

**8th MEETING OF THE IGBP-SCOR-IOC GLOBAL OCEAN ECOSYSTEM
DYNAMICS (GLOBEC) SCIENTIFIC STEERING COMMITTEE
Banff, Canada, 18, 19 and 24 June 2003**

Present: Dawn Ashby (IPO), Jürgen Alheit, Manuel Barange, Tim Baumgartner, John Field, Roger Harris, Eileen Hofmann, Patrick Lehodey, Rosemary Ommer, Geir Ottersen, Ana Parma, Ian Perry, Jeff Runge, Qisheng Tang, Cisco Werner.

Apologies: Celia Marrase, Umit Unluata (IOC).

Invited: Dagoberto Arcos (GECaFS/ IGBP SC), Ed Urban (SCOR) and Wendy Broadgate (IGBP).

1.0 Opening remarks

CW welcomed all delegates to the 8th meeting of GLOBEC's SSC, particularly the new members: Ana Parma (appointed 2002 but unable to attend the 2002 SSC), Jeff Runge and Qisheng Tang (both appointed 2003). He noted that this was the first meeting of the SSC under his chairmanship, thanked Roger Harris for his past work in the Chair, and announced that John Field had accepted the position of Vice-Chair that was vacated by Ian Perry. As most of the SSC had only received the papers for the meeting on arrival he asked all to read the minutes of the last SSC overnight so that they could be approved.

2.0 Report of IPO

MB started his report revisiting the structure of the programme, with particular emphasis on the Foci working groups and regional programmes. He noted that a total of 31 countries currently participate in national or regional GLOBEC activities. He then highlighted the major issues for the programme since the last SSC meeting in October 2002:

- Publications: The proceedings of the OSM will be published in August in Fisheries Oceanography. All the papers have now gone to print. IGBP Science Series 5, which describes the first phase of GLOBEC's research is now available, as well as GLOBEC Spec. Contr. 6.
- Past Meetings: The success of the GLOBEC/PICES/ICES "Zooplankton production symposium", held in Gijon, May 2003, as well as the IOC/SCOR "Ecosystem to basin scale modelling" meeting, held in Harlow (UK), May 2003. The latter originated from GLOBEC's Focus 3. The development of the Ecosystem Studies of Sub-Arctic Seas (ESSAS) programme, following their planning meeting in Bergen, May 2002.
- Future activities: Introduced some of the activities planned for 2003/2004, including the following:
 - June 2003: GLOBEC Focus 4 Working Group Meeting, Banff, Canada
 - October 2003: PICES XII (incl. GLOBEC co-sponsored session), Seoul, Korea
 - October 2003: IHDP Open Science Meeting, (incl. GLOBEC session), Montreal, Canada
 - October 2003: 2nd ESSAS meeting, Seattle, USA
 - November 2003: 1st CLIOTOP planning meeting. Sete, France
 - January 2004: SPACC meetings on spawning habitats of small pelagic fish, Concepción, Chile
 - April 2004: IOC-SCOR Symposium on 'Quantitative Ecosystem Indicators'. Paris, France (co-sponsored by GLOBEC)
 - May 2004: ICES-GLOBEC Symposium on 'The Influence of Climate Change on North Atlantic Fish Stocks'. Bergen.
- Pressing issues: The most important issues facing the SSC at this point are: a) Feedback on the ESSAS Planning, b) feedback on CCC/ CCCC synthesis, c) approval of Focus 4 membership, d) Feedback on the OCEAN draft Science Plan and e) Plans to initiate integration and synthesis of GLOBEC.
- Funding: The financial statement for 2003 was presented (\$244,000 spent, \$247,000 received), and the expected income for 2004 was visited in preparation for Tuesday's discussions.

Comments: IP asked whether any actions have been followed from the PICES-GLOBEC data workshop held in Qingdao last year. DA responded negatively and IP noted that any actions that may be followed must include PICES. RH requested that the list of publications in the GLOBEC website (included in the background papers) be separated between referred and non-refereed.

Actions:

- *The IPO (DA) will separate the list of publications in the GLOBEC website between refereed and non-refereed*

3.0 Report of Focus 1

JA reported on the activities of the group, starting from the actions agreed upon in the 2002 Focus 1 and GLOBEC SSC meetings:

- a) Informed that the group is putting together a workshop proposal on "Ecosystems comparisons" to the Rockefeller Foundation's Bellagio Conference Centre. The Foundation covers all expenses except flights. The deadline for conferences between Nov 04 and Mar 05 is 5 Sep.
- b) GLOBEC identified links with CLIVAR as essential for the future, and asked the IPO whether this had happen. MB responded that as H Cattle is attending the IGBP Congress it would be possible to ask him to join the SSC for a brief discussion.
- c) Article in the PAGES Newsletter: JA promised to complete an article on GLOBEC paleoceanographic efforts for the PAGES Newsletter during this week, with T. Baumgartner.
- d) Announced the forthcoming Focus 1/ SPACC WG in Japan, 8-12 December 2003, as a continuation of the rescue effort to identify available long term series. Previous efforts included meetings for the California-Humboldt and Benguela regions.
- e) Benguela- Humboldt cooperation: He informed that two meetings have taken place in Nov 2002 and Mar 2003, in Namibia, on "Long-term dynamics of the Benguela and Humboldt: an ecosystem perspective", financed by GTZ. The proceedings of these workshops will appear in a GTZ/ BENEFIT/ GLOBEC report later this year, and include papers from scientists from the two systems. MB commented that this is one of two separate initiatives trying to link both systems under the umbrella of GLOBEC, and encouraged JA to link GTZ's plans with that of the IRD-France. RH noted that there may be an opportunity to engage UK- DIFD and perhaps European Union development programmes in this direction.
- f) Global comparison of zooplankton populations: IP reported on this initiative which originated during the Gijon Zooplankton symposium. The aim of this initiative is to produce a comparison of time series of zooplankton populations in the world's oceans. It is envisaged that a workshop may be co-sponsored by PICES, ICES and GLOBEC in late 2004/2005 to follow this effort.
- g) Finally, he informed of a new initiative started in Peru by T Baumgartner to obtain Paleocceanographic records in the Humboldt.

Actions:

- *The group encouraged IP/ Focus 1 to continue developing plans to generate a comparison of time series of zooplankton populations in the world's oceans, in cooperation with PICES and ICES.*
- *SSC to consider funding a meeting of the WG early in 2004 to prepare a review presentation for the 4th World Fisheries Congress on Fisheries and Climate (pending acceptance of abstract).*

4.0 Report of Focus 2

RH introduced the report noting that he had joined the group at their last meeting in October 2002 and had taken the Chair in an effort to steer it a bit more actively. For this purpose he met with Dian Gifford, Serge Poulet, Sanae Chiba and Dave Mackas (members of the group) in Gijon,

Spain, 19 May 2003, to plan for a meeting in 2004 that would review and compare process studies within Regional and National GLOBEC Programmes, and would identify gaps between what has been achieved and the goals laid out in the Implementation Plan. He remarked that almost 70% of the funding required for this planning meeting was covered by the participants themselves. The main objectives for this major workshop planned for 2004 were:

- To summarise the key processes identified to impact on the dynamics of key trophic players and ecosystems in GLOBEC and GLOBEC type programs.
- To identify gaps in process related knowledge critical for resolving the effects of global change identified in the aforementioned programs for the inclusion in future research programs.
- Through a comparison of research approaches and implementation strategies identify the strengths and weakness of individual programs for the optimisation of future research initiatives.

The meeting is intended to contribute to the overall GLOBEC Integration and Synthesis effort. The group suggested that this meeting would include all the members of the WG plus representatives of the national programmes (at their own cost if necessary). It was agreed that the present F2WG members would work up summaries of a number of individual topics well in advance of the 2004 meeting:

- Ulf Bamstedt - Pelagic predators on zooplankton
- Uli Bathmann - Key species, with Mike St. John
- Sanae Chiba - Decadal-scale changes in processes and signals; plankton focus
- Richard Gowen with Dian Gifford - phytoplankton processes
- Dian Gifford with Suzanne Strom, David Montagnes and Evelyn Lessard - Microzooplankton and lower trophic levels
- Roger Harris with Ulf Bamstedt, Serge Poulet, Dave Mackas and Dian Gifford - Zooplankton feeding and nutrition
- Dave Mackas - Large-scale currents and zooplankton in patchiness context.
- Marina Sabatini with Serge Poulet and Song Sun - Reproduction and growth
- Mike St. John - Plankton/larval fish link-including biochemical tracers and phys/biol coupling
- Claude Roy - Physical/biological coupling

In addition RH informed the group that in the 2002 meeting Focus 2 indicated the need to run a number of workshops with Focus 3 starting in 2004 on the following topics:

- sensitivity of individuals and populations to variations in biological processes
- Lower trophic level models
- Review advances in the simulation of the dynamics of upper trophic levels
- Review model systems including the real time inclusion of biological parameters in hydrodynamic models

However, it was agreed in Gijon that this meeting would require substantial planning and would require additional funding from outside GLOBEC.

RH concluded by informing the SSC that Sanae Chiba (Japan), Sun Song (China) and Marina Sabatini (Argentina) had agreed to join the WG in 2003. The group is considering replacing Gary Kleppel (US) who has not attended for two meetings, with Ruben Escribano (Chile).

Comments: JA commented that no links with Focus 1 had been discussed. RH responded that this was more a reflection of the shortage of funds than a deliberate oversight. In an ideal world links between the four working groups would be considered.

Action:

- *The SSC and the IPO to consider funding for a full meeting of the F2WG - 13 members in early June 2004 (3/4 days)*

5.0 Report of Focus 3

CW reported on activities of the group since the October 2002 meeting, future plans and funding requests:

- The group obtained support for a Basin-Scale Ecosystem Model workshop from IOC/SCOR. Additional support is provided by PICES, JGOFS and GLOBEC. The group met in Harlow, UK (29 May – 2 June), and included B. de Young, M. Heath, C. Werner, M. Kishi, E. Murphy (all Focus 3), plus F. Chai, D. McGillicuddy (JGOFS), P. Monfray (IMBER), B. Megrey (PICES). The group intends to produce a review paper for *Science* or *Nature* by the fall of 2003. The paper will map out the steps involved in advancing marine ecological modelling towards a resolution of the ocean basin, multi-decadal problem, and ultimately a basin scale prognostic modelling capability. The group will meet again October 22-25, 2003.
- The group also participated in a workshop to develop a marine ecosystem model of the North Pacific Ocean, including pelagic fish, in Yokohama (Japan), March 3-6, 2003. The goals of the workshop were to develop a two-way model which includes prey-predator system between lower trophic ecosystem and fish, and to build a Lagrangian model which can be consider fish migration and fish population dynamics for embedded in a basin-scale 3-D circulation model. The output will be a set of papers to be submitted to *Ecological Modelling*. To this end the group will meet again in October at the PICES Annual Science Meeting in Seoul, and in Japan in December (funding secured by Shin-ichi Ito), before submitting in January 2004. A follow up meeting is expected in Summer/fall 2004, possibly in Seattle (funding in hand).
- Focus 3 is preparing a proposal, for submission to the APN for funding, to secure a workshop on “Climate Interactions and Marine Ecosystems: Effects on the Structure and Function of Marine Food Webs and Implications for Marine Fish Production in the North Pacific Ocean and Marginal Seas”. The request will also include 4-mo funding for two post-docs, from Russia and China, to conduct preliminary work.
- CW also reported on a meeting of the ICES WG on Physical-Biological Interactions (WGPBI) which took place in Chapel Hill, March 2003. The WG plans to meet again in March 2004 in Barcelona, Spain, to investigate how marine ecosystems may respond to nutrient load reductions. The WGPBI intends to conduct a joint review of their experimental simulations of nutrient load reduction in the Baltic and the North Sea/Skagerrak. In the medium term the group would like to organise a major symposium on Physical-Biological interactions, sponsored by GLOBEC, PICES and GEOHAB.
- The group reported that it had received a request to sponsor an Optical Particle Counter (OPC)- Video Plankton Recorder (VPR) workshop to teach new practitioners the basics of OPC-VPR technologies, comparisons, data processing and interpretative tools. This workshop would ideally take place in the summer of 2004.

Comments: MB asked whether there is a need for a Focus 3 WG meeting since everyone is involved on specific scientific activities. CW responded that in the synthesis phase we may need to move to a more matrix-based structure rather than the tight WG structure, to avoid “talking to ourselves”. IP concerned that the WG’s are small enough as they are, and that a devolved structure (matrix) may make the WGs not necessary. RH reinforced the need to have a discussion on this line tomorrow. JA showed interest in the VPR workshop because this technology does not seem to work so well except in low diversity environments, but it is widely used. JA also remarked that a lot of the modeling activity under SPACC is not reflected in the WG discussions.

Requests:

- *Support for an OPC-VPR workshop.*

- *Funding for a meeting of Focus 3 WG.*

6.0 Report of Focus 4

IP noted that the scientific topic entrusted to the Focus 4 WG (Feedback from changes in marine ecosystem structure) is very broad. Currently, only one part of the Focus is been addressed, namely "Social impacts of changes in marine ecosystems". The first meeting of the Focus was in Sidney in June 2002, and the second is in Banff immediately after the IGBP Congress. The goals of this activity are:

- 1) To understand the interactions between marine coastal communities and global changes in marine ecosystems;
- 2) To understand the capacity of these communities to adjust to these changes;
- 3) To understand the consequences of these adjustments for marine ecosystems.

The central questions so far identified are:

- 1) How do marine ecosystem changes affect coastal communities?
 - a) What types of marine ecosystem changes create these different responses as defined above?
 - b) What are the strategies (as either conscious responses or innate characteristics) on the part of coastal communities that lead to resilience or vulnerability to marine ecosystem changes?
- 2) What are the reciprocal effects of human responses on marine ecosystems?
 - a) When and under what conditions might coastal community responses to marine ecosystem changes exacerbate, intensify, or ameliorate these changes in marine ecosystems?
 - b) What are the characteristics of, or mechanisms within, marine ecosystems that result in vulnerability or resilience to these human responses to change?

The approach that the Working Group is following is to:

1. Develop a review/appraisal paper on the topic "What are the impacts of marine ecosystem changes on coastal communities
2. Explore the "significant issues" in detail, starting with the issue of scale.
3. Develop models which couple marine ecosystem changes with the socio-economic system.
4. Develop a series of activities for the Focus 4 Working Group at international meetings, to advance and explore issues and develop collaborations.
5. Develop active links with relevant programs, in order to gather information and experience for Focus 4 projects, and to facilitate exploration of these issues by these other programs.
6. Develop a major symposium on the general topic of "Natural and human societal implications of large-scale changes in marine systems" as a major centre-piece of the Working Group.

The activities of the group, past and present are:

- Session at 2nd GLOBEC Open Science Meeting, Qingdao (October 2002): Social impacts from changes in marine ecosystem structure (included presentations by R. Ommer and I. Perry, U.R. Sumaila and K Broad).
- Paper by Perry, I and R. Ommer on Scale issues in marine ecosystems and human interactions. (Accepted in *Fisheries Oceanography* "GLOBEC " issue).
- R. Ommer presentation on social issues/implications of marine ecosystem changes at the Alaska symposium sponsored by the Gulf of Alaska Ecosystem Monitoring Program, the Exxon Valdez Oil Spill (EVOS) program, and the U.S. GLOBEC program.
- F4WG is hosting a session at this 3rd IGBP Congress on "Vulnerability of coastal communities to natural and human-induced changes in living marine resources".

- Open Meeting of Human Dimensions of Global Change community (Montreal; October 2003). Session proposal on “Global Environmental Change and Coastal Systems: A Microcosm of Coupled Human-Environmental Systems”. Sponsored (in alphabetical order) by GECHS, GLOBEC, IDGEC and LOICZ. GLOBEC Paper accepted for oral presentation: “Communities of fish and Communities of fishers: understanding human-ecosystem interactions in the coastal ocean” by R. Ommer, B. Neis, I. Perry
- GLOBEC Focus 4 is supporting a speaker at the PICES XII Annual Meeting (October 2003 in Seoul, Korea) under the session “Human Dimensions of Ecosystem Variability”. The invited speaker is Lawrence Hamilton, who will present “Ecosystem–Society Interactions in the Northern Atlantic: Human Dimensions of Fisheries Collapse”.

In the immediate future the group will:

- Develop an activity on Eastern Pacific Coastal Fisheries in collaboration with GECaFS (The IGBP/IHDP/WCRP joint project on Global Environmental Change and Food Systems) and LOICZ with the objective of developing strategies to reduce societal vulnerability to changes in marine ecosystem productivity induced by El Niño/La Niña, and other aspects of GEC.
- 2nd F4WG Working Group meeting - 25-26 June 2003 (Banff) to discuss a review paper integrating natural system and social system models (focus on South Pacific and tuna), and plan a major symposium.

Finally, IP presented the composition of the WG for approval:

Rosemary Ommer – History, Sociology, Canada
 Ian Perry, Fisheries Oceanography, Canada
 Kenneth Broad, Anthropology, USA
 Ujjayant Chakravorty, Economist, USA
 Chris Cochlin, Anthropology, Australia
 Nigel Haggan, Management, 1st Nations, Canada
 Patrick Lehodey, Fisheries Oceanography, New Caledonia
 Molly McCammon, Management, Policy, USA
 Barbara Neis, Sociology, Canada
 Ana Parma, Fisheries management, Argentina
 Rashid Sumaila, Economist, Canada
 John Field, Marine Ecology, South Africa

Comments: The group noted that the composition of the Focus is heavily dominated by USA/Canada. IP expressed his view that the composition reflects existing expertise and the need to establish a good synchrony. Some debate followed as to whether the mandate of Focus 4 was different from the other Foci, thus explaining the difference in composition. It was suggested that some members could be ‘invited’ to participate in the group, but not be ‘permanent’ members, allowing an opportunity to balance the committee.

Actions:

- *IP/ RO to explore the possibility of dividing the group between ‘permanent’ and ‘correspondence’ members, to ensure a more geographically-balanced membership. Suggestions will be circulated to the SSC through e-mail, via the IPO, so that the group can be approved.*

7.0 ICES Cod and Climate Change

GO described the activities of the group in 2003/2004 are as follows:

- Workshop on synthesis book, New Bedford, US, May 2003
- WG meeting with focus on synthesis of past activities and new action plan for 2005-2009, New Bedford, US, May 2003
- Theme session on transport of cod larvae at ICES, Tallinn, Estonia, Sept. 2003

- WG meeting with focus on book and synthesis activities, Bergen, Norway, May 2004
- Symposium “*The influence of climate Change on North Atlantic fish stocks*”, Bergen, Norway, May 2004

He then described the ongoing effort towards synthesis of the CCC programme:

- (1) A book on cod based upon the activities of the WG (focus of recent workshop), probably published in the IGBP Science Series, although an offer from Kluwer is also available.
- (2) An ICES Symposium “*The influence of climate change on North Atlantic fish stocks*” to be held in Bergen, Norway, May 2004.
- (3) An update of the CRR report (205) on *Spawning and Life History Information for North Atlantic Cod Stocks* published in 1994 (a main focus of recent working group meeting)
- (4) A compilation of available data on cod to be made available to the broad scientific community

GO explained that the first phase of the CCC programme, as described in the CCC strategic plan, was completed in 2002. The new phase of the programme, 2003-2009 will be based on the following workshops:

- Cod survival through the first year of life: relationship to zooplankton dynamics and sources of mortality (2005).
- Influence of climate on tropho-dynamics of cod ecosystems (2006)
- The decline (and recovery) of cod stocks throughout the North Atlantic (2007)
- The response of cod to climate change scenarios (2007)
- Implications of results from CCC for fisheries management (2008)
- Synthesis II Workshop (2009).

Finally, he noted that the coordinator of the ICES-GLOBEC effort, Keith Brander, had dropped his (paid) working hours to 80% as a result of funding constraints. New funding is needed, and the possibility of joining a NoE from the European Commission has been discussed.

Comments:

RO questions whether the social focus has been filtered out deliberately, and remarked that the absence of social components in the programme would limit its ability to respond to the questions posed. JF asked whether the integration of CCC will be coordinated with the overall effort of synthesis of GLOBEC. JA showed concern that CCC did not appear in his view to be as active as in the past, although that may be his own perception. MB noted that the revised strategic plan of CCC would address JA's concern while also would allow the SSC an opportunity to contribute to the science of the programme. Such revised strategic plan would not have to be extensive, but would summarise the scientific achievements of phase 1, the gaps and new questions that have been identified and that justify a phase II, and a strategy to address this.

Action:

- *GO and the CCC WG will prepare a revised strategic plan, in line of the comments expressed above. The IPO will assist the group if necessary.*

8.0 Small Pelagic fish And Climate Change

MB briefly introduced recent and forthcoming activities of SPACC along the four main themes of the programme:

Theme 1: Retrospective data analysis - Activities under this theme are closely linked to GLOBEC's Focus 1. The most salient issues are a) a new paleoceanographic research activity to be initiated in the Humboldt (Peru), which has the potential to provide comparative data with existing time series in the California and Benguela regions, and b) the December 2003 working group meeting on Long-term Dynamics of Small Pelagic Fish and Zooplankton in Japanese waters, Tokyo, Japan.

Theme 2: Comparative Population Dynamics - Under this theme SPACC has just completed the activities of a IOC/SPACC Study Group on "Use of environmental data in the management of pelagic fish". The group has produced 8 research papers and one database of environmental data for the four main upwelling areas. The theme has decided to finalise the above papers and use the IOC/SCOR meeting on Environmental Indicators (Paris, March 2004) as a springboard to move from population dynamics to ecosystem- based management activities.

Theme 3: Spawning habitat dynamics – Under this theme SPACC is planning a workshop on "Characterising and comparing spawning habitats of small pelagic fish" (Convenors: L Castro, C van der Lingen and D Checkley) for 12-13 January 2004, followed by a meeting on "Spawning habitat quality and dynamics and the daily egg production method", for 14-16 January 2004 (Convenors L Castro, C van der Lingen and P Freon). Both meetings to take place in Concepcion, Chile. Funding limited to local sources, with the possible support from IRD and SCOR.

Theme 4: Economic Consequences of pelagic fish fluctuations – SPACC would like to host a workshop on economic and social consequences of climate change on small pelagic fish. (Convenors: S. Herrick/ R Hanesson). Dates and venue for this workshop still to be finalised, as funding is limited (currently GLOBEC and NOAA have approved some support).

Finally, a number of specific issues relevant to the programme were introduced:

- A research proposal has been submitted to IRD by French, Peruvian, Chilean scientists on coastal modelling- fish behaviour- regime shifts (coordinator Pierre Soler). If approved this would be a major field research activity of SPACC in the region.
- Eastern Boundary Current hydrodynamic modelling. Benguela, California and Humboldt hydrodynamic models are available with regional configuration based on the same tool (ROMS). The implementation of a fourth region (Canary Current) will commence in September.
- BENGUELA-HUMBOLDT Comparative studies in planning. Two separate initiatives underway (Germany- Alheit, France-Freon). SPACC and GLOBEC would like them to interact in their planning, as both have GLOBEC's support.
- The Trinational (Canada, USA, Mexico) Sardine Forum continues its activities, aimed at sustaining collaborative work on sardine in the three countries. T Baumgartner and J Hunter are leading this activity.
- An Executive meeting of SPACC is planned for January 2004 in Chile, subject to funding.

Comments: IP/RO noted that there was some overlap SPACC Theme 4 and GLOBEC Focus 4. It would be appropriate to discuss SPACC's plans to host an "Economic consequences" workshop with Focus 4. CW/EH would like more information on the ROMS modeling.

Actions:

- SSC to consider partial support for a SPACC Executive meeting in January 2004. Additional funding to be provided by IAI (TB) and possibly SCOR.
- MB to table the workshop planned under SPACC Theme 4 at the Focus 4 meeting later this week, to identify ways of linking both efforts better.
- MB to ensure that C Roy provides more information on his ROMS modeling activity to CW and EH.
- SPACC to consider writing a SPACC volume to celebrate the 10th anniversary of the programme's first meeting. JA to contact D Checkley and Claude Roy (present Chairs of SPACC).

9.0 Southern Ocean GLOBEC

EH introduced the Southern Ocean as a region heavily forced by climate and with close coupling between trophic levels. The primary objective of SO GLOBEC is to understand the physical and biological factors that contribute to enhanced Antarctic krill growth, reproduction, recruitment and survivorship throughout the year. It is also interested in the predators and competitors of Antarctic

krill, such as seal, penguins, whales, fish, seabirds and other zooplankton. The field programme includes:

- The Australian programme conducted near 70 E
- The German programme, focused in the west Antarctic Peninsula and Lazarev Sea. A new phase of this activity will start 2004-2007 in the Lazarev Sea if funding is approved (to be requested soon).
- The U.S. programme conducted around the west Antarctic Peninsula, which has completed its field work and is planning its synthesis.
- The British programme, centered in the west Antarctic Peninsula and Scotia Sea. As part of their activities they will deploy new current meters in South Georgia, providing flow fields in another area of SO GLOBEC activity.
- The Korean program, particularly near the Bransfield Strait

Summarizing the recently completed US-SO GLOBEC fieldwork, EH highlighted:

- The three mooring deployment/recovery cruises, the most recent in Feb-March 2003, which has provided the first long-term record of current measurements in Antarctic coastal waters.
- The process and survey cruises conducted in April-May 2001 and 2002, and in August-September 2001 and 2002, bringing up the total of cruises to eleven in two years.
- The passive acoustic mooring programme which has provided medium to long-term records of cetacean calls. Results of these programme revealed:
 - A) Blue whale recordings all year around in the Southern Ocean, although the animals were not visible to observers: is this an adaptation of the previously heavily exploited Blue whale to avoid humans, or the result of a single whale stranded in the area for a whole year?
 - B) Recordings of Sei whales obtained for the first time.
 - C) Recordings of unidentified whales collected, which appear to be from minke whales, although it is believed that they do not produce sound.

EH noted that cruise reports for all cruises are available, as well as a poster describing field activities, from the SO GLOBEC Office (www.ccpo.odu.edu/Research/globec_menu.html). SO GLOBEC published a special issue of *Oceanography* magazine last year and is planning special sessions at national and international meetings (e.g. IUGG). The first volume of SO GLOBEC research is to be published in *Deep Sea Research* in 2004. 22 manuscripts have been submitted and will be edited by Hofmann, Wiebe, Costa and Torres.

As part of the follow-on activities she mentioned:

- That the U.S. NSF Polar Program will issue a special announcement for SO GLOBEC synthesis and modeling activities, due late 2003.
- That planning for a follow-on program to SO GLOBEC started at the International GLOBEC Open Science Meeting in October 2002. The new programme will be named ICCED – Integrated analysis of Circumpolar Climate interactions and Ecosystem Dynamics in the Southern Ocean, and was designed as an activity to be linked to IGBP-SCOR IMBER (as no further support for field work under US GLOBEC activities is expected). It will be circumpolar and interdisciplinary, aiming to understand climate interactions in the SO and implications for ecosystem function and feedbacks to biogeochemical cycles. Its focus will include cetaceans, and the IWC will remain a full partner as with SO GLOBEC.

Comments: The group discussed the merits of having a follow-up to SO GLOBEC under IMBER, and reflected on whether the current emphasis of IMBER on lower trophic levels (viruses to zooplankton) would mean that ICCED may be better placed as a GLOBEC-IMBER initiative. EH was open to this, particularly as the end-to-end focus of ICCED resulted from the initial objective

of IMBER, while now it appears that end-to-end research will be conducted as a combined IMBER-GLOBEC effort.

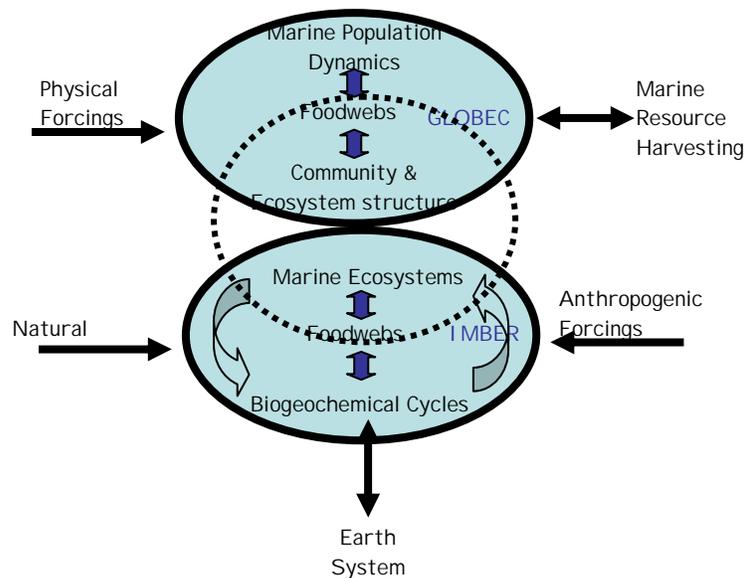
Action:

- *EH and co-leaders to discuss whether ICCED may be better placed as an international GLOBEC-IMBER initiative (outside US GLOBEC).*

10.0 IGBP/SCOR IMBER (Integrated Marine Biogeochemistry and Ecosystem Research)

JF introduced a draft response to the preliminary Science Plan of IMBER circulated shortly before this SSC meeting. After discussion the main points of the letter were agreed:

- (1) With the conclusion of JGOFS, the SSC of GLOBEC strongly endorses the scientific need for a complementary sister project focussing on biogeochemical cycles in the ocean.
- (2) We also endorse and support the general thrust of the draft Science and Implementation Plan for IMBER, but recognise the need to tighten it up in places.
- (3) Our main concern is that misleading impressions may be given to people not familiar with the sister projects in IGBP-2
- (4) The impression may be given that IMBER will cover most aspects of Marine Ecosystems and of Biogeochemical Cycles in the Ocean.
- (5) We therefore suggest that a section comparing the scope of IMBER with that of GLOBEC (and probably also SOLAS and LOICZ), should be given up front along the lines of the above diagram, and according to the issues described below.
- (6) GLOBEC is concerned with food webs and community structure but mainly at the larger end of the size spectrum, whereas IMBER will be concerned with the microbial loop, nutrient cycling, detritus and the smaller end of the size spectrum, and with primary production along with SOLAS.
- (7) We recommend that GLOBEC and IMBER form a joint task team with the explicit task of integrating studies, models and understanding of food webs from end-to-end. This would then be a joint responsibility of BOTH PROJECTS, and not either one alone.
- (8) There should be a clear time line for the initial IMBER project (e.g. 2004-2008) with a joint GLOBEC / IMBER task team to guide the formation of a new merged project in 2009 or 2010.
- (9) In conclusion, the GLOBEC SSC looks forward to co-operating with its new sister SSC and project in many joint ventures. At the national level, many countries, including most developing countries, will not be able to afford both GLOBEC and IMBER national programmes, and will have single national programmes addressing both international projects. This is also likely to be the case in polar oceans where joint programmes including both IMBER and GLOBEC scientists will be the norm. The GLOBEC SSC looks forward to synthesis and completion of GLOBEC by 2009 and will work, through a joint task team, towards a merged project thereafter.



Action:

- *IMBER to respond to GLOBEC's proposals in due time, either directly or through a new version of the draft science plan. CW/JF to follow up.*

11.0 PICES-GLOBEC Climate Change and Carrying Capacity (CCCC) in the North Pacific

IP presented a report of the PICES-GLOBEC Climate CCCC Programme on behalf of M Kashiwai and H Batchelder (current Chairs).

CCCC is moving into its "synthesis phase". An Integration Workshop was held in Qingdao, October 2002 to:

1. integrate research activities on:
 - comparisons of coastal ecosystems about the N. Pacific and N. Atlantic rim, with focus on zooplankton and small pelagic fishes;
 - latitudinal comparisons of North Pacific ecosystems;
 - linkages between open ocean and coastal ecosystems (with focus on salmon)
2. establish a planning team to evaluate and consider possible scientific directions, hypotheses, and experiments for PICES CCCC modeling activities,
3. continue monitoring activities through the MONITOR Task Team:
 - a) CPR time series collection
 - b) develop a protocol for contributing information to a "State of the North Pacific Ecosystem Status Report"
4. lead to a major symposium on CCCC Synthesis in 2005/6.

IP informed that the CCCC Session at PICES XII (Oct 2004) has the title of "CCCC, GLOBEC, and GLOBEC-like results: first steps toward synthesis of the impacts of large-scale climate change on North Pacific marine ecosystems". Planning will soon begin to identify a successor-program to CCCC.

In conclusion he noted that one of the Chairs of the CCCC expressed concern that IP/QT were approached to report on CCCC to the SSC rather than the Chairs.

Comments: In response to IP's last remark the SSC noted that all members of this committee are appointed in their private capacity to assist steering the programme. While efforts are made to ensure that the SSC has expertise on all the major lines of the programme there are no appointments along the programmatic structure of GLOBEC. Doing so would change the flavour of the committee from a steering/advisory group to a management body. It is for this reason only that IP and QT were asked to report on CCCC activities rather than the Chairs themselves. A similar strategy was employed for reporting on SPACC.

12.0 CLIOTOP

PL commenced by reporting on the "Oceanic Fisheries and Climate Change Project" (OFCCP), which is a multi-national GLOBEC initiative on tuna and tuna-like species in the Pacific Ocean. OFCCP is intended to be a major contributor to CLIOTOP, once it is up and running.

- The objective of OFCCP is to investigate the effect of climate change on the productivity and distribution of oceanic tuna stocks and fisheries in the Pacific Ocean with the goal of predicting short- to long-term changes and impacts related to climate variability and global warming.
- The partnership involves regional organisations (SPC, IATTC) and national Institutes (CSIRO (Australia), NIWA (New Zealand), Univ. Hawaii (USA), Univ. Maryland (USA), Univ. Maine (USA), NMFS Hawaii (USA), IPSL (France), NRIFS (Japan), and Univ. Tokyo (Japan)).

- OFCCP has four components:
 - o Monitoring the upper trophic levels of the pelagic ecosystems
 - Recent activities include a) Archival tagging by CSIRO (South Western Pacific), SPC (Western and Central Pacific), Hawaii Univ., Hawaii NMFS (Central and North Pacific), IATTC (eastern Pacific), NRIFS North Pacific (Japan -Kuroshio); b) Development of a new observation system for monitoring the upper trophic levels of the pelagic ecosystem (Dagorn L., Holland K.). Project funded by the PFRP Hawaii (400,000 USD); and c) Acoustic surveys (New Zealand, Australia).
 - o Food web structure in pelagic ecosystems
 - A new 3-year project on this component has recently been approved by SPC GEF + PFRP (414,000 USD) in collaboration with SPC, IATTC and University of Hawaii on Trophic structure and tuna movement in the cold tongue-warm pool pelagic ecosystem of the equatorial Pacific. (Allain V., Olson R., Galvan Magaña F., Popp B., Fry B.). The first meeting of the 4 PIs was organised in July 2002 in Honolulu and a second meeting funded by the project was organised in Noumea (SPC) in April 2003. The 4 PI intend to
 - Compute baseline values to establish isotope-derived biogeography.
 - Develop a common database (restricted access) in the first years of the project.
 - Organize a workshop in 2004 with a few invited key persons working in the same field. Possible venues include La Paz (Mexico, May 2004, after the US tuna conference) and New Zealand or New Caledonia (April 2004, after the *Isotope Ecology Meeting in New Zealand*). Support from GLOBEC would be required (4 invited scientists?) for the organization of this workshop.
 - o Modelling from ocean basin to individual scale
 - A project is currently underway on “Mixed-resolution models for investigating individual to population spatial dynamics of large pelagics” (Lehodey P., Kirby D., McClatchie S., Murtugudde R., Dagorn L., Holland K., Polovina J., Sibert J.). Project funded by the PFRP Hawaii.
 - o Socio-economical impacts
 - Efforts initiated at the GLOBEC Focus 4 continue, with the aim of coupling SEPODYM (a physical-biological model) with an economical model (in collaboration with U. Chakravorty), and considering the impact of regime shifts at a generational time scale (with R. Sumaila).

He then introduced CLIOTOP (CLimate Impacts on Oceanic TOP Predators), a potential new regional project of GLOBEC. The objective is to “organize a large-scale worldwide comparative effort aimed at identifying and elucidating the key processes involved in ecosystem functioning and, in particular, to determine the impact of climate variability at various scales on the structure and function of open ocean pelagic ecosystems and their top predator species”. The first planning meeting of CLIOTOP will take place in Sete, France Nov., 2003, to draft a science plan for submission to the SSC. Initial discussions on the Science Plan indicate that CLIOTOP may have four Foci:

- Focus 1- How climate variability affects biology of tuna and other top predator oceanic species at an individual level?
- Focus 2- How climate variability affects population dynamics of tuna and other top predator oceanic species?
- Focus 3- How climate variability affects pelagic ecosystems?
- Focus 4- How to integrate climate and environmental variability in the modelling of oceanic top predator populations and ecosystems?

These Foci may be structured along working groups on the following topics:

- Synthesis of archival and pop-up archival tagging experiments
- Aggregative behaviour, and the impacts of FADs fishing
- Physiology and climate variability
- Migrations and spatial distribution
- Reproductive biology and habitat
- Larval ecology and large pelagics recruitment variability in relation with climate change
- Planetary waves and bio-physical coupling
- Trophic ecology
- Ecosystem indicators for top predators pelagic ecosystems
- Structure, distribution and dynamics of the intermediate trophic level of the pelagic ecosystem
- From population dynamics and socio-economic constraint to efficient management measures and conservation policies
- Comparative analysis of ecosystem models from different ocean regions
- From individual scales to ecosystem models. IBM development and integration of archival tagging local observations into large scale population models
- Synthesis: integrative modeling. Putting together basic processes toward a basin scale comparison of ecosystem functioning

Comments: MB was concerned that the structure along many working groups follows exactly the initial structure of SPACC. This structure was not viable, because of its complexity and the funding needed to keep it alive, and lead SPACC to re-structure along four research themes.

Actions:

- *PL to encourage the leaders of CLIOTOP to have a successful meeting and submit a science plan for discussion at the 2004 SSC meeting.*
- *The SSC is requested to support up to 4 scientists for an OFCCP workshop on isotope biogeography.*

13.0 ESSAS

MB introduced the origins of ESSAS, following George Hunt's presentation at the 2002 GLOBEC SSC meeting. At that meeting the SSC encouraged G Hunt to develop a Science Plan of a programme on Sub-Arctic Ecosystems that could fit under the GLOBEC umbrella. The IPO was asked to assist G Hunt in this initiative.

A planning meeting was organised in Bergen (Norway) in May 2003, with financial support of NSF and the Norwegian Research Council. Attendees to the meeting included: S Astthorsson (Iceland), F Carlotti (France), K Drinkwater (Canada), H-J Hirche (Germany), G Hunt (USA), M Kashiwai (Japan), S Kristiansen (Norway), M Kingsley (Greenland), A Krovnin (Russia), H Loeng (Norway), B Megrey (USA), F Mehlum (Norway), S Moore (USA), G Ottersen (Norway), K Richardson (Denmark), V Ozhigin (Russia) and Y Sakurai (Japan).

At the meeting the goal of ESSAS was established as: "*to compare, quantify, and predict the impact of climate variability on the productivity and sustainability of sub-arctic marine ecosystems*". The following Cross-cutting Hypotheses were formulated:

- Forcing mechanisms and biological processes controlling energy flow are similar across all of the sub-arctic seas. Lessons learned in one system can be transferred to other areas.
- Temperature influences the direction on energy flow within the pelagic/benthic subcomponents of the ecosystem.
- (Changes in) physical and anthropogenic forcing mechanisms influence the relative importance of top down vs. bottom up control of energy flow in the ecosystem.

The Science Plan was outlined according to four major themes. Questions under each theme were identified, and the authors to contribute to the drafting selected. The themes are:

- How do large, regional and local-scale atmospheric patterns cascade into spatio-temporal changes in the ocean physics that are important for ecosystem dynamics in the sub-arctic seas?
- What are the mechanisms that link physical forcing to biological processes and their spatial and temporal scales of interaction?
- To what extent do biological processes regulate the structure, energy flow, and dynamics of the food webs in sub-Arctic ecosystems?
- What are the societal and economic impacts of climate variability on sub-arctic marine ecosystems and the feedbacks from changes in ecosystem use on these impacts?

A second planning meeting will take place in Seattle, October 2003, with a view of circulating a draft science plan to the SSC in May 2004. The SSC was asked to note the concerns expressed by M Kashiwai at the way ESSAS is developing. In summary M Kashiwai considered that ESSAS was in his view intended to stem from CCC and CCCC synthesis plans, as a way of linking the North Atlantic and Pacific GLOBEC programmes. He was disappointed that in the planning phase ICES and PICES had been overlooked.

Comments: GO, co-chair of CCC and participant in the Bergen meeting explained that ESSAS originated in a meeting held in Laguna Beach in 2002, aimed at setting up a programme of research on the Eastern Bering Sea. As a result of the meeting it was concluded that it would be appropriate to conduct a comparative study of sub-arctic regional seas. This comparison would also include, *inter alia*, the Labrador/ Newfoundland shelf, the western sub-Arctic Pacific and the Sea of Okhotsk. He noted that some scientific (and geographic) overlaps may exist between CCC/CCCC and ESSAS, but he was confident that this could be addressed in the planning phase. RO noted that the 4th theme of ESSAS is still to be developed, and that her Coast under Stress project (CuS), affiliated to GLOBEC, is currently in Phase II planning. It is intended to move the project northwards, to include some sub-arctic regions, and as a biological-social project it may be able to assist G Hunt in developing Theme 4.

Actions:

- *IPO to contact G Hunt to establish links with Coasts under Stress, to assist in the development of Theme 4.*
- *SSC encouraged G Hunt and the planning team to continue its development of the science plan in collaboration with scientists from the region of study. Institutional links with regional bodies such as PICES and ICES will be encouraged once the research Plan is in a more advanced stage.*

14.0 Report of Gijon meeting

RH introduced the meeting, which was co-sponsored by the International Council for the Exploration of the Sea (ICES), the North Pacific Marine Science Organization (PICES), and the International Global Ocean Ecosystem Dynamics (GLOBEC) programme. The title of the meeting was "*The Role of Zooplankton in Global Ecosystem Dynamics: Comparative Studies from the World Oceans*". The main goal of the Symposium was to define the current 'state of the art' of zooplankton ecology and to determine key research initiatives to be pursued in the 21st century. It was convened by Luis Valdes (ICES), Tsutomu Ikeda (PICES) and Roger Harris (GLOBEC).

Two sessions ran concurrently each day and each session included one or two keynote speakers followed by contributed papers. For all sessions, poster submissions were encouraged and time was allocated for poster viewing both during the day and during evening social events. The sessions were:

- a) Physical variability and zooplankton population dynamics
- b) Role of zooplankton in biogeochemical cycles
- c) Climate influences: What are the long-term zooplankton data sets telling us?
- d) New approaches to zooplankton modelling

- e) Progress in molecular biology
- f) Application of new technologies
- g) Comparative life histories and life cycles of zooplankton populations within and between the North Pacific and North Atlantic
- h) Microzooplankton in the marine pelagial: Recent advances from molecules to ecosystems

RH noted that this was the largest GLOBEC meeting so far, with 420 attendees from 50 countries. It also included three satellite workshops on:

- Gelatinous zooplankton and fish: Predators, prey or nuisance (Pat Kremer)
- Meso and bathypelagic zooplankton study: Current status and future aspects (Tom Ikeda)
- Climate variability, zooplankton abundance and distribution – comparative opportunities from the world's oceans (Ian Perry and Hal Batchelder)

The Proceedings will be published in a Special Issue of the ICES Journal of Marine Science, edited by Roger Harris, Tom Ikeda, Skip McKinnell, Bill Peterson and Luis Valdes. Submission deadline is 27 June 2003, with a publication date expected for spring 2004.

Finally, he acknowledged the superb support offered by the PICES Secretariat, both before and during the meeting, as well from the GLOBEC IPO during the meeting.

JR interjected to identify a number of scientific highlights of the Symposium, *inter alia*: improvements in estimates of *Calanus* mortality across regions, advancements in the measurement of *Calanus* nauplii feeding, new hypotheses linking overwintering depths and lipid content in copepods, further evidence of top-down control of zooplankton in upwelling regions, progress in the coupling of NPZD and IBM models and the role of food quality in determining copepod mortality.

15.0 Integration and Synthesis

CW introduced the main topic of this SSC: Integration and synthesis. This initiative is initiated now because GLOBEC is in full implementation and it requires a closer look at the interaction and integration of each of its components. The idea is to develop strategies for synthesis of GLOBEC studies and explore avenues for comparative analysis among GLOBEC regional and related national programs. Also to provide a framework for integrating process-oriented, broad/meso-scale and retrospective studies in conceptual and mathematical models and develop predictions of ecosystem response to climate/global change. In his introduction he used Harte's (2002) paper on Newtonian versus Darwinian systems, to describe the differences in the principles guiding Physics and Ecology:

PHYSICS	ECOLOGY
The more you look, the simpler it gets	The more you look, the more complex it gets
Primacy of initial conditions	Primacy of contingency and complex historical factors
Universal patterns; search for laws	Weak trends, reluctance to seek laws
Predictive (chaos and quantum mechanics notwithstanding)	Mostly descriptive, explanatory
Central role for the ideal systems (ideal gas, harmonic oscillator)	Disdain for caricatures of nature

Some of the general questions posed include:

- How does population variability of target taxa differ among systems types and how does climate/global change influence or determine variability?
- What are the most important determinants of change?

- Which systems are more productive (or more diverse) and why?

How should the integration and synthesis proceed? Should we develop a “Synthesis Implementation Plan” (under discussion in US GLOBEC)? Would we need additional funding? Should we target publications/books? What should be the *Modus Operandi* of the Foci WGs during integration?

He then opened the discussion to the floor. The summary of the discussion was:

- That integration/ synthesis may be better undertaken initially along programmatic lines (Regional programmes). In fact CCC, CCCC and SO have already started planning their synthesis.
- Because of the above a synthesis plan would only be useful if it is produced fast, and if it is broad enough to fit all. Otherwise it is best to leave the community to drive the synthesis (a-la-US JGOFS). It may be useful to draw a map of goals, milestones and pathways to synthesis.
- Before and at the same time as we start synthesis we must start the integration of the vast amount of research that is been conducted at national and regional level.
- It was recognized that the Foci WGs must play a substantial role in the synthesis, and in fact some synthesis activity is already happening at Foci level (e.g. Foci activities).

And the conclusions are encapsulated as actions:

Actions: (the first three should happen in parallel. The last two at their own pace)

- *To develop, by the next SSC meeting, a brief document to set up the goals, milestones and pathways to synthesis. This would include an inventory of existing synthesis– CW*
- *Support the synthesis activities already undertaken by CCC, CCCC and SO, and encourage SPACC to initiate planning.*
- *Consider the possibility of publishing a book with descriptions of the achievements of each national, multinational and regional programmes. This should also include the applications of the research – MB to initiate.*
- *Following the above, Foci wg to work with SSC in setting up how to synthesise information from nat/multinat/reg programmes. It may be that at this stage GLOBEC committees would need re-structuring, to ensure that we capture adequately GLOBEC’s legacy.*
- *The SSC will continue to plan for OSMs to continue to build the community and bring up the science.*
- *The SSC commits to prepare a brief (2-3 pages) research highlights publication every year, to be included in sponsors reports, and to continue focusing on delivery.*
- *The Executive may consider a strategy to ensure that these integration activities are sufficiently funded*

16.0 National programmes update

Requests for affiliation of GLOBEC activities are handled by the IPO in consultation with the Executive. Proposals are evaluated in terms of their consistency with GLOBEC’s goals and objectives and the PIs of the projects considered for affiliation are informed of the obligations and benefits of joining GLOBEC. In this occasion we have a specific request from Norway that arrived just before this SSC, and thus the SSC was asked to act on it.

GO informed that the Norwegian project “Mare Cognitum”, which was a contribution to GLOBEC, had come to an end. In its place, scientists from the Institute of Marine Research, the University of Bergen, the University of Oslo, the Bjerknes Centre of Excellence, the Nansen Environmental and Remote Sensing Centre and the Ålesund University College wanted to affiliate three projects focused on “Climate-zooplankton-fish” in the Norwegian and Barents Seas. The three projects are:

- ECOBE (Effects of North Atlantic Climate Variability on the Barents Sea Ecosystem). Focus on climate-hydrography-zooplankton-early stages of cod, haddock and herring (ecobe.imr.no). Objective: Understand and quantify the impacts of climate variability on trophic transfer and ecosystem structure of the Barents Sea in order to improve the prediction of growth and recruitment on key fish species.
- CLIMAR (Climate and Production of Marine Resources). Focus on climate-hydrography-zooplankton-herring in the Norwegian Sea. Objective: To establish the processes which constitute the coupling between climate fluctuations and the growth and migration patterns of the Norwegian spring spawning herring in the Nordic Seas.
- ADAPT (Adaption to the Ecosystem: Co-evolution of Life History of Calanus and Herring in the Norwegian Sea). Objective: to quantify the effects of the physical environment and other biological populations for the evolutionary adaptation of the populations of *Calanus finmarchicus* and Norwegian spring spawning herring in the Norwegian Sea

Comments: RH asked to separate GLOBEC-Norway from Norwegian contributions to GLOBEC, so that the decision of the SSC does not alienate other sectors of the Norwegian GLOBEC community that may want to also affiliate their projects.

Action:

- *The SSC agreed to affiliate these projects as part of Norway's contribution to GLOBEC. The IPO will inform the proponents in writing.*

To complete the discussion members of the SSC reported on news of the US GLOBEC, Mexico GLOBEC (IMECOCAL), Germany GLOBEC and China GLOBEC. The most important aspect reported was that China GLOBEC II to be completed next year, and that a 3rd phase may be contemplated but probably under IMBER.

17.0 IGBP Congress

The SSC allocated report-back duties to its members to maximize the outcome of the IGBP Congress the SSC and identify session highlights at the last day of the SSC.

A1	Indicating biodiversity changes	<i>Ottersen/ Harris</i>
A2	Development of Earth system models	<i>Hofmann/ Field</i>
A5	Vulnerability of coastal communities	<i>Parma/ Runge</i>
B2	Oceanographic data management	<i>Ashby</i>
B3	The Vostok challenge	<i>Barange</i>
B5	Top-to-bottom food webs	<i>Lehodey/ Tang/ Hofmann</i>
B6	biophysical and human dim. In biogeochem.	<i>Perry</i>
C2	OCEANS/LOICZ implementation	<i>Alheit</i>
C3	Model data fusion in ESS	<i>Hofmann/ Parma</i>
C6	International Nitrogen initiative	<i>Field</i>
D2	OCEANS/GLOBEC implementation issues	<i>Harris/ Field</i>
D3	The dynamic biosphere in ES models	<i>Runge</i>
D4	Earth Atlas	<i>Ashby</i>
D6	GEC and high latitude regions	<i>Ottersen</i>
D7	ESS and capacity building	<i>Barange</i>
D2	LOICZ/ GLOBEC implementation issues	<i>Perry/ Alheit</i>

Action:

- *Members of the SSC will report for 5' on each relevant Congress Session at the last SSC session on June 24th.*

18.0 SSC for 2004 and Executive

There are no members rotating off the SSC this year. The Executive for 2003 will be composed by C Werner, J Field (Vice-Chair), E Hofmann, R Harris (Past Chair) and M Barange (IPO). A possible meeting of the Executive may be planned for October 2003.

Two options will be considered for the next meeting of the SSC, either in Noumea (New Caledonia), to offer support to OFCCP and the large pelagic GLOBEC initiatives, or in Swakopmund (Namibia) to link better with BENEFIT and other southern African GLOBEC activities. The decision will be taken by the Executive based on funding and timing considerations. The preferred dates would be in the period 10-20 April or 15-30 May.

Action:

- *CW and the IPO will consider whether to have a meeting of the Executive in the fall, depending on pressing issues.*
- *The Executive for 2003 will be composed by C Werner, J Field (Vice-Chair), E Hofmann, R Harris (Past Chair) and M Barange (IPO).*
- *The GLOBEC Executive and the IPO to decide on the place and time of the next SSC meeting.*

19.0 GOOS

TB asked for a discussion on the links between GLOBEC and GOOS, to help him in planning deployment of monitoring equipment in the Eastern Pacific. RH noted that the monitoring of biological parameters under GOOS is not well defined, and that the continuous involvement with GLOBEC would be useful in defining those parameters. CW informed the group that he was planning to attend the next GOOS meeting, but that the meeting had been postponed due to international political events and had not been re-scheduled yet. TB offered to join him to try to influence GOOS views, if necessary.

Action:

- *CW to attend the next GOOS Coastal Panel meeting.*

20.0 Introduction to new SSC members

Drs Parma, Runge and Tang introduced themselves by presenting a summary of their research activities and interests.

21.0 Report on IGBP Congress

The SCC was reminded that reports of all sessions are available through the IGBP website (www.igbp.kva.se/congress/). The reports of the sessions proposed by GLOBEC (A5, B5 and D2) are included here:

Session A5 - Vulnerability of coastal communities to natural and human-induced changes in living marine resources. Co-Chairs: Rosemary Ommer; Ian Perry

Marine ecosystems and human social systems are highly complex, and are influenced by local and remote forcing. This session was motivated by the recognition that several Global Environmental Change (GEC) research projects are examining coastal communities under stress, the role of international institutions in managing the commons, transfers of energy and nutrients across coastal zones, and changes in renewable marine resources. While many details still remain to be worked out, this work provides a foundation for the next generation of GEC research that focuses explicitly on coupled human-environment systems, in the case of this session on the marine and coastal zone. This new work must differ from previous work by examining to a much greater extent the linkages amongst various sectors in the coastal zone rather than viewing each sector in isolation. The session was attended by over 20 participants, representing (among others) the IGBP programs PAGES, LOICZ, and GLOBEC, the IHDP program IDGEC, and the cross-cutting program GECaFS.

The participants in this session recognised that this research must take place at the *interface* of natural (IGBP) and social (IHDP) science research, rather than within any one program alone. Several *principal themes* were identified:

Vulnerability / resilience: these concepts were recognised as central to this research, and apply to both the natural and the social sciences. Rather than opposite concepts, they are at different ends of a continuum. “Vulnerability” was broadly defined as “stress minus adaptive capacity”; distinctions between biophysical and social vulnerability were also discussed. Stresses can accumulate to the point where adaptive capacity is so diminished that it can no longer function. That point is a threshold which research can help to identify. This concept of vulnerability - resilience response can be applied to social and natural systems. Vulnerability, and assessing the level of vulnerability, is greatly complicated when multiple stressors are involved, but the threshold concept helps here.

Adaptation represents the processes or coping strategies by which coastal communities increase their resilience (decrease their vulnerability) to ecosystem changes. It can involve the exploitation of multiple natural systems, such as utilising a range of terrestrial and marine species to create a sustainable harvest – a practice known in social science as occupational pluralism.

Trade-offs are the decisions that are made (consciously or sub-consciously) in response to a community’s level of vulnerability, level of natural system disturbance, and adaptive ability. Research on this theme involves the development of scenarios in which various alternatives are tested.

Reciprocal interactions: in discussing the vulnerability of coastal communities to natural and human-induced changes in living marine resources, the reciprocal nature of these interactions is important to remember, i.e. that while changes in marine ecosystems may affect coastal communities, the adaptive responses of these communities may also impact the marine ecosystem.

There are several *significant issues* to consider in examining these problems. Among these are:

scale; problems include the spatial scale of study, whether local, regional, or global, and how to generalise (scale-up) from local lessons to global generalisations (and *vice versa*). What is chosen for the spatial scale of the study also has important implications for how the “coastal community” is defined, and for identifying who are the major “policy makers” (as part of assessing the adaptive responses);

knowledge, and how it flows amongst members of the community, scientists, decision makers. Closely related to knowledge is the need for education (by all parties);

values will differ greatly amongst the various participants in the issue of coastal communities and marine ecosystem changes, but will be central to the decision process and for making trade-offs. In regards to the changes in marine ecosystems, are some states “better” than others, or put another way are some states possible but “undesirable” by humans (*cf.* the GAIM 23 questions)? **fit,** and how well a particular community and/or institutional response matches its ecosystem, is also a significant issue.

Participants in this session identified a number of *key questions*:

1. **What are the dependencies of coastal communities on marine ecosystems?** As a first step in studying the topic of this session, it is important to use a comparative approach and to identify the level of dependence of communities on the marine ecosystem and the level of resilience to environmental changes (Figure 1).
2. **What makes “outwardly similar” communities (potentially) differ in their resilience?** The use of “outwardly similar” communities is important, as it implies an attempt to minimise the number of independent variables. Note that this question applies equally to human social communities *and* to natural marine communities.
3. **What natural and/or social perturbations change community (social or natural) resilience?** Consideration of time scales is important, since some strategies may increase resilience on short time scales but decrease it at longer scales (e.g. catching all the fish and

putting the money in the bank increases short term resilience, but decreases long-term resilience).

Answering these questions will involve significant *methodological research issues*:

1. *How can knowledge be communicated amongst the various parties involved in the issues of coastal communities and vulnerability to marine ecosystem changes?* This is not a trivial question, and involves issues of who are the “users” of the information, such as fishers, scientists, decision and policy makers. It involves communicating what is known and what is not known; “formal scientific” and local knowledge; and starting early with educating students and the general public.
2. *What is the appropriate scale for a particular study, and how are the results applied to different scales (i.e. how are studies conducted at local scales generalised to larger spatial scales, or vice versa)?*
3. *How are significant (or secular) changes in coastal communities and marine ecosystems recognised, and distinguished from “normal” variability, in particular within “short” time scales?*
4. *How do the regulatory and legal systems affect access to resources and collaborations amongst participants, and therefore influence resilience and vulnerability?* In particular this methodological issue concerns how to compare studies conducted in different nations or political jurisdictions. It includes the issue of where decisions are made, and the extent to which the local coastal community has a voice in these decisions.

Participants in this session identified a number of *Capacity Building and Collaboration issues*:

1. Knowledge and communication are essential to facilitate collaboration and capacity building.
2. Collaboration is essential to deal with this topic. To develop the appropriate collaboration, it is necessary to: (a) bring representatives of the various programs together at the very start, rather than later; (b) ask questions that require input from the different research communities that are intended to be involved; and (c) find inspired leadership.
3. Capacity building on these inter-disciplinary issues is essential for developing countries, for whom the natural and social science experts may be the same person, but capacity building is also important for developed countries, i.e. for the natural and social scientists to learn about each other’s approaches, vocabulary, etc.

A number of additional points were made which should be considered when studying problems of vulnerability of natural and human coastal communities to global change. These include:

- To what extent can understanding of past (particularly long past) interactions between coastal communities and marine ecosystem changes be used to interpret present and future responses?
- What is the potential role of aquaculture in increasing or decreasing vulnerability of both marine ecosystems and coastal communities?
- The definition of “community” is problematic, and is likely to differ depending on the scale of study, etc.
- Human health issues surrounding the vulnerability of coastal communities to marine ecosystem changes are likely to be significant, and warrant special study by appropriate experts.
- Cities present special problems in regards to coastal communities and marine ecosystem interactions.

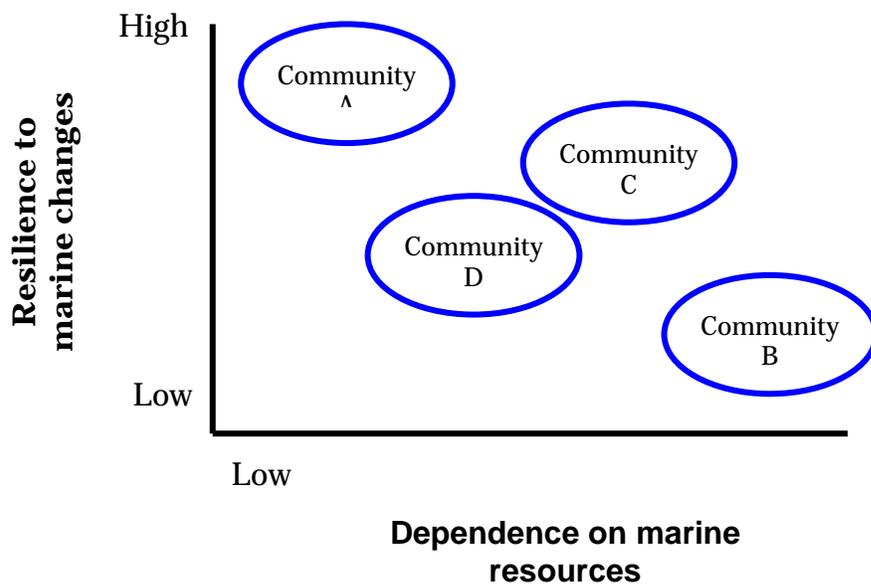


Figure 1. Schematic of how the dependence on marine resources and the resilience to marine ecosystem changes may be related for a variety of different coastal communities. Mapping the locations of communities within this phase space is a first step towards answering the question “What are the dependencies of coastal communities on marine ecosystems?”

Report of Working Group B5 on Top-to-bottom food web studies, from viruses and phytoplankton to fish. Chaired by John Field and Svein Sundby

Participants: Jürgen Alheit, Ken Denman, John Field, Tickey Forbes, Roger Hansson, Roger Harris, Eileen Hofmann, Vladimir Kasyanov, Patrick Lehodey, Patrick Monfray, Ragu Murtugudde, Geir Ottersen, Ana Parma, John Parslow, Kathie Richardson, Jeff Runge, Hiroaki Saito, Svein Sundby, Qisheng Tang, Cisco Werner.

The aim of the working group was to recommend ways to integrate food web studies, ranging from individual based studies, to size-spectra, to trophic guilds, or functional groups. The working group started by a discussion on questions related to the general structure and functioning of food webs. The discussion was organised by addressing four questions:

- 1) How are controls exerted in food webs? Are these top-down predator controls, bottom up controls or wasp-waist controls?
- 2) What is the relationship between biodiversity and ecosystem functioning?
- 3) Can the connection be made between community composition and biodiversity on one hand versus ecosystem functioning, nutrient cycling and energy flow on the other?
- 4) How are ecosystem functioning and trophic transfer forced by physical processes and climate change? This is important when considering both gradual changes in ecosystems and non-linear changes (e.g. regime shifts)

The first two questions were addressed by analysing characteristic differences between food web dynamics in upwelling ecosystems and in Arcto-boreal spring bloom systems. The two systems differ in the way that the transfer of energy from phytoplankton to fish seems to be more effective in spring bloom systems than in upwelling systems, resulting in a large sedimentation of phytoplankton in upwelling ecosystems. It was pointed out that this might be caused by several factors. The fraction of diatom versus flagellate production might be an important factor. Differences in species composition of zooplankton might lead to more effective grazing in spring bloom systems. The regenerated production later in the season of spring bloom systems might increase the efficiency of trophic transfer. The greater areal extent of the spring bloom ecosystems compared to the upwelling ecosystems might increase the efficiency in trophic transfer. Also the residence time for lower trophic level organisms might be important for the differences in the efficiency of trophic transfer.

It was pointed out there are examples of that changes and variations in ecosystem production are caused by control from the bottom as well as control from the top, but the time scales of such controls are different from above compared to from below. Also there are examples of the trophic transfer being controlled from middle trophic levels, more specific from plankton-feeding fish. It was suggested that ecosystems are not controlled from either the bottom or the top, but that it is rather a matter of interaction among various trophic levels.

It was noted that ecosystems with high species diversity at higher trophic levels, such as tropical ecosystems, have generally low fish production, while ecosystems of low species diversity, such as upwelling and spring-bloom ecosystems have high fish production. It was also noted that highly polluted regions have low species diversity although this might not have similar implications for the fish production.

Subsequent to the general discussion the workshop considered pro and cons of methods to integrate food webs from end to end. Particularly, size-based models, individual based models, nested simulation models, complex dynamical models, neural networks and ecopath box models were discussed. Workshop participants gave examples of the various types of model approaches.

John Field presented examples of size-based models. The first ideas of a size-based approach were presented by Azam et al. (1983). Cisco Werner presented simulations of drift/transport and growth of gadoid larvae on Georges Bank using particle-tracking and individual-based models. Jeff Runge and Cisco Werner presented model results on growth and transport of *Calanus finmarchicus* at the Northeast American Shelf and the adjacent deep waters. Eileen Hofmann presented a method for individual-based modelling of the life history of hard clams. While all the above presentation were limited to lower trophic levels, Patrick Lehodey presented a model for top-to-bottom food web integration using functional groups to model growth and distribution of tuna in the Pacific Ocean, with different levels of detail and aggregation at different trophic levels (e.g. one or a few functional groups for intermediate trophic levels constituting tuna forage). He presented a nested basin scale modelling approach for the Pacific Ocean which links tuna distribution and production to small forage fish and phytoplankton.

Conclusions: It is very difficult to generalize across whole foodwebs and all marine ecosystems and answer very general questions like is control top down or bottom up. In answering specific questions, at present we tend to look at parts of the foodweb in much greater detail than others. This is because there are huge problems in studying processes at very different scales of time and space. The microbial loop can be studied in a cubic meter of water over a few weeks, tuna need to be studied over years at the ocean basin scale. The general approach is to model the parts of interest at the individual or species-population level, whereas the trophic groups above or below that are modeled by aggregation into functional groups or size classes.

In general the smaller end of the size spectrum, which operates at short time scales and small spatial scales, is of greater interest for biogeochemical cycles than the upper end. The larger end of the size spectrum at higher trophic levels is of greater interest in studying the flows of energy to fish production. A nested series of models is needed to integrate from end-to-end, with the appropriate biological models linked to physical models of the spatial and temporal scales appropriate to the processes of interest, ranging from global, to basin-scale (implying decadal timescales) to regional, to local.

Models will vary according to the question being addressed and observations are needed on the appropriate scales. Time series observations are needed to validate models with appropriate scales of time and space. Modules of GOOS may be vital in providing the observations needed.

Figure 1. Schematic of how the dependence on marine resources and the resilience to marine ecosystem changes may be related for a variety of different coastal communities. Mapping the

locations of communities within this phase space is a first step towards answering the question "What are the dependencies of coastal communities on marine ecosystems?"

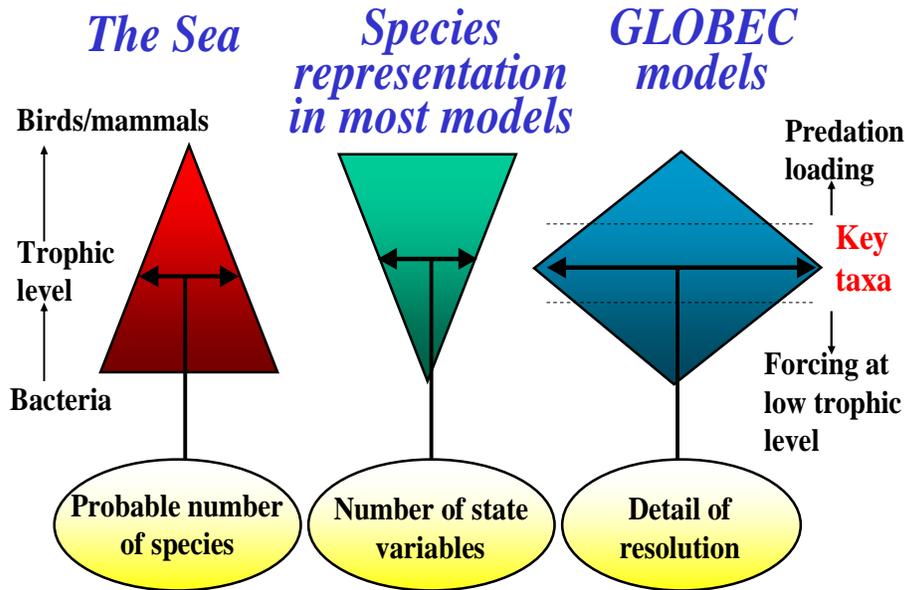


Fig. 2. depicting nested physical and biological models and matching observations needed to study the foodweb from phytoplankton, through forage fish to tuna in the Pacific Ocean. (P. Lehodey, GLOBEC).

Top-to-bottom integrated food web in marine ecosystem

1st principle: Models should reflect the level of information (observation and knowledge) available for the modeled system



22.0 Interactions with CLIVAR

H Cattle briefly introduced CLIVAR to the SSC, and its main objective of “understanding the physical processes responsible for climate variability and predictability at all scales”. CLIVAR is largely a global programme, with panels for each major basin (Atlantic, Pacific, VAMOS, Atlantic, Asian-Australian Monsoon, Africa, S Ocean...). The major issues addressed in each panel are different (e.g. NAO in the N Atlantic Panel, ENSO in the Pacific...). He noted that the Pacific panel has specifically identified links with PICES, IMBER and GLOBEC as priorities. Noted as well that the Pacific panel meets in Yokohama, Japan, 14-16 July 2003, and that the interaction with GLOBEC may be best under this panel. GO introduced his (and CCC's) links with climatologists in the N Atlantic and how they had become interested in cod and biological issues. H Cattle to circulate the membership of the Panels to the IPO to identify members that GLOBEC may be able to interact directly. The option of GO to attend an Atlantic Panel meeting was considered, subject to the Panel Chair's agreement. IP introduced the PAGES/CLIVAR/GLOBEC workshop of 2000, and promised to circulate the report to H Cattle. JA brought up the trends of pelagic fish at multi-decadal and centennial scales, and the phase/out-of-phase patterns that seem to respond to climate teleconnections and that may be of interest to climatologists. PL then introduced his modeling expertise in linking climate and tuna in the Pacific at the basin scale, and how he will present a GLOBEC presentation on Fish and Climate at the CLIVAR OSM in June 2004. JF asked whether the feedbacks from biota to the atmosphere were of interest to CLIVAR, to which HC responded that this is becoming an increasingly important issue.

Actions:

- HC to make the memberships of the CLIVAR Panel to the IPO for distribution to the SSC
- IPO to pass GLOBEC documentation to HC.
- IP to send the report of the CLIVAR/ PAGES/ GLOBEC workshop to HC
- GO to explore the usefulness of participating in a meeting of the Atlantic Panel
- IP/ IPO/ SSC to ensure that links with CLIVAR in the Pacific are linked to PICES.
- Prepare a brief ppt for HC on GLOBEC for presentation at the Pacific panel

23. Review of Actions

The Actions agreed upon were re-visited and allocated to specific members of the SSC or IPO.

24. Review of activities for 2004 and budget allocation

The following funding allocations were agreed:

1. "Ecosystem indicators" symposium, Paris, April 2004	\$ 5,000*
2. CCC symposium on Climate and Fish, Bergen, May 2004	\$ 5,000
3. SPACC Executive (1/2 funding requested)	\$ 8,000
4. Focus 1 meeting to write a paper for the 4 th Fisheries Congress	\$ 8,000
5. Targeted activities of Focus 2 and 3 (to be developed)	\$16,000
6. 1 invited guest to the OFCCP workshop	\$ 2,000
7. Unallocated	\$ 7,000

TOTAL\$51,000

* Includes inviting Gregory Beaugrand as GLOBEC's invited speaker

This does not include IPO expenses, travels of the Chair and IPO and publications, which are allocated following last year's expenses, and meetings of the SSC. It also does not include approximately \$50,000 targeted for ESSAS planning. Adding all these items the expenses for 2004 will approach \$200,000, subject to possible new funding to be identified.

Actions:

- RH and the Chairs of Focus 3, via the Chair of the SSC, to discuss the need for funding for activities of the Focus 3, and develop short proposals to act on the funding allocation

outlined above for both Foci. Should Focus 3 decline to conduct additional activities the funds would be sufficient for a full meeting of the Focus 2.

- *JA to develop plans for a meeting of Focus 1, with the constraints of the funding available.*

25. Next meeting

The IPO had received invitations to hold the 2004 SSC meeting in Noumea (CLIOTOP) and in Swakopmund, Namibia (BENEFIT-SPACC). The IPO and potential hosts would examine the costs of each and recommend the venue to the Executive Committee based on the outcome of the budgeting exercise.

26. Closing Remarks.

The acting chair, John Field, thanked the SSC for their participation through the meeting and the IGBP Congress. Several participants had had to leave before the end, these included the chair, Cisco Werner, Eileen Hofmann, Tim Baumgartner, Wendy Broadgate (IGBP) and Ed Urban (SCOR). The latter two had tendered their apologies for spreading themselves so thinly amongst the various marine-related meetings which had been held in parallel (GLOBEC, IMBER, SOLAS, LOICZ, GCP and others). EU had sent a message that he felt GLOBEC was on course, doing good science, and he had confidence in its IPO and experienced SSC. All were wished safe journeys home.

Appendix 1: ACTIVITIES FOR May 2003-May 2004

- 25-26 June 2003: GLOBEC Focus 4 Working Group Meeting, Banff, Canada
- 15-19 September 2003: SCOR Executive Committee, Moscow, Russia
- 24-27 September 2003: ICES ASC, Tallinn, Estonia (GLOBEC-CCC Session)
- 10-18 October 2003: PICES XII, Seoul, Korea (GLOBEC Focus 4 and CCCC sessions)
- 16-18 October 2003: IHDP Open Science Meeting, Montreal, Canada (GLOBEC Focus 4 session)
- 22-25 October 2004: IOC/SCOR Basin-Scale Ecosystem Model workshop, Harlow, UK
- 31 October- 1 November 2003: 2nd GLOBEC-ESSAS planning meeting, Seattle, USA
- 4-7 November 2003: GLOBEC-CLITOP planning meeting. Sete, France
- 9-12 December 2003: SPACC workshop on Long-term Dynamics of Small Pelagic Fish and Zooplankton in Japanese waters, Tokyo, Japan
- 12-14 January 2004: SPACC meeting on spawning habitats of small pelagic fish, Concepción, Chile
- 15-16 January 2004: SPACC meeting on spawning habitat and the DEPM. Concepcion, Chile.
- 17-18 January 2004: SPACC Executive committee meeting. Concepcion, Chile.
- February 2004: GLOBEC Focus 1 wg meeting. TBA
- 26 February 2004: UK-GLOBEC Open Meeting, London, UK
- 1-5 March 2004: SC-IGBP meeting. St Petersburg, Russia.
- 31 March - 3 April 2004: IOC-SCOR Symposium on 'Quantitative Ecosystem Indicators. Paris, France
- 2-6 May 2004: 4th World Fisheries Congress. Vancouver, Canada.
- 7-10 May 2004: CCC working group meeting. Bergen, Norway.
- 11-14 May 2004: ICES-GLOBEC Symposium on 'The Influence of Climate Change on North Atlantic Fish Stocks'. Bergen
- April/May 2004. GLOBEC SSC meeting