

JGOFS Executives Committee Meeting
The Johns Hopkins University, Baltimore, Maryland, USA
24-26 August 1999

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Opening Remarks and Arrangement

The 1999 JGOFS Executive Committee took place at the Johns Hopkins University from 24-26 August 1999. The Scientific Committee on Oceanic Research (SCOR) Secretariat hosted the meeting. The list of participants at the JGOFS Executive Meeting appears in Annex 1.

Fasham chaired the meeting and welcomed the executive members and participants. He announced that the Executives approved the DMTT recommendation that Margarita Conkright take over as Chair, 1 January 2000. Conkright, who attended the first day, is located at the National Ocean Data Center of National Oceanic Atmospheric Administration in Silver Springs, Maryland, USA. Fasham also announced that Hugh Ducklow had accepted JGOFS invitation to become the next JGOFS SSC Chair, pending IGBP and SCOR approval. Mardi Bowles, who attended the last two days of the meeting, confirmed that she accepted the copy editor job for the JGOFS glossy brochure.

SCOR Executive Director, Elizabeth Gross extended a welcome to the Executives and guests to the Secretariat and University for the meeting, and announced the arrangements for the evening dinner at her home.

Approval of the Agenda

Fasham remarked that the allocation of time on the Agenda was left open to allow for full discussion of the topics. The Executive agreed to discuss the JGOFS data sets archival, long term stewardship and other data management issues with DMTT Chair-elect in the afternoon before Conkright's departure. The Agenda was approved and appears in Annex 2.

Old Business

1999 Executive Committee Minutes

Fasham reviewed the actions from the 1998 Executive Committee meeting in Southampton, UK. Although most were completed, in regards to GAIM Task Force meeting last November, the Executives request that Monfray send a meeting report for the minutes of the SSC meeting in Yokohama. Under previous Actions, Item #1 GLOBEC data, Gross informed the Executives that the new Executive Officer for GLOBEC IPO at Plymouth Marine Biological Laboratory is Manuel Barange, who will be onboard in October 1999. Item #4 Iron Calibration, Fasham reported that the SCOR Working Group has not gotten far on the calibration issue in part because the WGs efforts have been mainly concentrated on getting the book completed, which is currently 3 months behind schedule. The Executives approved the minutes with minor modifications.

Action 1. Fasham will request a report from Monfray on the GAIM Task Force meeting.

14th Scientific Steering Committee Minutes

Fasham thanked Liu for chairing the 14th Scientific Steering Committee (SSC) in his absence and then reviewed the issues arising from the SSC meeting in Yokohama. Under Old Business, Fasham asked Hanson to brief the Executives on the Villefranche book. Hanson reported that the book master galley has been at CUP since June 1998. Although there has been communication on a couple of chapters with the Editors, they have yet announced the date for publication. Fasham asked Hanson to follow up on the book (i.e., publication date) and report back to the Executives. Commenting on publication delays with the Villefranche book, he asked Swanberg if IGBP has selected the next book publisher for the IGBP book series. Swanberg reported that Steffen has been in contact with three publishers (Academic Press, Springer-Verlag, and Blackwell). The negotiations continue and IGBP will select a publisher soon.

Action 2. Hanson will request information on the status of the CUP book and an estimated date for publication.

Under New Business, Fasham thanked Ducklow for filling in for him at the Congress and congratulated him on giving a strong and dynamic JGOFS presentation. Ducklow mentioned that the IGBP Congress was a stimulating meeting and enjoyed being there. Swanberg asked the Executives for their opinions and Lochte felt that there were too many parallel sessions, which limited the attendance by many players from the program elements. Unfortunately there was no other way to arrange the parallel session, said Swanberg, and he asked if there was another way? Lochte did not think so.

SSC Action 4: Fasham raised again the problem of non-attendance of SSC members at annual meetings. In Yokohama, 10 SSC members were absent, which contributed to matters arising and decisions deferred to the Executives. Hanson mentioned that there were legitimate reasons for several being absent, e.g., visa applications, health issues, and earlier commitments. But what probably contributed a great deal to the absentees was the lack of time. SSC meetings sandwiched around a large congress amounted to ca. 10 days (total), including travel time.

SSC Action 7: Fasham raised the issue of training that was once handled by GSMTT, now disbanded. Hanson informed the Executives that when the SSC disbanded GSMTT the SSC accepted the added responsibility for training under the revised Terms of Reference (May 1998),

which now includes synthesis and training. In the future, Fasham emphasised the importance of the Executives arranging the support for meetings and training sessions in developing countries. To start planning, the Executives offered some ideas. Since there are several active JGOFS programs in the Southern Hemisphere, the Executives suggested holding the next SSC meeting along side a training session. Fasham offered to contact Quinoñes in Chile and ask him if he would be willing to host a SSC meeting and help arrange a training session. The action to hold a meeting and training session in the Southern Hemisphere or elsewhere can be on the SSC agenda and decision made in Bergen.

Action 3. Fasham will contact Quinoñes about hosting the next SSC meeting along side of a training session in Chile.

SSC Action 7: Liu asked if the course material from the Training Course in India is available on the JGOFS homepage. He reiterated the intellectual importance of this material to those from developing countries who were unable to attend and even those who did. He emphasised that material from future training sessions must be distributed widely. Hanson informed the Executives that Baliño and Sathyendranath will put a package together for the JGOFS website.

Action 4. The IPO will provide future training course material on the JGOFS website.

SSC Action 16: Reports from international programmes, especially those with a link to JGOFS, are an important aspect of the annual SSC meetings. To insure that the SSC is updated on international programmes at their annual meetings, Fasham asked the Executive whether it would be useful to send a JGOFS representative in the region to such meetings. They unanimously supported the suggestion. Therefore, in regards to the next IOCGG meeting in Hobart, Fasham suggested that Tilbrook might attend and report back to the SSC in Bergen, if Platt could not attend the Bergen meeting. With an invitation from Platt, Tilbrook agreed that he would attend the next IOCCG meeting.

Action 5. Fasham will discuss the issue with Platt about IOCCG reporting back to JGOFS.

SSC Action 17: The Executives also felt that the SSC needed a status report from the GOOS and/or minutes of its recent Workshop. At the IGBP Congress, Field advised the SSC that JGOFS needs a representative at GOOS and OOPC (Ocean Observing Panel on Climate) meetings in the future. Present representatives have rotated or will be rotating off these panels. The Executives will take up representation during the discussion of SSC membership.

Action 6. Gross will call Collins, if she can not locate the Workshop report and also provide Fasham with the information and the membership of the GOOS and OOPC.

Action 7. Fasham will report to the Executives on the status of GOOS and OOPC.

SSC Action 18: Gross announced that SCOR had received a proposal for the new Working Group on Export Production, from Krishnaswami in India, and that a JGOFS letter of support should be sent to the Secretariat. Gross distributed the proposal to the Executives. Liu felt that the proposal should cover not only thorium method but also N15 methods. After discussion, the Executives agreed to support the proposal as written. For the letter, Liu expressed that this SCOR WG would actually help JGOFS synthesis, but questioned if the proposal compliments or overlaps with JGOFS. Executives believe that if SCOR supports of this proposal, the WG would compliment JGOFS synthesis. A better knowledge of export production and its variability is important to assess the role of oceans in sequestering atmospheric CO₂.

Action 8. Fasham will email a letter of support to SCOR before 10 October.

SSC Action 19: Although the SSC had welcomed a proposal from Monfray for a JGOFS-GAIM task team, one was not received for Executive review. Hanson mentioned that all JGOFS activities, including proposed activities, were reminded to submit proposals.

Action 9. Fasham will write or talk with Monfray about the new joint task team on ocean carbon modelling (JGOFS-GAIM).

New Business

Scientific Steering Committee

Membership and Nominations

Ducklow left the room during the discussion of the SSC Chair. Fasham announced early on that he would be stepping down from the SSC Chair this year. In Yokohama, the SSC was asked to nominate candidates for Chair and informed that the Executives would make a short list. Ducklow ranked at the top of several excellent candidates. In the end, the Executives agreed that Ducklow would be a strong advocate of ocean biogeochemistry. A list of the 1999 SSC membership appears in Annex 3.

Action 10. The Executives endorsed Ducklow's nomination for SSC Chair. Fasham will remain on the SSC as Past Chair for 1 year and continue to lead the work on the IGBP Science Series (brochure) and textbook.

Two SSC at-large members will reach the end of their terms this year: Egil Sakshaug (Norway) and Toshiro Saino (Japan). The Executives reviewed the SSC options and the size of the SSC and agreed that with contract renewal of the International Project Office in Norway, Norwegian representation is needed on the SSC. In Yokohama, Sakshaug named several excellent candidates residing in Bergen who might accept JGOFS invitation to sit on the SSC. The Executives agreed with the list of names, and Fasham asked Hanson to contact Peter Haugan on his availability and to enlist his services.

Action 11. Hanson will contact Haugan and ask him to consider the invitation to sit on the 15th SSC.

In regards to Saino's at-large membership, the Japanese have been strong players in ocean biogeochemistry, remote sensing and the KNOT time-series station in the North Pacific process study, and over the past three years, Saino has distinguished himself on the SSC. Fasham moved to nominate Saino for a second term on the SSC. The Executives unanimously agreed to invite Saino for a second term.

Action 12. Fasham will contact Saino about his interests and availability to serve a second term.

With the proposed changes in the at-large memberships of SSC and its activities, the 22 members of the Year 2000 SSC will be:

Fasham, Ducklow, Anderson, Bathmann, Burkill, Bychkov, Falkowski, Garçon, Hong, Le Borgne, Liu, Lochte, Conkright, Monfray, Platt, Quiñones, Saino, Haugan, Shimmield, Tilbrook, Wallace, Watson.

With these changes, the Executives expressed concern that the SSC has become too large and expensive. Hanson mentioned that the cost of SSC meetings run well over \$45,000 annually and the IGBP support for these meetings has not increased since around 1994, when they calculated their support (ca. 20,000), while the other half is covered by SCOR. This has placed considerable financial strain on the JGOFS (SCOR funds) over the last few years. Couple this with decreasing funds from SCOR partners, future JGOFS funds will be cut even more. The Executives noted future financial constraints and moved to reduce some financial burden from the SSC meetings, namely the travel support of both co-chairs to SSC meetings.

Action 13. The reduction of SSC size (numbers) will be decided at the next SSC meeting. Task Teams will be reminded to review co-chairs at their next meeting and be prepared to send only one representative to Bergen.

Executive Committee

Normally the SSC Chair selects the Executive members for the coming year. However, with the present chair stepping down and the present candidate for SSC Chair not approved, the selection is deferred until after IGBP and SCOR approval. When officially approved, the new chair will select the Executives for Year 2000 before the end of the year.

Synthesis Groups

North Atlantic Synthesis Group (NASG)

Fasham congratulated NASG Chair Garçon for securing funds to support the next NASG meeting in France (September 1999). NASG recommended a change in Spanish representation in the group. In addition, it was determined that Doney is NOT a NASG member and that Fasham will contact Lowry regarding his interest to remain on the group, in lieu of him stepping down as chair of the DMTT. Ducklow reported that the special volume planned under the NA synthesis phase is having some difficulty in receiving acceptable manuscripts from authors. The date for the volume has been pushed back from March-April to June-July. There are only 6-8 manuscripts in hand, originally 12-13 papers. The guest editors do not have a critical mass for publication and the deadline is in jeopardy to have a publication ready in time for the OSC.

The Executives decided to defer all discussions on requests for funds from synthesis groups and task teams until the discussion of the 2000 Budget.

Action 14. The Executives approved the NASG change: Emilio Fernandez replacing Fiz Perez.

Southern Ocean Synthesis Group (SOSG)

The Executives reviewed the membership and terms of reference for the SOSG. For the terms of reference, the main tasks of the SOSG must be folded into the generic TOR for synthesis groups (synthesis plans) and the tasks need to include a statement on collaborating with Southern Ocean GLOBEC and other relevant Southern Ocean committees. The restructured membership presented some discussion. The Executives approved the following nominees:

Bathmann, Smith*, Hall, Monfray, Pollard, Priddle, Tréguer, Trull, (one to be nominated)

*For USA representation, the Executives approved Smith with Anderson as the alternate, but not both, since Anderson is presently an at-large SSC member. The Executives will consider the nominee for the regional modelling when the SOSG submits a name for approval.

In accordance with one representative from each activity at SSC meetings, the Executives recommend the title of Vice Chair for the alternate representation.

The Executives deferred all requests for 2000 meetings to the discussion of the 2000 Budget.

Action 15. The Executives approved the new membership of the SOSC with exceptions noted.

Action 16. The Executives deferred final approval of the SOSG TOR until it is submitted in the form for synthesis groups (follow the NASG model on the JGOFS website).

Equatorial Pacific Synthesis Group (EPSG)

The Executives noted that although the membership of the restructured EPSG was approved, new TOR have not been submitted for final approval. The Executives deferred all requests for 2000 meetings to the discussion of the 2000 Budget.

Indian Ocean Synthesis Group (IOSG)

Hanson informed the Executives that the Office has not received a request for meetings, budget, etc. from the IOSG.

Task Teams

Data Management Task Team (DMTT)

Fasham reiterated the Executives gratitude to Conkright for accepting the post of DMTT Chair and taking the time to attend the Executive meeting today to discuss JGOFS long-term data archival concerns. However, before reviewing JGOFS data management with Conkright, the Executives reviewed DMTT recommendations: DMTT Chair, Past Chair, and funds for a DMTT meeting in Kiel, Germany. The Executives deferred all requests for 2000 meetings to the discussion of the 2000 Budget.

Action 17. The Executives approved the new DMTT Chair, Margarita Conkright, before the Executive meeting in August.

Action 18. The Executives approved the one-year term for Lowry on the DMTT as Past Chair for leadership continuity.

An open discussion followed on the long-term stewardship of JGOFS data sets at the WDC Oceanography A (USA) and other national data centres. Conkright offered her experiences with WOCE data being archived at the U.S. National Ocean Data Center. WOCE and JGOFS share similar data concerns: identifying data sets, collecting data sets, data originator, quality control and assurance, and archival of data sets. However, WOCE data is being handled through regional data centres in lieu of national data centres in participating JGOFS countries, and when data sets are delivered for archival at Oceanography A, they are also archived at mirror sites, Oceanography B, C, etc., allowing for easy accessibility and stewardship globally. This practice eliminates the problem of accessibility faced in JGOFS with national data centres under governmental control. For example, WOCE investigators submit their data directly to WOCE data centres that assemble the data and deliver it to the WDC Oceanography A. The Executives also mentioned the additional factor of the "JGOFS metadata" that describes ship operations, data collection, and handling procedures as well as biological data, such as microzooplankton grazing data along with time-series data. Conkright agreed that that alone supports the value of CD-ROMs for the distribution of metadata along with field measurements. However, the best method is having the data online for accessibility, CD-ROM for global distribution, since the web is inaccessible for many countries and too expensive for others. CD-ROM readers are cheap

and easily distributed. For long term archival and stewardship, data must be archived on tape and backups located at mirror sites.

The Executives recognised the importance of data assembly at the national level and assigned it a high priority for the next DMTT meeting. In support of data assembly, the Executives applauded the fine work that Lowry and Baliño have done with JGOFS metadata. To help the transition of the new Chair, the Executives encouraged an early meeting between Lowry and Conkright before the Kiel meeting next year to discuss national data assemblage¹ and other issues. Hopefully, with the residual end-of-the-year funds from SCOR, an inexpensive meeting could be arranged in either the US or the UK. Conkright agreed and will contact Lowry and see if they can arrange a meeting. She also felt that the minimal requirement for long-term archival is that each JGOFS country must assemble its national data sets. In the future, she also strongly recommended that data management must be aligned with field work at the very beginning of the project. This is important for early data analysis and interpretation. For now, Liu suggested that a supporting letter from the DMTT (and co-signed by the JGOFS Chair) be sent to representatives at national data centres asking for assistance with assembling JGOFS data sets.

Action 19. DMTT will write letters of support, co-signed by the JGOFS Chair, to national data centres asking for assistance with assembling JGOFS data sets.

Paleo-JGOFS Task Team (PJTT)

The Executives reviewed the joint Paleo-JGOFS Task Team recommendations: name change, membership, TOR, and first meeting/workshop. The Executives accepted the name change of the task team and the TOR with minor modification to include GLOBEC interests. The list of members lacked members from the eastern Pacific region, and the Executives asked the PJTT co-chairs to revise the membership for global balance. The Executives deferred the discussions of a meeting until the discussion on the Year 2000 Budget.

Action 20. The joint PJTT co-chairs will modify and revise the TOR and members for SSC approval in Bergen.

Photosynthesis Measurement Task Team (PMTT)

Sakshaug reported that PMTT did not meet in 1998 and has not yet made any progress on the techniques manual drafted last year. However, he still plans to complete the manual and have the manual printed in the JGOFS Report Series in early 2001. The Executives encouraged Sakshaug to hold a small meeting to complete the last task.

Action 21. Sakshaug will complete the photosynthesis measurement manual for the JGOFS Report Series.

¹ Baliño is working on a report entitled: "*JGOFS National Activities 1988-1999. A compilation of research projects and cruises & a data status report*" which summarises information gathered during her time at the IPO. It includes lists of national research initiatives and contacts, field work (i.e. cruises) and aspects of the management, archival and long-term stewardship of the data collected so far. For instance, the report indicates that only 6 of the 20 JGOFS countries have implemented (or are in the process of implementing) the necessary systems to secure the long-term stewardship of JGOFS data. Hanson handed a draft of this report to Conkright in order to help the new DMTT chair-elect to acquire an overview of the task she is launching into. The document will be published as a JGOFS report in 2000.

Carbon Dioxide (CO₂) Advisory Panel

SCOR and IOC drafted new TOR for the CO₂ Advisory Panel based on comments from JGOFS SSC in Cape Town, South Africa; CO₂ Advisory Panel meeting in Tsukuba, Japan; and others at the IOC meeting in Paris. Field (SCOR President) circulated a draft recently, but it has not been revised based on recent comments. The Executives questioned the bullet "to advise JGOFS, etc.". That is not correct. The CO₂ Advisory Panel provides service and support for JGOFS and international program activities. Gross was unaware of a second version but will contact Field during the meeting for information or send a revised version to Fasham, possibly after the SCOR General Assembly (Goa, India).

Action 22. Gross will send the latest version of the CO₂ Panel TOR to Fasham for SSC comment and approval.

Continental Margins Task Team (CMTT)

Liu summarised CMTT synthesis plans that were presented in Yokohama, and requested financial support for its synthesis. In September or October 2000, CMTT is planning a 3-day Boundary Current Workshop at Old Dominion University (ODU) in the USA. ODU will host and bear the on-site costs. The CMTT request \$18K for participant costs from its parent bodies (approx. \$9K each). In addition, CMTT request support for a part-time assistant for CMTT synthesis plans. The Executives deferred all requests for 2000 meetings to the discussion of the 2000 Budget.

North Pacific Task Team (NPTT)

Fasham applauded the efforts of the NPTT co-Chairs to secure funds for Year 2000 meetings and workshops. Saino received Japanese funds for the NPTT Synthesis Workshop (8-10 February) and Meeting (11 February) in Nagoya. Support covers the participation of the four JGOFS Synthesis Group Chairs, the eight NPTT members, and two JGOFS scientists. A Carbon Dioxide Workshop is also planned in conjunction with the PICES meeting (October 2000). The co-Chairs request JGOFS support and co-sponsorship for the CO₂ Workshop with PICES and CREST/KNOT. The Executives deferred all requests for 2000 meetings support to the Year 2000 Budget.

JGOFS and IPO Finance

Hanson reviewed the 1999 Budget (Annex 4). Funds from the international parent programs amounted to \$115,145 and expenses including estimated end of the year expenses totalled \$108,406 or a balance of \$6,739. Funds for the IPO from the Norwegian institutions amounted to \$167,975 and expenses to date totalled \$168,923 or a negative balance of-\$948. Normally, the IPO has covered the cost of JGOFS printing in Norway but this year, SCOR funds covered the costs for two of three JGOFS Reports (ca.\$5K). The reason is that the IPO has not yet received confirmation from the University for \$16K previously provided by the Meltzer Foundation. Other expected costs under SCOR funds are Brochure printing and Conference announcements and mailing. Hanson mentioned other upcoming expenses for copy editor fees for the Brochure and a planning meeting for the DMTT Chair and Chair-elect.

For 2000, funds for JGOFS and the IPO from the international and national sponsors are presently estimated at \$338,981. There are uncertainties in this estimate. We are requesting ~\$38K annually from the University for the next 4-year term. A JGOFS-University agreement

has not yet been negotiated or written for this amount, and the University has financial woes itself. SCOR Secretariat has informed us that their contributions will decrease due to a reduction in funds coming ICSU and other sponsors. Gross estimated the SCOR contributions at \$90K in Year 2000. IGBP supports remains frozen at \$20,145. The good news is that NRC agreed to increase its support for the IPO staff needs over the next 4 years (approximately \$197K/year). Estimated expenditures for 2000 are mounting with the increase costs of SSC meetings (ca. \$50K), Conference (ca. \$20K) and Lead Author expenses for the Conference (ca. \$25K), which leaves a balance of roughly \$17K for Year 2000 activities.

The Executives spent some time discussing the finances of the Open Science Conference (OSC) and the consequences for JGOFS meetings next year. In the end, they decided that until they know the outcome of the fund-raising being carried out by the organising committees, they must assume that there will be very little funds for meetings next year. If money is available, the Executives agreed that a high priority should be given to the DMTT because of the changeover of the Chair and data assembly issues, and the PJTT because it has yet to hold its first meeting.

Action 23. The Executives approved Year 2000 funds for the DMTT meeting in Germany.

Action 24. The Executives approved Year 2000 funds for the PJTT meeting in Europe.

The Executives know that the Synthesis Groups and Task Teams would like to hold meetings before or during the OSC and that they were encouraged to do so. However, because JGOFS lacks the funds to send these groups to the OSC, the Executives request for the moment that Synthesis Groups and Task Teams plan to finance these meetings from other sources. In addition, the Executives plan to reduce the burden of the SSC costs on the OSC. Executives request that all SSC members fund their accommodation and per diem costs for the duration of the OSC. SCOR funds will cover only the accommodations and per diem for the period of the SSC meeting. SSC members that can not raise funds for this purpose are asked to contact IPO as soon as possible.

Action 25. The Executives deferred financial decisions for the SGs and TTs meetings until after January 2000.

Action 26. Fasham will inform the SSC of the Year 2000 Budget issues.

Open Science Conference

The Executives spent some time discussing the Open Science Conference (OSC) science program as well as financing it. In the end, they decided to increase the number of contributed papers by reducing time allowed for presentations, from 20 to 15 minutes. This will allow the presentation of 10 extra contributed papers. Fasham asked if the theme lecturers have confirmed their presentations at the conference. Hanson will make an inquiry.

Action 27. Hanson will contact theme lecturers and confirm their presentations at the Conference.

The Executives agreed, after reviewing the OSC expenses and the fees of other international conferences, to set Conference Fees at \$300 (\$400 late fee) for regular registration and \$150 (\$200 late fee) for student registration. Cancellation and late fees will start after 1 March.

The Executives discussed their plans for the parallel and joint sessions at the Conference. For the parallel sessions, they decided in the interest of regional activities to allow the synthesis groups and task teams to arrange these sessions on synthesis or science issues. For the joint sessions on

last two days of the conference in lieu of open discussions on the *Future of Ocean Biogeochemistry Research and Conference highlights and future challenges*, the Executives decided to invite two guests to chair these sessions.

Action 28. Hanson will contact the SG and TT Chairs and request input on regional issues for the parallel sessions

Action 29. Ducklow will contact and invite the named chairs of the two joint sessions.

Hanson asked the Executives and guests for help in selecting an appropriate front-cover photograph for the conference announcement. Bowles offered the US JGOFS News collection of photos over the past 10 years. The IPO will select the JGOFS photos for the OSC announcement.

Action 30. Bowles will send some JGOFS photos to the IPO (Baliño) for the conference announcement

Science Brochure

The Executives spent a full day on discussing the scope, text, and illustrations of the latest draft of the JGOFS Brochure. To identify the style of the brochure and the textbook, the Executives agreed that the brochure will be written in a non-technical style and aimed at the global change scientists and science program directors. The textbook will be written in technical style and aimed at the ocean biogeochemists and graduate students at the university level as well as other earth and atmospheric scientists in IGBP. It will also include JGOFS views on the direction and focus for future ocean biogeochemical research.

For text content and revision, Bowles provided her experience on editing science brochures. She first suggested that the brochure should lead off with chapter 2 on the ocean carbon cycle and that the history (chapter 1) be moved to the appendix. She also suggested that the last chapter does not summarise the brochure and should be replaced with a summary of the achievements described in the brochure. The Executives after discussion agreed with Bowles' assessment. For further text revision, Fasham identified the following contributors to have copies sent to for comments:

Jim Murray, Steve Emerson, Trevor Platt, Dick Feely, Dennis Hansel, Dave Archer, Tony Michaels, Dave Karl, C.S. Wong, Catherine Jeandel, Phil Boyd, Andy Watson.

Chairs of the regional process studies need copies as well.

Action 31. Balino will send a colour draft to all contributors (white papers) and chairs of regional synthesis groups.

Action 32. Hanson will include a cover letter requesting their help in editing the colour draft under revision. Comments welcome on part or all. Comments to Fasham for assimilation into the next version.

Action 33. Fasham, Ducklow, and Bowles will be the brochure editors.

The Executives reviewed the value and content of each illustration in the brochure. In most cases, alterations or alternative illustrations as well as linking illustrations in different chapters for clarity were suggested. Fasham asked that alternative illustrations be sent to the IPO for handling and that he would contact contributors regarding their illustrations.

Action 34. Fasham will contact contributors regarding the alteration of figures and illustrations. Baliño will continue to provide the technical support on brochure illustrations.

After Fasham assimilates all comments and the IPO collects the revised, updated, or new illustrations (target date, September 1999), Mardi Bowles from the US JGOFS Planning Office will edit the next to last draft for consistency and readability (target date, October 1999). In early November, the SSC will review the brochure before the IGBP Secretariat will carry out the technical layout for the Science Series (target date, December 1999). This version of the IGBP Science Series will be printed in Norway (target date, February 2000) and distributed to the Global Change community before the OSC (target date, April 2000).

Synthesis Textbook

Fasham mentioned that several summaries of the textbook chapters are lagging behind schedule (30 July) as agreed on by the Authors in Yokohama. Chapter summaries are urgently needed so that the editors can get an overview of the coverage. Another call will be sent out requesting a 1-2 page summary of their chapters by 15 September.

Action 35. Fasham will contact delinquent chapter authors for summaries.

Fasham also mentioned some confusion over the lead authors (Murray and Falkowski) for the chapter on primary production and export processes and the list of Lead Authors invited to the OSC. Apparently, between the Southampton and the Authors' meeting in Yokohama, Murray's participation as lead author on the textbook was inadvertently omitted in the correspondence and discussions (Lead Authors Meeting), partly because he could not attend the IGBP Congress and Falkowski was there representing the chapter. So, there was no reason for omission of his name when the invitations to Lead Authors for contributed papers at the OSC were sent out. To rectify the OSC invitation to lead authors, the Executives suggest that Murray sends an abstract for a contributed paper to Hanson and he will fit him into the programme. For the book chapter, the Executives suggest that Murray contact Falkowski and discuss the issue with him and decide if Murray could either collaborate with Falkowski on the chapter as originally planned or agree to write a separate chapters on export processes.

Action 36. Fasham will contact Murray on the issues of lead author and OSC invitation

The Intergovernmental Panel on Climate Change (IPCC)

In line with JGOFS synthesis plans, Fasham mentioned that the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (TAR) is scheduled for completion in 2001. Like its predecessors, it will be a comprehensive and up-to-date assessment of the scientific, technical and socio-economic dimensions of climate change. It will concentrate on new findings since 1995 and pay greater attention to the regional scales as well as the global scale. The Panel will need ocean scientists input on the ocean carbon budget and JGOFS will be asked to comment on the ocean carbon cycle/budget.

Action 37. When Gross receives TAR, Hanson will send the report to SSC for comment.

The Future of Ocean Biogeochemical Research²

Ducklow was asked to elaborate on the situation in US JGOFS and in the USA regarding the future of ocean biogeochemical research. Ducklow reported that U.S. ocean biogeochemistry is drawing support from the proposed US Carbon Cycle Science Plan (CCSP) (<http://wiggler.princeton.edu/CANDC/>), which calls for continuing ocean biogeochemical research and ocean carbon modelling that could not be provided by US JGOFS under its present Synthesis and Modelling Plan. Ducklow mentioned that he had left Yokohama with the impression that the international sponsors were moving cautiously because of limited national resources, implementing another global-scale program on ocean biogeochemistry. Gross commented that the sponsors had arranged the meeting, not to inhibit a movement in ocean biogeochemistry, but to seek expert advice for a well-thought out interdisciplinary program and also to bridge the recent differences between SOLAS and JGOFS. Ducklow mentioned that the community also seeks an interdisciplinary program building on JGOFS advances and experience for a much more comprehensive view of the ocean carbon cycle. Scientific discussions need to take place freely. With IGBP undergoing a phase of synthesis and evolution, Swanberg commented that IGBP is asking itself what is ocean biogeochemistry going to be and what is going to be needed in the next decade. In short, IGBP is concerned about starting new core projects. That is why IGBP encouraged an activity status for SOLAS even though they still do not know what model (core projects, free-standing activities or cooperative efforts between existing projects) that IGBP will take on in the future. He said that he has always encouraged program elements to discuss future plans. Because JGOFS ends in 3 years, Ducklow mentioned that the U.S. wants something new in ocean biogeochemistry, not JGOFS, or a son-of-JGOFS. The ocean community needs to meet, although the SOLAS Open Science Meeting is not an ideal venue for JGOFS to plan future ocean biogeochemistry research. We need our sponsors' help. Swanberg mentioned that IGBP is still thinking about a fall meeting with broad representation from the international programs and groups. It is essential for a broader discussion of ocean biogeochemistry. Fasham mentioned that since the differences between SOLAS and JGOFS are behind us, Liss would give his support to a selected group who would discuss the broader issues of ocean biogeochemistry. However, Ducklow said that there is a problem concerning available resource for global-scale ocean programs. For what it is worth, Swanberg passed on IGBP views that JGOFS has been an excellent global change field program and IGBP SC encourages another form of JGOFS in the future. Fasham looks forward to IGBP support for broader discussions and co-ordination of ocean biogeochemistry research.

Ocean Carbon Co-ordinating Group

In the U.S., Ducklow explained that there are several interdisciplinary ocean carbon programs running under several funding agencies at the same time. To co-ordinate these field programs, the US agencies set up an interdisciplinary group, called COP Car (Central Ocean Processes in the Carbon Cycle). COP-Car is not a field program but provides advice on direction and co-ordination of the field programs. The chair is Cindy Lee (State University of New York at Stony Brook). Ducklow suggested that the IGBP and SCOR use an international "COP-Car" group for ocean biogeochemistry. Swanberg mentioned that this model is what IGBP is looking for, e.g.,

² International interest mounts to develop a program strategy for ocean biogeochemistry beyond JGOFS as scientists express concerns over the growing lack of action of an international strategy that builds on the technological advances and infrastructure that JGOFS has built up over the last 10 years. In Cape Town at the 1998 JGOFS SSC, members again moved to discuss the future ocean biogeochemical research even though sponsors expressed caution to future planning in order for JGOFS to successfully complete its synthesis. Based on letters supporting future ocean biogeochemical research (Annex 7), the 1999 JGOFS SSC in Yokohama agreed to discuss the future further. Before the SSC discussion took place, SCOR arranged an ad hoc meeting to discuss sponsors' politics and scientists' concerns. Following the ad hoc meeting, the SSC took the issue forward for discussion and recommended the formation of a group to develop a course of action now that JGOFS synthesis is well underway.

the academic pillars to develop a group on ocean biogeochemistry. Gross felt that an international group could be formed in about 6 months. However, the organisation concept for the group is required soon. The information needed is:

Organisation structure, List of participants, Suggestions for chair, Purpose.

The letter from the Executives to the SCOR General Assembly and the IGBP SC needs to be only a couple of pages.

The Executives scoped out the possible science issues/areas of coverage for the international group on ocean biogeochemistry and possible chairs. The following table lists the areas and names that were suggested by the Executives.

Issues/Areas	Names
<ul style="list-style-type: none"> ● Models on Ocean Ecology ● Global Carbon 	<ul style="list-style-type: none"> ● Michael Fasham ● Reiner Schlitzer (sp?)
<ul style="list-style-type: none"> ● Carbon Dioxide Exchanges: transport and storage 	<ul style="list-style-type: none"> ● Doug Wallace
<ul style="list-style-type: none"> ● Deep Ocean Fluxes 	<ul style="list-style-type: none"> ● Karin Lochte
<ul style="list-style-type: none"> ● Land-Shelf-Ocean 	<ul style="list-style-type: none"> ● Bob Buddemeier
<ul style="list-style-type: none"> ● Ocean Ecology 	<ul style="list-style-type: none"> ● Penny Chisholm
<ul style="list-style-type: none"> ● Sequestration 	<ul style="list-style-type: none"> ● Jim Orr
<ul style="list-style-type: none"> ● Paleo oceanography 	<ul style="list-style-type: none"> ● Tom Peterson or Steve Calvert
<ul style="list-style-type: none"> ● Physical forcing 	<ul style="list-style-type: none"> ● Bob Dixon
<ul style="list-style-type: none"> ● Remote Sensing 	<ul style="list-style-type: none"> ● Trevor Platt
<ul style="list-style-type: none"> ● JGOFS 	<ul style="list-style-type: none"> ● Hugh Ducklow
<ul style="list-style-type: none"> ● Other 	<ul style="list-style-type: none"> ● S. Manabe (Japan) ● Jim McCarthy (IPCC) ● Peter Brewer (Monterey)

Action 38. Ducklow will contact Don Rice (US NSF) on organisation structure of COP-Car and provide information to Fasham.

Action 39. Fasham will write a letter to IGBP and SCOR to start this effort.

The Executives also drafted a purpose statement for the group.

Purpose: To discuss progress and uncertainties regarding key processes in the ocean carbon cycle emerging from JGOFS, WOCE, LOICZ, PAGES and GLOBEC, and to identify ocean research priorities for the next decade of global carbon cycle research.

Suggested products from the meeting are recommendations and/or priorities for future ocean biogeochemistry.

Swanberg introduced a carbon consideration for future ocean biogeochemistry from Buddemeier (LOICZ) on calcium carbonate formation on continental shelves.

The Executives hope that this broad disciplinary group could meet before March, so that a report can be made to the JGOFS SSC and participants at the Open Science Conference in Bergen.

Conference organisers have scheduled a joint session on the Future of Ocean Biogeochemical Research.

Program Element and Programmes that need to be invited to the meeting are:

- IGBP (Moore)
- SCOR (Field)
- GAIM (Schellnhuber)
- JGOFS (Ducklow)
- CO₂ Advisory Panel
- LOICZ (Bob Buddemeier)
- Deep Ocean Program
- IGAC (not focussed on carbon)
- CLIVAR
- SOLAS (Bob Duce)

Other Business

During and after the SSC meeting in Japan, several members raised administrative matters regarding the organisation of annual meetings, information flow, and the function of the SSC and its Executive Committee.

Organisation of Annual Meetings

There were concerns that annual SSC meetings spent too much time on administrative matters and have moved away from science and future planning. The Executives noted that because SSC meetings are now linked to larger meetings³, full 3-day SSC meetings are no longer possible because participants need to reduce time away from home and to avoid meeting exhaustion. In 2000 and 2001, the SSC meetings will again be linked to other events, e.g., the OSC in Norway and a possible training course in the Southern Hemisphere.

To minimise administrative matters at meetings, the Executives felt that it requires early distribution of issues from the IPO, which has not been better since the IPO moved to Norway and then timely feedback from SSC members. In the past, leaving administrative matters to e-mail communication has not worked well. People are too busy for daily administrative matters. Consequently, the Executives felt that most administrative matters and issues will remain unfortunately a burden at future SSC meetings and the Executive Committee (see Executive Committee below).

Another concern on meeting organisation was the lack of science presentation. The Executives remarked that science presentations are generally a part of SSC meetings, if not actually during the annual meetings. When annual SSC meetings are linked with larger meetings, the larger program covers the relevant science topics of the project, e.g., the JGOFS Synthesis and Modelling Symposium and the IGBP Congresses. We did not have science presentations at these meetings because of time limitation and all of the science in the larger programs. Therefore, science presentations were abandoned to accommodate administrative matters (old and new business), reports from function leaders and national committee representatives, etc.

Executive Committee

SSC members expressed concerns that the Executives have not requested much input from the SSC before making critical decisions on budget and other controversial issues. To consider this

³ Examples of past linked SSC meetings are the JGOFS Symposium on Synthesis and Modelling in Scotland (1998) and the two IGBP Congresses in Germany (1996) and Japan (1999). The only recent full, 3-day SSC meeting occurred in South Africa where the SSC developed, structured, and planned its Synthesis Phase.

concern, the Executives reviewed the philosophy and operations of the Executive Committee with regards to SSC input.

The Executive Committee is an unofficial group of the SSC and is selected from the at-large members by the JGOFS Chair each year. Its purpose is to oversee the daily business of JGOFS and the International Project Office, and to administer the SSC activities. When additional information is needed, the Executives seek advice from the at-large members and function leaders, and its decisions and actions are reported to the SSC.

The Executives felt that for expediency and efficiency of doing daily business for JGOFS, the Executive Committee requires some latitude to operate under JGOFS and without terms of reference. As Fasham points out, the problem is that the SSC feels isolated from the daily executive decisions/actions and that information does not reach them soon enough. Thus perhaps improving the flow of information from the Executive meetings might answer their concerns.

Action 40. In the future, Chair will summarise the important issues discussed at the Executive meetings in a letter to all SSC members.

Action 41. In the future, Chair as well as the IPO will copy pertinent Executive E-mails to all SSC members.

Summary of the 2000 Finances

The Executives agreed that until they know the outcome of the fund-raising for the OSC, very little spare money is expected next year. If money is available the Executive will give priority to (1) the DMTT, (2) the PJTT, and (3) the CMTT meetings. In addition, they agreed that SSC members should find funds for their accommodation costs for the duration of the OSC with the IPO paying only for the period of the SSC meeting.

International Project Office

Fasham and Ducklow informed the Executives that Hanson is considering a science executive position and may leave the IPO this year. Hanson informed the Executives that there has been no further information regarding the time that NSF plans to release the best bid notice for the US Antarctic Support Contract. The anticipated time for the notice is mid-September and NSF expects if a new contractor is selected that a transition team needs to start soon thereafter. To bridge this contingency, Hanson has briefed Baliño and Stokke, and recommended that the Executives support Baliño as the acting Executive Officer until the SSC makes the selection and the new EO comes onboard.

Action 42. Executives agreed unanimously to support Baliño as acting Executive Officer.

As there was no further business, Fasham closed the meeting by again thanking Egil Sakshaug for his valuable contributions to JGOFS over the past six years, three years on the Executive Committee, and especially his energetic work chairing the Photosynthesis Measurement Task Team.

The Meeting adjourned at 15:00 on Thursday, 26 August 1999.

Annex 1 - List of Participants

Executive Committee

Dr. Michael J. R. Fasham, Chairman of the JGOFS SSC, Southampton Oceanography Centre, European Way, Empress Dock, Southampton SO14 3ZH, UNITED KINGDOM.
mjf@socnet.soc.soton.ac.uk

Professor Kon-Kee Liu, Vice Chairman of the JGOFS SSC; co Chair of the Continental Margins Task Team, Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei, Taiwan, ROC. kkliu@ccms.ntu.edu.tw

Professor Karin Lochte, JGOFS SSC; co-Chair of the Deep Ocean Flux Task Team, Chair of the Germany National Committee, Institut für Ostseeforschung, Seestrassse 15 D.18119 Rostock-Warnemünde, GERMANY. lochte@mailhost.io-warnemuende.de

Professor Egil Sakshaug, JGOFS SSC; Chair of the Photosynthesis Measurements Task Team, Trondheim Biological Station, Trondheim University, Bynesveien 46, N-7018 Trondheim, NORWAY. egil.sakshaug@vm.unit.no

Dr. Bronte Tilbrook, JGOFS SSC, CSIRO, Division of Oceanography, GPO Box 1538, Hobart, Tasmania 7001, Australia. bronte.tilbrook@marine.csiro.au

SCOR and IGBP Secretariat

Elizabeth Gross, Executive Director of the Scientific Committee on Oceanic Research, Department of Earth and Planetary Sciences, 125 Olin Hall, San Martin Drive, The Johns Hopkins University, Baltimore, MD 21218, USA. scor@jhu.edu

Dr. Neil Swanberg, Deputy Executive Director of the International Geosphere-Biosphere Programme, The Royal Swedish Academy of Sciences, Lilla Frescativägen 4, Box 50005, S-104 05 Stockholm, SWEDEN. neil@igbp.kva.se

JGOFS International Project Office

Dr. Roger B. Hanson, Executive Officer, Centre for Studies of Environment and Resources, University of Bergen, Bergen High-Technology Centre, 5020 Bergen, NORWAY.
roger.hanson@jgofs.uib.no

Guests

Professor Hugh Ducklow, Chair of the US National Committee, Virginia Institute of Marine Sciences, Box 1346, Gloucester Point, VA 23062-1346, USA. duck@vims.edu

Mardi Bowles, Editor of the US JGOFS News, US JGOFS Planning Office, MS #43, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA. mardi@dataone.who.edu

Dr. Margarita Conkright, Chair of the DMTT, NOAA/NODC,E/OC5, Silver Spring, MD, USA.
mconkright@nodc.noaa.gov

Annex 2 – Agenda

Opening remarks (09:00, 24 August 1999)

Introductions
Announcements
Local arrangements

Old Business

Executive Committee Meeting
 Review Actions, changes, etc.
SSC Minutes Draft (Yokohama)
 Review Actions, changes, etc.

Scientific Steering Committee

SSC Rotations and Nominations (2000)
 Review issues
Executive Committee (EXEC)
 Select 2000 EXEC
EXEC Terms of Reference
 Review issue from the SSC

Synthesis Groups & Task Teams

New Proposals
Terms of References (New or Modifications)
Membership (New or Changes)

JGOFS Budget Report

Review 1999 Budget Summary
2000 Budget Review

Requests for Year 2000 Meetings

Open Science Conference (OSC)
 Budget: expenses, fees, and funds
 SSC Meeting and schedule
 SG & TT Meetings
 Issues and schedule

Synthesis and Modelling Activities

Synthesis Workshop Notes (Southampton)
 Glossy Brochure, Timeline, editing, etc.
 Synthesis Book, Outline, timeline, drafts, etc.
 Open Science Conference
Science program, announcements, etc.
Data Sets Archival and Long-term stewardship
WOCE-JGOFS carbon synthesis meeting
JGOFS-OCMIP meeting
SCOR Working Group-Iron calibration update

Future Ocean Biogeochemistry

IGBP and SCOR strategy
JGOFS Future

Letters of Concerns and Action
SSC Responses to Call for Action
SOLAS Open Science Meeting (Germany, February 2000)
JGOFS Open Science Conference (Norway, April 2000)
Joint Discussion Session on Future of the Ocean Biogeochemistry Studies

Other Business

Science and administrative issues arising at SSC Meetings
SSC Concerns with policy and/or procedures
15th SSC Meeting (11-12 April 2000, Bergen)
EXEC Meeting (when, where and/or host)
IGBP Open Science Meeting (Amsterdam, July 2001)
16th SSC Meeting (Amsterdam, July 2001)

Adjourn (17:00, 26 August 1999)

Annex 3 - List of 1999 SSC Members

Name	Country	Position(s)	Function	Executive	Term	1999	2000	2001
Fasham, Michael	UK	JGOFS Chair	at-large	Chair	2000	SSC	SSC	
Anderson, Robert	USA	SSC	at-large		2001	SSC	SSC	SSC
Bathmann, Ulrich	Germany	SOSG Chair			2000	Chair	Chair	
Burkill, Peter	UK	IOSG Chair			1999	Chair		
Bychkov, Alex	Russia	NPTT cChair			1999	Chair		
Falkowski, Paul	USA	SSC	at-large		2001	SSC	SSC	SSC
Garcon, Veronique	France	NASG Chair			2001	Chair	Chair	Chair
Hall, Julie	New Zealand	CMTT Chair			1999	Chair		
Hong, Huasheng	China-Beijing	SSC	at-large		2000	SSC	SSC	
LeBorgne, Robert	France	EPSG Chair			2001	Chair	Chair	Chair
Liu, KK	China-Taipei	SSC 2 nd , CMTT cChair	at-large,	Vice Chair	2000	SSC	SSC	
Lochte, Karin	Germany	SSC 2 nd , DOFTT cChair	at-large,	EXEC	2000	SSC	SSC	
Lowry, Roy	UK	DMTT Chair			1999	Chair		
Monfray, Patrick	France	OCMIP Representative			1999	Repres		
Platt, Trevor	Canada	IOCCG Representative			1999	Repres		
Quiñones, Renato	Chile	SSC, CMTT	at-large,		2000	SSC	SSC	
Saino, Toshiro	Japan	SSC, NPTT cChair	at-large,		1999	SSC		
Sakshaug, Egil	Norway	SSC 2 nd , PMTT Chair	at-large,	EXEC	1999	SSC		
Shimmield, Graham	UK	DOFTT cChair			2000	Chair	Chair	
Tilbrook, Bronte	Australia	SSC 2 nd	at-large	EXEC	2001	SSC	SSC	SSC
Wallace, Douglas	Germany	SSC	at-large		2001	SSC	SSC	SSC
Watson, Andrew	UK	CO ₂ Panel Chair			1999	Chair		

Annex 4 - 1999 JGOFS/IPO Budget Summary

Sources	NOK	USD		Sources	NOK	USD
IGBP Fund	159,146	\$ 20,145		NRC Fund	1,200,000	\$ 151,899
SCOR Fund	750,500	\$ 95,000		UiB Fund	127,000	\$ 16,076
TOTAL INCOME	909,646	\$ 115,145		TOTAL INCOME	1,327,000	\$ 167,975
Expenses				Expenses		
CMTT	869	\$ 110		IPO Administration	1,184,958	\$ 149,995
IOSG	104,928	\$ 13,282		IPO Overhead	60,000	\$ 7,595
NPTT	82,684	\$ 10,466		IPO Equipment	3,436	\$ 435
SOSG	9,685	\$ 1,226		IPO Printing	29,455	\$ 3,728
SSC Japan	244,294	\$ 30,923		IPO Supplies	8,921	\$ 1,129
SSC Workshop	24,182	\$ 3,061		IPO Travel	10,652	\$ 1,348
EXEC (est.)	152,266	\$ 19,274		JGOFS Reports	10,345	\$ 1,309
JGOFS Reports (est.)	39,500	\$ 5,000		SSC Japan	26,723	\$ 3,383
Glossy Brochure (est.)	158,000	\$ 20,000				
Conference (est.)	40,000	\$ 5,063				
TOTAL EXPENSES	856,408	\$ 108,406		TOTAL EXPENSES	1,334,490	\$ 168,923
OVERALL TOTAL	53,238	\$ 6,739		OVERALL TOTAL	(7,490)	\$ (948)

Annex 5 - 2000 JGOFS/IPO Budget (provisional)

Sources	2000	2001	2002	2003
NRC Fund	\$188,861	\$ 194,051	\$ 199,367	\$ 204,937
SCOR Fund	\$90,000			
IGBP Fund	\$20,145			
University of Bergen ⁴	\$37,975			
TOTAL SUPPORT 1999	\$338,981			
EXPENSES				
IPO Administration	\$188,861	\$ 194,051	\$ 199,367	\$ 204,937
IPO Operation	\$37,975			
SSC/EXEC	\$50,000			
Open Science Conference	\$20,000			
Lead Authors	\$20,000			
North Atlantic				
Equatorial Pacific				
Indian Ocean				
North Pacific				
Southern Ocean				
Data Management	~10,000			
Paleo-JGPOFS	~6,000			
Photosynthesis Measurements				
Continental Margins	~6,000			
Contingency	0			
TOTAL EXPENSES				
BALANCE	0			

⁴ Funds will be requested (300,000 NOK/yr.) from the University of Bergen (2000-20003).

Annex 6 - Future of Ocean Biogeochemical Research

Beyond JGOFS by Trevor Platt

The JGOFS programme is now in its final synthesis phase. At the conclusion of this phase, the programme will be terminated under a premeditated sunset clause that other core projects of the IGBP would do well to emulate. The undoubted successes achieved within JGOFS provoke the question of what lies in the future for the world community of ocean biogeochemists that has functioned so cohesively and so effectively during the ten years of the programme: it would be irresponsible to allow this expertise to dissipate at a time when the planetary carbon cycle is still firmly on the societal agenda as a result, for example, of the Kyoto Protocol. In considering how the momentum may be sustained into the future, the following background elements should be kept in mind.

1. Although JGOFS planning was based on the premise that second-generation ocean-colour data would be available throughout the lifetime of the programme, delays in launching the relevant sensors (totally outside the control of JGOFS) meant that the entire field programme was conducted without the benefit of any contemporaneous ocean-colour data whatsoever. Our ability to attack the JGOFS goals has been constrained by this fundamental limitation.
2. Several new ocean-colour sensors are now in orbit or soon to be launched. These include the capability to retrieve chlorophyll even in Case II waters (in which attenuation coefficient is not necessarily dominated by phytoplankton). One of the principal limitations on global ocean biogeochemistry has therefore been removed.
3. Several conceptual advances have been made during the lifetime of JGOFS. One of these is the idea of partitioning the ocean into a suite of dynamic biogeochemical provinces to facilitate global-scale analyses over spatial fields that are organised into functional subunits. This approach is aiding JGOFS synthesis, but more importantly will be very helpful in the design of future programmes in global ocean biogeochemistry.
4. Also during the lifespan of JGOFS, other international programmes have emerged, both within and without the IGBP family. For example, IGOS (Integrated Global Observing Strategy) is an initiative of CEOS aimed at a comprehensive observing system for the Earth. One of its themes is the ocean. Again, GOOS (Global Ocean Observing System) is concerned with monitoring the ocean, including its living resources. If such programmes are to transcend mere data collection to gain scientific interest and lead to new understanding, they should be placed in the context of a scientific programme aimed at analysing the processes underlying the observations.
5. Within the IGBP, GLOBEC and LOICZ are new core projects in the marine sphere, neither of which takes a global view. They could benefit from a sister programme that took a global-scale view of pelagic biogeochemistry and that aimed at understanding the process mechanisms responsible for the variations that we observe across ocean basins and between years.
6. Among the issues that have emerged from JGOFS synthesis and from other initiatives during the same period is the anticipated response of the marine ecosystem (and the natural carbon cycle operating therein) to the suite of processes that we refer to collectively as climate change. Another is to characterise and understand the response of the pelagic ecosystem to

episodic events such as individual storms or higher-level phenomena such as El Niño. In such cases, the principal difficulty is to quantify the response.

7. During the lifetime of JGOFS, our ability to model the ocean biogeochemical system has improved considerably. This new strength will be of great value in the planning, execution and synthesis of new, coordinated programmes in the marine sphere.

In short, there is a need for a new marine programme that capitalises on the expertise, infrastructure and conceptual advances made during JGOFS and also on the newly-available streams of ocean-colour (together with surface temperature data collected at the same scales of time and space) as a spatially-, and temporally-, complete window on the global pelagic ecosystem and its embedded carbon cycle. It would include an extensive and intensive ship component to complement the remote-sensing part. It would emphasise from the start the importance of modelling studies. This programme would lay the scientific underpinning for IGOS, GOOS and similar initiatives, and would lend support to related core projects of the IGBP (GLOBEC, LOICZ). It would allow us to understand how biogeochemical weather in the ocean extrapolates to the biogeochemical climate that we observe at the seasonal and longer time scales. It would help us to anticipate how the natural carbon cycle of the marine ecosystem might respond to climate change, and would allow us to state objectively if, and to what extent, such changes had indeed taken effect. In this sense, it would address the second goal of JGOFS, namely the provision and implementation of a protocol for observing the ocean into the indefinite future with a view to detecting the effects of climate change. The results would also be of direct benefit to those responsible for the health of the ocean ecosystem at the largest scales (for example, supervision of the Antarctic Treaty) as well as to those engaged in coastal-zone management in the broadest sense.

It is therefore recommended that a small working group be financed to study the feasibility of constructing a new programme in ocean biogeochemistry based loosely on the foregoing material.

Future research in ocean biogeochemistry by Hugh Ducklow

To: Don Rice, NSF Chemical Oceanography, Phil Taylor, NSF Physical Oceanography, Cc: US JGOFS Steering Committee, Dick Barber, JGOFS IPO-Bergen, Lisa Dilling, Janet Campbell
From: Hugh Ducklow, Chair, US JGOFS S

Dear Don and Phil,

One of the agenda items at the recent US JGOFS Steering Committee meeting was to review current planning efforts for future research in ocean biogeochemistry. The following report summarizes our discussion of the topic, several conclusions and a resolution arising from our deliberations. A more complete report will be given in Minutes of the meeting.

Background. At our SC meeting in Woods Hole last fall, Don Rice briefly reviewed recent progress in planning future ocean research related to carbon cycling (CC). He encouraged the US JGOFS SC to consider new research themes related to ocean biogeochemistry at its next meeting. The SC placed future research plans on the agenda, and Bob Anderson agreed to lead discussion (see Minutes of 10/1998 mtg.). Rice and Taylor were unfortunately unable to attend the meeting held last week in Boulder. Don sent an email expressing a strong desire "...to receive proposals dealing with bold innovative suggestions for planning workshops in the area of big-scale CC research." The SC took up Don's challenge with alacrity.

Review of previous and current programs. We spent the major part of Tuesday considering the topic. Kendra Daly reviewed the various NSF planning workshops at the Divisional and Program levels. She concluded that broad research themes were being established, but specific

programs were not. Jim Yoder reported for Janet Campbell on the NASA view of future plans, and Rik Wanninkhof provided a NOAA OACES report on behalf of Lisa Dilling. Both NOAA and NASA are beginning to reorient current programs to parallel recommendations from the recent Carbon and Climate meeting held last summer in Westminster, CO, USA. Tony Knap outlined plans for GOOS, in which future long term and other relevant measurements will be made. Yoder also provided a summary of the draft Carbon Cycle Science Plan (CCSP) now being finalized. CCSP extracts were distributed in our briefing book and the report is accessible on the WWW. Jim Murray reviewed the National Research Council evaluation of Major Ocean Programs (MOP) and the activities of his *ad hoc* Future of Ocean Biogeochemical Research (FOBR) group. An EOS article on the latter is in the briefing materials. Jim also reviewed the sequence of meetings by which earlier MOP's (including JGOFS) had been initiated. Dick Barber presented updates on the IGBP candidate Program Element (PE), "Surface-Ocean Lower Atmosphere Study" (SOLAS). Dick is on the interim SOLAS steering committee, charged with organizing a large open meeting, to be held in Kiel in early 2000. Barber cautioned that SOLAS is not yet a recognized program, but may be adopted as a new PE by IGBP later in 2000-2001. Information on CCSP and SOLAS are provided in the briefing materials for our mtg. and will not be repeated here. Our program planning review segment concluded with presentations of science needs and new ideas by Bob Anderson, Tony Michaels and Ken Johnson. They identified several themes including interannual variability in climate forcing and biogeochemical responses, climate-biogeochemistry feedbacks, and deliberate perturbation experiments leading to improved predictability of ocean biogeochemical processes. Again, a fuller report will be in the Minutes of the SSC Meeting.

Discussion and conclusions. Spirited discussion and questioning proceeded through all the presentations. We concluded the day with over an hour of discussion. The main points are given here. The overall mood of the SC following the presentations was best summed up by Murray, who said in his report, "The future is now. Will we lead or follow?" We discussed the science priorities outlined in the CCSP and SOLAS summaries, the themes identified by Anderson, Michaels and Johnson, as well as other ideas raised during the entire discussion. Several themes emerged repeatedly, and included:

- Understanding the natural carbon cycle (not just the anthropogenic perturbation)
- The importance of deeper understanding of ecosystem structure and processes
- The need for longer time scale (interannual, decadal-centennial, evolutionary and paleo-) perspectives
- Importance and ignorance of feedback processes and mechanisms
- Importance and utility of both natural and deliberate perturbation experiments
- Need to study cycling mechanisms for other elements (N,P,S,Fe)
- Urgency of understanding and predicting responses to warming
- Importance of studying the biogeochemical reactions that occur in the deep ocean and sea floor as they pertain to controls on upwelling nutrient availability.
- Treating the global ocean as an integrated system (including margins)

A capsule summary of the scientific discussion included the following points. Ocean processes can impact the global carbon cycle through 1) a change in nutrient inventories; 2) a change in Redfield ratios; 3) a change in nutrient utilization efficiency; and 4) a change in organic-C/carbonate-C rain ratio. A program designed to address these four "simple" topics would be obliged to address the other themes recommended by the SC, including: a) stability and structure of ecosystems; b) feedback processes; c) response to perturbations; d) interannual variability, etc. Three other larger themes were also reiterated:

- JGOFS was a success because it encouraged true interdisciplinary work among biologists, chemists and physicists, and because it studied biogeochemical fluxes and processes together, enabling us to understand the fluxes in terms of governing mechanisms.

- The best way to proceed with planning a new generation of CC programs is for chemists and biologists to work together, not separately (even if in parallel), and to include physicists and modellers from the onset.
- It is critical to engage in planning the biogeochemical and ocean ecology communities at large, not just JGOFS, and/or other groups.
- Ocean biogeochemistry has great societal importance, but we are still far from setting long term policy in an informed way.

In the context of these points, the group concluded that both the CCSP and the proposed SOLAS could accommodate most of elements identified in our discussion. We recognize that both programs are in development and still subject to modification. In particular, CCSP is seen as an attractive “home” for a new suite of biogeochemical/ecological process studies. CCSP offers distinct advantages over creating an entirely new program, because it has already been recognized by several federal agencies. There was some concern that CCSP lacked sufficient scope for all the process studies that we could envision (especially marine ecosystem studies), but we felt that it could be modified or enlarged to provide a foundation for such research. SOLAS was viewed as too narrow and lacking in sufficient central theme to encompass the wider scope of our vision of carbon cycle/ecosystem process studies. For example, it is seen (in the currently articulated version) as treating the ocean as a two-dimensional surface for gas exchanges, not a fully dynamic, 3-dimensional biogeophysical system. However we do think that some projects arising from the JGOFS heritage could form part of a future US Contribution to SOLAS. Finally, the group took a page from the CCSP experience and stated its preference for a faster-track route to creating a new Program.

Resolution and recommendations. In summarizing the points noted above, we stressed the need for a large-scale, long-term program of coordinated process studies and other activities aimed at a new level of understanding of the ecological and biogeochemical mechanisms controlling the ocean carbon cycle. We decided that it was critical to explore further whether the kinds of studies we have in mind can be attached to CCSP and perhaps SOLAS as well. There is an urgent need to articulate a rationale for a coherent and thematically focussed program in which such studies can be accommodated. In response to your request that we provide bold new ideas for planning workshops, we propose to create a small (ca. 6 persons) steering group (SG) with membership drawn from within and outside JGOFS. The SG would be charged with writing a proposal for, and organizing an open planning workshop to outline a new program of ecological and biogeochemical process studies of the ocean carbon cycle in the coming decade. With your approval the SG will be formed shortly and be charged with reporting back to the US JGOFS Exec-Plus prior to our next SSC meeting.