

CURRICULUM VITAE

Lawrence W. Harding, Jr.

Research Professor, 1994-present

Horn Point Laboratory
University of Maryland
Center for Environmental Science
Cambridge, Maryland 21613

Phone: 410.221.8247

Fax: 410.221.8490

Email: larry@hpl.umces.edu

Maryland Sea Grant College
University of Maryland
4321 Hartwick Road, Suite 300
College Park, Maryland 20742

Phone: 301.403.4220.17

Fax: 301.403.4255

I. Education

1972 - B.A., Humboldt State University, Arcata, California, Zoology

1973 - M.A., Humboldt State University, Arcata, California, Biology

1978 - Ph.D., Stanford University, Stanford, California, Biology

II. Professional Background

1971 - 1973 - *Department of Oceanography, Humboldt State University*

- Research Assistant, Lawrence Livermore Laboratories Radionuclide Study of Humboldt Bay, California

1973 - 1978 - *Department of Biological Sciences, Hopkins Marine Station, Stanford University*

- NSF Graduate Research Assistant (1973-1975); Coordinator, Seminar Program (1975-1978) - Graduate Research Assistant, Biological Sciences Department, Fellowship (1975-1978)

1978 - 1981 - *Marine Science Institute & Department of Biological Sciences, University of California, Santa Barbara*

- NSF National Needs in Science Postdoctoral Fellow (1978-1980); - Instructor, Department of Biological Sciences (1981)

1981 - 1991 - *Chesapeake Bay Institute, The Johns Hopkins University*

1981 - 1987 - Associate Research Scientist

1987 - 1991 - Research Scientist

1989 - 1990 - NASA Summer Faculty Fellow, Goddard Space Flight Center

1991-present - *University of Maryland, Center for Environmental Science (UMCES) and University of Maryland Sea Grant College*

1991 - 94 - Research Assoc. Professor, Horn Point Laboratory (HPL) and Maryland Sea Grant (MDSG)

1991 - present - Graduate Faculty Marine-Environmental-Estuarine-Sciences (MEES)

Program, Univ. of Maryland, College Park

1994 - present - Research Professor, HPL and MDSG

Awards and Special Recognition:

1977 - Arthur C. Giese Annual Award for Original Experimental Work in Marine Biology, Stanford University

1978 - 1980 - NSF National Needs in Science Postdoctoral Fellowship

1989 - 1990 - NASA Summer Faculty Fellowship, Goddard Space Flight Center

III. Research

A. Areas of Professional Expertise

Phytoplankton physiology and ecology, aircraft and satellite remote sensing, estuarine biology, biological oceanography, land-margin ecosystem research.

B. Peer-Reviewed Publications (since 1994)

1994 - Harding, L.W., Jr.: Long-term trends in the distribution of phytoplankton in Chesapeake Bay: roles of light, nutrients and streamflow. *Mar. Ecol. Prog. Ser.* 104: 267-291.

Harding, L.W., Jr., E.C. Itsweire and W.E. Esaias: Estimates of phytoplankton biomass in the Chesapeake Bay from aircraft remote sensing of chlorophyll concentrations, 1989-92. *Rem. Sens. Environ.* 49: 41-56.

1995 - Glibert, P.M., D.J. Conley, T.R. Fisher, L.W. Harding, Jr., and T.C. Malone. 1995. The spring bloom of 1990 in Chesapeake Bay. *Mar. Ecol. Prog. Ser.* 122: 27-43.

Harding, L.W., Jr., E.C. Itsweire and W.E. Esaias: Algorithm development for recovering chlorophyll concentrations in the Chesapeake Bay using aircraft remote sensing, 1989-91. *Photogramm. Eng. Rem. Sens.* 61: 177-185.

1996 - Malone, T.C., D.J. Conley, T.R. Fisher, P.M. Glibert and L.W. Harding, Jr. (1996). Scales of nutrient limited phytoplankton productivity in Chesapeake Bay. *Estuaries* 19: 371-385.

1997 - Harding, L.W., Jr. and E. Perry: Long-term increase of phytoplankton biomass in Chesapeake Bay. *Mar. Ecol. Prog. Ser.* 157: 39-52.

Weiss, G.M., L.W. Harding, Jr., E.C. Itsweire and J.C. Campbell: Assessing lateral variations of surface chlorophyll concentrations in the Chesapeake Bay using aircraft remote sensing. *Mar. Ecol. Prog. Ser.* 149: 183-199.

Boynton, W.R., W. Boicourt, S. Brandt, J. Hagy, L. Harding, E. Houde, D.V. Holliday, M. Jech, W.M. Kemp, C. Lascara, S.D. Leach, A.P. Madden, M. Roman, L. Sanford and E.M. Smith: Interactions between physics and biology in the estuarine turbidity maximum (ETM) of Chesapeake Bay, USA. International Council for the Exploration of the Sea, CM 1997/S:11.

1998 - Harding, L.W., Jr.: Review of "Marine Ecological Processes" by Ivan Valiela, *Quarterly Reviews of Biology* 72: 216.

Scardi, M. and L.W. Harding, Jr.: Phytoplankton primary production estimates using neural network analysis: a case study for Chesapeake Bay. Paper presented at the International Workshop on Applications of Artificial Neural Networks to *Ecological Modelling*, Toulouse, France, 14-17 December 1998.

1999 - Hood, R.R., H.V. Wang, J.E. Purcell, E.D. Houde and L.W. Harding, Jr.: Modeling particles and pelagic organisms in Chesapeake Bay: convergent features control plankton distributions. *J. Geophys. Res.* 104: 1223-1243.

Smodlaka, N., T.C. Malone, A. Malej, and L.W. Harding, Jr.: Introduction, in Malone, T.C., A. Malej, L.W. Harding, Jr., and N. Smodlaka, (Eds.), *Ecosystems at the Land-Sea Margin: Drainage Basin to Coastal Sea*, Chapter 1, Amer. Geophys. Union, Estuarine and Coastal Sciences Series, No. 55, p 1-6.

Harding, L.W., D. Degobbi and R. Precali: Production and fate of phytoplankton: annual cycles and interannual variability, in Malone, T.C., A. Malej, L.W. Harding, Jr., and N. Smodlaka (Eds.), *Ecosystems at the Land-Sea Margin: Drainage Basin to Coastal Sea*, Chapter 4, Amer. Geophys. Union, Estuarine and Coastal Sciences Series, No. 55, p. 131-172.

Malej, A., L.W. Harding, Jr., N. Smodlaka and T.C. Malone: Summary and Conclusions, in Malone, T.C., A. Malej, L.W. Harding, Jr. and N. Smodlaka (Eds.), *Ecosystems at the Land-Sea Margin: Drainage Basin to Coastal Sea*, Chapter 12, Amer. Geophys. Union, Estuarine and Coastal Sciences Series, No. 55, p. 367-377.

Leonard, C.L., C.R. McClain, E. Hofmann, R. Murtugudde, and L.W. Harding, Jr.: An iron-based ecosystem model of the equatorial Pacific. *J. Geophys. Res.* 104: 1325-1341.

Scardi, M. and L.W. Harding, Jr.: Developing an empirical model of phytoplankton primary production: a neural network case study. *Ecol. Modell.* 120: 220-233 - based on Toulouse presentation.

2001 - Harding, L.W., W.D. Miller, R.N. Swift, and C.W. Wright: Aircraft remote sensing, In: Steele, J., S. Thorpe, and K. Turekian, (eds.), *Encyclopedia of Ocean Sciences*, Academic Press, London, UK, p. 113-122.

2002 - Harding, L.W., M.E. Mallonee, and E.S. Perry: Toward a predictive understanding of primary productivity in a temperate, partially stratified estuary. *Estuar. Coastal Shelf Sci.* 55: 437-463.

2003 - Adolf, J.E., D.K. Stoecker, and L.W. Harding, Jr. 2003. Autotrophic growth and photoacclimation in a mixotrophic protist *Karlodinium micrum* (Dinophyceae) and a common prey *Storeatula major* (Cryptophyceae). *J. Phycol.* 39: 1109-1115.

Harding, L.W., Magnuson, A., and M.E. Mallonee. 2003. Bio-optical and remote sensing observations in Chesapeake Bay. *Estuar. Coast. Shelf Sci.* (in review).

Jordan, C.L., L.W. Harding, Jr., and M.E. Mallonee. 2003. Phytoplankton production, biomass and community structure following a summer nutrient pulse in Chesapeake Bay. *Aquatic Ecology* (accepted, pending revision).

Jordan, C.L., L.W. Harding, Jr., M.E. Mallonee, and M.R. Roman. 2003. Microphytoplankton and microheterotrophs along a biomass gradient at a region of hydraulic control. *Marine Biology* (submitted).

Magnuson, A., L.W. Harding, Jr., J.E. Adolf, and M.E. Mallonee. 2003. Bio-optical model for Chesapeake Bay and the middle Atlantic bight. *Estuar. Coast. Shelf Sci.* (in review).

2004 –

Magnuson, A., L.W. Harding, Jr., M.E. Mallonee, and J.E. Adolf. 2004. Bio-optical model for Chesapeake Bay and the Middle Atlantic Bight. *Estuar. Coast. Shelf Sci.* 61, 403-424.

2005 –

Harding, L.W., Jr., A. Magnuson, and M.E. Mallonee. 2005. SeaWiFS retrievals of chlorophyll in Chesapeake Bay and the mid-Atlantic bight. *Estuar. Coast. Shelf Sci.* 62, 75-94.

Acker, J.G., L.W. Harding, G. Leptoukh, T. Zhu, and S. Shen. 2005. Remotely-sensed chl a at the Chesapeake Bay mouth is correlated with annual freshwater flow to Chesapeake Bay. *Geophys. Res. Lett.* 32, L05601, doi:10.1029/2004GL021852, 2005.

Miller, W.D., L.W. Harding, Jr., and J.E. Adolf. 2005. The influence of Hurricane Isabel on Chesapeake Bay phytoplankton dynamics. *Proc. Hurricane Isabel Conference* (in press).

Paerl, H.W., L.M. Valdes, B.L. Peierls, J.E. Adolf, and L.W. Harding, Jr. 2005. Anthropogenic and climatic influences on the eutrophication of large estuarine ecosystems. *Limnol. Oceanogr.* (in press).

Roman, M.R., J.E. Adolf, J. Bichy, W.C. Boicourt, L.W. Harding, Jr., E.D. Houde, S. Jung, D.G. Kimmel, W.D. Miller, and X. Zhang. 2005. Stimulation of plankton and fish abundance in Chesapeake Bay by Hurricane Isabel. *EOS* (in press).

Yeager, C.L.J., L.W. Harding, Jr., and M.E. Mallonee. 2004. Phytoplankton production, biomass and community structure following a summer nutrient pulse in Chesapeake Bay. *Aquat. Ecol.* (in press).

Adolf, J.E., C.L. Jordan, W.D. Miller, M.E. Mallonee, and L.W. Harding, Jr. 2004. Phytoplankton floral composition, biomass, and primary productivity in Chesapeake Bay. *Limnol. Oceanogr.* (in review).

Adolf, J.E., D.K. Stoecker, and L.W. Harding, Jr. 2005. The balance of heterotrophy during mixotrophic growth of *Karlodinium micrum* (Dinophyceae). *J. Plankton Res.* (in review).

Jordan, C.L., L.W. Harding, Jr., and M.E. Mallonee. 2004. *Acartia tonsa* in Chesapeake Bay microplankton blooms consume primarily ciliates when ciliates are abundant. *J. Plankton Res.* (in revision).

Jordan, C.L., L.W. Harding, Jr., and M.E. Mallonee. 2004. Phytoplankton production, biomass and community structure following a summer nutrient pulse in Chesapeake Bay. *Mar. Ecol. Prog. Ser.* (in revision).

Kemp, W.M., W.R. Boynton, J.E. Adolf, D.F. Boesch, W.C. Boicourt, G. Brush, J.C. Cornwell, T.R. Fisher, P.M. Glibert, L.W. Harding, Jr., E.D. Houde, D.G. Kimmel, W.D. Miller, R.I.E. Newell, M.R. Roman, E.M. Smith, and J.C. Stevenson. 2005. Eutrophication of Chesapeake Bay: Historical trends and ecological interactions. *Mar. Ecol. Progr. Ser.* (in revision).

Adolf, J.E., A.R. Place, D.K. Stoecker, and L.W. Harding, Jr. 2004. Modulation of polyunsaturated fatty acids in mixotrophic *Karlodinium micrum* (Dinophyceae), and prey *Storeatula major* (Cryptophyceae). *J. Phycol.* (in preparation).

Harding, L.W., Jr., M.E. Mallonee, J. Adolf, C. Jordan, W.D. Miller, K. Cone, A. Magnuson, and E.S. Perry. 2005. A time-series of phytoplankton biomass and primary productivity in Chesapeake Bay using aircraft remote sensing. *Limnol. Oceanogr.* (in preparation).

Harding, L.W., Jr., M.E. Mallonee, and E.S. Perry. 2005. Long-term trend analysis of chlorophyll in Chesapeake Bay using shipboard and aircraft observations. *Mar. Ecol. Prog. Ser.* (in preparation).

Scardi, M., and L.W. Harding, Jr. 2005. Artificial neural network (ANN) models of primary productivity in Chesapeake Bay from shipboard and aircraft observations spanning two decades. *Ecol. Modell.* (in preparation).

Tzortziou, M., J.R. Herman, C.L. Gallegos, P.J. Neale, A. Subramaniam, L.W. Harding, Jr., and Z. Ahmad. 2005. Bio-optical properties of water in the Chesapeake Bay determined from a combination of detailed measurements and radiative transfer closure calculations. *Estuar. Coast. Shelf Sci.* (in preparation).

Tzortziou, M., A. Subramaniam, J.R. Herman, P.J. Neale, C.L. Gallegos, and L.W. Harding, Jr. 2005. Remote sensing reflectance and inherent optical properties in the northern Chesapeake Bay waters. *Estuar. Coast. Shelf Sci.* (in prep.).

2. Technical Reports

Harding, L.W., Jr., E.C. Itsweire and W.E. Esaias: Algorithm development for recovering chlorophyll concentrations in the Chesapeake Bay using aircraft remote sensing, 1989-91. Proc. 1st Thematic Conf. Remote Sensing for Marine and Coastal Environments, pp. 1133-1150.

Harding, L.W., Jr., M. Leffler and G.B. Mackiernan: Dissolved oxygen in the Chesapeake Bay: A scientific consensus. Maryland Sea Grant College, Publication No. UM-SG-TS-92-03.

Harding, L.W., Jr., G.M. Weiss and S.M. Gennari: Analysis of spatial and temporal scales of variability in phytoplankton abundance in the Chesapeake Bay using airborne remote sensing. Proc. 1st Internat. Airborne Remote Sensing Conference and Exhibition, Strasbourg, France, 11-15 September 1994, Vol. III, pp. 745-761.

C. Contracts and Grants (since 1994)

"The Use of Ocean Color Data from SeaWiFS to Detect Seasonal and Interannual Variability of Phytoplankton Abundance in the Chesapeake Bay and Adjacent Coastal Waters," NASA Ocean Biology and Biogeochemistry (1 January 1994 - 31 December 1996; \$237,605; 17%.

"Aircraft and Satellite Remote Sensing to Detect Seasonal and Interannual Variability in the Distribution and Abundance of Phytoplankton in Chesapeake Bay and Adjacent Coastal Waters," Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 April 1994- 31 March 1995; \$80,671; 17%.

"Aircraft and Satellite Remote Sensing to Detect Seasonal and Interannual Variability in the Distribution and Abundance of Phytoplankton in Chesapeake Bay and Adjacent Coastal Waters," Maryland Sea Grant; 1 February 1994 - 31 January 1995; \$112,123; 17% (companion to above).

"Summer Fellowships in Ocean Remote Sensing: A Proposal to Train Future Scientists," NASA, 1 April 1994 - 31 March 1999; \$276,166; 8%.

"LMER: Trophic Transfers in Larger Estuarine Ecosystems: Pulsed Inputs, Physical Features and Biological Patchiness," NSF; 1 October 1994 - 30 September 2000; ~\$190,000; 5%.

"Aircraft and Satellite Remote Sensing to Detect Seasonal and Interannual Variability in the Distribution and Abundance of Phytoplankton in Chesapeake Bay and Adjacent Coastal Waters," Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 April 1995- 31 March 1996; \$58,875; 8%.

“Satellite Remote Sensing with SeaWiFS to Detect Seasonal and Interannual Variability in Phytoplankton Abundance in the Chesapeake Bay and Adjacent Coastal Waters,” Maryland Sea Grant; 1 February 1996 - 31 January 1998; \$102,058; 17%.

“Ocean Color Measurements from the Chesapeake Bay Observing System (CBOS) in Support of SeaWiFS Data Validation for Estuaries,” NOAA Coastal Ocean Program/Maryland Sea Grant; 1 August 1996 - 31 July 1998; \$321,350; 17%.

“The Study of Phytoplankton Dynamics in Chesapeake Bay by Remote Sensing of Ocean Color from Aircraft,” Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 April 1996 - 31 March 1997; \$69,654; 17%.

"Aircraft and Satellite Remote Sensing to Detect Seasonal and Interannual Variability in the Distribution and Abundance of Phytoplankton in Chesapeake Bay and Adjacent Coastal Waters," NOAA Chesapeake Bay Office/Maryland Sea Grant; 1 August 1997 - 31 July 1998; \$108,801; 17%.

“Assimilation Modeling of Planktonic Processes in Chesapeake Bay with Aircraft and Satellite Ocean Color Data”, Maryland Sea Grant; 1 February 1998 - 31 January 2000; \$108,812; 8%.

“Remote Observations and Modeling of Phytoplankton in Chesapeake Bay”; NASA Ocean Biology and Biogeochemistry; 1 July 1997 - 30 June 2000; \$492,445; 17%.

“The Choptank River: A Mid-Chesapeake Bay Index Site for Evaluating Ecosystem Responses to Nutrient Management; EPA and NASA; 1 September 1998 - 31 August 2001; \$447,423; 8%.

“The Study of Phytoplankton Dynamics in Chesapeake Bay by Remote Sensing of Ocean Color from Aircraft: A Proposal for Continuation in 1998”, Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 August 1998 - 31 July 1999; \$160,000; 17%.

“The Study of 1999”; Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 August 1999 - 31 July 2000; \$60,000; 8%.

“Indices of Nutrient Enrichment in U.S. Atlantic Estuaries from Remote Sensing of Ocean Color and Temperature”; NASA (component of EPA STAR program ACE INC); 1 September 2001 – 31 August 2005; \$595,936; 8%.

“Trophic Indicators of Ecosystem Health in Chesapeake Bay” (co-PI with E. Houde *et al.*); EPA (component of STAR program ACE INC); 26 February 2001 – 25 February 2006; \$1,977,715; 8%.

“The Study of 2000”; Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 August 2000 - 31 July 2001; \$60,000; 8%.

“Evaluation and Validation of Case 2 Algorithms in Chesapeake Bay” (with Andrea Magnuson-Denny); NASA SIMBIOS; 1 December 2000 – 30 November 2003; \$321,137; 8%.

“Chesapeake Bay Remote Sensing Program: An Education and Outreach Initiative”, Maryland Sea Grant; 1 February 2001 - 31 January 2002; \$47,000; 5%.

“The Study of 2001-2”; Maryland Sea Grant/NOAA Chesapeake Bay Office; 1 September 2001 – 31 August 2002; \$60,000; 8%.

“Synthesis and Forecasting in Estuarine Ecosystems: Bridging the Gap between Nutrients and Fisheries in Chesapeake Bay”; NOAA/Coastal Ocean Program; 1 September 2002 – 31 August 2004; \$1.4 M (total award); 4%.

“Menhaden Abundance and Productivity in Chesapeake Bay” (with Ed Houde); NOAA Chesapeake Bay Office; 1 August 2004 – 31 July 2005; \$84,916; 8%.

“Aircraft Remote Sensing of Chlorophyll and Temperature in the Patuxent and Choptank Rivers”; NOAA Coastal Services Center; 1 June 2004 – 31 May 2005; 4%.

“Primary Production, Spring Blooms, and Control of Recruitment in Pelagic Fish”; Maryland Sea Grant/NOAA; \$25,062 (year 1); 1 February 2005 – 31 January 2007; 8%.

D. Seminars and Presentations (since 1994)

1994 - Harding, L.W., Jr., S.M. Gennari and G.M. Weiss: Aircraft remote sensing of chlorophyll in the Chesapeake Bay, 1989-93; Seasonal and interannual variability. 1994 Ocean Sciences Mtg., AGU/ASLO, San Diego, California, 21-25 February 1994; EOS, Transactions, Vol. 75, p. 154.

Gennari, S.M., L.W. Harding, Jr. and G.M. Weiss: Development of a geographic information system to quantify winter-spring phytoplankton blooms in the Chesapeake Bay. 1994 Ocean Sciences Mtg., AGU/ASLO, San Diego, California, 21-25 February 1994; EOS, Transactions, Vol. 75, p. 154.

Weiss, G.M., L.W. Harding, Jr. and S.M. Gennari: Assessing lateral variations of surface chlorophyll in the Chesapeake Bay using aircraft remote sensing. 1994 Ocean Sciences Mtg., AGU/ASLO, San Diego, California, 21-25 Feb. 1994; EOS, Transactions, Vol. 75, p. 154.

Harding, L.W., Jr., G.M. Weiss and S.M. Gennari: Analysis of spatial and temporal scales of variability in phytoplankton abundance in the Chesapeake Bay using airborne remote sensing. Proc. 1st Internat. Airborne Remote Sensing Conference and Exhibition, Strasbourg, France, 11-15 September 1994.

1995 - Weiss, G.M., J.W. Campbell and L.W. Harding, Jr.: The effect of inter-pixel variance on satellite remote sensing. 4th Oceanography Society Mtg., Newport, Rhode Island, 18-21 April 1995.

Boynton, W.R., W. Boicourt, E. Houde, W.M. Kemp, M. Roman, L. Harding, S. Brandt and S. Jech: Design and preliminary results from a new LMER Program in Chesapeake Bay: Trophic Interactions in Estuarine Systems (TIES). Estuar. Res. Fed. Mtg., Corpus Christi, Texas, 12-16 November, 1995.

Cornwell, J.C., W.C. Boicourt and L.W. Harding, Jr.: Understanding eutrophication in the Chesapeake Bay: Indications of environmental change and changes in key ecosystem processes. Estuar. Res. Fed. Mtg., Corpus Christi, Texas, 12-16 November 1995.

1996 - Harding, L.W., Jr., E.S. Perry and E.C. Itsweire: Detection of a long-term increase of phytoplankton biomass in Chesapeake Bay using shipboard and aircraft observations. ECSA/ERF Meeting, Middelburg, the Netherlands, 15-20 September 1996.

Leffler, M., G. Mackiernan and L.W. Harding, Jr.: The influence of scientific consensus on public policy: A Chesapeake Bay case study. ECSA/ERF Meeting, Middelburg, the Netherlands, 15-20 September 1996.

Kemp, W.M., E. Smith, J. Hagy, C. Lascara, B. Boicourt, S. Brandt, L. Harding, E. Houde, M. Roman and W. Boynton: Trophic interactions in Chesapeake Bay: relations to organic carbon balance. ECSA/ERF Meeting, Middelburg, the Netherlands, 15-20 September 1996.

1997 - Harding, L.W., Jr.: Detection of a long-term increase of phytoplankton biomass in Chesapeake Bay using shipboard and aircraft observations. American Geophysical Union Meeting, Baltimore, Maryland, May 1997.

Boynton, W.R., W. Boicourt, S. Brandt, J. Hagy, L. Harding, E. Houde, D.V. Holliday, M. Jech, W.M. Kemp, C. Lascara, S.D. Leach, A.P. Madden, M. Roman, L. Sanford and E.M. Smith. 1997. Interactions between physics and biology in the estuarine turbidity maximum (ETM) of Chesapeake Bay, USA. International Council for the Exploration of the Sea (ICES) Meeting, Baltimore, Maryland.

Smith, E.M., L.W. Harding, Jr., M.E. Mallonee and W.M. Kemp: Phytoplankton productivity and community metabolism in Chesapeake Bay, 1995-96. Estuarine Research Federation Meeting, Providence, Rhode Island, October, 1997.

1998 - Harding, L.W., Jr.: LMER TIES (Rehoboth, Delaware, March, 1998) – Presentation of results at the annual TIES workshop to synthesize primary productivity and aircraft remote sensing results.

Harding, L.W., Jr.: NOAA/EPA Chesapeake Bay Program (Annapolis, Maryland, April, 1998) – Program review to outside review team for the Chesapeake Bay overflights we've conducted since 1989. In April, a site visit was held at the Chesapeake Bay Program with a

review team chosen by the consisting of two-hour presentation, detailing accomplishments, products and goals, and answered questions from the reviewers concerning this work.

Harding, L.W., Jr.: EPA Chesapeake Bay Program, Scientific and Technical Advisory Committee (Solomons, Maryland, July, 1998; Implementation Committee, November, 1998) – Presentation of results of Trophic Change workshop, reporting on the consensus developed by the group I chaired that surveyed the relative impacts of man and climate in generating the recent patterns we've observed in the Bay.

Harding, L.W., Jr., and H.R. Harvey: UMCES Faculty Senate/Administration Retreats (Donaldson Brown Center and Mount Washington Conference Center, August and October, 1998) –Presentation on graduate education in the second retreat.

1999 - Harding, L.W., Jr., R.R. Hood, and M. Scardi: Enhanced phytoplankton biomass and productivity associated with persistent mesoscale eddies in the lower Chesapeake Bay. American Society of Limnology and Oceanography Meeting, Santa Fe, New Mexico, January, 1999.

Harding, L.W., Jr.: EPA/NASA CISNet Annual Meeting, Gulf Breeze, Florida – I attended this first meeting of the US CISNet projects with you and presented a talk on the NASA component of our Choptank River Index Site program, February, 1999.

Harding, L.W., Jr., and M.E. Mallonee: LMER TIES Annual Workshop, Solomons, Maryland – Presented a summary of our TIES findings in an hour seminar, covering both the aircraft and shipboard components of TIES that my group undertakes, March, 1999.

Magnuson, A., and L.W. Harding, Jr.: NASA SeaWiFS Case 2 Algorithms Working Group, Goddard Space Flight Center – Andrea and I presented a poster and held a discussion of comparisons we have been making with others on the working group, April, 1999.

Magnuson, A., and L.W. Harding, Jr.: NASA SeaWiFS Science Team Meeting, Monterey, California – Andrea and I attended and presented a poster at the SeaWiFS Science Team at MBARI, Monterey, California, May, 1999.

Harding, L.W., Jr.: NASA/NOAA Site Visit, NASA Headquarters, Washington, DC – Presented an hour seminar at NASA to my sponsors and some invited guests, describing our progress and plans in the aircraft remote sensing program, June, 1999.

Magnuson, A., and L.W. Harding, Jr.: NASA SeaWiFS Case 2 Algorithm Working Group, Goddard – Andrea and I presented the results of level 2 processing (atmospheric correction) using several prospective new methods, using Chesapeake Bay data as a “test case, July, 1999.

Harding, L.W., Jr., E.C. Itsweire, W.E. Esaias, and M. Scardi; “An aircraft observing system in Chesapeake Bay: Remote sensing of chlorophyll 1989-1999”; Estuarine Research

Federation, New Orleans, Louisiana, September, 1999 (Invited talk, chaired session for T.C. Malone).

2000 - Magnuson, A., L.W. Harding, Jr., and J. O'Reilly: NASA SIMBIOIS Science Team Meeting, Annapolis, Maryland – Andrea and I presented a talk describing our bio-optical measurements in Chesapeake Bay and use of these data in refining the operational SeaWiFS chlorophyll algorithm, OC4V4.

Magnuson, A., L.W. Harding, Jr.: NASA SeaWiFS Science Team Meeting, Durham, New Hampshire – Andrea and I attended and presented a poster at the SeaWiFS Science Team Meeting at the University of New Hampshire, May, 2000, describing chlorophyll imagery for Chesapeake Bay obtained with competing atmospheric correction approaches for Case 2 waters.

Harding, L.W., Jr.: ASLO Copenhagen, June, 2000 – I attended ASLO and presented an invited paper and co-chaired a session with Hans Paerl, Kaisa Kononen, and Katharine Richardson.

Harding, L., A. Magnuson, M. Mallonee, K. Cone, C. Jordan, J. Adolf, and D. Miller: National Academy of Sciences, Eutrophication Symposium, Washington, D.C., October, 2000 – My group presented a poster at the National Academy of Sciences Eutrophication Symposium describing seasonal and inter-annual variability of chlorophyll from aircraft remote sensing.

Harding, L.W., Jr.: National Sea Grant Program, Performance Appraisal Team (P.A.T.), Cambridge, Maryland, October, 2000 – I prepared the written portfolio, convened the session on Sea Grant-funded research at UMCES, and made a presentation on aircraft and satellite remote sensing in Chesapeake Bay to the P.A.T.

2001 – Adolf, J.E., A.R. Place, D.K. Stoecker, and L.W. Harding, Jr.: American Society of Limnology and Oceanography, Albuquerque, February, 2001 – Jason presented a talk on *Gyrodinium galatheanum* (Dinophyceae) in semi-continuous batch culture: physiological studies of a phagotrophic phototroph, and co-chaired a session with Gabriella Smalley.

Harding, L.W., Jr.: EPA EMAP Symposium, Pensacola Beach, Florida, April, 2001 – I presented an invited talk in the session chaired by Jim Yoder and Darryl Keith (URI, EPA Narragansett) on remote sensing of coastal waters.

Adolf, J.E., A.R. Place, D.K. Stoecker, and L.W. Harding, Jr.: talk at 9th East Coast Protozoology Conference, Smithfield, Rhode Island, June, 2001 – Jason presented a talk on Effects of inorganic nutrient and prey additions on nighttime metabolism of photosynthate in the mixotrophic dinoflagellate *Gyrodinium galatheanum*.

Magnuson, A. and L.W. Harding, Jr.: NASA Ocean Color Science Team in San Diego, May 2001 – Andrea presented a talk on our bio-optical and SeaWiFS to the annual ocean color meeting.

2002 – Harding, L.W., Jr.: CBP STAC Remote Sensing Workshop in Annapolis, January 2002 – co-convended the workshop with Jonathan Phinney and presented a talk on remote sensing work in Chesapeake Bay.

Harding, L.W., Jr.: Lab Seminar at HPL, February, 2002 – weekly seminar at HPL focusing on our primary productivity work combining aircraft remote sensing and models to generate time-series of productivity with high spatial and temporal resolution.

Adolf, J.E., A.R. Place, D.K. Stoecker, and L.W. Harding, Jr.: poster at Phytoplankton Productivity: an Appreciation of 50 Years of the Study of Oceans and Lakes. Bangor, Wales, UK, March 2002 – Jason presented his work on autotrophic and heterotrophic C metabolism during mixotrophic growth of the dinoflagellate *Gyrodinium galatheanum*: ¹⁴C tracer studies.

Harding, L.W., Jr.: presentation at Phytoplankton Productivity: an Appreciation of 50 Years of the Study of Oceans and Lakes. Bangor, Wales, UK, March 2002 –on the recovery of primary productivity from remote sensing and models based on current work in Chesapeake Bay.

Harding, L.W., Jr. and M. Scardi: International Conference on Informatics in Rome, Italy, August 2002 –presentation on the results of work with Michele Scardi on artificial neural network (ANN) models for estimating primary productivity in Chesapeake Bay (Scardi presented).

Adolf, J.E., A.R. Place, D.K. Stoecker, and L.W. Harding, Jr.: Xth International Conference on Harmful Algae, St. Petersburg Beach, Florida, October 2002 – poster on octadecapentaenoic acid (18:5n-3) abundance in the dinoflagellate *Karlodinium micrum*: effects of light, inorganic nutrient starvation, and mixotrophy.

Magnuson, A. and L.W. Harding, Jr.: Ocean Optics, Santa Fe, New Mexico, November 2002 - Andrea presented a poster on our bio-optical and SeaWiFS work.

2003 – Adolf, J.E., C.L. Jordan, W.D. Miller, A. Magnuson, M.E. Mallonee, and L.W. Harding, Jr.: Atlantic Coast Estuaries Indicators Consortium (ACE INC) Annual Meeting. Charleston, South Carolina, May 2003 – Phytoplankton floral composition from pigment reconstructions.

Miller, W.D. and L.W. Harding Jr. Atlantic Coast Estuaries Indicators Consortium (ACE INC) Annual Meeting. Charleston, South Carolina, May 2003 - Climate and phytoplankton dynamics.

Miller, W.D. and L.W. Harding, Jr.: Estuarine Research Federation, Seattle, Washington, September 2003 - Influence of synoptic-scale climate variability on Chesapeake Bay phytoplankton biomass.

Harding, L.W., Jr.: NOAA Coastal Services Center, Charleston, South Carolina, October 2003 – I presented a talk at the CSC symposium on aircraft remote sensing, describing our work on Chesapeake Bay.

Harding, L.W., Jr.: Tidal Monitoring Work Group, Chesapeake Bay Program, Laurel, Maryland, October, 2003 – I presented an update on our remote sensing work in Chesapeake Bay in the context of chlorophyll criteria attainment.

Harding, L.W., J.E. Adolf, W.D. Miller, and M.E. Mallonee: EPA ALL EaGLes meeting, University of California, Bodega Marine Laboratory, Bodega Bay, California, December, 2003 - I presented two talks at the all-EaGLes meeting (NASA session, main session), describing our phytoplankton indicators work in Chesapeake Bay as part of ACE INC.

Adolf, J.E., Mallonee, M.E., Miller, W.D., Hoover, M., Benjamin, J., and Harding, L.W. Jr. Phytoplankton indicators in two differentially impacted sub-estuaries of Chesapeake Bay. Poster, EPA ALL EaGLes meeting, University of California, Bodega Marine Laboratory, Bodega Bay, California, 3-6 Dec 2003.

Kimmel, D.G., W.D. Miller, M.R. Roman, and L.W. Harding Jr.: EPA ALL EaGLes meeting, University of California, Bodega Marine Laboratory, Bodega Bay, California, December 2003, Synoptic scale climatic forcing of plankton dynamics in Chesapeake Bay.

2004 - Harding, L.W., Jr., J.E. Adolf, W.D. Miller, and M.E. Mallonee: ASLO/TOS, Honolulu, Hawaii, February, 2004 – I presented our work on primary productivity modeling based on aircraft remote sensing and depth-integrated modeling in a session on developing tools for ecosystem managers.

Adolf, J.E., C.L. Jordan, W.D. Miller, M.E. Mallonee, and L.W. Harding, Jr.: ASLO/TOS, Honolulu, Hawaii, February, 2004 – Jason presented a poster on coincident forcing of floral composition, biomass, and primary productivity in the same session.

Harding, L.W., Jr., J.E. Adolf, W.D. Miller, and M.E. Mallonee. Predictions of phytoplankton biomass and primary productivity using data from *in-situ* and remote sensing observations in Chesapeake Bay, USA. ASLO/TOS, Honolulu, HI, February 2004.

Adolf, J.E., C.J. Jordan, M.E. Mallonee, W.D. Miller, and L.W. Harding, Jr. 2004. Phytoplankton floral composition and primary productivity in Chesapeake Bay. Poster, ASLO/TOS, Honolulu, HI. February 2004.

Kimmel, D.G., X. Zhang, M.R. Roman, W.C. Boicourt and others. 2004. Spatial and temporal variability of mesozooplankton biomass size spectra in Chesapeake Bay as measured by an optical plankton counter. Ocean Research Conference. American Society of Limnology and Oceanography/The Oceanography Society. Honolulu, HI, USA, February 2004.

Houde, E.D., W.C. Boicourt, L.W. Harding, M.R. Roman. 2004. Trophic Indicators of Ecosystem Health, ACE INC, Chesapeake Bay. ACE INC All Hands Meeting, Morehead City, NC, April 2004.

Jung, S., D.G. Kimmel, J. Adolf, E.D. Houde, M.R. Roman and L.W. Harding, Jr. 2004. Biomass size spectra: linking spectra across trophic levels as indicators of estuarine state. EPA STAR, EaGLEs, University of California, Bodega Marine Laboratory, Bodega Bay, CA. Poster presentation. April 2004.

Jung, S, D.G. Kimmel, J. Adolf, E.D. Houde, M.R. Roman, and L.W. Harding, Jr. 2004. Biomass size spectra as integrative trophic indicators in Chesapeake Bay. EPA STAR EaGLEs 2004 Annual Meeting. Duluth, MN. Poster presentation. September 2004.

Adolf, J.E. and L.W. Harding, Jr. Interpreting phytoplankton indicators against a backdrop of high spatial and temporal variability in Chesapeake Bay. EPA STAR EaGLEs meeting, Duluth, MN. September 2004.

Adolf, J.E., M.E. Mallonee, W.D. Miller, M. Hoover, and L.W. Harding, Jr. Integrating phytoplankton indicators: relationships between phytoplankton floral composition and size structure in Chesapeake Bay. All STAR EaGLEs meeting, Duluth, MN. September 2004.

Harding, L.W., Jr. Recent progress in aircraft and satellite remote sensing of Chesapeake Bay. UMCES Integration and Application Network Seminar, Annapolis, MD. October 2004.

Miller, W.D., L.W. Harding, Jr. and J.E. Adolf. The influence of Hurricane Isabel on Chesapeake Bay phytoplankton dynamics. Hurricane Isabel in Perspective Conference, Linthicum Heights, MD. November 2004.

Miller, W.D., D.G. Kimmel and L.W. Harding, Jr. 2005. Predicting spring discharge of the Susquehanna River from a synoptic climatology for the eastern United States. Estuarine Research Federation. Norfolk, VA, USA. October 2005.

Kimmel, D.G., W.D. Miller, R.J. Wood, L.W. Harding, Jr., and M.R. Roman. 2005. Regional scale climate forcing of Chesapeake Bay trophic dynamics. Estuarine Research Federation. Norfolk, VA, USA. October 2005.

Harding, L.W., Jr. Recent progress in using aircraft and satellite remote sensing to study phytoplankton dynamics in Chesapeake Bay and the mid-Atlantic bight. Horn Point Laboratory, Cambridge, MD. April 2005.

E. Professional Societies

American Association for the Advancement of Science

American Geophysical Union

American Society of Limnology and Oceanography

Phycological Society of America

Society of the Sigma Xi

The Oceanography Society

Estuarine Research Federation

F. Reviewer

Estuaries
Estuarine, Coastal and Shelf Science
Geophysical Research Letters
Journal of Phycology
Journal of Geophysical Research
Limnology and Oceanography
Marine Biology
Marine Ecology - Progress Series
Marine Biology Vienna
Science
U.S. Environmental Protection Agency
National Science Foundation
Hudson River Foundation
NASA
NOAA Sea Grant
NOAA Coastal Ocean Program

III. Teaching and Training

1972 - 1973 - Teaching Asst., Dept. of Oceanography, Humboldt State University: Biological Oceanography; Dynamics of Primary Production.

1976 - 1978 - Teaching Asst. & Lecturer, Hopkins Marine Station, Stanford University: Marine Biology; Biology of Plankton; Undergraduate Research in Marine Biology.

1979 - 1981 - Lecturer, Dept. of Biological Sciences, University of California, Santa Barbara: Photosynthesis and Primary Productivity in the Oceans; Physiology of Algae; Aquatic Biology Seminar; Instructor, Photosynthesis and Primary Productivity in the Oceans.

1991 - present - Full Member, Graduate Faculty, University of Maryland, College Park, Marine-Environmental-Estuarine Sciences (MEES) Program.

1993 - 2001 - Graduate Education Committee, HPL / UMCES (Chair 1 July 1995 - 30 June 1999).

1995 - 1999 - Member, Graduate Faculty Council, UMCES.

1994 - 1998, and 2000-present - Chair, Admissions Committee, Oceanography Area of Specialization (AOS), MEES Program.

1998 - 2004 - Co-Chair, Oceanography AOS, MEES Program.

A. University System of Maryland Courses Taught

1991 - 1998 -Coordinator, Univ. of Maryland/NASA Summer Undergraduate Fellowship Program in Remote Sensing of the Oceans.

1991 - 1998 -Selection Committee and Staff, NSF Research Experience for Undergraduates (REU) Program, Sea Grant and UMCES.

1993 - MEES 699, Phytoplankton Ecology Seminar, Spring Semester.

1994 - MEES 699, Readings in Bio-Optics and Phytoplankton Physiology, Spring Semester.

1997 - MEES 699, Phytoplankton Photosynthesis and Primary Production (with Kana), Fall Semester.

2004 – MEES 699, Physical-Biological Interactions (with Li and Roman), Fall Semester

B. Graduate Students Supervised as Major Advisor

1. Degrees Completed

Leonard, Carrie; Ph.D.; Oceanography; 1998; HPL / UMCES, MEES Program; “An Ecosystem Model of Iron Limitation in the Central Equatorial Pacific Ocean.”

Schieber, Brian; M.S.; Oceanography; 1998; MEES Program; “Ross Sea Variability and the Performance of Case I Ocean Color Algorithms.”

Adolf, Jason; Ph.D.; Oceanography; 2002; HPL / UMCES, MEES Program; “Photosynthesis and Carbon Metabolism in a Mixotrophic Dinoflagellate, *Karlodinium micrum*”

Jordan, Christy; Ph.D.; Oceanography, 2003; HPL/UMCES, MEES Program.

2. Students Currently Supervised

Miller, David; Ph.D.; Oceanography, HPL/UMCES, MEES Program (anticipated graduation, 2005).

3. Graduate Student Committee Memberships

Del Vecchio, Rossana; Ph.D.; Environmental Chemistry, University of Maryland, College Park, Dept. of Chemistry and Biochemistry, MEES Program (successfully defended dissertation, 5 April 2002).

Smalley, Gabriella; Ph.D.; Oceanography, HPL / UMCES, MEES Program (successfully defended dissertation 8 March 2002).

Connelly, Bill; Ph.D.; Fisheries, CBL / UMCES, UMCES, MEES Program

C. Research Internships Supervised

Weiss, Greg; Graduate, Arizona State University, Tempe, Arizona, Summer 1993, NASA Summer Fellowship Program in Remote Sensing of the Oceans.

Gennari, Scott; Junior, Senior, College of the Atlantic, Bar Harbor, Maine, Summer 1992, Winter 1993, NASA Summer Fellowship Program in Remote Sensing of the Oceans.

Graf, Nathan; Junior, Harvard University, Cambridge, Massachusetts, summer 1995, NASA Summer Fellowship Program in Remote Sensing of the Oceans.

Franck, Valerie; Graduate, University of California, Santa Barbara, California, Summer-Fall 1996, NASA Summer Fellowship Program in Remote Sensing of the Oceans.

Polyakov, Olga; Senior, University of Maryland, College Park, Fall-Spring 1997, NASA Summer Fellowship Program in Remote Sensing of the Oceans, and independent study.

Hoover, Miranda; Junior, Wittenberg University, Springfield, Ohio, Maryland Sea Grant Research Experience for Undergraduates program, Summer 2003 (advised by post-doc, Jason Adolf).

IV. Outreach and Service

- Member of the SeaWiFS Science Team for seven years - I have been involved in the primary productivity workgroup that operates under the auspices of SeaWiFS and the EOS MODIS project, and of the *ad hoc* workgroup on chlorophyll recoveries in coastal waters from SeaWiFS that is implementing changes to SeaWiFS data processing to improve accuracy of satellite retrievals. Our group is providing bio-optical and pigment data from Case II waters in revisions of operational SeaWiFS algorithms to improve recoveries at high chlorophyll concentrations where the validation data set is weak at present.
- Member of the SIMBIOS Science Team for three years – I am involved in SIMBIOS bio-optical measurements in Case II waters in collaboration with Andrea Magnuson. Our SeaWiFS Science Team participation has transitioned into SIMBIOS as we continue to be the main providers of estuarine/coastal data for calibration and validation of ocean color sensors.
- Member of the UMCES Faculty Senate - I served on the Senate for three years and have rotated off. I served as secretary for the Senate for two years. The main issues we addressed during the time I served pertained to post-tenure review of faculty and strategic planning. I served as the Rapporteur for a group considering a Synthesis Center (now IAN) during the first retreat, and as Discussion Leader of a group discussing status and new initiatives in graduate education in the second retreat.

- Member of MEES Program Committee - I am currently a member of the MEES Program Committee in accord with my role as Chair of the Oceanography Area of Specialization (AOS) in MEES. The Program Committee is the main policy-setting organ of the MEES Graduate Program.
- Chair, Admissions Committee of the Oceanography AOS of the MEES Program - This committee makes recommendations on candidates for admission to the program. I chaired the committee for approximately 6 years and stepped down in fall 1998. I took up this job again in fall 2000 and continue to serve in this role.
- Chair of the Oceanography AOS of the MEES Program (with Bill Boicourt as co-Chair) – I took on this job in fall 1998 and continue to serve in this role.
- Coordinator of the NASA Summer Fellowships in Remote Sensing of the Oceans - I've served in this role for 9 years. The program remains on hiatus.
- Member of the NSF REU Selection Committee at Maryland Sea Grant - I've served in this role since 1991 and also have participated in orientation activities with the students
- Chair, member HPL / UMCES Graduate Education Committee – I chaired this committee from 1995 through 1999. During my service, we revamped the programs administered by the Education Committee and initiated a number of new ones. I stepped down as Chair in July, 1999, served as acting Chair in spring – summer 2000 during Paul del Giorgio's sabbatical, and served as a member of the committee until July, 2001.
- Member, UMCES Graduate Faculty Council – I have been a member of this body since its formation (now past)
- Participant, Chesapeake Futures - I serve on the Innovative Technologies Committee of Chesapeake Futures, a group addressing the use of new technologies for clean up and monitoring.
- Participant, Coastal Observing System workshop - I participated in this workshop sponsored by several federal agencies and chaired by Tom Malone in Solomons, Maryland, May, 1999.
- Member, Steering Committee Adriatic Observing System workshop - I am one of four US members of this committee and participated in a multinational workshop in Rovinj, Croatia, in October, 1999.
- Participant and Session Chair, STAC Workshop on Trophic Change - I led the discussion at the STAC workshop in Solomons, Maryland last summer that considered the role of meteorological forcing in eliciting recent patterns observed in water quality data on the Bay. I later reported on the conclusions of the workgroup to the Implementation Committee of the Chesapeake Bay Program in Annapolis, Maryland. Note STAC is the Scientific and Technical Advisory Committee of the EPA Chesapeake Bay Program.

- Member, Steering Committee, National Research Council Committee on Commercialization of Space-Based Remote Sensing in Earth Sciences – Appointed in Fall, 1999, three-year term.
- Participant, NASA Regional Application Center Meeting, October, 1999, Chesapeake College, Easton, Maryland.
- Organizer and participant, STAC Workshop on Remote Sensing – I co-led this workshop with Jonathan Phinney of ASLO in January, 2002, in Annapolis, Maryland, focusing on facilitating increased use of remotely sensed and in-situ observations for management of Bay resources and for assessing changes in water quality and land-use/land-cover.
- HPL representative, MEES Graduate Colloquium committee (held at Chesapeake Biological Laboratory (CBL), September, 2002.
- Member, Facilities Committee, HPL / UMCES, July, 2002 – June, 2003.
- Member, Library Committee, HPL / UMCES, July, 2002 – June, 2003.
- Member, EPA/CPB chlorophyll/nutrient criteria subcommittee, July, 2001 – present.
- Reviewer, *Marine Ecology Progress Series* – January, 2002 – present; serving as reviewer to evolve into regional editor.
- Coordinator, MDSG Seminar Series, September, 2002 – present.