

**Application for Consent to Conduct Marine Scientific Research
in Areas Under National Jurisdiction of**

United Kingdom and Argentina

Date:

1. General Information

1.1 Cruise name and/or #:	Melville
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1.2 Sponsoring institution:	National Science Foundation
Name:	Dr. David Garrison
Address:	Director, Biological Oceanography Program Division of Ocean Sciences National Science Foundation 4201 Wilson Blvd., Suite 725 Arlington, Virginia, USA 22230
Name of Director:	Dr. David Garrison

1.3 Scientist in charge of the project (include CV and passport photo):	
Name:	Dr. William M. Balch
Address:	Bigelow Laboratory for Ocean Sciences POB475 180 McKown Point Road W. Boothbay Harbor, ME 04575
Telephone:	207-633-9600
Fax:	207-633-9641
Email:	bbalch@bigelow.org

1.4 Scientist(s) from coastal state involved in the planning of the project:	
Name(s): Dr. Alex Poulton	N/A
Address: National Oceanography Centre, European Way, Southampton S014 3ZH, UK	
Email: Alex.Poulton@noc.soton.ac.uk 00 44 23 8059 6666	

1.5 Submitting officer:	
Name and address:	Rose M. Dufour/ Elizabeth Brenner Ship Schedulers/Foreign Clearances Scripps Institution of Oceanography University of California, San Diego La Jolla, California 92093-0210
Nationality:	USA
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	F-77 FAX Pacific 011-872-81600255637 Telex 81600255637 (AnsBk=WECB) Vessels guard standard GMDSS frequencies for calling, distress and dissemination of marine safety information. MMSI # 366784000 SELCAL # 11024
Name of master:	Capt. Christopher Curl
Number of crew:	23
Number of scientists on board:	38

3.2 Aircraft or other craft to be used in the project:
None

3.3 Particulars of methods and scientific instruments. 120 stations will be performed along entire cruise track (not just in the EEZ of the country).		
Types of samples and data	Methods to be used	Instruments to be used
Bathymetry and Sidescan	Swath mapping with multibeam system.	EM122 12 kHz 150 deg swath
Water Column Biological Sampling	Microbiological sample collection	CTD rosette, shipboard and laboratory processing of samples
Light measurements	Suspended sensor	Satlantic optical profiler
Underway analyses for chlorophyll, inherent optical properties and apparent optical properties	Standard underway sampling system	Chlorophyll fluorometer, light scattering sensor, light sensors, absorption attenuation meter
Large volume water samples taken on filters	In situ pumps suspended from ships cable	McClain pumps
<u>Surface sediment samples</u>	<u>clam shell type scoop</u>	<u>Van Veen Grab sampler</u>

3.4 Indicate whether harmful substances will be used: None

3.5 Indicate whether drilling will be carried out: None

3.6 Indicate whether explosives will be used:
None

4. Installations and Equipment

Details of installations and equipment (dates of laying, servicing, recovery; exact locations and depth):
None

5. Geographical Areas

5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):

We will sail from Punta Arenas, Chile, out of the Straits of Magellan across to the Falkland Islands (UK EEZ) passing around the eastern side of the islands to a point (50°W x 58° 40') whereupon we will travel eastward along the 50th parallel. At 50° S 50° 39.18' W we will head to 35° 37.38' S 33° W, we then will take a course due south along the 33° meridian to 61° 34' S 33° W. Enroute, we will pass by South Georgia Island and the Sandwich Islands (U.K. EEZ; closest point approximately 54° 22.26' 33° 10'W and 58° 02' S 26° 17'W). Next we will return to the 50th parallel (16° 21.24' W 50° S), then proceed eastwards to 50° S 8° 43'E, whereupon we'll turn to the northeast and head towards 35° 23' S 14° 29'E. From this point we'll head into Cape Town, S.A. The total cruise track distance from Punta Arenas, Chile to Cape Town, SA is 12,200 kilometers

5.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of installations and equipment.

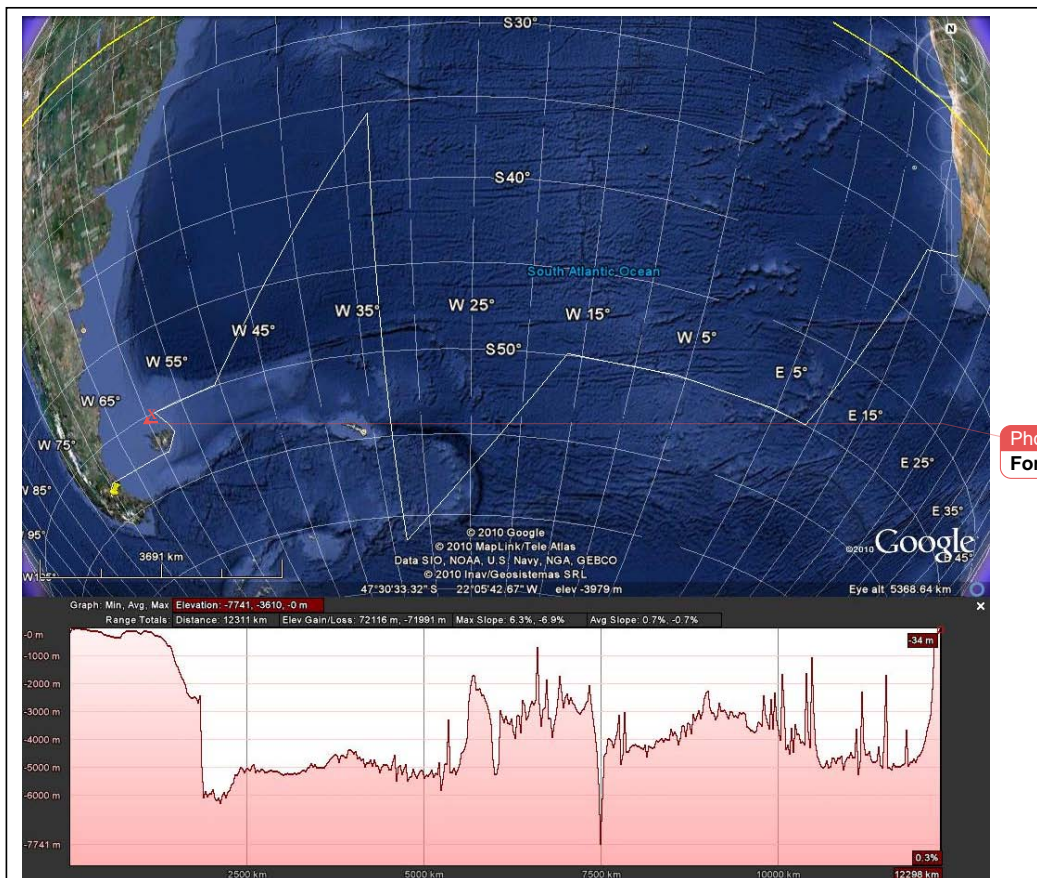


Figure 1- Proposed cruise track for R/V Melville cruise. Red x indicates location of sediment grab.

POC : **Name:** Steven Hobbs, John T. Rennie & Sons **Email:** stevenh@rennies.co.za No. 1
Thibault Square, 4th Floor Cape Town, South Africa 8001
Email: stevenh@rennies.co.za

8. Participation:

8.1 Extent to which coastal state will be enabled to participate or to be represented in the research project:

One berth available

8.2 Proposed dates and ports for embarkation/disembarkation:

3 January 2011 depart Punta Arenas, Chile /16 February 2011 arrive Cape Town, S. Africa

Access to data, samples and research results

9.1 Expected dates of submission to coastal state of preliminary reports, which should include the expected dates of submission of the final results:

A preliminary report of the cruise and cruise data will be provided by Dr. William Balch within 1 month of cruise. A final report will be delivered within 1 year of the cruise.

9.2 Proposed means for access by coastal state to data and samples:

Data taken in U.K. waters will be provided to the U.K. government officials and will be accessible by FTP from servers in the United States.

9.3 Proposed means to provide coastal state with assessment of data, samples and research results or provide assistance in their assessment or interpretation:

A full cruise report, including explanation and guides to all data sets will be provided to the U.K., in final form by February 2012, one year after the completion of the cruise.

9.4 Proposed means of making results internationally available: Publication in peer-reviewed scientific journals.



CURRICULUM VITAE

William McKay Balch
Bigelow Laboratory for Ocean Sciences
McKown Point
W. Boothbay Harbor, ME 04575

DATE: July 13, 2010

PERSONAL

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Home Address: 48 Kings Highway, Newcastle, ME 04553

Current Position: Research Scientist & Undergraduate Educational Coordinator

Citizenship: U. S. A.

INTERESTS Phytoplankton physiology, bio-optics, ocean acidification and remote sensing.

HIGHER EDUCATION

Institutional: Cornell University, B.A., 1980. *Cum laude* in biology
Scripps Institution of Oceanography, Ph.D., 1985

Certification, licensure: Univ. of Miami Radioisotope License, 1988-1995
Bigelow Laboratory Radioisotope License, 1995-present

EXPERIENCE

Academic:

Senior Research Scientist 1995-present, Undergraduate Education Coordinator 1995-2005

Adjunct Professor. Division of Life Sciences, University of New England, Biddeford, ME. 1996 to 2005

Associate Professor. Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida. 1992-1995. Tenure awarded June 1994. Leave of absence from 5/95-8/97.

Assistant Professor. Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida. 1988-1992.

Post-doctoral Investigator. Institute of Marine Resources, Scripps Institution of Oceanography, San Diego, California. 1986-1987.

Non-Academic:

Research Associate. Joint program between Bigelow Laboratory for Ocean Sciences and the Instituto Español de Oceanografía, Vigo, Spain. 1986.

Contract Scientist with Dr. W.G. Harrison. Marine Ecology Laboratory, Bedford Institute of Oceanography, Dartmouth, N.S., Canada. 1985-1986.

Visiting Investigator with Dr. P.M. Holligan, Marine Biological Association, Plymouth, England. 1980.

Laboratory Technician for Drs. C.S. Yentsch and C.M. Yentsch, Bigelow Laboratory for Ocean Science, Boothbay Harbor, Maine. 1974-1979.

Laboratory Technician for Drs. C.S. Yentsch and Dr. C.M. Yentsch. University of Massachusetts Marine Station, Gloucester, Massachusetts. 1972-1973.

PUBLICATION

Juried or refereed journal articles

- 69) Fabry, V.J., and **W.M. Balch**, 2010, Direct measurements of calcification rates in planktonic organisms, in Riebesell U., Fabry V. J., Hansson L. & Gattuso J.-P. (Eds.), 2010. *Guide to best practices for ocean acidification research and data reporting*, 260 p. Luxembourg: Publications Office of the European Union.
- 68) Vaughn, J.M., Novotny, J.F., **Balch, W.M.**, Vining C.L., Drapeau D.T., Booth E., Kneifel D. M., Bell A.L. 2010. Isolation of *Emiliana huxleyi* viruses from the Gulf of Maine. **Applied Environmental Microbiology**. 58: 109-116. doi: 10.3354/ame01375.
- 67) Doney , S.C., **Balch, W.**, Fabry, V.J., Feely, R., 2009. Ocean acidification: A critical emerging problem for the ocean sciences. **Oceanography** 22 (4), 16-25.
- 66) **Balch, W.**, Utgoff, P., 2009. Potential interactions among ocean acidification, coccolithophores and the optical properties of seawater. **Oceanography** 22 (4), 146-159.
- 65) Gordon, H.R, T. J. Smyth, **W.M. Balch**, G. C. Boynton, and G. A. Tarran, 2009. Light scattering by coccoliths detached from *Emiliana Huxley*. **Applied Optics**. 48 (31): 6059-6072.
- 64) **BALCH, W. M.**, D. **DRAPEAU**, B. **BOWLER**, E. **BOOTH**, A. **PLUEDDEMAN**. 2009. *CHALK-EX –THE FATE OF CaCO₃ PARTICLES IN THE MIXED LAYER: EVOLUTION OF PATCH OPTICAL PROPERTIES*. *JOURNAL OF GEOPHYSICAL RESEARCH- OCEANS*. 2009. 114 (C07020), doi:10.1029/2008JC004902

- 63) **Balch, W.M.** and V. Fabry. 2008 Ocean acidification: documenting its impact on calcifying phytoplankton at basin scales. **Marine Ecology Progress Series**. 373: 239–247, doi: 10.3354/meps07801
- 62) **BALCH, W. M., DRAPEAU, D. T., BOWLER, B. C., BOOTH, E. S., WINDECKER, L. A. AND ASHE, A.** 2008. *SPACE-TIME VARIABILITY OF CARBON STANDING STOCKS AND FIXATION RATES IN THE GULF OF MAINE, ALONG THE GNATS TRANSECT BETWEEN PORTLAND, ME AND YARMOUTH, NS.* **JOURNAL OF PLANKTON RESEARCH**. 30(2): 119-140. doi: 10.1093/plankt/fbm097.
- 61) **BALCH, W. M., J. M. VAUGHN, J.I. GOES, J. NOVOTNY, D. DRAPEAU, E. BOOTH, AND C. VINING.** 2007. *BIO-OPTICAL CONSEQUENCES OF VIRAL INFECTION OF PHYTOPLANKTON: I. EXPERIMENTS WITH THE CYANOBACTERIUM, SYNECHOCOCCUS SP.* **LIMNOLOGY AND OCEANOGRAPHY**. 52: 727-738.
- 60) **POULTON, A. J., ADEY, T. R., BALCH, W. M. & HOLLIGAN, P. M.** 2007. *RELATING COCCOLITHOPHORE CALCIFICATION RATES TO PHYTOPLANKTON COMMUNITY DYNAMICS: REGIONAL DIFFERENCES AND IMPLICATIONS FOR CARBON EXPORT. DEEP-SEA RES II (CHAPMAN CALCIFICATION CONFERENCE- SPECIAL VOLUME). VOL. 54, NO. 5-7, PP. 538-557.*
- 59) **BALCH, W. M., DRAPEAU, D. T., BOWLER, B. C. & BOOTH, E.** 2007. *PREDICTION OF PELAGIC CALCIFICATION RATES USING SATELLITE-MEASUREMENTS. DEEP -SEA RESEARCH II (CHAPMAN CALCIFICATION CONFERENCE SPECIAL VOLUME). VOL. 54, NO. 5-7, PP. 478-495* doi:10.1016/j.dsr2.2006.12.006.
- 58) **BERELSON, W. M., W. M. BALCH, R. NAJJAR, R. A. FEELY, C. SABINE, AND K. LEE.** 2007. *RELATING ESTIMATES OF CaCO₃ PRODUCTION, EXPORT AND DISSOLUTION IN THE WATER COLUMN TO MEASUREMENTS OF CaCO₃ RAIN INTO SEDIMENT TRAPS AND DISSOLUTION ON THE SEA FLOOR: A REVISED GLOBAL CARBONATE BUDGET. GLOBAL BIOGEOCHEMICAL CYCLES*. 21, GB1024, doi:10.1029/2006GB002803.
- 57) **Balch, W. M.,** Howard Gordon, B. C. Bowler, D. T. Drapeau, E. S. Booth. 2005. Calcium carbonate measurements in the surface global ocean based on MODIS Data. **Journal of Geophysical Research-Oceans**. 110, C07001 doi:10.1029/2004JC002560.
- 56) **Balch, W. M.,** D. Drapeau, B. Bowler, E. Booth, J. Goes, A. Ashe, and J. Frye. 2004. A multi-year record of optical properties in the Gulf of Maine: I. Spatial and temporal variability. **Progress in Oceanography**. 63: 57-98.
- 55) **Knobelspiesse, K.D., C. Pietras, G.S. Fargion, M. Wang, R. Frouin, M.A. Miller, A. Subramaniam and W.M. Balch.** 2004. Maritime aerosol optical properties measured by handheld sun photometers. **Remote Sensing of Environment**. 93:87-106.
- 54) **Vaillancourt, R.D., C.W. Brown, R.R.L. Guillard, W. M. Balch.** 2003. Light backscattering by phytoplankton algae and a heterotrophic bacterium measured with a multi-wavelength, fixed-angle backscattering meter. **J. Plankton Res**. 26: 191-212.
- 53) **Broerse, A.T.C., Tyrell, T., Young, J. R., Poulton, A. J., Merico, A. and W. M. Balch.** 2003. The cause of bright waters in the Bering Sea in winter. **Continental and Shelf Research**. 23: 1579-1596.

- 52) **Balch, W.M.**, Vaughn, J.M., Novotny, J.F., Drapeau, D.T., Goes, J.I., Lapierre, J.M., Scally, E, Vining, C.L., Ashe, A., and Vaughn, J.M. Jr. 2002. Fundamental changes in light scattering associated with infection of marine bacteria by bacteriophage. **Limnology and Oceanography**. 47(5): 1554-1561.
- 51) Campbell, J.W., D. Antoine, R. Armstrong, K. Arrigo, **W. Balch**, R. Barber, M. Behrenfeld, R. Bidigare, J. Bishop, M.-E. Carr, W. Esaias, P. Falkowski, N. Hoepffner, R. Iverson, D. Kiefer, S. Lohrenz, J. Marra, A. Morel, J. Ryan, V. Vedernikov, K. Waters, C. Yentsch, and J. Yoder. 2002. Comparison of algorithms for estimating ocean primary productivity from surface chlorophyll, temperature, and irradiance. **Global Biogeochemical Cycles**, 16(3), 10.1029 / 2001GB001444.
- 50) Goes, J.I., H.R. Gomes, A. Limsakul, **W. M. Balch**, T. Saino. 2001. El Nino related interannual variations in biological production in the North Pacific as evidenced by satellite and ship data. **Progress in Oceanography** 49: 211-224.
- 49) **Balch, W. M.**, D. Drapeau, J. Fritz, B. Bowler, and J. Nolan. 2001. Optical backscattering in the Arabian Sea- Continuous underway measurements of particulate inorganic and organic carbon. **Deep Sea Res. I**. 48: 2423-2452.
- 48) Gordon, H. R., G. C. Boynton, **W. M. Balch**, S. B. Groom, D. S. Harbour , and T. J. Smyth. 2001. Retrieval of Coccolithophore Calcite Concentration from SeaWiFS Imagery. **Geophysical Research Letters**, 28: 1587-1590.
- 47) **Balch, W.M.**, Vaughn, J., Novotny, J., D. T. Drapeau, R.D. Vaillancourt, J. Lapierre, and A. Ashe, 2000. Light scattering by viral suspensions. **Limnology and Oceanography**. 45:492-498.
- 46) Vaillancourt, R. D. and **W. M. Balch**. 2000. Size distribution of coastal sub-micron particles determined by flow, field flow fractionation. **Limnology and Oceanography**. 45: 485-492.
- 45) Graziano, L., **W. Balch**, D. Drapeau, B. Bowler, and S. Dunford. 2000. Organic and inorganic carbon production in the Gulf of Maine. **Cont. Shelf Res.** 20: 685-705.
- 44) **Balch, W. M.**, D. Drapeau, and J. Fritz. 2000. Monsoonal forcing of calcification in the Arabian Sea **Deep Sea Research II**, 47: 1301-1333.
- 43) Milliman, J., P.J. Troy, **W. Balch**, A.K. Adams, Y.-H. Li, and F.T. MacKenzie . 1999. Biologically-mediated dissolution of calcium carbonate above the chemical lysocline? **Deep-Sea Res. I**. 46: 1653-1669.
- 42) **Balch, William M.**, David T. Drapeau, Terry L. Cucci, and Robert D. Vaillancourt, Katherine A. Kilpatrick, Jennifer J. Fritz. 1999. Optical backscattering by calcifying algae-Separating the contribution by particulate inorganic and organic carbon fractions **J. Geophys. Res.** 104: 1541-1558.
- 41) Esaias, W. E., M. R. Abbott, O. W. Brown, J. W. Campbell, K. L. Carder, D. K. Clark, R. L. Evans, F. E. Hoge, H. R. Gordon, **W. M. Balch**, R. Letelier, and P. Minnett. 1998. An overview of MODIS Capabilities for Ocean Science Observations. **IEEE Transactions on Geoscience and Remote Sensing**, EOS-AM Special Issue. 36(4): 1250-1265.
- 40) Voss, K., **W. M. Balch**, and K. A. Kilpatrick. 1998. Scattering and attenuation properties of Emilia huxleyi cells and their detached coccoliths. **Limnol. Oceanogr.** 43: 870-876.
- 39) Archer, D., J. Aiken, **W. M. Balch**, R. Barber, J. Dunne, P. Flament, W. Gardner, C. Garside, C. Goyet, E. Johnson, D. Kirchman, M. McPhaden, J. Newton, E. Peltzer, L. Welling, J. White, J. Yoder.

1997. A Meeting Place of Great Ocean Currents: Shipboard Observations of a Convergent Front at 20°N in the Pacific. **Deep-Sea Res. II**, 44: 1827-1849.
- 38) **Balch, W. M.**, B. Bowler, and C.F. Byrne. 1997. Sea surface temperature gradients, baroclinicity, and vegetation gradients in the sea. **J. Plank. Res.** 19: 1829-1858.
- 37) **Balch, W. M.**, J. J. Fritz, and E. Fernandez. 1996. Decoupling of calcification and photosynthesis in the coccolithophore *Emiliania huxleyi* under steady-state light-limited growth. **Marine Ecology Progress Series**. 142: 87-97.
- 36) **Balch, W. M.**, K. A. Kilpatrick, P. M. Holligan and C. Trees. 1996. The 1991 coccolithophore bloom in the central north Atlantic I- Optical properties and factors affecting their distribution. **Limnology and Oceanography**. 41: 1669-1683.
- 35) **Balch, W. M.**, K. Kilpatrick, P. M. Holligan, D. Harbour, and E. Fernandez. 1996. The 1991 coccolithophore bloom in the central north Atlantic II- Relating optics to coccolith concentration. **Limnology and Oceanography**. 41: 1684-1696.
- 34) Fernandez, E., J. J. Fritz and **W. M. Balch**. 1996. Growth-dependent chemical composition of the coccolithophorid *Emiliania huxleyi* in light-limited chemostats. **J. Exp. Mar. Biol. Ecol.** 207: 149-160.
- 33) Fritz, J. J. and **W. M. Balch**. 1996. A coccolith detachment rate determined from chemostat cultures of the coccolithophore *Emiliania huxleyi*. **J. Exp. Mar. Biol. Ecol.** 207: 127-147.
- 32) **Balch, W., M.** and K. A. Kilpatrick. 1996. Calcification rates in the equatorial Pacific along 140°W. **Deep Sea Research**. 43: 971-993.
- 31) Fernandez, Emilio, E. Maranon and **W. M. Balch**. 1996. Intracellular carbon partitioning in the coccolithophore *Emiliania huxleyi*. **J. Marine Systems**. 9: 57-66.
- 30) **Balch, W. M.** 1995. Underwater bio-optics - Review of *Light and Photosynthesis in Aquatic Ecosystems, Second Edition*. **Bulletin of Marine Science**. 57: 297-299.
- 29) Fernandez, Emilio, **W. M. Balch**, E. Maranon, and P. M. Holligan. 1994. High rates of lipid biosynthesis in cultured, mesocosm and coastal populations of the coccolithophore *Emiliania huxleyi*. **Marine Ecology Progress Series**. 114: 13-22.
- 28) Yoder, J. A., S. G. Ackleson, R. T. Barber, P. Flament, and **W. M. Balch**. 1994. A line in the sea. **Nature**. 371: 689-692.
- 27) **Balch, W.M.** and C.F. Byrne. 1994. Factors affecting the estimate of primary production from space. **J. Geophys. Res. Oceans**. 99: 7555-7570.
- 26) Ackleson, S.G., **W.M. Balch**, and P.M. Holligan. 1994. The response of CZCS and SeaWiFS Visible-band water-leaving radiance to particulate calcite and pigment concentration within *Emiliania huxleyi* blooms. **J. Geophys Res. Oceans**. 99: 7483-7499.
- 25) Townsend, D.W., M.D. Keller, P.M. Holligan, S.G. Ackleson, and **W.M. Balch**. 1994. Blooms of the coccolithophore *Emiliania huxleyi* with respect to hydrography in the Gulf of Maine. **Cont. Shelf Res.** 14: 979-1000.
- 24) Paull, C.K., and **W.M. Balch**. 1994. Oxygen isotopic disequilibrium in coccolith carbonate from phytoplankton blooms. **Deep Sea Research**. 41: 223-228.

- 23) Holligan, P.M., E. Fernandez, J. Aiken, **W.M. Balch**, P. Boyd and others. 1993. A geochemical study of the coccolithophore *Emiliana huxleyi*, in the North Atlantic Global Biogeochemical Cycles. 7(4): 879-900.
- 22) Matrai, P.A., **W.M. Balch**, D.J. Cooper, and E.S. Saltzman. 1993. Ocean Color and Atmospheric DMS: on their Mesoscale Variability. **J. Geophys. Res.** 98 (D12): 23,469-23,476.
- 21) **Balch, W.M.**, K.A. Kilpatrick, and P.M. Holligan. 1993. Coccolith formation and detachment by *Emiliana huxleyi* (Prymnesiophyceae). **J. Phycol.** 29: 566-575.
- 20) **Balch, W.M.** 1993. Sophisticated models of primary production: Performance versus complexity-Reply to Platt and Sathyendranath. **J. Geophys. Res.** 98: 16585-16587.
- 19) **Balch, W. M.** and K. A. Kilpatrick. 1992. Particulate reflectance measurements of phytoplankton. **J. Plank. Res.** 14:721-735.
- 18) **Balch, W. M.**, R. Evans, J. Brown, G. Feldman, C. McClain and W. Esais. 1992. The remote sensing of ocean primary productivity—use of a new data compilation to test satellite algorithms. **Journal Geophysical Research.** 97:2279-2293.
- 17) **Balch, W. M.**, P. M. Holligan and K. A. Kilpatrick. 1992. Calcification, photosynthesis and growth of the bloom - forming coccolithophore. *Emiliana huxleyi*. **Cont. Shelf Res.** 12:1353-1374.
- 16) **Balch, W. M.**, P. M. Holligan, S. Ackleson, and K. Voss. 1991. Biological and optical properties of mesoscale coccolithophore blooms in the Gulf of Maine. **Limnology and Oceanography.** 36:629-643.
- 15) Weiler, C. S., **W. M. Balch**, S. W. Shisholm, J. J. Cullen, W. G. Harrison, P. A. Matrai, M. M. McCarthy, J. R. Nelson, M. J. Perry. 1990. Richard W. Eppley's contributions to phytoplankton physiology and biological oceanography. *Oceanography.* 3 (2): 42-46.
- 14) **Balch, W. M.**, M. Abbott, R. W. Eppley, and F. M. H. Reid. 1989. Bias in satellite-derived pigment measurements due to coccolithophorids and dinoflagellates. **Journal of Plankton Research.** 11:575-581.
- 13) **Balch, W. M.**, R. W. Eppley, and M. Abbott. 1989. Remote sensing of primary production I. a comparison of empirical and semi-analytical algorithms. **Deep Sea Research.** 36:281-295.
- 12) **Balch, W. M.**, R. W. Eppley, and M. Abbott. 1989. Remote sensing of primary production II. introduction of a semi-analytical algorithm. **Deep Sea Research.** 36: 1201-1217.
- 11) Ackleson, S., **W. M. Balch** and P. M. Holligan. 1988. White waters of the Gulf of Maine. **Oceanography.** 1: 18-22.
- 10) **Balch, W. M.** 1987. Studies of nitrate transport of marine phytoplankton using $^{36}\text{Cl-ClO}_3$ as a transport analogue. I. Physiological findings. **J. Phycol.** 23:107-118.
- 9) **Balch, W. M.**, C. Garside, and E. Renger. 1987. Studies of nitrate transport of marine phytoplankton using $^{36}\text{Cl-ClO}_3$ as a transport analogue. II. Field observations. **Deep-Sea Res.** 34:221-236.
- 8) **Balch, W. M.** 1986. Exploring the mechanism of ammonium uptake in marine phytoplankton with an ammonium analogue, methylamine. **Mar. Biol.** 92:163-171.

- 7) **Balch, W. M.** 1985. The effect of light of methylamine uptake by phytoplankton. **Limnol. Oceanogr.** 30:665-674.
- 6) Holligan, P. M., **W. M. Balch**, and C. M. Yentsch. 1984. Significance of subsurface chlorophyll, nitrate, and ammonium maxima in relation to the supply of nitrogen for phytoplankton growth in stratified waters of the Gulf of Maine. **J.Mar. Res.** 42:1051-1073.
- 5) **Balch, W. M.** and F. T. Haxo. 1984. Spectral properties of *Noctiluca miliaris* Suriray, a heterotrophic dinoflagellate. **J. Plankton Res.** 6:515-525.
- 4) Townsend, D. W., C. M. Yentsch, C. E. Parker, **W. M. Balch**, and E. D. True. 1983. An island mixing effect in the coastal Gulf of Maine. **Helgolander Meeresuntersuchungen** 36:347-356.
- 3) **Balch, W. M.**, P. C. Reid, and S. C. Surrey-Gent. 1983. Spatial and temporal variability of dinoflagellate cyst abundance in a tidal estuary. **Can. J. Fish Aquat. Sci.** 40:244-261.
- 2) **Balch, W.M.** 1981. An apparent lunar cycle of phytoplankton blooms and community succession in the Gulf of Maine. **J. Exper. Mar. Biol. and Ecol.** 55:65-77.
- 1) Yentsch, C. M. and **W. M. Balch**. 1975. Lack of secondary intoxicification by red tide poison in the American lobster, *Homarus americanus*. **Environmental Letters.** 2:246-254.

BOOK CHAPTERS, SYMPOSIA PROCEEDINGS AND MONOGRAPHS:

- 15) Fabry, V., Langdon, C., **Balch, W.**, Dickson, A., Feely, R., Hales, B., Hutchins, D., Kleypas, J., and Sabine, C. 2008. Ocean Acidification's Effects on Marine Ecosystems and Biogeochemistry Ocean Carbon and Biogeochemistry Scoping Workshop on Ocean Acidification Research; La Jolla, California, 9–11 October 2007. **EOS.** 89(15): 143-144.
- 14) **Balch, W. M.** 2007. Coccolithophores and the “sea of milk”. In “*Our Changing Planet: The View From Space*”. Editors Michael King, Claire Parkinson, Kim Partington, and Robin Williams. Cambridge University Press. Cambridge, U.K.
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- Balch, W.M.. The Gulf of Maine GNATS program. Gulf of Maine workshop, University of New Hampshire, Alumni Center, Durham, NH. 2 May 2008.**
- Balch, W.M.. Carboy Results from the Equatorial Biocomplexity Experiment. 19-20 May 2008. Tiburon Center, Univ. San Francisco, San Frisco, CA. I participated in the meeting remotely and presented the above talk via video conference.**
- Balch, W.M., A.J. Plueddeman, B. C. Bowler, D. T. Drapeau.** On the mechanisms of thin layer formation: Evidence from Chalk-ex. 2008 Ocean Optics Meeting XIX, Tuscany Italy, October 2008.
- Cuhel, R., C. Aguilar-Diaz, W.M. Balch.** 2008. Midwest Flood of 2008: Lake Michigan Basin-Wide Summer Plankton Bloom is not due to Nutrient Injection. AGU Fall Meeting. San Francisco, December 2008.
- Balch, W.M. 2008. Pelagic Calcification. Workshop on Best Practices for Ocean Acidification Research, Kiel, Germany, November 19-21, 2008.**
- Dierssen, H.M., K. Randolph, C. Buonassisi, M. Twardowski, S. Freeman, W.M. Balch, and D. Drapeau.** 2009. Differentiating sources of backscattering in the Southern Ocean for ocean color remote sensing: calcite, bubbles and phytoplankton. ASLO Meeting. Nice France (January 2009).
- Balch, W.M., G. Aiken, A. Barnard, T. Huntington, C. Roesler, H. Xue.** 2009. Land to ocean carbon coupling between the Penobscot watershed and Gulf of Maine. North American Carbon Program Meeting, Town and Country Hotel, San Diego, Feb 17-20, 2009.
- Balch, W.M.** 2009. Ocean acidification: documenting its impact on calcifying phytoplankton at basin scales. Presented at "Rising CO₂, ocean acidification and their impacts on marine microbes" organized by the Plymouth Marine Laboratory and the Center for Microbial Oceanography: Research and Education (C-MORE) at the East-West Center on the Campus of the University of Hawaii 24 – 26 February 2009.
- Balch, W.M.** 2009. Coastal Time Series: Documenting change across the land-sea transition zone. Ocean Color Research Team Meeting, New York, NY. May 4-6, 2009.
- Balch W. M.** 2009. The MODIS time series of suspended calcium carbonate in the global ocean. IGARRS Meeting, Cape Town, South Africa. July 13-17, 2009.
- Balch, W.M.** 2009. Ocean Acidification: Another Facet of the Global CO₂ Problem. Café Scientifique. Boothbay Opera House, W. Boothbay Harbor, ME 28 July 2009.

- Balch, W.M.** 2009. The Gulf of Maine North Atlantic Time Series, **GNATS**: A retrospective of the productivity of the Gulf of Maine. Gulf of Maine Symposium St. Andrews, New Brunswick, NB, Canada. 4-9 October 2009.
- Balch, W.M.**, Drapeau, D.T., Bowler, B.C. and Alley, Danielle. 2009. Gas-Ex III results. Univ. Connecticut Progress Meeting, SoGasExIII. 6 November 2009
- Balch, W.M.** 2009. The Gulf of Maine North Atlantic Time Series, **GNATS**: A retrospective of the productivity of the Gulf of Maine. University of Connecticut Departmental Seminar. 6 November 2009.
- Balch, W.M.** 2009. Radioisotope Techniques for measuring coccolithophore calcification NSF-sponsored course on Ocean Acidification, Marine Biological Laboratory, Woods Hole, MA Nov 7, 2009.
- Balch, W.M.** 2010. Viewing the ocean's carbonate cycle with MODIS. Plenary Talk. MODIS meeting. Washington, D.C. 25-28 January 2010.
- Balch, W.M.** 2010. MODIS PIC algorithm (mod 23). MODIS meeting. Washington, D.C. 25-28 January 2010.
- Balch, W.M.** 2010. **GNATS** (The Gulf of Maine North Atlantic Time Series)—combining synoptic in situ and space-based observations to evaluate long-term change in coastal waters. Ocean Sciences Meeting, Portland Oregon. 22-26 February, 2010.
- Poulton, A.J., A. Charalampopoulou, **W.M. Balch**, and S. Painter (2010), Contrasting Coccolithophore Dynamics from the Iceland Basin (North Atlantic) and Patagonian Shelf (South Atlantic), in *From observation to prediction in the 21st century: 2010 Ocean Sciences Meeting*, pp. 68, AGU, ASLO and TOS, Portland, OR.
- Lee, P., **W.M. Balch**, T. Cyronak, D. Drapeau, E. Lyczkowski, M. Saggiomo, V. Saggiomo, I. Santarpia, A. Strand, and G.R. DiTullio (2010), Potential impact of increased pCO₂ on particulate DMSP and the production of dissolved DMSP through microzooplankton grazing, in *From observation to prediction in the 21st century: 2010 Ocean Sciences Meeting*, pp. 61, AGU, ASLO and TOS, Portland, OR.
- Balch, W.M.**, Drapeau, D.T., Bowler, B.C., Lyczkowski, E., Alley, D. 2010. The "Great Calcite Belt": Are there really coccoliths down there? NASA Ocean Color Research Team Meeting, New Orleans, LA 10-13 May 2010.

PROFESSIONAL

Funded Research:

- 1) NASA - "Evaluation of satellite primary production algorithms"
January 1, 1987 - December 31, 1990
NAGW-1291 \$301,727
- 2) NASA - "Marine phytoplankton productivity as a source of dimethylsulfide in surface ocean waters and the atmosphere" to P. Matrai, E. Saltzman and W. Balch
3 years \$324,459
- 3) NSF - "Photosynthesis and Calcification by Blooms of the Coccolithophore, *Emiliania huxleyi* in the Gulf of Maine"
2 years April 89 - April 90 OCE - 8900189 \$203,258
- 4) ONR - "An investigation of coccolithophore optical properties under bloom conditions" Sub-contract to proposal through Bigelow Laboratory for

	Ocean Sciences July 1, 1988 - December 31, 1988	\$13,924
5)	ONR - "An investigation of coccolithophore optical properties under bloom conditions: a continuation" July 1, 1989 - June 30, 1990	\$16,768
6)	ONR - "Bio-optical properties of coccolithophores" October 1, 1990 - September 30, 1991	\$29,978
7)	ONR - "Bio-optical properties of coccolithophores - Part II" April 1, 1991 - September 30, 1992	\$99,944
8)	NASA - "Evaluation of physiologically-based algorithms for the remote sensing of ocean primary productivity" January 1, 1991. 3 yrs.	\$379,740
9)	NSF - "Calcification and photosynthesis measurements for the JGOFS Equatorial Pacific Study" November 1, 1991 - November 1993	\$196,142
10)	NOAA - "Climate and global change—productivity algorithm development" March 1, 1991. 1 year	\$20,000
11)	NASA - Ocean observations with EOS/MODIS: Algorithm Development and Post Launch Studies. December 15, 1993. - December 15, 2001	\$2,019,533
12)	ONR - "Assessing the importance of calcite to optical backscatter in the Ocean" October 1, 1992 - September 30, 1994	\$200,000
13)	NASA - "Towards improved estimates of primary production and carbon turnover during the SeaWiFS mission" May 1, 1992 - April 30, 1996	\$433,642
14)	NSF- "Calcite production rates in the Arabian Sea" May 1, 1994- April 30, 1997	\$300,000
15)	ONR- "Measuring the calcite-specific backscattering coefficient in the sea" October 1, 1994- September 30, 1996	\$179,992
16)	ONR- "Optical properties of marine viruses" with J. Vaughn (UNE) July 1, 1996-June 31, 1999	\$496,978
17)	RMRP- "Organic and inorganic carbon production in the Gulf of Maine. October 1, 1995- September 30, 1997	\$200,001
18)	NOAA- "Development and validation of regional time-varying coastal marine algorithms- "Gulf of Maine- A Case Study", with C.S. Yentsch, D. Phinney and M. Keller. July 15, 1996-July 14, 1999	\$447,000
19)	ONR- "Impact of Turbulence and growth rate on the scattering signatures of marine phytoplankton" 1 October 1996- Sept 30, 1998	\$230,000
20)	NASA- "Validation of Surface Bio-Optical Properties in the Gulf of Maine as a Means for Improving Satellite Primary Production Estimates", Sept. 1 1997-Aug. 31, 2000. \$588,690	

	Supplement	Nov. 2000		\$ 40,000
21)	NOAA-	"Ferry-based validation of satellite ocean color sensors in the Gulf of Maine" 9/9/00-9/30/01		\$10,000
22)	NASA-	"Development of a particle backscattering algorithm: Theoretical basis concurrent ship measurements, and global biogeochemical implications. with Dr. Janet Campbell (UNH) and Dr. John O'Reilly (NOAA, Narragansett, RI) July 1 1997- June 31, 2000. One year supplement	BLOS Portion	\$51,048 \$17,984
23)	ONR-DEPSCOR-	"Impact of viral infections on absorption and scattering properties of marine bacteria and phytoplankton". With J. Vaughn (UNE). 1 May 99 to 30 April 02.		\$460,000
24)	ONR-	"Factors affecting the backscattering probability in the sea" 9/21/98 to 9/20/99.		\$150,000
25)	ONR-	"Chalk-Ex: Transport of optically active particles from the surface mixed layer" With A. Plueddemann (WHOI) and C. Pilskaln (BLOS) 10/1/00 to 9/30/03. Balch component \$360,013; total project \$1,034,033		
26)	ONR- DURIP	"Upgrading instrumentation to measure light scattering in the sea", with J. Vaughn (UNE). 4/1/01-3/31/02		\$119,040
27)	NASA-	The Gulf of Maine"- A test site for satellite studies of the "black" and "white" carbon cycle. 2/1/01 to 1/31/04		\$499,982
28)	NASA-	Viral control of meso-scale coccolithophore blooms in the Gulf of Maine (with J. Vaughn & J. Novotny, Univ. of New England; P. Matrai, Bigelow Laboratory). 01/01/02-12/31/04		\$520,220
29)	NSF-	"Production and dissolution of calcium carbonate in the global ocean: A synthesis and modeling project. (With W. Berelson, K. Lee, R. Najjar, R. Feely, and C. Sabine). 03/01/02-02/28/05		\$196,646
30)	NSF-	"Phytoplankton dynamics and carbon cycling in the equatorial Pacific Ocean: Control by Si and Fe. 12/1/03-11/30/07 Balch component \$337,000; Total Project \$2,000,000		
31)	NASA-	"Using remote sensing to understand the consequences of climate, sea level changes and increased human activities in the coastal Gulf of Maine-- An interdisciplinary study of land-sea carbon coupling " 3/1/04-2/29/07 Balch Component \$507,575; Total Project- \$1,475,000		
32)	NSF-	"Collaboration Research: ITR: Interactive Software Systems for Expert-Assisted Image Analysis and Classification of Aquatic Particles" 11/1/03-10/31/08 Balch Component \$281,227; Total Project- \$1,936,000		
33)	NASA-	"The MODIS Ocean Product for Particulate Inorganic Carbon (MOD 25): Refinement of calcium carbonate estimates in the global ocean" 3/1/04 -2/28/07.		

\$586,269

- 34) ONR- "A Supplement to Chalk-Ex: Transport of Optically Active Particles from the Surface Mixed Layer" 10/1/03- 9/30/04 ; with C. Pilskaln; \$58,268
- 35) ONR- "Nanoparticles and Ocean Optics" 1/1/05-12/31/07 with J. Vaughn (UNE) and J. Goes (Bigelow Laboratory for Ocean Sciences) \$544,841
- 36) NASA- "GNATS", the Gulf of Maine North Atlantic Time Series: Integrating terrestrial and ocean carbon cycles in a coastal shelf sea through coordinated ship and satellite observations. \$800,386
- 37) NASA- Differentiating sources of backscattering in the Southern Ocean: Bubbles, whitecaps, and Coccolithophores (w/ Dr. H. Dierrson and A. Twardowski, Co-I's) 9/1/07-8/31/10 \$437,026
- 38) NASA- Using remote sensing to understand carbon flow and its transformations from upland ecosystems into the coastal ocean. 11/28/07-11/27/09 \$524,795
- 39) Maine Bond Fund- A proposal to add two Slocum Gliders to the Gulf of Maine/North Atlantic Time Series (GNATS) 12/1/2006-10/2010 \$282,400
- 40) NASA- A proposal for refinement of the MODIS calcite algorithm and Cal/Val Activities towards assembly of earth system data records 3/1/08 to 2/28/11 \$678,980
- 41) NSF- Patagonian Shelf coccolithophores: ecological factors regulating the southern hemisphere's largest recurring coccolithophore bloom 9/07-8/10 \$499,733.
- 42) ONR- "Expansion to Nanoparticles and Ocean Optics" 4/08-9/30/08 \$49,995
- 43) NSF- "The Great Southern Coccolithophore Belt" 6/1/10-5-31/14 \$2.56million (\$1.49 million to Bigelow Laboratory (Balch and Twining)).

SEA-GOING AND FIELD EXPERIENCE:

Gulf of Maine 1978/79 (30h flight time in Cessna sea plane for aerial infra-red radiometry)
Gulf of Maine, Monhegan Island 1978 (Ran field sampling station) 4 months
Gulf of Maine, Southport Island 1979 (Ran field sampling station) 4 months
Gulf of Maine 1978 (R/V Tioga) 10 d
Sargasso Sea 1979 (R/V Eastward) 14 d
Mid Atlantic Bight 1979 (R/V Westward) 6 weeks
Sargasso Sea/Georges Bank 1979 (R/V Oceanus) 13 d
Southern California Bight 1980 (R/V New Horizon) 14 d
Celtic Sea/English Channel 1980 (R/V Sarsia) 14d
Gulf of Maine 1982 (R/V Gyre) 18 d
Southern California Bight 1983 (R/V New Horizon) 4 d
Sargasso Sea 1983 (R/V Cape Hatteras) 7 d
Southern California Bight 1984 (R/V New Horizon) 10 d
Southern California Bight 1985 (R/V Sproul) 8 d
Southern California Bight 1986 (R/V Sproul) 10 d
Southern California Bight 1987 (R/V Sproul; chief scientist) 9 d
Gulf of Maine 1988 (R/V Argo Maine) 7 d

Gulf of Maine 1989 (R/V Argo Maine) 14 d
Sargasso Sea/Mid Atlantic Bight (R/V Atlantis II) 14 d
Gulf of Maine 1990 (R/V Cape Hatteras) 14 d
North Atlantic 1991 (R/V Charles Darwin) 21 d
Gulf of Maine 1991 (R/V Cape Hatteras) 12 d
Equatorial Pacific 1992 (R/V Thompson) 45 d
Florida Current 1993 (R/V Corwith Cramer) 6d
Florida Current 1995 (R/V Westward) 6d
Arabian Sea July, 1995 (R/V Thompson) 30d
Arabian Sea October, 1995 (R/V Thompson; chief scientist) 30d
Gulf of Maine 1996 (R/V Pelican) 8d
Gulf of Maine 1997 (R/V Albatross) 11d
Gulf of Maine 1997 (R/V Delaware) 12d
Gulf of Maine 1998 (R/V Albatross) 11d
Gulf of Maine 1998 (M/S Scotia Prince) 10d
Gulf of Maine 1999 (M/S Scotia Prince) 20d
Gulf of Maine 2000 (M/S Scotia Prince) 12d
Gulf of Maine 2001 (M/S Scotia Prince) 12d
NW Atlantic 2001 (R/V Endeavor; chief scientist) 11d
Gulf of Maine 2002 (M/S Scotia Prince) 12d
NW Atlantic 2003 (R/V Endeavor; chief scientist) 11d
Equatorial Pacific 2004 (R/V Revelle) 30d
Atlantic 2004 (R/V Discovery; AMT transect U.K. to S. Africa) 44d
Gulf of Maine 2004 (M/S Scotia Prince) 12d
Gulf of Maine 2005 (misc ships of opportunity) 12d
NW Atlantic 2006 (R/V Cape Hatteras) 10d
Gulf of Maine 2006 (misc. ships of opportunity) 8d
Gulf of Maine 2007 (misc. ships of opportunity) 19d
Gulf of Maine 2008 (misc. ships of opportunity) 12d
Patagonian Shelf 2008 (R/V Roger Revelle, chief scientist) 30d

PROFESSIONAL AND HONORARY ORGANIZATIONS:

American Society of Limnology and Oceanography
Oceanography Society
American Association for the Advancement of Science (past member)
Honorary Society of Sigma Xi (past member)
Phycological Society of America (past member)

OTHER PROFESSIONAL ACTIVITIES:

Academic advisor to the National Oceanographic Data Center for designing a global production data set.
January 1988-1991.

Globec Planning Group - to develop long-range focus for the NSF-sponsored Global Ecosystem Dynamics program. 1988.

Member of West Coast Time Series Science Working Team- responsible for advising NASA with regard to the reception, processing, archival and distribution of CZCS and AVHRR data, 1989.

NSF review panel, Biological Oceanography 1990, 1994.

JGOFS Arabian Sea Planning Group 1991

NASA SeaWiFS Team 1992-present.

MODIS Team Collaborator, Miami, FL March 1996 to present

IOC/NODC Meeting on a Global Data Base for Biological and Chemical Data. Hamburg Germany May, 1996.

NASA SIMBIOS team: September 1997-2000

ONR-sponsored Coccolithophore Experiment Planning Meeting, August, 1999

NSF-sponsored OCTET Planning, March 2000

NSF-sponsored EDOCC Planning, March 2000

Keynote speaker- Conference on "Coccolithophores- from molecular processes to global impact", Ascona, Switzerland. February, 2002

NASA Biological Oceanography panel review- 2002

NASA Biological Oceanography panel review- 2005

NASA Review of future measurements- Oct 2006

Ocean Carbon Biogeochemistry steering sub-committee on Ocean Acidification and invited plenary speaker- October 2007, Scripps Inst. of Oceanography.

Subcommittee on Ocean Acidification (part of the U.S. Ocean Carbon and Biogeochemistry Program) September 2008 to present.

NASA Science Working Group for GEO-CAPE (geostationary ocean color mission)

TEACHING:

Classes taught:

- 1) U. Miami MSC 116- Descriptive Physical Oceanography (for undergraduate marine science majors)
Taught Spring, 1989-1993
- 2) U. Miami MSC 101- Oceanography Under Sail (for undergraduate non-science majors) Winter, 1994
- 3) U. Miami MBF 503- Biological Oceanography (for non-biology graduate students). Fall, 1989-1993
- 4) U. New England- Gulf of Maine Seminar (team taught) Spring 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005
- 5) BLOS; July 2003, Taught part of MODIS Ocean Color course (with Evans, Kilpatrick and Banzon)

Thesis and Dissertation Advising: Aline Rodrigues (MS) 1988 - 1991
Ian Gilbert (MA) 1991-1993
Jennifer Fritz (MS/PhD) 1991 - 1997

Post-doctoral Advising: Dr. Raleigh Hood 1991-1992.
Dr. Emilio Fernandez, 1993.
Dr. Lisa Graziano 1995-1998
Dr. Robert Vaillancourt 1996-1999
Dr. Jennifer Fritz 1997
Dr. Joaquim Goes 1999-2002

Bigelow Laboratory Summer Course organizer 1996-2006- Organized 37 courses
Coordinator of Bigelow Laboratory interns (from UNE): dealt with all aspects of shepherding 76 student interns through Bigelow.

SERVICE:

University of Miami Committee and Administrative Responsibilities:

- 1) MBF Academic Committee
- 2) Thesis committees: Aline Rodrigues, MBF (Chairman), RSMAS
Ian Gilbert, MBF (Chairman), RSMAS
Jennifer Fritz, MBF (Chairman), RSMAS
Catherine Campbell, MBF (Chairman), RSMAS
Joshua Feingold, MBF, RSMAS
Richard Edwards, MBF, RSMAS
Sarah Shaw, MBF, RSMAS
Richard Sikorski, MAC, RSMAS
Laura Valera, MBF, RSMAS
Maia McGuire, MBF, RSMAS
- 3) External Committee Member - Rafael Cervantes Duarte, CICESE, Encinada, Mexico
Steve Gadreau, Univ. New Hampshire (Masters committee)
- 4) Other Committee Work:
U. Miami MBF Computer Committee
U. Miami School Council-MBF representative
U. Miami Sexual Harassment Committee
- 5) U. Miami Undergraduate interns
Ms Shannon Cass Calay (she went on to Scripps Inst. of Oceanography for graduate work)
Jaime Kinney

Bigelow Laboratory Committee and Administrative Responsibilities:

- 18) CCMP Search Committee (Bigelow Laboratory 2009-2010)
- 17) Education Committee, Bigelow Laboratory 1995 to present
- 16) Chair- Search committee new Senior Scientist Positions at Bigelow Laboratory; August 2005 to present
- 15) Search committee for UNE Director of Marine Sciences Center (2003)
- 14) Long-range committee for academic activities (2002-2003)
- 13) Program committee (2000-present)
- 12) Planning committee for BLOS university activities (2002)
- 11) Search committee, Chair- Systems administrator position (2001)
- 10) Chair Remote Sensing Committee (1996-2001)
- 9) Compensation Committee (1996-97)
- 8) P.I. Search Committee; 3 searches convened (1997-2001)
- 7) UNE/BLOS Physics Position Search Committee (1997-1998)
- 6) UNE/BLOS Masters planning committee (1997-present)
- 5) BLOS Sign Committee (1995)
- 4) BLOS academic coordinator with UNE- responsible for coordinating teaching activities (including Gulf of Maine Seminar series), summer course organization,
- 3) Undergraduate/High School Interns:
Jessica Nelson (received Ph.D. from Scripps Inst. of Oceanography)
Kerry Tetrault
Krystal Wescovitch
Kerry Weber
Jessica Zima
Laura Windecker
Sara Komoroski
Emily Lyczkowski
- 2) Moderator CORE Ocean Sciences Bowl (1998 (UNE), 1999 (UNH), 2000 (UMO)), 2001 (UNE), 2004 (UNE), 2005 (UNH).
- 1) BLOS program committee (with BLOS board members) 2/99- present.

Community Activities: Design Review Board (Newcastle, ME), Gifted and Talented

Committee (Great Salt Bay School, Damariscotta, ME), Jazz trombonist

Discography:

Page, R., D. Page, M. Havenstein, **B. Balch**, T.J. Wheeler, B. Terrie, and J. Tukey 2009. "Live at Lincoln Academy", Lincoln Academy, Newcastle, ME.

Balch, B., B. Boege, Dave Clark, M. Felder, M. Macksoud, H. Maine, M. Mitchell (Novel Jazz Septet). 2008. "Novel Ellington and Strayhorn." Produced by B. Balch and B. Boege. Sheepscoot Jazz and Swing Co., Newcastle, ME. SJSC 11082008; <http://cdbaby.com/cd/noveljazz>.

Havenstein, M. with J. Howe, L. Harris Jr., C. Jennison, R. Norris, N. Kaletsky, S. Philbrick, A. Doane, G. Wright, B. Page, D. Page, J. Tukey, **B. Balch**, P. Collins, L. McAuslin, M. Hamilton, P.I Runnels, L. Percy, B. Costa, A. Delgado, J. LaValle, S. Neale, B. Mulkern, J. Hunter, B. Bragan, D. Pierce and C. Stone. 2003. "Muriel in concert". Beach Road Recording, Lincolnville, ME.

Page, R., **B. Balch**, P. Collins, L. McAuslin, D. Page, and J. Tukey. 1998. "Cash is a problem". Recorded and mixed at Rosewood Studio, Bremen, ME. Jump & Shout Records JASR 1001, Atlanta, GA.

Page, R., **B. Balch**, P. Collins, D. Creeden, D. Page, and J. Tukey. 1996. Bob Page "Project II- Blues in Dixieland". Produced by Aleck Janoulis. Recorded at R. W. Studio. Hottrax Records 5125-60004-2, Atlanta, GA.

List of four references:

Ocean Optics/Remote Sensing :

Dr. Howard Gordon

Physics Dept.

University of Miami

Coral Gables, FL 33124. tel. (305) 284-2323

Ocean Optics/Remote Sensing:

Dr. Otis Brown

Rosenstiel School for Marine and Atmospheric Science

4600 Rickenbacker Causeway

Miami, FL 33149-1098 tel. (305) 361-4018

Biological Oceanography :

Dr. Marlon Lewis

Oceanography Dept.

Dalhousie University

Halifax, Nova Scotia, B3H 4H9, Canada. tel. (902)492-4780.

Biological Oceanography:

Dr. Patrick Holligan

Univ. of Southampton Highfield

Dept. of Oceanography

Southampton SO17 1BJ. 44-1703-594806.