Notarization: I have read the following and certify that this Curriculum Vitae is a current and accurate statement of my professional record

Signature

3/2/15
Date

CURRICULUM VITAE

NAME: Allen R. Place

PRESENT ADDRESS: Institute for Marine and Environmental Technology, University of Maryland Center of Environmental Science, Columbus Center, Suite 236, 701 East Pratt Street, Baltimore, Maryland 21202. 1-410-234-8828

PRESENT OCCUPATION: Professor (Since 2001 with tenure)

PAST OCCUPATIONS:

Professor (**2001-2010**)
Center of Marine Biotechnology,
University of Maryland Biotechnology Institute,
Columbus Center, Suite 236,
701 East Pratt Street, Baltimore, Maryland 21202.

Associate Professor (**1987-1989**; With tenure **1989-2001**)
Center of Marine Biotechnology,
University of Maryland Biotechnology Institute,
Columbus Center, Suite 236,
701 East Pratt Street, Baltimore, Maryland 21202.

Assistant Professor of Biology **(1980-1987)**
Department of Biology, Leidy Laboratories/G5,
University of Pennsylvania,
Philadelphia, Pennsylvania, 19104

Acting Director, Information Resource Group,
University of Maryland Biotechnology Institute
(1991-1993)

Adjunct Associate Professor
Center for Environmental and Estuarine Studies
Horn Point Environmental Laboratory

Cambridge, MD 21613 **(1994-1997)**

Affiliate Associate Professor
Department of Poultry Science
University of Maryland at College Park
College Park, MD **(1993-1995)**

DATE AND PLACE OF BIRTH: May 24, 1951, Norwalk, Connecticut

CITIZENSHIP: U.S.

MARITAL STATUS: Married, June 23, 1973; three children

EDUCATION:

Undergraduate: The Johns Hopkins University,
Baltimore, Maryland. B.A.,
Earth and Planetary Sciences,
January, 1973.

Graduate: The Johns Hopkins University,
Baltimore, Maryland. Ph.D.,
Biochemistry,
June, 1979.

Postdoctoral: The Johns Hopkins University,
Baltimore, Maryland,
Molecular Biology,
July, 1980.

HONORS:

B.A. with General Honors
NIH Predoctoral Fellow
UMBI Regent's Award Candidate for Research/Scholarship/Creative Activity -2005, 2008
UMBI Regent's Award Winner for Public Service - 2009
National Research Council Fellow, Summer 2010
UMCES President's Award for Excellence in Application of Science 2012

PROFESSIONAL SOCIETIES:

World Aquaculture Society
Phycological Society of America

AWARDS AND GRANTS:

(Sole PI unless indicated otherwise)
NSF Student Originated Studies Grant ($17,000) 1972.

NIH Biomedical Grant (Competitive) ($10,000)
1980-1981.

Cancer Center Institutional Research Grant

(Competitive) ($10,000) 1980-1981.

National Science Foundation Biochemistry Program PCM-8110819) ($165,000) 1981-1984.

University of Pennsylvania Research Foundation (Competitive) ($8,700) 1982-1983.

NIH Biomedical Grant (Competitive) ($17,000) 1982-1983.

NIH BRSG Equipment Grant (Co-PI) Protein Sequencing Facility ($229,000) 1984. (Co-PI with Ruth Angelliti-Hogue)

NIH Biomedical Grant (Competitive) ($13,000) 1984-1985.

NATO Collaboration Grant with H. Gutfreund and J.F. Eccleston ($3500) 1985-1988.

IBM AEP Threshold Award ($100,000, computer hardware) 1985-1986.

University of Pennsylvania Computer Grant ($18,000) 1985-1986.

Markey Fellowship for work at Mount Desert Island Biological Laboratory ($6000) 1986.

National Science Foundation Regulatory Biology Program, Wax Ester Digestion in Birds ($120,000) 1987-1990.

University of Maryland Project Fulcrum ($24,835.00 computer hardware). 1988.

Project BIOQUEST (Annenberg/Corporation for Public Broadcasting Project ($40,945). 1988-1990.

University of Maryland Apple MacIntosh Academic Tool Development Program ($20,000, computer hardware). 1988.

National Science Foundation Research Experiences for Undergraduates, Regulatory Biology Program ($4132.00). 1988.

Maryland Sea Grant Starter Fund ($5000.00)

National Science Foundation Research Experiences for Undergraduates, Regulatory Biology Program ($2500.00). 1989.

IBM, "A student biochemist learning station: a component of an intergrated, bioscience learning environment. ($312,000.00) 1990-1993.

National Aquarium in Baltimore, "Enivronmental Sex Determination in Diamond Back Terrapins." ($9500.00) 1991-1992.

Office of Naval Research, Protocols for Archaeal Research, ($5000) 1993-1993.
Co-PI with E. M. Fleischmann, H. J. Schreier, F. Robb, & K. R. Sowers

Entotech, Inc. A Novo Nordisk Company, Protocols for Archaeal Research, ($5000) 1993-1993.
Co-PI with E. M. Fleischmann, H. J. Schreier, F. Robb, & K. R. Sowers

US Biologicals, Protocols for Archaeal Research, ($5000) 1993.
Co-PI with E. M. Fleischmann, H. J. Schreier, F. Robb, & K. R. Sowers

CEM Corporation, Equipment Donation, "Microwave Protein Hydrolysis System, 1992, $8000.00

Cambridge Scientific Abstracts, Subscription Donation, Aquatic Sciences and Fisheries Abstracts (ASFA), CD-ROM, 1978-present, 1992, ($10,000.00)
Co-PI with R. Colwell.

EDUCOM Distinquished Natural Sciences Curriculum Innovation Award (Biology), 1992, ($1000.00)

New England BioLabs, Protocols for Archaeal Research, ($5000.00) 1992-1993.
Co-PI with E. M. Fleischmann, H. J. Schreier, F. Robb, & K. R. Sowers

Maryland Sea Grant, "Treasures of the Chesapeake", ($5290.00) 1992-1993. **Co-PI** with S. Fuqua.

National Aquarium in Baltimore, "Where Do Female Diamond-back terrapins Hatch." ($8,500) 1992-1993.

City Life Museum, "Heroes like you."
($1,750) 1992-1993.

Maryland Agricultural Experiment Station's
Competitve Grants, "Digestive Physiology in
Turkeys and Chickens." ($22,000.00) 1993-1994.

NIH BRSG Small Equipment Grant Molecular Graphics
Facility ($6329) 1993.

Maryland Sea Grant, "Treasures of the Chesapeake",
($1500.00) 1993-1994. **Co-PI** with S. Fuqua.

Marizyme, Inc. "Thermostabile Lipases",($27,600.00),
1993-1994.

Genecor, Protocols for Archaeal Research, ($2500.00)
1993-1994.
Co-PI with E. M. Fleischmann, H. J. Schreier, F. Robb,
& K. R. Sowers

Martek, Inc. "The Search for Prion-like Genes in Fish"
($6,854) 1993-1994.

Perkin-Elmer Corp. Equipment Donation,
Model 373A-01 Automated DNA Sequencer, $135,000,
1994. **(Reporting and receiving authority)**

Beckman Instruments, Inc. Equipment Donation,
LF 3400UT Protein Sequence and P/ACE Method
Development Package $165,000, 1994.
(Reporting and receiving authority)

Molecular Dynamics, Inc., Equipment Donation,
Fluorimager 575, $75,000, 1994.
(Reporting and receiving authority)

Shimaduz Scientific Instruments, Inc., Equipment
Donation, MALD I time of flight mass spectrometer,
$95,000. 1994
(Reporting and receiving authority)

W.M. Keck Foundation, "Establishment of a Molecular
Imaging Facility" PI M. Fletcher , **Co-PI** ($124,315),
1994-1996 **(Reporting and purchasing authority)**

Maryland Agricultural Experiment Station's
Competitve Grants, "Improving Seed Production and

Quality in Striped Bass Aquaculture: Vitellogenin-Mediated Transport" ($14,500.00) 1994-1995.

Maryland Agricultural Experiment Station's Competitve Grants, "Improving Seed Production and Quality in Striped Bass Aquaculture: Vitellogenin-Mediated Transport II" ($15,000.00) 1995-1996.

Northeastern Regional Aquaculture Center, "Dietary Modulation of Food Conversion Efficiency in Farmed Hybrid Striped Bass." ($65,000.00) 1995-1996.

National Committee for Biotechnology, Department of Commerce, U.S. Israel Science and Technology Committee, Subcontract, AquaPharm, Inc.($152,000.00) 1995-1999. (Funding rescinded by Company later reinstated by AquaFuture and Martek)

Maryland Agricultural Experiment Station's Competitive Grants, "Digestion and Absorption of Dietary Phospholipids by Striped Bass" ($14,000.00). 1996-1997. **Co-PI** S. Ozkizilcik.

Maryland Industrial Partnerships "Development of a liposome-based enrichment for fish and shrimp hatcheries " ($68,156) 1996-1997.

Northeastern Regional Aquaculture Center, "Development of a microparticulate diet for striped bass larvae." ($73,500.00) 1996-1997.
Co-PI S. Ozkizilcik.

National Science Foundation, Integrative Biology and Neuroscience Program, Functional and Physiological Ecology "The Biochemical Basis and Ecological Significance of Chitin Digestion in Seabirds and Passerines". ($243,220.00). 1997-2001. (In one year no cost extension).

National Science Foundation, Integrative Biology and Neuroscience Program, Functional and Physiological Ecology Research Opportunities for Undergraduates ($5,369). 1997.

National Science Foundation, Integrative Biology and Neuroscience Program, Functional and Physiological Ecology Research Opportunities for Undergraduates ($5,369). 1998.

USDA Cooperative Agreement, *Pfieisteria piscicida:* Molecular characterization of elicitors of toxigenicity ($15,400.00) 10/1/97-9/30/98.

ECOHAB, " Molecular approaches to *Pfiesteria*-complex dinoflagellates in Chesapeake Bay 9/1/98-8/30/03, $2,731,514 **($128,734 per year for PI Place Project, "**Molecular characterization of elicitors of toxigenicity"), P.I. Y. Zohar, **Co-PI's** with G. Vasta, B. Belas.

NIEHS. Subproposal "The molecular and cellular control of toxigenicity" in Program Project "*Pfiesteria*: impact on human health and the environment.", (Dr.Glenn Morris, Jr., MD, MPH&TM, UMAB, and Dr. Yonathan Zohar, PhD, project coordinators). 1998-2003. $914,632. **($74,925 per year for Place Project**), **Co-PI** with B. Belas.

Maryland Department of the Environment, "Request for Funds to Improve a Core Facility for the Culture and Molecular Identification of Toxic Marine Algae." PI Y. Zohar, **Co-PI** with G. Vasta, & B. Belas. $294,137, 1998-1999
(Reporting and purchasing authority)

Hewlett-Packard Instruments (now Agilent Technologies, Inc), Equipment Donation, Model 6850 Gas Chromatogram with Chemstation, $35,000, 1998. For SciTech Teaching Training
(Reporting and receiving authority)

Maryland Industrial Partnerships " High Density Culture of Fingerlings in Recirculating Aquaculture Systems " ($110, 222). 1998-2000

National Science Foundation, Integrative Biology and Neuroscience Program, Functional and Physiological Ecology Research Opportunities for Undergraduates ($5,369). 1999.

Martek BioSciences, Inc. "Use Of Heterotrophic Algae in The Culture Of Marine Fish Larvae", $11,239, 4/1/02 - 3/30/02

BARD "Development of a Nutrient Delivery system to Enhance Growth and Survival of Post-larvae Abalone (*Haliotis spp*.) 8/1/00-7/31/01, $100,000, Co-PI. with M. Shpigel.

Maryland Sea Grant Development Funds "A Retrospective Analysis of Harmful Algal Impacts on Aquaculture Operations in the Chesapeake Bay." 9/1/01-12/31/02, $5,000,
Co-PI Daniel Terlizzi

Maryland Sea Grant Development Funds "Functional Gene Marker Polymorphisms of the Polyenoic Fatty Acid Desaturases in the *Morone*."
12/1/01-11/31/02, $10,000

Phillips Seafood, Corp. "DNA microsatellite Tags of Blue Crabs" 8/1/01-01/03, $49,500.

NIEHS Supplement "The molecular and cellular control of toxigenicity" in Program Project "Pfiesteria: impact on human health and the environment.", (Dr.Glenn Morris, Jr., MD, MPH&TM, UMAB, and Dr. Yonathan Zohar, PhD, project coordinators). 2003. $40, 000. **($74,925 per year for Place Project**).

NOAA Award #NA17FU2841 (Y. Zohar, PI; A. Place, J. Trant, coPIs) Blue Crab Advanced Research Consortium Project:"The Blue Crab, *Callinectes sapidus*: An Integrated Research Program of Basic Biology, Hatchery Technologies And The Potential For Replenishing Stocks". 3/1/02-11/30/03$1,425,000 ($500,000 to COMB). **NOAA's Chesapeake Bay Fisheries Research Program, Blue Crab Advanced Research Consortium (BCARC)** 18 months $140, 508; 12 months $187,000.

NOAA, Living Marine Resource Cooperative Research Center, Summer Intern Support. $10,000, 2002

NOAA, Living Marine Resource Cooperative Research Center, Summer Salary Support. $8,350, 2002

NOAA, Living Marine Resource Cooperative Research Center, Graduate Student Support. $30,000, 2002, 2003

Northeastern Regional Aquaculture Center,
"Development Broodstock Diets for Atlantic Halibut" Total: $61, 417 ($19,338.00) 2003-2005. **PI:** N. Brown

Department of Health and Human Services, Center for Disease Control and Prevention, "Research on Harmful Algal Blooms in Maryland." PI. Dr. Diane Matuszak;

Subcontract; "The Effect of Chesapeake Bay Algal Toxins on Human Activity," $475, 519; 9/1/03- 8/31/31/06

Perdue Farms, "Monitoring Odor Removal during Microbial Modification of Chicken Litter," 9/1/03-8/31/04, $63,688. Co-PI R. T. Hill

Maryland Industrial Partnerships "Monitoring Odor Removal during Microbial Modification of Chicken Litter." ($100, 000). Feb. 1 2004 – Jan. 31, 2005.

U. S. Egg and Poultry Association "Monitoring Odor Removal during Microbial Modification of Chicken Litter." $43, 539. 4/1/04-3/31/05**.**

ECOHAB 2004, "Causes and consequences of variable toxicity in *Karlodinium micrum*." Jan. 28, 2003, Co-PIs, J. Adolf, T. Bachvoraff 9/30/04-08/31/07, $455, 419.

UMBI/BARD "Reduction in fish meal and fish oil dependency in feeds for Gilthead Seabream & Hybrid Striped Bass and their effect on product quality and consumer heath and acceptance." 8/1/04-7/31/07, $288, 000**, PI George Kissel, Co-PI A. R. Place**

NOAA, Living Marine Resource Cooperative Research Center, Harmful Algal Roadblocks to Oyster Restoration – *Prorocentrum mininum* and *Karlodinium micrum* Bay Blooms**.** $71, 880 ($29, 723) 2004- 2006. Co-PI G. Ozbay, DSU

NOAA, Living Marine Resource Cooperative Research Center, *Hematodinium perezei:* development of detection assays, prevalence, and effect on crab species structure, $64, 000 ($31,235) 2004- 2006. Co-PI R. Jagus.

DHMH Proposal Request "Development of a Multi-Algal Toxin Screen Using LC/MS" Total: $34,838.10; 2005

Department of Health and Human Services, Center for Disease Control and Prevention, "Research on Harmful Algal Blooms in Maryland." PI. Dr. Diane Matuszak; Subcontract; "The Effect of Chesapeake Bay Algal Toxins on Human Activity," $197,871; 9/1/06- 8/31/31/07

NOAA Award #NA17FU2841 (Y. Zohar, PI; A. Place, J. Trant, coPIs) Blue Crab Advanced Research Consortium Project:"The Blue Crab, *Callinectes sapidus*:

An Integrated Research Program of Basic Biology, Hatchery Technologies And The Potential For Replenishing Stocks". **NOAA's Chesapeake Bay Fisheries Research Program, Blue Crab Advanced Research Consortium (BCARC)** 35 months $325, 968; 12/1/04-11/30/07.

Department of Natural Resources, Maryland "Efficient Assessment of Chesapeake Bay HABS with Rapid Toxin Screening" 4/1/07-5/31/09, $ 64,580.00

National Science Foundation, Microbial Genome Sequencing *"Dinoflagellate full-Lenght cDNA Sequencing"* **Total Proposed Cost/Budget Period:** $989,036 ($112,478) 10/01/06 – 2/28/09 (PI Senjie Lin).

NOAA, Maryland SeaGrant, "Does cryptophyte abundance drive mixotrophic harmful algal blooms? K. micrum as a model system". $138,264, 2/1/07-1/31/09. (PI. A. R. Place and J. E Adolf).

Department of Natural Resources, Maryland "Molecular Monitoring of Chesapeake Bay HABS" 4/1/07-5/31/09, $ 80,580.00 (Co-PI Holly Bowers)

Northeastern Regional Aquaculture Center (NRAC), "Development Broodstock Diets for Atlantic Halibut" Total: $31, 380 ($5,146.00) 2007-2008. **PI:** N. Brown.

An Integrated Research Program of Basic Biology, Hatchery Technologies And The Potential For Replenishing Stocks". **NOAA's Chesapeake Bay Fisheries Research Program, Blue Crab Advanced Research Consortium (BCARC)** 12 months $216, 654; 12/1/06-11/30/07.

Algenol Biofuels, Inc. " 6X Sequencing coverage of 6 plasmids. $60, 000, 4/1/07 – 5/1/07. Contract

Maryland Seagrant Development Funds, "Feasibility study: Miniature, portable mass spectrometer for on site, rapid identification of toxins generated by Harmful Algal Blooms (HABs). Co-PI Timothy Cornish and Miquel D. Antoine, Johns Hopkins University/Applied Physics Laboratory, $7500, 9/1/07-8/31/08.

Maryland Seagrant Development Funds, "The Storage Effect, Biodiversity, and Recruitment Pathways for Chesapeake Striped

Bass." Co-PI Tom Miller and Dave Secor, UMEES, Chesapeake Biological Laboratory, $15, 000, 11/1/07-10/31/08.

NOAA-NMAI "Farming cobia in fully contained, environmentally sustainable recirculating marine aquaculture: Evaluation of concept, performance and economic feasibility." (PI: Y. Zohar; co-PIs: A. Place, H. Schreier, K. Sowers, Y. Tal, UMBI-COMB; S. Summerfelt, CFFI; D. Lipton, MDSG; F. Barrows, US-FWS). 2008-2011; $400,000.

Maryland Seagrant, "The Storage Effect, Biodiversity, and Recruitment Pathways for Chesapeake Striped Bass." PI Tom Miller Co-PI Dave Secor, UMEES, Chesapeake Biological Laboratory, $183,297 ($72,779) (2/1/09-1/31/11).

Department of Natural Resources, Maryland "Molecular Monitoring of Chesapeake Bay HABS" 4/1/09-3/31/10, $ 30,000.00 (Co-PI Holly Bowers).

NIST, Chemical Science and Technology Laboratory: "The Impact of Nanoparticles on Estuarine Foodwebs - Removal or Bioconcentration?" 1/1/10-12/31/11. Total costs $54,778. 0% commitment.

NASA, "Pilot Application of the Chesapeake Bay Forecast System" Maryland Department of Natural Resources subcontract. $49, 236 ($10,000). 4/15/2009-6/30/2010.

NOAA, Living Marine Resource Cooperative Research Center, The use of DNA markers to evaluate US fishery management areas and effective population size of monkfish, *Lophius americanus* $23,800 ($7,517) 2010- 2011. PI A. Johnson 0% commitment

NOAA PCM 2010, "Mitigating *Microcystis* in the Chesapeake Bay" A.R. Place PI $870, 000 ($604,996**)** 9/1/2010-8/31/2013. 8% commitment.

JMH Foundation 2010, "Determine the optimal most cost effective extraction method of algal lipids for biodiesel production." A.R. Place $40,000 7/1/2010-6/30/2011.

NOAA, Chesapeake Bay Office, *"Metagenomic analysis of microalgae in the Chesapeake Bay". $99,900; 9/1/2010-8/31/2012*

NSF, Directorate for Biological Sciences Division of Biological Infrastructure, "*MRI: Acquisition of a high-resolution mass spectrometer system for research and education"* $645, 369. 9/1/2010- 8/31/2013.

Maryland Seagrant, "The Storage Effect, Biodiversity, and Recruitment Pathways for Chesapeake Striped Bass." PI Tom Miller Co-PI Dave Secor, UMEES, Chesapeake Biological Laboratory, $7, 500 (2/1/11-1/31/12).

NOAA, Living Marine Resource Cooperative Research Center, Taurine – the missing ingredient for development of fish free diets for aquaculture? $41, 156 ($26, 028) 2010- 2011. PI A. Place Co-PI:Thomas E. Rippen , UMES 0% commitment

NIH RO-1/RFA-ES-11-005-NIEHS Program - Combining bioavailability assays with modeling to predict PCBs in fish after remediation. PI Upal Ghosh, UMBC 09/22/2011-8/30/2013 $225, 750 8% commitment.

NOAA, ECOHAB: Ecology and Oceanography of Harmful Algal Blooms Mid-Atlantic Region 2012, NOAA-NOS-NCCOS-2012-2002987 - Integrating Cell and Toxin Cycles of *Karlodinium veneficum* with Key Environmental Regulators: In Situ Studies of Predictive Determinants for Bloom Toxicity $234, 094 9/1/13-8/31/16 0% commitment.

NSF, NIEHS: Oceans, Great Lakes and Human Health RO1, Title: "Translation regulation by eIF2α phosphorylation in toxic dinoflagellates" **PI: R. Jagus** Proposed Start Date: 9/1/2012; Proposed End Date: 8/31/2017 Total R01 Budget: $2,117,691; Research Project Budget: Direct Costs: $504, 755; Indirect Costs: $254, 901; Total: $759, 656. 8% commitment.

NOAA, Living Marine Resource Cooperative Research Center, "Evaluating the effects of prey quality on tissue lipids, taurine and growth in juvenile Chinook salmon (*Onchorynchus tshawytscha*) with a controlled feeding study*"* $54, 596 ($20, 287) 2012- 2013. PI J. Miller, OSU, Co-PI: A. Place , UMES 0% commitment

NOAA, Living Marine Resource Cooperative Research Center, Trophic Ecology of Forage Fishes: Linking Primary Productivity to Fisheries Production $125, 000 ($40,000) 2012- 2013. PI A. Place Co-PI:Dr. David Secor UMES 0% commitment

NOAA, Living Marine Resource Cooperative Research Center, "Diet and feeding of menhaden using DNA barcoding*"* PI A. Hannif, $43,628 2014- 2015. Co PI, B. Stevens , UMES 0% commitment

Maryland Industrial Partnerships "Plant Based Aquafeed with Low-Leaching Taurine ($100,). 2015-2016

PENDING GRANTS:

NOAA, CSI Coastal and Ocean Climate Applications (COCA) program, Supporting Resilient Coastal Communities and Ecosystems in a Changing Climate: Understanding Climate-Related Human Health Risks within the Coastal Environment. "*Adapting to Changing Climate: Tools, products and training to improve public and ecological health outcomes in respon*se to harmful algal blooms. *$300,000 8/1/15 7/31/17*

NOAA, ECOHAB: Ecology and Oceanography of Harmful Algal Blooms Mid-Atlantic Region 2014, NOAA-NOS-NCCOS-2012-2002987 - Integrating Cell and Toxin Cycles of *Karlodinium veneficum* with Key Environmental Regulators: In Situ Studies of Predictive Determinants for Bloom Toxicity $385, 094 9/1/15-8/31/17 0.2% commitment.

NSF, IOS Physiological Mechanisms and Biomechanics 2015 IOS Preliminary Proposal: Biological Sunscreens as Ultraviolet Optical Filters in Mantis Shrimp - Function, Distribution, and Molecular Origin 09/1/2015

PUBLICATIONS:

Doctoral Dissertation: Place, A.R. (1979). The Lactate Dehydrogenase Allozymes of *Fundulus heteroclitus* (Lin.) A Study in Molecular Evolution.

ABSTRACTS:

1. **Place, A. R**. (1972). Nutrition and Systematics of Chesapeake Bay Plankters. In: Student-Originated Studies Projects Abstract Reports (Berton F. Hill, editor), NSF pp. 123-125.
2. **Place, A. R.** (1977). Liver LDH Allozymes of *Fundulus heteroclitus*: A Selective Adaptation or Genetic Drift? *Fed. Proc.* **36**, 738.
3. Powers, D. A., Greaney, G. S., and **Place, A. R.** (1978). A Physiological Correlate of Allelic Selection: Lactate Dehydrogenase Genotype and Hemoglobin Function in *Fundulus heteroclitus. Fed. Proc.* **37,** 1609.
4. **Place, A. R.,** Powers, D. A. and Sofer, W. (1979). Structural Basis of an Alcohol Dehydrogenase Null Mutant from *Drosophila melanogaster. Fed. Proc.* **38,** 497.
5. **Place, A. R.,** Powers, D. A., and Sofer, W. (1980). *Drosophila melanogaster* Alcohol Dehydrogenase Does Not Require Metals for Catalysis. *Fed. Proc.* **39,** 1640.
6. **Place, A. R.** (1985). *Drosophila* Alcohol Dehydrogenase: A Case for Convergent Evolution of A Common Active Site. *Fed. Proc.* **44,** 1060.
7. Roby, D. D., **Place, A. R.** and R.E. Ricklefs. (1985). Assimilation of Dietary Wax Esters in Seabirds. *Fed. Proc.* **44,** 1762.
8. Hollocher, H. and **Place, A. R.** (1985). Intra-Allelic Complementation of *Drosophila* Alcohol Dehydrogenase Null Mutants. *Fed. Proc.* **44,** 1078.
9. Schmidt, T. G. and **Place, A. R.** (1985). "Dr. Sanger's Apprentice"- A Computer-Aided Instruction to Protein Sequencing.*Fed. Proc.* **44,** 1925.
10. Crawford, D.L., **Place, A. R.,** Cashon, R. and Powers, D. A. (1985). Thermal Accimilation or Differential Regulation? *American Zoologist* **25**, 122A.

11. **Place, A. R.,** Stoyan, N. and Ricklefs, R. (1986). Transient Steatorrhea May Be Responsible for Pre-Fledging Weight Loss in Chicks of Leach's Storm-Petrel, *Ocenaodroma leucorhoa.* Bull. M.D.I.B.L. **26,** 70-73.
12. **Place, A. R.,** Stoyan, N. and Ricklefs, R. (1986). The Physiological Basis of Stomach Oil Formation in Leach's Storm-Petrel, *Oceanodroma leucorhoa.* Bull. M.D.I.B.L. **26,** 73-76.
13. **Place, A. R.,** and Butler, R. G. (1986). The Importance of Bile Salts to Wax Ester Assimilation in Leach's Storm-Petrel, *Oceanodroma leucorhoa.* Bull. M.D.I.B.L. **26,** 79-83.
14. **Place, A. R.,** and Eccleston, J. (1987). Pre-Steady State Transients in the Drosophila Alcohol Dehydrogenase Catalyzed Reaction: Isotope Effects and Stereospecificity. *Fed. Proc.* **46**,1475.
15. **Place, A. R.,** and Brown, S. (1987). Solubization and Localization of Cetyl Oleate in Egg Phosphatidylcholine vesciles. *Fed. Proc* **46**,475.
16. Schmidt, T. G. and **Place, A. R.** (1987). "Dr. Sumner 's Apprentice"- A Computer-Aided Instruction to Protein Purification and Characterization. *Fed. Proc* **46**,375.
17. **Place, A. R.** (1987). The Problem of Cerophagy - Thirty Years Later *AOU*
18. Goulden, C. E. and **Place, A. R.** (1987). Low Fatty Acid Synthesis Rates in *Daphnia.* **In Symposium** on "The Role of Lipids in the Transport, Fate and Effects of Contaminants in Aquatic Environments.
19. **Place, A. R.** (1988). Problem-Posing, Problem-Solving, and Persuasion in Biology Education. In IBM Conference on Academic Computing, Princeton University and The University of Pennsylvania. pp 65-66.
20. Rosenzweig, R. F., **Place, A. R.** and Burton, R.S. (1988). Overexpression of glycolytic enzymes influences patterns of carbon utilization, growth, and sporulation in the yeast, *Saccharomyces cerevisiae.* XVI International Congress of Genetics, , Toronto, Canada.
21. **Place, A. R.** and Burton, R. S. (1988). Allozyme Variation and the Physiological Phenotype: The Importance of Branchpoints, Intermediates and End Products. Workshop entitled, " Evolution, enzyme variation and metabolic control analysis", moderated by H. Kacser. XVI International Congress of Genetics, , Toronto, Canada.
22. **Place, A. R.** (1988). Poor and slow assimilation are not prequisties for wax digestion. Centennial Meeting of the Wilson Ornithological Society, Rosemont, Pennsylvania.
23. **Place, A. R.** (1988). The Biochemist's Workshop: Learning the Tools of Modern Biology through Apprenticeship. Association of Midwestern College Biology Teachers Meeting, Beloit, Wisconsin.
24. **Place, A. R.** and Schmidt, T.G. (1988). The Molecular Biologist's Workshop: Learning the Tools of Molecular Biology Through Apprenticeship. National Association of Biology Teachers (NABT) 1988 Convention, Chicago, Illinois.
25. **Place, A. R.** (1988). Adaptive Aspects of Wax Ester Assimilation in Birds and Marine Mammals. Second International Congress of Comparative Physiology and Biochemistry, Baton Rouge, Louisiana.
26. Peterson, N. and **Place, A. R.** (1988). BioQUEST: A Two-Year Curricullum Project Employing Quality Undergraduate Educational Simulation and Tools in Biology. EDUCOM workshop. Washington, D.C.
27. **Place, A. R.** (1990). Chitin Digestion in Nestling Leach's Storm Petrels, *Oceanodroma leucorhoa.* Bull. M.D.I.B.L. **29,** 139-142.
28. P. R. Sievert, R. Butler and **Place, A. R.** (1990). Total Body Water And Its Turnover in Normal And Salt-Loaded Nestling Leach's Storm Petrels, *Oceanodroma leucorhoa.* Bull. M.D.I.B.L. **29,** 143-146.
29. Robb, F. R., **Place, A. R.** and R. Hill (1990). Unusual Bacteria Flora in Leach's Storm Petrel, *Oceanodroma leucorhoa*. Bull. M.D.I.B.L. **29,** 147-148.

30. **Place, A. R.** (1990). BioQUEST: Problem-Posing, Problem-Solving, and Persuasion in Biology Education. Proceedings of the First Annual Educational and Research Conference, American Medical Informatics Association pages 78-79.
31. **Place, A. R.** (1990). Stomach Oils XX International Ornithological Congress.
32. **Place, A. R.**, Duke, G., Jackson, S. and Roby, D. (1990). The Problem of Cerophagy - Revisited. XX International Ornithological Congress.
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International Symposium on The Biology of Vertebrate Sex Determination Kona, Hawaii. **(Oral Presentation)**

115. **Place, A. R.,** Steven, C., and Feng, X. (2003). Blue crab (*Callinectes sapidus*) genetic structure and diversity. June 2003 Annual Summer Meeting of The Crustacean Society. **(Oral Presentation)**

116. Deeds, J. R., Kao, J. P. Y., and **Place, A. R.** (2003). Bioactive Properties of KmTx2: a Novel Lipid-Soluble Toxin from the Dinoflagellate *Karlodinium micrum.* September, Marine Biotechnology Conference 2003, Chiba, Japan **(Oral Presentation)**

117. Jiang, Q. Moe, C. M., and **Place, A. R.** (2003). Chitin Degration in the Marine Environment: The Vertebrate Side of The Story Part II September, Marine Biotechnology Conference 2003, Chiba, Japan **(Oral Presentation)**

118. **Place, A. R.,** and Harel, M. (2003). Use of Heterotrophic Algae in Enhancing the Nutritional Value of Aquaculture Feeds. September, Marine Biotechnology Conference 2003, Chiba, Japan **(Oral Presentation)**

119. **Place, A. R.,** Feng, X., Steven, C., Hill. J. Masters, B., Fourcade, H M. and Boore, J. L. (2003). Genetic markers in blue crabs (*Callinectes sapidus*) I: Isolation and characterization of microsatellite markers and Complete Mitochondrial DNA Sequence and Characterization of Variation. Aqua Genome Satelite Meeting Chiba, Japan. **(Poster Presentation)**

120. **Place. A. R.,** and Deeds, J. (2003). Harmful Algal Toxins and Sterols: Not So Strange Bedfellows? Second Symposium on Harmful Marine Algae in the U. S. Woods Hole, MA. December. **(Oral Presentation)**

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123. Deeds, J. R., Reimschuessel, R., and **Place. A. R.** (2004). Gill Histopathology Induced by the Mid-Atlantic, Bloom-Forming Dinoflagellate *Karlodinium micrum*. **(Poster Presentation**) 10th annual FDA Science Forum May Washington DC.

124. Enticknap, J. J., **Place, A. R**., and Hill, R. T. (2004). Microbial analysis of a chicken manure process for odor improvement. **(Oral Presentation)**10th International Symposium on Microbial Ecology. August, Cancun, Mexico.

125. Jiang, Q. Goetz, F. W., and **Place, A. R.** (2004). Chitinase - A New Member Of The Fish Innate Immune Repertoire **(Poster Presentation**) May 25-29, The Sixth International Symposium on Fish Immunology, Turku, Finland (**Winner of Best Student Poster)**

126. **Place, A.R**. and Coats, D.W. (2004) Sneaking Under The Toxin Surveillance Radar: Parasitism And Sterol Content **(Poster Presentation**) November , XI HAB2004 Cape Town, South Africa.

127. Bachvaroff, T. R. and **Place, A. R**. (2004) Distinguishing Strains Of *Karlodinium micrum* Based On Microsatellite Markers **(Poster Presentation)** November , XI HAB2004 Cape Town, South Africa.

127. Bachvaroff, T. R., Sanchez-Puerta, M. V., Delwiche, C. F., and **Place, A. R.** (2004) Multiple Plastid Origins In Chromophytes - Toxicity Unleashed. **(Oral Presentation)** November , XI HAB2004 Cape Town, South Africa.

129. Deeds, J. R. and **Place, A. R.** (2004). Sterol Specific Membrane Interactions With The Toxins From *Karlodinium micrum* (Dinophyceae) – A Strategy For Self-Protection? **(Oral Presentation)** November , XI HAB2004 Cape Town, South Africa.

130. **Place, A. R.** (2004) Amphidinols And Karlotoxins – Brothers In Arms **(Oral Presentation)** November , XI HAB2004 Cape Town, South Africa.

131. Adolf, J. E., Krupatkina, D. N., **Place, A. R**., Brown, P. J. P., and Lewitus, A. J. (2004) The Allelopathic Specificity Of *Karlodinium micrum* Toxins (Karlotoxins) **(Oral Presentation)** November, XI

HAB2004 Cape Town, South Africa.
132. Findiesen, A. L. and **Place, A. R.** (2005). Developing diets for the juvenile blue crab, *Callinectes sapidus* (Rathbun), in a recirculating system: determination of rations and dietary fiber utilization. **(Oral Presentation)** International Workshop on Culture, Fisheries and Stock Enhancement of Portunid Crabs, Iloilo City, Phillippines
133. Hill, J. M., and **Place, A. R.** (2005). Multiple paternity in blue crabs (*Callinectes sapidus*) assessed with microsatellite markers **(Poster Presentation)** International Workshop on Culture, Fisheries and Stock Enhancement of Portunid Crabs, Iloilo City, Phillippines
134. **Place, A. R.** (2005). Genetic markers in blue crabs (*Callinectes sapidus*) -Nuclear and Mitocondrial in Origin **(Oral Presentation)** International Workshop on Culture, Fisheries and Stock Enhancement of Portunid Crabs, Iloilo City, Phillippines
134. Adolf, J. E., Bachvaroff, T., Reidel, G. F., and **Place, A. R.** (2005). The effects of macro- and micro-nutrient limitation on karlotoxin production in *Karlodinium micrum* strains. **(Oral Presentation)** GEOHAB. Open Science Meeting on HABs and Eutropication. March, Baltimore. MD.
136. Bachvaroff, T., Adolf, J. E., and **Place, A. R.** (2005). Strain Variation in *Karlodinium micrum* toxin production. **(Poster Presentation)** GEOHAB. Open Science Meeting on HABs and Eutropication. March, Baltimore. MD.
137. Bai, X., Adolf, J. E., Bachvaroff, T., **Place, A. R**., and Coats, D. W. (2005) Effect Of Host Toxicity On Success Of The Parasitic Dinoflagellate *Amoebophrya Ex K. micrum.* ASLO Summer Meeting, Santiago de Compostela, Spain. **(Poster Presentation)**
138. **Place, A. R.** (2005). Genetic Consequences of Blue Crab Stock Reduction and Enhancement **(Invited Oral Presentation)** in Blue Crabs: Ecological and Genetic Influences of Declines and Restoration, Benthic Ecology Meeting 2005, Williamsburg, VA.
139. **Place, A. R**., Adolf, J. E., and Bachvaroff, T. R. (2005). The Bay's Other Toxic Dinoflagellate – *Karlodinium micrum* (**Oral Presentation**) 18th Biennial Conference of the Estuarine Research Foundation.
140. Bachvaroff, T. R., Adolf, J. E. and **Place, A. R.** (2005). Genetic Correlates Between *Karlodinium micrum* Strains With Differences In Toxin Type And Abundance . Third Symposium on Harmful Marine Algae in the U.S. Asilomar, CA. (**Oral Presentation**)
141. Adolf, J. E., Bachvaroff, T. R., Deeds, J. R., Begum, A. Hosja, W., Reitsema, T., Ringeltaube, P., Robb, M. and **Place, A. R.** (2005). Ichthyotoxic *Karlodinium micrum* In The Swan River Estuary (Western Australia): An Emerging Threat In A Highly Eutrophic Estuarine System. Third Symposium on Harmful Marine Algae in the U.S. Asilomar, CA. **(Poster Presentation)**
142. **Place, A. R.**, Bachvaroff, T. R., and Adolf, J. E.. (2005). The Toxin From *Gymnodinium veneficum* Ballantine – Rediscovered: It's A Karlotoxin. Third Symposium on Harmful Marine Algae in the U.S. Asilomar, CA. (**Oral Presentation**)
143. Bai, X., Adolf, J. E., Bachvaroff, T., **Place, A. R**., and Coats, D. W. (2005) Effect Of Host Toxicity On Success Of The Parasitic Dinoflagellate *Amoebophrya,* With Preliminary Examination Of Host And Parasite Membrane Sterol Composition. Third Symposium on Harmful Marine Algae in the U.S. Asilomar, CA. **(Poster Presentation)**
144. Bai, X., Adolf, J. E., Bachvaroff, T., **Place, A. R**., and Coats, D. W. (2005) Effect Of Host Toxicity On Success Of The Parasitic Dinoflagellate *Amoebophrya,* With Preliminary Examination Of Host And Parasite Membrane Sterol Composition. ECP **(Poster Presentation)**
145. Wikfors, G.H., Ozbay, G**., Place, A.R.,** Li, J.Y., Meseck, S.L., Hégaret, H., and Alix, J.H. (2005). Harmful Algal Roadblocks to Eastern Oyster Restoration – *Prorocentrum mininum* and *Karlodinium micrum.* 8th International Conference on Shellfish Restoration – Enhancement & sustainability of shellfish resources. October, Brest, France. **(Oral Presentation)**
146. Adolf, J. E., Bachvaroff, T. R., Deeds, J. R., Begum, A. Hosja, W., Reitsema, T., Ringeltaube, P., Robb, M. and **Place, A. R.** (2005). Ichthyotoxic *Karlodinium micrum* In The Swan River Estuary (Western Australia): An Emerging Threat In A Highly Eutrophic Estuarine System. Open Science Meeting on

HABs and Stratification. December, UNESCO Headquarters, Paris, France. **(Poster Presentation)**
147. Jiang, Q., Goetz, E. W., Phillips, R., and **Place, A. R.** (2006). Chitinase – a new member in the fish innate immunity repertoires. SICB 2006 Annual Meeting, Orlando, Fl. **(Oral Presentation)**
148. Trant, J. M. and **Place, A. R.** (2006). Production and analysis of normalized cDNA libraries from blue crab (*Callinectes sapidus*) endocrine tissues. SICB 2006 Annual Meeting, Orlando, Fl. **(Oral Presentation)**
149. Allman, A. L. and **Place, A. R.** (2006). The effect of dietary chitin and cellulose on growth and digestive enzyme production in the juvenile blue crab, *Callinectes sapidus*. SICB 2006 Annual Meeting, Orlando, Fl. **(Poster Presentation)**
150. Brownlee, E. F., Sellner, S. G., Sellner, K. G., Adolf, J. E., Nonogaki, H. Bachvaroff, T. R. and **Place, A. R.** (2006) *Crassostrea ariakensis* and *C. virginica* responses to ichthyotoxic *Karlodinium veneficum.* March, National Shellfisheries Association, Asilomar, CA.
151. Adolf, J. E., Krupatkina, D., Bachvaroff, T., and **Place. A. R**. (2006). The role of karlotoxins in microbe-microbe interactions involving the mixotrophic dinoflagellate, *Karlodinium veneficum*, its prey, and its predators. Accepted for the Gordon Research Conference on Marine Microbes, July 23-28, University of New England, Biddeford, ME. **(Poster Presentation)**
152. Bai, X., Adolf, J. E., Bachvaroff, T., **Place, A. R**., and Coats, D. W. (2006) Sneaking Under The Toxin Surveillance Radar: Parasitism And Sterol Content . Accepted for the Gordon Research Conference on Marine Microbes, July 23-28, University of New England, Biddeford, ME. **(Poster Presentation)**
153. Tang, Q., Goetz, F. W., Phillips, R. and **Place, A. R.** (2006) Chitinase - A New Member Of The Fish Innate Immune Repertoire. 10th International Congress - International Society for Developmental and Comparative Immunology. July 1-6, Charleston, South Carolina, USA. **(Oral Presentation).**
154. Feng, X, Hill, J. and **Place, A. R.** (2006) Genetic Considerations During the Experimental and Expanded Phases of Blue Crab Stock Enhancement in the Chesapeake Bay. International Symposium Genetics in Aquaculture IX, June 25-30, Montpellier, France. **(Poster Presentation).**
155. **Place, A. R**., Feng, X, and Hill, J. (2006) Genetic Considerations During the Experimental and Expanded Phases of Blue Crab Stock Enhancement in the Chesapeake Bay. 3rd International Symposium on Stock Enhancement and Sea Ranching. Seattle, WA. **(Oral Presentation).**
156. Sellner, S. G., Brownlee, E. F., Sellner, K. G., Adolf, J. E., Nonogaki, H. Bachvaroff, T. R. and **Place, A. R.** (2006) *Crassostrea ariakensis* and *C. virginica* responses to ichthyotoxic *Karlodinium veneficum.* 12th International Conference on Harmful Algae, September 4-8. Copenhagen, Denmark. **(Poster Presentation).**
157. Adolf, J. E., Bachvaroff, T. R. Krupatkina, D., and **Place, A. R.** (2006) Karlotoxins mediate interactions between the mixotrophic dinoflagellate, *Karlodinium veneficum*, its prey, and its predators. 12th International Conference on Harmful Algae, September 4-8. Copenhagen, Denmark. **(Oral Presentation).**
158. Bachvaroff, T. R, Adolf, J. E., and **Place, A. R.** (2006) Genetic differences between *Karlodinium veneficum* strains: Using DNA variation to understand strain variation at the bloom, regional and worldwide level. 12th International Conference on Harmful Algae, September 4-8. Copenhagen, Denmark. **(Oral Presentation).**
159. Sheng, J., Malkiel, E., Pfitch, D.W., Katz, J., Adolf, J. E , Belas, E. R., and **Place, A. R.** (2006) Holographic Digital Imaging of Dinoflagellate Behavior. 12th International Conference on Harmful Algae, September 4-8. Copenhagen, Denmark. **(Poster Presentation).**
160. **Place, A. R.**, Adolf, J. E., Bachvaroff, T. R., Peng, J., and Hamann, M. (2006) Amphidinols And Karlotoxins – Brothers In Arms Part Deux: Structural Similarities. 12th International Conference on Harmful Algae, September 4-8. Copenhagen, Denmark. **(Oral Presentation).**
161. Sheng, J., Malkiel, E., Pfitch, D.W., Katz, J, Belas, E. R., and **Place, A. R.** (2006) Recording High resolution 3D Lagrangian Motions In Marine Dinoflagellates using digital holographic microscopic cinematography. 59th Annual Meeting of the Divison of Fluid Dynamics, Tampa Bay, Florida **(Poster**

Presentation).
162. **Place, A. R.** Feng, X., and Hill. J. (2006) Genetic Considerations during the Experimental and Expanded Phases of Blue Crab Stock Enhancement in Chesapeake Bay. Third International Symposium on Stock Enhancement & Sea Ranching. Seattle Washington. **(Oral Presentation).**
163. Hill. J. and **Place, A. R.** (2006) Using Microsatellites to Track Hatchery Released Blue Crabs. Third International Symposium on Stock Enhancement & Sea Ranching. Seattle Washington. **(Poster Presentation).**
164. Feng, X., Hill. J., and **Place, A. R.** (2007). Tracking Hatchery Blue Crabs (*Callinectes sapidus*) Using Molecular Genetic Markers. 8th International Marine Biotechnology Conference, Eilat, Israel **(Oral Presentation).**
165. Nonogaki, H., Kissil, G. W., Lupatsch, I., and **Place. A. R.** (2007). Reduction In Fish Meal And Fish Oil Dependency In Feeds For Hybrid Striped Bass And Their Effect On Product Quality, Consumer Health And Acceptance. 8th International Marine Biotechnology Conference, Eilat, Israel **(Oral Presentation).**
166. **Place, A. R.** (2007). Harmful Algae Genomics; New Insights Into Toxicity and Biotechnology Applications. 8th International Marine Biotechnology Conference, Eilat, Israel **(Keynote Oral Presentation).**
167. Sheng, J., Malkiel, E., Pfitch, D.W., Katz, J, Belas, E. R., and **Place, A. R.** (2007) High Resolution 4D Lagrangian Measurement of Micro-Organisms in Dense Suspensions. ASLO **(Oral Presentation).**
168. Qiong Tang, John D. Hansen, Frederick W. Goetz, Ruth Phillips, and **Allen R. Place** (2007). The Gene Structure Of Rainbow Trout (*Onchorhynchus mykiss*) Chitinases –New Members Of The Innate Immunity Repertoire. Seventh International Symposium on Fish Immunology, organised by the Nordic Society for Fish Immunology (NOFFI) held 18th-22nd June, 2007, and is hosted by the Institute of Aquaculture, University of Stirling. **(Poster Presentation).**
169. **Place, A. R.,** Adolf, J., Bachvaroff, T. R., Zhang, H. and Lin, S. (2007) Strain Variability in *Karlodinium veneficum.* Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
170. Stoecker, D.**,** Adolf, J., **Place, A. R.,** Glibert, P. and Merritt, D. (2007) Effects of *Karlodinium veneficum* on early life history stages of the Eastern Oyster. Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
171. Sheng, J., Malkiel, E., Katz, J., Adolf. J. and **Place, A. R.** (2007) Prey-Induced Changes in Swimming Behavior of Predatory Dinoflagellates. Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
172. Bachvaroff, T. and **Place, A. R.** (2007) From Stop to Start: Comparing expressed and genomic versions of geins in the dinoflagellate *Amphidinium carterae.* Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
173. Adolf, J., Bachvaroff, T. R., and **Place, A. R.** (2007) Cryptophytes Drive Blooms of Mixotrophic Harmful Algae: A Testable Hypothesis Based on *Karlodinium veneficum.* Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
174. Lin, S., Zhang, H., Adolf, J., **Place, A. R.,** Gassterland, T., Rogers, Y-H., Gill, J., and Tran, B. (2007) The Dinoflagellate Genome,: Insights from Full-Length cDNAs for *Karlodinium* and *Amphidinium.* Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
175. Litaker, W., Hall, N., Fensin, E., Adolf, J., **Place, A. R.** and Paerl, H. (2007) Development of a Toxic Dinoflagellate (*Karlodinium veneficum*) Bloom in a Shallow Eutrophic Lagoonal Estuary. Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
176. Tester, P, Waggett, R. and **Place, A. R.** (2007) Grazing on the Estuarine Bloom Forming Species

Karlodinium veneficum Deterred by Production of Karlotoxins. Joint Meeting of Phycological Society of America & International Society of Protistologists. Warwick, Rhode Island **(Oral Presentation).**
177. Peng, J., Hamann, M. T., Anklin, C., and **Place, A. R.** (2007). Structure Determination of Karlotoxin Using ^{13}C Enrichment and Cryo-dual NMR Spectroscopy. 233rd ACS National Meeting, March 25-29, 2007, Chicago, IL, United States. **(Oral Presentation).**
178. Hamann, M. T., Peng, J., Anklin, C., and **Place, A. R.** (2007). Structure Determination of the Elusive Pfiesteria-Associated Fish Killing Toxin Using ^{13}C Enrichment and Cryo-dual NMR Spectroscopy. American Society of Pharmacognosy. Maine. **(Oral Presentation).**
179. Wikfors, G. H., Li, Y., Meseck, S. L., Hégaret, H., Ozbay, G., and **Place, A. R.** (2007). Variable Expression of Toxicity in *Prorocentrum minimum*, and Possible Relationships with Trophic Status. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA.
180. Mooney, B. D., Hallegraeff, G. M. and **Place, A. R.** (2007). *Karneniaceae* Common to Australia and USA: Variable Icthyotoxicity. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Poster Presentation).**
181. Adolf, J. E., Bowers, H.A., Bachvaroff, T. R., and **Place, A. R.** (2007). Cryptophytes in Chesapeake Bay And Their Potential Relationship to Mixotrophic Harmful Algal Blooms. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Oral Presentation).**
182. Litaker, W., Hall, N., Fensin, E., Adolf, J., **Place, A. R.,** and Paerl, H. (2007). Development of a Toxic Dinoflagellate (*Karlodinium veneficum*) Bloom in a Shallow Eutrophic Lagoonal Estuary. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Oral Presentation).**
183. Bachvaroff, T. R., Coats, D. W., and **Place, A. R.** (2007). Using Deep-Branching Dinoflagellates to Understand Dinoflagellate Evolution. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Poster Presentation).**
184. Lin, S., Zhang, H., Adolf, J., **Place, A. R**., Gassterland, T., Rogers, Y-H., Gill, J., and Tran, B. (2007) Genetic Network Regulating Cell Division And Toxin Production In *Karlodinium* and *Amphidinium:* A Genomic Approach. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Oral Presentation).**
185. Bowers, H. A., Coats, D. W., Adolf, J. E., Bachvaroff, T. R., and **Place, A. R.** (2007). Using Real-Time PCR To Demonstrate Co-Occurrence Of *Karlodinium veneficum* and *Amoebophyra sp. ex. Karlodinium veneficum.* Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Poster Presentation).**
186. Sheng, J., Malkiel, E., Katz, J., Adolf. J. and **Place, A. R.** (2007) Prey-Induced Changes in Swimming Behavior of Predatory Dinoflagellates. Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Oral Presentation).**
187. **Place, A. R.** and Bachvaroff, T. R., (2007). Scrabbled Modules, Spliced Leaders, Cap Dependent Translation Control – What Next In Dinoflagellate Polyketide Toxin Synthesis? Fourth Symposium on Harmful Algae in the U.S. Woods Hole, MA. **(Oral Presentation).**
188. Schott, E., Hines, A., Johnson, E., **Place, A. R.,** Messick, G., Zmora, O., and Zohar, Y. 2007. *Hematodinium* Associated Diseases: Research Status and Future Directions. September 20-22 Charlottetown, Prince Edward Island. **(Oral Presentation).**
189**.** Adolf, J.E., Bowers, H.A., and **Place, A.R.** 2008. Cryptophytes, karlotoxins and bloom formation by the ichthyotoxic dinoflagellate, *Karlodinium veneficum*. Ocean Sciences meeting, Orlando, Florida, March 2 – 7, 2008. **(Oral Presentation)**
190. Waggett, R.J., Tester, P. A., and **Place, A.R.** 2008. Anti-grazing properties of the dinoflagellate, *Karlodinium veneficum*, during predator-prey interactions with the copepod, *Acartia tonsa*. Ocean Sciences meeting, Orlando, Florida, March 2 – 7, 2008. **(Oral Presentation)**
191. Novoveska, L.; Liefer, J. D.; Smith, W. L.; **Place, A. R**. and MacIntyre, H. L.: Abundance And Toxicity Of A *Karlodinium veneficum* Bloom In The Weeksbay National Estuarine Research Reserve, Alabama Ocean Sciences meeting, Orlando, Florida, March 2 – 7, 2008. **(Oral Presentation)**
192. Adolf, J.E. and **Place, A.R**. 2007. Toxic dinoflagellate blooms in the Inner Harbor, Baltimore MD

and a proposal for real-time continuous monitoring of water quality in this highly visible urban environment. Poster presented at the Baltimore Ecosystem Study Annual Meeting, October 17, 2007 . **(Poster Presentation)**

193. Hamann, M., Peng, J., Anklin, C., and **Place, A. R .** 2008. "At last a structure for a 50 year old toxin from a *Karlodinium sp*. collected at the Plymouth Marine Laboratory. A product of improvements in Cryodual and other NMR techniques" 235th ACS National Meeting, New Orleans, LA, April 6-10, 2008. **(Oral Presentation)**

194. Belas, R. J. Sheng, E. Malkiel, J. Katz, J. Adolf, and **A.R. Place.** 2008. Digital Holographic Microscopy Reveals Prey-Induced Changes in Swimming Behavior of Predatory Dinoflagellates. Sensory Transduction in Microorganisms Gordon Research Conference. 01/13-18/2008. Ventura Beach, CA**. (Oral Presentation).**

195. **Place, A. R.,** Bachvaroff, T. R., Lidie, K. and Jagus, R. 2008. Scrabbled Modules, Spliced Leaders And Cap Dependent Translational Control – *Karlodnium veneficum* Breaks All The Paradigms. The 13th International Conference on Harmful Algae. Hong Kong, China **(Oral Presentation).**

196. Mooney, B.D., de Salas, M., Hallegraeff, G. M, and **Place, A. R.** 2008. Survey for karlotoxin production in 15 species of potentially ichthyotoxic gymnodinioid dinoflagellates (Kareniaceae, Dinophyta). The 13th International Conference on Harmful Algae. Hong Kong, China **(Oral Presentation).**

197. Lidie, K., Jagus, R., Darzynkiewics, E., and **Place, A. R.** 2008. Identification of Two Eukaryotic Translation Initiation Factor 4E Homologues in Dinoflagellates with Distinctive Cap Binding Properties. Cold Spring Harbor, Translational Biology. **(Poster Presentation).**

198. Dagam P. R., Prasanna, S., Peng, J., **Place, A. R.**, Hamann, M. T. and Doerksen, R. J. 2008. Computational efforts to predict absolute configuration and protein-ligand interactions of marine natural products. Oceans and Human Health Gordon Conference. Tilton, NH, July 29-July 4. **(Poster Presentation).**

199. Fu, F**., Place, A. R.**, Garcia, N., and Hutchins, D. A. 2009. Interactive influences of changing pCO2 and phosphate availability on toxin production and physiology of the harmful bloom dinoflagellate *Karlodinium veneficum*. ASLO Aquatice Sciences Meeting 2009, Nice, France. **(Oral Presentation).**

200. Feng, X., Williams, E.P, and **Place, A. R.** 2009. Mitochondrial DNA heteroplasmy in blue crab *Callinectes sapidus*. The NSA 101st Annual Meeting, Savannah, GA. USA. **(Oral Presentation).**

201. Feng, X., P. M. Gaffney, Williams, E. P., and **Place, A. R.** 2009. The phylogeography of the blue crab *Callinectes sapidus*: genetic variation to the MAX. The NSA 101st Annual Meeting, Savannah, GA. USA. **(Oral Presentation).**

202. Williams, E. P., and **Place, A. R.** 2009. The genetic diversity of blue crab megalopae entering the Chesapeake Bay. The NSA 101st Annual Meeting, Savannah, GA. USA. **(Oral Presentation).**

203. Bowers, H. A., **Place, A. R.,** and Schott, E. J. 2009. The Contribution Of Molecular Techniques In Understanding The Bay: We're Just Scratching The Surface. The Chesapeake Bay Consortium – Ecosystem Based Management. Baltimore, MD March**. (Oral Presentation).**

204. Lovko, V. J., Lohrenz, S. E. and **Place, A. R.** 2009. Detection and characterization of *Karlodinium veneficum* in the Northern Gulf of Mexico. Fifth Symposium on Harmful Algae in the U.S. Seattle, WA. **(Oral Presentation).**

205. Esposito, L., Pasiche Lisboa, C. J, Robataille, N., **Place, A. R.** and Sellner, K. G. 2009. *Karlodinium* impacts on rotifers and crab larvae, further indication of a cosmopolitan foodweb manipulator. Fifth Symposium on Harmful Algae in the U.S. Seattle, WA. **(Oral Presentation).**

206. Vaitkus, J., **Place, A. R.** and Sellner, K. G. 2009. *Karlodinium veneficum* CCMP 1609: Toxin content as a function of nutrient species, absence of mixotrophy, and import for tidal Chesapeake Bay. Fifth Symposium on Harmful Algae in the U.S. Seattle, WA. **(Poster Presentation).**

207. Sheng, J., Katz, J., Adolf, J. E. and **Place, A. R.** 2009. Behavioral Correlates of Karlotoxin Production - Stun your Prey Before you Eat! Fifth Symposium on Harmful Algae in the U.S. Seattle, WA. **(Oral**

Presentation).
208. Zohar, Y, Zmora, O. **Place, A. R.,** Feng, X., Chung, J. S., Schott, E. J., Stubblefield, J. Hines, A. H., and Johnson, E. G. 2009. A multidisciplinary approach to responsible stock enhancement of the blue crab in the Chesapeake Bay: hatchery technologies and basic tools. 2009 Shanghai Crab Symposium, Shanghai Ocean University, China **(Oral Presentation).**
209. Nguluwe, B., Johnson, A. K., **Place, A. R.**, Carlin, J. and Richards, A. 2009. Stock discrimination of American monkfish in northwest Atlantic using mitochondrial DNA. American Fisheries Society, Nashville, TN **(Poster Presentation).**
210. Watson, A., R. Barrows, G. Kissil, and **Place, A. R.** 2010. Alternative protein and lipid sources in partial and complete fish product replacement diets for juvenile Cobia, *Rachycentron canadum.* Aquaculture 2010, World Aquaculture Society Meeting. San Diego, California. (**Oral Presentation).**
211. Watson, A., G. Kissil, and **Place, A. R.** 2010. Digestibility of plant proteins as fishmeal replacement candidates in juvenile Cobia, *Rachycentron canadum*. Aquaculture 2010, World Aquaculture Society Meeting. San Diego, California. (**Oral Presentation).**
212. Watson, A., M. Avella, O. Carnevali, E. Williams, and **Place, A. R.** 2010. Effects of *Lactobacillus rhamnosus* on the Growth and Survival of Larval Cobia, *Rachycentron canadum.* Aquaculture 2010, World Aquaculture Society Meeting. San Diego, California. (**Oral Presentation).**
213. Sheng, J., Katz, J., Adolf, J. E., and **Place, A. R.** 2010. A mixotrophic dinoflagellate utilizes toxins as a means of stunning prey prior to ingestion. Ocean Sciences Meeting 2010, Oregon, USA. (**Oral Presentation).**
214. Saba, G.K., Steinberg, D. K., Bronk, D. A. and **Place, A. R.** 2010. The effects of harmful algal species and food concentration on zooplankton grazer production of dissolved organic matter and inorganic nutrients. Ocean Sciences Meeting 2010, Oregon, USA. (**Oral Presentation).**
215. Nguluwe, B., Johnson, A.K., Williams, E., Carlin, J., Richards, A. and **Place. A. R. 2009.** Stock discrimination of American Monkfish Northwest Atlantic Using Mitochondrial DNA. The National Oceanic and Atmospheric Administration Educational Partnership Program (EPP). The Fifth Education and Science Forum. Howard University November. **(Poster Presentation).**
216. Dominique, V. J. III, Williams, and **Place. A. R. 2009.** Genotyping of Blue Crab (*Callinectes sapidus*) Megalopea in the Beaufort Inlet. The National Oceanic and Atmospheric Administration Educational Partnership Program (EPP). The Fifth Education and Science Forum. Howard University November. (**Poster Presentation). **2nd prize poster in Living Marine Resources ($200)**.
217. Taylor, G. R., Watson, A. and **Place, A. R.** 2009. Determination of a Plant Protein Diet for a Marine Fish. The National Oceanic and Atmospheric Administration Educational Partnership Program (EPP). The Fifth Education and Science Forum. Howard University November. **(Poster Presentation). **3rd prize poster in Living Marine Resources ($100)**.
218. Thompson, M. N., Watson, A. and **Place, A. R**. 2009. The Use of Probiotics to Improve the Survival and Growth Rate of Cobia Larvae. The National Oceanic and Atmospheric Administration Educational Partnership Program (EPP). The Fifth Education and Science Forum. Howard University November. **(Poster Presentation).**
219. Lovko, V. J., Lohrenz, S. E., Bowers, H. A., and **Place, A. R.** 2010 Characterization and bloom-forming potential of the toxic, fish-killing dinoflagellate *Karlodinium veneficum* in the northern Gulf of Mexico. Northern Gulf Institute Annual Conference May 18-20, 2010 Mobile, Alabama. (**Oral Presentation).**
220. Pagenkopp, K. M., Shields, J. D., Xiao, J., Miller, T., Small, H. J., **Place, A. R.** and Reece, K. S. 2010 The frequency and distribution of genetic strains of *Hematodinium*, a parasitic dinoflagellate of the blue crab (*Callinectes sapidus*) along the Delmarva Peninsula, VA. Sixth International Symposium on Aquatic Animal Health. September 5-9, Tampa Florida, USA. (**Oral Presentation).**
221. Williams, E, Peer, A., Secor, D., Miller, T. and **Place, A. R.** 2010 Genotyping Mismatches Between Generations of Striped Bass Due to Mitochondrial Heteroplasmy. American Fisheries Society Meeting

2010, September 12th-16th, Pittsburgh, PA.
222. Williams, E, Peer, A., Secor, D., Miller, T. and **Place, A. R.** 2010 How Striped Bass Population Structures can be Confounded Across Generations by Mitochondrial Heteroplasmy. American Fisheries Society Meeting 2010, September 12th-16th, Pittsburgh, PA.
223. Wang, H., Anderson, M. A., Chen, F., Williams, E., **Place, A. R**., Zmora, O., Zohar, Y., Zheng, T., and Hill, R. T. 2010 Diversity of bacterial communities associated with the potential biofuel-producing alga *Nannochloropsis* at different temperatures. 9th International Marine Biotechnology Congress, October 8-12 2010, Qingdao, China.
224. Watson, A. M., Barrows, F.T., and **Place, A. R**. T. 2010 Taurine – the missing ingredient for development of fish free diets for aquaculture? 9th International Marine Biotechnology Congress, October 8-12 2010, Qingdao, China.
225. Lidie, K., Jagus, R., Darzynkiewics, E., Stepinski, J., and **Place, A. R.** 2010. Identification of Eukaryotic Translation Initiation Factor 4E Family members with Distinctive Cap Binding Properties in Dinoflagellates. Cold Spring Harbor, Translational Control 2010. page 150. **(Poster Presentation).**
226. **Place, A. R.** 2010. LIPIDOMICS: Lipid Targeted Algal Toxins. 2010 Phycological Society of America Annual Meeting, Michigan State University, July 10-13. (**Oral Presentation).**
227. **Place, A. R.** 2010. Karlotoxins - Their Structure, Mode of Action and Ecological Function 14th International Conference on Harmful Algae. Hersonissos, Crete-Greece, November 1-5. (**Oral Presentation).**
228. **Place, A. R.** 2010. 5-Hydroxymethyluracil is synapomorphic to the Dinokaryotes only. 14th International Conference on Harmful Algae. Hersonissos, Crete-Greece, November 1-5. (**Poster Presentation).**
229. Roche, S. A., Porter, N. M., **Place, A. R.** and Leblond, J. D. 2010. Sterol Biosynthesis in the Marine Dinoflagellates, *Karenia brevis* Piney Island and *Karlodinium veneficum* MD5. 14th (**Poster Presentation).**
230. Sellner, K., Bowers, H., Certner, R., Cho, H., Gibbons, A., Kim, C., Liu, T., Miller, H., Parikh, N., **Place, A. R.,** Savranskay, N., Sun, A., Throwe, T., Wazniak, C., and Wooten, M. 2010. Clay Flocculation of *Microcystis aeruginosa* in the Chesapeake: Preliminary Laboratory and Socio-Economic Assessment Results. 14th International Conference on Harmful Algae. Hersonissos, Crete-Greece, November 1-5. (**Poster Presentation).**
231. Smith, S. M. E., Morgan, D., Musset, B., Cherny, V. V., **Place, A. R**., Hastings, J. W. and DeCoursey, T. E. 2011. A Novel Voltage-gated proton channel in a dinoflagellate. Biophysical Society 55th Annual Meeting, Baltimore, MD.
232. Baptist, C., Laber, C., Smalley, G. W. and **Place, A. R.** 2011 The Influence of Irradiance on Growth, Feeding, and Toxin Production in the Mixotrophic Dinoflagellate *Karlodinium veneficum*. 2011 ASLO Aquatic Sciences Meeting in San Juan, Puerto Rico from 13-18 February. (**Oral Presentation).**
233. Nguluwe, B., Johnson, A. K. Williams, E., Carlin, J., Richards, A., and **Place, A. R.** 2011 Stock Discrimination of American monkfish in Northwest Atlantic Using Mitochonrial DNA Variation. 2011 ASLO Aquatic Sciences Meeting in San Juan, Puerto Rico from 13-18 February. (**Oral Presentation).**
234. Smith, S. M. E., Morgan, D., Musset, B., Cherny, V. V., **Place, A. R.**, Hastings, J. W. and DeCoursey, T. E. 2011 A Novel Voltage Gate Proton Channel in a Dinoflagellate. Biophysical Society, Baltimore, MD. (**Poster Presentation).**
235. Watson, A. M., and **Place, A. R.** 2011 Fatty acid profiles of cobia, *Rachycentron canadum,* and Gilthead Sea Bream, *Sparus aurata,* fed diets containing alternative lipid sources. World Aquaculture Society, March 3, New Orleans (**Oral Presentation).**
236. Pagenkopp Lohan, K.M., Shields, J. D., Xiao, J. , Miller, T. L., Small, H. J., **Place, A.R.**, and Reece, K.S. 2011 The frequency and distribution of genetic strains of *Hematodinium*, a parasitic dinoflagellate of the blue crab (Callinectes sapidus), along the Delmarva Peninsula, VA. National Shellfisheries Association in Baltimore, MD. (**Oral Presentation).**
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Application No. 09/010,485
Filed: January 21, 1998
Inventors: A. Place & S. Ozkizilcik
Note that this applicationhas been abandoned.

Place-97-004-CIP - METHODS FOR THE ENRICHMENT OF LIVE FEED WITH NUTRIENTS ESSENTIAL FOR FISH LARVAE
Patent No. July 17, 2001
Issue Date: 6,261,590
Inventors: A. Place, S. Ozkizilcik, & M. Harel

Place-97-004-PCT - METHODS FOR THE ENRICHMENT OF LIVE FEED WITH NUTRIENTS ESSENTIAL FOR FISH LARVAE
Application No. PCT/US99/01374
Filed: January 21, 1999
Inventors: A. Place & S. Ozkizilcik

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Patent No. 752720
Issue Date: January 21, 1999
Inventors: A. Place & S. Ozkizilcik

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Application No. 2,318,913
International Filing Date: January 21, 1999
Inventors: A. Place & S. Ozkizilcik

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International Filing Date: August 8, 2000
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Chairman, Organizing Committee, *First* International Symposium on Marine Molecular Biology, 1988

Co-Chairman, Organizing Committee, Workshop at the ICSEB, *"Molecular Evolution of Archaebacteria"*, July, 1990.

Focus Group for Omega-3 Fatty Acids, September, 1997 (Co-Organizer, R. Katz).

Development and Application of Molecular Technologies to *Pfiesteria* Research Workshop, October, 1997, (Co-Organizers, B. Belas, J. Kramer, Y. Zohar, G. Vasta)

Molecular Studies in Fish Endocrinology, 2nd International Congress on the Biology of Fishes, July, 1998 (Co-Organizers, J. Trant and Y. Zohar).

The Interface Between Aquaculture and Stock Enhancement: Assessing the Promise of Replenishing Marine Fisheries, March 2002 (Organizer: Y. Zohar, Co-Organizers: A. R. Place, A. Hines).

ADJUNCT APPOINTMENTS:

Adjunct Associate Professor, Horn Point Environmental Laboratory, Center for Estuarine and Environmental Studies, University of Maryland, 1990-1994.

Affiliate Associate Professor, Poultry Science Department, University of Maryland College Park, 1993-1995.

Graduate Faculty, The University of Maine, School of Marine Sciences, Orono, Maine, 2001-2007.

ADVISORY BOARDS:

Science and Mathematics Advisory Board, Institute of Academic Technology, The University of North Carolina at Chapel Hill 1990-1992

Community College of Baltimore, Biotechnology Technician Curriculum, 1989-1992

Center for Excellence in Urban Education, Coppin State College,1990-1993

City Life Museum, "Heroes Like You" 1993

Statewide Systemic Initiative in Science, Mathematics and Engineering Education, Member of the Professional Organizations Support Group, 1992-1994.

Chancellor's Commission on Mathematics and Science Teaching, 1992-1995.

Downtown Baltimore Center Program and Policy Board, 1992-1994.

Coordinator of MBI's participation in the Martin Marietta Graduate Fellows Program, 1992-1997.

Advisory Committee for the Life Sciences Institute of the New Community College of Baltimore, 1992-1995.

Christopher Columbus Center of Marine Exploration and Research, Training Center Committee, 1992-1995.

CONSULTANT:

Christopher Columbus Center of Marine Exploration, Exhibition Center Design Selection Committee, 1992-1995

Terrapin Raise and Release Project, Chespax, Environmental Education in Calvert County. 1993
Offspring Marine, Ltd., 1999-2002.
Algenol Biofuels, Inc. 2007-2010.

SITE VISITS:

Virginia Sea Grant, 1990
National Institutes of Health, Special Study Section, Small Business Innovation Research 1990, 1991,
National Institutes of Health, Prophet Advisory Subcommittee, Three Site Visits in 1996-1997.
"Feasibility of Hatchery-based Restoration of Chesapeake Bay Blue Crabs: Fact Finding Mission to Japan" Maryland Sea Grant, D. Secor, A. Hines, and A. Place July, 2001

NSF GRANTS REVIEWED:

Population Biology
Physiological Processes
Biochemistry
Education and Human Resources

GRANT REVIEW PANELS:

National Institutes of Health, Special Study Section, Small Business Innovation Research 1990, 1991, 1992, 1993 (7 panels).
National Institutes of Health, Shared Instrumentation Program, 1993
National Institutes of Health, Prophet Advisory Subcommittee, 1993, 1994, 1995, 1996, 1997
National Science Foundation, 1996, 1998
Maryland Sea Grant Academic Advisory Committee 1998 to present.
Delaware Sea Grant Technical Advisory Committee, 2002, 2003
New Jersey Sea Grant Technical Advisory Committee, 2005-2006.

JOURNALS PAPERS REFEREED

Analytical Biochemistry
Journal of Experimental Biology
Physiological Zoology
Auk
Journal of Biological Chemistry
Theoretical Biology
The Condor
American Journal of Physiology
Environmental Toxicology and Chemistry
General and Comparative Endocrinology
Fish Biochemistry and Physiology
Wilson Bulletin
Journal of Phycology
Harmful Algae

INVITED PRESENTATIONS AT SYMPOSIA OR MEETINGS:

III International Conference on Methods in Protein Sequence Analysis, 1980, Heidelberg, Germany.

IV International Conference on Methods in Protein Sequence Analysis, 1981, Brookhaven National Laboratories, Upton, New York.
Mid-Atlantic Drosophila Conference, 1984.
IBM's 1985 University AEP Conference.
Educom 1986.
IBM Academic Information Systems 1986 University Study Conference.
IBM's 1987 University Executive AEP Conference.
IBM's 1987 University AEP Conference.
IBM's 1988 Conference on Academic Computing.
2nd International Congress of Comparative Physiology and Biochemistry, 1988.
XVI International Congress of Genetics, 1988.
National Association of Biology Teachers, 1988.
Association of Midwestern College Biology Teachers Meeting, 1988.
Educom, 1988
First S-system Symposium, 1989
1990 Maine Bird Conference, April, 1990.
Computers in Learning and Teaching, American Medical Informatics Association (AMIA), June, 1990.
American Orntilogical Society, UCLA, June, 1990.
American Physiological Society, "Comparative Intestinal Nutrient Transport"; October, 1990.
XX International Ornithological Congress; Christchurch, New Zealand; December, 1990.
American Physiological Society, "Comparative Intestinal Nutrient Transport"; October, 1990.
IBM's 1991 Conference on Academic Computing.
Stock Enhancement: New Options through Marine Biotechnology in The Chesapeake Experience (L. Sage, Coordinator) at 16th Biennial Conference and Exposition, International Association on Water Pollution Research and Control, Washington , D. C. May, 1992.
Annual meeting of the American Society of Zoologists, "Environmental Sex Determination in Reptiles: Patterns And Process." Vancouver, B.C. Canada, December 29, 1992.
American Ornithological Society, "Avian Energetics and Nutritional Ecology", University of Alaska, June, 1993.
APS Intersociety Meeting, San Diego, 1994
"Molecular approaches to Zoological and Evolution: A short course", American Society of Zoologists, January 5-8, St. Louis, MO., 1994
1995 Keystone Symposia, The Molecular Basis for differences between the sexes., Tamarron, Colorado.
5th International Symposium on Reproductive Physiology of Fish, University of Texas, July 1995.
Second International Symposium on Chitin Enzymology, Senigallia, Italty, May, 1996.
IV International Aromatase Conference, Tahoe City, CA., 1996
First Comparative Nutrition Society Symposium, Leesburg, Viriginia, August, 1996
Society for Integrative and Comparative Biology, "The Biology of Lipids: Integration of Structure and Function". Albuquerque, New Mexico, December, 1996.
Second International Symposium on Chitin Enzymology, Senigallia, Italty, May, 1996.
IV International Aromatase Conference, Tahoe City, CA., 1996
Society for Integrative and Comparative Biology, "The Biology of Lipids: Integration of Structure and Function". Albuquerque, New Mexico, December, 1996.
First International Symposium on the Biology of Vertebrate Sex Determination, Honolulu, Hawaii, April, 1997
Cascade Symposium: Update on Avian Gastrointestinal Tract Function, July, 1997

4eme Atelier Determinisme et Differenciation du Sexe, Rennes, Bretagne, France, October, 1997.
Striper 2000: Technological Advances in the Culture of Striped Bass and its Hybrids, June 6-7, College Park, 1998.
Comparative Nutrition Society, Second Biennial Symposium, Banff, Alberta, Canada, 1998.
Physiological Challenges of Aquacultured Animals, 5th International Congress of Comparative Physiology and Biochemistry (IUBS). Calgary, Canada, 1999.
CDC Inter-Laboratory Quality Assurance of Fish Bioassays of the Microorganism, *Pfiesteria piscicida, January, 2000 Atlanta*
5th International Marine Biotechnology Conference 2000 Sept, 2000 (IMBC''00) to be held in Townsville, Australia
Second International Symposium on the Biology of Vertebrate Sex Determination, Honolulu, Hawaii, April, 2000
CDC National Conference on Pfiesteria: From Biology to Public Health, 2000 October, Stone Mountain, Georgia, USA.
Third International Symposium on Chitin Enzymology, Senigallia, Italy, May, 2001.
Mycotoxins and Phycotoxins Gordon Conference, June, 2007, 2009, 2011, 2013

INVITED WORKSHOPS:

NSF sponsored, "Future Directions in Zooplankton Population Biology", 1989, W. K. Kellogg Biological Station, Michigan State University
IBM sponsored, "Institute for Academic Technology", 1989, University of North Carolina at Chapel Hill.
IBM sponsored, "Institute for Academic Technology", 1990, University of North Carolina at Chapel Hill.
Smithsonian sponsored, "Modeling Digestion", 1990, National Zoological Park, Washington, D.C.
FASEB Summer Conference, "Intestinal Lipid Absorption, Metabolism and Transport, 1994, Saxton River, Vermont.
ATTC Workshop, Theory and Techniques for Archaeal Research, July 29, August 1, 1997, 1998, 1999
NSF sponsored, "Zooplankton nutrition", 1999, Charleston, SC.
NSF sponsored, "Workshop on the Interactions Among the Environment, the Endocrine and Immune Systems and Resistance to Disease in Marine Organisms ", 2000, Honolulu, HA.
Sea Grant sponsored, "A Meeting to Discuss Research Needs Related to Improving Blue Crab Production in Maryland", SERC, Edgewater, MD, 2000 June.
CDC National Conference on *Pfiesteria*: From Biology to Public Health, Stone Mountain, GA, October, 2000.
Maryland BioScience Forum Technology Showcase Participant, "*Advanced DHA, EPA And AA Enrichment Materials For Marine Aquaculture, Using Single Cell Heterotrophs"*
International Symposium on Marine Fishery and Aquatic Products Processing Technology, Rongcheng, China September, 11-13, 2001.
Mote Marine Laboratory, 30th UJNR, "Stock Enhancement", (For Y. Zohar), 2001
The Interface Between Aquaculture and Stock Enhancement: Assessing the Promise of Replenishing Marine Fisheries, March 2002 (Organizer: Y. Zohar, Co-Organizers: A. R. Place, A. Hines).

INVITED LECTURESHIPS:

Escola Superior de Biotechnologia
Universidade Catolica Portuguesa
Rua Dr. Antonio Bernardino de Almeida

4200 Porto, Portugal
"Lipid Biochemistry", 1993

FDA
"Molecular Biotechnology - A Short Course"
August and September, 1994
41 Ph. D.'s and B. A.

Bowie State University
Biochemistry 309 (Invitation of R. Poljak)
Two 2 1/2 hour lectures
10 undergraduates

Sea Grant Extension Course in Marine Biotechnology
"Stocks/Transgenics & Hormones/Reproduction"
12 Ph. D.'s.

UMBC
Department of Biology
Comparative Physiology (Invitation of T. Cronin)
Two hour lecture (1994-2003)
18 graduate students.

Virtue Aquaculture Course
Fall, 1999, Four one hour lectures. (Organizer: John Trant)
Fall, 2000, One two hour lecture ((Organizer: Karen Pitman)

INVITED SEMINARS:

Waksman Institute, Rutgers University; October, 1983.
University of Maine at Orono, 1986
University of Minnesota, 1987
University of Maryland Center of Marine Biotechnology, 1987
American Museum of Natural History 1988
University of Maryland's Marine Estuarine Enivornmental Sciences Seminar. " Topics in Marine Biotechnology". 1988.
Drexel University, 1988
University of Chicago, 1989
Chesapeake Biological Laboratory, 1989
Animal Sciences, University of Maryland, 1990
University of Delaware Marine Sciences, 1990
National Zoo, 1990
Horn Point Environmental Laboratory, 1991
University of Delaware, Department of Zoology, 1991
Princeton University, Department of Ecology and Evolutionary Biology, 1991
Virginia Institute of Marine Science, School of Marine Science, 1992
Keynote Speaker, The Martin Marietta Graduate Fellows Program, UMBC, 1992
University of Maryland, Baltimore County, Department of Biology, 1992
University of Maryland, College Park, Department of Poultry Sciences, 1993
Florida State University, Department of Biological Sciences, 1993

Monell Chemical Senses Center, 1994
Wake Forest University, 1994
Scripps Institute of Oceanography, 1994
San Diego Zoo, 1994
National Zoological Park, Department of Zoological Research, 1997
Darling Marine Center, University of Maine, 2001
Department of Natural Resources Science, University of Rhode Island, 2001
Mote Marine Laboratory, UJNR, (For Y. Zohar), 2001
Chesapeake Biological Laboratory, 2003, 2004, 2005 (Visiting Scholar)
Delaware State University, 2003
Virginia Institute of Marine Sciences, 2005
Hood College, 2005
University of North Carolina-Charlotte, 2007
University of Delaware, 2007
UMBI, Medical Biotechnology Center, 2008
University of Mississippi, School of Pharmacy 2010
Florida International University, 2011

TEACHING EXPERIENCE:

(At the University of Pennsylvania)

Biology 438 Comparative Animal Physiology (Spring 1981-1987) Average enrollment 15-25 students.
Biology 3 General Honors Introductory Biology C (Spring 1982-1987) Average enrollment 7-12 students.
Biology 558 Protein Chemistry (Fall 1983) Enrollment 45 students
Biology 526 Experimental Principles in Cell and Molecular Biology (Fall 1981-1986). Average enrollment 20 students
Biology 615 Biochemical Adaptation (Spring 1983) Enrollment 25 students.

(At The Johns Hopkins University)

Biology 20.665, Advanced Biochemistry and Molecular Biology (1988)

Undergraduate Independent Study Students

Michael B. Finkelstein 1981
Daniel Kohane 1981 Boston College Medical School
Sonja B. Potrebic 1984 Harvard Medical School
Brian Schwartz 1984 Syracus Medical School
Walter Merry 1985 Stanford University
Jeffrey Litton 1986
William DeLeon 1986 Tufts Medical School

(At the Center of Marine Biotechnology)

June Hall 1988, AB, Medical Technology
Mira Kautzky 1990, 1991 (Yale undergraduate, summer intern), 1993, Medical School
Ditina Raval 1991 (Dulaney Valley High School Junior)
SANDALS Research Internship Mentor
Nicole Hooker - Summer 1990,
Damien Lyles, Summer 1992,
Sheron Matthews, 1993,

Michelle Bianca, 1994, 1995,
Anna Hazard, 1997.
Natalie Alandar, Martin Marietta Graduate Fellow, 1992.
Pamela Terry, Martin Marietta Graduate Fellow, 1993.
Don Shaffer, Martin Marietta Graduate Fellow, 1994.
Don Shaffer, Martin Marietta Graduate Fellow, 1995.
Eric Meyers, Martin Marietta Graduate Fellow, 1995.
Don Shaffer, Sea Grant Fellow, 1996.
Erik H. Gorman, (REU Fellow) 1997
Ryan Hebert (REU Fellow) 1997, 1998, 1999, 2000
Michael Masucci (REU Fellow) 1997, 1998, 1999
Jonathan Leshin (REU Fellow) 1998
Rosemarie Woodall (REU Fellow), 1998, 1999, 2000
Raquel Gomes (International Intern), 1998-1999 **(Awarded Gulbenkian PhD Fellowship in Biomedicine)**
Viveca Murdock**,** Goucher College/BCCC Bridges Program **2001, 2002**
Allyson Cunningham, Sheron Thompson, Hampton College, Living Marine Resources Cooperative Science Center, Summer Intern, 2002
Patricia Caldwell, NSF Teacher Enhancement and Retention Program (TERP): Partnerships in Science Summer Intern, 2002.
Carol Riegelman, NSF Teacher Enhancement and Retention Program (TERP): Partnerships in Science Summer Intern, 2003
Reuwai Mount, NSF Teacher Enhancement and Retention Program (TERP): Partnerships in Science Summer Intern, 2003
Seth Kenton, Sherwood High School, Extended Professional Experiences in Research for Teachers (ExPERT), 2004
Kelly W. Garton, Walt Whitman High School, UMCES/Sea Grant Chesapeake Teacher Research Fellowship, 2005.
Belinda R. Hauser, UMES, Living Marine Resources Cooperative Science Center Summer Intern, 2005.
Nicole Wilson, UMES, Living Marine Resources Cooperative Science Center Summer Intern, 2005.
Jaivy Guillermo, Chesapeake Teacher Research Fellowship Program, Summer 2007
Antoinette Kennedy, Chesapeake Teacher Research Fellowship Program, Summer 2008
Sarah Ann Roi, Chesapeake Bay Teachers Research Fellowship, North County High School, 2009
Crystal Szczesny, Chesapeake Bay Teachers Research Fellowship, Lansdowne High School, 2009
Vincent J. Dominique III, UMES, Living Marine Resources Cooperative Science Center Summer Intern, 2009.
Michele Thompson, UMES, Living Marine Resources Cooperative Science Center Summer Intern, 2009.
Gordon Taylor, UMES, Living Marine Resources Cooperative Science Center Summer Intern, 2009.
Belita Nguluwe, UMES, Living Marine Resources Cooperative Science Center Summer Intern, 2009.

High School Independent Study Students:
Howard County Intern-Mentor Program, Justin Roman, Jonathan Leshin, 1997-1998.

Ryan Hebert (REU Fellow) 1997
Kristin Hunter-Cevera, 2001-2002, River Hill High School **Winner of five awards at the 47th Baltimore Science Fair, Award in Biodiversity Conservation Science, National Society of Black Engineers Achievement Award, United States Army Certificate of Achievement, United States Coast Guard Certificate of Appreciation, and 3rd Place in Division One, Biological Sciences.**
Johnathan Wilkes, 2002-2003, River Hill High School
LeShaywn Keyser, 2003, Ingenuity Program **Winner of the Commissions Officers US Public Health Department Health and Medicine Award at the Baltimore Science Fair at Towson University – Kwanis Association Sponsored, March 27, 2004.**
Justin Tibbels, 2004-6, Ingenuity Program. **Testified on behalf of UMBI to the State Legislature. February 10 & 13, 2006. Full scholarship to The Johns Hopkins University.**

GRADUATE STUDENTS:

(At the University of Pennsylvania)

Virginia Buechner 1982-1988 Master of Science.
Ronald Loser 1982-1985 Master of Science.
Daniel S. Roby 1982-1986 Ph. D. (Co-advisor with Robert Ricklefs)
Gonzalo Castro, (1984-1989) Ph. D. (Co-advisor with J. P. Myers)
Winner of the Best Student Presentation at Centennial Meeting of the Wilson Ornithological Society, Rosemont, Pennsylvania, 1988

(At the Center of Marine Biotechnology)

Jeyasuria Pancharatnam, 1990 - 1997, Ph. D. *"The Embryonic Brain Gonadal Axis in the Temperature-Dependent Sex Determination of Malaclemys terrapin, A Role for P450 aromatase"*

Winner of the Best Poster Award at the 1992 MBI Symposium

Eric D. Lund, 1990 - 1998, Ph. D. *"Aspects of Essential Fatty Acid Function in Growth and Reproduction of Striped Bass"*
Brian Johnstone, 1992, Ph. D. (Co-advisor with Fred. Singleton). Currently Research Scientist at Sangama BioSciences, Inc. Richmond, CA.
Paul Sievert, University of Pennsylvania (Primary Advisor - Bob Ricklefs) **Winner of the Best Poster Award at the 1992 ASZ Meeting, Vancouver, Canada, 1996, Ph. D.**
Joe Zurovchak, Rutgers, The State University (Primary Advisor - Ted Stiles), 1997, Ph. D. *"Nutritional Role of High Lipid Fruits in the Diet of Migrant Thrushes."*
Sureya Ozkizilcik, Virginia Institute of Marine Sciences (Primary Advisor - Fu-Lin Chui), 1996, Ph. D. *"Nutrition and Feeding in Striped Bass Morone saxatilis: Lipid and Fatty Acid Requirements and Microencapsulation."*
Susan Laessig, 1994-1997, MS. (Received Ph. D. from UMAB Toxicology Program) *"Exploring Steroid Metabolism and the Effects of Extrogen on Reproduction in Daphnia magna"*
Cassandra Moe, Ph. D. 1996-2001. *"Chitinase: The Vertebrate Side of the Story"*; **Second Prize Winner of the Best Poster Award at the 1996 MAES Meeting. Best Student Poster Award by the Division of Comparative Physiology of SICB, 1999**
Amanda Hannaford MS. 1999 *"Development of a narB probe for Synechococcus WH7803."* (Co-advisor with Jon Kramer)
Jonanthan Deeds, 1998 – 2003, Ph. D. Toxins And Toxicity From The Cosmopolitan, Bloom-Formimg Dinoflagellate *Karlodinium Micrum*

Awarded a COMB Graduate Fellowship , 1999-2000; Awarded a Student Travel Award to the Xth International Conference on Harmful Algae, October 21-25, 2002, St. Pete Beach, Florida, USA; Winner of the Best Student Presentation at the Xth International Conference on Harmful Algae, October 21-25, 2002, St. Pete Beach, Florida, USA

Qiong Jiang, 2001-2008 Ph. D. **Awarded a two year COMB Graduate Fellowship , 2001-2003. Winner of the Best Student Poster at The Sixth International Symposium on Fish Immunology, Turku, Finland May 25-29.**

Andrea L. Findiesen Allman, 2002-2006. MS **"Fiber Digestion in the Juvenile Blue Crab, *Callinectes sapidus* Rathbun".**

Xiaojun Feng, 2002 – 2009 Ph. D. "The Mitochondrial Genome of the Blue Crab (*Callinectes sapidus*), An Informative Genetic Marker for the Evolutionary Biology and Population Genetics of the Species".

Samala B. Lewis, 2002- 2003 MS, (Morgan State University Student) Co-Advisor with Wayne Coats, Living Marine Resources Cooperative Science Center Graduate Support, 2002 – 2004.

Jan Knouse, 2001-2002, Hood College, MS

Laura Nagle, 2004-2005. Living Marine Resources Cooperative Science Center Graduate Support, MS UMES.

(At the Institute of Marine and Environmental Technology)

Aaron Watson, 2008-2013, Ph. D.

Jerren Liu, 2008-present, Ph. D.

Shannon Roche, 2010-2012, Ph. D. (Withdrew)

Steve Rodgers, 2012-Present

Mary Larkin, 2014-Present

Saddef Haq, 2014-Present

Ammar Hannif, 2013-Present.

GRADUATE STUDENT COMMITTEE MEMBER:

Rebekah Marsh	MS.	Department of Biology, University of Nebraska at Omaha, 2001
Jason Adolf	PhD	Marine, Estuarine & Environmental Science (UMCES)
Sejong Ju	PhD	Marine, Estuarine & Environmental Science (UMCES), 2001
Colin Steven	MS	COMB, 2000
V. Vathiphandchai	PhD	COMB, 1999
Eric Odum	PhD	COMB, 1992-2004
Jared Ackers	Ph. D.	COMB, 2000-2001
Qian Wang	M.S.	COMB 2000-2003
Todd Miller	Ph. D.	COMB 1999-2005
Gang Wu	Ph. D.	COMB 2000-2002
Barbara Wilson	Ph. D.	2003 Department of Natural Resources Science, University of Rhode Island
Will Stein	M.S.	2003 Department of Biological Sciences, Simon Fraser University
Ian Voparil	Ph. D.	2003 University of Maine, Darling Marine Center
Jessica Hill	M. S. – 2001-2004, Multiple Mating in Blue Crabs (Callinectes sapidus) Assessed with Microsatellite Markers, Towson University	
Tsyr-Hue Chiou	Ph. D. 2001 – 2008, University of Maryland Baltimore County	
Vince Lovko	Ph. D. 2001 – 2008, VIMS	
Shanna Chambliss	M.S.	2006 – 2008, Delaware State University
Michael Bok	Ph. D. 2008 – Present, University of Maryland Baltimore County	
Kathryn D Feller	Ph. D. 2008 – Present, University of Maryland Baltimore County	
Adam Peer	Ph. D. 2006 – Present, UMCEES, Chesapeake Biological Laboratory	
Laura Belicka	Ph. D. 2003 – 2009, UMCEES, Chesapeake Biological Laboratory	

Katrina Pagenkopp Ph. D. 2008 – 2011 Present, VIMS

POST DOCTORAL FELLOWS

Sureya Ozkizilcik, 1996-1997; Current Position, Managing Director of TrouwYem AS, the Turkish subsidiary of Nutreco.
Moti Harel, 1997-2001; Current Position, Director of Aquaculture, Advanced BioNutrition, Maryland, USA
Rie Kazeto, 2000-2002; Current Position, Postdoctoral Fellow with John Trant
Tsetvan Bachvoraff, 2004- 2007, Postdoctoral Fellow. Current Position, Postdoctoral Fellow with Wayne Coats.
Jason Adolf, 2004-2008, Postdoctoral Fellow. Assistant Professor, University of Hawaii-Hilo.
Kristy Lidie, 2007-2009, Postdoctoral Fellow.
Holly Bowers 2008-2011, Postdoctoral Fellow.

VISITING SCIENTISTS

Attaya Kungsuwan, 1992, Department of Fisheries, Bangkok, Thailand.
Odi Zmora, 2001 –2003.
Gil Lumasag, Fulbright-Phillippine Agriculture Scholarship Program 2002-2003.
George Kissil, 2008-2009

DEPARTMENTAL ACTIVITIES:

(At the University of Pennsylvania)

Population Biology Search Committee, 1981
Curriculum Committee,1980-87
Long Range Planning Committee,1983-1984
Member and Chairman, Comprehensive Exam Committee,1981-84; 1984
Executive Committee Biology Graduate Group, 1985-87
Departmental Shop Co-ordinator, 1983-87
Departmental Microcomputer Co-ordinator, 1983-87

(At the Center of Marine Biotechnology)

Member of Curriculum Advisory Committee: 1988-1989
Organizing Chairman of the Seminar Series: 1988-1989
Co-Chairman of the Distinguished Lecture Series: 1989
Chairmen, Faculty Search Committee (Eukaryotic Position) 1989-1990 (Hired Rose Jagus)
Chairmen, Faculty Search Committee (Prokaryotic Position) 1989 -1990 (Hired Bob Belas)
Radiation Safety Officer: 1989-1990
Faculty Search Committee (Eukaryotic Position) 1990-1991 (Hired Yoni Zohar)
Faculty Search Committee (Prokaryotic Marine Molecular Biology Position) 1990-1991 (Hired Frank Robb)
Chairmen, Faculty Search Committee (Prokaryotic Molecular Biology Position) 1990-1991 (Hired Kevin Sowers)
Acting Director of Computer Facilities, Center of Marine Biotechnology, 1990-1993.
Acting Director, Information Resource Group, Maryland Biotechnology Institute, 1991-1993.
Promotion and Tenure Committee, 1991,1992,1996
Appointments Committee, Chairman, 1993-present

Director Search Committee, 1993-1994 (Hired Madilyn Fletchter)
Member, Faculty Search Committee (Transgenic Biologist's Position, hired Jim Du) 1996-1997
COMB's Space Committee, 1996-present
BASLab Use Committee, 1996-present
Computer Committee, Chairman, 1991-2007.
BasLAB Director, 2005-present.
Member, Faculty Search Committee (Aquaculture Microbiologist, hired Yossi Tal) 2007

(At the Institute of Marine and Environmental Sciences)

UNIVERSITY AND CENTER RELATED ACTIVITIES:

(At the University of Pennsylvania)

Member, Faculty of Arts and Sciences Computer Committee.
Member, Protein Chemistry Facilities Board.

(At the Center of Marine Biotechnology)

Co-Chairman, Organizing Committee, Molecular Evolution of Archaebacteria, Life at Edge, Fourth International Congress of Systematics and Evolutionary Biology Workshop, 1990.
Faculty Search Committee, Horn Point Environmental Laboratory, CEES (Nutritional Biochemist) 1990 -1991
Faculty Senate 1992-1994, 1995-1998
Faculty Search Committee, Chairman, Maryland Sea Grant ,(Biostatistican) 1990 - 1991
Faculty Search Committee, Horn Point Environmental Laboratory, CEES (Nutritional Biochemist) 1991-1992 (No candidate hired)
Chancellor's Commission on Mathematics and Science Teaching, 1992-1996
SIS Task Force Member, 1994-1996.
MEES Review Committee: Brian Bradley; Gian Gupta; Grant Gross; Larry Harding; George Helz; Debbie Morrin; Allen Place; Ivar Strand
Maryland Sea Grant Academic Advisory Committee 1998 to present.
UMBI Promotion and Tenure Committee 2003- 2009

Research Interests

My approach to biological research has always crossed traditional boundaries with a strong conviction in the "comparative approach", be it at the molecular, cellular, or organismal level. In essence, my laboratory war cry is *"Research Without Boundaries."* I believe our knowledge of biological processes is too strongly biased by our willingness to accept the rat, mouse, or cell line as "model systems."

The central question which drives my research is: "What are the fundamental structures and functions of living systems that can be adaptively modified to allow an organism to exploit the diversity of habitats we observe in nature?" Along these lines there are three major research problems that have molded my career. The first involves elucidating the mechanisms whereby enzyme function can be fine-tuned to the environment (as evidenced by allelic variants). The second involves the biochemical and physiological adaptations that allow the utilization of unique food sources. And the third involves elucidating the mechanisms responsible for sex determination.

Biochemical Adaptations to the Environment

For my doctoral research with Dennis Powers, I examined the functional significance of allelic variation in the lactate dehydrogenases from *Fundulus heteroclitus*, a nearshore minnow common along the eastern seaboard of the United States (***Place, A. R****. and Powers, D. A. 1978. Genetic Bases for Protein Polymorphism in Fundulus heteroclitus (Lin.) I. Lactate Dehydrogenase (Ldh-B), Malate Dehydrogenase (Mdh-A), Glucosephosphate Isomerase (Gpi-B), and Phosphoglucomutase (Pgm-A). Biochem. Genet.* ***16;*** *577-592.; Powers, D. A. and* ***Place, A. R.*** *1978. Biochemical Genetics of Fundulus heteroclitus (Lin.) I. Temporal and Spatial Variation in Gene Frequencies of Ldh-B, Mdh-A, Gpi-B and Pgm-A. Biochem. Genet.* ***16;*** *593-607; Powers, D. A., Greaney, G. S., and* ***Place, A. R.*** *1979. Physiological Basis for Allelic Selection: Lactate Dehydrogenase Genotype and Hemoglobin Function in Fundulus. Nature* ***277;*** *240-241;* ***Place, A. R.*** *and Powers, D. A. 1979. Genetic Variation and Relative Catalytic Efficiency: Lactate Dehydrogenase B Allozymes of Fundulus heteroclitus (Lin.). Proc. Natl. Acad. Sci. U.S.A.* ***76;*** *2354-2358).* This research area was extended in a short one year postdoctoral position with Bill Sofer working on the alcohol dehydrogenase variants in *Drosophila.* I took aspects of this research project to my new assistant professor position and established it as my first NSF grant at the University of Pennsylvania *(Benyajati, C.,* ***Place, A. R.,*** *Powers, D. A. and Sofer, W. 1981. Alcohol Dehydrogenase Gene of Drosophila melanogaster: Relationship of Intervening Sequences to Functional Domains in the Protein. Proc. Natl. Acad. Sci. U.S.A.* ***78;*** *2717-2721; Benyajati, C.,* ***Place, A. R.,*** *Wang, N., Pentz, E., and Sofer, W. 1982. Deletions at the Splice Sites in the Adh Gene of Drosophila . Nucleic Acids Res.* ***10;*** *7261-7272; Benyajati, C.,* ***Place, A. R.,*** *and Sofer, W. 1983. Formaldehyde Mutagenesis in Drosophila: Molecular Analysis of ADH-Negative Mutants. Mutation Res.* ***111;*** *1-7; Martin, P.,* ***Place, A. R.,*** *Pentz, E. and Sofer, W. 1985. UGA Nonsense Mutation in the Alcohol Dehydrogenase Gene of Drosophila melanogaster . J. Mol. Biol.* ***184;*** *221-229; Hollocher, H. and* ***Place, A. R.*** *1987. Re-examination of Alcohol Dehydrogenase structural mutants in Drosophila using protein blotting. Genetics* ***116****; 253-263; Hollocher, H. and* ***Place, A. R.*** *1987. Partial Correction of Structural Defects in Alcohol Dehydrogenase through Interallelic Complementation in Drosophila melanogaster. Genetics* ***116****; 265-274).*

While in the Biology Department of the University of Pennsylvania, I began interacting extensively with the ecologists especially Bob Ricklefs and his students. During this period I

became interested in the biochemical machinery responsible for digestion of unique food sources like wax esters which resulted in a new NSF funded research area *(Roby, D., **Place, A . R.** and Ricklefs, R. 1986. Assimilation and Deposition of Wax Esters in Planktivorous Seabirds. J. Exp. Zool. **239;** 29-41; **Place, A. R.** and Roby, D. A. 1986. Assimilation and Deposition of Dietary Fatty Alcohols in Leach's Storm-Petrel, Oceanodroma leucorhoa. J. Exp. Zool. **240;** 149-161; Ricklefs, R. E., **Place, A. R.** and Anderson, D. J. 1987. An Experimental Investigation of the Influence of Diet Quality on Growth Rate in Leach's Storm-Petrel. Amer. Naturalist **130**; 300-305; Diamond, A. W. and **Place, A. R.** 1988. Wax Digestion in Black-Throated Honeyguides Indicator indicator. The Ibis **130;** 558-561; Duke, G. E., **Place, A. R.** and Jones, B. 1989. Gastric Empyting and Gastronintestinal Motility in Leach's Storm-Petrel Chicks (Oceanodroma leucorhoa). AUK **106;** 80-85; Castro, G., Meyers, J. P., and **Place, A. R.** 1989. Assimilation Efficiency of Sanderlings (Calidris alba) Feeding on Horseshoe Crab (Limulus polyphemus) Eggs. Physiol. Zool. **62;** 716-731; Roby, D. D., Brink, K. L., and **Place, A. R.** 1989. Relative Passage Rates of Lipid and Aqueous Digesta In The Formation of Stomach Oils. AUK **106;** 303-313; **Place, A. R.,** Stoyan, N., Butler, R. G. and Ricklefs, R. R. 1989. The Physiological Basis of Stomach Oil Formation in Leach's Storm-Petrel, Oceanodroma leucorhoa. AUK **106;** 687-699; Jackson, S. and **Place, A. R.** 1990. Gastrointestinal Transit and Lipid Assimilation Efficiences in Three Species Of High Latitude Seabird. J. Exp. Zool. **255;** 141-154; Goulden, C. E. and **Place, A. R.** 1990. Fatty Acid Synthesis and Accumulation Rates in Daphniids. J. Exper. Zool. **256;** 168-178; **Place, A. R.,** Sievert, P. R. and Butler, R. G. 1991. The Volume Of Stomach Oils Increases During Pre-Fledgling Weight Loss In Leach's Storm-Petrel (Oceanodroma leucorhoa) Chicks. AUK **108;** 709-711; **Place, A. R.** 1992. Comparative Aspects of Lipid Digestion and Absorption: Physiological Correlates of Wax Ester Digestion. American Physiological Society, Fall Symposium, Comparative Intestinal Nutrient Transport. Amer. J. Physiol. **263;** R464-R471).*

Future Directions

Reduction in Fish Meal and Fish Oil Dependency in Feeds

Using a diet formulation (ARS plant based diet) developed by Rick Barrows at the Agricultural Research Service, Hagerman Fish Culture Experiment Station, Idaho we have successfully replaced the fishmeal and fishoil component of an aquaculture feed. The growth rate of cobia on this diet exceeds the fishmeal and fishoil diet. George Kissil was in our laboratory for six months helping with study. These findings were presented by Aaron Watson, a graduate student in the laboratory as three oral presentations at the recent World Aquaculture Meeting in San Diego.

The Chesapeake Bay's other Toxic Algae: Harmful Algae and Fish Kills

For decades, high densities of the dinoflagellate *Karlodinium micrum* have been associated with aquatic faunal mortalities worldwide. Recently we have described several toxic compounds (karlotoxins, KmTx) from *K. micrum*, both in the laboratory and in the field, with hemolytic, ichthyotoxic, and cytotoxic properties which may explain some of the observations associated with high densities of this organism. Our research has revealed substantial variability in toxin yields for different isolates (ca. 0.1 – 1 pg cell^{-1}). Moreover, samples collected during fish kills have contained 10-100 fold this amount on a per cell equivalent (10-12 pg cell^{-1}). We find that a geographic strain variation exists in the toxin produced among *K. micrum* populations from Southeastern estuaries of the United States. All *K. micrum* isolates and samples from the Chesapeake Bay contained KmTx1 while all strains from North Carolina to Florida

contained KmTx2. Cellular toxicity occurs through non-selective permeabilization of plasma membranes, leading to osmotic cell lysis. Susceptibility to karlotoxins is determined by membrane sterol composition, which also appears to underlie *K. micrum's* immunity from its own toxins. **It is our fundamental premise that *K. micrum* populations have an extensive variability in toxin production, both in terms of amount and type, and that karlotoxins are primarily produced to aid in prey capture.** The proposed work will pose the following questions:

- *Do environmental conditions and/or genotype modulate toxin production?*
- *Does genetic strain variation exist within and between populations of K. micrum, and does this genetic variation vary during bloom events?*
- *Do differences in the structure of KmTx1 and KmTx2 correlate with biological activity*

While we do not have a complete structure for a karlotoxin at this time, primarily due to +16 congeners recently discovered, we do have the following partial structures shown which clearly show it to be a polyketide. These structures were obtained from $^{13}CO_2$ enriched cultures producing KmTx 2 using ^{13}C NMR experiments in colloboration with Mark Hamann.

Deciphering the genomic organization of the dinoflagellate genome.

Taken together dinoflagellates are both important primary producers in oceans, estuaries, and lakes, and create environmental problems with disruptive and destructive blooms. Compared to most eukaryotes dinoflagellates have a number of aberrant features including large amounts of DNA , unusual DNA bases, the absence of nucleosomes and a proclivity for endosymbiosis. While most dinoflagellates are pigmented with the distinctive carotenoid peridinin, some dinoflagellates also harbor plastids derived from haptophytes, diatoms, green algae and cryptophytes. Since gene transfer is required for plastid retention, dinoflagellates would seem to have an active gene transfer mechanism. An example of gene transfer is that most organellar genes have been transferred to the nucleus with few genes retained in either the mitochondrial, or chloroplast genomes.

Because dinoflagellates have adopted so many different plastid types, they are assumed to have an effective gene transfer mechanism. Thousands of nuclear encoded genes are required to maintain a plastid, since most cyanobacterial genes have migrated from the plastid genome. In dinoflagellates, this process has proceeded to an extent not seen in other eukaryotes, with tens of genes retained on DNA minicircles thought to be relicts of the plastid genome rather than the hundreds of genes found in other plastid genomes. One hypothesis would be that dinoflagellates are able to incorporate foreign genes more easily because they have an gene expression system that is regulated differently from other eukaryotes. The logic behind this argument is that for gene transfer to be successful the gene has to not only be incorporated into the genome, but it also must be appropriately regulated and transcribed. If dinoflagellate gene regulation avoids promoters, a potentially significant barrier to gene transfer is removed. The apparent amplification of gene copies shown here suggests an inherent flexibility in the genome. Trans splicing provides a unified mechanism for incorporating mRNAs into the pool of translatable messages.

Our large scale NSF funded EST sequencing project of two dinoflagellate transcriptomes has shown that many genes are found as slightly different sequence variants implying that many copies of each gene are present in the genome. A PCR based approach was used to avoid problems with large insert libraries, and primers were designed using ESTs for 47 different genes representing many different expression levels. One primer set was oriented to amplify the genomic complement of the cDNA. The second primer set was designed to amplify between tandem repeats of the same gene. Each gene was also tested for the presence of a spliced leader oligonucleotide by using cDNA as a template. Remarkably almost all (17 / 19) of the highly expressed genes (i.e. those with high representation in the cDNA pool) were shown to be in tandem arrays with short intergenic spacers. Only one moderately expressed gene was shown to

be in a tandem array. A putative polyadenylation signal was found in genomic copies containing the sequence AAAAG at the exact site of polyadenylation and is conserved between species. Four genes were found to have a high intron density (>6 introns) while most either lacked introns in the amplified region, or had only one to three. The spliced leader was detected in the majority of genes that were present in the cDNA pool, and almost all tandem array genes were spliced. The actin gene was selected for deeper sequencing of both genomic and cDNA copies. Two clusters of actin gene copies were found, separated from each other by many non-coding features including intron length and synonomous substitutions. An intron rich gene containing a PolyKetide Synthase – Ketoyl Reductase domain (18 introns) was selected for genomic walking using inverse PCR. Upstream sequencing of almost two kb did not find another open reading frame.

The first glimpse of dinoflagellate genome structure suggests that there are two general categories of genes in dinoflagellates, a highly expressed tandem repeat class of genes and an intron rich, rarely expressed class of genes. This combination of features appears to be unique among eukaryotes, and provides some explanation for the oddities of the dinoflagellate nucleus. Our next plan of research is to sequence large genomic inserts (fosmids) to see if the same chromosomal arrangement of tandem repeated genes are found among different dinoflagellate species.

Bachvaroff, T. R., and Place, A. R. (2008) From stop to start: Tandem gene arrangement, copy number and splicing sites in the dinoflagellate Amphidinium carterae. PLos One 3(8):e2929

Transcriptomic and Proteomic analysis of toxic and nontoxic strains of K. veneficum

One of the goals for my recent research is to identify taxonomic biomarkers and/or potential toxin biomarkers between toxic and nontoxic K. veneficum, using two dimensional gel electrophoresis (2D SDS-PAGE) or LC-MS based proteomics.

Why proteomics? The whole of the proteins produced by the genome of a cell or an organism is the proteome. Proteins produced by an organism are often much more complex than the functional gene predicted from its genomic sequence, as a significant amount of proteins are produced through regulatory cascades and post-translational modification of proteins. Compared to genomics and transcriptomics (study of mRNA transcripts), cellular protein profiles (proteomics) will therefore, in greater details, provide the information on the actual metabolic activity of an organism at a given moment.

The proteome of an organism can be separated and visualized using such techniques as 2D SDS-PAGE and/or 2D LC-MS, which allows for the separation and comparison of several hundreds or more individual proteins from an organism. The 2-D gel patterns from different strains/species, or the same organism under different environments can be compared. Proteins of interest can be further identified via mass spectrometry or peptide sequencing. With rapid input of genomic data in GenBank in the past 5-10 years, proteomics has become an important post-genomic tool for understanding the complex biological functions occurred in an organism.

Proteomics of dinoflagellates. Procedures for protein extraction and precipitation, and 2D PAGE analysis have been optimized for several HAB species including thecate (e.g. Prorocentrum spp.) and non-thecate (e.g. Karenia spp.) dinoflagellates (Chan et al. 2004). Recently, 2D PAGE based proteomics has been applied to discriminate the protein expression profiles between toxic and non-toxic strains of Alexandrium minutum (Chan et al. 2005). Several proteins unique to toxic and nontoxic strains have been identified and characterized using mass spectrometry and N-terminal peptide sequencing. It was found that some of these protein spots might be isoforms of the same proteins (from the same gene) (Chan et al. 2005). Although proteomics has been widely used in prokaryotic and eukaryotic organisms, its application to dinoflagellates is still very limited. A major hurdle for studying dinoflagellate proteomics is the lack of genomic sequences from dinoflagellates. Dinoflagellates contain large nuclear genome (ca.

50-100 times of human genome size). However, we have recently complete the largest scale full length cDNA library characterization of two dinoflagellates (> 150K sequences).

Preliminary work

Recently, the protein profiles of a toxic strain (strain 2064) and a nontoxic strain (strain MD-5) of K veneficum were analyzed using 2D PAGE. Although these two strains are known to be identical in terms of their ITS sequences, their proteomic patterns were distinguishable on 2-D gels. The two images were compared using the Z3 proteomics software package. Although the software automatically detected 400-500 spots for each gel, a total of 282 spots were confirmed in both gels by eye examination. Among 282 spots, 204 spots were common to both strains, while 19 and 56 spots were unique to strain 2064 and MD-5, respectively. For the common spots, 49 spots were over-expressed for the toxic strain 2064, and 53 proteins were under-expressed for the toxic strain 2064. In our preliminary test, efficiency of protein extract could be low because no additional effort (e.g. sonication or pressure) was made to physically shear the cells. We expect that the number of protein spots will increase if the optimized procedures described by Chan et al. (2004) were applied. In addition, our preliminary 2-D gel analysis was analyzed on a gel with a wide pH range (pH3-10). The protein spots could be better separated if the gels with a narrower pH range (e.g. pH4-7) were used.

Objectives

To compare multiple strains of toxic and nontoxic strains of K. veneficum in order to achieve a better understanding on unique proteins from each group

To identify the proteins responsible for the regulation of toxin production

Protein Identification by Mass Spectrometry. Protein spots of interest will be manually excised from gels using Pasteur pipettes and digested as described by Mann et al. (Mann et al., 1996). Tryptic peptides will be analyzed both via MALDI-TOF and LC-MS/MS. MALDI spectra will be acquired on a Bruker (Billerica, MA) Biflex III MALDI mass spectrometer operating in reflectron mode with delayed extraction. External calibration will be performed using Calibration Mixture 2 from the Sequazyme Peptide Mass Standards Kit (Applied Biosystems, Foster City, CA). LC-MS/MS will be performed on a Micromass (Beverly, MA) Q-ToF Ultima API-US coupled to a Micromass capLC. Tryptic digests will be separated using both a C18 trapping column for washing and concentrating (LC Packings (Sunnyvale, CA) 300μm x 5mm C18) and a C18 analytical column for enhanced separation (LC Packings 180μm x 15 cm C18). The solvent system consisted of 95% 0.1% Formic Acid, 5% Acetonitrile for the aqueous phase and 95% Acetonitrile, 5% 0.1% Formic Acid for the organic phase. A 60/60 gradient (to 60% organic in 60 min) running at 1µl/min will be employed with most peptides eluting by ~30% organic. The LC eluent will be electrosprayed directly into the Q-ToF using the nanosprayer source. Data dependent scanning will be used with both MS and MS/MS spectra being acquired during a LC run. Spectra will be processed and deconvoluted using programs found with the Micromass operating system, MassLynx v. 3.5.

MALDI-TOF peak lists will be searched against protein sequence databases using the Matrix Science Mascot web interface (http://www.matrixscience.com/search_form_select.html) or against custom made databases using the EST libraries generated to date. Deconvoluted MS/MS spectra will be analyzed using a demonstration version of PeaksStudio 3.0 software (Bioinformatics Solutions Inc., Canada) for de novo sequence prediction. All sequences for each protein spot will be used as queries in MS-BLAST searches as described by Shevchenko et al. (Shevchenko et al., 2001) via the MS-BLAST web interface (http://dove.embl-heidelberg.de/Blast2/msblast.html).

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THE GENOMIC ENABLEMENT OF THE BLUE CRAB, Callinectes sapidus

Throughout its habitat, and particularly in the Chesapeake Bay, the fisheries for blue crab (Callinectes sapidus) are experiencing dramatic declines. The long-term management of blue crab populations in the Bay (and other habitats) must rely on a full understanding of the blue crab's basic biology, natural history and ecology, as well as assessing and remediating current problems. This ongoing, multi-institutional, collaborative project utilizes a multi-disciplinary approach to develop and evaluate the feasibility of replenishing wild stocks of blue crab on the East Coast and in the Gulf of Mexico. To date, consortium results on blue crab abundance and stock assessment indicate that Callinectes is a good candidate for the stock enhancement approach. Encouraging field releases of hatchery-raised crabs have led to recent efforts to mass-produce juveniles on a scale sufficient for stock enhancement. Partnerships with watermen and state agencies have been formed to develop mass-production facilities, as well as to educate and involve local stakeholders in the optimal fishery management.

The benefits of this integrated and multi-faceted approach are expected to be both immediate and long-term. Much information has already been transferred (through presentations, local press and facility tours) to the watermen and state fisheries managers. While the project is clearly focused on assessing and rectifying current regional problems associated with the decline of blue crab harvests, the underlying goal of developing state-of-the-art methodologies to be used in blue crab research and development, expanding our information base, and establishing shared databases is expected to result in better management practices on a national level and faster solutions to local issues that may arise in the future. We want to now bring this species into the 21st century by applying a genomics approach.

The long term goal of this project is to generate a resource for research and aquaculture scientists working at the molecular level with crustacean models (physiologists, endocrinologists evolutionists, etc). The initial goal was to discover the suite of genes expressed by the blue crab's neuroendocrine glands. Of greatest interest are the genes that may be involved in the control of molting and reproduction.

Normalized cDNA library construction:
Animals were collected from the Rhode River by SERC personnel and dissected on site. Fresh tissues were dissected from animals of mixed sexes, ages, and in various physiological conditions of molting and reproductive cycle. Tissues were stored in RNA-Later on ice, and mRNA was isolated using oligo-dT bound to a magnetic support. The SMART cDNA Library Construction Kit (Clontech) was used to generate each cDNA library from 1 μg of poly-A enriched RNA. The cDNA was normalized by denaturing the double stranded cDNA, allowed to partially re-hybridizing to itself, followed by a selective digestion of double-stranded DNA using a thermostable crab nuclease (Trimmer-Direct, EvrΩgen). The principle is base on the fact that abundant transcripts will re-hybridize much more readily than rare transcripts and thus be digested with a double-strand specific DNAse. The result is that highly and moderately abundant transcripts will be significantly reduced and rare transcripts will be relatively better represented. The cDNA was amplified, uni-directionally cloned into a pDNAr plasmid vector, and electroporated into JM109. The library was characterized for insert length and recombination efficiency. Resultant colonies were selected at random, grown overnight, plasmids isolated and the 5′-termini were sequenced using M13 forward primer. The remains of the plasmid prep not used for sequencing are systematically stored at -80°C for later retrieval. The sequence data was compared to available sequence databases (The Marine Genomics Project [www.marinegenomics.org], DOE JGI's porcelain crab EST database, and GenBank). Clones of immediate interest are being fully sequenced. Annotated sequence data will be posted on a searchable database maintained on the web by BCARC and COMB. Currently we have generated normalized libraries from the Y-organ, Neuroendocrine organs, and the hepatopancreas. We have sequenced 7392 randomly picked clones and obtained sequence from 6296 with an average read of ~750 bp. Of this nearly 4576 unique sequence were obtained. Nearly 20% of the sequences do not match anything in the current databases. We have found only 10 actin sequences and 5 arginine kinase sequences in the over 6000 sequences read.
Interesting genes found include crustacean cardioaction peptide, cryptocyanin, peroxinectin, pyroglutamyl peptidase I and peptide deformylase.

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INTRA-POPULATION BIODIVERSITY AND RECRUITMENT PATHWAYS FOR CHESAPEAKE BAY STRIPED BASS (MORONE SAXATILIS)

To demonstrate our ability to quantify intra-population genetic diversity in striped bass we determined the microsatellite genotypes for two annual young-of-year striped bass cohorts in the Paxtuxent River using 7 microsatellite markers. Observed and expected heterozygosity was 0.79 for all loci during both years , indicating that these loci would be very useful for large-scale genetic analyses such as those being proposed. All loci, except MSM1617 were in Hardy-Weinberg equilibrium (HWE). Finally, all loci except one from the 2006 year-class (MSM1617) showed low null allele frequencies (< 0.05) , again indicating that these loci would be quite useful for genetic analyses.

We have determined the mitochondrial genome sequence for Morone saxatilis including the control region and neighboring tRNAs. The consensus sequence for the striped bass (Morone saxatilis) mitochondrial genome consists of 17580 bps generated from 93 overlapping fragments. Sequencing consisted of >2x coverage with reads in both directions except for a stretch from base 3211-3272 which consisted of 3x coverage in a single direction. The entire genome has an AT percentage of 53.2 which was common for most regions except for the non coding stretches of the control region and tRNAs phenylalanine-GAA, glycine-UCC, arginine-UCG, histidine-GUG, and serine-AGA which were all above 60% AT. Orientation of all the traditional coding sequences is identical to that of Coreoperca kawamebari and is the canonical orientation in teleost fish. The only exception is the additional serine tRNA found in striped bass just downstream of the ND5 ORF which has not been reported in any other fish mitochondrial genome. This tRNA lacks the DHU arm and possesses the anti-codon AGA.

The extra serine tRNA is also the only coding sequence in a 352 base pair stretch between ND5 and the glutamic acid tRNA which is not found in other mitochondrial genomes. BLAST results of this region did not yield significant matches to other sequences, but a ClustalW alignment with the C. kawamebari mitochondrial genome resulted in 48.1% similarity to the 3' end of the 16S rRNA sequence. Normally the region of the mitochondrial genome downstream of ND5 is occupied by ND6. In striped bass the ND6 ORF has been transferred in it's entirety to the control region 200 base pairs from the T stretch and 105 base pairs from the first tandem repeat. Alignment of the ND6 sequence of striped bass to the published control region sequence of the European seabass Dicentrarchus labrax reveals a full ND6 sequence in this closely related species with 78.0% identity 194 base pairs away from the T stretch. Stop codons appear to occur in the coding sequence as a result of a pair of two base pair deletions in the D.labrax sequence. Whether this is a sequencing error cannot be determined from the published data.

Sibship Analysis

The second practical requirement for success in our proposed research is the ability to assign sibship relationships among samples of individual offspring based on molecular markers. We have successfully demonstrated this ability using juvenile striped bass collected in 2006 (n = 81) and 2007 (n = 83) at 12 different sites in the Patuxent River. The purpose of this analysis was to determine the degree of relatedness among individuals and the size of sibling groups that survived to the juvenile stage. We used KinGroup 2.0 (Konovalov et al. 2004), which performs pairwise likelihood calculations and determines Type I error rates to determine sibling relationships.

The 2006 striped bass year-class was extremely small and accordingly we analyzed individuals collected from seine samples conducted from June through August without regard to sampling date. Our analyses indicated that this group of individuals was composed of 49 significantly (all P > 0.05) related groups, six of which were composed of 3 to 4 full- and half-sibs. The remaining 43 groups were represented by 2 or fewer individuals. Unlike 2006, the 2007 year class was very strong.

Our expectation for this sample was that relatedness should be increased because our analysis was conducted on 83 juveniles collected on a single date in June from a restricted range of sites sampled. Sibship reconstruction on this group indicated there were 44 significantly related groups (all $P > 0.05$), nine of which were composed of 3 to 4 full- and half-sibs. Interestingly, related individuals were often found at the same or adjacent collection sites in the river during both years. More importantly however, the significant sibling relationships and the varying sizes of the sibling groups provides some evidence for the possibility of differential survival based on genotype of offspring, which may be tied to the phenotype of their maternal parent.

Parentage Assignment

To test our ability to correctly assign both eggs and larvae to candidate parents, we used eggs and larvae from eight wild female striped bass spawned at the Watha State Fish Hatchery.

Genetic Considerations During the Experimental and Expanded Phases of Blue Crab Stock Enhancement

Our most recent research effort involves COMB's Blue Crab Stock Enhancement program funded by NOAA. A responsible approach to marine stock enhancement requires that potential negative impacts upon the gene pools of wild populations be mitigated through the use of genetically sound breeding and release protocols. There are numerous ways in which cultured organisms can have a direct genetic impact on recipient stocks. The majority of genetic hazards may be grouped into three categories. *Type I genetic hazards* involve introduction of hatchery-mediated exogenous genes into native populations. The admixing of genetically divergent stock can break down local adaptations through introgression of maladapted genes or by disruption of co-adapted genomes, thereby affecting the fitness of the native stock. If the genetic stock structure in a candidate species has been characterized, genetic hazards associated with intraspecies introgression may be minimized through judicious broodstock source selection. *Type II genetic hazards* arise from genetic changes in a hatchery population, irrespective of the source of broodstock, that directly result from the processes of broodstock sampling, breeding, and rearing. Hatchery populations must usually be propagated over multiple generations without sufficient input from wild stock before experiencing the deleterious effect of inbreeding. The *Type III genetic hazards* results from the genetic swamping of natural populations through successful enhancement efforts. According to the Ryman/Laikre model reductions in effective population size (*Ne*), if severe, can result in substantial allelic and genotypic frequency changes over time and, depending upon future population abundance, excessive loss of genetic diversity. Inorder to adopt an effect broodstock selection approach, the genetic structure of *Callinectes sapidus* population must be assessed at the sites of enhancement.

This project has been the MS thesis work of Jessica Hill and the Ph. D. work of Xiaojun Feng. Jess has shown that the blue crab can have multiple dads which influence the performance of the offspring. Feng has show that the variation in the mitochondrial genome can be used to distinguish hatchery vs wild crabs in nature. See below.

Intrapopulation Biodiversity, and Recruitment Pathways for Chesapeake Striped Bass

With recent funding from Maryland Seagrant we are beginning to address three fundamental hypotheses relating to the importance of intrapopulation
biodiversity in spawning and early life history dynamics to the resilience of exploited natural resources using striped bass as a model population. The objectives are:

Objective 1: Does reproductive diversity influence recruitment potential?
Objective 2. Does phenotypic selection during early life cause the representation of maternal lines in the egg and juvenile stages to differ?
Objective 3. Do Striped bass early YOY undergo deliberate retentive or dispersive behaviors resulting in two broadly classified "contingents" corresponding to two modalities in nursery habitat use?

Along these lines we have determined the entire sequence of the striped bass mitochondrial genome. To our surprise, the entire Moronidae family exhibits a unique translocation of the NAD6 gene to the control region of the mitochondrial genome. This has been prepared for publication and will be submitted this summer.