

Report on POGO Biology Initiative

Institutional Contacts

Eight institutions responded to the query regarding biological observations, and the following people have been named the institutional contacts for the POGO Biology Initiative:

CSIRO (Australia)	Tony Koslow	Tony.Koslow@csiro.au
LDEO (USA)	John Marra	marra@lamont.ldeo.columbia.edu
BIO (Canada)	Glen Harrison	HarrisonG@dfo-mpo.gc.ca
IMR (Norway)	Francisco Rey	pancho@IMR.no
SOC (UK)	David J. Hydes	djh@soc.soton.ac.uk
PML (UK)	Carol Robinson	carol.robinson@pml.ac.uk
WHOI (USA)	Larry Madin	lmadin@whoi.edu
SIO (USA)	Greg Mitchell	gmitchell@ucsd.edu

The group discussed how the POGO Biology Initiative might proceed, and made suggestions on possible actions. They are listed below.

1. **Advertise available data and new techniques:** Greg Mitchell has offered access to all the data that are collected through the CALCOFI Programme. POGO should provide links to CLCOFI and other sources of data on phytoplankton and primary production through the POGO web site. The web site can also be used to provide access to reports on new and emerging operational techniques for measuring phytoplankton and primary production.
2. **Promote New and Emerging Techniques for Measuring Phytoplankton Pigments or Primary Productivity:** David Hydes has offered to contribute to this topic. Again, the simplest way to do this would be for POGO to promote new and emerging techniques and related developments through the POGO web site. The idea would be for short write-ups about the new technologies to be posted on the POGO web site, with appropriate pointers to the scientists who are behind the initiatives.
3. **Organise a workshop on Molecular Oceanography:** One of the recommendations of the POGO biology workshop was to promote the use of molecular techniques in biological oceanography. To take this recommendation forward, it would be useful to have a workshop with presentations from leading researchers who have been using molecular techniques in biological oceanography. Their contributions would be organised into a text book on Molecular Oceanography. The workshop would be followed by a training programme on the theme of the workshop. Dr. Osvaldo Ulloa has taken the lead in this initiative. John Marra has suggested that it might be useful to have a session or two at an ocean or aquatic sciences meeting prior to the workshop.

- 4. Organise a Workshop on Chlorophyll-a as a Geophysical Variable:** Of all the biological variables that are likely to become “operational”, the most likely candidate is chlorophyll. Yet, unlike physical variables, we have no primary or secondary standards for calibration of this variable. We have many techniques and methods for measuring this variable, ranging from the chemical to the optical. The scale of measurements range from the single cell using flow cytometry, to the basin scale using satellites. But we have no operational definition of chlorophyll concentration, and inter-comparison of results from various methods remains problematical. There are ambiguities also on what is measured by the various techniques. The workshop would invite a small number of experts to address these issues; make recommendations on primary standard and secondary standards for chlorophyll-a estimation; recommend an operational definition for chlorophyll-a; and suggest methods of inter-comparison and interpretation of results from different types of sensors and instruments. (See draft proposal attached). Alternate suggestion from John Marra: organise workshop on ocean colour as a geophysical variable, rather than on chlorophyll-a.
- 5. Promote new technologies for observation of large phytoplankton and zooplankton:** There are now quite a range of promising acoustic and optical technologies, such as ADCPs, ship's sounders, multi-frequency acoustic systems; video plankton recorders, optical counting/sizing instruments, and flow cytometry. SCOR has a working group on New Technologies for Observing Marine Life sponsored by Census of Marine Life. To enhance this effort, POGO, perhaps in conjunction with the Census for Marine Life, can explore ways of developing one or more pilot observational programs to evaluate relative costs and benefits of some of the most promising technologies.
- 6. Accelerate generation of end-user products:** Adopt a strategy for marine biology that accelerates end-user products. The obvious model is the focusing of biology on improving human health. In the case of marine biology, the customer is environmental prediction in the broadest sense, including fisheries, epidemiology and toxic algal blooms, as well as pollution. It would be easier to attract more funding for marine biology and biological oceanography if POGO were to adopt a strategy for linking it to such applications. In the language of economics that means increasing the focus of customer pull, and not relying merely on science/technology push. This suggestion came from John Woods.

Draft proposal prepared for submission to:

- (1) The National Aeronautics and Space Administration (NASA)
- (2) The European Space Agency (ESA)
- (3) The National Science Foundation (NSF)
- (4) The Office of Naval Research (ONR)
- (5) The Intergovernmental Oceanographic Commission (IOC)/Global Ocean Observation System (GOOS)

by the

Partnership for the Observation of the Global Oceans (POGO)

and the

Scientific Committee on Oceanic Research (SCOR), under the leadership of the
International Ocean-Colour Co-ordinating Group (IOCCG)

to host an International Workshop entitled

CHLOROPHYLL: A FUNDAMENTAL BIOGEOCHEMICAL PROPERTY

Proposed Date:	Workshop will take place in mid-2003
Total Requested (per organisation):	\$15,000 (per agency)
Proposed Venue:	Dartington Hall, Devon, U.K.

Principal Organisational Representatives:

Dr. Shubha Sathyendranath
Executive Director, POGO
Bedford Institute of Oceanography
1 Challenger Drive
Dartmouth, Nova Scotia
Canada, B2Y 4A2
Tel: 902-426-8044
Fax: 902-426-9388
E-mail: shubha@dal.ca

Dr. Venetia Stuart
Executive Scientist, IOCCG
Bedford Institute of Oceanography
PO Box 1006
Dartmouth, Nova Scotia
Canada, B2Y 4A2
Tel: 902-426-3817
Fax: 902-426-9388
E-mail: .vstuart@dal.ca

Proposal for funding from NASA/ESA/NSF/ONR/IOC to sponsor an
International Workshop entitled:

CHLOROPHYLL: A FUNDAMENTAL BIOGEOCHEMICAL PROPERTY

to be hosted by the Partnership for the Observation of the Global Oceans (POGO)
and the International Ocean Colour Co-ordinating Group (IOCCG)

1. Rationale

To study the biogeochemical cycles in the global ocean requires that we collect and archive data on biogeochemical properties worldwide. This initial task is by no means trivial: the problems of archiving ocean data magnify when the scope of the archive extends beyond the hydrographic through the geochemical to the biogeochemical. Generally speaking, biogeochemical data will be more complex, more variable with respect to measurement protocols, and less standardised with respect to how they should be interpreted. These differences arise partly from matters of definition, in particular from the translation of an absolute definition into an operational one, and partly from the related issue of lack of a primary standard against which some of the measurements can be compared.

Many of the biogeochemical variables have no universally-agreed definition, and this is especially true in the ecological field. This is true even for the two most important ecological variables, biomass and production. And if the definitions could be agreed upon, it would not necessarily follow that these variables are, in fact, observables of the pelagic ecosystem, in the sense that acceptable operational equivalents of the basic definition could be found. It goes without saying that such a situation creates fertile ground for germination of the seeds of controversy.

Problems with settling on an operational definition spawn problems in standardisation. In particular, it will often be difficult to trace procedures back to a primary standard. Usually, we will be fortunate if we have a secondary standard. Often, we will be even further removed from the absolute. An example is *in vivo* fluorescence, a proxy variable (with non-linear response) for chlorophyll concentration, which is itself an imperfect proxy variable (conversion factor not constant) for particulate organic carbon, which many workers believe to be the correct way to index phytoplankton biomass. To put the implied uncertainty into perspective, bear in mind that phytoplankton biomass is perhaps the single most important variable in the marine ecosystem.

The significance of chlorophyll-a concentration, measured as a proxy for the biomass of phytoplankton, is heightened by the availability of ocean-colour remote sensing. Chlorophyll-a is the only property of the pelagic ecosystem that can be measured with worldwide coverage and high frequency repeat coverage: remote sensing of ocean colour is our only window into the marine ecosystem on synoptic scales. In this methodology, chlorophyll-a is estimated from the optical properties of the ocean, measured from a

downward-looking radiometer on a spacecraft, using algorithms developed on the basis of *in situ* data.

Given the enormous richness of the ocean-colour archive, and given that chlorophyll-a concentration is undoubtedly the most commonly-measured biological property during expeditions by ship (including both discrete samples and continuous vertical profiles), it becomes clear that we have more information on chlorophyll-a concentration than on any other biological-oceanographic variable. It is our greatest archive for the marine ecosystem. The difficulty lies in the differences in methodology represented by the various members of the archive.

2. Objectives

POGO and the IOCCG propose to host a small international workshop to examine the different techniques currently available for measuring chlorophyll-a and to try and establish a standard procedure for interpreting these results. The workshop aims to bring together scientists who require routine measurements of chlorophyll-a for monitoring programmes as well as those investigating other aspects of phytoplankton dynamics, including the use of chlorophyll-a as a parameter in biogeochemical models. Specifically, the main objectives of the workshop are to:

- review current methodologies for measuring chlorophyll-a;
- determine what could be done to standardise different entries into a common form;
- review what each technique is actually measuring and discuss how the results of different techniques can be interpreted;
- review the recommendations concerning the use of chlorophyll-a as an index of phytoplankton biomass;
- recommend an operational definition for chlorophyll-a concentration;
- identify primary and secondary standards for chlorophyll-a;

The proceedings of the workshop will be published in the form of a POGO/IOCCG report, and distributed free of charge to interested parties.

3. Current methodologies and new advances in measuring chlorophyll-a

The advantages and disadvantages of various methods of measuring chlorophyll-a will be discussed, highlighting possible areas for agreement. These techniques include:

- HPLC methods, including CHEMTAX (Hervé Claustre, France)
- Fluorometric methods (Richard Geider, UK)
- Spectrophotometric methods (Chuck Trees, USA)
- Phytoplankton analysis by flow cytometry (Bill Li, Canada)
- Remote sensing of chlorophyll-a (Roland Doerffer, Germany)
- Moored sensors (John Cullen, Canada)
- Other new sensors/instruments for measuring chl-a (David Hydes, UK)

Participants will evaluate the different techniques and equations used to calculate chlorophyll-a to determine if it is possible (or desirable) to recommend a 'standard protocol' for sample preparation, analysis, extraction and measurement. Participants will also discuss how the various measurements of chlorophyll-a can be interpreted. Furthermore, the calibration of the various instruments will also be reviewed, as this can influence significantly the interpretation of the results.

4. Proposed Invitees to Workshop

A number of distinguished scientists actively engaged in various aspects of the estimation of phytoplankton biomass and primary production, and experts in data management aspects of biological oceanographic products will be invited to attend the workshop. It is proposed that these participants would include:

Ichio Asanuma – NASDA, Japan
Dick Barber – Duke University, USA
Ray Barlow – Marine and Coastal Management, South Africa
Hervé Claustre – LOV, Villefranche, France
John Cullen – Dalhousie University, Nova Scotia, Canada
Roland Doerffer – GKSS, Germany
Ken Furuya – University of Tokyo, Japan
Richard Geider – University of Essex, UK
Laurie Van Heukelem - Horn Point Laboratory, UMCES, USA
David Hydes - Southampton Oceanography Centre, UK
Shirley Jeffrey – CSIRO, Hobart, Australia
William Li – Bedford Institute of Oceanography, Nova Scotia, Canada
Steve Lohrenz – University of Southern Mississippi, USA
Roy Lowry – Proudman Laboratory, UK
John Marra - Columbia University, USA
John Parslow – CSIRO, Hobart, Australia
Trevor Platt – Chairman, IOCCG, Canada
Mini Raman – ISRO, India
Francisco Rey – Institute of Marine Research, Bergen, Norway
Shubha Sathyendranath – Executive Director, POGO, Canada
Venetia Stuart – Executive Scientist, IOCCG, Canada
Chuck Trees – NASA HQ, USA
Mohideen Wafar – National Institute of Oceanography, Goa, India

5. Budget for the workshop

TOTAL BUDGET FOR THE WORKSHOP

INCOME:

NASA (proposal submitted)	\$15,000
ESA	\$15,000
NSF	\$15,000
ONR	\$15,000
IOC/GOOS	\$15,000
POGO	In kind
IOCCG	In kind

TOTAL

\$75,000

EXPENSES

Airfare for 24 invited participants (\$1,500 each)	\$36,000
Accommodation/per diem for 20 invited participants (\$800 each)	\$16,000
Printing of report (1500 copies)	\$15,000
Distribution of report	\$8,000

TOTAL EXPENSES

\$75,000

It is proposed that the NASA (/ESA/ONR/NSF/IOC) share of this budget be \$15,000 (each). The balance of the workshop costs will be funded by other sponsors (ESA, NSF, ONR, IOC). It should be noted that it is not POGO or SCOR's practice to charge overhead or indirect costs on grants it receives for its activities; none are shown in the budget summary.

POGO and SCOR shall be responsible for administration of the workshop funds. All expenditures will be approved by the Chairs of POGO and the IOCCG before payments are made. A financial statement of expenditures and current balance shall be submitted to POGO and the IOCCG at their meetings, or upon request by the chairman.

As autonomous non-profit organisations, POGO and SCOR can receive government grant funds independently without involving the bureaucracy of their host institutions. For this reason, no separate institutional representative has been identified.