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## **Research and Monitoring of Marine Reefs Using Volunteer Divers**

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**Fisheries Centre, University of British Columbia, Canada**

# RESEARCH AND MONITORING OF MARINE REEFS USING VOLUNTEER DIVERS

*Proceedings of the North American Practitioners Workshop  
Held in  
Sidney, British Columbia, Canada  
20-22 June 2002*

*Edited by  
William Seaman, Brian Smiley, Tony Pitcher  
and Louisa Wood*

*Sponsors:  
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Science Branch  
Florida Sea Grant College Program, University of Florida  
University of British Columbia Fisheries Centre*

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# RESEARCH AND MONITORING OF MARINE REEFS USING VOLUNTEER DIVERS

*Proceedings of a North American Reef Practitioners Workshop, Sidney, BC, Canada 20-22 June 2002*

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# Director's Foreword

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## Virtue on the Reef

One of my favorite sayings by the pioneer American conservationist, Aldo Leopold is:

*Relegating conservation to government is like relegating virtue to the Sabbath. Turns over to professionals what should be daily work of amateurs.* (Meine and Knight 1999)

The saying contains an element of the disdain of the frontiersman for government, but this is only a superficial view. As always, Leopold expresses not only a deep concern for a continual scrutiny of the natural world and its conservation, but also imputes value and veracity to the observations of amateur naturalists, who, he implies, must act as watchdogs on behalf of all of us. Indeed, an important role for amateur watchdogs for ecosystem-based monitoring and management has been suggested (Pitcher 2000).

Hence, the assumption behind this published report is that well-trained citizens who can make accurate observations of the natural world are a proven asset to scientific research. Such individuals have long contributed to the scientific study of terrestrial wildlife, especially birds, angiosperms and a growing number of littoral and freshwater databases.

Evidently, the workshop reported herein was likely the first formal effort to convene volunteer divers and allied university, governmental and non-governmental organization scientists and managers concerned with North American ocean reefs and sub-tidal habitats for an exchange of technical information. For human-made reefs designed to mitigate anthropogenic depletions (Pitcher and Seaman 2000), monitoring the progress of settlement and biodiversity is a critical task that is, unfortunately, rarely covered satisfactorily in the costs of reef design and emplacement. It is here that members of the public can make a valuable contribution.

The invited workshop participants reflected a

representative sample of the dedicated work being conducted underwater and on land to characterize reef habitats and organisms. The aim was to begin in a modest way to bring this audience together, in a small group, in order to determine the feasibility and foundation for larger and more encompassing such meetings in the future, should the outcome of this workshop in Sidney, British Columbia in June 2002 be as desired. The conveners are grateful for the positive response of the attendees, and with some confidence anticipate additional such assemblies. That the workshop met or exceeded expectations is gratifying (see evaluation of the workshop in Appendix Four).

Sponsors of the workshop were the Science Branch of the Canadian Department of Fisheries and Oceans, Florida Sea Grant College Program at the University of Florida, and the Fisheries Centre at the University of British Columbia.

In addition, we especially acknowledge the service of the two workshop rapporteurs, Andrea Coombs and Amy Poon, both of the University of British Columbia Fisheries Centre. The Institute of Ocean Sciences, Canada Department of Fisheries and Oceans, provided facilities in Sidney, Vancouver Island, British Columbia for the meeting. James Cato, Florida Sea Grant College Program, provided partial funding for travel expenses to enable three volunteer divers to attend. Jackie Whitehouse, University of Florida, typed parts of the document and assisted with formatting.

The Fisheries Centre Research Reports series publishes results of research work carried out, or workshops held, by the UBC Fisheries Centre and its partners. The series focusses on multi-disciplinary problems in fisheries management, and aims to provide a synoptic overview of the foundations, themes and prospects of current research. Fisheries Centre Research Reports are distributed to appropriate workshop participants or project partners, and are recorded in the Aquatic Sciences and Fisheries Abstracts. A full



Aldo Leopold (1886-1948), shown in the 1930s, with simple wildlife sampling device.

list appears on the Fisheries Centre's Web site, [www.fisheries.ubc.ca](http://www.fisheries.ubc.ca). Copies of the reports are sent to all meeting participants, and all papers are available for free download from our web site as PDF files. Paper copies of the reports are available on request for a modest cost-recovery charge.

**Tony J. Pitcher**  
*Director and Professor of Fisheries*  
*UBC Fisheries Centre*

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**Participants** at the reef practitioners workshop in Sidney, BC, June 2002. *From left to right:* Bill Seaman, Erika Boulter, Sean Melvin, Kevin Conley, Bill Austin, Tom Tomascik, Doug Biffard, Glen Jamieson, Amy Poon, Brenda Burd, William Lindberg, Lex Waters, Dana Haggarty, Tex Enemark, Christy Pattengill-Semmens, Bryan Nichols, Marc Dillon, Brian Smiley, Jeff Marliave, John Perkner, Noelle Barger, Jeff Marliave, Susan Francis, Rob Russell, Katia Freire, Andrea Coombs. *Missing from photo* are Jim Cosgrove and Gerry Fletcher.

## Introduction and Summary of the Workshop

**William Seaman and Brian Smiley**  
*Florida Sea Grant & DFO, Canada*

The North American Practitioners Workshop on *Research and Monitoring of Marine Reefs Using Volunteer Divers* brought together recognized, established interests from Canada and the United States. Their common goal was the accurate observation and reporting of ocean reef habitats, organisms and systems. During the meeting 20-22 June 2002, exchanges of technical information via presentations and discussion took place, complemented by underwater sessions on 22 June. In this section we describe the workshop's purpose, some of the principal subjects, and the format of this document.

### Purpose

The workshop provided an opportunity for "practitioners" to meet and collaborate as biologists and scientists who have first-hand experience and current interests in volunteer-based research and monitoring of natural and designed ocean reefs and other marine habitats around the United States and Canada, for the purpose of improving the utilization of recreational divers as "citizen scientists" in augmenting basic and applied scientific knowledge of sub-tidal habitats. Objectives of the workshop were:

- To build an expanded network of international colleagues and friends who are active in scientific activities involving regular data collection by volunteer divers;
- To outline projects, programs and other initiatives--past, current and planned;
- To exchange first-hand knowledge and practical experience about accomplishments and lessons learned about methodologies, training, coordination, reporting, funding and other topics;
- To identify opportunities for future collaboration and partnering;
- To agree on some next steps to be taken in the months following the workshop.

As the first formal program in North America to address this subject, the workshop was convened on an invitational basis. A cross-section of experienced programs thus were afforded the opportunity to meet for an extended period in a small-group setting. Following the agenda listed in Appendix One, a keynote presentation first

challenged attendees to consider the ways in which data from field observations ultimately were analyzed and applied. Invited presentations then profiled experiences, successes, shortcomings, and the needs and issues of nine Canadian and United States organizations. Ample time for discussion was provided throughout both days, with two rapporteurs capturing the information. Finally, three sessions dealing with study objectives and design, logistics, and data analysis and reporting were conducted as roundtable discussions.

### Reader's Guide to the Proceedings

The papers in this volume are "extended abstracts," and as such are concise enough that we do not need to offer complete summaries here. Rather, this section indicates some of the subjects covered by them, in order to give the reader a sense of the breadth of material covered. There is no handbook that reviews and discusses organizing and operating a generic volunteer ocean dive program. However, in concert these papers offer a wealth of information toward such a purpose.

The keynote presentation by W. Lindberg set a collegial tone for the workshop by challenging divers who assess underwater environments to consider how the data they acquire are ultimately used in scientific, educational and resource management situations. An example of a successful volunteer-based program from a non-ocean setting was described. Its attributes included a long-term and accessible database, and volunteers equally as proficient as professional biologists in making observations.

Meanwhile, nine case studies of volunteer-related efforts at various stages of development reflected marine habitat observations in British Columbia and the states of California, Florida and Washington. (According to the definition of "monitoring" offered in the keynote paper, not all observing is monitoring.) For each paper, the reader might ask a series of common questions about their content, as follows:

- **What is the motivation for the volunteer effort?** Common to the efforts reported is an attempt to provide education for the volunteer citizen divers, who bring with them high curiosity for ocean subjects. In one case, another factor was presented by R. Russell: the reality of budget cutbacks in a governmental agency necessitates enlistment of volunteers to carry on essential habitat monitoring, to supplement shortfalls in professional staffing.

- **What are goals and objectives of observing/monitoring?** For both natural reef and human-made reef settings, purposes of assessment include description of baseline conditions and measurement of colonization and restoration success. As succinctly stated by N. Barger in describing monitoring of the HMCS Yukon, a Canadian ship purposefully sunk as a human-made reef in California, "Without proper study and evaluation we have no way to accurately assess the impacts of this new reef."

- **How are volunteers organized, trained, and retained?** Some elaborate materials and procedures have been developed, such as training videos, guided field trips and scuba instructional modules on scientific diving. Volunteer divers are not only adults assigned to monitor; secondary school students transplanted eelgrass in British Columbia, as described by D. Biffard.

- **What do volunteer dive practitioners do in the field?** Observe and record! For almost a decade "fish watchers" have been trained by the Reef Environmental Education Foundation. As an example of the large amount of data that can be acquired, 415 invertebrate surveys have been completed in a Pacific Northwest project described by D. Haggarty and S. Francis.

- **How reliable are the data? How are datasets managed?** These are issues of concern to everyone. B. Smiley and B. Burd assessed the sources of bias in field data, and make 19 recommendations about the quality and content of diver training and the level of workload for any observer, professional or volunteer. The biggest challenge facing reef research divers in Florida is to build a strong connection to the scientific community, report Perkner, Waters and Dillon.

**How are results of monitoring used?** Data from 596 dives during annual "Lingcod Egg Mass" surveys yielded basic fishery science statistics (e.g., catch per unit of effort) from fishery-independent studies. In turn, the data agree with government findings used to manage fishing activities in British Columbia, reports J. Marliave.

- **What are the benefits of volunteer diver programs?** Consistently the papers in this report cite learning and increased awareness of marine issues as results of volunteer dive programs. Furthermore, C. Semmens describes the publicly accessible database that is available via Internet for interested public and private interests.

- **Are there issues, needs and problems facing volunteer diving?** Of course. Retention of volunteers and affirming their importance are

two of them. Another is matching the workload to the skills of volunteers, as reported by B. Nichols in solving problems of invertebrate species group identification. A digest of issues is described in Appendix Three.

- **How do we learn more about the project?** In some cases websites are listed in individual papers. Contact information for all presenters is given in Appendix Two. Gradually a North American network for volunteer diving for scientific purposes is emerging.

By offering this list of questions, the editors hope to provide a framework with which not only the programs reported in this volume but also other volunteer practitioner efforts may be examined in a consistent and comparable fashion. This is commended particularly to work planned or just starting.

Recognition of the important role of volunteers in marine reef science has grown to the point where governmental agencies incorporate them into monitoring programs, as reflected by three presentations of Fisheries and Oceans Canada and British Columbia Parks. Five other presentations were made by private organizations, and one was given by a public institution.

Complementary to the formal presentations were extensive discussions: the reader is referred to the detailed record in Appendix Three. In sum, workshop participants addressed issues concerning the objectives of undersea projects, as well as their logistics and the reporting of findings. According to the interests of volunteers, managers and scientists involved, the objectives of projects may vary and be multi-faceted (e.g., environmental conservation, hypothesis testing). Retention and training of volunteers drew considerable attention from workshop participants, and Appendix Three supplements the ideas presented in the papers. The value of building partnerships among divers, academia and government was stressed. There is debate over whether field methods can ever be standardized, although comparison of different studies is a strong area of interest. Pilot studies are regarded as an effective way to develop longer term studies. Accessibility of data is a priority, with the Internet viewed as an important tool. Finally, the role of what attendees called a "blender" was emphasized, in terms of having a leader in each volunteer organization who could devote significant time to coordinate field work, partnering, and reporting of findings to both lay and scientific audiences.

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## KEYNOTE PAPER

### Data Rich and Conclusion Poor: How Can We Learn More for the Effort?

**William J. Lindberg**

*Department of Fisheries and Aquatic Sciences,  
University of Florida*

Volunteer divers are action-oriented. Marine resource managers need fisheries independent data, some of which can only be collected underwater. Many foresee public-private partnerships with volunteers monitoring artificial and natural reefs more cost-effectively. Two goals for these partnerships would be to foster public stewardship and to supply data needed for resource management. For this potential to be fully realized, data must be consistently collected and adequately structured. If not, well-intentioned efforts may leave us data rich but conclusion poor.

The purpose of this paper is three-fold: (1) to contextualize data collection for both science and management, (2) to describe an example of effective volunteer monitoring, and (3) to offer suggestions for volunteer reef monitoring programs. The insights shared below come from 18 years of artificial reef research and the wisdom and experiences of valued colleagues.<sup>1</sup>

#### Research Background

Since 1990 my artificial reef research has been concentrated on the Suwannee Regional Reef System of Florida, a 40-km tract of 22 reef sites in the northeastern Gulf of Mexico. These reefs were constructed as an experiment in which habitat complexity was controlled and habitat patchiness was manipulated. The target species was gag grouper, *Mycteroperca microlepis*, although the fish assemblage had 85 species. Results of six studies to date indicate that reef fish production depends on prey from the surrounding soft-bottom and pelagic compartments of the system; gag growth and condition is affected by reef patchiness; gag select habitat primarily for shelter; shelter limits local densities of gag which,

in turn, regulates individual growth dynamics; juvenile-to-adult gag show a homing capacity and remain resident for an average of 9 months; and suitable shelter is sparsely distributed within naturally occurring hard-bottom habitat. All this has led us to hypothesize that juvenile-to-adult gag experience a shelter-related life history bottleneck in their transition across the shallow continental shelf of the region. To test this hypothesis, we now have pending federal reef permits and state reef construction funding to develop a 260-km<sup>2</sup> Fisheries Management Area in the northeastern Gulf of Mexico.

Our research has mostly been process-oriented, developing an ability to predict what will happen when artificial reefs are built as fisheries management tools. Such studies are generally beyond the scope of volunteer divers, unless closely directed by scientists using reefs built with an experimental design in mind. As noted in the next section, university researchers often concentrate on these types of studies, but they are not the only types needed for effective resource management.

#### Science in Support of Management

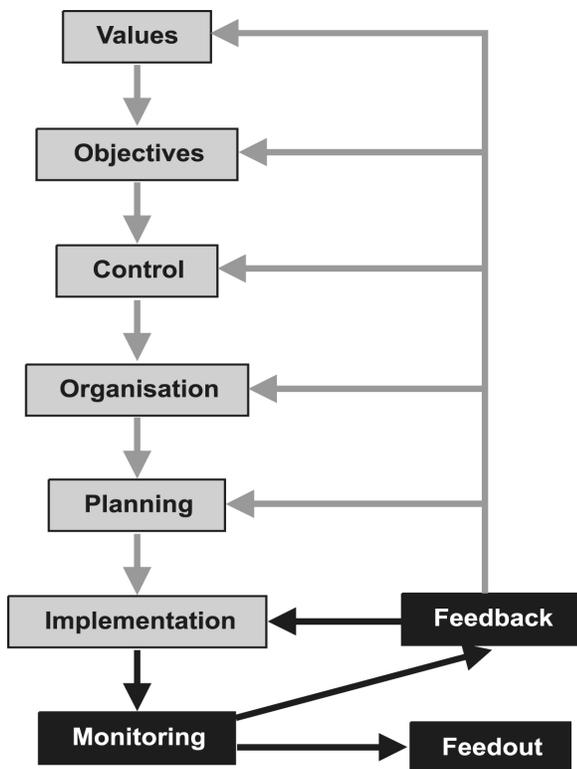
There are five types of studies needed for effective resource management. All provide important information and knowledge, and a balanced portfolio of studies is essential for science-based management. The different study types include:

- Inventories – “snapshots” of what exists at a given place and time, qualitatively or quantitatively;
- Baseline studies – “movies” of how the quantitative inventories vary over time, without expectations of specific changes;
- Process studies – scientifically testing cause-and-effect relationships, often through experimentation, to understand the mechanisms underlying patterns in nature;
- Predictive studies – the “pointy end of understanding,” forecasting changes in response to perturbations or management actions, using quantitative models of various kinds;
- Monitoring – assessment of and accountability for management actions, i.e., is the system behaving as predicted or within acceptable norms?

In reef studies, the term monitoring has often been used to describe inventories and baseline studies rather than the more rigorous meaning implied above. Process studies are steadily moving toward predictive capabilities, yet they

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<sup>1</sup> Dr. Chuck Jacoby provided the framework for relating science, management and monitoring. Dr. Dan Canfield created and directs Florida LAKEWATCH, an exemplary volunteer monitoring program. Dr. Bill Seaman has regularly stimulated collegial discussions related to artificial reef monitoring.



**Figure 1.** Steps in resource management with monitoring for evaluation and accountability.

need to be grounded in a stronger foundation of baseline data to be more generally applicable. This could be a significant contribution of volunteer efforts.

### Attributes of Effective Management

As depicted in Figure 1, monitoring in the more rigorous sense mentioned above entails an assessment of whether or not a planned management action, once implemented, has had the desired effect. The feedback loop from monitoring allows management to be adjusted at any or all of several different steps, possibly resulting in modified plans and actions, followed by further monitoring. Of course, the dissemination (“feed-out”) of results to the accountable authorities and public can reinforce or redirect management efforts. Effective monitoring is essential to effective resource management, which responds to the evolving state of knowledge and changing conditions of the resource.

Elements of effective monitoring include: clear management objectives, standardized methods, credible sampling designs, quality assurance/quality control (QA/QC) protocols, database management, validated models into

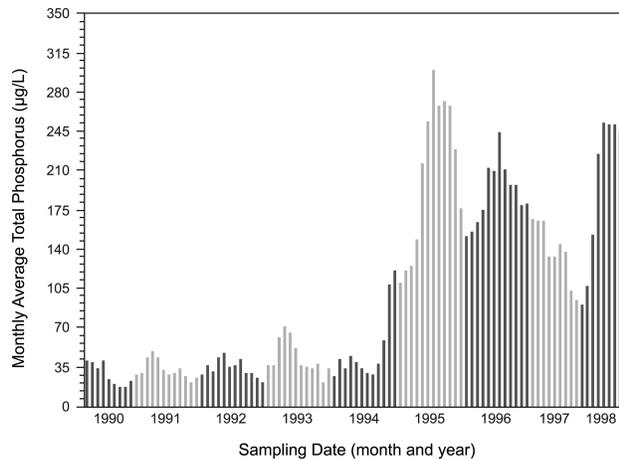
which the data are entered, defined triggers for results to prompt management actions, and feedback/feed-out mechanisms so the results have utility in resource management decision-making. Without specific objectives, validated models and defined triggers, the data collection and data management by volunteers is more likely to serve as a baseline study for future management actions, which nonetheless is an important function.

### An Exemplary Volunteer Monitoring Program

To illustrate an effective volunteer program I am highlighting the Florida LAKEWATCH Program for citizen water quality monitoring of Florida lakes and rivers<sup>2</sup>. The reader is referred to [www.lakewatch.ifas.ufl.edu](http://www.lakewatch.ifas.ufl.edu) for more thorough coverage. Since its inception in 1986, Florida LAKEWATCH has expanded steadily to include in its database monthly sampling results from over 600 lakes. This university-based program represents 18% of all water quality monitoring in the State of Florida, second only to the Florida Department of Environmental Protection at 28%, and greater than that of 40 other monitoring entities. Clearly, volunteers can contribute great amounts of data cost-effectively.

Granted, training citizens to properly collect and handle water samples and measure Secchi depths may not be as challenging as training divers to consistently identify and enumerate reef fish, but the principals are the same. To be credible, the proficiency of volunteers should approach that of professionals. The water quality measurements taken by LAKEWATCH volunteers correlate to those taken by professional biologists with an  $R^2 \geq 0.97$  for all parameters, which reflects effective QA/QC. To be useful, the data must be consistently gathered for the same sites over an extended period. As seen in Figure 2, a long time-series of data allows one to distinguish natural variation from changes coinciding with management actions, in this case the introduction of sterile grass carp for aquatic weed control. To be sustainable, professional staff must be committed to volunteer training, feedback and feed-out. Five regional LAKEWATCH Coordinators work as a team to give personal attention to their cadre of committed citizens. Program publications educate and empower volunteers to be engaged in decisions affecting their water bodies.

<sup>2</sup> This is safer than highlighting any one constituent group of volunteer reef divers!



**Figure 2.** Water quality, expressed as total phosphorus, in Lake Redwater (Putnam County, Florida) as sampled by volunteers.

LAKEWATCH produces a variety of educational materials for volunteers and lake dwellers alike. To be useful, data must be accessible. Scientists regularly publish in the peer-reviewed literature using data generated by LAKEWATCH volunteers, and the entire database is archived in the University of Florida Science Library. The program does not take advocacy positions on management issues, but rather serves as a forum for opposing positions to be heard and evaluated openly with respect to the available data. When necessary, LAKEWATCH Coordinators facilitate a modified American assembly process that yields agency-accepted lake management plans, based on science, with minimal conflict.

### Summary of Recommendations

- Establish lasting public-private partnerships;
- Match the scope of the objectives and the capabilities of the volunteers
- Use a selection of “standard” methods, without becoming dogmatic
- Plan and follow study designs to ensure proper structure for the questions being asked
- Network into a database that is adequately maintained and accessible (e.g., GIS)
- Take reasonable QA/QC seriously, again without becoming dogmatic
- Balance data input and educational feedback efforts
- Use the data in scientific publications
- Engage the resource managers, and get them involved
- Have fun. After all, we’re talking about volunteers!

## TECHNICAL REPORTS

### The Yukon Artificial Reef Monitoring Project

**Noelle Barger**

*San Diego Oceans Foundation*

This paper reviews experiences from development of the Artificial Reef Monitoring Project on the HMCS Yukon. Current data are not provided, but rather how we chose our methods and trained volunteer divers.

#### Background

The San Diego Oceans Foundation (SDOF) sank the HMCS Yukon in 100 feet of water, 1.85 miles off Mission Beach, California as a haven for sea life, an attraction for scuba divers, a platform for environmental education, and a research site for marine scientists.

Commissioned in 1963 as a Canadian Mackenzie-class destroyer escort, the HMCS Yukon is approximately 366 feet in length, 80 feet tall from keel to tower, and 42 feet wide amid ships. The hull is composed of steel plate while the superstructure and upper decking is aluminum.

Prior to being scuttled, the Yukon was cleared of all debris and hazardous materials. After passing rigorous EPA inspections, access holes were cut throughout the ship and the Yukon was towed out to the site to be scuttled. Unfortunately, the ship took on water while being transferred to the sink site and just hours later the HMCS Yukon sank prematurely on July 14, 2000. The vessel is resting on her port side pointing due north – ironically exactly where she was intended to be.

#### Significance

Monitoring the Yukon is an essential part of its creation as an artificial reef. Without proper study and evaluation, we have no way to accurately assess the impacts of this new reef. Are new fish populations being created – increasing the number of species overall, or is the reef only attracting and concentrating fishes from other areas? Because artificial reefs may have a strong negative impact, data are needed to make valid judgments to lay this controversy to rest.

## Objectives

The main objective of this study is to determine the rate of colonization by fishes, invertebrates, and plants, and to determine if fishes remain resident or if they travel between reefs. An advisory team of scientists was created to oversee the project and to provide ongoing consultation regarding data collection and analysis. Observations and samplings are being conducted in two phases: phase one will examine the Yukon and phase two will incorporate the other ships and natural reefs in the area.

By involving members of the local community in direct participation in this research, we enhance public knowledge and understanding of the marine environment, the effects of human activities on marine species, and the need for responsible and sustainable use of the resources we share. We hope to make significant contributions in artificial reef research in the following ways:

- To describe the movement of fish between artificial reefs and natural reefs
- To describe the colonization of the vessel by fishes, invertebrates, and plants
- To undertake the monitoring program with sufficient scientific support for publication of the results in peer reviewed journals
- To use reef research as a method of educating others about the importance and utilization of artificial reefs

## Considerations

While developing the research project, there were many considerations to consider, including, diver experience, diver safety, and the logistics of the dive site. The Yukon is a deep dive with harsh conditions (i.e., it's disorienting, extremely cold, and has heavy surge). Research methods had to be safe and simple to reduce diver task-loading but also needed to be scientifically credible to address our study objectives. Two methods were chosen based on the Yukon limitations: permanent transect surveys and permanent quadrant surveys.

## Methods

Fish surveys are comprised of visual transects 20 m long by 4 m wide and were adapted by methodologies described by AIMS (1997). Four permanent stainless steel cables are being placed on the Yukon in the following areas: bow, bridge, starboard hull, and stern. The observer moves along the transect and counts pre-selected fish

species and numbers. The species include: black surfperch (*Embiotica jacksoni*), white seaperch (*Hyperprosopon argenteum*), pile surfperch (*Damalichthys vacca*), rubberlip surfperch (*Rhacochilus toxotes*), blacksmith (*Chromis punctipinnis*), garibaldi (*Hypsypops rubicundus*), sheephead (*Pimelometopon pulchrum*), senoritas (*Oxyjulius californica*), rock wrasse (*Halichoeres semicinctus*), kelp bass (*Paralabrax clathratus*), barred sand bass (*Paralabrax nebulifer*), halfmoon (*Medialuna californiensis*), sculpins (*Scorpaena guttata*), rockfish (*Sebastes sp.*), cabezon (*Scorpaenichthys marmoratu*). The observer records the species on a slate, then submits data via an online report form.

Besides the importance of reducing among-site variation, advantages of permanent transects include reduced diver task loading (the volunteers do not carry reels or extra equipment) and the opportunity to evaluate variability resulting from differences at the same site for the same diver over time, and among-diver variability. These sources of error are rarely evaluated. The disadvantages of installing permanent transect lines mostly involve logistical problems such as drilling through warship-steel with limited equipment and resources; transect lines become camouflaged with algae, which are difficult for new divers to locate; and the tendency for divers to hold onto the line during conditions with heavy surge, which damages surrounding marine life. The advantages of having permanent transects outweigh the disadvantages as the disadvantages have solutions: C&W Diving, an underwater engineering company has been contracted to install the remaining lines; algae is scrubbed off the transect lines every month by a local dive club; all transects will be marked with small lobster buoys for better identification. The only disadvantage that cannot be solved is the damage divers inflict to surrounding marine life, and here we have made large improvements by careful training and selection of competent divers.

Sessile benthos surveys comprise quadrants made out of PVC pipe. Forty (2' x 2') quadrants will be placed in groups of ten in four distinct areas of the Yukon to account for vertical/horizontal planes and seaward/leeward currents. The areas include the bow, bridge, starboard hull and the stern. Each quadrant will have a number associated with it and can be identified using a combination of its location and individual number (e.g., Bow1, Bow3). These numbers are plainly visible on the top of the quadrant. These quadrants will be photographed over time to allow us to observe changes in the sessile benthos

communities. Initially the quadrants were attached to the ship using splash zone epoxy. This epoxy failed and all forty grids fell off the ship. Currently C&W Diving is reinstalling the quadrants using rods to weld them onto the hull.

### Data Analysis

An essential aspect of the Artificial Reef Monitoring Project is its connection to the scientific community. All data are reviewed by the Project's Advisors, Dr. Paul Dayton and Dr. Ed Parnell of Scripps Institution of Oceanography. Drs. Dayton and Parnell also provide ongoing consultation and program review. Before data are submitted to Drs. Dayton and Parnell, they are reviewed by SDOF staff for quality control. The staff interview each volunteer to verify that the data they submitted are accurate.

### Training Volunteers

The San Diego Oceans Foundation hosts free training workshops once a year at the Birch Aquarium at Scripps. Species identification training is taught using slide shows and guided identification tours through the aquarium. Research techniques are taught by Dr. Ed Parnell. Wreck diving safety procedures are taught by PADI Instructor, Quincy Morris. Research-specific underwater sign language is taught by Seassigns Instructor, Laurieanne Askinazy. Volunteers are shown a video entitled "Research Made Easy ~ How to Monitor the Yukon's Garden" which was produced by the Foundation. Aside from the free training workshop, all volunteers have the opportunity to take the PADI "Yukon Research Diver" Specialty Course where they gain hands-on diving experience. The Course involves a pool session, two open water dives, and reviews all research techniques. To date 154 divers have been trained. Roughly 10% have collected data.

### Volunteer Incentives

- All volunteers receive laminated diver identification cards that provide dive and merchandise discounts at local operations.
- All workshop and training sessions are provided free of charge.
- A Yahoo email group was established so that the dive boat operators could email the volunteers concerning dive openings.
- Fish identification flash cards were created so the divers could study at home. Online resource tools were made available through our web site.
- Provision of routine weekend open water

"one-on-one training".

### Conclusions

The San Diego Oceans Foundation has successfully bridged the gap between the volunteer and scientific communities. The volunteers collect the data. The Foundation reviews and checks the data. Drs. Dayton and Parnell write up the material for submission to peer reviewed journals. In this fashion, all data are analyzed, published, and made accessible to the public. One possible shortcoming is that we have not been able to assess the value of the data we are asking the volunteers to collect. Volunteers are unsure of the worth of the trove of information they are gathering, and therefore they may be unenthused about participating. The biggest challenge we are facing is maintaining volunteer interest.

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## Project Emerald Sea: Volunteer Restoration and Monitoring of a Highly Disturbed Estuary

**Doug Biffard**

*British Columbia Parks*

### Project Description

SeaChange Marine Conservation Society along with government and community partners developed and implemented a project to restore eelgrass (*Zostera marina*) habitat in Tod Inlet within Gowland Tod Provincial Park, British Columbia. The project was initiated in 1998 and is ongoing. The main goals of the project are:

#### *Education*

- Provide hands-on education for young people
- Increase public awareness of the values of eelgrass and of Tod Inlet

#### *Conservation*

- Gather knowledge
- Take actions to reduce detrimental impacts

#### *Restoration*

- Restore eelgrass community

Key roles for the project partners were:

*SeaChange*: initiated the project, secured funding, convened the necessary science and community partners, recruited and organized volunteers.

*Fisheries and Oceans Canada*: provided a modified ReefKeepers protocol for eelgrass monitoring, provided science staff to train and supervise volunteer divers.

*Cynthia Durance (consulting biologist)*: provided expertise on eelgrass restoration including donor and transplant site suitability, transplant techniques and monitoring protocols, assisted transplant.

*Stelly's Secondary School*: Clint Surry and his students volunteered to carry out the post-transplant monitoring using the modified ReefKeepers protocol.

*Community Volunteers*: a variety of professional and non-professional people volunteered and lent equipment to help with the many tasks required to carry out the project.

## Methods

The project consisted of three phases: pre-transplant habitat surveys, eelgrass transplant and post-transplant monitoring.

### *Pre-transplant Habitat Survey*

A visual shoreline survey was conducted to identify existing eelgrass beds and potential transplant sites. This was followed up with diver surveys to inventory eelgrass communities at both donor and control sites and to confirm transplant site suitability. This work required at most six divers and a small surface support team of two or three persons.

### *Transplant of Eelgrass*

Sprigs of eelgrass were hand picked from the donor site by divers, processed for out planting, then planted by divers along three 20 metre transects at three sites. The transects were laid out at an angle to the shoreline starting just below the lowest tide to a depth of about 4 metres. Three different anchoring techniques were used to plant the sprigs at 1-metre intervals along the transects. The three techniques were: individual sprigs tied to steel washers; 5 sprigs tied to 20-cm section of steel rebar; or bare root. The anchor types were alternated along each transect. The 2-day transplant event required a substantial number of participants including up to 12 divers plus 2 dive supervisors and a 2-3 person surface support crew, as well as a shore crew of almost 20 people preparing the sprigs and attaching them to the anchors.

### *Post-transplant Monitoring*

The objectives of monitoring were :

- to determine the most suitable anchoring technique, and;
- to verify the successful establishment of an eelgrass community by measuring (1) plant density, (2) plant length and blade width, and (3) community composition

Divers (mostly Stelly's Secondary School students) worked along each transect sampling at predetermined random quadrat stations to measure eelgrass density and growth at both transplant and monitor sites and record anchor type (transplant sites only). The biological community composition was surveyed using the modified ReefKeepers protocol. The divers swam each transect 3 times, noting fish and other pelagics on the first pass, highly motile invertebrates on the second pass, and finally, sessile invertebrates on the third pass. In addition, five random quadrat stations per transect were sampled to more accurately account for benthic organisms. Monitoring events were conducted at 17 weeks and 31 weeks after transplant. Including the monitor site, there were 12 transects. Ideally, each dive team of 2 divers would survey 2 transects; hence a monitoring event required 12 divers plus support crew and supervisor.

## Results

With respect to the three project goals, there was indeed excellent community participation in and appreciation of the project; and new eelgrass communities were indeed established. The project spurred interest in various groups to conduct other baseline investigations in Tod Inlet, such as marine habitat mapping and bivalve inventory. Much more is now known about the marine environment of Tod Inlet.

The post-transplant monitoring was partially successful and provides a good illustration of the contribution that volunteer recreational SCUBA divers can make to scientific studies. Most importantly, the volunteer diver plays a unique role in relating human experience to non-divers. Project divers were able to share stories with park visitors of juvenile crabs moving into the newly planted eelgrass beds. The divers were able to confirm successful transplant and colonisation by other organisms. More specifically, the divers were able to follow the modified ReefKeeper protocol involving the 3-pass transect swims.

Activity	Scientific Diving Experience
3 pass transect swim	Beginner
Simple quadrat study	Intermediate
Multi method or complex quadrat study	Advanced

With sufficient replicates spaced over time, a valid time series data set could be developed. The random quadrats for benthic species counts were more difficult for volunteer divers to perform due to difficulties with buoyancy control, fatigue and chilling (the quadrats were done by the same dive teams after completing the 3 pass swims).

The experimental design to determine the best anchoring method and to monitor plant density and growth simply did not work. This is probably an example of what might work on land does not work in water. The design relied heavily on very accurate repositioning of the transect line for each monitoring event – on soft substrates this is not easily achieved. (The transect lines could not be left in place due to concerns with boaters or others pulling out the lines and eelgrass along with it.) In addition, Canada geese grazed on the transplanted eelgrass with the result of moving the washer anchored plants throughout the transplant site.

#### For Next Time

- Match the data collection activity with the divers' experience, for example:
- Do not overload the dive teams with too many activities in one monitoring session. A volunteer diver can work for about 30 to 40 minutes before fatigue sets in regardless of depth or air supply. More data with better integrity would have been collected if the dive teams were assigned either swims or quadrats but not both.
- Consider time series data collection designs that do not rely on accurate repositioning of quadrats or transects. Even if a permanent transect line can be established it is quite likely to go missing – experimental design should anticipate this.
- Consider a pool training session prior to field work. Most recreational divers do not have the buoyancy control skills to collect data and avoid damaging benthos. Divers should also learn to work in a vertical, head down position to collect quadrat data.

Irrespective of these drawbacks, the volunteers of Project Emerald Sea succeeded in restoring

eelgrass communities, raising public awareness and collecting valuable ecological knowledge. The enthusiasm and dedication of volunteers should continue to be matched by conservation management professionals through the development and refinement of monitoring programs that contribute to scientific knowledge and that can be implemented by volunteers.

## The Living REEF Project: Monitoring Invertebrates in a Fish-Monitoring Project

**Dana Haggarty and Susan Francis**  
*Living Oceans Society & Breathe Underwater*

### Background

The waters of British Columbia, Canada and the Pacific Northwest United States team with life. The marine life of this region is among the most diverse in the world. The Living Oceans Society ([www.livingoceans.org](http://www.livingoceans.org)), committed to the preservation of marine biodiversity, and the Reef Environmental Education Foundation (REEF) ([www.reef.org](http://www.reef.org)) collaborated to develop a sub-tidal monitoring project for this region: the Living REEF Project (for further information about REEF, see paper by C. Semmens in this volume). REEF started training divers and snorkellers to identify and collect data on fishes in 1993 in Florida and the Caribbean. In 1998 REEF expanded the fish watching program to the Pacific Northwest and British Columbia (BC). After an initial pilot project, the Living REEF Project was created, and with Living Ocean Society's help, the region's fish program was refined and officially launched. In 2001, the Living Oceans Society developed an invertebrate program to serve as a companion to the region's fish monitoring project.

### Focus on Invertebrates

Invertebrates such as colourful anemones, starfish, and sponges dominate the landscape seen by divers in the Pacific Northwest. Whereas tropical divers spend most of their time looking at fishes seen against a backdrop of invertebrates, invertebrates are predominant in cold water. Divers in the Pacific Northwest study common invertebrates and search for rare invertebrates. The invertebrate monitoring project arose from our desire to monitor invertebrates as well as

fishes, and thanks to the urging of our volunteers, eager to learn more about these fascinating spineless creatures so apparent to underwater naturalists. By monitoring invertebrates as well as fishes, we hope to develop a clearer understanding of the marine environments. We also saw a need to establish good baseline data sets, track changes over time, collect fisheries independent data on key invertebrate species, identify habitats of interest, and to educate the public about the marine biodiversity.

We used the following list of criteria to choose the species to monitor:

1. *Identifiable/distinctive*: Every species on the list had to be easily identified by amateur naturalists with minimal training. If a species could be confused with another similar species, either the volunteers were taught how to distinguish them or the similar species were lumped and monitored together. Two examples of taxa that we lumped together are cloud sponges (*Aphrocallistes vastus*, *Chonelasma calyx*) and plumose anemones (*Metridium sp.*)

2. *Representative*: We also wanted the monitoring list to represent the great diversity of habitats and phyla encountered in the waters of the Pacific Northwest. Eight phyla, numerous classes and families, and 44 species inhabiting a wide range of habitat types are covered in the list.

3. *Common and distinctive*: Some species were chosen merely because they are common, distinctive and divers are likely to find them. In many cases, divers will already be familiar with them and eager to learn more. For instance, divers love nudibranchs, so we added a few extra to keep our volunteers happy!

4. *Indicators*: Zacharias and Roff (2001) consider two types of indicators: composition and condition indicators. The presence or abundance of composition indicators are used to characterize a particular habitat or community. Condition indicators, also called bio-indicator and sentinel species, are species used to monitor the condition of habitats, communities or ecosystems as they may be vulnerable to anthropogenic change (Zacharias and Roff, 2001). Pink hydrocorals were included as a composition indicator of current-swept rocky habitats, while spiny pink sea stars, predators of clams, are indicators of sandy bottoms and clams that are usually not visible to divers. Sand dollars are condition indicators that have been shown to be sensitive to sediment pollution (Castillas *et al.*, 1992).

5. *Conservation value*: Species that are, or are at risk of becoming, endangered, overexploited or

damaged by human activity are another key monitoring group. Examples include the endangered northern abalone; cloud sponges that are vulnerable to damage by divers, anchors, and dragging; and several species that are recreationally or commercially harvested. Fisheries-independent data help to monitor the health of populations.

6. *Unique/Cultural or economic value*: Species with unique qualities or which have cultural or economic value due to recreational or commercial catches. For instance, the gumboot chiton is the largest chiton in the world and was a traditional food source of coastal First Nations.

7. *Species interactions*: Species that may play a significant role in structuring communities. These may be important predators, herbivores or species that provide physical structure for other organisms to live in or around. These are often termed keystone, foundation or focal species (Zacharias and Roff, 2001). Examples from our list include the sunflower star, an important predator of many invertebrates; the red sea urchin, an important grazer of macroalgae and prey of sea otters; and chimney sponges that provide shelter for many other organisms.

8. *Introduced species*: Non-native species that could disrupt native communities. The green crab, native to Europe but introduced worldwide has devastating effects on communities. Divers are unlikely to see them while diving, but we wanted to educate divers about them as they might find them in the inter-tidal.

## Results and Issues

To date, 415 invertebrate surveys in BC and Washington have been completed and input into the data base. 43 out of 44 species have been found. The green crab is the only species so far not identified.

In training volunteers, we found that many people are interested and attend training while a handful will continue to become avid surveyors. The training itself must be fun and simple with a dual objective of training surveyors and creating environmental awareness. Add stories to the facts. Take them diving. Allow them to visualize the adventures and creatures they may encounter. It also is very important that they know and can see what is happening to the data they collect.

The more user friendly the research method, the better it is. Slates, sheets and even pencils were redesigned to fit Pacific Northwest conditions. Included in the training was at least one guided dive with the trainer. It was found that many who

attended training but did not attend the guided dive, did not perform a single post-training survey. We need to find ways to show these volunteers how easy and fun this programme really is!

Simple tools allow the program to spread once key leaders are identified. Available for purchase is a fishes and invertebrates curriculum with a full slide set. Following up with leaders is imperative. These people need goals to work towards, such as increasing their personal lifetime list of sightings, or reaching the status of a higher level surveyor.

A big challenge is in providing continuity for volunteers, as the ebb and flow of funding leaves them without a key contact person for several months at a time. At these times, many question if the program has ended and stop their efforts. A strength of volunteer programs is the development of personal relationships. With follow up support, motivation stays keen and surveys continue to augment the database.

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## The Annual Lingcod Egg Mass Survey in British Columbia

**Jeff Marliave**

*Vancouver Aquarium Marine Science Centre*

### Introduction

The evaluation of prototype marine protected areas (MPAs) in British Columbia has focused on sportfishing impacts on rockfishes and lingcod. For lingcod, *Ophiodon elongatus*, using volunteer divers to census spawning was initiated in winter of 1994 by the Marine Life Sanctuaries Society (MLSS), following the 1993 designation, under the Fisheries Act of Canada, of Whytecliff Park in West Vancouver as a no-take zone.

### Site

Whytecliff Park borders both Howe Sound and

the Strait of Georgia, an inland sea crossing the US/Canada border, joining Puget Sound in Washington State to form the Georgia Basin ecosystem. The Strait of Georgia has a much greater sea area compared to Puget Sound. The American Fisheries Society has identified Puget Sound as the most problematic coastal region in North America for recovery of depleted marine fish populations. One tool recommended for management of sedentary groundfish populations is the designation and operation of MPAs.

### Fishery

Lingcod underwent biomass reduction from commercial fishing through the last century until the stock in the Strait of Georgia collapsed (at 3-5% of original biomass) in the late 1980s and was closed to commercial fishing in 1990. Sport fishing regulations were instituted in 1990, but the depressed state of lingcod abundance was still a concern when Whytecliff Park was designated as a no-take closure area.

### Project Description

The MLSS designed a data form which was printed on waterproof paper for use by divers. The annual Lingcod Egg Mass Survey (LEMS) was initiated during the third and fourth weeks of February 1994.

Lingcod spawn from December to early April in the Strait of Georgia, with peak egg mass abundance in late February. The behavior of the guarding male and the distinctive appearance of the egg mass are easy for divers to recognize. The male guards the egg mass, which resembles styrofoam, for over a month, until hatching. A four-year female lays an egg mass of about 2-2.5 liters, whereas five-year and older fish lay much larger egg masses. Females at three-years age sometimes spawn, their egg mass being up to one liter volume. In 1995 a measure of egg mass size was added to the data entry, based on whether the egg mass resembled in size a grapefruit (under one liter, from a 3-yr female), a cantaloupe (ca. two liters, from 4-yr female), or watermelon (5-yr or older).

### Diver Participation

The 596 dives undertaken to date during the annual Lingcod Egg Mass Survey were performed by volunteer divers as well as by staff from the Vancouver Aquarium Marine Science Centre. The volunteer divers were enlisted through a variety of sources including dive organizations, stores, charters, magazines, and personal contacts. For

the most part, dives by Aquarium staff have been limited to Howe Sound, whereas volunteer divers account for the majority of dives both in Howe Sound and in other areas of British Columbia. Volunteer divers did not receive any specific training beyond written instructions on how to perform the survey. Additionally, volunteers were asked to sign a waiver absolving the Vancouver Aquarium of any responsibility for injuries incurred while diving. Most volunteers performed more than one survey dive. Between 1994 and 1997, 289 divers took part (including several staff). In 2002, 64 divers volunteered. Feedback has been irregular; 2002 saw the first prompt summary sent out.

In 1996 a grant was obtained so that dive slates could be printed, with the information to be returned to the Vancouver Aquarium for collation. From that time the operation of the survey fell more to the Aquarium ([www.vanaqua.org](http://www.vanaqua.org)) than to MLSS, on the basis of staff availability.

## Results

Direct funding was achieved only for 1996, yet LEMS has averaged 59 dives per year from 1994 to 2002. A grand total of 1,613 egg masses has been documented during a total of 596 LEMS dives (24,698 minutes dive time). The unit of measure is the count per unit effort (CPUE), which is the number of egg masses sighted during a dive, divided by the number of minutes diving, multiplied by 60 (to yield egg masses per hour). The average CPUE for areas outside Howe Sound has ranged in different years from 1.94-5.17, and for dives inside Howe Sound, from 1.77-6.50. Overall average CPUE is 3.92.

Nearly half of the LEMS dives have been conducted inside Howe Sound, which is the only area for which statistical analysis has been possible. No significant difference in CPUE occurred from 1994-1999, but a strong 1995 year-class was recruited to the spawning population and resulted in significantly higher CPUEs of 6.5 and 5.58 in 2000 and 2001. Proportions of watermelon-size egg masses fell in Howe Sound in 2002, indicating that the 1995 year-class had been depleted by sport angling, whereas older lingcod remained abundant outside Howe Sound. This set of observations matches federal creel surveys which have revealed that sport anglers landed mostly legal-sized lingcod outside Howe Sound after 1990, whereas undersized lingcod dominated catches inside Howe Sound, which has the highest concentration of anglers, being adjacent to Vancouver. Depletion of lingcod by

sport fishing has been identified by federal scientists, with the LEMS survey data included as fishery-independent evidence.

## Collaboration

In addition to government fishery data, complementary graduate studies were supported by the Vancouver Aquarium during the late 1990s in order to provide corroborative lines of evidence about lingcod abundance in and around MPAs. In particular, census work on lingcod outside of the spawning season showed similar size and abundance trends compared to the LEMS data, and a diver tagging program showed considerable site fidelity for lingcod in Howe Sound, including no-take zones.

## Outlook

In spring of 2002, Fisheries and Oceans Canada cancelled the annual summer lingcod sport fishing season for inside waters, including Georgia Strait and Howe Sound. The LEMS survey data now provide a baseline for comparison with future trends, following this final closure of the last fishery for lingcod in the inside waters of BC. The reporting of results to volunteers has been more timely this year, and a follow-up inquiry will be used as a basis for amending and streamlining the data entry for 2003.

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## Developing a Marine Species List for Identification by Volunteers: Experiences of the Georgia Strait Alliance Inter-tidal Quadrat Studies

**Bryan Nichols**  
*Georgia Strait Alliance*

## Project Description

The Georgia Strait Alliance (GSA) of British Columbia (BC) adapted the quadrat protocol in the early 1990s based on techniques developed in part to assess the effects of oil spills on intertidal life. In 2000, we streamlined the process to make it more volunteer friendly. The project runs on a remarkably small budget as it requires no fancy equipment, and can be performed almost entirely by volunteers. We presently have data from Cortes Island to Sooke, some going back seven years. GSA provides a part time, seasonal biologist/coordinator and equipment for interested communities.

The objective of the study is to compile baseline data on the inter-tidal flora and fauna of rocky shores in the Strait of Georgia. This can then be used by managers and scientists to assess long and short term changes. Most volunteers are motivated by a curiosity and love of seashore life as well as a desire to better understand and protect their local beaches.

## Issues

Though this study is inter-tidal, it shares many of the issues that hinder sub-tidal studies using volunteers. Balancing data that will make scientists happy with a methodology that volunteers will actually do more than once or twice is a core issue. We addressed this last year by tackling three main issues.

*Issue 1 – Methodology:* The original methodology became vague and somewhat inconsistent over time and geography.

*Solution:* Standardized new techniques were developed that attempted to balance ease of use, quality of data and compatibility with previous work. The changes were introduced and tested successfully in 2001 and a new, detailed manual that tackles grey areas was written and is available for anyone to download. Regional volunteers were assembled for a workshop in 2002 and provided input.

*Issue 2 – Data Use:* Data were not being used.

*Solution:* This is an ongoing problem. The most important solution is a working database, which has proven difficult to finish. There is presently an online version as well as a streamlined portable one, but neither has been completely debugged enough to start running statistics yet.

Another issue which is a problem in BC is compatibility and availability of other data sets. We have been working to integrate our data with other programs such as shoreline inventories, exposure and habitat mapping data, Shorekeeper's surveys and others. Government maps and data (Canadian Hydrographic Service and BC Land Use Coordination Office) are notoriously difficult and/or expensive to obtain, often well beyond the means of volunteer groups.

*Issue 3 – Quality of Data:* The quality of data at the species identification level. There are thousands of invertebrate species that might be found inter-tidally in the Northwest, and unfortunately there is no definitive guide that is accessible to volunteer surveyors. This makes the issue of identifying to the species level difficult. Over the course of the past year I have looked at

three possible solutions. Geographical and logistical differences among our surveyors have inadvertently tested these solutions in the field.

*Solution 1: Do It All!* Train enough volunteers to accurately identify every species they might reasonably encounter on a survey.

### *Good Points*

- Data are complete, comprehensive and testable right to the species level.

### *Problems*

- Highly impractical. Even experts haggle over many species and with no comprehensive reference, we cannot guarantee the time or expertise at every survey;
- Even experts are usually specialized. Who in the Northwest can effectively identify every chiton, colonial tunicate and filamentous red algae?
- Looking up every questionable organism would require considerable time and resources that brief low tides don't allow; many volunteers would not approve of fatal collection;
- If we try to do this and fail, all of the data are suspect.

*Solution 2: Pick A Few.* Pick a finite list of species to survey and train volunteers to recognize them.

### *Good Points*

- Much easier to do accurately, training and time wise;
- The absence of a listed species is also valuable data;
- Important species (exotics, endangered, indicator) can be given special emphasis;
- REEF (for invertebrates) and Reefkeepers (fish and inverts) both use this technique subtidally.

### *Problems*

- Leaving off species that are relatively easy to identify is like throwing away potential data; our time is limited, but unlike divers, we can look up some animals *in situ*;
- A significant percentage of our past data will be lost;
- Considering the range of our surveys, some locations would likely have to ignore potentially important data.

*Solution 3: Clump.* Clump species that are difficult to identify into identification groups, creating a master list that every organism will fall into.

### *Good Points*

- This is teachable, and reasonable accuracy can be expected of diverse volunteers
- We don't lose as much past data; species that

end up in clumps have a high chance of being misidentified in the past anyway;

- We maximize the amount of data we collect without making unreasonable demands on volunteers;
- This is adaptable as new information on species comes out;
- Important species (exotics, endangered, indicator) can be given special emphasis.

#### *Problems*

- Requires a significant amount of work to devise a master list that can be incorporated into field sheets and a database;
- Analysis to the species level will not work on all groups – scientists and managers using the data will need to be aware of the implications and limitations of the list.

### **Outlook**

Solution 3 was chosen and the list is nearly complete. Input on the list will continue to be sought from scientists and managers. Hopefully we can get most of the data entered this winter (2002). The results should be available (likely via the internet) to any interested parties. In coming years the focus will be on expanding the program to other islands and communities, and crunching numbers and encouraging scientists, students and local managers to use the data.

For those interested, current versions of the methodology, data sheets, species list and related information can be downloaded from [www.georgiastrait.org](http://www.georgiastrait.org). A working version of the master species list should be available online by mid-July, and input from biologists and other interested parties is welcome. Did your favourite species get clumped? Tell me why it should or shouldn't be.

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## **Monitoring Bunny's Web Reef off Jacksonville, Florida, and Challenges Facing a Volunteer Dive Team**

**John Perkner, Lex Waters and Marc Dillon**  
*Jacksonville Reef Research Team*

### **Monitoring Grant Efforts on Bunny's Web**

For the past two years, the Jacksonville Reef Research Team has been focusing its monitoring efforts on a site off Ponte Vedra Beach, Florida called Bunny's Web (BW). The site is in the

Atlantic Ocean almost directly between the Mayport and St. Augustine inlets in Northeast Florida (14.7 nautical miles (25 km) from the Mayport jetties on a heading of 163 degrees) and lies in 50-55 feet (16-18m) of water. The site is approximately 5.6 nautical miles (10 km) directly east off the beach from Mickler's Landing in Ponte Vedra Beach.

The Bunny's Web site comprises an artificial reef of three primary deployments: a large deployment of concrete culverts placed in 1998; a smaller placement of concrete bridge rubble that is older, placed in 1992; and, most recently, a reef made of 500 Reef Balls deployed in June 2000. This reef, called the Kirbo Memorial Reefball Reef, lies within 1/2 mile (2/3km) of the other two older concrete placements. It is made up of a variety of Reef Balls varying in size from 2 to 6 feet (60-200cm) in diameter and ranging in weight from 90 to 3,800 lbs (40-1700 kg).

As part of our State-funded monitoring grant requirements, all three sites were carefully mapped over the past year by our underwater methods "certified" Reef Research Team dive members (methods as defined in Artificial Reef Research Divers Handbook, Florida Sea Grant College, J. Halusky, 1991). Besides the mapping, we also completed numerous fish counting events directly related to the monitoring grant at all three deployments from April through September 2001.

### **Fish Counts**

The fish counting data collection efforts (which actually started prior to the monitoring grant work) began shortly after the reefball deployment in June 2000. This has allowed us to monitor the reefball placement over time since its introduction into the BW deployment area.

Fish counting utilized the "relative abundance/SOCA" method (also defined in the Artificial Reef Research Divers Handbook cited above), where S=single, O=occasional, C=common, and A=abundant. Although it was not part of the monitoring grant work there was a significant amount of additional information gathered around as reef ball placement evolved in terms of invertebrate growth, encrustation of the reefballs and the size of fish species recorded. Unfortunately, the relative abundance method as currently defined does not capture species size. However, it was noted in numerous fish count logs that many of the species counted were either juveniles and/or much smaller adult fish compared to similar species on the surrounding

older artificial reef placements.

Since we were able to look at all of these artificial reefs in a relatively contained deployment area over time we were able to do “similarity indices” for all combined data collection events and for individual events that occurred on the same day at the various placements. This provided some excellent insight as to how different fish populations (from both an attraction and abundance perspective) might relate to the type of placement and the maturation of a placement (specifically the reefball placement). For example, one key finding was that “common” populations of red snapper (populations of 11 – 100 fish) were almost always found on the older placements, while they were almost non-existent on the reefballs.

It was also interesting to note that although the reefballs seem to attract primarily “smaller” fish, two of the largest fish ever counted in our monitoring events were spotted on the reefballs. Our first officially “counted” goliath grouper (a single one) was identified at the reefball placement on September 8, 2001 and measured 4-5 feet in length (estimated). Numerous large black drum have also been “counted” at the reefball site during late August and September (usually counted as “occasional” or 2-10 fish).

Overall, we feel our study of the reefballs and surrounding reef structures/placements has provided a good deal of data around how this type of structure can support certain types of fish species/populations. We feel that with definition and enhancement of the methods and with further data collection (more fish counting events, over time as the reef further matures) we can learn even more about the attraction and abundance enhancement that these structures may provide.

### **Challenges Facing a Volunteer Dive Team in Supporting “Quality” Grant Work**

Part of our presentation focuses on the challenges facing a volunteer dive team in doing high quality reef monitoring work. After gaining feedback from members the following “top 5” key issues were identified:

1. Need for clear team vision, leadership and direction;
2. Methodology fit to study objectives;
3. Variability of team skills and methods;
4. Team membership base and engagement with members;
5. Data input and reporting.

In discussing these issues with the leadership of the Jacksonville Reef Research Team (RRT) a series of RRT recommendations were developed to enhance the effectiveness of RRTs. These recommendations revolved around three key areas of enhancement.

- Stronger connections to the scientific/academic/state communities;
- Methods enhancement and guidelines on skills/usage and testing;
- Streamlining the data reduction and delivery process.

The specific recommendations under each of these areas are as follows:

#### *Stronger Connections to Scientific /Academic/ State Officials/Community Groups*

- Tie in academic or State “sponsor” to each RRT that desires one;
- Provide study results and communications that tie RRT work directly to socio-economic needs of the of the community;
- More formally include RRT leadership groups on mailing/distribution lists that identify trends in industry, key findings and/or key events;
- Better leverage RRTs for data collection work against projects already underway by sponsors;
- Fund usage of RRTs as a “subset” of a larger project or initiative (i.e., pay per dive event).

#### *Methods Enhancement and Guidelines on Skills, Usage and Testing*

- Evaluate methods relevant to key research project objectives;
- Designate and define a group to update and standardize a methods manual
- Outline a “continuing education” process and/or annual testing/usage process on all methods (particularly fish ID and fish counting).

#### **Streamline the Data Reduction and Delivery Process**

- Develop data transmission process that allows for input directly from the log sheets to the end user database;
- Establish a quality control check point where the data come to the end user;
- Standardize data format for all studies of a similar nature;

The single most important recommendation is the direct tie/linkage to a state or academic community with clear communication around how the research helps drive some type of socio-economic value. It is this type of recognition that drives and motivates the membership base over the long term. We would also like to note that it is this same linkage to socio-economic value that often drives the funding for the work that we enjoy enough to engage in as volunteers.

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## **Assessing the Habitat Productivity of Reefs Created from Blasted Rock**

**L. Rob Russell**

*Department of Fisheries and Oceans, Canada*

### **Rock Reef Habitat**

Blasted rock reefs have been constructed at many inter-tidal and sub-tidal locations in British Columbia (BC), primarily as compensatory habitats to offset equivalent rocky habitat losses associated with log handling or industrial development. When sited appropriately, they immediately attract marine animals. When placed within the photic zone (intertidal to about 10m deep) during the growing season, they provide substrate for the settlement of marine plants. Over a period of several years, rock reefs go through a successional process. Depending on currents and proximity to natural reefs, they become relatively stable fish habitats making a contribution to the nearshore marine ecosystem.

### **Monitoring Methods**

In order to record and document the contribution rock reefs make to fish habitat, they should be monitored fairly frequently during the first few years. Scuba divers establish permanent transects along the longitudinal axis of the reef, and perpendicular transects are established at regular intervals off the permanent transect, which bisect the reef. A dive team uses quadrats to record sedentary and cryptic species of plants and animals as well as neritic fish associated with the reef structure. Visibility estimates are made during each inspection so that relative coverage estimates can be calculated. Video or photographic records are kept of the assessments and all of the field data recorded underwater are correlated with these records to produce a data set for the time period. Depending on the intent of the reef creation, diel or seasonal monitoring may be a requirement. Depending on site

characteristics, the fish habitat afforded by the rock reef should closely resemble natural rock reef habitats in the vicinity within a period of 3 to 5+ years.

### **Outlook**

In the last several years, the capability of Fisheries and Oceans Canada staff to conduct scuba assessments of the numerous rock reef sites on the BC coast has rapidly declined. Shrinking budgets and restrictive Worker's Compensation Board regulations essentially preclude our involvement in assessing reefs. Once the monitoring period stipulated in our Habitat Authorization agreements has expired, and consultants are no longer responsible for providing monitoring data, we must depend on volunteers to assist us. There is a growing interest in science-based scuba assessment among certified divers and this represents a valuable opportunity for DFO to partner with divers to collect consistent ecological information about rock reefs.

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## **The REEF Fish Survey Project**

**Christy Semmens**

*Reef Environmental Education Foundation*

The Reef Environmental Education Foundation (REEF) enlists divers to provide meaningful information while enabling them to learn how to really see underwater. REEF was founded in 1990 out of growing concern about the health of the marine environment, and the desire to provide the scuba diving community with a way to contribute to the understanding and protection of marine populations. REEF achieves this goal primarily through its volunteer fish monitoring program, the REEF Fish Survey Project. The project was developed with support from The Nature Conservancy and guidance by the Southeast Fisheries Science Center of the National Marine Fisheries Service. The REEF Fish Survey Project allows volunteer scuba divers and snorkelers to collect and report information on marine fish populations. The data are collected using a standardized method, and are housed in a publicly accessible database on REEF's Website ([www.reef.org](http://www.reef.org)). Participants in the project not only learn about the environment in which they are diving, but also produce valuable information.

The project started in Florida in 1993, and has since expanded to encompass all coastal areas of

North and Central America and the Hawaiian Islands. The program was expanded to the Pacific Northwest (Oregon, Washington, and British Columbia [BC]) in 1998. After an initial pilot program, REEF collaborated with BC-based Living Oceans Society to form the Living REEF Project. This regional program enhanced the fish training materials and developed an invertebrate monitoring program as a companion to the fish program. By the end of 2001 over 40,000 surveys had been conducted by REEF members throughout the world.

## Methods

To collect data for the project, REEF volunteers use the Roving Diver Technique (RDT; Schmitt and Sullivan 1996), a visual survey method specifically designed for volunteer data. The only materials needed are an underwater slate and pencil, a 'scantron' recording sheet available at no charge from REEF, and a good fish identification book. During a REEF survey, divers swim freely throughout a dive site and record every fish species that can be positively identified. The goal is to find as many species as possible, so divers are encouraged to look under ledges and up in the water column. At the conclusion of a survey, each recorded species is assigned one of four abundance categories based on how many individuals were seen throughout the dive (single [1]; few [2-10], many [11-100], and abundant [>100]). Following the dive, each surveyor records the species data on the REEF sheet specific for the region of the survey. Completed sheets are returned to REEF, where they are processed and entered into REEF's database.

## Data Availability and Use

A variety of summary reports are available on REEF's website, including geographic area reports, species distribution reports, and personal survey reports. Raw data files are also available upon request.

Data collected through this project have been used in many scientific publications and symposia, by resource managers in the Florida Keys and other marine managed areas, by the State of Florida's artificial reef program, and by the U.S. National Oceanic and Atmospheric Administration (NOAA) Biogeography Office among others. Applications have included evaluating the efficacy of no-take zones in the Florida Keys, establishing a baseline taxonomic inventory for the Bonaire Marine Park, using GIS (Geographic Information Systems) to analyze fish-habitat relationships to better understand

essential fish habitat, tracking non-native fish species distribution, and evaluating trends in fish populations through time. For a complete list of projects and papers that have used REEF data, visit [www.reef.org/data](http://www.reef.org/data).

## Education and Awareness

In addition to the usefulness of the data, REEF's educational contributions are equally significant. Participation in REEF's survey program enhances a diver's ability to discern details about the marine environment. For divers with no training as naturalists, areas begin to blend together and the attitude that "it's just another coral reef" or "one more kelp forest" prevails. The excitement of finding a rare fish can only be appreciated if one knows it's rare. By learning identification techniques and recording their fish observations, REEF surveyors become keen observers, true naturalists.

Divers and snorkelers are not required to attend any specific training program to participate in the Fish Survey Project. Many of them have become adept at fish identification through continued practice and self-education similar to many birdwatchers. However, REEF does offer several educational opportunities to get people started and to further their knowledge. REEF produces a standardized training curriculum for introductory fish identification and has modules for all of its project areas. These courses are taught through dive shops, dive clubs, educational institutions, and public aquaria.

Broader outreach is achieved through the Great Annual Fish Count. In collaboration with NOAA's National Marine Sanctuary Program in the U.S. and numerous local partners, REEF coordinates this annual event each July as a way to promote awareness about marine resources and to encourage naturalists. It also encourages divers to take up REEF surveying as a regular diving activity. Free fish identification seminars and survey dive opportunities are offered throughout the United States, Canada, and the Caribbean leading up to and during the event.

The scientific and management applications of REEF's volunteer-generated database are ever expanding and will become more powerful as the amount of data grows. Regardless of the data applications, the awareness that comes from becoming a naturalist provides REEF surveyors continued benefit. REEF's co-founder, Paul Humann, describes fish watching as "a passionate hobby within a hobby: it gives purpose to a dive, anyone can take it up and have an instant good

time." And benefits extend beyond enhancing an individual diver's underwater experience. The sense of stewardship that arises from involvement in citizen science programs such as REEF's Fish Survey Project raises the public's awareness of and involvement in resource issues. Ultimately, REEF's efforts empower volunteers, and this often makes the process of marine resource management easier.

### Reference

Schmitt, E.F. and Sullivan, K.M. 1996. Analysis of a volunteer method for collecting fish presence and abundance data in the Florida Keys. *Bulletin of Marine Science* 59(2): 404-416.

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## Reliability and Utility of Sidney Pier Artificial Reef Monitoring Data from Volunteer Reefkeeper Divers

**Brian Smiley and Brenda Burd**

*Fisheries and Oceans Canada, Science Branch & ECOSTAT Research Ltd.*

### Introduction

The British Columbia Shorekeepers and Reefkeepers programs were established by the Fisheries and Oceans Canada Science Branch. Their vision is "Science in support of citizens and citizens in support of science." The aims of "citizen science" are to: (i) Promote the protection, conservation and restoration of coastal habitats, (ii) enable coastal citizens to study marine ecosystems, and to monitor status and trends of the sea; (iii) educate and inform the public about ecosystem threats and human solutions; and (iv) produce comprehensive, defensible data for biologists and scientists who advise coastal managers and other decision-makers. Since 1995 these programs have worked in the Vancouver Island area of British Columbia (BC). The intent is to achieve monitoring at 50-100 sites throughout the Province. It is hoped that this approach will be adopted at other coastal areas nationwide.

### Accomplishments

As two Marine Environmental Quality stewardship initiatives for implementing the Canada Oceans Act, Shorekeepers and Reefkeepers have been established in partnership with the Royal British Columbia Museum and the Habitat and Enhancement Branch and Oceans Directorate. Successes include:

- Developed, tested and published two protocols with training curriculum for intertidal and sub-tidal monitoring; two more protocols under development
- Recruited, trained and coordinated over 200 individuals including displaced fishers, youth interns, divers, scuba instructors, school teachers, high school and university students, First Nations, community advisors, habitat biologists
- Employed six youth intern biologists to provide project coordination, volunteer recruitment, training courses and field surveys; organized seven 2-3 day training courses
- Designed, tested and produced two custom PC-based information systems for producing survey forms, archiving data, and generating summary reports
- Archived field-test datasets and verified the metrics such as species identification, habitat types, size, substrate types, physical properties
- Commenced the analyses, interpretation and publication of findings about temporal and geographical ecological trends and diver performance
- Monitored 80 Shorekeepers sites (with 200+ visits) and 5 Reefkeepers sites (one with 165 surveys) largely on Vancouver Island for one to 4 years
- Created <http://www.pac.dfo.mpo.gc.ca/oceans/meg/stewardship.htm>

The benefits of citizen participation include: (1) Easing the cost of hiring staff for agencies with limited resources; (2) increasing comprehensiveness of data collection in terms of spatial and temporal range; (3) ecosystem monitoring is a valuable learning tool to bring people in closer contact with their natural surroundings; (4) this awareness leads to greater respect and care for the environment, and builds environmental stewardship in the community; (5) volunteers and scientists encourage and vitalize one another when working together with a common purpose.

### General Challenges of Citizen Science

Issues facing these programs include:

- Volunteers find it challenging to collect data accurately and in an unbiased manner for statistical analysis
- Field training, manuals, equipment and ongoing support from the organization are difficult to match to the ability of the

volunteers

- Volunteers get frustrated, lose interest in the project and cannot commit enough time
- Volunteers require work, hand-holding, ongoing feedback and official recognition
- Scientists too are limited by mandates and budgets.

### **Specific Challenges of Collecting and Using SPARS Data**

One of the pilot projects undertaken by the department to develop and implement citizen science is Sidney Pier Artificial Reef Science (SPARS), a multi-year study of two 3-m x 30-m reef structures constructed with 270 concrete igloo-like Reefballs placed in 10-m water depth close to shore. The project began when community leaders approached federal government scientists at the neighboring Institute of Ocean Sciences (IOS), asking for guidance and support for their commitment of “three years monitoring” to the Reef Ball Foundation. Limited monies, busy researchers and few divers required that IOS collaborate and partner with the Royal BC Museum, other local agencies, private companies and interest groups. What resulted was the general concept of a “Reefkeepers Guide” protocol for non-professional marine monitoring, by recreational divers. The objectives of the monitoring included: assessing rates of colonization for 100 selected taxa; measuring trends in species richness and abundance; estimating survey biases resulting from differences in diver expertise; evaluating differences between reefs compared to controls; assessing effects of water temperature, salinity and currents; and measuring the effects of adjacent habitats.

To date there have been over 90 project participants; 28 are volunteer sports divers who have taken one or more training workshops, and conducted one or more surveys. One third of these divers are PADI Divemasters and Instructors. Three are professional marine biologists and museum curators. Five divers have conducted 12 or more surveys. Surveys (ca. 130) were conducted on all three SPARS reefs from March 15, 1997 to April 14, 2001, resulting in over 5,000 minutes of recorded observations along four standard passes, and 12 video transect surveys for assisting species ID and for estimating vegetative cover.

Analysis of project implementation and findings has proceeded on two fronts: One, to interpret the field observations to date; the other to evaluate the quality of data generated by the volunteer

divers.

### **Reef Ecology**

Subjects of particular emphasis in data analysis have been recruitment, colonization and seasonality of plant, crab and fish species at natural and artificial reef sites. Video observations suggest that algal cover in winter 1997 – spring 1998 was more intense and protracted than in later years. Observations of Dungeness crab (*Cancer magister*) revealed movement into shallower water for molting. Comparisons of fish assemblages show rockfish (*Sebastes* spp) as more common on artificial than natural reefs, while surf perches (Embiotocidae) and tubenout (*Aulorhynchus flavidus*) were virtually absent from natural reefs. Physical data (e.g., water temperature, salinity, current) also are archived.

### **Diver Performance: Bias and Corrections**

Not all divers perform equally. For example, bias was introduced in 12% of the paired-diver surveys by unacceptable sampling precision (based on total biota abundance metrics) from inexperienced divers who usually saw fewer taxa. One diver consistently saw considerably more taxa than any other divers, even the volunteer professional biologist. Sources of error include identification of species, counting bias, search image (ubiquitous or “background” forms), and variable conditions (light, turbidity, current, algal cover). These issues have been evaluated by examining pair-wise dissimilarities between reefs from concurrent dates and surveys. Lessons for improving future monitoring include:

#### *1. Selecting taxa*

- The identification of various types of rockfish (*Sebastes* spp) appears to be a problem for volunteers with entry-level training. The natural variability of the copper rockfish markings and shape confuse some divers.
- Taxa that are not reef dwellers such as several ophiuroid species and incidental pelagic fish should be eliminated from the taxa list.
- Shrimp appeared to be ubiquitous and numerous on all reefs from the beginning, but were frequently missed by divers because of a lack of dive lights and the animals’ hiding and “scattering” behaviour.
- In general, the taxa list needs to be reduced in number and/or simplified to help avoid mis-identifications. More rigorous training of the divers in species identification is another solution.

## 2. Reducing diver bias

- Detailed diver debriefing is essential at the end of each dive to pick up discrepancies between divers, but also to more clearly delineate how each diver counts and identifies different organisms. This can help inexperienced divers to identify species that they could not during the dive, or to clear up any ambiguous notations on their dive sheets.
- Extra habitat and behavioral information should be obtained and added to dive logs after dives, such as whether certain taxa tended to be obvious or hiding.
- A video of each transect on each dive date would allow some corrections for mis-identifications, and help standardize the different “search images” of divers.
- Potential divers and core volunteers should have training sessions using video and professional biologists to help clear up any misidentifications.

## 3. Defining survey methods

- More systematic seasonal sampling is required. The actual number of dive dates could be reduced considerably, but should include an intensive set of surveys four times a year, ideally at about the same time each year.
- Each reef and date should be surveyed by at least one “expert” research diver with auxiliary divers providing additional data. Specifically, the expert diver(s) should attempt the enumeration and detailed identification whereas auxiliary divers map the general distribution of sessile organisms and rooted algae. The expert and auxiliary divers can compare notes and match identifications with the maps.
- In the case of artificial reef monitoring, a natural reef (or reference site) should be surveyed on every dive date.
- Divers should always use underwater lights to aid in species searching and identification.
- Some distinction should be made between juvenile and non-juvenile fish and crabs. In addition, general size ranges for important colonizers such as barnacles, anemones and starfish will help to determine if these immigrate as adults, or by settling as juveniles.
- The survey protocol should include a minimum survey time as well as required time expended by the diver for each pass reef. Training must stress that the divers are

required to swim the entire transect during the prescribed time, and no more.

- There should be separate counting strategies such as percent cover and reef location for colonial vegetative reproducers (e.g., tunicates, anemones and sponges). Species that tend to settle en masse such as acorn barnacles should probably also be counted using the same method.
- Rooted algae should be consistently surveyed as percent cover as usually standard for hard substrate surveys, on a rank scale appropriate to each species. Algal coverage data could also be obtained from systematic video transects rather than diver counts, freeing up the divers for more detailed biotic work.
- Dive conditions such as visibility need to be recorded carefully and consistently.

## 4. Managing the data

- More attention, time and effort are required on data standardization, both immediately following dives and at the time of data entry. This is important particularly for data from untrained divers. As such the post-dive protocols need to be tightened, especially those pertaining to the project’s data manager.
  - Periodic testing procedures to assess diver bias in identifications and counting or coverage techniques should be conducted to help standardize data.
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# Appendix One



## AGENDA



**NORTH AMERICAN PRACTITIONERS WORKSHOP  
Research and Monitoring of Marine Reefs Using Volunteer Divers  
Institute of Ocean Sciences, Sidney, B.C. 20-21 June, 2002**

### Day One - 20<sup>th</sup> June

0930-1230h	Welcome, objectives and introductions - <b>Brian Smiley and Bill Seaman</b>	45 min
	— Key note speaker: <b>Bill Lindberg</b> , University of Florida "Data rich and conclusion poor: how we can learn more for the effort"	1 hour
	<b>Break and no host refreshments</b>	15 min
	— <b>Christy Pattengill-Semmens</b> - REEF Pacific "Reef Environmental Education Foundation: some Pacific Northwest experiences"	30 min
	— <b>Susan Francis and Dana Haggarty</b> - Living Reef "Reef Environmental Education Foundation: some British Columbia experiences"	30 min
1230-1330h	<b>No host lunch in cafeteria</b>	60 min
1330-1530h	— <b>Bryon Nichols</b> - Georgia Strait Alliance "Developing a species list for identification by volunteers"	30 min
	— <b>Lex Waters</b> - Jacksonville Reef Research Team "Monitoring dives off NE Florida with emphasis on Bunny's Web artificial reef"	30 min
	— <b>Rob Russell</b> - Fisheries and Oceans Canada "Assessing the habitat productivity of reefs created from blasted rock"	30 min
	<b>Break and no host refreshments</b>	30 min
1530-1630h	IOS Walk-About Tour	60 min
1630-1730h	— <b>Brian Smiley</b> - Fisheries and Oceans and Brenda Burd - Ecostat Consulting "Data analyses of Sidney Pier Artificial Reef Science monitoring by volunteers"	30 min
	— <b>Doug Bifford</b> - BC Parks "Project Emerald Sea: eelgrass monitoring by volunteer divers in Todd Inlet, BC"	30 min
1900h	<b>Dinner at Sea Horse Café in Brentwood Bay</b>	

## Day Two - 21<sup>st</sup> June

0900 - 1230	Overnight insights and Today's agenda	30 min
	— <b>Noelle Barger</b> - San Diego Oceans Foundation "Volunteer research and monitoring on the Yukon artificial reef"	30 min
	— <b>Jeff Marliave</b> - Vancouver Aquarium "Annual lingcod egg mass surveys by volunteers in Georgia Strait"	30 min
	<b>Break and no host refreshments</b>	30 min
	— Overview of presentations: <b>Andrea Coombs and Amy Poon</b> - UBC rapporteurs and final comments by presenters	30 min
	— Issues & solutions discussion # 1 - Study Objectives & Protocols	60 min
1230-1330h	<b>No host lunch in cafeteria</b>	
1330-1630h		
	— Issues & solutions discussion # 1 -- Study Objectives & Protocols (cont'd)	60 min
	— Issues & solutions discussion # 2 -- Coordination, training and funding	60 min
	<b>Break and no host refreshments</b>	30 min
	— Issues & solutions discussion # 3 -- Analyses and reporting	60 min
	— Collaborative opportunities, next steps and farewells	60 min
1830h	<b>Dinner at Blue Peter Pub (optional)</b>	
2000h	<b>One hour boat tour of local islands and wildlife</b> Compliments of Sidney Harbour Cruise Ltd.	

## Day Three – 22<sup>nd</sup> June - Optional activity for qualified divers and interested observers

- 0900h Morning. Shore dive at Victoria breakwater
  - 0800h Morning-Afternoon dive on Saskatchewan and Cape Breton ship reefs off Nanaimo's Snake Island
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## Appendix Two

<b>PARTICIPANTS</b>				
<b>Name</b>	<b>Position</b>	<b>Affiliation and Address</b>	<b>Phone Number</b>	<b>E-mail Address</b>
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## Appendix Three

### RAPPORTEURS' RECORD OF DISCUSSIONS

Compiled by Andrea Coombs and Amy Poon

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#### Day One – 20<sup>th</sup> June

##### *Lex Waters*

I want to ask about your slant on the current attitude towards Marine Protected Areas (MPAs). I've been reading a lot of controversy about it. Sports and recreational fishers seem to be vehemently opposed to them.

##### *William Lindberg*

MPAs, like any other management practices, have good points and bad points. How much benefit they are depends on the objectives. The proposed MPAs in Florida State are part of the conflict. Sports-fishing fishermen in Florida are opposed to MPAs because they feel that MPAs impose on their freedom of access. It comes down to values – it has more to do with the values of competing interest groups than the underlying science. In the case of MPAs, it's about free access to a common property resource, not conservation of biodiversity or use of a management practice thought to provide the opportunity to replenish stocks under pressure. Having said that, there have been studies done when MPAs were first proposed. It's a tool. Tools can be inappropriately used and have consequences opposite to what's intended. If MPAs redirect fishing effort from one locality, they might put a greater pressure on a more vulnerable aspect of the stock's life cycle. The same can be said for artificial reefs. Our research says that artificial reefs can enhance growth rates with the architecture on the reefs. But depending on fishing mortalities, any benefit derived from artificial reefs can be just a drop in the bucket. Is production of habitat enough to offset fishing mortality? It comes down to clarifying values and knowing the consequences of using the tools.

##### *Dana Haggarty*

I wonder if the reefs are protected. Are they closed to fishing?

##### *William Lindberg*

There is no legal protection of reef systems. We did some work 5 to 6 years leading up to the establishment of the reef, which is how I started working with commercial fishing groups. By the time we got it set up, the public was more interested in what would come out of it than fishing it. We were able to construct the reefs and

not publish their locations. The public honoured it for 5 years. In the sixth year, we opened up a third of the reefs for experimental fishing, but the behaviour of the fishers has reversed itself. They're now redirecting fishing effort to the reefs that were not published. The reefs whose locations were published are being ignored because everyone knows about them. It's interesting to see. We had excellent co-operation over the time we needed the reefs closed. It all came from public education.

##### *Gerry Fletcher*

In your pie chart of relative funds, there is a huge proportion allocated to something. I think there's a real problem there.

##### *William Lindberg*

The pie chart was distribution of samples. The funding was part of cost-effectiveness. It required the faculty to be more involved with citizenship science. Lakewatch is channelled through a government agency to the university. That kind of hardwired funding comes with political strings. It's a hard line to walk in maintaining objectivity and keeping funds. Because of citizen involvement, government funding has been there.

##### *Gerry Fletcher*

Are your volunteers getting financial support to pay for boating and diving expenses? Is there any inducement for them, like financial compensation, to do it?

##### *William Lindberg*

Volunteers are provided with the training and equipment they need to collect the data. In terms of travel, diving, and boat time, the volunteers have taken the responsibility for providing those on their own. What it has led to are distribution networks. There's a series of collection points where regional co-ordinators go through and collect the information sheets. Organisation helps, but most of the financial burden is on the volunteers.

##### *John Perkner*

For Jacksonville, we do provide funding for divers to do the dives and for their boat charters. We do things to raise money like apply for grants, which provides funding. What's interesting is that unless volunteers have feedback or a sense of

connectedness, they'd still lose interest. It's not just getting paid; they want something out of it, more than just a free dive.

*Bill Austin*

What works and doesn't work with regards to involving media?

*William Lindberg*

In the Lakewatch program, there's an information office that's part of the program. We have people on staff in the background that take reports that biologists generate and translate those for public consumption. Those of us with too many initials after our names don't particularly do very well at that, so we have our own in-house desktop office publication to get the literature out. As part of that, they produce news releases. One of the things they maintain is this non-advocacy position. Often in the community, we have volunteers wanting to take a strong position based on the values people bring to the table to begin with. But as an organisation, the program does not do that. There is a tremendous amount of press coverage in TV, radio, and the print media, which gives the program itself identity and individuals credit. That's a big component of the program.

*Bill Seaman*

In the late 1980s and early 1990s, several marine extension agents were working with Sea Grant in Florida to help local organisations learn diving. The training program took 6 weekends to go through the scientific stuff, but also took a weekend for the press to help dive clubs learn how to deal with the press and to communicate their results.

*William Lindberg*

That kind of coverage is how public support is generated. That's how the program grows. That's how Lakewatch went from 10s to 100s of lakes.

*Bill Seaman*

Looking towards tomorrow's discussion, I've been keeping a list of issues that have been coming out. I'll mention a couple of those to prime the pump:

- How to keep people involved in our projects?
- How to define monitoring?
- How to leverage people for volunteer programs?
- How to get past scientific scepticism?
- What about turnover and retaining people once they're involved in the program?
- There is the idea of mentoring and refresher courses for projects that are not

regular or are seasonal.

- Expenses for volunteers are also an issue...
- ...As is funding.
- How results are used came up as well.

I'm suggesting that people keep a list when they think of issues and some solutions for them. What are advantages of using volunteers? What ideas come up with regards to agency, funding, and leverage? Volunteer monitoring could give scientists data for journal publication. As an outcome of the meeting, we may discuss the advantages gained from using volunteers for monitoring.

**Christy Pattengill-Semmens, REEF Pacific**  
– **“Using Volunteers as a Tool: Experiences from REEF's Fish Survey Project in the Pacific Northwest”**

+

**Dana Haggarty and Susan Francis**  
**Living Reef**  
– **“Reef Environmental Education Foundation: Some British Columbia experiences”**

*Doug Biffard*

Are exotic or special species like abalone blocked from people getting data requests?

*Christy Pattengill-Semmens*

Not really, but this has come up before. For example, it was a concern in Hawaii – there are several species that have been depleted by the aquarium trade there. Some were worried that aquarists would use the database to target very rare species. We discussed the notion of limiting the spatial aspect of the data but we haven't done any limiting of data yet. If you look up geographic reports for special species, you just get regions – not sites – and that was done all along with protection for some species of concern in mind. So we haven't done anything like that yet but we certainly can. It's a continuing discussion. We have a panel of scientific advisors. It always comes back to the notion of free access to our data. The greater good that comes from complete access and good things that people can do with complete data overshadows the potential harm from the bad eggs out there. Also, the time aspect is not available to the general public. There is no way to know if an abalone reported from a site was seen last year or yesterday. We're not closed to the idea of particular incidents where we'd have to. The bottom line is that there is a lot of messing people would have to do to figure out all the details to pinpoint the rare species.

*Glen Jamieson*

In the diving I've done, people go out but there's not really a spatial component. If you use this from a science perspective in terms of providing information to managers, is that enough? It's okay if you're characterising in general but how do you balance the utility of how the data is used with site-specific habitat information to make sure? In general, we're getting a lot of data but at the end of the day, are we really getting useful data in a management sense and are volunteers getting enough?

*Christy Pattengill-Semmens*

For the REEF data set the extreme values come from sheer effort. So when you have 500 or 1000 surveys from one site, divers go in different paths but they're entering from the same spot and there's only so far that they can go so it's not that different. Divers are also asked to stay within a 100-m radius from the start site. They're all averaged out, the distributional component at a scale most data is appropriate for analysis. But when the data effort is really high, like in the Florida Keys, we have a great benthic habitat map so we know the likelihood of seeing that habitat.

*Glen Jamieson*

In a place like the Florida Keys I can see how you would get that representation but British Columbia has a huge coastline, small population, and multiple references. What was the process? Is there much effort in establishing where sites are? In the Florida Keys, there are lots of people and well-defined sites.

*Christy Pattengill-Semmens*

We don't have any sites selected. As soon as you tell volunteers where and when to monitor, you're going to lose their commitment. Part of the attraction is that people can go anytime they want. But here the potential for sites is huge, and what we do everywhere is say, "Okay, in addition to general surveying, we have set sites and surveys that we're going to do". We've been trying to work with special projects every year at certain sites.

*Tomas Tomascik*

But if you already have sites, you just have to mark them. People don't randomly go to particular spots. Divers tend to stick close to known sites and dive charters bring people to the best sites in the area.

*Dana Haggarty*

We have lots of surveys in sites like Whytecliff Park, protected sites with mooring buoys. We have also worked with the underwater society of

BC which takes their divers to known sites.

**Bryan Nichols**  
**Georgia Strait Alliance**  
**– “Developing a species list for**  
**identification by volunteers”**

*John Perkner*

Would photographic sampling be a way to get around the identification problem?

*Bryan Nichols*

It's possible, but it's not ideal for many quadrats because of algal cover. It'll work better higher up where there isn't algae. We do take photographs of each quadrat to show change over the years, but it's harder to quantify and run statistics on photographic data. Photographs of quadrats are there, but they are not being used yet. That may change as technology improves.

*Christy Pattengill-Semmens*

When they collect the data in the field, how does it get into the database? Do they give you the data in the field or do they send you raw sheets?

*Bryan Nichols*

Ideally what we'd like is to train one or two data entry persons in each community, but the online database has been moving slowly.

*Christy Pattengill-Semmens*

Originally, we were worried that people would pigeonhole organisms towards what was on a pre-printed list. We wanted to give our surveyors waterproof paper. To avoid the potential for problems, at first we just gave them blank lines to write down what they saw, but the willingness of people to write things down and transfer them to a scan sheet was so-so, so we eventually created these pre-printed sheets, which were pretty inclusive. The whole backside was available as writing space. It went through an evolution for an inclusive list that is usable in the field. My feeling is that, as a general rule, people do not force their sightings into something in the pre-printed list.

*Bryan Nichols*

What we do here is that if you find something that's not on the sheet you add it to the bottom. If it wasn't on the sheet, you'd look for it on the master list, then add it in. Once numbers are available, each region will have its own datasheet of common species. For example, Cortez will have its own datasheet; Victoria will have its own data sheet, et cetera.

*Christy Pattengill-Semmens*

It's always an evolutionary process

*Bryan Nichols*

Yes, it is.

**Lex Waters**

**Jacksonville Reef Research Team –  
“Monitoring dives off NE Florida with  
emphasis on Bunny’s Web artificial reef”**

*Tex Enemark*

What is the depth at the site?

*Lex Waters*

Fifty feet and it's about 5 miles offshore which makes a big difference as far as recreational divers are concerned.

*Unidentified*

Are the reef balls commercial?

*John Perkner*

Yes, they are.

*Glen Jamieson*

This goes back to species. What we look for are charismatic species and it seems to me that the information lacking are the life histories and ecological characteristics of the animals. What are the ecological features of a pristine habitat? That's the type of information that we need to collectively accumulate and organise. For those who work in the Pacific Northwest, there is a combined inventory with graduate students working on it. I did my Doctorate on insects. Some animals have broader distributions; some have narrow ones. Collectively, we need to organise and characterise habitat requirements to see how useful they are as indicator species. One of my concerns is that marine habitats haven't really been impacted that much, except in harbours, so we're monitoring relatively pristine habitats. In the Great Lakes, it's not so pristine. We don't know what species are represented in impacted areas. We need to pull together and collectively accumulate information.

*Bill Austin*

With respect to different species having different requirements, I don't think it's trivial to lump species together but for those with no known niche, I don't think you can treat them in the same way. Put the data together to recognise that you're looking at species or genus level, which makes a big difference.

*Christy Pattengill-Semmens*

You said that anything outside the harbour is pristine. That may be true for water quality but

it's certainly not true for fish fauna. Nothing in the whole region is pristine anymore. Habitats are completely altered by taking top predators out.

*Glen Jamieson*

That is quite right, which is why we differentiate between goals. Overall yes, but when you're talking about invertebrates, not really. Certainly, removing otters would affect urchins, which would affect the kelp, and so on.

*Christy Pattengill-Semmens*

Yes, and when you're talking about habitat destruction from fishing. Fishing would certainly impact it as well.

*Glen Jamieson*

It comes back to what your objectives are and where you want to use the data.

*Dana Haggarty*

With all the artificial reef talks, as well as keynote talks, you were talking quite a bit about putting reef balls down and getting big fish. I didn't hear anything about the negative concerns, which I'm sure you've heard many times before. So you put big, attracting devices in, smaller fish come over first to find protection, which then attracts big fish, and then you open the area and fish the big fish out of the population. Have you monitored the amount of fishing pressure on an artificial reef?

*Lex Waters*

We haven't done any monitoring about fishing pressure on reefs. Other monitoring efforts on boat catches to see which catch was gotten where and gave fairly good results, though not super-duper accurate ones because fishermen don't want to tell you where they caught the fish – they want to keep the area a 'secret'. It's difficult in that regard to monitor where fishing pressure is. There's a strong argument that artificial reefs are another kind of fishing tackle. You can look at it that way, but another point of view is that you can also argue that prior to the reef balls being there, there was nothing there. So it depends on how you want to look at it. Does it attract fish that then attract fishermen? Ultimately, that's what artificial reefs are for, for the end user.

*John Perkner*

That's where the money comes from, from fishermen. It's about what happens to fish populations after you put the reef balls out there. What's the ultimate end game as far as increasing biomass, we would love to be more tied into presenting new goals and move towards them.

*Dana Haggarty*

I think it'll be really beneficial to monitor fishing pressure on artificial reefs, using line transects to count fishing boats. Steve Martell's study at Porteau Cove is a good example.

*Jeff Marliave*

First of all it's not legal; you're not allowed to put anything down at Porteau. One day you get good visibility and you will snag everything. They said that the shoreline is actually a locus for poaching.

*Marc Dillon*

Another example of economic power of fishing where we are is that fishing clubs are also involved in reef deployment. They go so far as to place reefs in a linear fashion so they have trolling lanes. We'd like to but have to do what we can afford to do.

*William Lindberg*

Because of the work that's been going on, this question biases balance of sustainability. A lot of conservation reefs built with that as the primary objective. Last June regulations in Florida changed and the primary objective and location of the reefs don't have to be advertised. That in itself has great conservation value. Regulations were re-drafted two years ago and have gone through a public comment period. Change in policy of the first objective is enhancement of fishing stocks, basically conservation, with the secondary objective to be fishing access. That's a complete turnaround from the original drafted policy in 1995. So with the changes in policy come changes in deployment. Whether these changes in practices still accomplish the objectives is another question.

*Glen Jamieson*

Do reef balls tumble over in storms?

*Lex Waters*

No. I was worried about that too when I saw how easy it was to flip them over but no, with the holes in them and the way they are designed, the water goes through and cannot get a hold of them.

**Rob Russell,  
Fisheries and Oceans Canada  
– “Assessing the habitat productivity of  
reefs created from blasted rock”**

*Christy Pattengill-Semmens*

Did you ever go out before the areas were altered to get a measure of what productivity you're trying to replace?

*Rob Russell*

Always. It's generally up to management biologists to decide what types of habitats are destroyed and what's limiting. We have to come to an understanding with the logging company as to the location and type of the structure. An argument has been made that you are destroying something by putting the structure in. It's a value judgement – what are we destroying, and are the benefits we provide by doing so enough?

*Bill Austin*

Are you replacing rock with rock and mud with mud so that it's the same type of habitat?

*Rob Russell*

That's the idea, but we are replacing a two-dimensional rock surface with a three-dimensional habitat that is more amenable to productivity. A second choice would be to add hard sand bottom without bivalves. We would like to replace habitat that we're destroying with what we'd like, but the important thing is to document what we've done.

*Noelle Barger*

Can you touch on the divers' roles on doing the survey?

*Rob Russell*

In the past, we had several teams with a couple of divers on each team. One diver would run out a transect and look at the animals and plants, while the other person would do fish in and out of the area. That person has a video camera so they can see if they missed anything or if they counted twice. We tried to get reproducible results in that fashion. We also require them to give us a visibility estimate of that day.

**Brian Smiley, Fisheries and Oceans  
and Brenda Burd, Ecostat Consulting  
– “Data analyses of Sidney Pier Artificial  
Reef Science Monitoring by volunteers”**

*John Perkner*

Funding supported monitoring reef biology but did it also support other things like monitoring shrimping, crabbing, and fishing?

*Brian Smiley*

We stuck with reef science data, but also desired observations right on dock. There are so many luxury condos around here, surely one of those people would want to be involved but we seem to have our hands full just dealing with underwater things, let alone outside stuff. That's a major limitation to this project, that we don't have a good data set for fishing harvests and other

things.

*William Lindberg*

What was particularly useful with Brenda's analysis of your data was identifying the shortcomings and weaknesses. Every study has them, but it's useful when we're upfront about what known shortcomings there are. Someone mentioned earlier that a simple ANOVA would be inappropriate for the data. When providing access to data, you have to make it clear what the limitations are and this would allow it to be used more objectively. Going through these types of biases and how to deal with them was good.

*Christy Pattengill-Semmens*

You had abundances on the y-axes of your graphs, but didn't you use categories?

*Brenda Burd*

The data was originally done the way you set them up. The way the dive sheets were set up, there were categories and there was a column in the margin. The original database has the original numbers on a log scale and the divers actually put down the number of individuals that they think they saw. In many cases, the diver put down what they thought the actual number was. There was enough of that kind of information to go through and analyse it. We ended up going back to a lot of the divers and taking a look at their logbooks and got even tighter estimates. That kind of data fiddling is scary. All it did was decrease the scale a little.

*Christy Pattengill-Semmens*

I'm not sure about that. You were asking divers to go back to 1998 and estimate the number of tunicates they saw? What about divers who didn't have logbooks?

*Brenda Burd*

When they didn't have that information in their logbooks we had to use whatever we had. Anything up to 20 they would usually give a number but beyond that, estimates get fuzzier.

*Christy Pattengill-Semmens*

Then I think the abundance axis is inappropriate and shouldn't be labelled "abundances".

*Brenda Burd*

Yes, we should change it. There wasn't time to go into it. It was a struggle.

*Brian Smiley*

This struggle is part of what we wanted to express here. You end up with a lot of work on your hands. We just have to be aware of this as we

move into this arena and figure out what to do with the data.

*Brenda Burd*

If you're upfront at the beginning with these types of things, with the data and what you're doing, it's okay. Just make sure you don't over-interpret.

## **Day Two – 21<sup>st</sup> June**

### **Today's agenda and yesterday's comments**

*Brian Smiley*

Are there any comments or observations on yesterday's events? Does anyone have any insights that came up over dinner or in the middle of the night?

*John Perkner*

I was struck by the incredible diversity of backgrounds and experiences of the participants in this workshop. We took different paths to get here, but we have common interests. This is a good opportunity to leverage people's ideas and to pull something out of this workshop to take back to our respective projects.

*Brian Smiley*

So we can forward to the next practical steps. I got some feedback from all the staff at the restaurant we went to last night. The comment was, "I thought biologists and scientists were stuffy." They had already judged us from their observations of people from the Institute of Oceanographic Sciences. They had a lot of fun and wanted to express their appreciation for how happy we seemed. Are there any other comments?

*Bill Seaman*

The proceedings that'll develop keep growing in my mind. For example, the websites of the speakers for training materials and other things are a good start for the exchange of methods and materials between the groups that are here and groups who couldn't make it.

*John Perkner*

There's a sense of shared connectiveness and knowing what others are doing.

*Marc Dillon*

Yesterday we talked about not treading on each other's turf and building camaraderie. Have you ever seen that bumper sticker that says, "Support wild life, throw a party". Twice a year we have a social event. That seems to build camaraderie for our team. A lot of new relationships are built and problems are solved in those events. A simple social event can help a lot.

*Brian Smiley*

You call the party, we'll come!

*Glen Jamieson*

It'll be useful for people to give their PowerPoint presentations to you.

*Brian Smiley*

I thought of that too. I don't know how comfortable people would be to make their PowerPoint slides into PDFs. That way, we'll have records of the talks. They don't have to go into the proceedings, but they will be helpful for us here. Is there anyone uncomfortable about doing that here?

*Christy Pattengill-Semmens*

You'll be making a PDF out of them, not distribute them in the electronic format?

*Brian Smiley*

Right. Would that be a good suggestion?

*Glen Jamieson*

It doesn't have to be published, but available just for participants.

*Brian Smiley*

Maybe that'll be a next step – to put a webpage together and make the presentations available.

*Dana Haggarty*

Can you clarify as to the information you wanted from the participants? Did you want an abstract, one page, or a few pages? What about illustrations?

*Jeff Marliave*

Can it be longer than a page with citations?

*Bill Seaman*

We didn't want to make the requirement a burden, but if you submit an extended abstract that is 2 or 3 pages long, that's fine, but condense it. Make your abstract not indicative, but informative. Put something quantitative, like x number of samples by x number of divers. If literature is cited, that'll be of help.

*Dana Haggarty*

What is the deadline for it?

*Brian Smiley*

We'll talk about it in the next sessions.

*Doug Biffard*

We had a discussion about liability. As a provincial employee that tries to get things going,

one of my major hurdles is liability. Clubs have to ask their members for liability insurance.

*John Perkner*

We had lots of pressure on that when we applied for the monitoring grant. There was an exemption for non-profit organisations but we still had to get liability insurance for staff. That came into play only when we went for the grant.

*Brian Smiley*

We can talk about liability later in the afternoon. Is a waiver form really good enough? It would be interesting to see what each other's waiver forms look like.

**Doug Biffard, BC Parks**

**– “Project Emerald Sea: volunteer restoration and monitoring of a highly disturbed estuary”**

*Rob Russell*

Doug, what's your ultimate goal in all this? Are you eventually going to cordon off some of these areas in Tod Inlet?

*Doug Biffard*

That's really up to the community. Seachange is doing outreach about anchoring. What we need is to talk about the impact of soft bottom anchorages, and maybe see if someone at the University of Victoria is interested in doing that. We were able to get signs that say, “Do not anchor between these buoys”. In Tod Inlet there are already areas that are cordoned off. The next step of putting in mooring buoys will be very difficult because many boaters don't like going to them. They like to anchor at the marine buoy route. It's going to have to be a community effort. Certainly we're still going to work with the eelgrass; it's a highly disturbed area.

*Glen Jamieson*

This is in a provincial park so recreational values are high on the list instead of conservation values – DFO is protecting the eelgrass. What's the process of working together with DFO on this? How can the two agencies work together? There are lots of impacts and most are attributed to anchorages. Shelter for eelgrass is what boaters look for in shelter.

*Doug Biffard*

If DFO came out with a directorate that said “boats shall not anchor in eelgrass beds”, there would be a lot of protest and not much compliance so that's not the way to go. It's a misconception to say that parks are there for recreational opportunity. But that's not all of it;

the second part of the saying is “without impact to the environment”. The trick is to still allow boats to go into Tod Inlet and to moor in appropriate ways without impacting the environment so it will still be there for future generations as it is now.

*Jeff Marliave*

I missed the calendar years. What’s the time period?

*Doug Biffard*

1998 to now. The transplant occurred in 1999.

*Brian Smiley*

For those who are interested, we have protocols for massaging the data; that is, what we were able to squeeze out in the past from what the divers were able to gather. So, there is a report if you’re interested in getting a copy of it.

*Marc Dillon*

Down in the Keys, people were anchoring on coral reefs for decades and destroying them. This is something similar to that. There’s no law to say you can’t anchor on coral reefs but communities were educated not to do it so people just don’t do it anymore. It’s more of an opportunity for cultural or societal change to put pressure on people who do. Maybe this is an opportunity to educate and show the benefits and advantages of having eelgrass. It could take several years, but it’s something to work towards.

*Doug Biffard*

That’s exactly what I meant about the divers bringing back the human experience and people realising that they should anchor a little deeper. The problem in Tod Inlet is that you have 200 anchors being dropped and pulled up again every day. The sedimentation problem is probably the biggest problem right now.

*Marc Dillon*

This sounds like an opportunity to get the students involved, so they can be educated and do some educating.

*Doug Biffard*

Cultural change is definitely a big part of it.

*Brian Smiley*

The whole policy issue of some of these issues is really interesting and could be the subject of a workshop in itself.

**Noelle Barger, San Diego Oceans Foundation – “Artificial Reef Monitoring Project: San Diego Oceans Foundation’s Experience Highlights & Pitfalls**

*John Perkner*

Besides the training, is there a testing component for the methods or for fish identification?

*Noelle Barger*

No, because the method is very simple. There are only 11 fish species to identify.

*John Perkner*

How long is the training session?

*Noelle Barger*

It’s one full day. We felt that to keep divers interested, we would offer one day of training free of charge so that even if the divers don’t end up participating, it’s still an educational experience for them.

*William Lindberg*

If you install transects before you scuttle the ship, you don’t know how the ship is going to end up, and so you can end up with sampling sites that aren’t representative of the habitat. Maybe you can just put in reference points instead of transects?

*Noelle Barger*

The idea is to install transects all around the ship so that we’d have our choice of transects. You never know if you’re going to have a ship on its side.

*Tomas Tomascik*

Has a pilot study been done for the video transect technique? We tried it here, but visibility was terrible so it didn’t work very well.

*Noelle Barger*

I took a video camera down a couple weeks ago and the laser system flooded. When it returns from the shop I’ll be able to practice with it more. There is a lot of literature published on video and laser documentation so we’ll be following other’s protocols.

*Tomas Tomascik*

Are you using any special software to analyse your data? If so, which one?

*Noelle Barger*

We’re going to use Adobe Premiere, but we don’t have it yet. We’re in the process of securing grant funding for it.

*Bill Seaman*

How popular is the *Yukon* as a dive site?

*Noelle Barger*

The *Yukon* has become a very popular dive site in

San Diego. Dive boat operators reported that revenue has increased 70%. They've been key in getting support for this project underway. Besides research site installation, another problem we're facing is the upkeep and maintenance of the Yukon mooring lines. Because we have so many people coming from out of town, there are charter boats on the Yukon buoys all weekend long. We have dive boat operators contributing monthly donations to a savings account to maintain the mooring lines.

*John Perkner*

It's interesting that the Yukon is being marketed as an attraction.

*Doug Biffard*

It sounds as if you have the same problem as I do – navigation and figuring out where the transects were. Were the volunteers able to go back to the sites once they found them?

*Noelle Barger*

After they've found the site once, yes. We have maps that show the exact locations of the holes and references they can look for. I don't know what else we can do.

*Christy Pattengill-Semmens*

The artifact of people holding on to your transect lines is going to confound the data.

*Noelle Barger*

We also have other lines on vertical faces. That's why we're putting them on different locations – so we can account for things like that. It just so happens that our permanent transect line is horizontal.

*Dana Haggarty*

How about putting a holding line near the transect line, and have a sign asking divers to hold on there rather than on the transect line?

*Noelle Barger*

It won't make a difference. Divers don't care, especially those who are not locals and won't know of our project.

*Brian Smiley*

A great place for a quadrat is near the gunnels, because there you know exactly where the edges are.

*Noelle Barger*

Divers only hold onto them during conditions of heavy surge. Otherwise, they'd get pulled off or sucked into a hole.

*William Lindberg*

Given that the wreck is intended for a different community, it might be interesting to study the divers who do go.

*Noelle Barger*

We also thought about following divers down to the site to observe their behaviour.

**Jeff Marliave, Vancouver Aquarium**  
– “Annual lingcod egg mass surveys by volunteers in Georgia Strait”

*Doug Biffard*

I've done Saanich Inlet for a number of years. My observations in Saanich Inlet track yours for Howe Sound very closely. Very few lingcod got up to legal size.

*Jeff Marliave*

The 1995 year classes are persisting elsewhere in the Strait of Georgia. I think we'll see spectacular recovery. They closed the lingcod fishery because of a push to include rockfish in protection areas; they couldn't wait for the Oceans Act. Rockfish are dangerously collapsed and the managers see it difficult to save rockfish when you've got lingcod being overfished. At least this way they will be protected together.

*Doug Biffard*

When doing egg mass surveys, do your divers go back to the same place every year?

*Jeff Marliave*

We have some expert old divers who consistently do an excellent job in the same spot every year but we don't know why they dive in just the one spot. I think that our failure to provide timely feedback caused some of the interest to dwindle.

*Tomas Tomascik*

There has been a dramatic increase in cabezon in fish markets in the last year and a half so they have to include both rockfish and lingcod.

*Jeff Marliave*

Cabezon have never been protected here. They aren't as abundant as they are in California, but there was an obvious collapse in cabezon stocks despite not being fished except in sport and spear fishing. With the inshore rockfish being fished out we have more greenlings and cabezon being fished and going at about \$7 a pound on the market.

*Dana Haggarty*

You didn't mention that you've got people doing this on the other side of the border as well as in

the San Juans.

*Jeff Marliave*

We don't get reports back from them but there have been recruitment events. In the Edmonds underwater park in Puget Sound rocky reefs, the transect lines have gullies along them where the eggs are well incubated. It's totally artificial but they see all the fish they monitor and follow them from start to finish and they're doing something that biologists could never afford to do. There's continuity to it. It's a very successful site. I think there will be some wonderful insights from them.

*Christy Pattengill-Semmens*

On the REEF website is a short video clip of a lingcod eating a starry flounder. This video was taken at Edmonds Underwater Park. For those of you not familiar with it, it is just north of Seattle; it has been a no-take area for approximately 20 years. The size of fish there is amazing, with huge lingcod and cabezon. The Park has been created by volunteers over the years. It is all artificial.

### **Issues & Solutions Discussion #1 – Study objectives & protocols**

*Bill Seaman*

I've been making some notes over the last day and half and thinking of issues that people have been expressing. One of them was in regards to design of data analysis – when numbers are collected, how do you proceed? How do you keep people involved? What about leveraging public interest or deal with scientific scepticism over the quality of data? Funding? Liability? Interest? Three issues that Brian Smiley came up with are listed in your program: Objectives and protocols; Co-ordination, training and funding; and Analyses and reporting.

What I suggest we do is go around and compile a list of issues and then rank them. Then we can discuss solutions for dealing with these issues. As we've been hearing the presentations, I made a chart of attributes of the seven different monitoring groups and I've developed a comparison of the groups. Among other things, I looked at the focus of the program and whether there are people paid as staffers or if they were volunteering. The final column lists issues encountered by the program. I will be asking people from the 7 organisations to think of key issues relating to objectives and protocols. Before I do that, we should establish what we mean by objectives and how we frame it. Is there an extension service in Canada like the Agricultural Service in US? How do you define an objective when thinking of a project?

*John Perkner*

What do you want to accomplish? What's your vision?

*Bill Seaman*

What are a few examples of study objectives?

*Marc Dillon*

Community Education.

*Bill Seaman*

Objectives can be broad or tightly focused. Another way to think of it is why we are doing this work. That's a critical thing to explain to a volunteer, so they understand why they are going out to make these observations or counts. In the book and in other places, we tend to say that before you can formulate a study, you need to know your objectives so you can bring things full circle to evaluate how successful the project was. You might have one project objective, like increase biodiversity, but several study objectives.

*William Lindberg*

I wondered about the difference between objectives of managers, project co-ordinators, and volunteers. The motivation of volunteers seems to be different from those wanting the volunteers as a trained workforce. How do you match those?

*John Perkner*

We often feel there are several sets of objectives: the volunteers' objectives of getting something out of their involvement; a very specific objective for the grant; and the third objective of the overall study.

*Bill Seaman*

I came in thinking of scientific study objectives, but there is a lot more to it than I thought. We'll spend a few more minutes on this. What are the elements of objectives? I mean, there needs to be a rationale for pursuing the project objectives, both for the sponsoring organisation and for the participants. Another part of the objective is specifying methods and, clearly, how we're going to analyse the data. It is important to get a sense of how the analysis will be done before the first numbers come in. Another thing I've looked for in the presentations of the seven organisations is meta-data. I'm trying to teach myself how to use Geographic Information Systems. Meta-data is important. I want to know about the particular divers, the time of day the observations were made, and other things. Those things are important. Then we talk about protocols. What are the elements? We heard about the need for simplicity, repeatability, and training. I thought

before we launch into a brainstorming session that we could list concerns relating to concerns on objectives. It might broaden our perspectives.

*Doug Biffard*

Most volunteers I interacted with came with the objective to do something for the environment. That was the overarching objective, above everything else. They might want to be social, or learn about marine life, but overall, helping the environment is what they want to do.

*Bill Seaman*

And that's a personal objective.

*Erika Boulter*

In the north coast, the situation is very different. Volunteers want to come in and they have their own livelihood to think of, first and foremost. There is a very pioneer attitude in the north coast. That's what I've been listening to, and it's difficult to inspire volunteers to do something based on a conservation perspective. In the north, volunteers want to find out how things can be done to benefit themselves. Will their volunteering lead to paid work? Will it improve their catch? They're not very conservation-minded people. In the marine conservation program, we're trying to do outreach to make people proactively do conservation rather than reactively. The programs down in the Strait of Georgia are mainly reactive – you have things like the lingcod collapse to get people moving. The idea of getting baseline data to establish the situation in a proactive fashion is hard to get funding for.

*Dana Haggarty*

I have a comment on what Erika said. Affluent populations support environmentalism. It's a luxury of an affluent population. We can't look at every single community and expect it. Down in the city we can, particularly among divers who are in the middle to top end of the financial bracket.

This is how I see this discussing unfolding: all protocols are related to the objectives, so I'm having trouble understanding how we can talk about protocols and objectives separately. The programs we've heard about have specific objectives, which the co-ordinators will have to tailor studies for. How do we talk in the general sense of protocols given such a diversity of objectives? Bill Lindberg talked about the reality of divers doing the monitoring versus the study objectives. How much can we expect divers to do and how do we design our study in such a way that we can marry those things? How do we make sure that it's scientifically credible and how do we communicate it to the scientific community

to get something valuable out of these programs? That's what we need to be spending time focusing on.

*Bill Seaman*

Are those realistic expectations of volunteers and scientists?

Let's work down the list of organisations and hear about the key issues they face. *Doug Biffard*, do you want to start?

*Doug Biffard*

We're talking about volunteers coming to parks and wanting to do something for the environment, and our reaction to that? Is that what you're asking?

*Bill Seaman*

We're looking for key issues you've encountered in your projects.

*Doug Biffard*

Oh, the key is designing a program that'll yield conclusions that can be implemented by volunteers, so it's about good project design and practical implementation.

*Brian Smiley*

As obvious as it may seem, it's just clearly stating your objectives in the form of a hypothesis and linking it with metrics or measures. What do you want to measure? Obviously, something that has a unit, like this per that or whatever. You'd want some actual measure you can enter in a database. Already you're thinking about data on how it's going to be put that will meet your hypothesis. It's not just an objective. Restoration of eelgrass in Todd Inlet is a goal. To the community groups, drop out the null part of your because it's discouraging to them. Put your objectives in hypothesis form.

*Bryan Nichols*

We have two different groups at this workshop: people who are putting things into the environment and seeing what changes occur, and people who are trying to see what's in the environment in the first place, to see what's going on. We're the latter. We are trying to get baseline data. The specific objectives are to identify change and how it affects the baseline data. Until we have baseline data, however, we can't say that anything is happening. What the volunteer organisers are often trying to do is give anecdotal evidence of change some scientific strength.

*Brian Smiley*

A baseline is a snapshot in a movie. What you're

saying is that we're missing that part?

*Dana Haggarty*

I'd echo what Bryan was saying. Most of our work is geared toward collecting baseline data. Volunteers often collect baseline data because it doesn't take a large budget for that type of work. It's not going to show any results in any given time if the goal is to look at change over time. Projects are funded on a 2, 3, maybe 5 year time series. It leads to special projects with respect to scientific experimental design, volunteer attrition and participation. It's not really different from what's up on the flipchart already; I was just tying it up. In baseline monitoring, the null hypothesis says that there is no change over time. That's difficult to deal to test, with no endpoint to it.

*Lex Waters*

We're trying to figure out how to walk that tightrope between recruiting and retaining volunteer divers, and being able to keep them up to speed for collecting credible data. Right now I'm thinking that the scale is tipped in favour of having people who are highly qualified, but at the expense of keeping people engaged. We're thinking that we task loaded them too much with quality at the expense of having them stay in the organisation. That closely ties in with making sure that the volunteers feel that what they're doing is valued.

*Bill Seaman*

We're going to come back to that and discuss that, but let's first go to San Diego.

*Noelle Barger*

Our project ties in with Brian's point. We use actual measures, so we have specific areas that meet with our objectives. We have standardised our methods so that volunteers can produce reliable results repeatedly.

*Bill Seaman*

So we're looking for credible designs that are volunteer friendly?

*Jeff Marliave*

I haven't heard much about rules on working with volunteers. I work for an organisation that has included volunteers for a long time. There are a few rules that have to be followed:

- Volunteers have to enjoy themselves or they won't come back.
- Volunteers cannot be held responsible. If they screw up, you screw up. If they misunderstand, you have to do the rewriting.
- Never have volunteers do work that you're

having paid employees do. Always make the roles significantly different.

Also, you must have funding somewhere for management. For all volunteers, there is always a tendency to have things disperse or turn to dust.

*Noelle Barger*

Your point about volunteers not being accountable is very good. I think we were pretty flexible. If they don't understand it, you have to adjust what you're teaching them.

*Jeff Marliave*

Adaptive management is important - capable of recognising flaws and adapting to fix them.

*Sean Melvin*

I'm a volunteer diver, but I have a science background so I understand a lot of the theory that is behind the studies. An everyday layperson doesn't want all that, and they shouldn't be so heavily involved in cause and effect. You can never prove cause and effect, and you can lose the public if that's what you tell them. There's ecosystem health that can be used to link with the volunteers. As a diver, it's not hard to tell which ecosystems are doing well and which are not. A recreational diver is much better at seeing that than a scientist with their baseline data.

*William Lindberg*

There's a lesson in here for scientist, and that's transparency. As scientists, we may be very much into cause and effect, but that might not be what volunteer groups have to deliver to us. Because studies are so hypothesis driven, sometimes they take place out of context. Sometimes we don't see inter-spatial and inter-annual variation that divers can show us. The objective of Lakewatch was to get a baseline estimate, but the procedure was interested in broad-scale questions; it wasn't detail-oriented. It's important for us in selling our product to pitch it appropriately and explain what we can provide as a volunteer group for the scientific community that they might not be able to provide for themselves. Another comment is adaptive management. As you find things that work and don't work, you have to adjust your protocol. The metadata that Bill mentioned is important. I don't know how often I've gone back to datasets to adjust for stuff like red tide.

*Tomas Tomascik*

With respect to types of studies and objectives, what's needed is development of sound scientific approaches, no matter what study is being done. What's more important is standardisation of methodology and data. That's missing;

comparing many studies is like comparing apples and oranges. There's a need for standardisation. For example, *Brian Smiley* showed us technique for using reef balls. Right now we're monitoring kelp forests. We're doing a similar project, but there's no way we can do what he's doing in 60 feet of water. There needs to be some sort of standardisation and a way to compare data from those types of studies to results from different types of studies. With respect to Dana's comment on environment conservation coming from the financially affluent, let me remind you that some of the most successful conservation efforts came from some of the most impoverished places in the world.

*Dana Haggarty*

You're right, it's not a hard and fast rule, but if they're starving, conservation isn't going to be high on their list of priorities.

*Bill Seaman*

I think we have enough issues here to have a fruitful discussion. Do you want to talk about science first? It seems like the underlying issue.

*Brian Smiley*

There are one or two metrics common no matter what the objectives are. One metric is critical – what would that be? If we don't get that right, everything else goes into the ditch. For me, it's species identification. For my way of thinking, if we had to set a single exact metric, it would be species ID. The only exception is the lingcod project, which is only dealing with one species. Even if you have your hypothesis sorted out, if you don't have a good method of species identification, everything else is useless. Even simple presence of species, whether it's there or it's not there, is the most basic hypothesis you can have.

*Bill Seaman*

We could just go down the list here and discuss how we can solve these issues. The first issue deals with differing objectives between volunteers, agency, group, and community. Who voiced this one?

*William Lindberg*

I think I did. It would seem to me that having multidimensional objectives would be most workable. If you put your blinders on and only look for what you want, it's not going to work. If all the scientists want is rigorous data, the volunteers aren't going to get anything out of it. If volunteers only want to have fun, then the data might not be rigorous. There has to be a blend.

*Noelle Barger*

Volunteers have different objectives than the foundation, which has different objectives than Ed and Paul, who wants statistics out of the project. It's easy for me to differentiate between the three. Maybe you have different problems.

*William Lindberg*

How easy is it to reconcile the differences?

*John Perkner*

It's easier for a group like the Oceans Foundation, which has paid staff that could see the differences in objectives and reconcile them. We don't have that connection. That's why we're here, to try to make that connection.

*Noelle Barger*

Can you establish that connection within your group?

*John Perkner*

We lack someone from the community on board. Right now, we're on our own.

*Bill Seaman*

This workshop will be important in acting as a link between volunteers and the academic community. We have lots of volunteers, but they are set adrift because agencies and universities were a little naïve as to the capabilities of the volunteers. Are there any other comments toward this point?

*Doug Biffard*

Let me offer an example pertaining to the lingcod survey. My motivation to count egg masses is that my world is a diminished place without large lingcod. Someone else has diminished lingcod through their actions. Hopefully the people collecting data could use it to show management or society that they need to change. My motivation may be different from Jeff's, where he's getting some scientific data.

*Jeff Marliave*

Doug has brought up an important point not of goals of managers, but of scientists. This is the first year of our study. Jackie King has asked to use our data because the managers at DFO and the scientists are saying that we can't shut down the lingcod fishery or we wouldn't know what's happening with the stocks. That's what volunteers can provide. We've seen from the Atlantic cod debacle that fisheries data can be very misleading.

*Dana Haggarty*

It's important to acknowledge that there are

different motivations for volunteers. You have to acknowledge that they're different, but you can't let the different objectives stop you from doing what you want to. You can't let sceptics detract from what you're doing. In 2, 5, or 10 years' time, you're going to be the only one with the data and they might want to use this huge dataset further down the line. That's what happened. You also have to be very careful to acknowledge limitations of your data set, be clear about what should or shouldn't be said with the sets, and communicate it to volunteers so they don't go and make statements that you can't necessarily support.

*Kevin Conley*

We're focusing a lot on differences, and sure, it's important to recognise that lots of people have different objectives. For example, scientists want data and volunteers want to have fun. But in my experience, scientists know that although they want good data, volunteers are a cost-effective way of doing studies. Volunteers want to have fun, but they also want to learn and contribute to something useful. It's important to look at similarities as well. Volunteers want to have fun, but I want to have fun at work too and for the most part I manage to do that with a "work to live" rather than a "live to work" kind of philosophy.

*Bill Seaman*

I think the discussion has taken us down the page, which is fine. The first three points on realistic expectations are part and parcel for this discussion.

*Brian Smiley*

I only have one addition, that the main solution is to take this word blend and add an 'er' to the end. We're blenders. It's your own personal enthusiasm and creativity that brings the differences together. We're practitioners; we're doing all this. The key is to have the blenders bringing all of the various things together. The only way it's going to happen is to have a person with a warm personality between the divers and the scientists.

*William Lindberg*

It's useful if the blender can make daiquiris, too.

*Bill Seaman*

Item four on the list is good project design. Let's bypass this for a minute and get to having a scientific design first before we get to implementation.

*William Lindberg*

Most projects are site-specific, yet part of the

power of a volunteer monitoring program is that you're able to get a broader geographic coverage from volunteers. That's something that could be extremely valuable. Citizens in Lakewatch who are monitoring their lake are only concerned about their own lakes, but it's the comparisons between all the lakes that bring scientific interest in.

*Bill Seaman*

Let's continue on this topic, then.

*Doug Biffard*

From a management point of view, when we look at a project, there are lots of things you can do. In a practical sense, you want to do something that could change management; for example, are there too many boats in Todd inlet? If there were a project where scientists talked to the boaters and have them moor elsewhere, it might not yield very good results. On the other hand, if there were a project that had a measurable metric and outcome that shows sediment rates are higher when boats are moored there, then we could make a management change. That could be more effective than talking to boaters.

*Bill Seaman*

Is that like the Lindberg chart of going from collecting baseline data to management changes?

*Doug Biffard*

What I'm learning is maybe that particular study is not the place to use volunteers.

*Christy Pattengill-Semmens*

Not every project that managers can think of where they don't have the resources to do is appropriate to give to volunteers. That's such an easy trap, to think that they can just get volunteers to collect the data that they need. Sometimes it's not appropriate. From REEF's perspective, we wanted to design a project that would give valid scientific results. We had lots of scientific advisors, and we did lots of thinking, talking about options and developing methods for how we'd do the survey. What's lacking in some of the presentations I've heard is getting the volunteers, not scientists or managers, in the field and trying things out. A lot of the stuff that scientists want volunteers to do is not what the volunteers are prepared to do. But if you get people out there and try it, and refine the method based on a pilot project, at the end of it you'll have something lasting. This whole notion of standardising methodologies might not work in practice. We haven't changed what we've been doing in 10 years because we had a good pilot program. You have to use core scientists to do

basics, but don't let them design the protocol. Figure out what works in the training. It's really important to get volunteer input.

*Brenda Burd*

From a science point of view, the SPARS data was only an example. I was dealing with data that I had no input into it. 90% of published data is not hypothesis-driven. The difference between baseline work and project studies is not real. If I were to talk to volunteer divers about what we need, I'd tell them that we're trying to get the natural variability of something. That's all we're trying to do. Volunteers can do that as well as anyone else can, and they can usually do it better because there are more of them. Studies can be very broad and temporal. That's a blend of how the data are used and how reliable they are over space and time.

*Bill Seaman*

*Brian Smiley* made that point a little while ago – where are they, how many there are, and how big they are. These groups are federation of volunteer divers. One of the mission statements for the seven groups is determining natural variability. Standardisation of findings is also an issue.

*William Lindberg*

The hard experience I just had is the reverse education from volunteers to the research community. Volunteers are not graduate students. I think we enter relationship with unrealistic expectations because we don't distinguish between those two groups.

*Brian Smiley*

If you're studying artificial reefs, it's hard to study natural variability.

*Brenda Burd*

For terms of objectives and answering hypotheses, you have to know the natural variability.

*Bill Seaman*

We've covered some of these issues in detail. We have a few more points. One is scientific use for collected data and the second is volunteer retention. We can pass the latter off to the lunch discussion. Scientific credibility will be a theme that comes up all the time and we can bring it up in part 3 of the discussion.

**Issues & Solutions Discussion #2  
– Co-ordination, training and funding**

*Brian Smiley*

There's a difference between a Salisbury steak sandwich and a hamburger: a Salisbury steak isn't a hamburger by itself; you need two slices of bread on either side. The way I look at it, the first session of objectives was the top bun, the last session on analyses is the bottom bun and this one on co-ordination, training and funding is the meat of it. Without this, you just end up with two great pieces of bread but without the steak it's really going to be a non-event. I think we've nibbled around this enough to get a sense of what we should talk about. So, we've got our protocol and co-ordination ready, and now we're ready to do it. Not only do we need co-ordination but we also need a co-ordinator – we need a champion and there are some incredible champions in this room that hold the top and bottom buns together. The whole issue of training has come up again and again and again. Having protocol is excellent but it's not only about getting the data but also analysing it and doing something with it. This year we're finally getting around to that loop.

You have to have a number of years of data for monitoring efforts to really start the analysis. You need a few points on a graph before you can see any trends. That's where I'm coming from. Jim Cosgrove is a heavy-duty taxonomist and a dive head, one of those kinds of people who will come here and spend a day and a half to build a community of practitioners. I emulate after he said: "The only advice I give you is to start slow, build accordingly, and then expand". That was his only solution. Starting slow must be frustrating to everyone. My department wants to see results right now. They give you \$10,000 and want to know what you've done with it. Is it clear what we mean with these as topic areas? I guess they don't need much explanation. I'd really like to throw up some solutions here, some success stories. I want to move beyond the "we have issues" and get into the solutions. Noelle has a great story about a solution and how she was able to get here. I called her a few months ago and she said she might not be able to come due to a lack of funding. Well, she is here because her mother won some money at the casino and needed to donate to a non-profit organisation for tax purposes. She donated it to the San Diego Oceans Foundation and Noelle was then able to make the trip. Gambling is maybe not one of the solutions you'd recommend.

*Bill Seaman*

So funding is an issue – I'll start a note here.

*Christy Pattengill-Semmens*

One of the things that carried on from this morning is the retention of volunteers. In looking at our successes and failures in being able to

retain volunteers, like all the groups, we have trained volunteers and just not had them come back after doing only one or two surveys. Probably about 50% of them do that. But we do retain a high percentage of divers who do up to 100 surveys per year and we keep getting reports from them. And for us one of the biggest things that keeps volunteers coming back, well it's a whole mixture of things (not that you have to have all of them and knowing that you can't do a complete taxonomic list like we do), but the opportunity for discovery on a dive is what keeps them coming back. It's the same reason for people who become avid birders, because there's always the opportunity for people to come back and see something new. They're listers and like writing down the new things. So that's our big draw, the opportunity to see something new.

Also, the online feedback is very important; we get over 100,000 hits a month and half of those are going to the survey section. The opportunities for advanced surveyors are there; we have tiers where we have experts and novices. As our services are being discovered by agencies, they come to us and say, "We will fund you to monitor this area for us". We pass that opportunity on to our Advanced Assessment Team who is invited to be involved in the monitoring. We're in our 6<sup>th</sup> year of monitoring no take zones off the Florida Keys. Our contract is put toward the monitoring and then the feedback goes to whoever is supporting it. The social aspect is also an important factor in retaining people; group experience and opportunity for advancement that people seem to enjoy the most. We try to coordinate trips every year because it's a way to not just do the survey on your own but to get in a group setting and people love it.

Reporting above and beyond the webpage is important too, because everyone wants to see the results. In the Florida Keys project, for example, every year I write a report for the members who participated even though I only have to write one at the end of the five years of funding for the grant providers. The feedback from members is great. They like to get these reports to see what's happening but you need to have someone who can cross the line between the technical and non-technical writing. A copy of the member report is also given to the sanctuary and they love it because they can turn right around and give it to others.

*Dana Haggarty*

REEF publishes newsletters, and top surveyors from every region get to see their name in it. Members like that.

*John Perkner*

It's a form of recognition, then.

*Christy Pattengill-Semmens*

Yes, care and feeding of the volunteers in a sense.

*Brian Smiley*

These are the kinds of gems that are relatively easy to do. Do you have any other ideas on how to retain volunteers? It's been frustrating for us. At the beginning, when piloting our protocol, we were just taking anyone we could get. University students have been very helpful and very pragmatic. It's an important volunteer experience for their resumes but once they learn it, they're off to summer jobs or graduating. So we're burning a lot of our effort on people who aren't the right candidates to start with. As far as retention of volunteers goes, we need to get residents of the community involved instead of visitors.

*Dana Haggarty*

Maybe you need to make a connection with teachers who would have waves of students every year. As long as you make those key partners and connections in the community you will have that continuity you're looking for. You just need one or two motivators and those are the key people to network with. I know sometimes I do the training and most don't go and get the word out, but there are always one or two really motivated people who'll really work hard – like dive instructors and boaters.

*Kevin Conley*

Or managers of dive shops.

*Bill Seaman*

I started a new list, and wrote recruitment rather than retention because it's the candidates we're really talking about.

*William Lindberg*

How much is continuing education a part of retention? There's skill development and competency but are you doing continuing education for people to come back, a sense of continuity?

*John Perkner*

I was thinking the same thing – continuing education, or something like that. We have a lot more people attending our meetings when we have a guest speaker, say, from Sea World to come and talk specifically about stingrays or something. So it's more than just training, they're learning a lot more. So enhancing this by bringing

in a guest speaker did attract more people to the meeting.

*Bryan Nichols*

As far as recruitment or retention goes, we're thinking about this as scientists and managers, but as managers we need to think about what motivates volunteers. Different things motivate different people. If you sit down with a piece of paper and ask yourself, "If I were a volunteer, why would I do this?" this would let you strategise. Are they students wanting something for their CV's? Are they residents feeling a sense of ownership? If it's a dive site, whoever lives up the hill is a prime candidate for a volunteer. Go through the list of motivations and strategise so you can speak to people more directly. Figure out how to get them involved and more specifically, how to keep them involved.

*John Perkner*

An action would be a survey of existing team members across a certain geography to see what they're in it for. Get direct feedback from them rather than what we think they're in it for.

*Brian Smiley*

Noelle, when you gave your talk, you brought up a few things like discount cards and a training video that's not used just in training but could be taken home and to be shown to volunteers' families as well. Some of those things you highlighted in your presentation I hope we can bring them forward into the discussion. You too, Dana.

*Christy Pattengill-Semmens*

Noelle talked about financial incentives. We've done that too where people who do the training can get cards to for 'free airfills' or 'do 3 surveys and get the 4<sup>th</sup> free' or something to that effect. They're not financial in the sense that you're getting money, but they're perks and rewards.

*Dana Haggarty*

The cost of being involved in a program like this, it's a cost-benefit analysis. Whatever it is, the benefits must outweigh the costs. If you're not achieving that then the program isn't going to work. Either decrease the cost by giving them free boat dives or free air, or increase the benefits by having special speakers. Biologists can learn a bit from economists.

*Noelle Barger*

This is specific to the Yukon but one of the things I try to stress in the training program is that they get a 50% discount off the dives. The data they're collecting only takes about 5 minutes to do so the

rest of their dive, about 25 minutes, can simply be fun. So, the reward is getting 50% off a 25-minute fun dive.

*Brian Smiley*

This room and the cafeteria seem to be a nice place to hold such events. Kevin, you've organised a couple of open houses, and the volunteers brought their families. To actually hold it in a research facility is building that linkage. The corollary of that is to get the scientists into the dive shops or at the dive sites on the beach. Building that geographic linkage really helps.

*Jeff Marliave*

One question I'd like to ask Christy about REEF: you have all these projects where you can gather and train people and reward them, but we're definitely in remote contact with our volunteers and we don't hope to ever get to Port Hardy to meet some of them. We have outreach but our procedures are written and self-guided. Are there protocols for remote places? Can someone be involved with a REEF project without ever meeting one of you?

*Christy Pattengill-Semmens*

Absolutely, yes, someone can be involved without ever meeting someone from REEF. It's all up on the website.

*Dana Haggarty*

Every region has a set of slides that eventually make it onto CDs. We also hand out a binder. It goes through the preamble about what you need to know before you start instruction and then gets into technique. There is also a quiz at the end. At the bare minimum, someone could just get up and give a presentation with the material in the binder or manual.

*Christy Pattengill-Semmens*

But that's for the training. Most of the training is not done by REEF staff but by local partners. Some people don't even get that training but just get a survey sheet and go. The method is self-evident; it's easy to pick up, much like birding. As they do more surveys they get better and better and get 'sucked in' – once they're hooked the social aspect comes into play.

*Dana Haggarty*

There are also online quizzes, with a gallery, where at the end the user gets their score.

*Christy Pattengill-Semmens*

The online training is one of the highest visited sites. There's also a database and online store.

*Dana Haggarty*

Videos are very good curricula as well where you can see and point out fish motions. It's a tool to teach people how to identify fish but the onus is on them to go out and get a good field guide and perhaps even go to an aquarium.

*Brian Smiley*

We've moved into training now.

*Doug Biffard*

I'd like to congratulate REEF on their website. It's very neat and I would encourage people to go visit the site.

*Brian Smiley*

How about other solutions to help with training? I'd suggest one. This transect business, we do it but we do it around the building on the floor to simulate the transects underwater. We throw pictures of animals on the floor and have the divers crawl along, like they're diving, and try to identify the different pictures. It's a good way to see how long it takes to do 30 feet and the divers think it's a hoot – it's hands-on and knees-on!

*Kevin Conley*

It's an intangible benefit of having the big research scientists there, particularly those with their name on a field guide. People really liked hanging out with the naturalist from the museum. To the volunteers, they're the coolest people on earth. To be able to go out on a dive with Jim Cosgrove is thought very highly of.

*Christy Pattengill-Semmens*

We have the same thing with the big time authors on one of the books. We get them to guest speak and it draws people in.

*Lex Waters*

One thing we've been hearing here is that a lot of the other training methods are much more streamlined than ours. Ours was harder, which is perhaps a reason why we've scared a few people away already. Other organisations get good data but their methods are much more streamlined so that's what we're going to try next – something tiered, rather than 10 months of training or not involved at all. Some of these organisations have training in one day. That's definitely opened our eyes to things done in different ways.

*Brian Smiley*

That's something we're going to take away as well, something to look at in our next steps.

*Christy Pattengill-Semmens*

You can do two or three hours of training and get

them to go home and study flashcards, video, or a website. On our website (<http://www.reef.org/>) there's a fish gallery for our major regions and quizzes to go along with each. The galleries we have are for the most common species and the quizzes are by region. There are randomised questions of about 50 fish. The quiz program we use is just freeware, originally developed at the University of Virginia, which we modified. The quizzes aren't just for fish either; we have quizzes for invertebrates too. The quizzes are the most common things right now. We always have comments on the quizzes, for people wanting more. For anyone who wants to use this site or wanted to look more at our papers and projects, they're all there for you on the website. You can also download all of the papers and reports that have been produced using REEF data; they're all PDF files. So this has definitely enabled us to reach remote participants. All they have to do is go to the online form and order what they need.

*William Lindberg*

Would it be possible in this kind of system to develop a simulation where they're running a transect on video and they're doing an evaluation?

*Christy Pattengill-Semmens*

We haven't done that although we've now put up a quick 1 to 2 minute blurb on how to do it. We can do a 3 minute-long clip focusing on different fish.

*William Lindberg*

The reason I ask is because some years ago a group in the Living Sea was testing with video a known population. With something like this you could actually test their ability in real time, beyond simply species identification, rather than just the fish quiz or in addition to the fish quiz.

*Christy Pattengill-Semmens*

Ed Green did that.

*Lex Waters*

Who and where is he?

*Christy Pattengill-Semmens*

I don't know where he is now. He's a fish ecologist and was comparing transect and video in the Epcot aquarium.

*Brian Smiley*

We have 10 minutes before we have to wrap this part up. I want to hear some things about resourcing/getting funding. I know it really depends on the project but maybe as North Americans there might be some kind of basic

principles we can get down. Many of you are good grant writers, good for squeezing money out of sponsors. Just wondering if you have any tips on how to do so? At the end of the day, I think we can all agree that funding is important.

*Dana Haggarty*

I have some other training ideas. When you were talking about doing the transect line around the building here, an instructor in Washington did the same sort of thing by hanging floating fish cards in a pool. It seemed to get the kids really into it. Something I developed was a game called "fisho". I scrambled the slides and names and we'd play an open round to call the names out or a silent round and whoever knew what fish it was could look for it on their card. It's like bingo so whoever gets them all in a line first would yell out 'fisho'. Even adults like it. Another thing is weekend retreats to teach divers how to teach. One of the major benefits of the weekend setting is getting people involved in projects, showing them how fun it is and giving them a lot of skills to go back and be able to disseminate the project to their own communities.

*Christy Pattengill-Semmens*

That weekend involves networking and training the trainers. After that, they'd be comfortable e-mailing each other with comments or concerns.

*Doug Biffard*

To take that up one level from that and tying it into funding, Noelle brought up the idea of certification and linking it to PADI – i.e., *Yukon* diver under PADI. That way you're getting the diver to pay for the training. If PADI would take it up as part of their curricula and make it part of the instruction divers can pay for, it would help to raise funds. Do it for places like the *Yukon* and Race Rocks so you would have Race Rocks-specific diving to be able to dive there. That's methodology.

*Noelle Barger*

It was not very difficult to have the PADI card approved. We had a lot of guidelines to follow – basically, the instructor just took the volunteer manual and tweaked it a little bit. However, an instructor has to take on the project, teach the class and then submit all the paperwork. Divers paid \$100 to take the course. In our case it was really quite easy.

*Christy Pattengill-Semmens*

REEF has had a different experience, almost opposite, with that and it was a real pain but we did it about 4 years ago. Once it was done though, it gave some incentive for instructors because a

lot of divers like to take specialties. We haven't done a very good job of tracking it though; PADI will not give you the names of the people who take the course.

*Noelle Barger*

We only have one PADI instructor so it's not hard for us; we just get the names from him.

*Christy Pattengill-Semmens*

I think there's some PADI protocol not to release that information so I don't think your instructor is even supposed to do that.

*Dana Haggarty*

In regards to funding, one of the biggest things people can do is co-ordinating and building partnerships. It strengthens both projects and prevents people from going to the same foundations for funding to essentially do that same thing. Another thing is that it's different to get funding for ongoing year round projects. It's easier to focus fundraising around events. So it seems to be good to have focus events. This year it's focused on the Great Annual Fish Count. Another easy thing to fundraise for is instructor workshops because they have specific outcomes.

*John Perkner*

Another option, as a secondary use for the data, is packaging and selling the information you've collected in a nice way and then selling it to the local marine/dive shops. A 'hotspots' guide can generate revenue.

*Brian Smiley*

It can be focused on hot research spots.

*Marc Dillon*

As a scientist working in the business world, I find that if you're going for money I often see that scientists don't often write good business documents. That's a generalisation of course but if you're a scientist and want a grant from a non-scientific source, you really have to adjust your writing style for a greater degree of success. You have to focus on the audience you're writing to rather than writing in normal scientific style. We get feedback a lot of times that sometimes scientists don't communicate well with the general public so if we can adjust we might get more success.

*Noelle Barger*

Writing in phases also helps. We were successful with the PADI foundation two years in a row. First we asked them to just pay for the pilot study and this year we went back to say that we really wanted to take it one step further for fish tagging.

Saying 'this is where we've been and this is where we're going' showed them that we're always progressing forward; private foundations want to know that.

*Marc Dillon*

It's important to build credibility.

*Noelle Barger*

Yes and going in stages is important as well.

*Christy Pattengill-Semmens*

I'm not involved in grant writing but there's a CD out there called the Environmental Grant Writers and it's a good resource for a list of every place that gives out grants. REEF is a little different because we're an organisation. We're a non-fee-based organisation and we always have been. Being a member of REEF is free. We're asking them to do something and we don't want people to pay an annual fee just to get a number and some newsletters. We end up getting about 40% of our operating budget from charitable donations (i.e., from our members), which is about same as a fee-based organisation like Audobon.

*John Perkner*

We don't ask for any fees or anything either, but we need to redirect their charitable donations to us.

*Christy Pattengill-Semmens*

It's really expensive to solicit. Mail-outs are expensive.

*Noelle Barger*

Unless you find a sponsor that'll do your printing and mailing for free. Sea World does all our mailing for us.

*Sean Marvin*

How much success have people had from getting funding from Greenpeace, Sierra Club, or other large NGOs?

*Noelle Barger*

In San Diego, since 9-11, almost every large non-profit organisation has been suffering and some even have closed their doors. Opportunities are very limited right now.

*Christy Pattengill-Semmens*

REEF has collaborated with the Ocean Conservancy but never got any funding from them. They're interesting projects but it's hard to work with them because they are a large organisation and very bureaucratic. It's a business and they can't just write a cheque or make things

happen.

*Noelle Barger*

We teamed up with the Sierra Club for one of our projects, the canyon watch program. One of the problems was that I had to write the grant proposals under our 501C3 because they can't. It's important to be careful when writing grants in this way – someone might end up getting screwed.

*Brian Smiley*

The whole area of in kind finances, someone doing the mailing for you etc., that's the bulk of funding initiatives. Actually the web-based development of databases would help to link sponsorship within kind as well.

*Jeff Marliave*

Do people who are 501C3 have special status? At least in our Canadian status, we pay the charter and he pays a donation to us.

*Christy Pattengill-Semmens*

We don't do it that way. They give us a receipt of what it's worth and they get the tax write-off.

*Jeff Marliave*

It doesn't work like that here. Money actually has to exchange hands in Canada.

*Christy Pattengill-Semmens*

We have found that sometimes you have to explicitly ask our advisors and donors for help. Of course, they know that we have costs but it actually took saying at an annual meeting that the reason we didn't get 4 newsletters out this year was because it cost too much to print. After hearing this, one board member said they knew a printer who would probably like a tax write-off and ever since then we've had free printing. Putting a list of costs down on paper makes it clear to everyone what the needs are so if anyone knows a potential sponsor they can help to get things going.

*William Lindberg*

There's irony about the quandary on funding. This type of work or volunteer effort has the capacity to provide the sector and agencies, which are in a position to give grants, with the work that they can't do. Some funding agencies aren't compatible with long-term baseline datasets so feedback to potential funding sources is very important. The very things they look to volunteers to provide would require a change in policy to provide themselves. In Florida the state issues reef monitoring grants at \$25,000 a pop but they're very science specific and don't provide for

a long-term broad-based project. They don't address what Brenda was talking about.

### **Issues & Solutions Discussion #3 – Analyses and reporting**

*William Lindberg*

Let's start off and begin with the end in mind. As we have been doing in the other discussions, it would be good to get some idea of the problems you've encountered with analysing and reporting, and possible solutions for them. Some people have reported on the kinds of reports that are available. What do you find to be effective in getting reports back to your members, your funding sources, and the public?

*Jeff Marliave*

Tom's gone, but he made a plea for uniform transect methodology. I was at the table at the Pacific Biological Station when Glen Jamieson was doing his pitch for uniform transect methodology. Phil answered him by saying, "I've been doing these longer than anyone else; my methodology is superior, you're not going to tell me how to change." Anecdotal data can be turned into publishable data. In a debate, you need to confront both sides of an argument. A lot of studies are not necessarily compatible to use uniform methodology unless they are studying the same species in the same location. I don't think I buy into the idea of only using one method.

*William Lindberg*

So you're saying that using the same methodology may not be necessary due to the power of meta-analysis? Perhaps some latitude is necessary?

*Jeff Marliave*

Particularly when we get into traditional or local knowledge. There are a lot of divers who were diving in the 1950s when scuba gear was invented, and they saw things we didn't because we weren't around at the time. They could see the change.

*Dana Haggarty*

I agree with Jeff. There's nothing magical about a transect. There are biases associated with transects, just as there are biases in every methodology you use. Tom acknowledged that a single methodology isn't going to work in every environment. Those things, those realities are what you have to grapple with. You have to tailor methods to your own study. That makes it impossible for completely standardised studies. You can have standardised goals or principles to try to achieve, like replication, but having the

exact same methodology is not possible. The important thing is to document your methods and be clear what the biases are. The divers in Reefkeepers are using transects and comparing methodologies so people know what works in which situations.

*William Lindberg*

So our job is to be aware of biases in our data and to do comparisons and pilot studies.

*Dana Haggarty*

If you have those comparisons, you will be able to know what you can make sense of and what you can't.

*Christy Pattengill-Semmens*

I would definitely agree with those two points. The call for a standardised method is ridiculous and wouldn't ever happen, so it isn't worth bringing up in my mind. Within a program, you decide what the objectives are and that's what you want to aim for. You don't want different people on different parts of the island doing things in a different way. But across programs, how do you expect that to happen? And what would be the advantage? There is no doubt that every method has its biases and limitations, and using complementary methods can provide a more complete picture of what is going on in a system.

Following up on Dana's point about comparisons, they are useful to do. We have a huge dataset from the Florida Keys, and so does the National Marine Fisheries Service. What are the complementary things that show up in the data sets and what can we say that's larger than simply the sum of the components? You don't want to use just one method because it can't tell you everything. How could you expect the volunteer community to come to an agreement on methodology when the scientists themselves can't do it?

*William Lindberg*

So long as it's well documented. So in all sampling methods, there must be a clear expression of what sampling unit was used? There seems to be a sampling unit implied, but not explained.

*John Perkner*

I think the scientific community would want to enhance methodology. There's lots of interpretation from the Roving Diver Method. Just by looking at it, I can see there's lots of variation, like estimating visibility rather than using a secci dish. Capturing that next level of

information can enhance the methodology without having to come to an agreement on whether to use transects or point counts.

*William Lindberg*

This deals with being able to measure the error of measurement caused by the variation from diver to diver rather than the variation caused by the method of sampling. Is there discussion within the groups for sample sizes and replications necessary to offset that variation?

*Christy Pattengill-Semmens*

It goes back to the importance of doing a pilot project before doing the actual study. You have to figure out the area/effort or species/effort curve to overcome variability.

*Brenda Burd*

You can also do an experimental or pilot study to see where the errors are and devise a weighting scheme. A lot of things you can't control even if you know where the errors are. Prototype studies are so important for that. Do specific studies where you send experts down there to do their observations, and then send volunteer divers down for observations and see what the difference is. By doing so, you can figure out a weighting scheme. You can assess divers at different stages, like after their first dive, fifth dive, etc. It's fun for divers too if they see that they're improving.

*William Lindberg*

Do training programs involve pilot study programs? Almost like a certification?

*Brian Smiley*

We built it into Reefkeepers to a degree because we were matching newbies with oldies. It's not systematic, but it's there. Paired observations are good too. Noelle, I'm not sure why you chose to have the divers in your program go in front of the other rather than do the transects side by side.

*Noelle Barger*

That's so two divers can go along the exact same line in a matter of minutes. If those buddies are not educated or trained, we have a trained person make a pass and then have them do another pass. That way, we can estimate diver error.

*William Lindberg*

Do the volunteer organisations feel you have enough guidance on what's useful in developing pilot studies to have information to go with your data sets?

*Marc Dillon*

I think it would be beneficial to have literature on building correction factors from someone who's done this, something that includes the methodology, the math and how they did that to try to replicate or use alone. An example would be good.

*John Perkner*

It would help us to have someone from a supervisor group to relate their experience; instead of having us coming up with our own method, have someone say relate the best method they have found, and provide hands on training.

*Bryan Nichols*

The scientific community has been too quick to ignore anecdotal or volunteer data. Instead of ignoring or deriding it, scientists need to provide advice and help make volunteer data more rigorous and more useful statistically, instead of wasting it. It's like what Brenda was saying – here are some tips that would make the Reefkeepers data better. Instead of telling volunteer organizations that you have to stop what they're doing or have them do it in an entirely different way, think of ways to give advice that would make the data better.

*Brenda Burd*

Noelle made a point about divers making repeated passes of a transect. That brings up a new level of importance of doing passes. That brings up variability in what they see each time. A different level is sampler bias – what they're identifying correctly and what they're not. If you can incorporate those aspects, you can get a really good handle on those kinds of biases. I've run across a few pieces of literature that deals with these issues.

*William Lindberg*

It struck me that because we're dealing with people and volunteers, there's a human dimension that's not represented by the biologists in the room. What are the characteristics of people that make them appropriate for diver sampling or not? Someone who is involved in behavioural psychology might be interested in this.

*Dana Haggarty*

We have to start acknowledging and looking for opportunities to network with those scientists. We can start by making presentations at different symposia and getting our results out to the literature to start building credibility. The onus is on us. Another thing we can do to open up scientists' eyes to this is to point it out to them. At the end of a symposium in Seattle about chum

salmon, they were saying how there was no long-term data. It didn't occur to anyone there that volunteer monitoring is an option until I reminded them that there had been someone presenting on just that at the symposium. I think they immediately forgot about it again, but I think that if they start hearing it often enough from enough sources, they will start to realise that volunteer monitoring is an option.

*William Lindberg*

There have been groups in the scientific community that have dealt with meta-analysis. If one were trying to assimilate scientific literature and bring it together for analysis, there may be groups out there who are wrestling with the same kinds of problems. Maybe some of their tricks can be stolen for dealing with data sets.

*John Perkner*

Like the GIS project that we've been talking about – it has a common data entry format. Is that not a foundation to have information that you're always capturing when you're out there getting data?

*Bill Seaman*

I think it could be. Many of you are familiar with GIS. It is used in many applications for fisheries. We're doing a pilot project to see if GIS is appropriate for one of Florida's counties. If it works, then maybe it can be used at a state level to compare to other states. The spatial aspect of GIS makes it very user friendly and you can show it to the volunteers in the community. We'll have a booklet on metric data and placement of the reefs. There will also be fish counts and seasonality of species. It'll be more than what we have now. It will promote comparison.

*William Lindberg*

This is the caveat: GIS comes with the capacity to over-interpret more easily than you'd expect. A little data can make a big huge map. The State of Florida made beautiful maps, but they were extrapolating the data so that the map was giving the locations of seagrass beds where I know there aren't any because there were only soft shell sand bottoms. GIS is a double-edged sword. It is simple to use, but it could be misapplied or over-interpreted.

*Doug Biffard*

One thing I'd like to mention is the availability of data. It's nice for people who are helping us collect data to access data whenever they want. It's also good for others to access it as well. The problem for us is that government-collected bathymetry isn't available unless you pay, which

is frustrating for volunteers.

*Christy Pattengill-Semmens*

For the reporting, something that has come up for REEF is that when we write contracts about our projects, we are explicit about deliverables. We don't just say we'll give raw data and a summary report, but we say that the summary report will contain x, y and z. When proposing to write your report, be very specific or else the funding sources will try to get you to do stuff with the data that it's not meant for.

*William Lindberg*

We've opened the door to the reporting aspect of this discussion. What do you anticipate your report output to be? Does it go beyond reporting back to your volunteers? What are the outputs? How do you market them?

*Dana Haggarty*

Your volunteers aren't going to be interested in the scientific reports, but seeing it in print might be useful for some of them. It's also nice to have a friendlier version for people who aren't as scientific. There is a newsletter that is published four times a year. In it, they go through the literature and choose four hot papers and summarise them in a page-long format, with a reference to the original study. I've told a lot of my volunteers about that. It's a good example of bridging science and the public.

*William Lindberg*

We've seen REEF websites a few times. Do all the organisations here have an Internet component like that to make the information accessible?

*Jeff Marliave*

Not satisfactorily.

*William Lindberg*

We're all on different levels of sophistication? It seems that the bigger the institution, the slower the process.

*Brian Smiley*

It's harder for us because the moment we put something on our webpage, it has to be bilingual.

*William Lindberg*

Are the websites of the volunteer programs growing spontaneously within the community?

*John Perkner*

We'd like to add links to your websites from ours.

*Brian Smiley*

Hot links to each other would be good.

*Doug Biffard*

The Georgia Strait Alliance has a great site. One of its key parts is an *ad hoc* GIS on a common website. There are all sorts of information including habitat information. The URL is <http://www.shim.bc.ca/>.

*Bryan Nichols*

They'll host your dataset and overlay it on their GIS.

*William Lindberg*

Do you have multiple audiences that you're tailoring to? Or are you just saying "This is the capacity we have" or "This is what we have to deliver"? Is anyone using print media?

*John Perkner*

We have newsletters and hardcopies.

*Dana Haggarty*

We had an article in the newspaper last week.

*Noelle Barger*

If you prepare a short one minute clip for the media with a write-up, they'll like it because they don't have to shoot anything themselves. It can go straight into the news.

*Christy Pattengill-Semmens*

We found the same thing for radio public service announcements. Almost all radios will give you time to do it. If you give them the script or a recording, they'll put it in eventually because they have to devote a certain amount of airtime to PSAs.

*William Lindberg*

What about accountability? We talked about the need for feedback and feedback for the volunteers doing monitoring. Is feedback communicated through the media? Do you provide analyses of your own work and give it back to the public as news releases? Or do you only provide public relations promotions to the media?

*Dana Haggarty*

Mostly our media releases deal with public relations and getting people to our events. But every time our organisation does something newsworthy, we get it out to the media to get publicity and to make volunteers proud of being involved in it.

*William Lindberg*

It's important to have recognition for the organisation and the people who are involved.

*John Perkner*

It seems that you can leverage other events like sinking ships to get publicity. Working with high school students will get the attention of the press automatically, but they want a high level of summarising. They offer little detail.

*William Lindberg*

What are the challenges of reporting? No one wants to do it; what compels you to do it?

*Lex Waters*

Sometimes it's hard to get media interest in Jacksonville, even if you send press releases and make contacts. Right now, in Jacksonville, we don't get a lot of media attention unless it's a big event or it involves students. When the 500 reef balls were completed, we had a kick-off party and we invited media to talk about concerns. There were some big players present, but only one news media showed up.

*Noelle Barger*

One solution I found is to invite the mayor or get him there. Make him push the first reef ball off or pull the crane.

*Tex Enemark*

Try to find someone around the community who's a professional public relations person and will spend the effort to do these things. Many times you're not trying to sell the event, you're selling the video clip the media can have. This is something that requires the help of someone who does that for a living. It's good practice for them and sometimes business opportunities come out of it for them.

*Dana Haggarty*

Also, don't take it personally if you don't get put in the paper when they said they would – you might be bumped for something a bit more pressing, like the death of the Queen Mum.

*William Lindberg*

Earlier in the day, there was some discussion about conflicts among user groups that might be part of this broader community. For example, competing economic interest in the north coast. Do you find yourselves with situations or opportunities to bring data to bear in arbitrating conflict resolutions?

*John Perkner*

We're not supposed to be interpreting data; we're supposed to be collecting data in a standardised manner. We're always asked what we found in the data, though.

*Brian Smiley*

What about reporting back on decisions made from the data? How has it actually affected making changes in policy or zoning? One area I'm working on is with Rob Russell. We're looking at how long it takes for our artificial reef to resemble a natural environment. After 5 years, there are more similarities between the two artificial reefs than they have with the natural reef. This might have a big impact on our region and on the regions watching us. We have to try to get our data out so they have something to go on.

*Katia Friere*

This is in regards to the standardising of invertebrate common names and scientific names, which is a complete mess. Some groups have their own list. Is there a need to standardise this? There is a list for fish (FishBase), but not for invertebrates.

*Bryan Nichols*

I think the American Fisheries Society is making a list but it hasn't gotten off the ground.

*Brian Smiley*

The American Oceanographic Society has a CD out with a hierarchical list, but taxonomy is always changing so you need to buy the \$300 CD every year to get the update.

*Amy Poon*

The people who did FishBase are now working on a database for southeastern Asian invertebrates.

*Brenda Burd*

Bill Austin has been trying to get a list of local invertebrates out since 1985.

*William Lindberg*

It's hard to use the common names or scientific names if they are changing before the ink dries.

*Christy Pattengill-Semmens*

We had problems with Spanish names in the Caribbean. There isn't a list, but there's been a published list in the Fishes of Cuba book and we acknowledge our source of names.

*Jeff Marliave*

If you want to be able to use scientific literature, you need synonymy for fish. There are dozens of synonyms in the literature. Andy Lam is trying to make a list of all synonymies of common and Latin names. It needs to be pointed out to all the volunteers because the Luciana red snapper is now called something else – it's not even a snapper.

*Doug Biffard*

There is power in informal reporting. In the eelgrass restoration project, there were discussions between volunteers and boaters. When we put buoys in the water and got the boaters not to anchor there, there was no complaint from the boaters. I think it's because of the reporting between the volunteers and the divers.

*William Lindberg*

Is a training process on networking and informal reporting necessary? Volunteers will eventually take that role.

*Dana Haggarty*

I think it happens naturally. People ask the volunteers what they're doing, and the volunteers just talk about it.

*John Perkner*

For us, the public relations were a component of the training. We worked on how to communicate the project to others, whether in a presentation or just talking to friends.

**Collaborative opportunities, next steps  
and farewells**

*Bill Seaman*

There is a conference on the Artificial Reef Association in 2003. They might have a session on volunteer divers.

*Dana Haggarty*

There are other conferences too, like the American Fisheries Society, that are coming up as well, because not all of us work on artificial reefs.

*Brian Smiley*

What we hope to do here is talk about next steps. But before we get into that, I'd like to remind all the presenters that we need your 2-page summary for your presentation and we'd like to have it within the next couple of weeks. Andrea and Amy will have the rapporteur notes ready for editing by the 3<sup>rd</sup> of July and will send it out to everyone. After some turnaround, we should have a draft of the proceedings for participants to look at by the end of August. So you'll have the final product by the time the kids go back to school. It's contingent on getting those 9 sets of 2 pagers. You could go beyond the blurb that you've already given us at this workshop. The pages should not describe what you've done, but the lessons learned and where you'd like to go next. The networking part of it should be there.

*Bill Seaman*

As an appendix, a profile of the 7 groups that reported here today would also be good, to get a sense of if there's a blender on staff, budget, number of staff, number of volunteers, training sessions etc. It's not really a yellow pages, but just some basic information. We can start getting a census on which organisations are involved with reef monitoring. I'll try to see if any other states other than Florida have reef-monitoring programs.

*Christy Pattengill-Semmens*

There are tons of organisations that do volunteer monitoring. The journal, the Volunteer Monitor, is online and a good start. This is mostly freshwater monitoring but they do run stories on marine projects too. And the birding community is another great resource for volunteer monitoring.

*Bill Seaman*

I was thinking reefs specifically.

*Marc Dillon*

New Jersey and Louisiana have reef monitoring as well.

*Katia Freire*

Why are you restricting the summaries to 2 or 3 pages? This is a good opportunity to present more information and not restrict the summary to just a couple of pages. There are only a few presentations so there's room for more and I think comparing the methods used between you would be useful.

*Brian Smiley*

Well, we're not looking for a publication for a conference but rather an extended abstract just to help fill in the gaps that aren't in the presentations. We're trying not to make too much work or make it too daunting. You can write as long as you need to and if you need elbow room then go for it. It's not meant to be a constraint, but rather a blessing.

*Bill Seaman*

So we're providing more of a snapshot than a movie.

*Brian Smiley*

So, other areas where you've thought of collaboration? Let's do some brainstorming.

*John Perkner*

Just to follow up more formally with REEF, we have a similar format – Florida is almost identical to REEF but we don't have many publications.

Actually we became an outpost to REEF for a short while but it never really caught on.

*Brian Smiley*

Reefkeeper and REEF studies at the same location at the same time with the same divers trained in both protocols might also work. That was something Dana and I were talking about proposing here.

*Doug Biffard*

I think there are some of us that'll take up Rob's offer to look at the compensation reefs that he's been looking at over the years.

*Brian Smiley*

There's a publication out there now on the compensation reefs that is pretty up to date. You can look at volunteer opportunities and pick up where Rob left off.

*Kevin Conley*

I am speaking for Tom Tomascik in his absence, but Tom was indicating an interest in working with volunteers under the newly passed National Marine Conservation Areas legislation, potentially through partnership with DFO. It will be necessary though to nurture culture change within the marine science and management sectors but we can link with managers and scientists who are currently supportive of this to keep it going. Also, in our Oceans and Community Stewardship group within DFO, there will be a position to develop a strategic plan. I'm hoping that it can look at bringing together all these different tools into a toolbox and come up with a strategic plan that best utilises all the various protocols out there.

*Brian Smiley*

I'm not holding my breath on it but our department is starting, it would appear, to realise that this stewardship science can be useful in looking at indicators of environmental health – annual pickup of debris for example, making sure that kind of initiative is endorsed. Leaders are feeling encouraged and the QA/QC is getting better. We're getting into national archives, providing co-ordination and leadership. I've been really pushing for that for a long time. A major thing for next steps would be working with others.

*Marc Dillon*

If there are still turf battles going off while we talk about this, I would hope that we'd have enough respect for each other to sit down face to face, get rid of emotions and misconceptions, and get to the real issues that usually aren't as big a deal

when you get right down to it. Finding common ground, or working together and finding a solution – those are the important things.

*Brian Smiley*

One of the areas I'd really like to collaborate on is species ID. Unless you get that right, everything else that we talked about today is in the ditch. As we've already begun to do, there are some really good approaches and it would be really nice to build on that in the Pacific Northwest, somewhat internationally between Seattle and Prince Rupert. There's not much that's different or would have to change. That's something I'd like to see us working on together, until the bells go off and you've got a winner. Some of those tools we commonly share, like an electronic flashcard system of a full range of species.

*Jeff Marliave*

They're under DFO and BC Parks. I don't know if it's the same in America, but here in BC the Vancouver Port authority feel that it is above and beyond DFO. They have huge mitigation power in monitoring artificial reefs. It's problematic having volunteers work in a busy port. We'd need a liaison between them. There's a gap between law and reality.

*Brian Smiley*

Do you think it would be a way to help if we included hotlinks to each other on our webpages? It's a way to open doors. I don't know about you but I find it kind of depressing when I see that my contact information or web link isn't on a similar site. If that could be something we could facilitate via e-mail by providing our webpages and descriptors to each other, that would be great. Just put in a one-line descriptor. I think that would be a really neat way to demonstrate that we are trying to build a network here. It doesn't cost anything except for stretching the mandate a little.

*Dana Haggarty*

I can't speak for Living Oceans but it could be problematic because our stance doesn't include artificial reefs. So, I can't promise anything about that but it's certainly something to check out.

*John Perkner*

Electronic distribution lists are also helpful.

*Brian Smiley*

I could give everyone the list of practitioners that I have in my outlook address book so if you think of something that might be of interest, you can send or forward it out to everyone – like new publications etc.

*Noelle Barger*

Just a comment about webpages: on our website, we have a link on reef research to both natural and artificial reefs, so most of you are already on there. It's a research tool for people doing research.

*Brian Smiley*

What about another workshop like this one? Is that worth discussing at this point? Should we be thinking of another workshop?

*John Perkner*

I liked it, and especially if the workshops evolve each time, it would be useful. This workshop was a lot about learning and idea sharing but maybe the next time we could work on action sharing – looking at a specific component like methodology enhancement or something like that.

*Bill Seaman*

Or draw in other volunteer dive groups that are out there.

*Marc Dillon*

Or maybe get a few volunteers represented at these workshops to provide their views as well. We're the blenders, the scientists, the managers and we need to know their point of view.

*Bryan Nichols*

Each of us could get one or two key volunteers to participate. As part of our discussions we determined that we need their input; they could provide the much-needed insight into recruitment that we're looking for.

*Dana Haggarty*

If it's not possible to actually bring the volunteers to the meeting, some sort of survey might be useful where the organiser can report on what they think.

*Brian Smiley*

Fire out the proceedings of this workshop to see if any volunteers are interested. I'd be interested to see, in principle, if it is this worth doing again. A show of hands is saying 50-100% yes.

*William Lindberg*

In the second workshop, beyond the sharing of program reports, have a few specific themes. One could be statistical aspects or meta-analysis, or leadership development in the groups. What are the components of leadership development and how do different organisations do it?

*John Perkner*

Fund raising and money/business aspects seem to have a common interest.

*Erika Boulter*

Yes, and liabilities and legalities too.

*Bill Seaman*

Connect the data collection to management resources.

*William Lindberg*

Have a vibrant liaison where there might be difference of opinion.

*Brian Smiley*

What about other partnerships and potentials for collaboration? I'd like to see a linkage between the BC ships and the California ships. We represent three different sectors. When it comes to a standardised approach, a quadrat is a quadrat no matter where you do it. Data analysis is the problem. If we could collaborate on software we'll be ahead of the game.

*Christy Pattengill-Semmens*

There is a huge body of literature on evaluating photos of quadrats and other reef communities. I've seen whole sessions on how to analyse data from quadrats. There are a lot of really cool tools now; we don't need to reinvent the wheel.

*William Lindberg*

We've dealt so much with biology and sampling methods, what about some of the other aspects like economic evaluations of placements for the placement of ships? Is there a way to get information before sampling or socio-economic information as well?

*Tex Enemark*

I just finished a study on the government importance of artificial reefs but there's not much out there. The report hasn't been released yet because it has to be translated into French first but I can give you a copy when the government releases it.

*John Perkner*

Florida has a strong business case for support and funding.

*Noelle Barger*

I've given a survey for dive boat operators to fill out but it didn't get done, so I'm trying to redevelop it. I finally got all the dive boat operators to realise and agree that it is an important aspect of sinking ships and needs to be done. It's important to figure out how it's

impacting the San Diego area in terms of economic value. It's sad when you have a bunch of dive boat operators limiting you.

*Christy Pattengill-Semmens*

In thinking about groups that develop new or up-and-coming programs, REEF has a broad base of surveyors and some are top-notchers. If there's ever a need for a group to help you in a pilot study, we have a lot of them. We have a good idea of what divers are willing to do and there's opportunity to use experienced surveyors to help evaluate up and coming programs. We've used our experienced surveyors this way before and they were pretty honest with the developers saying, "This was pretty good", "That's not feasible" etc. Using them as 'guinea pigs' is a good way to test out new protocol. In general, our surveyors are looking for opportunities to try something new.

*Bill Seaman*

Are all the members of REEF volunteer divers?

*Christy Pattengill-Semmens*

No, we have around 25,000 members and some haven't done any surveys, others have done a few, while others still aren't even divers. We have lots of core groups all over the place.

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# Appendix Four

## WORKSHOP EVALUATION

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Verbatim comments of all participants completing the post-workshop evaluation form

### 1. What part of the workshop was most useful to you, and why?

- Tips on volunteer recruitment and retention; networking with successful programs and their "blenders";
- Networking and presentations;
- New encounters detailed in talks were very stimulating, but the issues/solutions sessions were well done too; personal contacts were also very stimulating;
- Presentations about what other groups are doing; networking;
- The interactive discussion components, especially around the scientific components and methodology; hearing the different presentations;
- Noelle Barger's presentation because also she went into the organization and training of volunteers the most;
- Mainly the second day on issues and solutions; however, both sessions were "on-the-nose" concerning volunteer dive projects and concerns;
- The keynote speaker was very relevant to the subject. He provided a base that underlined the following discussions;
- The facilitated discussion during the second day; they provided a forum for the exchange of applied information such as challenges, experiences and brain-storming;
- Most useful - building relationship; also useful - learning other's mistake and experiences, and sharing our experiences to gather feedback;
- The long time for discussion in the second day was the most useful part;
- Hearing the summaries and talks, and meeting and networking with other practitioners;
- Networking was the major advantage of the workshop for me, particularly to hear common challenges with a variety of solutions. I think the presenters also did a great job of highlighting a key challenge and how they solved it and it turned out that we received presentations on the range of issues (i.e., nobody picked the same issue to highlight in their presentation... it was like telling everyone the party is potluck, not asking them what type of dish to bring and we didn't end up with everyone just bringing buns!)

### 2. If you could change one part of the program, or add/delete something for a future workshop, what would that be?

- Further focus on more isolated communities, i.e., how to start volunteer programs; increased focus on conservation issues
- More topic-related discussion groups
- First day tour talks lead to participant dropout for end-of-day talks; tour should have been optional end-of-day;
- More time for questions and discussion;
- It would be great to have a representative from our government/state organization since they are often the governing body for grant work. They are key "agents-of-change" for this type of work;
- More "mechanics" on recruitment, training and motivating volunteers, and financing their involvement;
- Registration fees to cover meals and break refreshments;
- Great workshop as is. But maybe an onsite visit at one of the projects;
- Invite some volunteers to provide their views; we had managers, scientists, agencies and volunteers who are scientists and/or "blenders", but no "pure volunteers". I think that their view would add value to the program;
- Have a print out of abstracts on first day, to write notes on throughout the workshop;
- More question and answer time during talks; less issues and discussions stuff on second day; more informal time to talk. Brian and Brenda's talk going over by 1/2 hour was a bummer;
- More informal time to chat would have been good or more workshop open discussion time, or like Jeff Marliave pointed out, a chance to have frank discussion;
- Add a TECH-TALK section about all the neat scientific equipment used by the various groups and maybe discussion on communities being able to share equipment or come together for large purchases such as satellite data, computer modeling programs or other expensive gear;

### 3. How did the workshop program meet, or fall short of, your expectations?

- A bit too much focus on monitoring of artificial environments;
- It was good. Learned lots, met good people and found inspiration;
- Could have generated better (more) debate, in order to address controversy by examining both

points of view, such as data protocols vs local knowledge and different analytical approaches;

- Discussions about scientific methods with scientists from agencies in the room;
- Very much met expectations especially with meeting many diverse people with many new ideas. Also like the evening "get-togethers" to share informally. Would like more "workshop" time on a specific topic;
- Good contacts, interesting perspective and experiences;
- Provided a great platform for "real-life" problems and solutions. Also very good to see other highly qualified individuals involved in similar projects;
- Exceeded expectations since many of the issues discussed apply to other aspects of conservation management;
- The workshop met and exceeded my expectations for the level of passion and enthusiasm of the other participants. Also the type and quality of work and effort going into reef research in North America is impressive. This is a good start. One day, it would be great to see a broader representation of organizations at future programs;
- It far surpassed all my expectations! I truly cannot express how beneficial this workshop was, and how well organized and well prepared it was. I high commend both Brian and Bill on an A+ event. Thank you sincerely.
- All expectations were met;
- It met my expectation, but it would have been nice to have known the objectives more ahead of time in order to prepare;
- It exceeded my expectations, mainly in the diversity of the group/projects gathered, the number of connections relevant to my work, both by people near and far (even connections within my own department that I was not thinking of before). It was a real eye-opener to possibilities for collaboration.
- I learned a great deal of extremely useful information that will guide me in my scuba research pursuits. Unfortunately, my schedule did not allow me the best opportunity to join the group for dinner and I know that I missed out a great deal on hearing more about the variety of activities undertaken by those groups attending the workshop. Still I felt very fortunate to have been in the same room with all the others.

#### 4. Any other comments?

- Excellent workshop. Looking very much forward to the next one. Hope I will have something more to report by then;

- Invite one or two regular volunteers from various organizations to provide insight for a talk on volunteer motivation and maintenance;
  - Great facility for a meeting of this sort;
  - Would love to do it again and to see us actually take action on some of our ideas;
  - I frequently had trouble hearing presenters; a microphone should have been used;
  - Let's do it again! Maybe next time in Florida.
- The Keys?
- Outstanding location and hospitality as well as organization. Much thanks to our hosts;
  - Congratulations, the trip was definitely worth spending my mom's \$1,000 donation;
  - It would be good if presenters could obey the time schedule, in order to have the discussion right after the presentation;
  - Venue and timing were good. The no host refreshments were fine but water and glasses in room would have been good;
  - "Thanks!" for all the great hospitality up in Sidney. Like all the rest of those who have not seen the beauty of Vancouver before, I'm awed at the scenery! You certainly do live in another kind of pristine paradise. Just don't ever get too tired of the mountainous backdrop; it is certainly beautiful. I was very impressed with the quality and calibre of the workshop;
  - A sincere "Thanks" for the invitation to come up to your beautiful neck of the woods. It was a wonderful experience, to learn a lot regarding the work that is being done by others who share areas of interest. All the best to the rest of the crew up there; they were all so helpful and friendly;
  - Thank you so much for the photo. The workshop team was definitely worth recording for posterity, and so photogenic, too. As you pointed out the discussions and networking were invaluable, and forecast things to come. Thanks again for all you did to make the experience a very pleasant success!
  - Compliments on the terrific reef monitoring workshop. As the World Soccer folks say, "Goallllllllll!"
  - A big THANK YOU! Enjoyed the meeting - a good bunch of hard-working people.
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## **Appendix Five**

### **WORKSHOP PRESENTATIONS**

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This section presents unedited copies of the Powerpoint presentations as shown at the workshop.