommended that a separate gridded data base be included representing the data obtained from satellite altimetry measurements. This should not be the merged gravity and bathymetry measurements of "estimated bathymetry" since this contains too many assumptions. On the issue of which gravity or altimetry grids to employ, Dr. Carron said he understood that there were choices, but assured the meeting that the Gridding Group would be guided by the requirement to select the best options available.
- 99 Dr. Andrew Goodwillie, SIO, gave a presentation on his gridding project with the contours from Dr. Fisher's work in the Indian Ocean. He described how contours and ship track data were used. He said that in areas such as abyssal plains, shipboard depths (ground truth) were essential to control the grid.
- 100 Dr. Carron said that Dr. Goodwillie's grid is probably better than GEBCO can hope to produce for the 1st Edition of its grid, due to lack of shipboard data available to those working up the GDA grid. -
- 101 The Chairman, GEBCO, said that to get the whole world gridded to the standard set by Dr. Goodwillie, would be a very time consuming business, probably taking six months or more to review. Recognizing that the GDA grid will be of variable quality, it was agreed that a target date of June 1999 be set so that the gridded data base can be reviewed at the next meeting of the SCDB and the Guiding Committee.
- 102 The work and conclusions of the Gridded Data Set Group are described by Dr. Michael Carron at Annex IX.

5.3.2. Digital Techniques for Labelling Undersea Feature Names.

- 103 The Chairman asked what had happened to the work carried out by Dr. Gary Robinson, 1993-96, and whether this work should be developed.
- 104 Dr. Jones replied that Dr. Robinson had generated a number of useful Resources are required to convert these technical innovations for use in GDA, so that scale related names can be correctly assigned for colour filled features, thus permitting print-on-demand mapping, or other viewing choices. The main problems were defining the extent of features, automatic name placements, font sizes and scale relationships. He added that most Geographic Information Systems have this feature built in. Unfortunately, Dr. Robinson will be unable to continue with this work - further development is required.
- 105 Dr. Loughridge reported that Ing. en Chef Michel Huet, IHB, was working on the digital version of the Undersea Features Gazetteer to improve accessibility and ease of use.

5.3.3. Derived Products.

- 106 Dr. Carron proposed that, in tandem with the development of the GDA scientific grid, a coarser gridded educational spin off -as a popularised version with imagery - should be developed. He said that such a product would be a very useful but inexpensive tool, for which he envisaged a world-wide demand.

- 107 This proposal generated a long debate which raised several difficult issues. Chief among these were consideration of the addition of land topography, funding, organisation, product development, marketing and strategic direction, together with questions about the danger of moving away from the core of GEBCO. In support of the proposal Dr. Falconer presented a vision of earth sciences teaching with such a product which could enjoy 3D viewing, real-time 'fly-throughs' below water, changing patterns/colours, and depiction of ocean currents, etc.
- 108 In acknowledging the potential host of educational opportunities as spin offs from the GDA, numerous difficulties were also recognised. These included software development, marketing, distribution, and a host of problems associated with the almost certain need to enter into a joint production venture with an existing educational publisher.
- 109 In summarising, the Chairman said the debate reflected the important considerations given by the participants to the proposal. It was clear that such radical innovation will cause problems in both IOC and IHO. The focus of GEBCO for the present was the 3rd Release of the GDA, with all its additional elements. Anything which diverted attention from this should be avoided. Additionally, the reason why the UK Natural Environmental Research Council had agreed to fund the GEBCO, should be kept in mind.

5.3.4 GEBCO Web Site

- 110 Following discussions on the introduction of the WWW site for IBCWIO and AGSO's site for the ORMS project, Dr. Loughridge suggested that such a site, designed specifically for GEBCO could prove most advantageous. This site could include graphical data, interactive maps, information on updates and a hyperlink to the GDA WWW site at BODC. He added that development and maintenance should not prove difficult and could be carried out remotely. The Chairman asked if Dr. Loughridge and Mr. Hunter could examine this suggestion and report back to him at the next meeting.
- 111 Commodore Guy said he will also investigate the possibility of a duplicate Web page including the updating problems.

5.4 GEBCO Guidelines

5.4.1. Part 2 Bathymetric Data Management.

- 112 Commodore Guy accepted that Section 2. A.3 was out of date and that it was the intention of the IHB, promised at the 1997 meeting, to redraft a replacement. He hoped the draft would be made available before the next meeting of the GEBCO Guiding Committee.

5.4.2. Part 4 Multibeam Echo Sounders.

- 113 Commodore Guy said he would enquire what had happened to the final extensive comments from France and the additional inputs required for IHB.
- 114 Dr. Loughridge said that due to the requirements of UNCLOS research there had been a surge of multibeam mapping. He recognised the need for an inventory of where multibeam data had been collected. It was agreed to ask IHB to help set up this facility thus informing others where they may request data from original sources.

- 115 Dr. Loughridge said he would ask Dr. George Sharman, NGDC, to draft a one-page document, to be included in Guidelines Part.4, which describes how to compile multibeam data files.
- 116 Dr. Jones said that, in addition, proposals should also be also be sketched on the best way of informing institutions/countries on how to build Multibeam Inventories.

5.4.3 Annex 2

- 117 Changes were proposed to Annex 2 Specifications for International Bathymetric Charts (IBCs) produced under the IOC's Regional Ocean Mapping Projects. (See Item 9.2).

6 ECHO-SOUNDING DATA - COLLECTION AND MANAGEMENT

6.1 World Wide Seafloor Swath Mapping Systems

- 118 Mr. Cherkis presented a six-page detailed updated version of Seafloor Swath Mapping Systems which lists Operators and Ship Names for 295 Swath Mapping Systems that have been, or are, in use in 31 countries.

6.2 IHO Data Centre for Digital Bathymetry

- 119 Dr. Loughridge, reported that, in May 1997, a new Global Trackline Geophysical Data Base (GEODAS) CD-ROM, version 3.3, had been released. Version 3.3 now contains over 13.7 million nautical miles of bathymetry from 3969 cruises with 33.1 million digital records. The next edition is expected to be released by NGDC by mid-1998.
- 120 Since June 1997, date of the 14th Meeting of the GEBCO Sub-Committee on Digital Bathymetry, the National Geophysical Data Center (NGDC) has responded to 447 international requests for data or information from 46 countries, of which 33 are IHO Member States. During the period since the cutoff date (end of 1996) for data included in version 3.3 of the Global Trackline Geophysical Data Base (GEODAS), a total of 83 cruises/legs of bathymetric data have been assimilated into GEODAS, including over 1.1 million soundings from 13 agencies located in 9 countries.
- 121 NGDC is continuing the development of its GEODAS software. Version 3.3 will run under Microsoft® Windows™ for PCs and X Windows for SUN/SOLARIS UNIX™ platforms. These window driven interfaces simplify data searches, guide users with an on-line Windows-style help system and support colour postscript plotting capabilities. Source code is also available for other UNIX operating systems. Originally developed to manage marine geophysical trackline data, GEODAS software has also been enhanced to allow application to survey type data. GEODAS now consists of two distinct applications, GEODAS/TRKDAS for marine geophysical trackline data and GEODAS/HYDDAS for hydrographic (bathymetric) survey data. Data can now be downloaded in the MGD77 format or in a space delineated X, Y, Z, ASCII format.
- 122 Dr. Loughridge, noting that NGDC had recently received data from *RV Polarstern*, *RRS James Clark Ross*, *RV Polar Duke* and *RV Nathaniel Palmer*, reminded the meeting about the promise made in Southampton (1997) by Dr. Peter Morris, BAS; to release data if others would co-operate. The Chairman said he would write to Dr. Chris Rapley, Director BAS, asking for release of data not presently in the international domain.
- 123 Dr. Jones enquired whether NGDC had contacted Dr. Rupert Summerson with respect to the acquisition of the bathymetry data collected by the Australian Antarctic Division.
- 124 Dr. Loughridge concluded by saying that the benefits of exchange are filtering through to new senders - however, NGDC does not have the resources to be pro-active in seeking data collection.

- 125 Dr. Loughridge informed the meeting that in December 1993, NGDC was officially named as a Data Assembly Center for bathymetric data acquired on World Ocean Circulation Experiment (WOCE) cruises. During 1994, procedures were established for data submission and for data exchange with WOCE participants. To date, data received from 49 WOCE cruises have been added to the DCDB bathymetric data holdings. 1997 marked the end of the data collection period, and it is anticipated that many more cruises will be submitted in the next two years. He added that there has been a consistent attribution problem with WOCE data. Institutions have not properly identified WOCE data as such, making submissions difficult to identify when receiving data or information requests specific to WOCE.
- 126 In concluding his report Dr. Loughridge said that NGDC's Marine Geology and Geophysics World Wide Web pages have served users from over 70 countries. Since the Marine Geology and Geophysics division of NGDC went on-line in January 1995, over 207,000 unique users accessed its pages, viewing/downloading more than 3.6 million files containing over 81.5 gigabytes of data and information. These figures do not include anonymous ftp transfers and although statistics are not readily available on this parameter, conservative estimates suggest that the volume transferred via this method is at least equal to the web.
- 127 Bathymetry offerings on NGDC's WWW server include interactive inventory searches and generation of location plots for specific cruises selected from trackline bathymetry or hydrographic data. Data updates are offered for on-line download to NGDC's Trackline Marine Geophysical Data CD-ROM owners. Searches of global gridded bathymetry and topography offer custom subsetting and a choice of ASCII or binary output options for 5 minute gridded data.

6.3 Ocean Plotting Sheet Data

- 128 Dr. Jones said he was still very concerned about data left on the old GEBCO Plotting Sheets held by the VHOs and what might be recovered. He asked what had been the response to the IHO Circular Letter to VHOs on this subject. Commodore Guy said he would enquire and report back to the Chairman.
- 129 Dr. Loughridge said he realised that there was still a great deal of such data and added that NGDC were only too willing to help VHOs in the digital capture of this data via the GEODAS/HYDDAS system.

6.4 Future Development of Digital Data Management

- 130 Mr. Macnab introduced this item by showing a series of 15 overheads which described the content of a working paper in preparation entitled *Design Requirements for the Management of Bathymetric Data - an Overview*. He outlined problems associated with diverse data collection and management which BIO had experienced over 30 years. His projected solutions to homogenise these data, included the introduction of Helical Hyperspatial code for space and time, which he saw as the key to the construction of the data base and an Oracle engine to run the system. When completed, he promised to send copies of the paper to the Permanent Secretary for onward distribution to participants.

7. REPORT OF THE ARCTIC BATHYMETRY WORKSHOP

- 131 Mr. Macnab, Project Chairman, introduced the report of the inaugural Arctic Bathymetry Workshop, held 18-19 September 1997, hosted by the All Russia Institute for Geology and Mineral Resources of the Ocean (OKEANGEOLOGIA) in St. Petersburg, Russia, and sponsored by the IASC (International Arctic Science Committee).

- 132 He said that a plan to develop a new data base and map of Arctic bathymetry was initiated, to be co-sponsored by IASC and IOC. Representatives from Russia, USA, Canada, Denmark, Sweden, Norway, Germany, IASC and IOC attended the meeting. There was a series of presentations on data and information holdings of various agencies. It was decided that the bathymetry would be compiled by assigning national areas of responsibility, and combining results at the bathymetric contour level. An international data base would not be synthesized at this time. An Editorial Board was formed.
- 133 Mr. Macnab said he was working with Dr. Holcombe, NGDC to prepare web pages for the Project.
- 134 Dr. Travin, speaking for the IOC, welcomed the proposal to transform the Arctic Bathymetry Workshop into an IOC Regional Bathymetric Mapping Project: IBCAO, to be governed by similar Terms of Reference as those for the other five regional projects.
- 135 In furtherance of this task, discussions are to be held with HDNO, in April 1998, about the management and manipulation of Arctic data and in particular about the release of Russian data to the project. Dr. Travin said he understood that HDNO were willing to release contours from their 1:1,000,000 compilations.
- 136 Mr. Macnab added that one of the associated goals of the Project is to produce a new version of GEBCO Sheet 5.17.

8. SCOR WG 107 IMPROVED GLOBAL BATHYMETRY. REPORT ON ACTIVITIES

- 137 Mr. Hunter introduced the draft report, prepared by the Chairman, Dr. Colin Summerhayes, IOC, of the second meeting of SCOR WG107 held in Baltimore, USA, 1997. He said that, although this meeting was planned to be the second and last of the Working Group, another may yet be held.
- 138 GEBCO Chairman, Sir Anthony Laughton, said that the tabled report of the Baltimore meeting did not focus on GEBCO problems - what was needed by GEBCO was a set of recommendations addressing the scientific case for the collection and exchange of data world-wide and for the release of funding to support these activities. He said he hoped that SCOR WG 107 would provide the ammunition to change government views about the collection and release of data.
- 139 It was agreed that the Chairman would write to Dr. Summerhayes saying that GEBCO is looking forward to the full report and asking that two GEBCO needs: Shallow Water Bathymetry and General Data Collection and Exchange, are specifically addressed.

9. IOC MATTERS

9.1 IOC Resolutions

- 140 The Chairman reminded the participants that the GEBCO community was anxious to see an outcome to the IOC Resolution XVIII-10 (June 1995) "Support for the Joint IOC-IHO Ocean Mapping Programme" and on the considerations of the Sixteenth Session of the IOC "Consultative Group on Ocean Mapping" (April 1997).
- 141 He reported that Mr. Desmond Scott, ex Chairman CGOM, attended the Nineteenth Session of the IOC Assembly in Paris, 2-18 July 1997, where IOC Resolution XVIII-10 and the business of the Sixteenth Session of CGOM were considered. Extracts from the minutes of the 1997 IOC Assembly and from Resolution XIX-3 are reproduced below:
- 142 Extract from IOC Assembly minutes:

- *In order to increase the level of co-ordination, certain delegates asked the IOC Executive Secretary to find necessary funds to organise IOC Editorial Board Meetings every two years.*
- *The Assembly, in view of the increasing Importance of refined bathymetry information, instructed the IOC Executive Secretary to broaden co-operation with IHO in the areas of bathymetry and hydrography so as to ensure adequate relationship to all governmental institutions concerned and proper intergovernmental leadership and dialogue.*

143 Extract from IOC Resolution XIX-3, Part A:

The Intergovernmental Oceanographic Commission.

- *Recalling that, the IOC Assembly at its seventeenth session (March 1993), "stressed that the Ocean Mapping Programme was a priority action of the IOC and should be provided with necessary support". (Document SC/MD/101, paragraph 120).*
- *Recalling further, the IOC Resolution XVIII-10 "Support to the Joint IOC-IHO Ocean Mapping Programme", which inter alia: (i) instructed the IOC Executive Secretary to initiate discussions on how to establish scientific priorities for bathymetric surveys of the world ocean, etc., and (ii) invited the Director-General of UNESCO to establish one professional post for the Ocean Mapping Programme as of 1996.*
- *Thanks the Scientific Committee on Oceanic Research (SCOR) for establishing Working Group 107 "Improved Global Bathymetry", as a first step towards the preparation of "a well co-ordinated and comprehensive plan for the coming decade".*
- *Invites the International Hydrographic Organization (IHO) to collaborate closely in the preparation of this plan so as to ensure adequate links with all governmental, as well as non-governmental, institutions concerned, and to improve intergovernmental leadership and dialogue.*
- *Instructs the Executive Secretary IOC to continue consultation with the Director-General of UNESCO regarding the establishment of a permanent professional post for Ocean Mapping in the interest of continuity in the present position of the Technical Secretary for Ocean Mapping in the IOC Secretariat.*

144 Extract from IOC Resolution XIX-3, Part C:

- *Recommends that Member States equip their research vessels with geophysical sensors in addition to hydrographic instruments, permitting simultaneous recording of bathymetry, as well as geophysical parameters.*
- *Urges Members States to make available the results of analyses of bathymetric data for contouring and digitizing, also providing other related geophysical data.*

145 Dr. Travin said that in 1998 the IOC were supporting four IBC Editorial Board meetings: IBCM, IBCCA, IBCEA and IBC-Arctic Ocean.

- 146 Dr. Loughridge remarked that the money available to the IOC does not match their priorities. The Chairman said the IOC were looking to SCOR WG 107 to identify bathymetric needs of scientists in their quest to build accurate models for climate, ocean currents, and tidal predictions

9.2 Inclusion of 500 metre contour lines.

- 147 The Chairman reminded participants about discussions at GEBCO XVI in June 1997 concerning IOC Regional Map Series. A requirement was raised for compilers of these Maps to provide the GBE with 500m contours (even if they were not included on the printed map) and for the 2,500 contour to be printed on all IOC maps.

- 148 As a result of this request Mr. Desmond Scott, Past Chairman CGOM, wrote to Dr. Günter Giermann, Chairman CGOM, enclosing a draft proposed amendment to GEBCO Guidelines Annex 2 "Specifications for International Bathymetric Charts (IBCs) produced under IOC's Regional Ocean Mapping Projects". The changes to Section 400 (paragraph 403) specifically met requirements expressed at GEBCO XVI.

- 149 He explained that Annex 2 is a copy of Annex IV of the Summary Report of CGOM II (February 1987) which was approved at that session, and as such any amendment to that Annex must therefore be approved by CGOM. They were offered to the meeting for consideration and approval. The changes were agreed in principle

- 150 The Chairman said he would attend the next meeting of CGOM when this proposed amendment will be discussed. Mr. Scott also wrote to the five Chief Editors of IOC Regional Mapping Projects asking for their co-operation - to date he had received no responses.

9.3 Supply of IOC Mapping to GEBCO

- 151 The Chairman reported that in addition to writing to the IOC Regional Mapping Editors about contour intervals, Mr. Scott had reminded each of them about their commitment to providing their maps to GEBCO as laid down in the introductory paragraph in Annex 2 to the GEBCO Guidelines:

"The Specifications which follow have been reproduced in this volume to provide information for compilers of bathymetric material outside the GEBCO structure on the standards to be followed to ensure that their work can be incorporated into the "GEBCO Digital Atlas (GDA)" with a minimum of additional work. Such compilers are invited to take these Specifications into account when deciding on the standards they will use in their own compilations".

10. STRATEGIC PLAN OF THE IHO FOR THE NEXT TEN YEARS

10.1 GEBCO Policy Input.

- 152 The Chairman explained that the IOC had written to GEBCO (16 September 1997) asking for their views on the Strategic Plan of the IHO for the next ten years. The response (sent 30 October 1997) was intended as a basis for a reply to be drafted by the Secretary of IOC to IHO. In the event, the IOC have merely filed the letter - no further correspondence has been received by GEBCO.

- 153 Commodore Guy said he was sorry to hear this and asked if Dr. Travin could find the letter and pass it to IHO. He added that this was the time to ensure a closer link between IHO and IOC. In this respect he proposed that when Sections 1 and 2 of the Guidelines are revised, extra text is inserted to promote closer ties between the two bodies. The Chairman said such an addition would be most valuable.

- 154 Commodore Guy said the IHO wanted to complete this review by end 1998 and that the requirement of GEBCO and IOC should reach IHB as soon as possible.

10.2 Data Supply

- 155 The Chairman said the main thrust of the reply to IOC was covered by the general heading of Data Supply. This embraced the need for data in general and for Continental Margin Data in particular. He said it was the view of GEBCO that if the growing demands from the world's scientific community for a comprehensive set of global bathymetry is to be met, calls for contributions from HO archives are inevitable. If the GEBCO Digital Atlas (GDA) is to become the definitive map of the World's oceans and seas, it can only achieve this goal if it includes data in the World's oceans and for the Continental Margin areas.

10.3 Continental Margin Data.

- 156 Dr. Loughridge commented that the wish for the Member States of the IHO to supply data to GEBCO was only an extension of their existing commitment. Additionally, they should know that GEBCO was not necessarily looking for sounding data - in most cases, contours would suffice. It was agreed that the contour interval, acquired to control the gridding process, was dependent on the nature of the shelf.
- 157 Commodore Guy said some statement of support for the Shallow Water requirement was needed from IOC so that Member States can see that the request doesn't threaten any products to be published by them. In the meantime, he said it was firstly a matter of principle and was thus important to establish if HOs will make contours available on request. He said that requirements may vary as time progresses. Dr. Jones said that Member States should know that GEBCO has the structure to protect copyright, this is clearly laid out in a statement in the documentation of the GDA. Dr. Falconer said the copyright problem clearly paralleled those experienced by the World Meteorological Organization - however, ways had been found to resolve these difficulties.
- 158 Commodore Guy said that although he recognized that some Member States already contributed coastal margin data, or had indicated their willingness to do so, most had not been approached. He added that he would draft a Circular Letter to replace that prepared by RAdm Andreasen (1997) seeking the co-operation of Member States on this issue. He promised to send the draft to the Chairman for his comments.
- 159 It was pointed out that in some cases the HOs may not hold the required information. To cover such cases, it was suggested that the draft letter asks the HOs to identify the appropriate agency. It was agreed to seek the following contours: 0, 10, 20 or 25, 50, 100 and 150m.
- 160 Release mechanisms for the data were discussed. Dr. Loughridge said that NGDC does not normally contact IHO Member States directly, correspondence is usually conducted through IHB. This avenue may be preferred by Member States.
- 161 Ing. Bessero said he was not sure that all data needed to be held in one place - as long as it was available. In this context, Dr. Loughridge said the European directive on intellectual property rights was a serious issue, which already affects the exchange of weather and climate data.
- 162 Mr. Macnab said the framework for successful co-operation between nations providing data for a large mapping project was already in operation in the Arctic region. Each nation develops and compiles maps in its own allotted area, to identical specifications. There is no need to release data - grids could provide the necessary contours. Bilateral agreements may be necessary to exchange or release such data.

163 In summarising the debate, the Chairman said that bathymetry was the province of GEBCO, and two intergovernmental committees had been given a charter to do this work. The issue of shallow water data was of the greatest concern in the quest to ensure GEBCO delivered the product demanded by the ocean scientific community. He added that obtaining shallow water bathymetry was not likely to be resolved by a single tactic, or in the short term. He suggested GEBCO adopt a pragmatic stance by trying to obtain shelf data presently available from a number of sources, and meanwhile, requesting the IHO to approach Member States, asking them to release shelf data in whatever form they find most convenient.

11. FUTURE STRUCTURE OF GEBCO MEETINGS

164 The Chairman said that this matter was of an administrative nature and will be debated during the intersessionary period by the Chairman SCDB, the Permanent Secretary and himself.

12. IOC/IHO EDITORIAL BOARD - CONTINENTAL SHELF DEFINITION UNDER UNCLOS

165 The Chairman said this was essentially an information item. Both Dr. Jones and he had made contributions to the IOC/IHO publication "*Sovereign Limits Beneath the Oceans Delimiting the New Continental Shelf*". The book, written to interpret Article 76 of the United Nations Law of the Sea (UNCLOS), edited by Cdr. Chris Carleton, UKHO, is expected to be ready for publication, by the Oxford University Press, at the end of 1998.

166 It was reported that the UN is currently drafting its own set of rules on the interpretation of Article 76 on the Law of the Sea.

13. GEBCO CENTENARY (2003-2005)

167 There was nothing to report from Mr. Scott. He is still trying to find a suitable author for the 'popular' book on GEBCO - investigating recommendations made by Walter Smith.

168 Commodore Guy said that Prince Rainier was very amenable to anything connected with GEBCO. He suggested that any proposed GEBCO Centenary activities should be co-ordinated by an IHB Centenary Committee. He said that when a suitable date was found to mark the Centenary, the IHO Directing Committee would approach the Prince with proposals for an event to mark it. Mr. Harper said he could supply information to Commodore Guy on possible dates and outline work planned and already in hand by Mr. Scott.

14. DATES AND PLACES FOR FUTURE MEETINGS

14.1 1999 Meetings: Seventeenth Session of the GEBCO Guiding Committee

169 Mr. Macnab announced that, having spoken with his Director, he was in a position to invite the GEBCO Guiding Committee and its two Sub-Committees to hold their 1999 meetings in June, at the offices of the Geological Survey of Canada (Atlantic), Dartmouth, Nova Scotia, Canada.

170 In thanking the Director of GSC for his kind invitation, the Chairman said that precise dates would be announced after receiving advice from the hosts about Public Holidays and potential clashes with tourist activities.

14.2 2000 Meetings: Twelfth Meeting of the GEBCO Officers

171 Commodore Guy said that the IHB were very willing to host the 2000 meeting of the GEBCO Officers and Sub-Committee on Digital Bathymetry.

172 Dr. Loughridge added that the GEBCO Officers and SCDB would also be most welcome at NGDC, Boulder, USA.

Seattle and Vancouver were also discussed as possible venues.

14.3 Future Meetings

173 Mr. Tani said Japan would like to host a session of the GEBCO Guiding Committee - 2001 was earmarked for this possible invitation. The 2003 session, being Centenary year (see Item 13), might be hosted by IHB in Monaco.

15. ANY OTHER BUSINESS

174 Commodore Guy reported that Mr. Adam Kerr, ex Director of IHO, was working on a review of the IHO Publication "*Limits of Oceans and Seas*". When he has assessed all the comments from the Member States, he will report his findings to the Directing Committee.

16. CLOSURE OF THE MEETINGS

175 The Chairman closed the session at 12.30 on Tuesday 17 March 1998. He especially thanked Dr. Robin Falconer (IGNS) and Dr. Ian Wright (NIWA) for their kind hospitality. He also noted the work of many others who had contributed to the GEBCO during the previous nine months and for their papers. He thanked the participants for sharing in some lively and informative debates.

ANNEX I**AGENDA**

1. OPENING OF THE SESSION
2. CONDUCT OF THE SESSION
 - 2.1 Adoption of the Agenda
 - 2.2 Documentation, Administrative Arrangements, etc
3. COMPOSITION OF THE GUIDING COMMITTEE AND ITS SUB-COMMITTEES
 - 3.1 Guiding Committee
 - 3.2 Sub-Committee on Digital Bathymetry (SCDB)
 - 3.3 Sub-Committee on Undersea Feature Names (SCUFN)
 - 3.4 Scientific Advisers
 - 3.5 GEBCO Reviewers
 - 3.6 General Review of the GEBCO Personality List
4. MATTERS ARISING FROM REPORTS OF PREVIOUS MEETINGS
 - 4.1 Summary Report of the Sixteenth Session of the Joint IOC-IHO Guiding Committee for the GEBCO (Doc IOC-IHO/GEBCO-XVI/3)
5. GEBCO ACTIVITIES
 - 5.1 Review of Bathymetric Mapping World Wide.
 - 5.2 The GEBCO Digital Atlas
 - 5.2.1 GEBCO Digital Atlas Questionnaire, Review and Analysis
 - 5.2.2 The GEBCO Bathymetric Editor - Report
 - 5.2.3 The GEBCO Digital Atlas Manager - Report
 - 5.2.4 GEBCO Reviewing System
 - 5.2.5 New Mapping and Technical Changes identified for inclusion in the Third Release of the GDA
 - 5.2.6 Sales and Distribution
 - 5.3. Future Development of GEBCO Products
 - 5.3.1 Update on the work of the GEBCO Gridded Data Set Group.
 - 5.3.2 Digital Techniques for Labelling Undersea Feature Names
 - 5.3.3 Derived Products
 - 5.3.4 GEBCO Web Site
 - 5.4 GEBCO Guidelines
 - 5.4.1 Part 2 Bathymetric Data Management
 - 5.4.2 Part 4 Multibeam Echo Sounders
 - 5.4.3 Annex 2

6. ECHO-SOUNDING DATA - COLLECTION AND MANAGEMENT
 - 6.1 World Wide Seafloor Swath Mapping Systems
 - 6.2 IHO Data Centre for Digital Bathymetry
 - 6.3 Ocean Plotting Sheet Data.
 - 6.4 Future Development of Digital Data Management
7. REPORT ON MEETING OF THE ARCTIC BATHYMETRY WORKSHOP
8. SCOR WG 107 - IMPROVED GLOBAL BATHYMETRY, REPORT ON ACTIVITIES
9. IOC MATTERS
 - 9.1 IOC Resolutions
 - 9.2 -Inclusion of 500 metre contour line
 - 9.3 Supply of IOC mapping to GEBCO
10. STRATEGIC PLAN OF THE IHO FOR THE NEXT TEN YEARS
 - 10.1 GEBCO Policy Input
 - 10.2 Data Supply
 - 10.3 Continental Margin Data
11. FUTURE STRUCTURE OF GEBCO MEETINGS
12. IOC/IHO EDITORIAL BOARD - CONTINENTAL SHELF DEFINITION UNDER UNCLOS
13. GEBCO CENTENARY (2003-2005)
14. DATES AND PLACES FOR THE NEXT MEETINGS
 - 14.1 1999 Meetings: Seventeenth Session of the GEBCO Guiding Committee
 - 14.2 2000 Meetings: Twelfth Session of GEBCO Officers
 - 14.3 Future Meetings
15. ANY OTHER BUSINESS
16. CLOSURE OF THE SESSION

ANNEX II**LISTS OF DOCUMENTS, PAPERS & MAPS****Documents ***

IOC-IHO/GEBCO Officers-XI/1 prov	Provisional Agenda
IOC-IHO/GEBCO Officers-XI/2	Annotated Agenda (Chairman only)
IOC-IHO/GEBCO Officers-XI/3	Summary Report of the Session
IOC-IHO/GEBCO Officers-XI/4	List of Documents
IOC-IHO/GEBCO Officers-XI/5	The GEBCO Bathymetric Editor - Annual Report (see Annex III)
IOC-IHO/GEBCO Officers-XI/6	The GEBCO Digital Atlas Manager - Annual Report (see Annex VI)
IOC-IHO/GEBCO Officers-XI/7	GEBCO Digital Atlas - Distribution/Sales (see Annex VII)
IOC-IHO/GEBCO Officers-XI/8	GEBCO Digital Atlas - Questionnaire (see Annex VIII)
IOC-IHO/GEBCO-XVI/3	Summary Report of the sixteenth session of the GEBCO Guiding Committee, Hydrographic Office, Taunton, UK, 23-25 June 1997
IOC/INF-1063	Report of the Consultative Group on Ocean Mapping (CGOM) to the Nineteenth Session of the IOC Assembly, 21-22 April 1997
B-7	Guidelines for the GEBCO (excepting Part 4)
GEBCO Personality List	Revised 16 February 1998

* For reference only. Only stocks of Summary Reports of Sessions and Meetings are maintained.

The following papers and maps were tabled for the consideration of the meeting:

Papers

- British Oceanic Data Centre - Annual Report 1996-97.
- World Data Center A & IHO/DCDB - Report to GEBCO.
- Report of Arctic Bathymetry Workshop, September 26 1997.

- SCOR Working Group 107 - Report of 2nd Meeting, October 1997.
- US Naval Research Laboratory - Digital Bathymetry Activities 1997- 98.
- List of world wide seafloor swath-mapping systems.
- SCAMP: A submarine-mounted geophysical survey system for use under the Arctic ice.
- Review of the International Bathymetric Chart of the Western Pacific (IBCWP)
- Review of the International Bathymetric Chart of the Caribbean and the Gulf of Mexico (IBCCA).
- Data Sources for "Alliance exotique"/GEBCO 6 Bathymetric Interpretations.
- Bathymetric survey activities in Japan.
- Survey Maps - Philippine sea Structures.
- Gridded affine transformation and rubber-sheeting algorithm with Fortran program for calibrating scanned hydrographic survey maps.

Maps

- Southwest Indian Ocean: physiography @ 1:10,000,000. 16°W - 75°E, 31°S - 71°S.
- Southeast Indian Ocean: physiography @ 1:10,000,000. 70°E - 150°E, 31°S - 71°S.
- Southwest Indian Ocean: ship track Plot: @ 1:10,000,000. 16°W - 75°E, 31°S - 71°S.
- Southeast Indian Ocean: ship track Plot: @ 1:10,000,000. 70°E - 150°E, 31°S - 71°S.
- Indian Ocean: plot of digitised contours and tracks for Dr Fisher's ocean data set 30°E - 140°E, 24°N - 31°S.
- Indian Ocean: 4 coloured plots of Dr Fisher's digitised contours (500 m) @1:5,000,000:

31°S- 57°S, 70°E -111°E	56°S- 72°S, 70°E -111°E
31°S- 57°S, 109°E -150°E	56°S- 72°S, 109°E -150°E
- Indian Ocean: 4 corrected digitized trackline plots for above contour sheets.
- Barents and Kara Seas: plot of digitised contours and tracks @ 1:10,000,000 68°N - 82°N, 0° - 80°W. extracted from chart published by Geological Society of Armenia @ 1:2,313,000.
- Franz Josef Land: plot of digitised contours @ 1:5,000,000 40°E- 68°E, 79°N-82°N, extracted from chart published by Geological Society of Armenia @ 1:2,313,000.

- Antarctica: diagram of BAS Cruises, single beam bathymetry recorded on geophysics cruises 1967-1997.
- Pacific and Indian Oceans: index of charts compiled by Dr Alex Svaritchevsky.
- Canada East Coast: Gulf of St Lawrence, detailed marine and continental relief @ 1:8,250,000
- Canada East Coast: St John's, Newfoundland, small scale representation of shallow seabed.
- USA East Coast and Gulf of Mexico: 3D colour shaded relief with contours.
- USA East Coast: Topography and bathymetry, 3D colour shaded relief.
- Lake Erie and Lake Saint Clair: 3D colour shaded relief with contours (1 metre intervals)
- New Zealand: Miscellaneous chart of Regional Bathymetry @ 1:4,000,000 (NIWA, 1997)
- New Zealand: Miscellaneous chart of Regional Physiography @ 1:4,000,000 (NIWA, 1996)
- New Zealand (north): Miscellaneous chart of swath maps @ 1:500,000 (NIWA, 1997)
- New Zealand (south): proof of miscellaneous chart of swath maps @ 1:500,000 (NIWA)
- Pacific Ocean: Oceanic series, Esperance Bathymetry @ 1:1,000,000 (NIWA, 1997)
- Mediterranean Sea: Israel Coastal Chart (No 1 of 5) @1:50,000 (Jan 1998)
- Mediterranean Sea, eastern part: Bathymetric chart @1:625,000 (1994)
- Cyprus: Hypsometry @ 1:250,000, based on 25 m DTM (1995)
- Cyprus: Shaded Relief @ 1:250,000, based on 25 m DTM (1996)
- Japan: East of Ogasawara Guntō. Chart 6726 @ 1:1,000,000. 4 versions depicting, Bathymetry, Gravity Anomalies, Magnetics and Submarine Structure.
- Japan: Nansei Syotō, Bathymetric Chart 6315 @ 1:1,000,000 (1995)
- Japan: Central Nippon, Bathymetric Chart 6313 @ 1:1,000,000 (1982)
- Japan: DTM of Japan Continental Shelf (Shelf Survey Project, Version 3.1, March 1998)

ANNEX III

LIST OF REVIEWERS

Antarctic Waters south of 46°40'S	Hans-Werner Schenke	Accepted
North Atlantic Ocean (excluding Caribbean Sea & Gulf of Mexico)	Peter Hunter David Monahan (link to Galina Agapova for area 0°-7°N)	Accepted Accepted
Caribbean Sea & Gulf of Mexico	Troy Holcombe	Accepted
Mediterranean & Black Seas	John K Hall Andrey Popov	Accepted Accepted
Arctic Ocean	David Monahan & Valery Fomchenko	Accepted Accepted
South Atlantic Ocean	Norman Z Cherkis (link to Brazilians, also Robert L Fisher)	Accepted
Indian Ocean	Robert L Fisher	Accepted
North-west Pacific Ocean	Gleb B Udinstev Alexander Svarichevskiy	Accepted Accepted
Central west Pacific Ocean	Kunio Yashima	Accepted
South-west Pacific Ocean	Alfred Simpson	Accepted
North-east Pacific Ocean	George Sharman	Accepted
Central east Pacific Ocean	Juan Garcia Abdeslem Luis Delgado Argote	Accepted Accepted
South-east Pacific	<i>Vacant position</i>	
New Zealand region	Ian Wright	Accepted

ANNEX IV

Report of the GEBCO Bathymetric Editor - July 1997 to February 1998.

Meetings Attended:

SCOR WG107 - 'Improved Global Bathymetry', second meeting.

The second meeting of SCOR Working Group 107 took place at Johns Hopkins University, Baltimore, during October 1997. A report will be made to the GEBCO Officers meeting. The deliberations of the working group will be published and widely circulated. No further meetings of this working group are envisaged.

Editorial Board of the IBCWIO, fourth meeting.

The meeting took place at the offices of the South African Hydrographic Office in Cape Town. South Africa is a new and welcome addition to the Editorial Board and is expected to take a prominent role. Mr Sidney Osborne, the Superintendent Chart Production at the Hydrographic Office, will be visiting the GBE and BODC during April later this year. They are keen to increase their bathymetric mapping abilities. (Following the meeting, the office was also visited by Dr Hans-Werner Schenke and Mr Norman Cherkis who were joining a research ship in Cape Town.)

Bathymetric Compilation:

IBCEA Sheets 1.04 and 1.05

The GBE is responsible for compiling two sheets of the International Bathymetric Chart of the Central Eastern Atlantic. They have been compiled at a scale of 1:250,000. Contours are shown at intervals of 100 metres with additional contours in the flatter areas. (Note: The IBCEA only requires contours at intervals of 200 metres.) The main sources of data are: GEODAS, the analogue GEBCO Plotting Sheets, SOC cruise data not in GEODAS yet, and published bathymetric maps. Sheet 1.05 contains multibeam data in the vicinity of the Canary Islands that was collected during the last year and made available for GEBCO purposes by Dr. Doug Masson, SOC. Other multibeam data collected by GEOMAR, Germany and the University of Barcelona, Spain have been used. These sheets are complete except for the shallow contours in the region of the coasts of Africa, and Europe. These are particular problems as the source datasets do not extend into water above 200 metres in depth. Hydrographic charts have been obtained to see if they can provide these information. (For Index of Maps, see Page 3 of this Annex)

An area extending from the above work out to 30° west and 20° south has been compiled at a scale of 1:500,000. Contours are shown at the same levels as in the above maps. In addition to the above data sources, this compilation has used predicted bathymetry from satellite altimetry by Walter Smith and David Sandwell to guide its contours. Final versions of the contours from the above will be fair drawn in order to optimise them for scanning. They will be submitted to BODC for digitizing by the end of April. As this work progresses to the west, a decrease in the density of data will make it difficult to maintain a contour interval of 100 metres, thus it will be increased to 500 metres. This will simplify the work and speed up the mapping process.

A gridded version of these compilations will be prepared in due course.

Bathymetry has been compiled to fill gaps in the north-west and south of a compilation (32°-50° x 0°-31°) by Dr J-C Sibuet, IFREMER. These have been passed to him for comments. The north-east quadrant of the four sheet compilation has been digitized by BODC already.

Contacts:

Contact has been made with Professor Alexander V. Ilyin, of the N.N. Andreyev Acoustics Institute, Moscow. He is interested in collaborating in the updating of Atlantic Ocean bathymetry between the Equator and 40° North.

A group working on Tsunami research in the North Pacific Ocean has been in contact with the GBE and others in the GEBCO community. They have arranged an international workshop on 'Bathymetry and coastal topography data management'. It takes place at the University of Washington, Seattle immediately after this meeting. The GBE will be attending. This workshop is of interest to the SCOR working group as well. (A full account of this meeting is at Annex XII)

Interesting Web-sites containing bathymetric information.

During the search for bathymetry, the GBE 'surfed' the Internet. A number of Web-sites were found to contain large amounts of useful information.

Of particular note is the Web-site of the Geosciences Department of IFREMER. It contains a catalogue of nearly 150 Sea-beam bathymetric documents from 43 cruises of the Research Vessel *Jean Charcot*. They form part of the Cartographic and Drawing Unit's work between 1977 and 1990. Details of how these maps can be purchased are included. The same site also provides information on the current mapping programmes and research cruises.

(<http://www.ifremer.fr/drogm>)

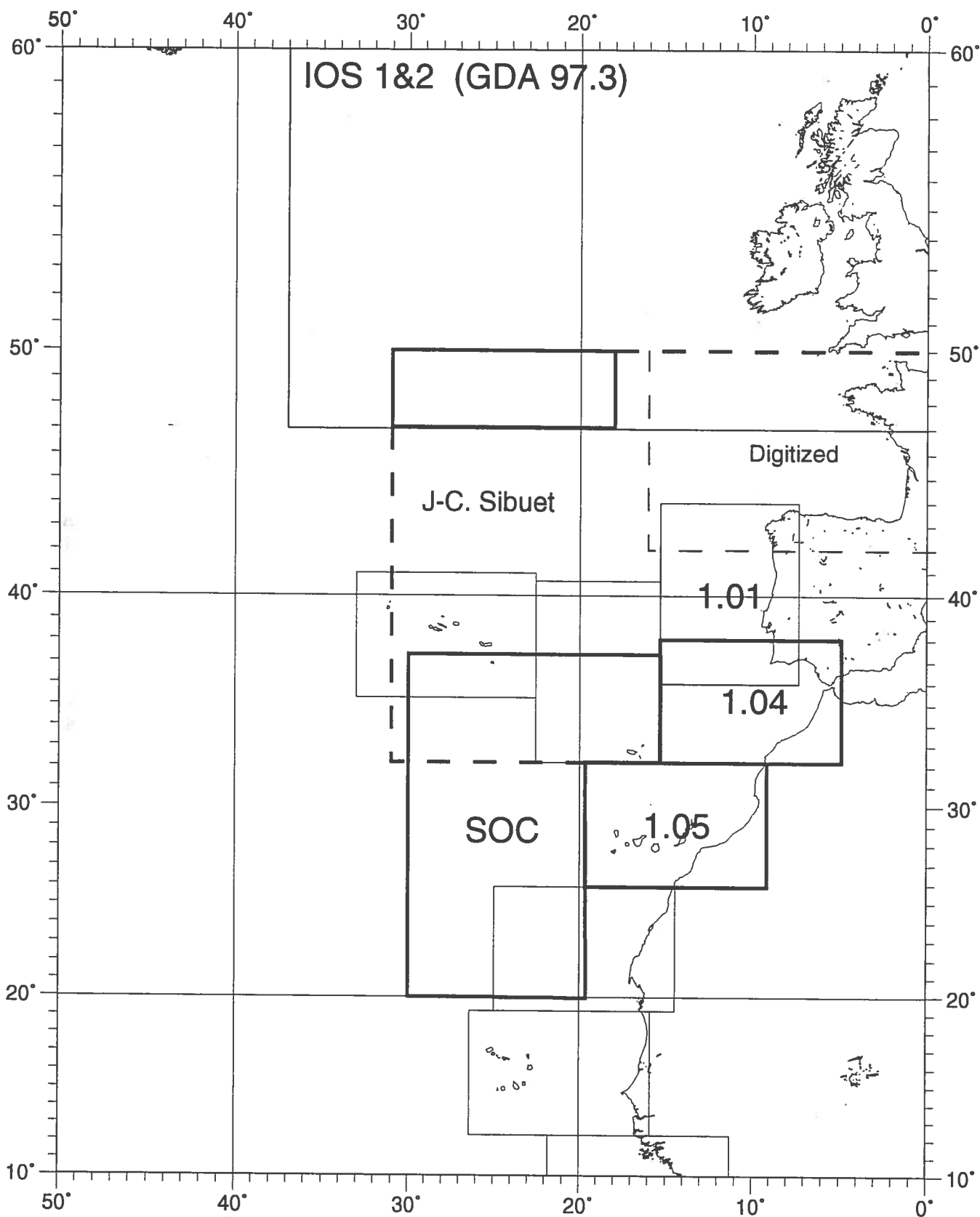
Other interesting Web-sites are:

Woods Hole Oceanographic Institution - for the multibeam data archive and how to request copies, try - (<http://mbdata.whoi.edu/MbData/mbMain.html> /)

University of Hawaii, School of Oceanography and Earth Sciences - for information about the survey areas carried out by the MR1 swath seafloor mapping system, try - (<http://www.soest.hawaii.edu/HMRG/mr1/mr1surveys/mr1surveys.html>)

Japan Oceanographic Data Center - for the J-BIRD bathymetric dataset and information about the 'Sea Depth in Mesh' facility, try - (<http://www.jodc.jhd.go.jp/inf/data-inf.html>)

Lamont-Doherty Earth Observatory - for gridded multibeam data on the mid-ocean ridges collected for the United States' RIDGE project, try - (<http://imager.ldeo.columbia.edu/>)

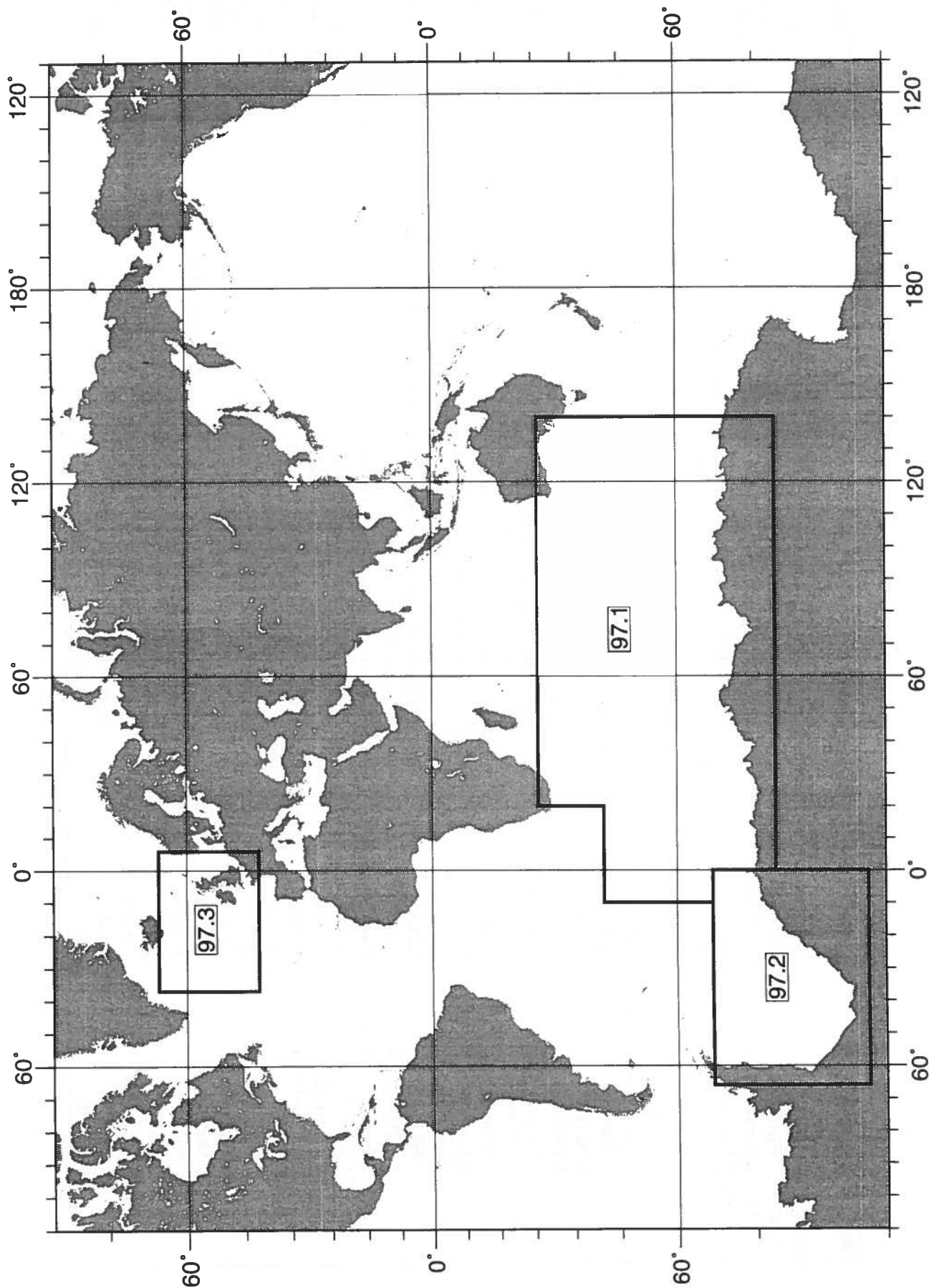


ANNEX V

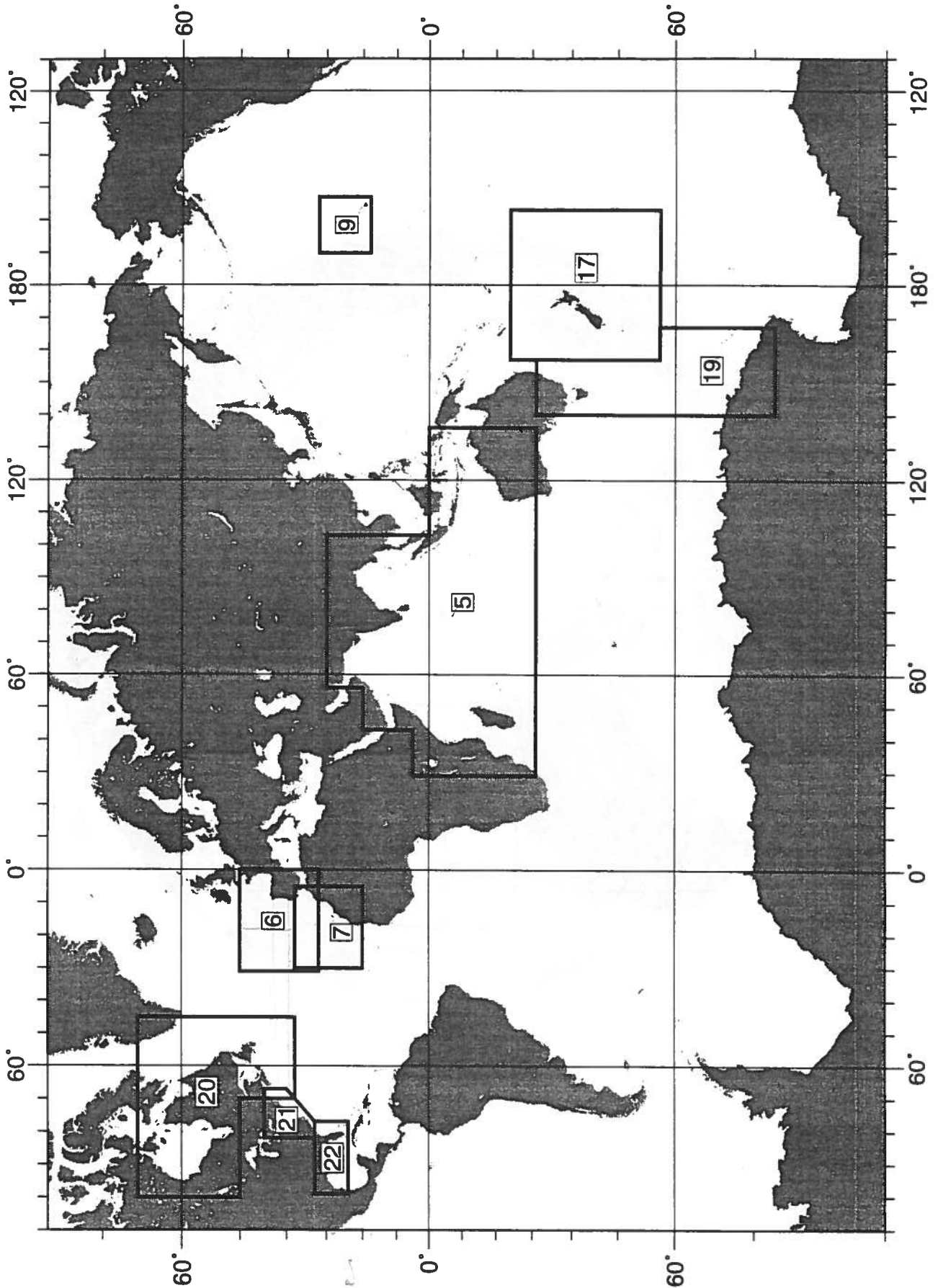
Maps included in the Original and 1997 Editions of GDA
and others (including grids) considered for the 1999 edition

No.	Author	Source	Date	Title	Scale	Status
5.01 - 5.18	GEBCO	IHO/IOC/BODC	1975-84	General Bathymetric Chart of the Oceans	1:10,000,000	GDA
IBCM	EB-IBCM	IOC/IHO/HDNO	1981	International Bathymetric Chart of the Mediterranean	1:1,000,000	GDA
5.12 Rev	Hunter PM et al.	GEBCO	1994	GEBCO Sheet 5.12 (Revised) - South Atlantic	1:10,000,000	GDA
97.1	Fisher RL	SIO		Bathymetry of the Southern Indian Ocean	1:1,000,000	GDA97
97.2	Schenke H-W et al.	AWI	1997	AWI Bathymetric Map of the Weddell Sea	1:250,000	GDA97
97.3	Hunter PM	IOS/SOC		Bathymetry of the Northeast Atlantic off the British Isles	1:1,000,000	GDA97
1	Cherkis NZ	NRL	1991	Bathymetry of the Barents and Kara Seas	1:2,313,000	GDA99/1
2	Cherkis NZ & Vogt PR	NRL	1994	Regional Bathymetry of the Northern Norwegian - Greenland Seas	1:3,000,000	GDA99/1
3	Matshov GG	MMBI/NRL	1995	Bathymetric Map of the Franz Josef Land Area	1:500,000	GDA99/1
4	HDNO	HDNO	1995	GEBCO Plotting Sheet areas 593 & 594	1:1,000,000	GDA99/1
5	Fisher RL	SIO		Bathymetry of the Northern Indian Ocean	1:1,000,000	GDA99/1
6	Sibuet J-C	IFREMER		Bathymetry of the Bay of Biscay	1:1,000,000	GDA99/1
7	Hunter PM	SOC		Bathymetry of the Northeast Atlantic	1:1,000,000	GDA99/1
8	Mammerickx J	SIO	1992	Bathymetry of the Southcentral Pacific	1:6,442,194	GDA99/2
9	Duenebir T et al.	HIGP	1995	Northwestern Hawaiian Islands	1:4,000,000	GDA99/1
10	Keeton JA et al.	SOC	1997	Bathymetry of the Reykjanes Ridge	1:200,000	Unassigned
11	RIDGE	LDEO	1996	Northern Mid-Atlantic Ridge Terrain Model - Multibeam Surv Proj	Grid	Unassigned
12	EQUARIDGE	Geol Inst RAS		Equatorial Atlantic	Various	Unassigned
13	Svarichevskiy A	Pac Oc Inst RAS	1995	Bathymetric Map of the Obruchev Rise	1:2,500,000	Unassigned
14	Svarichevskiy A	Pac Oc Inst RAS	1995	Bathymetric Map of the North-west Pacific Basin	1:5,000,000	Unassigned
15	Japan HD	Japan HD	1995	Continental Shelf Areas of Japan	1:1,000,000	Unassigned
16	Hsu S-K et al.	IFREMER	1996	Bathymetric Map Around Taiwan	1:1,600,000	Unassigned
17	CANZ	NIWA	1997	New Zealand Region Bathymetry	1:4,000,000	GDA99/1
18	Fisher RL	SIO		Bathymetry of the Southern Indian Ocean (Update ?)	1:1,000,000	GDA99/1
19	Fisher RL	SIO		Bathymetry of the Southeastern Indian Ocean	1:1,000,000	GDA99/1
20	Macnab R	GSC		Bathymetry of Canadian Waters, including Hudson Bay		GDA99/1
21	NGDC	NGDC		Bathymetry of the US East Coast	Grid	GDA99/1
22	NGDC	NGDC		Bathymetry of the (US) East Coast and Gulf of Mexico	Grid	GDA99/1
23	Japan HD	Japan HD	1998	Continental Shelf Survey Project	Grid	GDA99/2
24	Henrys S	LINZ		Bathymetry of the Ross Sea		GDA99/2
25	Hall JK	GSI		Bathymetry of the Red Sea		GDA99/2

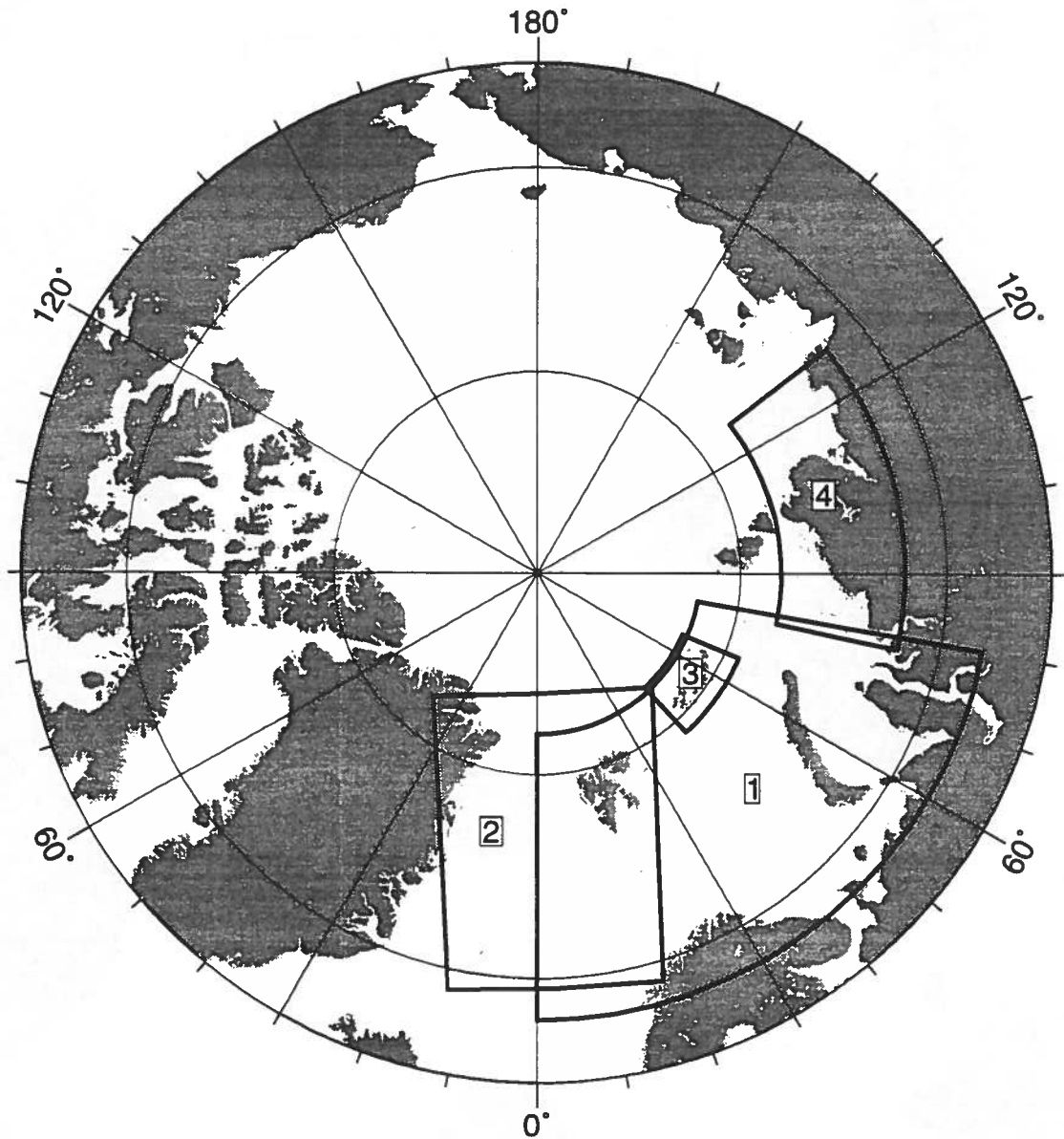
Maps included in 1997 Edition of GDA
(See Page 1 for details)



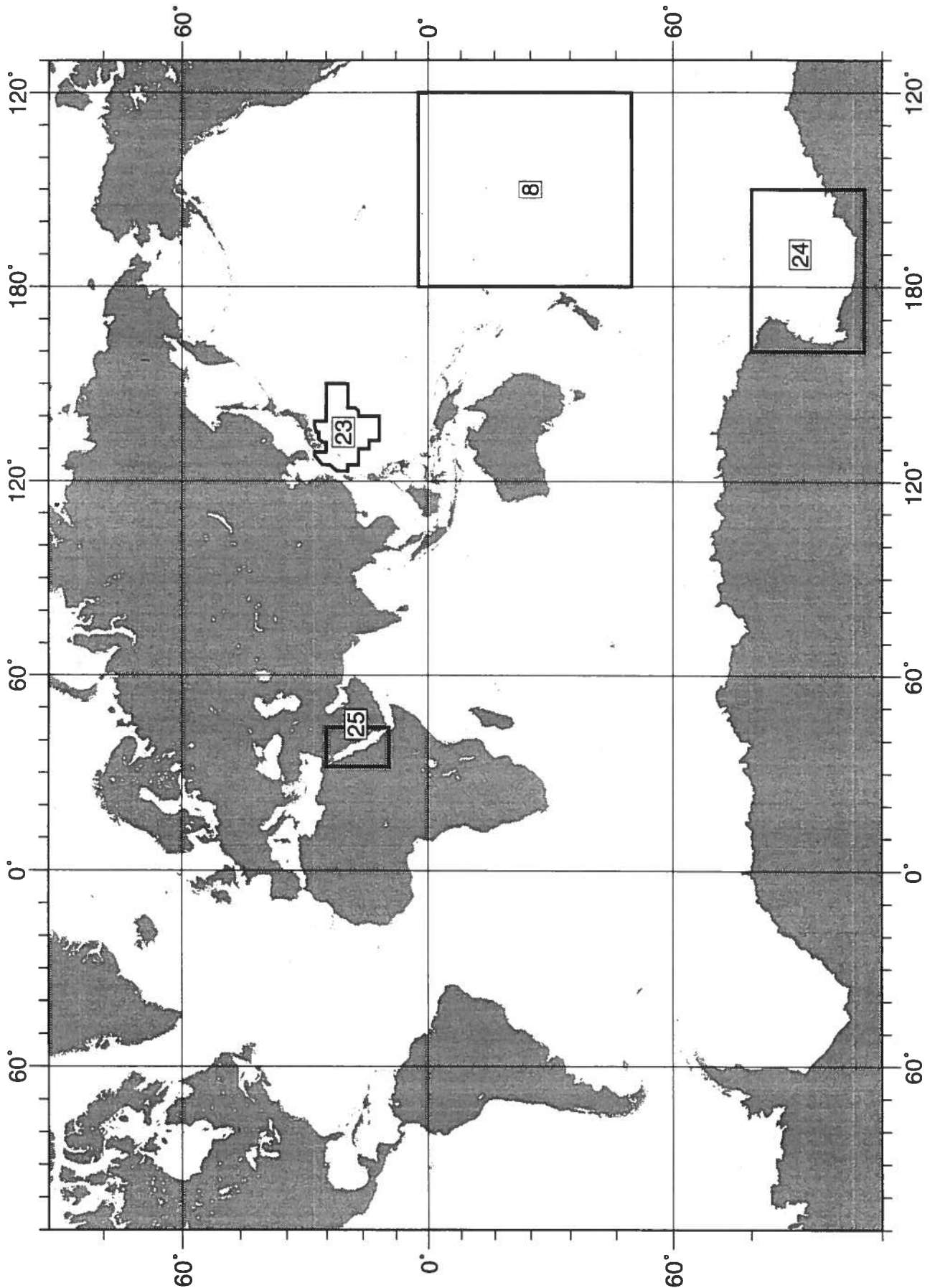
Category 1 maps (excluding Arctic region) to be included in 1999 Edition of GDA
(See Page 1 for details)



Category 1 maps (Arctic region) to be included in 1999 Edition of GDA
(See Page 1 for details)



Category 2 maps to be considered for the 1999 Edition of GDA
(See Page 1 for details)



ANNEX VI

Report of the GEBCO Digital Atlas Manager June 1997 - March 1998**Indian Ocean Area**

Since the release of the GEBCO97 CD-ROM, work has continued on the digitisation of Dr. Fisher's bathymetric contour and trackline control charts for the Indian Ocean. Extending the eastern boundary of the GEBCO97 data set, 10 contour charts and 7 trackline control charts have been digitised in the region 31°S - 72°S; 140°E - 150°E.

Since the completion of the GEBCO97 data set, 143 update charts have been received for the area 20°E - 140°E; 17°S - 72°S. To date, 45 of these charts have been digitised. Update bathymetric contour and trackline control data in digital form have also been supplied by Scripps Institution of Oceanography for the area : 10°E - 40°E; 40°S - 53°S.

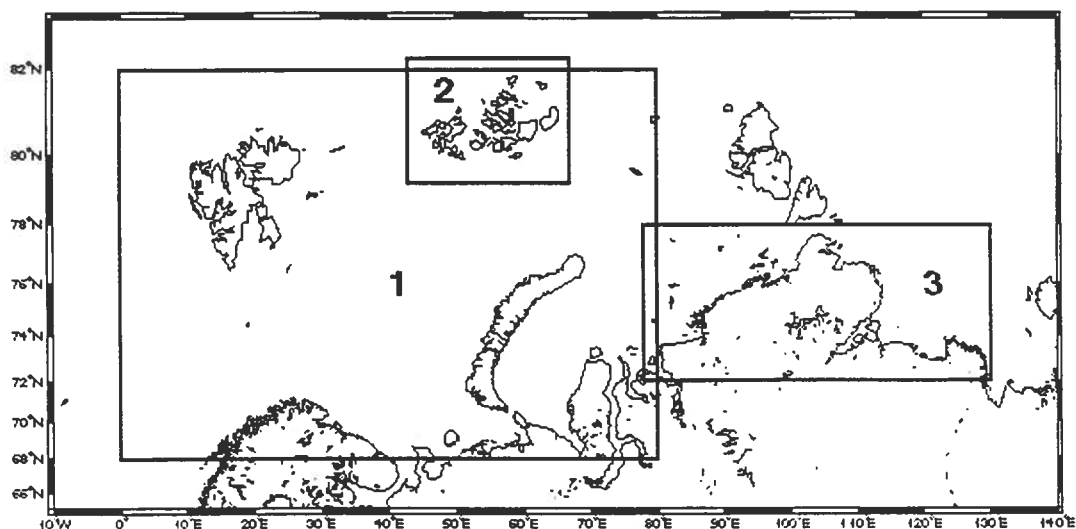
A working data set for the region 70°E - 150°E; 31°S - 72°S, including data from 30 of the updates charts has been supplied to Dr. Fisher along with 1:5 million scale plots of the bathymetric contours and tracklines for this area.

The attached diagram outlines the current status of the preparation of the data set for the whole of the Indian Ocean area. Work will now continue to complete the digitisation of the trackline control charts for region 3 and also to digitise and edgematch in the updates received for the areas shown. The bathymetric contours and tracklines for the area 150°E - 170°E; 31°S - 72°S will also be digitised when they become available. Work is also required to complete the quality control of the digital data for area 1. Further updates are also due for this area before the next release of the GDA.

Arctic Area

The bathymetric contour and trackline control data have been digitised from the 1:2,313,000 scale map : 'Bathymetry of the Barents and Kara Seas' by N. Z. Cherkis, H.S. Fleming, M.D. Max, P. R. Vogt and M. F. Czarnecki, published by the Geological Society of America. Plots have been produced to compare the data with that shown in the GEBCO97 data set and to investigate any possible problems with edgematching the data sets together.

The diagram below shows the extent of the digital bathymetric contour data sets held for this region.



1. Barents and Kara Seas data set
2. Franz Josef Land Area data set
3. HDNO data set

Plots have been produced of the digital bathymetric contour data taken from the 1:500,000 scale map: 'Bathymetric Map of the Franz Josef Land Area', compiled by G. G. Matishov, N. Z. Cherkis, M. S. Vermillion and S. L. Forman, published by the Geological Society of America, area 2 in the above diagram. The digital bathymetric contour data set supplied by HDNO for the area 78°E - 128°E; 72°N - 78°N has also been plotted, area 3 in the above diagram.

Work Done with Other Bathymetric Data Sets

To gain experience in working with gridded bathymetry data, I have been involved in producing bathymetry data sets for two projects for which BODC has data management responsibilities. The data for these two projects were collected during cruises of the RRS Charles Darwin using its Simrad multibeam system.

A 5 second of arc gridded bathymetric data set for the region: 10° 5'W - 9° 20'W; 41° 43'N - 43° 5'N, (off Iberia), produced for the EC funded OMEXII-II project.

A 3 second of arc gridded bathymetric data set for the region: 9° 25'W - 8° 55'W; 56°N - 57°N, (off the Hebridean shelf edge), produced for the NERC Community Research Project LOIS.

Work was also done to finalise a one minute gridded bathymetric data set for the UK sector of the North Sea. This gridded data set was produced using sounding data collected by the British Geological Survey between 1968 and 1988.

P. Weatherall

3 March 1998

ANNEX VII

DISTRIBUTION/SALES OF GEBCO DIGITAL ATLAS (1 MARCH 1998)

Country	Sector				Total (sold)	
	GOV	UNIV	COMM	Other		
Albania	1	-	-	-	1	(0)
Algeria	2	-	-	-	2	(1)
Argentina	1	-	-	-	1	(0)
Australia	26	12	9	-	47	(42)
Austria	1	-	-	-	1	(1)
Barbados	-	-	1	-	1	(1)
Belgium	3	7	1	2	13	(10)
Bermuda	-	-	1	-	1	(1)
Brazil	4	9	-	-	13	(12)
Bulgaria	1	-	-	-	1	(0)
Canada	18	14	4	3	39	(32)
Chile	2	2	-	-	4	(4)
China	2	1	-	-	3	(1)
Colombia	2	-	-	-	2	(0)
Costa Rica	-	1	-	-	1	(1)
Côte d'Ivoire	2	-	-	-	2	(1)
Croatia	3	-	-	-	3	(1)
Cuba	1	-	-	-	1	(0)
Denmark	8	3	1	1	13	(11)
Ecuador	2	-	-	-	2	(0)
Egypt	2	-	-	-	2	(0)
Falkland Is.	1	-	1	-	2	(2)
Faeroes	2	-	1	-	3	(3)
Fiji	-	-	-	1	1	(0)
France	16	7	7	9	39	(29)
Gabon	-	-	1	-	1	(1)
Germany	23	28	6	2	59	(57)
Greece	4	1	-	1	6	(4)
Guinea	1	-	-	-	1	(0)
Hungary	-	1	-	-	1	(1)
Iceland	5	2	1	-	8	(8)
India	5	1	-	-	6	(3)
Indonesia	-	-	1	-	1	(1)
Iran	1	-	-	-	1	(0)
Ireland	3	3	3	-	9	(7)
Israel	1	1	-	-	2	(1)
Italy	9	6	2	6	23	(21)
Jamaica	-	-	-	1	1	(1)
Japan	8	9	25	1	43	(41)
Kenya	4	-	-	-	4	(0)
Korea	6	-	1	-	7	(5)
Madagascar	1	-	-	-	1	(0)
Malaysia	1	-	-	-	1	(0)
Malta	-	1	-	-	1	(1)
Mauritania	1	-	-	-	1	(0)
Mauritius	-	1	-	-	1	(0)
Mexico	1	1	-	-	2	(1)
Monaco	-	-	-	9	9	(7)
Morocco	2	-	-	-	2	(1)
Mozambique	2	-	-	-	2	(0)
Netherlands	4	2	6	2	14	(13)
New Caledonia	-	-	-	1	1	(1)
New Zealand	4	1	2	1	8	(6)
Nigeria	1	-	-	-	1	(0)
Norway	12	3	14	3	32	(27)
Papua New Guinea	1	1	-	-	2	(1)
Peru	1	-	-	-	1	(1)
Philippines	-	2	-	1	3	(2)
Poland	2	-	-	-	2	(2)
Polynesia (French)	-	1	-	-	1	(1)
Portugal	1	2	-	-	3	(3)

Romania	1	-	-	-	1	(0)
Russia	16	1	-	1	18	(1)
Seychelles	1	-	-	-	1	(0)
Singapore	1	-	-	-	1	(1)
South Africa	5	-	2	-	7	(5)
Spain	7	8	6	3	24	(22)
Sri Lanka	-	-	-	1	1	(1)
Sweden	1	1	-	-	2	(1)
Switzerland	-	1	1	-	2	(2)
Taiwan	-	1	-	-	1	(1)
Tanzania	2	-	-	-	2	(0)
Tunisia	1	-	-	-	1	(0)
Turkey	3	1	-	-	4	(2)
Ukraine	4	-	-	-	4	(0)
UK	82	57	50	13	202	(124)
USA	45	62	42	5	154	(128)
Vietnam	1	-	-	-	1	(1)
TOTAL	374	255	189	67	885	(660)

Figures above refer to total number of copies sold or distributed up to 1 March 1998. GOV = Government/Public funded organization; UNIV = University; COMM = Commercial organization. Number in parenthesis refers to total number of copies sold as opposed to complimentary copies.



GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)



GEBCO Digital Atlas (GDA) Questionnaire

Section A: GRIDDED BATHYMETRY

Do you have a requirement for a gridded version of the GEBCO bathymetry? YES NO

If YES, please answer the following:

- a) What would you use it for?
- b) What geographic coverage do you require? GLOBAL REGIONAL
If REGIONAL, please specify region(s)
- c) Is a latitude/longitude grid convergent on the poles acceptable? YES NO
If NO, please specify your requirement:
- d) What grid cell dimensions do you require? minutes latitude by minutes longitude
- e) What is the coarsest grid cell you would find useful? minutes latitude by minutes longitude
- f) Should a nested/variable grid be used? YES NO
- g) Other comments:

Section B: SHALLOW WATER BATHYMETRY

The GDA is essentially a deep water product, and the shallowest standard contour is at 200m depth, although occasionally 50m and 100m contours may also be present.

Does the lack of shallow water bathymetry limit your usage of the GDA? YES NO

If YES, then:

- a) What is the minimum contour interval you would find acceptable in shallow water? metres
- b) What grid dimensions do you require for shallow water bathymetry?
- c) Is your geographic interest in shallow water bathymetry GLOBAL or REGIONAL
If REGIONAL, please specify region(s)

Section C: PAPER CHARTS

Do you have any needs for a paper version of GEBCO that you cannot easily meet by using the GDA?

YES NO

If YES, please specify your requirements:

Section D: SUGGESTIONS

What improvements or changes would you like to see in the GDA?
.....
.....
.....
.....

Section E: USER PROFILE

E1: What is the general nature of your business?

E2: How many people use your copy of the GDA? 1 2 to 5 more than 5

E3: What is your geographical area of interest in the GDA? GLOBAL REGIONAL

If REGIONAL, please specify region(s)

E4: Which GDA data sets do you use? GEBCO IBCM WVS

E5: On what type of computer system do you run the GDA?
PC Mac Unix Other Please specify:

E6: Do you export data from the GDA for use with other software packages? YES NO

If YES, then:

a) Which package(s) do you export data into?

b) Which GDA export format do you use? DXF ASCII

Section F: MAILING ADDRESS

Unless you state otherwise, your free copy of GEBCO-97 will be mailed to:

«Name»
«Address1»
«Address2»
«Address3»
«Address4»
«Address5»
«Address6»
«Address7»

Please check that this is correct, and modify if necessary. The corrected information will be used to update our customer database so that we can keep in touch with you.

To claim your free copy of GEBCO-97, please return the completed questionnaire to:
GEBCO-97, British Oceanographic Data Centre, Bidston Observatory, Birkenhead, Merseyside L43 7RA,
United Kingdom

An addressed envelope is enclosed for your convenience.

THANK YOU FOR YOUR COOPERATION

GEBCO Digital Atlas (GDA) Questionnaire

Provisional Analysis of Returns as of 1 March 1998

1. When GEBCO-97 was issued in April 1997, an offer was made to holders of the First Edition of the GDA (released in March 1994) for them to upgrade free of charge to GEBCO-97 on condition that they completed and returned a simple questionnaire. The questionnaire was intended to solicit their views as to how the GDA could be improved in future releases.
2. As of March 1997, the First Edition had been distributed to 735 users in 67 countries. The questionnaire was sent to 636 users. It was not sent out to active members of the GEBCO community - they received their copies of GEBCO-97 without the questionnaire. A further 40 questionnaires were not sent out because BODC could not identify the copy holders of the First Edition e.g. ordered through booksellers, anonymous recipients in large institutions or recipients known to have changed address.
3. As of 1 March 1998, completed questionnaires had been received from 385 recipients of the First Edition (i.e. 60% of the 636 questionnaires sent out). The returns covered users in 43 countries as follows:

1	Argentina	31	Germany	1	Portugal
23	Australia	3	Greece	4	Russia
1	Barbados	4	Iceland	2	South Africa
4	Belgium	1	India	16	Spain
4	Brazil	2	Ireland	2	Switzerland
19	Canada	9	Italy	1	Taiwan
2	Chile	15	Japan	1	Tunisia
2	China	1	Kenya	2	Turkey
1	Colombia	4	Korea	2	Ukraine
1	Cote d'Ivoire	1	Malta	86	UK
2	Croatia	1	Morocco	76	USA
9	Denmark	8	Netherlands		
1	Ecuador	5	New Zealand	385	Total
1	Falklands	1	Nigeria		
2	Faeros	14	Norway		
17	France	2	Philippines		

The distribution of returns according to the category of the user's host organisation was as follows:

Government Funded	158	(41%)
Universities	139	(36%)
Commercial Sector	68	(18%)
Others	20	(5%)
	<hr/>	
	385	

4. A statistical summary of the responses from the 385 questionnaires returned as of 1 March 1998 is given on the following pages. Please note that this does not include an analysis of the information supplied in plain text form (e.g. comments and suggestions) - this information is still being digested.

SECTION A: USER REQUIREMENT FOR A GRIDDED BATHYMETRY

Do you have a requirement for a gridded version of the GEBCO bathymetry?

YES !_! 278 responses (72%)
 NO !_! 107 responses (28%)

(Percentages that follow relate to the 278 respondents requiring a gridded version)

What geographic coverage do you require of a gridded data set?

Global !_! 190 responses (68%)
 Regional !_! 88 responses (32%)

Is a latitude/longitude grid convergent on the poles acceptable?

YES !_! 252 responses (91%)
 NO !_! 8 responses (3%)
 ?? !_! 18 no response (6%)

(If NO, please specify your requirement - all 8 respondents were interested in shelf regions and required either a UTM or an equidistant grid)

Should a nested/variable grid be used?

YES !_! 176 responses (63%)
 NO !_! 45 responses (16%)
 ?? !_! 57 no response (21%)

(Comment: There was a general requirement for the highest resolution possible providing the high resolution was justified by the available data i.e. the variability/nesting should be dependent on data coverage. Higher resolution was required for the continental slope, the shelf areas and into the coastal zone. Concern was expressed that the grid should be continuous across the nests, should be easy to use and that fixed lower resolution grids should be easily extractable if required.)

What grid dimensions do you require?min.latitude bymin.longitude

In virtually all cases responses were expressed as equal intervals in latitude and longitude. A summary of the number of responses for each requested grid cell size is given below (Note that many respondents did not specify dimensions - some simply said "do the best you can!"):

grid cell (minutes)	Those requiring Regional Grid	Those requiring Global Grid	Total
< 0.5	3	5	8 (4%)
0.5 - 0.99	9	13	22 (10%)
1.0	21	45	66 (30%)
2.0 - 3.0	10	23	33 (15%)
5.0	18	34	52 (23%)
10.0	5	12	17 (8%)
>14.9	7	16	23 (10%)
TOTAL	73	148	221 (100%)

What is the coarsest grid cell you would find useful?min.latitude bymin.longitude

In virtually all cases responses were expressed as equal intervals in latitude and longitude. A summary of the number of responses for each grid cell size is given below (Note that many respondents did not specify dimensions):

grid cell (minutes)	Those requiring Regional Grid	Those requiring Global Grid	Total
< 0.5	2	1	3 (1%)
0.5 - 0.99	1	1	2 (1%)
1.0	7	13	20 (9%)
2.0 - 3.0	6	19	25 (12%)
5.0	20	46	66 (31%)
10.0	13	18	31 (14%)
>14.9	24	45	69 (32%)
TOTAL	73	143	216 (100%)

SECTION B: USER REQUIREMENT FOR SHALLOW WATER BATHYMETRY

The GDA is essentially a deep water product, and the shallowest standard contour is at 200m depth, although occasionally 50m and 100m contours may also be present.

Does the lack of shallow water bathymetry limit your usage of the GDA?

YES !_! 286 responses (74%)

NO !_! 99 responses (26%)

(Percentages that follow relate to respondents requiring shallow water bathymetry)

If 'YES', is your geographic interest in shallow water bathymetry

GLOBAL !_! 96 responses (34%)

or REGIONAL !_! 176 responses (61%)

!_! 14 no response (5%)

If 'YES', what is the minimum contour interval you would find acceptable in shallow water? A summary of the 262 responses given is presented below:

Contour Interval	Contour Interval
1m 2 responses (1%)	20m 60 responses (23%)
2m 7 responses (3%)	25m 19 responses (7%)
5m 30 responses (11%)	50m 63 responses (24%)
10m 76 responses (29%)	100m 3 responses (1%)
15m 2 responses (1%)	

On reflection, the above question was poorly formulated as it implied contours at equal intervals. A number of respondents commented that equal intervals did not reflect their requirements and that it was more appropriate to define a sequence of contours with increasing intervals e.g. 5m, 10m, 20m, 50m, 100m, 150m, 200m. It is anticipated that many of the above figures reflect a compromise on the part of respondents who would have preferred to express a sequence of contours.

SECTION C: USER REQUIREMENT FOR PAPER CHARTS

Do you have any needs for a paper version of GEBCO that you cannot easily meet by using the GDA?

YES	!_!	50	responses	(13%)
NO	!_!	319	responses	(83%)
??	!_!	16	no response	(4%)

SECTION D: PROFILE OF USAGE OF THE GEBCO DIGITAL ATLAS

How many people use your copy of the GDA?

1	!_!	73	responses	(19%)
2 to 5	!_!	216	responses	(56%)
more than 5	!_!	95	responses	(25%)

What is your geographical area of interest in the GDA?

Global	!_!	262	responses	(68%)
Regional	!_!	180	responses	(47%)

Which GDA data sets do you use?

GEBCO	!_!	381	responses	(99%)
IBCM	!_!	76	responses	(20%)
WVS	!_!	105	responses	(27%)

On what type of computer system do you run the GDA?

PC	!_!	344	responses	(89%)
Mac	!_!	30	responses	(8%)
Unix	!_!	108	responses	(28%)

Do you export data from the GDA for use with other software packages?

Yes	!_!	309	responses	(80%)
-----	-----	-----	-----------	-------

If 'Yes' which GDA export format do you use?

DXF	!_!	137	responses	(45%) (of those exporting)
ASCII	!_!	213	responses	(69%) (of those exporting)

Which package(s) do you export data into?

42 respondents did not specify which package they used, while 44 stated that they exported data into their own home-grown software.

The remaining 223 listed a total of 44 different packages, the most popular packages being:

49 (22%)	ArcView/ArcInfo	9 (4%)	GIS - unspecified
47 (21%)	Surfer	9 (4%)	Idrisi
37 (17%)	GMT	7 (3%)	IDL
24 (11%)	MapInfo	6 (3%)	MapViewer
21 (9%)	Matlab	5 (2%)	CARIS
18 (8%)	Corel Draw	5 (2%)	Adobe Illustrator
17 (8%)	AutoCAD	5 (2%)	PowerPoint
14 (6%)	Intergraph Microstation		

ANNEX IX

Report of the GEBCO Grid Task Group

Wellington, 1998

Michael Carron

1. A report was given by Dr. Michael Carron, Chairman of the GEBCO Grid Task Group. The report contained the following:

- History of the GEBCO Grid effort
- Some results of the Grid Task Group analysis
- Review of recent studies on possible gridding techniques
- Request to the SCDB to make decision to produce grid to be included in next

GEBCO Digital Atlas

- Draft Plan of action and milestones (What/How/Who/When)

Mr. William Rankin presented his analysis of various test grids produced in GEBCO region 5.07.

Dr. Andrew Goodwillie (Scripps Institution of Oceanography) presented some preliminary grids in the Indian Ocean (based on recent contours produced by Dr. Robert Fisher.

Dr. Michael Loughridge (NGDC) presented results of recent high-resolution grids of the U.S. continental margins. Dr. Loughridge stated that these grids will be available for use in the GEBCO Grid.

Dr. Ian Wright (NIWA) presented products produced from a 1km x 1km grid of the New Zealand region. He implied that there is a strong possibility that a coarser grid may be able to be produced from the high-resolution grid presented and be available for inclusion in the GEBCO Grid.

2. SCDB agree by acclamation that a grid should be produced for the next GEBCO GDA.

3. It was decided that Drs. Walter Smith (NOAA) and David Sandwell (Scripps) be invited to put a copy of their GEOSAT/ERS-1 Marine Gravity Anomaly grid on the GDA as a supplement to the GEBCO Grid.

4. Dr. Carron presented options for production of the GEBCO Grid:

- Produce grids from GDA only
- Merge GDA with synthetic bathy from Smith and Sandwell
- Produce grids from GDA supplemented by additional contours in shallow

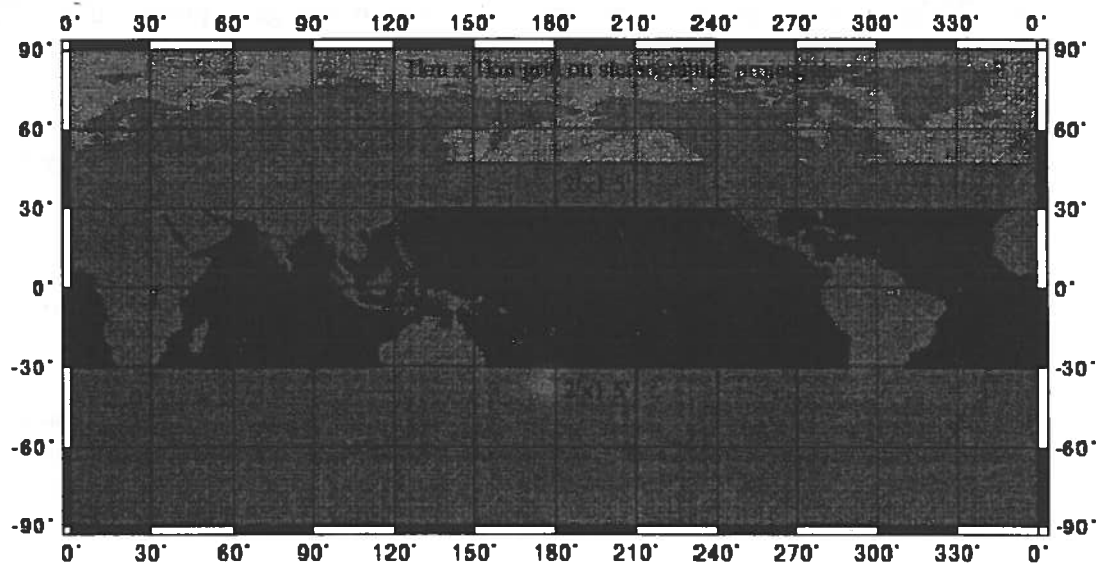
regions.

5. SCDB recommended that the GEBCO grid for the next GDA be produced by adding supplemental contours in shallow water to the most recent digital contours. In support of

this Commodore Neil Guy (IHO Director) volunteered to request digital contours of shallow regions from member states.

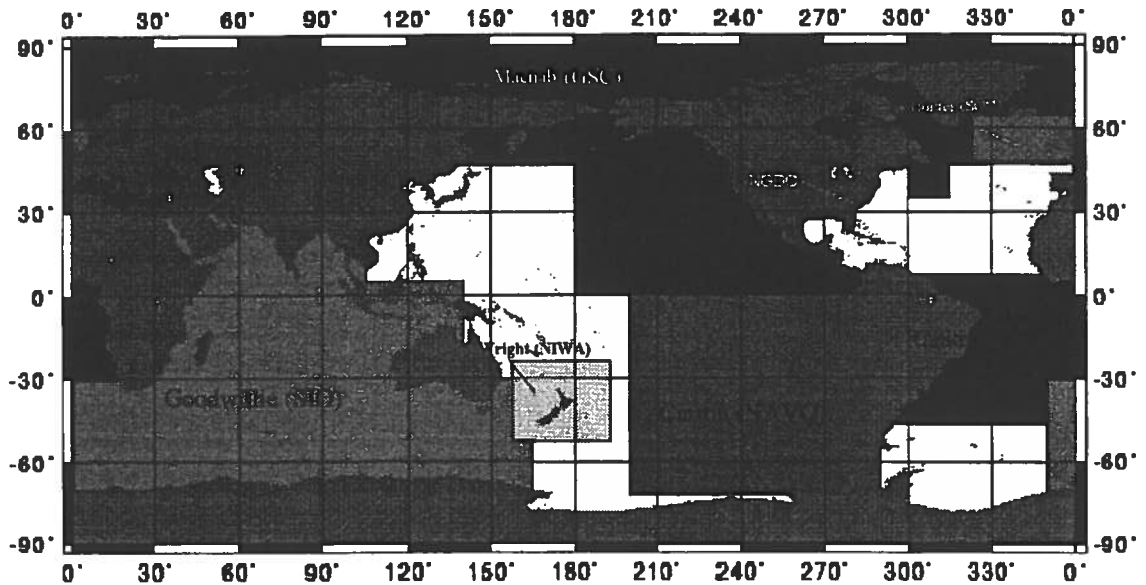
6. Task group will determine the final algorithms to be used. Task group is leaning towards GMT utilities possibly supplemented by additional code. Grid producers will not be constrained by techniques. Dr. Carron and Mr. Rankin will perform the final merge of various grids and QC. Their results will be presented to the GEBCO SCDB and Guiding Committee at the 1999 meeting.

7. Task group recommended that a variable resolution grid be produced (Figure 1). Task group will supply basic extraction software to enable users of GEBCO Grid to produce standard grid formats (i.e., .grd, netcdf, etc.).



8. Preliminary commitments to produce grids (Figure 2) were made by the following:

- Macnab (GSC)– 46.66N to 90N and parts of GEBCO regions 5.04/5.08 in collaboration with Hunter
- Rankin (NAVOCEANO)– GEBCO chart regions 5.07 and 5.12
- Goodwillie (SIO) – GEBCO chart regions 5.05, 5.09 and 97.1
- Wright (NIWA) – New Zealand Regions of GEBCO chart 5.10 and 5.14
- Hall (GS Israel) – Mediterranean Sea
- Hunter (SOC) – GEBCO 97.3 and parts of 5.04/5.08 in collaboration with Macnab
- Carron (NAVOCEANO) – GEBCO Chart 5.11 and overall coordination
- Smith (NOAA) – GMT and Gridding Algorithm consultation



9. Other possible commitments from:

- Schenke (Alfred-Wegener-Institute für Polar-und Meeresforschung) – GEBCO chart 97.2 and other Antarctic regions.
- Japan (Tsunami Lab of the Inst. Of Computational Mathematics and Mathematical Geophysics) – Kuril-Kamchatka 42-61N 144-168E.
- Japan (Meteorological Research Institute) – Western Pacific 20-48N.

10. Task group will meet during the Summer of 1998 to produce a final Plan of Action and agree on various techniques.

ANNEX X

LIST OF PARTICIPANTS

Sir Anthony Laughton PhD FRS
Chairman GEBCO (representing SCOR)
Okelands, Pickhurst Road
Chiddingfold, Godalming
Surrey GU8 4TS
UNITED KINGDOM

Fax: +44 (1428) 683967
Tel: +44 (1428) 683941
Email: anthony.laughton@soc.soton.ac.uk

Mr Alan Atkins
Assistant Hydrographer, Royal New Zealand Navy
New Zealand Hydrographic Office
PO Box 33-341, Takapuna
Auckland
NEW ZEALAND

Fax: +(09) 489 3560:
Tel: +09 489 7227:
Email: noi@hyhro.navy.mil.nz:

Dr Ruth Baldwin*
Land Information New Zealand (LINZ)
Lambton House
160 Lambton Quay, Private Box 5501
Wellington
NEW ZEALAND

Fax: +64 (4) 460 0110
Tel: +64 (4) 460 0575
Email: rbaldwin@linz.govt.nz

Ing. en Chef Gilles Bessero
Service Hydrographique et Océanographique de la
Marine
BP 5 00307 Armées
FRANCE

Telex: 285 421 (prefix: pour SHOM)
Fax: +33 1 40 65 99 98
Tel: +33 1 44 38 41 54
Email: gilles.bessero@shom.fr
Web: <http://www.shom.fr>

Dr Mike Carron
Director, Scientific Technology Staff
Code OTT
United States Naval Oceanographic Office
1002 Balch Boulevard
Stennis Space Center
Mississippi 39522-5001
UNITED STATES OF AMERICA

Telex: 510-101-2406 NSTL,BST
Fax: +1 (228) 688 4931
Tel: +1 (228) 688 4459
Email: carron@navo.hpc.mil

Mr Marco Antonio de CARVALHO Oliveira
Diretoria de Hidrografia e Navegação
Rua Barão de Jaceguay
s/no Ponta da Armação
CEP - 24. 048-900
Niterói, RJ
BRAZIL

Telex: 21-53259 MMAR BR
Fax: +55 (21) 620 0073
Tel: +55 (21) 620 0073
Email: gebco%hinave@mhs.mar.mil.br

Mr Norman Z. Cherkis
Chairman BGN/ACUF
Code 7420/Marine Physics
Naval Research Laboratory
Washington DC 20375-5350
UNITED STATES OF AMERICA

Fax: +1 (202) 767 0167
Tel: +1 (202) 404 1103
Email: cherkis@qur.nrl.navy.mil

Dr Robin K.H.Falconer (representing CMG)*
Institute of Geological and Nuclear Sciences Ltd.
Gracefield Road
PO Box 30 368
Lower Hutt
NEW ZEALAND

Telex: NZ31483
Fax: +64 (4) 569 0600
Tel: +64 (4) 570 1444
Email: r.falconer@gns.cri.nz

Dr Robert L. Fisher
Chairman SCUFN
Geosciences Research Division
Scripps Institution of Oceanography
La Jolla, California 92093-0215
UNITED STATES OF AMERICA

Fax: +1 (619) 534 0784
Tel: +1 (619) 534 3597
Email: jgsclater@ucsd.edu
or: sclater@bullard.ucsd.edu

Dr Andrew Goodwillie
Geosciences Research Division
Scripps Institution of Oceanography
La Jolla, California 92093-0220
UNITED STATES OF AMERICA

Fax: +1 (619) 534 0784
Tel: +1 (619) 534 1899
Email: andrewg@baltica.ucsd.edu

Commodore Neil Guy
Director
International Hydrographic Organization
4 quai Antoine 1er
B.P.445 - MC 98011 Monaco Cede
PRINCIPALITY OF MONACO

Telex: 479164 MC - INHORG
Fax: +377 93 10 81 40
Tel: +377 93 10 81 01
Email: dir1@ihb.mc
Web: <http://www.iho.shom.fr>

Dr John Hall
Marine Geology, Mapping &Tectonics Division
Geological Survey of Israel
30 Malchei Israel Street
Jerusalem 95501
ISRAEL

Fax: +972 (2) 534 6590
or (2) 538 0688
Tel: +972 (2) 534 6455

Commander Carlos Miguel Passeri Hansen
Diretoria de Hidrografia e Navegação
Rua Barão de Jaceguay
s/no Ponta da Armação CEP - 24.048-900
Niterói, RJ
BRAZIL

Telex: 21-53259 MMAR BR
Fax: +55 (21) 620 0073
Tel: +55 (21) 620 0073
Email: dh202%hinave@mhs.mar.br

Dr Stuart Henrys*
Institute of Geological and Nuclear Sciences Ltd.
Gracefield Road
PO Box 30 368
Lower Hutt
NEW ZEALAND

Fax: (04) 570 4603:
Tel: (04) 570 1444:
Email: s.henrys@gns.cri.nz

Mr Peter Hunter
GEBCO Bathymetric Editor
Challenger Division for Seafloor Processes
Southampton Oceanography Centre
Empress Dock
Southampton SO14 3ZH
UNITED KINGDOM

Fax: +44 (1703) 596554
Tel: +44 (1703) 596559
Email: cart@soc.soton.ac.uk

Dr Meirion T. Jones, Chairman SCDB)
Director
British Oceanographic Data Centre
Proudman Oceanographic Laboratory
Bidston Observatory
Birkenhead
Merseyside L43 7RA
UNITED KINGDOM

Telex: 628591 OCEANB G
Fax: +44 (151) 652 3950
Tel: +44 (151) 653 8633
Email: bodcmail@pol.ac.uk

Dr Michael S. Loughridge
Director
National Geophysical Data Center
NOAA Mail Code: E/GC
325 Broadway
Boulder, Colorado 80303
UNITED STATES OF AMERICA

Fax: +1 (303) 497 6386
Tel: +1 (303) 497 6215
Email: mloughridge@ngdc.noaa.gov
or msl@ngdc.noaa.gov

Dr Ron Macnab
Geological Survey of Canada (Atlantic)
PO Box 1006
Dartmouth
Nova Scotia B2Y 4A2
CANADA

Fax: +1 (902) 426 6152
Tel: +1 (902) 426 5687
Email: macnab@agc.bio.ns.ca

Dr Guillaume Ramillien
National Institute of Water and
Atmospheric Research Ltd.
Greta Point
Evans Bay Parade
PO Box 14-901
Kilbirnie
Wellington
NEW ZEALAND

Temporarily with Dr Ian Wright (NIWA)

Mr William Rankin
Code OTT
United States Naval Oceanographic Office
1002 Balch Boulevard
Stennis Space Center
Mississippi 39522-5001
UNITED STATES OF AMERICA

Telex: 510-101-2406 NSTL, BST
Fax: +1 (228) 688 4931
Tel: +1 (228) 688 5709
Email: rankin@navo.hpc.mil

Dr John Spittal*
Land Information New Zealand (LINZ)
Lambton House
160 Lambton Quay, Private Box 5501
Wellington
NEW ZEALAND

Fax: +(04)472 2244
Tel: +(04) 471 6856
Email jspittal@linz.govt.nz

Mr Shin Tani*
Hydrographic Department of Japan
5-3-1, Tsukiji,
104-0045
JAPAN

Fax: +81 (3) 3541-4535
Tel: +81 (3) 3541-3810
Email: stani@jhd.go.jp

Dr Dmitri Travin
Intergovernmental Oceanographic Commission
UNESCO
1, rue Miollis
75732 Paris Cedex 15
FRANCE

Telex: 204461 PARIS
Fax: +33 1 45 68 58 12
Tel: +33 1 45 68 40 44
Email: d.travine@unesco.org

Mr Bruce Wallen
Hydrographic Adviser
Land Information New Zealand
PO Box 5501
Wellington
NEW ZEALAND

Fax: 64 (4) 472 2244
Tel: 64 (4) 471 6852
Email: bwallen@linz.govt.nz

Ms Pauline Weatherall
GEBCO Digital Atlas Manager
British Oceanographic Data Centre (BODC)
Proudman Oceanographic Laboratory
Bidston Observatory
Birkenhead
Merseyside L43 7RA
UNITED KINGDOM

Telex: 628591 OCEANB G
Fax: +44 (151) 652 3950
Tel: +44 (151) 653 8633
Email: bodcmail@pol.ac.uk

Dr HOU Wenfeng (Chief Editor IBCWP)
Director
National Marine Data and Information Service
93, Liuwei Road, Hedong District
Tianjin 300171
CHINA

Telex: 23138 NODC CN
Fax: +86 (22) 24304 408
Tel: +86 (22) 24301 297
Email: houwf@netra.nmdis.gov.cn

Mr Phil Woodward
South Pacific Applied Geoscience
Commission (SOPAC)
SOPAC Technical Secretariat
Private Mail Bag, Suva
FIJI

Fax: +679 370040
Tel: +679 381139
or +679 381377
Email: phil@sopac.org.fj

Dr Ian Wright
National Institute of Water and
Atmospheric Research Ltd.
Greta Point
Evans Bay Parade
PO Box 14-901
Kilbirnie
Wellington
NEW ZEALAND

Fax: +64 (4) 386 2153
Tel: +64 (4) 386 0300
Email: i.wright@niwa.cri.nz

Mr Brian Harper
Permanent Secretary GEBCO
Park House
Donyatt
Somerset
TA 19 ORN
UNITED KINGDOM

Fax: +44 (1460) 52994
Tel: +44 (1460) 52994
Email: 101524.3422@compuserve.com

* Denotes part attendance

ANNEX XI**LIST OF ACRONYMS**

(Acronyms used only in the paragraph in which they are already defined are not included)

ACUF	Advisory Committee on Undersea Features (of BGN)
AGSO	Australian Geological Survey Organization
AGC	Atlantic Geoscience Centre, Geological Survey of Canada
AGU	American Geophysical Union
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung (Bremerhaven, Germany)
BAS	British Antarctic Survey
BGN	Board on Geographic Names (USA)
BODC	British Oceanographic Data Centre (Bidston Observatory, Birkenhead, UK)
BRIDGE	British Mid-ocean ridge project of NERC
CAP	Circum-Atlantic Project (of IUGS)
CD-ROM	Compact Disc - Read Only Memory
CEDD	Committee on Exchange of Digital Data (IHO) (merged with CoE)
CGM	Carte générale du monde (IGN)
CGOM	Consultative Group on Ocean Mapping (of IOC)
CHRIS	Committee on Hydrographic Requirements for Information Systems
CHS	Canadian Hydrographic Service
CICESE	Centro de Investigación Científica y Educación Superior de Ensenada (Mexico)
CLCS	Commission on the Limits of the Continental Shelf (UNCLOS)
CMG	Commission for Marine Geology (IUGS)
CoE	Committee on Electronic data (IHO) (formerly Committee on ECDIS, predecessor to CHRIS)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DBDB5	Gridded Bathymetric Data Set on 5 minute squares, produced by USNOO

DBWG	Data Base Working Group (IHO)
DCDB	Data Centre for Digital Bathymetry (IHO - at NGDC, Boulder, Colorado, USA)
DEM	Digital Elevation Model
DMA	Defense Mapping Agency (predecessor to NIMA)
EB	Editorial Board
ECDIS	Electronic Chart Display and Information System (IHO)
EEZ	Exclusive Economic Zone
EPSHOM	Etablissement Principal du Service Hydrographique et Océanographique de la Marine (France)
ERS-1	European Research Satellite-1
ESA	European Space Agency
ETOPO5	Earth Topography on a 5-minute grid (NGDC)
EU	European Union
GBE	GEBCO Bathymetric Editor
GDA	GEBCO Digital Atlas
GEBCO	General Bathymetric Chart of the Oceans (IOC/IHO)
GEODAS	GEophysical DATA System for Marine Geophysical Data (NGDC)
GIS	Geographic Information System
GMT	Generic Mapping Tools (P. Wessel and W.H.F. Smith)
GOOS	Global Ocean Observing System (IOC)
GPS	Global Positioning System
GSA	Geological Society of America
GSC	Geological survey of Canada
HDNO	Head Department of Navigation & Oceanography (Russian Federation Ministry of Defence, St Petersburg)
HIGP	Hawaii Institute of Geophysics and Planetology
HYDAS	HYdrographic DATA System for Marine Geophysical Data (NGDC)

IASC	International Arctic Science Committee
IBCCA	International Bathymetric Chart of the Caribbean Sea and Gulf of Mexico (IOC)
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic (IOC)
IBCM	International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series (IOC)
IBCWIO	International Bathymetric Chart of the Western Indian Ocean (IOC)
IBCWP	International Bathymetric Chart of the Western Pacific (IOC)
ICA	International Cartographic Association
ICSU	International Council of Scientific Unions
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
IGN	Institut Géographique National (Paris, France)
IGNS	Institute of Geological and Nuclear Sciences Ltd. (Wellington, New Zealand)
IH	International Hydrographic (Review and Bulletin)
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
INEGI	Instituto Nacional de Estadística, Geografía e Informática (Mexico)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOSDL	Institute of Oceanographic Sciences Deacon Laboratory (now part of SOC)
IUGS	International Union of Geological Sciences
KORDI	Korea Ocean Research and Development Institute
LDEO	Lamont-Doherty Earth Observatory
LINZ	Land Information New Zealand (Wellington, New Zealand)
MGD77	Magnetics, Gravity and Depth Format 1997 (NGDC)
MMBI	Murmansk Marine Biological Institute
NATO	North Atlantic Treaty Organisation
NavOceano	US Naval Oceanographic Office

NERC	Natural Environment Research Council (Swindon, UK)
NGDC	National Geophysical Data Center (Boulder, Colorado, USA)
NGS	National Geographic Society (USA)
NIMA	National Imagery and Mapping Agency (USA)
NIO	National Institute of Oceanography (predecessor to IOSDL)
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
NMDIS	National Marine Data and Information Service (China)
NOAA	National Oceanic and Atmospheric Administration (USA)
NOS	National Ocean Service (USA)
NRL	Naval Research Laboratory (USA)
NSF	National Science Foundation (of USA)
NZOI	New Zealand Oceanographic Institute (NIWAR)
OMG	Ocean Mapping Group (University of New Brunswick, Canada)
PSMSL	Permanent Service for Mean Sea Level
PWGCA	Permanent Working Group for Co-operation in the Antarctic
RAN	Royal Australian Navy
RAS	Russian Academy of Sciences
R/V	Research Vessel (IHO Hydrographic Dictionary)
S.57	IHO Transfer Standard for Digital Hydrographic Data
SACLANT	Supreme Commander Allied Command Atlantic (NATO)
SAR	Synthetic Aperture Radar
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCDB	Sub-Committee on Digital Bathymetry (GEBCO)
SCICEX	Submarine Science Exercise (US Navy under-ice cruises in the Arctic)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SCUFN	Sub-Committee on Undersea Feature Names (GEBCO)

SHOM	Service Hydrographique et Océanographique de la Marine (France)
SIO	Scripps Institution of Oceanography (La Jolla, USA)
SOC	Southampton Oceanography Centre (UK)
SOPAC	South Pacific Applied Geoscience Commission
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
USGS	United States Geological Survey
USNOO	US Naval Oceanographic Office
VHO	Volunteering Hydrographic Office (IHO)
WDC	World Data Centre
WESTPAC	Western Pacific regional programme of the IOC
WGS-84	World Geodetic System 1984
WVS	World Vector Shoreline (NIMA)
WWW	World Wide Web

**The International Workshop on
Bathymetry and Coastal-Topography Data Management.**
(A Report by the GEBCO Bathymetric Editor)
University of Washington, Seattle, USA. March 1998.

[*Tsunami*, a Japanese word meaning (*Tsu*) harbour (*nami*) wave.]

The GEBCO Bathymetric Editor attended an International Workshop on Bathymetry and Coastal-Topography Data Management. It was organised by Professor Harry Yeh, Department of Civil Engineering at the University of Washington, Seattle and was supported by the US National Science Foundation.

The workshop was attended by about 30 persons. The participants included hydrographic specialists, tsunami scientists and engineers, a few deep-water oceanographers (geoscientists) and near-shore coastal engineers, they were divided equally between university and government institutions. With two exceptions they came from countries in the North Pacific region: mainly Japan and the USA, but also Canada and Russia.

Since 1995, members of the Tsunami research community have met three times. Last September, several Japanese tsunami and hydrography scientists gathered at JODC, to discuss how to improve and arrange bathymetry and coastal-topography data. Unlike other ocean-related topics, tsunami analyses require the integrated data for the entire ocean basin plus dry coastal information: for example, they need the data from 10,000 m deep ocean trenches to, say, 50 m above sea level. The JODC meeting realised that they needed to find out about and to link into existing global bathymetry projects such as GEBCO.

The GEBCO questionnaire had been received from Meirion Jones and the members of the tsunami community were pleased to have been given the opportunity to give their opinion.

First Session

The session discussed significant improvements in global deep ocean bathymetry and summarised recent developments and future directions to be taken by data centres. A number of presentations were made, including one by the GBE on the latest developments in GEBCO, the participants were most interested to hear about the plans for a gridded bathymetry as they have used ETOPO5 in the past and find its' depth values to be very inaccurate on the continental shelves (This was due to their lack of knowledge about how it was prepared.). Presentations were also made on JODC (Yutaka Michida), NGDC (George Sharman) and Satellite Altimetry (Dave Sandwell, Scripps).

Second Session

This session concentrated on bathymetry data in shallow water regions (on continental shelves) and runup topography, also discussed were the reasons why shallow water data are important and what grid resolution is adequate for the numerical computations. Presentations then described grids in current use by Japanese (Yuichiro Tanioka, MRI) and Russian (Viacheslav Gusaikov, ICMMG) Tsunami researchers and the grids of the US margins being produced by NOAA (Lincoln Pratson, Univ. Colorado/NGDC).

The resolution of the MRI (Meteorological Research Institute) grid is one minute x one minute. It covers the seafloor around Japan between latitudes 20° and 48° North. The longitude limits are variable. The shallower waters are well represented. The data source is JODC and consisted of approximately 30,000 depth values and 1:20,000 scale bathymetric charts. GEBCO have been given permission to use the grid. The deeper water regions of the grid agree favourably with the predicted bathymetry of Smith and Sandwell.

The Russian grid produced at the Tsunami Laboratory of ICMMG (the Institute of Computational Mathematics and Mathematical Geophysics) is also a one minute x one minute grid. It covers the Kuril Islands and Kamchatka Peninsula between 42° and 61° North and 144° and 168° E. The owner is willing to let GEBCO use it but he would like any requests to be made officially through HDNO who provided the source data which was scanned contour maps.

The US margin grids are part of the same project on the US East Coast and in the Gulf of Mexico of which Dr Mike Loughridge, NGDC informed the Wellington GEBCO meetings.

Two further presentations in this section discussed the coastal topography data in Japan and the USA.

Session 3

This session discussed the long-term and ultimate goals for a Tsunami Data System. These were summed up as - having a computer-based system without a central database but knowledge and access to many databases containing parameters such as, bathymetry, topography, sediment character, seismicity, man-made structures, vegetation, instrumentation, estuarine and river, benthic data (corals), etc., with a 'smart' interface to find, access and synthesise these data. The databases should contain references to position, time, and data accuracy, quality and reliability.

Session 4

The session focused on the short-term goals for a Tsunami Data System. Suggestions included carrying out a survey of unused original data to improve the bathymetric database, the creation of a detailed bathymetry in the vicinity of Japan and a Pacific-wide bathymetric grid resolution of 1 minute x 1 minute.

The workshop thought that an inventory of existing bathymetric grids was desirable, however it was noted that globally this should be the responsibility of GEBCO. They remarked that the tsunami community could influence the release of data in important regions and should identify datagaps. In addition, it should foster international integration, the incorporation of historical data, the gathering of new data and de-classifying of data.

Session 5

This session discussed the standardisation of vertical (elevation and depth) and horizontal datums. As there were no experts on this subject present the workshop were unable to discuss this fully, however they did recognised that there were many datums in use at present, but that it was possible to convert from one to another with available software so long as there was enough basic information available, such as time of measurement when working with vertical data. There was some discussion about the mismatch of vertical datums used by the marine and land survey communities. For reasons of navigational safety, the marine community measures depths with respect to Mean Low Lowest Water (MLLW) whilst the land community measures elevations with respect to Mean Sea Level (MSL). (George Sharman introduced a useful graphic of this difference.) This poses considerable problems for the tsunami community as they require their grids to pass seamlessly from the water to the land.

The workshop thought that there must be other research groups who require similar kinds of data, such as the storm surge communities.

The meeting concluded with a general discussion, in particular:

The workshop participants agreed to use the GEBCO grid as their main grid, although they would prefer one minute x one minute resolution in the deep water and finer resolutions as the water shallows (they mentioned 5 metres right next to the coast, although this it was agreed, should be the problem of the concerned researcher).

They will contribute relevant depth information to help GEBCO's efforts.

It is important for them to know the existence of features in the deep ocean as they can interfere with the track of a Tsunami. The shallower waters are more important, particularly the run-up to the coast. Their models seem to be very sensitive to small changes in the seafloor morphology.

Because of their requirement for finer grids adjacent to the coasts, and also for the need for their grids to extend inland, they are very concerned about the problem of the different vertical datum used by the land and marine mapping communities.