



Integrated **M**arine **B**iogeochemistry and **E**cosystem **R**esearch

To provide a comprehensive understanding of, and accurate predictive capacity for, **ocean responses to accelerating global change** and the **consequent effects on the Earth System and human society**.



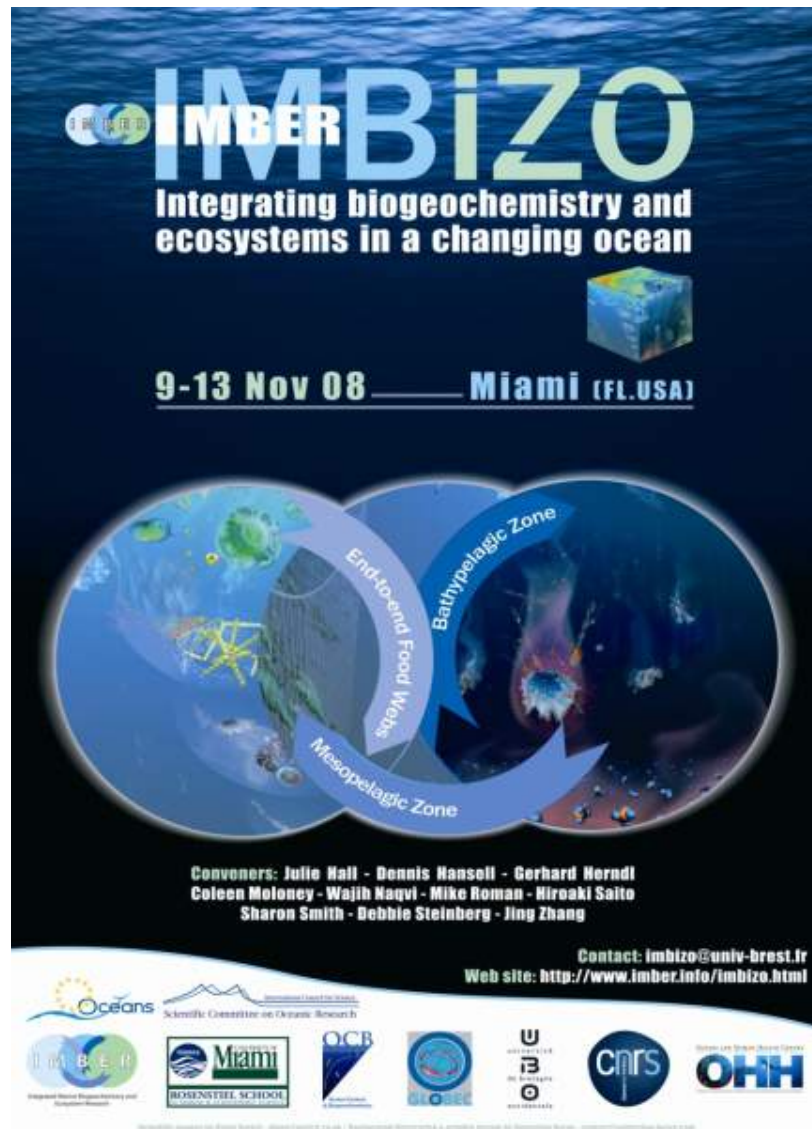
IMBER IMBIZOs

a mechanism for supporting synthesis and integrations across IMBER

- IMBIZO is a Zulu word for “**gathering**”
- **Bottom-up mechanism:** the topics are proposed by the scientific community
- Forum for promoting discussion among **interdisciplinary experts** and encouraging linkages between biogeochemistry and ecosystem research.
- Highlight the **current stage of knowledge and uncertainties** and identify **opportunities for future research**

IMBER IMBIZOs

- IMBIZOs use an innovative format of three concurrent workshops
- Plenary presentations provide overviews of the science that is highlighted in the workshops
- Workshops are designed to discuss the current state of science and to identify areas where advances can be made
- Products from the IMBIZO are individual review/synthesis papers published in the peer-reviewed literature and special issues of scientific journals that include many papers



IMBER **IMBIZO**
Integrating biogeochemistry and ecosystems in a changing ocean

9-13 Nov 08 _____ Miami (FL, USA)

End-to-end Food Webs
Mesopelagic Zone
Bathypelagic Zone

Conveners: Julie Hall - Dennis Hansell - Gerhard Herndl
Coleen Moloney - Wajih Naqvi - Mike Roman - Hiroaki Saito
Sharon Smith - Debbie Steinberg - Jing Zhang

Contact: imbizo@univ-brest.fr
Web site: <http://www.imber.info/imbizo.html>

Oceans Scientific Committee on Oceanic Research
IMBER
Miami ROSENSTEL SCHOOL
OCB
U
CMRS
OHH

IMBIZO I

Miami, FL, November 2008

Three concurrent workshops on

- End-to-end food webs*
- Mesopelagic zone
- Bathypelagic zone

* Sponsored by



IMBIZO I Workshops

WS1: Ecological and Biogeochemical Interactions in End-to-End Food Webs



WS2: Ecological and Biogeochemical Interactions in the Mesopelagic

WS3: Ecological and Biogeochemical Interactions in the Bathypelagic



WS1 Primary recommendation

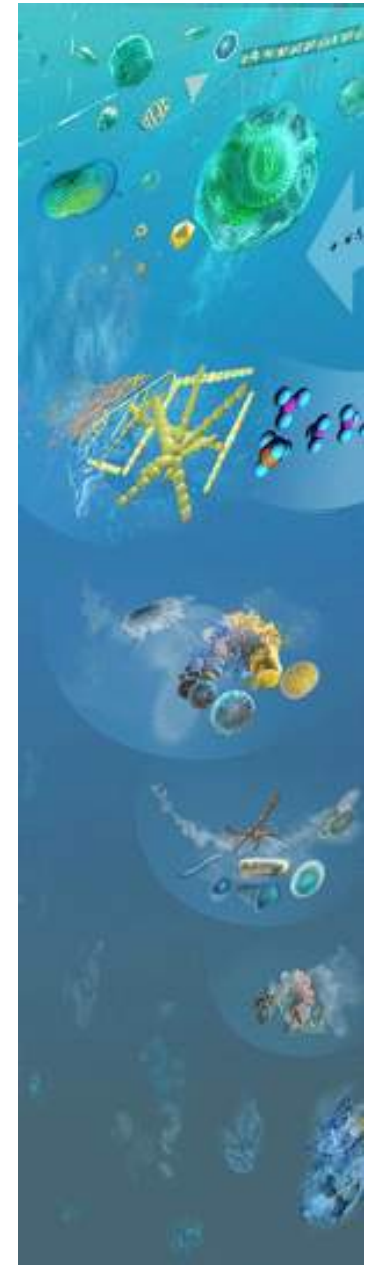
- To conduct comparative studies between regional systems

WS2 Primary recommendation

- Focus on key species or functional groups (mechanisms)

WS3 Primary recommendation

- Undertake synthesis of deep sea microbial dynamics and biogeochemistry of organic matter, and metabolism (autotrophy vs. heterotrophy)



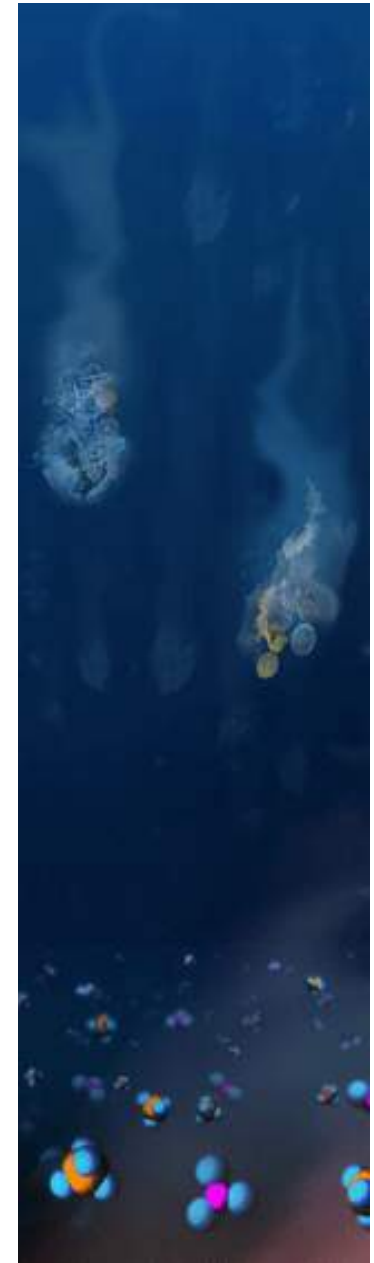
IMBIZO I: MAJOR OUTCOMES



DSR II « **Ecological and biogeochemical processes in the Dark Ocean** »

Synthesis and new research papers from WS 2 and WS 3

Two synthesis papers from WS 1 were published in the *Journal of Marine Systems*



IMBER IMBIZO II

10-14 Oct 2010 — Crete (Greece)

Integrating biogeochemistry and ecosystems in a changing ocean

Regional comparisons

Concurrent workshops :
 From elemental ratios to food quality
 Large-scale regional comparisons
 Food web sensitivity to enhanced stratification

Contact: imbizo@univ-brest.fr Web site: <http://www.imbizo-2010.confmanager.com>

Scientific logo for IMBIZO logo by Diana Garcia - gparica@cc.uoi.es / Illustration & graphic design by Sebastian Herber - contact@sebastianherber.com

IMBIZO II

Crete, Greece, October 2010

Objectives were to:

- foster synthesis across IMBER regional and national programmes
- focus on important linkages between food webs and biogeochemical cycles



IMBIZO II Workshops

WS1: The effects of varying element ratios on community structure at low trophic levels and food quality at mid and high trophic levels

WS2: Large-scale regional comparisons of marine biogeochemical cycles and ecosystem processes: Research approaches and results



WS3: Sensitivity of marine food webs and biogeochemical cycles to enhanced stratification



WS1 Primary recommendation

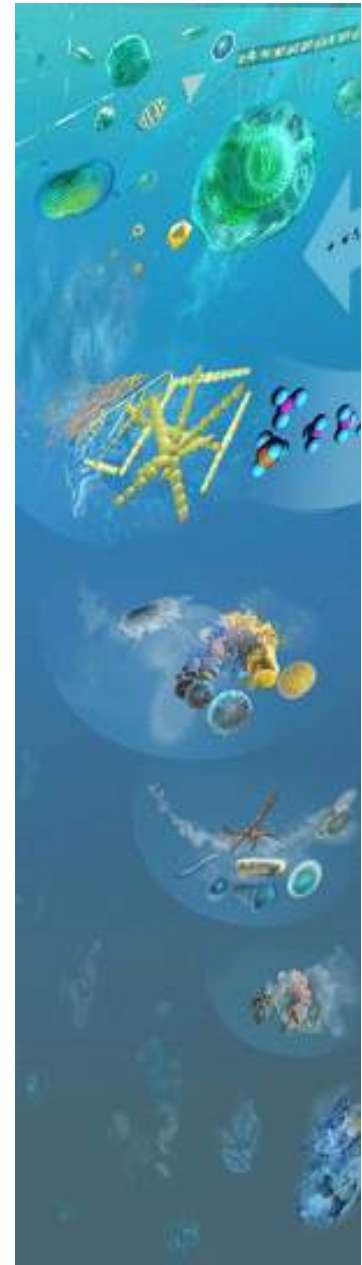
- Understanding the response of ecosystem mass and energy transfer to oceanic physical and chemical changes particularly at higher trophic levels is critical.

WS2 Primary recommendation

- Data and models available for comparative studies of several systems which will give new insights into ecosystem structure and function.

WS3 Primary recommendation

- Enhanced stratification - need improved understanding of regional ocean ecology and biogeochemistry & interactions – observation, process and experimental studies. Also need to consider selection effects on organisms - (include in models of organisms/strategies) and wider links



WS2: Large-scale regional comparisons of marine biogeochemical cycles and ecosystem processes: Research approaches and results



Overarching Questions/Discussion Sessions:

- 1) How do we improve integration of biogeochemistry and food web research?
- 2) How should comparative studies be conducted?
- 3) What have we learned from comparative studies?

WS2: Large-scale regional comparisons of marine biogeochemical cycles and ecosystem processes: Research approaches and results



Workshop Organization

Session 1: Comparative Methodology

Session 2: Integrating Biogeochemistry and Food Webs

Session 3: Regional Comparisons – High Latitudes

Session 4: Regional Comparisons – From Estuarine to Basin Scale

Session 5: Intra- and Interbasin Comparisons

Session 6: Global Comparisons



IMBIZO II Workshop 2

Large-scale Regional Comparisons of Marine Biogeochemistry and Ecosystem Processes - Research Approaches and Results

- For the most part, experiments cannot be conducted in studies of large marine systems. An alternative method of investigation is the comparative approach.
- In the comparative approach insights into biogeochemical, physical and ecological processes, as well as the overall structure and function of systems are sought through comparing different geographical regions.
- This can help to determine what is fundamental and what might be unique within particular systems.
- In this workshop we have explored how this approach has been used to compare and contrast processes in the widely diverse systems of the world's oceans.
- The papers and posters presented and syntheses of the discussions will be published in the form of a special volume in a primary journal.

1. How do we improve integration of biogeochemistry and food web research?



Major Conclusions and Recommendations:

- Biogeochemical and food web studies (especially higher trophic level studies) are usually not carried out at the same time/place.
- There are social, institutional and scientific barriers that need to be overcome.
- More information/data are needed for mid-trophic levels (e.g., MACROES project).
- The IMBER regional programs need to define specific, testable scientific questions/hypotheses that demand integration of biogeochemistry and food web research. (Following recommendations from the IMBER end-to-end food web working group)
- IMBER should develop a sub-group or working group to construct an implementation plan for integration of biogeochemistry and food web research.

Possible Synthesis Paper:

Controls on Ecosystem Structure: The Need for an Integrated Fisheries to Biogeochemistry Approach.

2) How should comparative studies be conducted?

Major Conclusions and Recommendations:



- Combined biogeochemical and ecosystem comparative studies have been employed routinely in freshwater and estuarine systems. In contrast, the comparative approach has not yet been widely adopted/applied in marine/open ocean systems.
- The time is right. Both the data and the models are now available to allow comparative studies in several different marine systems. Regional comparisons can and should be conducted.
- Regional comparisons can be used to identify gaps in our knowledge
- IMBER should promote across region comparative studies as a powerful tool to gain new insights into the structure and function of marine ecosystems. Motivation of a workshop or working group is recommended.

Possible Synthesis Paper:

How comparative studies should be conducted. Recommendations and Best Practices for Marine Ecosystem and Biogeochemical Research.

3) What have we learned from comparative studies?



Major Conclusions and Recommendations:

- Comparative studies can reveal how systems might respond to perturbations and/change.
- They can also reveal where potential tipping points might be.
- Comparative studies can be used to generate hypotheses.
- However, ecosystems and higher trophic levels provide new modeling challenges due in part to the influences of behavior.

Possible Synthesis Paper:

End-to-End Modeling of Marine Ecosystems.



IMBIZO II OUTCOMES AND PRODUCTS

- Articles published in EOS, ASLO Newsletter, IMBER Newsletter
- One special issue of Journal of Marine Systems based on WS2 is accepted and papers are due in Spring 2011
- Synthesis papers are planned from WS1 and WS3

“In a very real sense, JGOFS met GLOBEC in Crete, and the result was stimulating, enlightening and fun!” *Raleigh Hood said (ASLO journal)*

IMBIZO III

- Planning is underway – now evaluating potential venues
- Focus will likely be on Human Dimensions and interactions with ecosystems – new area of research for IMBER designed to promote understanding of the multiple feedbacks between human and open ocean systems, and to clarify what human institutions can do, either to mitigate human-caused perturbations in the ocean systems, or to adapt to system changes
- Community input for workshops will be requested in 2011



EUR-OCEANS Consortium / IMBER joint activities in 2010



Two IMBER-events co-funded by EO

CLIOTOP into the future - Building scenarios for oceanic ecosystems in the XXI Century (Feb 2010, France)

IMBIZO II – Regional Comparisons Workshop (Oct. 2010, Greece)

One IMBER-event endorsed by EO

IMBER summer school

ClimECO₂ - Oceans, Marine Ecosystems, and Society facing Climate Change

(France, Aug. 2010)

Publication on interactions between marine biogeochemical cycles and end-to-end food webs

Parameterisation of Trophic Interactions in Ecosystem Modelling,

Progress in Oceanography, Vol 84, Issues 1-2, pages 1-138 (2010).

Edited by Michael A. St. John, Javier Ruiz, Patrick Monfray and Ivo Grigorov,

