INTRODUCTION (1)

To really optimize the scientific value of an international research project, such as JGOFS and its successors, proper data management practices are essential. They should aim to ensure the elaboration of quality-controlled, homogeneously formatted and extensively documented datasets and their rapid, worldwide dissemination and long-term stewardship within the World Data Centres (WDCs) system.

The JGOFS data management is the responsibility of each national participant, without a centralized clearing-house for the data. As a result, many data are still not fully available for the modelling and synthesis phase.
INTRODUCTION (2)

The Data Management Task Team (Figure 1: DMTT set-up and interactions), a consortium of national data management offices (DMO), is working hard to put together a single database (so-called, the International JGOFS Master Dataset), in a single location (in the WDCs system, thanks to an initiative of PANGAEA / WDC-MARE), in a single format and with uniform metadata. This should be achieved by adapting previously developed tools, especially from the US-JGOFS DMO (for the user query interface) and from ODV/PANGAEA (for the datasets visualization and metadata handling). This dataset will also be disseminated in a forthcoming CD-ROM series.
DMTT ACTIVITIES

In this framework, the past, current and future DMTT activities are:

► production of nationally approved JGOFS cruise inventories ➔ Figure 2
► preparation of a list of core parameters, associated units, methodology, and quality control criteria ➔ Figure 3
► preparation of metadata standards to describe the datasets;
► production of CD-ROMs and/or on-line databases ➔ Figures 4 & 5
► adaptation of existing data management tools, such as user interface (e.g., J-LAS) and visualization package (e.g., ODV-derived), to be incorporated into the International CD-ROM dataset ➔ Figures 6 & 7
► collection of relevant references associated with the datasets ➔ Figure 8
► interactions within the DMTT with other JGOFS WGs and TTs and with other competent bodies (e.g., NODCs, WDCs, ICES, IODE, national data managers not involved in the DMTT);
► preparation of recommendations for proper data management to the JGOFS SSC, JGOFS parent bodies (IGBP and SCOR) and (inter)national funding agencies; in preparation of future marine biogeochemistry programme(s) ➔ Figure 9

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**Figure 2. Example of Nationally Approved Cruise Inventory**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Ship</th>
<th>Project</th>
<th>Cruise ID</th>
<th>Chief Scientist</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>15/10/1993 - 28/10/1993</td>
<td>Venus</td>
<td>Margin flux in the East China Sea</td>
<td>F9310</td>
<td>B. Zhan</td>
<td>East China Sea</td>
</tr>
<tr>
<td>5/06/1999 - 03/07/1999</td>
<td>Yanping Nr.2</td>
<td>-</td>
<td>-</td>
<td>H. Hong</td>
<td>Taiwan Strait, 22-27N,117-122E</td>
</tr>
<tr>
<td>12/02/1997 - 09/03/1997</td>
<td>Science 1</td>
<td>Ocean Flux in the East China Sea</td>
<td>F9702</td>
<td>B. Zhan</td>
<td>East China Sea</td>
</tr>
<tr>
<td>7/08/1997 - 21/09/1997</td>
<td>Yanping Nr.2</td>
<td>-</td>
<td>-</td>
<td>H. Hong</td>
<td>Taiwan Strait, 21-27N,116-121E</td>
</tr>
<tr>
<td>26/02/1998 - 08/03/1998</td>
<td>Yanping Nr.2</td>
<td>-</td>
<td>-</td>
<td>H. Hong</td>
<td>Taiwan Strait, 21-27N,116-121E</td>
</tr>
<tr>
<td>10/08/1998 - 16/08/1998</td>
<td>Yanping Nr.2</td>
<td>-</td>
<td>-</td>
<td>H. Hong</td>
<td>Taiwan Strait, 21-27N,116-121E</td>
</tr>
<tr>
<td>13/03/2001 - 03/04/2001</td>
<td>Yanping Nr.2</td>
<td>-</td>
<td>-</td>
<td>M. Dai</td>
<td>Northern South China Sea, 20-25N,113.5-116E</td>
</tr>
</tbody>
</table>
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### Figure 3: Provisional List of JGOFS Core Parameters (2)

<table>
<thead>
<tr>
<th>Group</th>
<th>Parameter</th>
<th>Method</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>H₂ - Bioluminescence</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Phaeopigments</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>H₂ - Hematoporphyrin</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Phaeopigments</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Phaeopigments</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll b</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Phaeopigments</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Phaeopigments</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Σ - Caroten</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Σ - Caroten</td>
<td>HPLC</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll a</td>
<td>Photochemical</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll</td>
<td>Photochemical</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>Particulate Organic Carbon</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>Particulate Nitrogen</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>Dissolved Organic Carbon</td>
<td>μmol l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Photosynthesis</td>
<td>New Production</td>
<td>μmol C m⁻² d⁻¹</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>Primary Production</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>Integrated Daily Production</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3: Provisional List of JGOFS Core Parameters (3)

<table>
<thead>
<tr>
<th>Group</th>
<th>Parameter</th>
<th>Method</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>Bacterial Ploidy Abundance</td>
<td>Colony</td>
<td></td>
</tr>
<tr>
<td>Bacteria</td>
<td>Bacterial Production</td>
<td>Mead-Dribble Method</td>
<td>μg l⁻¹</td>
</tr>
<tr>
<td>Bacteria</td>
<td>Bacterial Production</td>
<td>Tritiated Thymidine</td>
<td>μg l⁻¹</td>
</tr>
<tr>
<td>Microscopic</td>
<td>Microscopic plankton biomass</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Microscopic</td>
<td>Microscopic plankton biomass</td>
<td>μg l⁻¹</td>
<td></td>
</tr>
<tr>
<td>Sediment Trap</td>
<td>Mass Flux</td>
<td>Sediment trap</td>
<td>mg m⁻² d⁻¹</td>
</tr>
<tr>
<td>Sediment Trap</td>
<td>Particulate Organic Carbon Flux</td>
<td>Sediment trap</td>
<td>mg m⁻² d⁻¹</td>
</tr>
<tr>
<td>Sediment Trap</td>
<td>Particulate Nitrogen Flux</td>
<td>Sediment trap</td>
<td>mg m⁻² d⁻¹</td>
</tr>
<tr>
<td>CO₂ system</td>
<td>Dissolved pCO₂</td>
<td>μatm</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Initial or initial temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Salinity</td>
<td>Initial or initial salinity</td>
<td>psu (practical salinity units)</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>Initial or initial pH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redox potential</td>
<td>Initial or initial redox potential</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Meiofauna</td>
<td>Benthic meiofauna</td>
<td>Ind m⁻²</td>
<td></td>
</tr>
<tr>
<td>Meiofauna</td>
<td>Water mass</td>
<td>mg m⁻³</td>
<td></td>
</tr>
</tbody>
</table>
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Figure 4. JGOFS & JGOFS-Related CD-ROM Products (as of May 2002) (1)

- Biogeochemical Ocean Flux Study (BOFS) N. Atlantic (1989-1991)
- Netherlands Indian Ocean Programme (NIOP) (1990-1995)
- Arabesque Data from RRS Discovery Cruises 210 and 212 (1994)
Figure 4. JGOFS & JGOFS-Related CD-ROM Products (as of May 2002) (2)

- NOPACCS – NW Pacific Carbon Cycle Study (1990-1996)
- JGOFS Canada Data Sets 1989-1998 CD-ROM version 1.0
- CANIGO (Canary Islands Azores Gibraltar Obs., 1996-1999)
- PRIME - Plankton Reactivity in the Marine Environment (2000)

Figure 4. JGOFS & JGOFS-Related CD-ROM Products (as of May 2002) (3)

- SOIREE - Southern Ocean Iron Release Experiment (2001)
- BOFS Sterna92 CTD XBT & SeaSoar Data (2002)
- OzGOFs Equatorial Pacific (2002)
- CANIGO (Canary Islands Azores Gibraltar Obs., 1996-1999)
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**Figure 4. JGOFS & JGOFS-Related CD-ROM Products (as of May 2002) (4)**

Ocean Margin EXchange (OMEX I) Project Data Set (1993-1997)


World Ocean Circulation Experiment (WOCE) Hydrogr. Data (1999)

WOCE Global Data version 2.0 (2000)

Ocean Margin Exchange (OMEX II) Project Data Set (1997-2000)

The LOIS - River-Atmosphere-Coast Study (RACS) (2001)
Figure 5. JGOFS & JGOFS-Related Datasets Websites (1)

www.marine.csiro.au/datacentre/JGOFSweb/cmrr_jgofs.htm
CSIRO Marine Research Website of JGOFS

www.nio.org/ National Institute of Oceanography
www.indian-ocean.org/ Gateway to the Indian Ocean

www.obs-vlfr.fr/jgofs/html/index_eng.html
PROOF / JGOFS-France database

www.bodc.ac.uk/
British Oceanographic Data Centre (BODC)

Figure 5. JGOFS & JGOFS-Related Datasets Websites (2)

www.meds-sdmm.dfo-mpo.gc.ca/jgofs/
Canadian JGOFS Data Management Website

www.mirc.jha.or.jp/IJCD/en/top.html
Inventory for Japanese Chemical oceanographic Data
www.jodc.go.jp/JGOFS_DMO/jgofs-study.html
Japan JGOFS Data Management Office

www.ifm.uni-kiel.de/jgofs/dm/
German JGOFS Data Management Office

usjgofs.whoi.edu/general_info/data_management.html
U.S. JGOFS Data Management Office
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Figure 6. Examples of application of the J-LAS package (1)
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Figure 7. Examples of application of the ODV package (1)

(extracted from http://www.awi-bremerhaven.de/GEO/Flux/model.html)

Figure 7. Examples of application of the ODV package (2)

(extracted from http://www.awi-bremerhaven.de/GEO/Flux/model.html)
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**Figure 8. Examples of national compilations of JGOFS publications (2)**

**U.S. JGOFS Publications**

The JGOFS Project has been highly successful in providing new insights into global biogeochemical cycling in the oceans through a multi-national effort. As new programs are being designed and implemented, we must however learn from the JGOFS data management experience. The following is a set of recommendations for new programs:

1. Establishment of a centralized international project data center responsible for:
   - acquisition of data, data access, and distribution of data to the World Data Center system to ensure its long-term archive;
   - establishment of experienced/full-time national data coordinators who will: identify cruises and PIs associated with the program, work with PIs to ensure data and metadata are complete and in common file and data formats, submit data to the international data center.

These recommendations are designed to ensure the rapid dissemination of data and its long-term archive.

During the JGOFS project, key biological and chemical variables have been sampled by over 20 countries at the regional scale (process studies in the North Atlantic, Arabian Sea, Equatorial Pacific, Southern Ocean and North Pacific), global scale (carbon survey) and from long-term measurements at key ocean sites. As we proceed with the synthesis and modeling phase of JGOFS, it is becoming much likely that JGOFS may fall short in providing a satisfactory data legacy for future generations.

The JGOFS data management plan was set up so each nation had a data coordinator responsible for that nation’s data. Data are either managed by a national JGOFS data manager (e.g., Australia, Canada, France, Germany, India, Japan, U.K. and U.S.), or reside with individual Principal Investigators (PIs). A Data Management Task Team (DMTT) was formed to coordinate the data management efforts, but in effect, the DMTT does not represent all nations involved in JGOFS activities, and does not have the manpower to go far beyond coordination of data collections carried out nationally. The lack of a centralized international data office severely hampers the use of JGOFS data for synthesis and model validation, now and in the future.
Additional problems identified with the current JGOFS Data Management are:

1. ambiguity in many countries as to what constitutes a JGOFS cruise;
2. no time limit, and in most countries, no requirement for delivery of data to a data center from where it can be disseminated and archived;
3. reluctance by PIs to share data;
4. data in diverse formats with incomplete documentation or missing key core JGOFS parameters.

Efforts to acquire funds to compile all JGOFS international data into a common file and data format, to be distributed internationally, have failed in the U.S. These efforts have failed mainly because such supporting activities, although extremely important to make optimal use of the scientific data, have been fared poorly in competition with proposals to initiate new science projects. This view by the funding agencies appears short-sighted since the acquisition of data is very costly compared to the small cost of effective data management.

Thanks!

Please feel free to contact the JGOFS IPO, if you wish to obtain this presentation (as ppt files).