

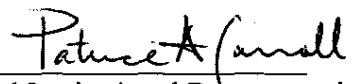
**RESEARCH PROPOSAL SUBMITTED TO:
National Ocean Service, National Oceanic and Atmospheric Administration
FY 2008 Implementation of Regional Integrated Ocean Observing Systems**

**PROPOSAL TITLE:
PNW-BIOOS – Pacific Northwest Biological Integrated Ocean Observing System:
Application to salmon forecasting, detecting harmful algal blooms
and monitoring hypoxia in the Pacific Northwest.**

MONTEREY BAY AQUARIUM RESEARCH INSTITUTE


MBARI Principal Investigator

Chris Scholin, Ph.D.
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Authorized Institutional Representative

Patrice A. Carroll
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Grants Office
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831 775 1803/1788 (ph)
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Funds requested: Yr 1 \$116,715; Yr 2 \$117,623; Yr 3 \$103,297 – Total \$337,635

Statement of work – MBARI

Scholin's group will be responsible for configuring, servicing, deploying and recovering of an ESP to carry out the work described below. The instrument system will be loaned to this project for the time required at no cost. All deployments will take place in Willapa Bay. A data telemetry system will be installed to provide real-time access to the ESP for data transmission and communications.

The ESP will be programmed to collect samples on a periodic basis and apply antibody and DNA probe assays for detection of DA and a variety of HAB species. It will be possible to interrupt that schedule should the need for event response arise. Materials for the DA assay will be obtained from Dr. Greg Doucette, NOAA, Charleston (see separate budget and budget justification). Materials for the HAB species assays will be supplied by Scholin's lab. Support for conducting marine operations (deployments/recoveries; ship, divers if required) will be provided by Dr. Vera Trainer.

The ESP will be fitted with environmental contextual sensors including a CTD/fluorometer/transmissometer and ISUS. Data from the instrument (DA and HAB spp probe arrays, as well as environmental contextual data) will be made available to project participants in real-time. In addition, two-way communication with the instrument will allow for flexible sampling, e.g. the ESP can be "requested" to sample outside the usual frequency during HAB events. After review of the raw data by selected members of the project team, quality controlled data products and time series plots will be posted on a server accessible to the public.

This work assumes a start date of August 2008. Deliverables for each project year are summarized below

Year-1

- Assess options for deploying the ESP in Willapa bay that place the instrument in a suitable location for DA/HAB species monitoring as well as in compliance with any waterway/harbor rules and restrictions that might apply. This will be done in concert with other members of the project team, harbor master, local fisherman, etc.
- Train selected members of the project team how to operate the ESP and interpret assay results.
- Deploy the ESP for approximately 2 months (end of year-1, Aug – Sept '09).

Year-2

- Recover the ESP following year-1 deployment (~Sept. '09).
- Deploy the ESP for approx 4 months (~June – Sept '10).

Year-3

- Recover the ESP following year-2 deployment (~Sept. '10).
- Deploy the ESP for approx 4 months (~June – Sept '11).

PNW - BIOOS Pacific Northwest Biological Integrated Ocean Observing System
Monterey Bay Aquarium Research Institute

Chris Scholin, Ph.D.

Three Year Budget Summary

	Yr 1		Yr 2		Yr 3		Yr 1-3	
	# Months	2008	# Months	2009	# Months	2010	# Months	Total
SALARIES/WAGES								
Scholin		0		0		0	0	0
Massion	1.00	11,369	1.00	11,824	0.50	6,148	3	29,341
Roman		0		0		0		0
Everlove	3.00	19,988	4.00	27,716	4.00	28,825	11	76,529
Schramm		0		0		0	0	0
Machinist	0.50	2,888		0	0.00	0	1	2,888
Total Reg Salary		34,245		39,540		34,973	14	108,758
TOTAL SALARY & WAGES		34,245		39,540		34,973	14	108,758
BENEFITS (Rate-Reg) 53.00%		18,150		20,956		18,536		57,642
TOTAL BENEFITS		18,150		20,956		18,536		57,642
TOTAL SAL & BEN		52,395		60,496		53,509	0	166,400
SUPPLIES: Instrument Spares		5,000		5,000		2,500		10,000
Mooring Hdwr		7,500		2,500		2,500		12,500
Expendable Reagents		5,000		2,500		2,500		10,000
Subtotal Supplies		17,500		10,000		7,500		35,000
TRAVEL Domestic Travel: \$300 air, \$500 hotel, \$200 meals, \$200 rental car/truck = \$1.2K per trip								0
Yr 1 - 2 to scope site, Yr2&3 3 to deps/turnarounds		2,400		2,400		2,400		
Subtotal Travel		2,400		2,400		2,400		7,200
SHIPPING/POSTAGE								
Shipping		5,000		5,000		5,000		15,000
Subtotal Shipping		5,000		5,000		5,000		15,000
Total Direct Costs		77,295		77,896		68,409		223,600
Modified Total Direct Costs Base *IMPORTANT:		77,295		77,896		68,409		223,600
ADD \$25K TO FORMULA PER SUBAWARD >\$25K								
Total Indirect Costs Rate: 51%		39,420		39,727		34,888		114,035
TOTAL DIRECT & INDIRECT COSTS		116,715		117,623		103,297		337,635

Budget Justification- MBARI

Annual support requested for the MBARI/ESP portion of this project, inclusive of personnel, supplies, travel, shipping and indirect costs, totals \$116.7k for year-1, \$117.6k for year-2, and \$103.2k for year-3.

Personnel

C. Scholin will dedicate up to 2 months of time at no cost to this project. He will oversee the application of the ESP for detection of DA (however, costs for DA array quality control and assembly are found in a separate budget justification by Dr. Greg Doucette) and selected HAB species as proposed and coordinate MBARI's participation in the project. In addition, Roman Marin III will also dedicate up to 2 months of time at no cost to this project. He will be responsible for the preparation and quality assurance of expendable reagents used in the ESP, and will assist in the configuration and operation of the instrument as required.

Salary support is requested for a mooring/marine operations specialist, ESP instrument technician and machinist. The mooring/marine operations specialist is responsible for overseeing deployment site characterization, mooring assembly, annual mooring inspection, installation, recovery and maintenance. They will dedicate 1 month of time to this project in year-1 and 2, and 0.5 month in year-3. The ESP instrument technician is responsible for preparing the ESP for service, integrating the contextual sensors, pre- and post-deployment calibration, data telemetry system, maintenance of the instrument and mooring hardware, transport of equipment to/from the deployment site, and will participate in all deployment and recovery operations. They will dedicate 3 months of time to this project in year-1, and 4 months in each of year-2 and 3.

The machinist is required to modify the existing ESP mooring for use in Willapa bay. This will entail minor fabrication, welding, etc. S/he will dedicate 0.5 month to this project in year-1.

Supplies

Supplies include instrument components and spares (\$5k in each of year-1, 2, and \$2.5k in year-3), mooring hardware (\$7.5k in year-1, \$2.5k in each of year-2,3), and expendable reagents (\$5k in year-1, \$2.5k in each of year-2,3).

Instrument components and spares include batteries, electrical and mechanical components, cabling, o-rings, lubricants, etc. Mooring hardware includes anchors, chain, rode, electromechanical cable, connectors, ESP subsurface support structure/battery case, surface float, shackles, bracketry, communications modems, etc. Expendable reagents include probe arrays, chemicals, filters, expendable plastics, etc.

Travel

Travel requests total \$2.4k per year for each year of the project. Each year it will be necessary for members of the ESP team to visit the deployment site in support of deployment and recovery operations. For planning purposes we assume 2 trips per year

at \$1.2k per 5-day/4 night trip. Each trip includes \$300 for airfare, \$500 lodging, \$200 meals, \$200 car/truck rental.

Shipping

Each year the ESP instrument and mooring hardware must be transported to/from the deployment site. At other times of the year it will reside at MBARI. In addition, samples and supplies must be transported between MBARI and NOAA (Trainer) for laboratory validation studies and training. In support of those requirements, \$5k per year for each year of the project is requested.

Indirect Costs

MBARI's Nonprofit Rate Agreement is dated September 4, 2007. The predetermined indirect cost rate is 51% applied to total direct cost less capital equipment, participant support costs and subcontract costs exceeding the first \$25,000 of each subcontract. MBARI's rate is established by the National Science Foundation.

Christopher Alan Scholin (10/07)

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Education

1979–81, University of Missouri, Columbia, Department of Forestry and Wildlife
1984 B.A. (Hons.), University of California, Santa Barbara, Department of Biology
1986 M.A., Duke University Graduate School, Department of Microbiology and Immunology
1992 Ph.D., Massachusetts Institute of Technology - Woods Hole Oceanographic Institution Joint
Program in Biological Oceanography
1992–94, Postdoctoral Fellow Monterey Bay Aquarium Research Institute (MBARI)

Professional Work Experience

1986–87, University of South Carolina, Columbia, Research Assistant Professor
1994–97, MBARI, Assistant Scientist I
1997–2001, MBARI, Associate Scientist II
2001–2006, MBARI, Associate Scientist III
July 2005–present, Chair, MBARI Research Division
2006–present, MBARI, Senior Scientist IV

Current Committee Service

External advisory committee for the University of Miami's NSF-NIEHS Oceans & Human Health Center
(<http://www.rsmas.miami.edu/groups/ohh/>)

Selected Recent Peer Reviewed Publications

W.J. Jones, C. Preston, R. Marin III, C. Scholin, R. Vrijenhoek. A Robotic Molecular Method for in situ Detection of Marine Invertebrate Larvae. *Molecular Ecology Notes* (in press).

John Paul, Chris Scholin, Ger van den Engh, Mary Jane Perry. 2007. In situ Instrumentation. *Oceanography* **20**: 58-66.

Scholin, C.A., G.J. Doucette, and A.D. Cembella. In press. Prospects for developing automated systems for in situ detection of harmful algae and their toxins. In: M. Babin, C.S. Roesler and J.J. Cullen (eds.) *Real-Time Coastal Observing Systems for Ecosystem Dynamics and Harmful Algal Blooms*, pp 413-462, UNESCO Publishing, Paris, France.

Roman, B., C. Scholin, S. Jensen, E. Massion, R. Marin III, C. Preston, D. Greenfield, W. Jones, and K. Wheeler. 2007. Controlling a Robotic Marine Water Sampler with the Ruby Scripting Language. *Journal of American Laboratory Automation* **12**: 56-61.

Greenfield, D.I., R. Marin III, S. Jensen, E. Massion, B. Roman, J. Feldman, C. Scholin. 2006. Application of the Environmental Sample Processor (ESP) methodology for quantifying *Pseudo-nitzschia australis* using ribosomal RNA-targeted probes in sandwich and fluorescent *in situ* hybridization. *Limnology and Oceanography: Methods* **4**: 426-435.

Metfies, K., K. Töbe, C. Scholin, and L.K. Medlin. 2006. Laboratory and field applications of ribosomal RNA probes to aid the detection and monitoring of harmful algae. In: *Ecology of Harmful Algae* (Granéli, E., and Turner, J.T. eds), pp. 311-325. Springer Verlag, Berlin, Heidelberg, New York.

Lundholm, N., Ø. Moestrup, Y. Kotaki, C. Scholin, P. Miller. 2006. Inter- and intraspecific variation of the *Pseudo-nitzschia delicatissima*-complex (Bacillariophyceae) illustrated by rRNA probes, morphological data and phylogenetic analyses identification of *P. decipiens* and *P. dolorosa* spp. Nov. *Journal of Phycology* **42**: 464-481.

Goffredi, S.K., W. Jones, C. Scholin, R. Marin, S. Hallam, R.C. Vrijenhoek. 2006. Molecular detection of marine larvae. *Marine Biotechnology* **8**: 149-160.

Ayers K, Rhodes L, Tyrrell J, Gladstone M, Scholin C. 2005. International accreditation of sandwich hybridisation assay format DNA probes for micro-algae. *New Zealand J. Marine and Freshwater Res.* **39**: 1225–1231.

Anderson, D.M., D.M. Kulis, B.A. Keafer, K.E. Gribble, R. Marin and C.A. Scholin. 2005. Identification and enumeration of *Alexandrium* spp. from the Gulf of Maine using molecular probes. *Deep-Sea Research II* **52**: 2467-2490.

Babin, M., J.J. Cullen, C.S. Roesler, P.L. Donaghay, G.J. Doucette, M. Kahru, M.R. Lewis, C.A. Scholin, M.E. Sieracki, and H.M. Sosik. 2005. New approaches and technologies for observing harmful algal blooms. *Oceanography* **18**: 210-227.

Ryan, J.P., H.M. Dierssen, R.M. Kudela, C.A. Scholin, K. S. Johnson, J.M. Sullivan, A.M. Fisher, E.V., Rienecker, P.R. McEnany, and F.P. Chavez. 2005. Coastal Ocean Physics and red tides: an example from Monterey Bay, California. *Oceanography* **18**: 246-255.

Matweyou, J.A., D.A. Stockwell, C.A. Scholin, S. Hall, V.L. Trainer, J.D. Ray, T.E. Whitledge, A.R. Childers, F.G. Plumley. 2004. Use of *Alexandrium* rRNA targeted probes to predict PSP events on Kodiak Island, Alaska. In: K. A. Steidinger, J. H. Landsberg, C. R. Tomas and G. A. Vargo (eds.) *Harmful Algae 2002*, pp. 267-269. Florida Fish and Wildlife Conservation Commission, Florida Institute of Oceanography, and Intergovernmental Oceanographic Commission of UNESCO. St. Petersburg, Florida, USA.

Scholin, C.A., F. Gulland, G. Doucette and others. 2000. Mortality of sea lions along the central California coast linked to a toxic diatom bloom. *Nature* **403**: 80-84.

Scholin, C., R. Marin, P. Miller, G. Doucette, C. Powell, J. Howard., P. Haydock and J. Ray. 1999. Application of DNA probes and a receptor binding assay for detection of *Pseudo-nitzschia* (Bacillariophyceae) species and domoic acid activity in cultured and natural samples. *Journal of Phycology* **35**: 1356-1367.

Selected Contribution

Scholin, C. S. Jensen, B. Roman, E. Massion, R. Marin, C. Preston, D. Greenfield, W. Jones, K. Wheeler. 2006. The Environmental Sample Processor (ESP) – An Autonomous Robotic Device for Detecting Microorganisms Remotely using Molecular Probe Technology. Proceedings, OCEANS 2006 MTS/IEEE Conference. Boston, MA. Marine Technology Society, Columbia, MD.

NONPROFIT RATE AGREEMENT

EIN #: 77-0150580

NSF INS CODE: 4000069000

ORGANIZATION:

DATE: September 4, 2007

Monterey Bay Aquarium Research Institute
7700 Sandholdt Road
Moss Landing, CA 95039-9644

FILE REFERENCE: The preceding
agreement was dated October 11, 2005.

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section II.

SECTION I: INDIRECT COST RATE

<u>Type</u>	<u>Effective Period</u>	<u>Rate</u>	<u>Base</u>
PREDETERMINED	1/1/03 – 12/31/03	47.00%	(a)
PREDETERMINED	1/1/04 – 12/31/04	47.00%	(a)
PREDETERMINED	1/1/05 – 12/31/05	49.00%	(a)
FINAL	1/1/06 – 12/31/06	49.00%	(a)
PREDETERMINED	1/1/07 – 12/31/09	51.00%	(a)

Rate Application Base

- (a) Total direct cost less capital items, participant support costs and subcontract costs exceeding the first \$25,000 of each subcontract.

Note:

Fringe benefits associated with direct salaries and wages are treated as direct costs and included in the indirect cost rate application base.

SECTION II: GENERAL TERMS

- A. **LIMITATIONS:** Use of the rates contained in this agreement is subject to any applicable contractual or grant limitations. Acceptance of these rates agreed to herein is predicated upon the conditions: (1) that no costs other than those incurred by the contractor or grantee were included in its indirect cost proposal and that such costs are legal obligations of the contractor or grantee, (2) that the same costs that have been treated as indirect costs have not been claimed as direct costs, and (3) that similar types of costs have been accorded consistent treatment.
- B. **ACCOUNTING CHANGES:** The rates contained in this agreement are based on the accounting system in effect at the time the proposal was prepared and the rates were negotiated. Changes to the method of accounting which effect the amount of reimbursement resulting from the use of these rates require the prior approval of this office. Failure to obtain such approval may result in subsequent cost disallowances.
- C. **FIXED RATES:** If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.
- D. **NOTIFICATION TO FEDERAL AGENCIES:** Copies of this document may be provided to other Federal offices as a means of notifying them of the rates agreed to herein.

BY THE ORGANIZATION:

Monterey Bay Aquarium Research Institute

(Organization)

(Signature)

(Name)

(Title)

(Date)

ON BEHALF OF THE FEDERAL GOVERNMENT:

National Science Foundation

(Agency)

(Signature)

Carol Orlando

(Name)

Team Lead, Cost Analysis and Indirect
Cost, CAAR/DIAS/BFA

(Title)

(Date)

NSF Negotiator: Kwame Fosu
Telephone: (703) 292-8244