

SCOR Panel on New Technologies for Observing Marine Life  
Meeting #4  
Auckland, New Zealand  
17 November 2007

Meeting Summary

**Panel Members Attending:** Geoff Arnold, Elgar de Sa, David Farmer, Gaby Gorsky, John Gunn, Antonio Pascoal, Heidi Sosik (by phone), Song Sun, Alex Rogers, Bob Ward

**Others Attending:** Barbara Block (TOPP), Dan Costa (TOPP), Lew Incze (GoMA), Ed Urban (SCOR)

Objectives of the Meeting, Review of Agenda, and Actions Since Last Meeting

Elgar Desa opened the meeting with a statement on the meeting goals and suggested that the Panel should probably still use the approach of individual members following different topic areas. Ed Urban continued by reviewing the Panel's work for the past year:

- Review of project renewal proposals—The Panel reviewed all the proposals for renewal of Census field projects and OBIS, and provided comments to the Sloan Foundation.
- Review of Methodologies Report—The Panel reviewed the draft Methodologies report for CoML and provided comments to the CoML Secretariat. Dan Costa noted that the proposals did not have a full description of the technologies they were using and Urban responded that the Panel took into account these limitations.
- Session on Technology at Auckland meeting—Urban moderated a session on technology for the Auckland All Program meeting, and Alex Rogers and Jesse Aububel (for Ed Harrison) made presentations in the session. Urban noted that the session may have been unnecessary, as it was obvious from the project presentations that all of the projects are using one kind of technology or another, and there was no shortage of technology presented throughout the meeting.
- Papers on optical technologies and satellite communications—Ed Urban noted that two papers discussed at the Kobe meeting have not yet been completed, on optical technologies and satellite communications.
- Report on Geolocation Methods Workshop—Geoff Arnold gave a summary of the outcomes of the Geolocation Methods Workshop, sponsored by the Panel on 5-6 October 2007 in San Sebastián, Spain. The meeting was organised by Karen Evans (CSIRO) and convened by John Gunn and Geoff Arnold. There were 27 participants, including tag users and tag makers. The objectives of workshop were to
  - Assess current technology and methods
  - Identify problems/issues
  - Identify potential solutions and practical means of achieving them
  - Make recommendations and suggest a program of collaborative research

The workshop was structured as follows:

- Short presentations by participants focusing on existing technology and methods (*17 talks*)
- Two working groups:
  - WG 1: estimation of position – identification of key problems (*Chair: Julian Metcalfe*)
  - WG 2: interpretation and management of position data (*Chair: Barbara Block*)

A summary report is being prepared from the meeting and will be added to the Panel Web site, when available.

John Gunn commented that he didn't see any new problems identified at the workshop, although the meeting did come up with some new solutions. Geoff Arnold responded that there had been several significant advances since the previous workshop in Honolulu in 2000, notably in the development of ways of estimating geolocation errors. The critical next step is to send off some groups to work together on the key topics identified. Barbara Block summarized her view of the advances at the meeting:

- A new technique for geolocation has been developed, which has decreased the error of animal-based tags from about 100 km to about 25 km. Validation tests will be needed to confirm this method.
- The tidal method has been improved substantially for use in turbid coastal waters.
- The selection of which geolocation method to use on a given day in a specific location might be accomplished using statistical methods.

Block concluded by stating that the workshop on geolocation methods was important in facilitating discussions on an international level. Dan Costa added that TOPP was the first to obtain data using geolocation tags and GPS tags on the same animal. This is significant because birds with GPS tags, location tags, and temperature-sensing tags on their feet are capable of providing SST data with high-quality geositions.

Antonio Pascoal added that when they design geolocation for AUVs, they use traditional techniques, but they are experimenting with geophysics-based navigation method (e.g., using the Earth's magnetic field). It is important for the AUV and animal tag communities to communicate.

The Panel expressed its thanks to Geoff Arnold and Karen Evans, and asked that Ed Urban send a thank-you letter to Evans.

#### Action Items from All-Program Meeting and Project Meetings

The Panel briefly discussed topics from the All-Program Meeting that it might take up. A major topic that was mentioned by several speakers was the idea of biological observatories, particularly in the deep sea. Gaby Gorsky noted that both cabled and autonomous observatories could be used to measure organic matter, oxygen concentrations, meiofauna, and currents, through combinations of optical and chemical sensors. Alex Rogers attended the recent Pacific Marine Sciences Organization (PICES) meeting, at which information was presented about the

cabled Neptune (<http://www.neptune.washington.edu/>) and Venus (<http://www.venus.uvic.ca/>) observatory systems. One application of these systems will be to observe the acoustic behavior of the deep scattering layer. A major problem being faced is how to handle enormous amounts of data that will be generated. Gorsky added that bioluminescence is measured in the deep Mediterranean Sea from observatories. Antonio Pascoal mentioned the AzoreNet system. He also expressed his surprise that there is not more use of combined optical and acoustic methods for habitat mapping. Rogers noted that acoustic sensors are increasingly being used on AUVs. In relation to optical methods, Gorsky noted that they are used on many types of AUVs and ROVs and there are many ideas for new applications and approaches.

Lew Incze added that Scott Gallagher's NEBO project focuses on flying an AUV 1.5 meters above the seafloor, for rapid assessment of benthic communities. Such a system is needed to obtain the right data for the models being used by GoMA. Rogers responded that this type of technology could have a large impact in studies of marine biodiversity in the future. Also important could be analyses of existing photos and films.

#### CoML Contributions to the Global Ocean Observing System (GOOS)

The Pane began discussions of the potential CoML contributions to GOOS at its 2006 meeting in Kobe and the Scientific Steering Committee (SSC) of the Global Ocean Observing System (GOOS) discussed the same topic at their subsequent meeting. John Gunn introduced this discussion by stating that the GOOS SSC requested help from the Panel in relation to biological observations. (Gunn is a member of both groups.) A number of parallel international initiatives – run under the auspices of IOC, WMO, UNEP, ICSU, POGO and CoML - have highlighted the need for incorporation of routine observation of biological components of ocean systems within global observing systems. For example, the most recent GOOS Scientific Steering Committee noted:

*“Progress in establishing (jointly with GEO) the first biological pilot project on ocean chlorophyll (ChlorOGIN) was welcomed, and several other potential pilot projects were mentioned (e.g. Harmful algal blooms, land-based sources of pollution, multi-hazard early warning systems, wind-wave-current interactions, the Ocean Tracking Network) and it is recommended that each GRA [GOOS Regional Alliance] should demonstrate its activity by undertaking at least one pilot study of its own choice and priority.”*

Gunn noted that as national, regional and global observing systems are scoped and developed, there is a need for assessment of new and emerging technologies for biological/ecological observations and evaluation of whether these can be incorporated into GOOS in an operational mode.

Ed Harrison posed the following questions before the meeting, for which GOOS needs answers in relation to animal-based tag data:

1. Can animal-based observations be used in a sustained, routine and quality-controlled mode or is more R&D needed?
2. For which of the 6 societal goals/benefits of GOOS are they most applicable?
  - a. Improve the safety and efficiency of marine operations
  - b. More effectively control and mitigate the effects of natural hazards

- c. Improve the capacity to detect and predict the effects of global climate change on coastal ecosystems
  - d. Reduce public health risks
  - e. More effectively protect and restore healthy ecosystems
  - f. Restore and sustain living marine resources
3. Would the data streams improve nowcasts and forecasts that help achieve these goals?
  4. What are the applications and who are the users?
  5. Have common standards and protocols for measurements and data telemetry been established?

Biological data (e.g., chlorophyll) are important to get into the GOOS data stream because outputs from GOOS are used in global models of climate change. The United States, Australia, Canada, and other nations are investing significant new financial resources for ocean observations, although most are not dealing much with biological observations, focusing mostly on physical parameters.

David Famer noted that there is a tremendous opportunity to push the idea of “animal oceanography”; there is value in deploying a large number of animal-based tags, even if they are not as accurate as other measurements. Data from such tags are useful for understanding biological processes because the animals react to biologically interesting phenomenon. Barbara Block noted that NASA is interested in animal-based data for sea-truthing purposes, and that animal-based data can have high accuracy and high resolution, even better than data from Argos. Gunn presented slides of candidate measurements for biological parameters; the list was augmented during the Panel discussion:

- Ocean Tracking Network: acoustic/physics arrays
- Coupled archival/acoustics/physics, upward-looking ADCP, pH meters. Dan Costa noted that the IOOS (see [http://www.ocean.us/ioos\\_system](http://www.ocean.us/ioos_system)) may have acoustic sensors.
- Sophisticated archival tags/animal oceanography: temperature, salinity, productivity, chlorophyll, etc. Are there tags that can differentiate among different types of algae?
- Argo: optical/productivity sensors added, such as fluorometers
- Underway samplers for nutrients, phytoplankton, and zooplankton
- Water column acoustic profiles from buoys or ships of opportunity
- Makris-like acoustic systems, David Farmer noted that the Makris approach is expensive, because two ships are required.
- Benthic biology observations: temperature and turbidity are important
- Measurement of a biodiversity index, which could be important for understanding the effects of climate.
- DNA sensors

David Famer noted that species identification can be a problem with acoustic techniques Gaby Gorsky added that data from tagged marine mammals is used by MedGOOS. Farmer noted that the ocean is biologically heterogeneous and we need to understand this heterogeneity to understand climate change. One hint at the effects of climate change could be gained by studying how animal tracks and behavior change during the El Niño-Southern Oscillation cycle. Barbara Block responded that to achieve this goal, we need to have biological and physical oceanographers work together in the field. Farmer suggested using approaches that are

complementary to animal oceanography, such as asking ships of opportunity to pass by biological hotspots. Block suggested that gliders could also be deployed in hot spots.

John Gunn asked what the Panel could do and posed some options:

- Voyeurs - reporters?
- Passive or active contributors?
- Champions/sponsors of R&D on new technology?
- Co-ordinating pilot studies across ocean observing systems?
- Advocates and advisors to POGO, GOOS, GEOSS etc

Dan Costa responded that it is valuable to have SCOR documenting what are important biological measurements for GOOS to be making. People deploying animal-based tags still need to work on quality control of the data. Barbara Block added that they have developed QC routines, comparing tag-based data with the World Ocean Data Atlas.

John Gunn noted that the geolocation workshop was the first pursuit of the Panel and could be a model for future Panel activities. Block stated that a workshop to develop animal oceanography needs to be convened. Gunn responded that one important aspect of animal oceanography is the development of standards. Alex Rogers stated his opinion that the Panel should have a meeting across the biological community, including biologists, to determine what biologists want to measure and what can be measured from biological observatories, and regarding the impacts of climate change on biological communities. Block responded that perhaps two meetings are needed: (1) the general meeting suggested by Rogers and (2) a meeting of scientists who work on animal oceanography to discuss what data they can provide and the characteristics of these data. Dan Costa suggested that the Panel refer to the report from the U.S. Orion planning process ([http://orionprogram.org/PDFs/workshop\\_report.pdf](http://orionprogram.org/PDFs/workshop_report.pdf)). Elgar de Sa suggested looking at the POGO report on biological observations from 6 years ago also ([http://www.ocean-partners.org/documents/Dartington\\_Report.pdf](http://www.ocean-partners.org/documents/Dartington_Report.pdf)). Gunn suggested asking the CoML projects what long time series they will be able to provide.

#### Development of Panel Work Plan for 2008-2010

Ed Urban introduced the discussion by explaining that the current grant for the Panel's work would soon expire and the Sloan Foundation has invited a proposal for the 2008-2010 period. The Panel's role during this period should be less to provide advice and more to help CoML and its projects to synthesize their work and to create legacies that will extend beyond the end of CoML at the end of 2010. The Panel discussed several different ideas and identified the following as areas in which the Panel could make contributions to CoML and to future observations of marine life:

1. Geoposition of animal-based tags: A working group could be formed to pursue recommendations of workshop, including someone involved with AUV navigation – John and Geoff
2. Integrated biological observatories (IBOs) for GOOS, including animal-based oceanographic data, indicator species, molecular techniques, autonomous platforms and networked systems, passive acoustics – working group, perhaps with GOOS and POGO – Alex & John will suggest someone, TOPP

3. Image collection, analysis, and storage: This idea could be pursued by a working group/workshop, including training. Using image data with other data on habitats and environmental parameters to predict biodiversity patterns. Surrogacy approaches – knowing what species are found in a certain habitat helps predict what is in similar habitats elsewhere, imaging systems (sound and light). Species description. Involve CoML projects, publication of special issue with papers on imaging for different taxa and habitat types. Draft a questionnaire and send to Panel for comments – Comments by end of year.
4. Data management across CoML and interacting with other projects. Interactions of OBIS with other communities –need to survey the projects and others about how they use OBIS, what value is added, what problems they have, etc. – David/Ed – CAMERA/Moore Foundation

These ideas will be transmitted to the CoML Scientific Steering Committee for feedback and their input will be used to draft the proposal to the Sloan Foundation for the next grant.

#### Identify potential new Panel members

The identification of new Panel members was postponed until a proposed work plan has been agreed with CoML.

#### Discuss Panel Web site

Panel members agreed that the Panel needs a dedicated Web site. The CoML Technology Web site (see <http://www.coml.org/edu/tech/t1.htm>) is adequate for public outreach, so the Panel does not need to fulfill that purpose. Ed Urban offered to set up a page on the SCOR Web site for the Panel (see <http://www.scor-int.org/TechnologiesPanel.htm>) and Panel members agreed. This page will be linked to the CoML Technology page.

#### Location of next Panel meeting

The location and timing of the 2008 Panel meeting will be determined in the process of putting together the new proposal to the Sloan Foundation.



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Others Attending: Barbara Block (TOPP), Dan Costa (TOPP), Ed Urban (SCOR)

9:00 Objectives of the Meeting, Review of Agenda, and Actions Since Last Meeting – *Elgar de Sa, Ed Urban*

- Review of project renewal proposals
- Review of Methodologies Report
- Session on Technology at Auckland meeting
- Papers on visual technologies and satellite communications – not yet completed
- Report on Geolocation Methods Workshop - *Geoff Arnold*
- Action Items from All-Program Meeting and Project Meetings -All

10:30 Break

11:00 CoML Contributions to GOOS – Introduction – John Gunn

Use of animal-based oceanographic data as a data stream for GOOS

- Plans for meeting at Royal Society
- What data are available?
- At what quality and what quality control?
- How is it available

Questions from GOOS

1. Can animal-based observations be used in a sustained, routine and quality-controlled mode or is more R&D needed?
2. Which of the 6 societal goals/benefits of GOOS are they most applicable?
  - a. Improve the safety and efficiency of marine operations;
  - b. More effectively control and mitigate the effects of natural hazards;
  - c. Improve the capacity to detect and predict the effects of global climate change on coastal ecosystems;
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3. Would the data streams improve nowcasts and forecasts that help achieve these goals?
4. What are the applications and who are the users?
5. Have common standards and protocols for measurements and data telemetry been established?

12:30 Lunch

13:30 Development of Panel Work Plan for 2008-2010 (proposal due by Jan. 15)  
Potential topics (based on discussion with Jesse Ausubel and past and current Panel work) – Pick 3-5 of these, or others

- Introduction – Ed Urban
- Animal-based oceanographic data
- Geolocation of animal-based tags
- Image analysis and storage
- Barcoding
- Autonomous Platforms
- Marine Vehicles
- Imaging systems (sound and light)
- Data management across CoML and interacting with other projects
- Passive acoustics

15:00 Break

15:30 Identify potential new panel members

16:30 Discuss Panel Web site

- How could we build onto the CoML Technology Web site (see <http://www.coml.org/edu/tech/t1.htm>)?
- What changes could be made to the CoML Web site to make it more informative?

17:20 Location of next Panel meeting

- 2008: USA, South America, Africa?

18:00 Adjourn Meeting