Virginia Institute of Marine Science - Hampton University

Cooperative Marine Education and Research Program

Annual Report 2006

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VIMS
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

HAMPTON UNIVERSITY

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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Introduction

The Virginia Cooperative Marine Education and Research (CMER) Program was established in 2000 under an agreement signed between the National Oceanic and Atmospheric Administration, the Virginia Institute of Marine Science (VIMS), and Hampton University (HU). In addition to supporting the overall goals of NOAA and the Northeast Fisheries Science Center, this program is designed to facilitate interactions between a historically minority-serving university with an excellent undergraduate program (HU) and an established and focused program in marine science (VIMS).

Graduate education and research are at the core of the VIMS-HU CMER Program. The program has directly supported graduate student research projects in fields as diverse as tracking sea turtle movements in Chesapeake Bay, molecular systematics of billfishes, effects of feed enhanced with essential fatty acids on survival of larval fishes, the pathology of amoebic infections on blue crabs and American lobster, effects of global climate change on growth and mortality of surf clams in the mid-Atlantic Bight, and the economic impacts of regulating and managing northwest Atlantic fisheries. In addition, the CMER program has provided direct support for both the Diversity in Environmental and Marine Sciences (DREAMS) and the Hall Bonner Programs. The former is a joint effort between VIMS and HU faculty and supports undergraduate research projects for minority students that are traditionally under-represented in the marine sciences. The Hall-Bonner Program (centered HU) is designed to provide direct support for minority graduate student in the marine sciences, primarily at VIMS.

The VIMS-HU CMER Program is a truly interactive endeavor, with all parties contributing to the success of the program. Program direction and funding priorities are set by a coordinating committee consisting of representatives from VIMS, HU, and NOAA. The program is directed by a NOAA employee (Dr. Richard Brill) located on the VIMS campus. Dr. Brill holds affiliate faculty status in the VIMS Department of Fisheries Science, maintains an active research program, supervises graduate (VIMS) and undergraduate (HU) students, and teaches at VIMS.

The VIMS-HU CMER program has primarily received support through funds provided by direct Congressional appropriation to the NMFS Northeast Fisheries Science Center. Through FY 2005, funding to support graduate research projects at VIMS was $100,000 per year. Funding to support research which included undergraduates at HU was $50,000 per year.

FY 2005 Projects

The Influence of Land Use on Habitat Quality in the Hampton River, an Urbanized Estuary. Principal investigators: Robert A. Jordan, George P. Burbanck, and Eric A. Wooden, Department of Marine Science, Hampton University

The project is an essential fish habitat study being carried out by Hampton University undergraduate students applying fishery techniques, water quality monitoring and GIS

methodology to characterizing selected fish habitats in the Hampton River, an urbanized tributary of the Chesapeake Bay estuarine system. Data collected primarily during spring and summer are being used to produce a GIS database of shoreline types, subtidal features and water quality characteristics at the selected study sites. Hardened shoreline with no emergent vegetation, hardened shoreline with sparse emergent vegetation, and depositional shoreline with sparse emergent vegetation are the three-shoreline types that have been selected for comparison. Video monitoring and drop nets are being used to evaluate the nekton communities. Nekton collected with drop nets are enumerated and measured and habitats characterized and mapped. Analysis consists of comparing selected habitats in terms of urban influence and nekton utilization. Undergraduate research assistants are involved at all stages, from planning through completion. The results will contribute to evaluating the contribution of urbanized tributary estuaries to the productivity of Chesapeake Bay.

Energy density of common prey species of recreationally and commercially important marine fishes in Chesapeake Bay. Principal investigators: Robert J. Latour, Department of Fisheries Science, VIMS. Graduate student participant: Andrij Z. Horodysky, Kathleen McNamee VIMS.

A major hurdle to the successful implementation of ecosystem-based fisheries management within the Chesapeake is the lack of basic data on biomass, trophic interactions, and prey quality required to construct multispecies assessment models. This study is providing these necessary data by measuring the temporal and spatial variation in lipid content and energy density (KJ g^{-1}) of common prey species of recreationally and commercially important fish predators in Chesapeake Bay. Tracing energy flow in an ecosystem context is especially critical in coastal estuarine systems, where the synergistic effects of fishing pressure, anthropogenic stressors, and climatic variation impact population dynamics and trophic interactions. Identifying and quantifying mechanisms of energy flow resulting from food web interactions between multispecies predator and prey guilds are critical first steps towards combining ecosystem level processes and population level inferences.

Directed global climate in the middle Atlantic Bight: is this the cause of large scale mortality in the surf clam *Spisula solidissima*? Principal investigators: Roger Mann Department of Fisheries Science, VIMS; Associate PIs: James Weinberg NOAA-NMFS Woods Hole), Eric Powell (Rutgers University). Graduate student participant: Adriana Picariello, VIMS

The surf clam, *Spisula solidissima*, occupies a bathymetric range from the shallow subtidal to approximately 30-40 m along the eastern continental shelf of North America from Georges Bank to Cape Hatteras. Within the described latitudinal and bathymetric range it is a benthic dominant species (biomass estimated to exceed 1,148,000 MT) offering the only major structure in a bottom that is predominantly muds and sand, and occasional gravel. A recent and very dramatic reduction in species biomass has occurred off the mid-Atlantic coast, however. This study is investigating the hypothesis that with continued global climate change (i.e., warming) this

southernmost limit will be shifted both northward and into deeper water with a concomitant mortality of populations in the transitional zone of change. As a consequence, the surf clam may be caught in the vice of approaching warm water to the south and the immobility of the geology of the western North Atlantic to the north. Given the surf clams benthic dominant role, potential instability in community structure may well result from local extinction of surf clams in response to long-term directed climate change.

Dietary modulation of innate immunity to mycobacteriosis in striped bass (*Morone saxatilis*). Principal Investigator: Peter A. Van Veld, Department of Environmental and Aquatic Animal Health, VIMS. Graduate student participant: Danielle Johnston

Populations of Chesapeake Bay striped bass are currently experiencing an epizootic of mycobacteriosis that threatens an economically and ecologically important resource. Disease prevalence as high as 80% has been reported in striped bass collected from some tributaries and portions of the Bay. Currently, little is known regarding environmental, physiological or immunological factors contributing to the epizootic. In recent years, the Bay also has experienced a decline in abundance of menhaden *(Brevoortia tyrannus*) to record low numbers. Menhaden have historically represented a major, if not the major, food for striped bass in the Bay. The objectives of this study are to evaluate the effect of dietary fat intake and starvation on the anti-mycobacterial activities of striped bass serum, mucus and associated apolipoproteins. This project is, therefore, providing important information on the effect of dietary fat intake on the ability of the innate immune system to respond to pathogen challenge, and assessing directly the association between the decline of an important forage fish (menhaden) on susceptibility of striped bass to mycobacteriosis.

FY 2004 Projects

Specific identification of western north Atlantic scombrids: molecular marker development and application. Principal investigators: John E. Graves and Jan R. McDowell, Department of Fisheries Science, VIMS. Graduate student participant: Melissa Paine, VIMS.

Members of the family Scombridae (tunas, skipjack, bonitos, mackerels, etc.) are important components of pelagic ecosystems, and many species support large commercial and recreational fisheries throughout the world's oceans. The taxonomy and phylogeny of the scombrids have been extensively studied using morphological characters, and there are excellent morphological keys for the specific identification of adults. However, identification of early life history stages (eggs, larvae, and early juveniles) remains problematic. This project developed a molecular key for the identification of 18 species of common western North Atlantic scombrid fishes by focusing on sequence analysis of a mitochondrial gene region.

Effects of plankton composition and nutritional quality on growth of newly metamorphosed winter flounder. Principal Investigators: Kam W. Tang and Fu-Lin Chu, Department of Biological Sciences, VIMS, Deidre Gibson, Department of Marine Science, HU; graduate student participant: Adriana Veloza; undergraduate participants: Maiyai Taal, Calvin Peters, and Christopher Schweitzer

It is well documented that essential fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are critical for growth and development of larval and juvenile fish. This project tested the effects of nutritional quality of plankton, in terms of their protein and lipid contents, and essential fatty acid profiles, on the growth of newly metamorphosed winter flounder. The project showed that (1) heterotrophic dinoflagellates displayed different fatty acid profiles than the microalgae that they fed on, and (2) as trophic intermediaries, they upgraded poor quality microalgae and resulted in enhanced egg production in copepods. The project also included a field study in New Jersey estuaries designed to measure the plankton nutritional quality in the natural habitats of juvenile winter flounder. The field study, together with the laboratory experiments, provided detailed information on the nutritional and environment requirements of newly metamorphosed winter flounder. Results of this project are also helping resource managers identify essential habitat for newly settled juvenile winter flounder, providing the fishery industry important information on the nutritional requirement of juvenile winter flounder, and assisting aquaculturists to formulate optimal live feed for culturing juvenile winter flounder.

Directed global climate in the middle Atlantic Bight: is this the cause of large scale mortality in the surf clam *Spisula solidissima*? Principal investigators: Roger Mann Department of Fisheries Science, VIMS; Associate PIs: James Weinberg NOAA-NMFS Woods Hole), Eric Powell (Rutgers University). Graduate student participant: Adriana Picariello, VIMS

Loggerhead (*Caretta caretta*) Sea Turtle Behavior and Population Estimates in Virginia. Principal investigator: John Musick, Department of Fisheries Science, VIMS; Graduate student participant: Katherine Mansfield.

The VIMS Sea Turtle Research Program has used aerial surveys to determine relative abundance and seasonal distribution of animals found in Chesapeake Bay and coastal waters since the late 1980s. However, questions remain concerning the influence of sea turtle surfacing behavior on the aerial census data. The objective of this project was, therefore, to determine if there is a correlation between temperature and swimming/diving behavior and seasonal differences in these values. The resultant data has subsequently allowed the standardization of aerial survey methods thus preventing the overestimate sea turtle populations in the spring when water column temperatures are stratified.

Enhanced education and training of under-represented students in marine sciences through the Diversity in Research in Environmental And Marine Sciences (DREAMS) Program. Project directors: Kam Tang (VIMS) and Diedre Gibson (HU).

The overall objective of the DREAMS program is to enhance the education and researching training of under-represented students in marine sciences and to promote ethnic diversity in marine science higher education and the general marine science work force. The project is a collaborative program between Hampton University and the Virginia Institute of Marine Science and is intended to guide undergraduate students step-by-step toward academic excellence through enriching learning activities, rigorous research training, and strong mentoring. The 2004 CMER award was used to strengthen the DREAMS by supporting six Hampton University students. Three of these students have completed the program and are presently pursuing advanced degrees in environmental science (University of East Anglia, UK), marine geochemistry (University of South Carolina), and medical science (Wayne State Medical School). The award also allowed the other students to conduct intensive summer research at VIMS and to present their results at national conferences such as ERF and ASLO. This CMER award also allowed the DREAMS program to reach out to the broader Hampton University community and strengthen the link between DREAMS and the Hall-Bonner Program, a program serving underrepresented graduate students in marine science. The DREAMS and Hall-Bonner Programs co-organized a workshop for Hampton University students to improve their poster and oral presentation skills, as well as skills in scientific writing. These programs also developed a student forum at Hampton University where minority graduate students spoke to the undergraduate students about the graduate school experience, and encouraged them to pursue graduate degrees in marine science.

FY 2003 Projects

A Molecular Phylogeny of the Echeneoidea and an Investigation of Population Structuring within the Echeneidae. Principal Investigators: John E. Graves and Jan R. McDowell, Department of Fisheries Science, VIMS. Graduate student participant: Kurtis Gray

The purpose of this project was to develop a molecular phylogeny of the superfamily Echeneoidea, which includes the Echeneidae (remoras), Coryphaenidae (dolphin fish), and Rachycentridae (cobia) and to investigate the population genetic structure of *Remora osteochir*. The mitochondrial 12S rRNA, 16S rRNA, and NADH dehydrogenase subunit 2 (ND2) regions and the nuclear ITS gene region were analyzed to infer taxonomic relationships. In addition, sequences of the mitochondrial control region (D-loop) were analyzed to elucidate the population structure of *Remora osteochir*. The observed patterns were then compared to those of their istiophorid (billfish) hosts.

Effects of plankton composition and nutritional quality on growth of newly metamorphosed winter flounder. Principal Investigators: Kam W. Tang and Fu-Lin Chu, Department of Biological Sciences, VIMS, Deidre Gibson, Department of Marine Science, HU;

graduate student participant: Adriana Veloza; undergraduate participants: Maiyai Taal, Calvin Peters, and Christopher Schweitzer

Comparative pathology of amoebic infections in the blue crab and the American lobster. Principal Investigator: Jeff Shields, Department of Environmental and Aquatic Animal Health, VIMS; graduate student participant: Andrea Maniscalco

The American lobster and the blue crab are vital marine and estuarine resources, both supporting large fisheries with considerable economic importance. This project was designed to understand how amoebic infections damage these crustaceans and to provide data on the impacts of disease to resource managers. The project undertook a comparative pathological study of *Paramoeba perniciosa* infections in the blue crab with similar infections in the American lobster. The assessment of the pathology centered on differences between infections in the two host species and provided baseline histopathology data on *Paramoeba perniciosa* in blue crabs as well as comparative data for infections in lobsters.

Development and Testing of Specific DNA-Based Diagnostics for Detection of Sirolpidium zoophthorum, a Pathogenic Fungus in Bivalve Larval Culture. Principle investigators: Nancy A. Stokes, Eugene M. Burreson, Department of Environmental and Aquatic Animal Health, VIMS; graduate student participant: Delonna White

The fungus *Sirolpidium zoophthorum* is the causative agent of larval mycosis, which is responsible for infection and mortality in marine bivalve larval culture. Currently, the only means of diagnosis is microscopic examination of larvae, but thalli are not detectable until infections are advanced. The project developed a DNA-based diagnostics, PCR primers and DNA probes, specific for *S. zoophthorum* that will allow detection of early infections, so that control measures can be implemented within the hatchery. These new diagnostic tools are being tested for specificity and sensitivity with samples of larval cultures from Milford, CT (where the fungus is endemic) to investigate transmission dynamics in hatcheries.

National Standard Eight and Processing Labor: An Assessment of Processors in The Mid-Atlantic Region. Principle Investigator: James E. Kirkley, Department of Fisheries Science, VIMS; graduate student participant: Winifred Ryan

The objective of this study was to obtain information about processing labor dependency on fisheries subject to federal fishery management plans (FMPs); assess how changes in fishery regulations might affect labor; determine product levels and sources of raw materials required for processing fish and shellfish products; assess the distribution of sales by geographic region and market level; determine the level of employment and types of jobs in processing; assess the distribution of labor by gender, job or occupation, race, and national origin; determine the dependency of processing plants on H2B workers; assess how other types of regulations (e.g.,

land-use policies, environmental, and OSHA) may have affected processing activities; and assess the potential future plans of the processors. The results provided a broad overview of the processing sector in the Mid-Atlantic region.

FY 2002 Projects

Loggerhead (*Caretta caretta*) Sea Turtle Behavior and Population Estimates in Virginia. Principal investigator: John Musick, Department of Fisheries Science, VIMS; Graduate student participant: Katherine Mansfield.

Molecular Systematics of the Billfishes (Istiophoridae and Xiphiidae). Principal investigators: John E. Graves and Jan R. McDowell, Department of Fisheries Science, VIMS. Graduate student participant: Kurtis Gray

Several taxonomic questions remain regarding the relationships within the billfishes (Istiophoridae), including the actual number of species compromising with genus *Tetrapturus* and the designation of the white marlin (*T. albidus*) and striped malin (*T. audax*) as separate species. This project analyzed both mitochondrial and nuclear gene sequences to address these questions and investigate the alpha and higher level relationships of the Istiophoridae.

Black sea bass biology and population dynamics. Principal investigators: Deborah Bodolus, Department of Marine Science, HU; John Musick, Department of Fisheries Science, VIMS. Graduate student participant: Roy Pemberton.

Little is known about the mechanisms that control sex-reversal in black sea bass or the level of sexual imbalance that can be sustained by the population before it becomes reproductively unstable. The goal of this project was to look at the current age and size structure of the population and compare its stability to previous studies done in the 1970's when the population was not over-fished. This project also provided funding support for the training of four Hampton University undergraduate students in Fisheries Science. Students were able to work on the project during the summer and then continue their training and involvement during the subsequent academic year.

Habitat use of Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus* in the James and York Rivers. Principal investigator: John Musick, Department of Fisheries Science, VIMS. Graduate student participant: Daniel Ha.

The population of sturgeon in Virginia waters is far below historic levels due to overfishing and environmental degradation in spawning and nursery areas. It was the objective of this project to provide information on the small scale movement patterns, home range size, and habitat utilization of sturgeon critical to the management and recovery of this species.

Programming modules for the NMFS toolbox. Principal investigators: John M. Hoenig and Daniel A Hepworth, Department of Fisheries Science, VIMS.

This project provided improved techniques for virtual population analysis (VPA) under the NMFS Toolbox program, including: moment-type estimators of total mortality rate based on mean length, length-converted catch curves, length-based pseudo-cohort analysis, and projections of populations and catch characteristics under new levels of fishing mortality.

Project to determine pot designs that reduce the risk of sea turtle entanglement, and their relative efficacy at capturing targeted whelk species. Principal investigators: John Misick and Richard Brill, Department of Fisheries Science, VIMS. Graduate student participant: Meredith Fagan.

The whelk pot (or "conch pot") fishery may well pose a threat to the seasonal population of loggerhead turtles both in the Chesapeake Bay and the continental shelf area immediately off shore due to the risk of entanglement in the gear. This project was aimed at determining if newer pot designs are "safer" (i.e., present a lower risk of turtle entanglement) than traditional designs; and measuring the efficacy of newer pot designs at capturing the targeted whelk species, relative to traditional designs.

Impact Estimates by the Mid-Atlantic I/O Model. Principle Investigator: James E. Kirkley, Department of Fisheries Science, VIMS.

The Mid-Atlantic input/output (I/O) model was used to estimate economic impacts related to Mid-Atlantic regional fishery landings in 1998 and 2002. For 1998, the Mid-Atlantic total regional impacts of commercial landings for the commercial fishing and seafood industries included 10,392 FTE jobs, $484 million in labor income and $1.3 billion in output by regional businesses. These impacts occurred throughout the six-state region.

FY 2001 Projects

Essential fish habitat of juvenile Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus* inVirginia. Principal investigator: John Musick, Department of Fisheries Science, VIMS. Graduate student participant: Daniel Ha.

The population of sturgeon in Virginia waters is far below historic levels due to overfishing and environmental degradation of spawning and nursery areas. It was the objective of this project to provide information on the small scale movement patterns, home range size, and habitat utilization of sturgeon critical to the management and recovery of this species.

Spatial and temporal distribution of newly-settled juvenile tautog (*Tautoga onitis*) from the lower Chesapeake Bay and seaside Eastern Shore south of Wachapreague, VA. Principal investigator: Deborah Bodolus, Department of Marine Science, HU.

This study proposed to develop data on relevant biological and fishery parameters necessary for effective management of tautog by determining spatial and temporal patterns of juvenile tautog settlement in the lower Chesapeake Bay and the seaside portion of the eastern shore south of Wachapreague, VA. Data were also collected on age, time of settlement, growth and stomach contents.

Enhanced tautog (*Tautoga onitis*) survival via essential fatty acid enrichment of larval feed. Principal investigator: Fu-Lin Chu, Department of Biological Sciences, VIMS. Undergraduate student participants: Mariah Love and Alisha Acy, HU.

The objective of this project was to test the efficacy of the enhancing the survival of larval tautog via essential fatty acid enrichment of rotifers using three species of algae.

Population structuring of western Atlantic fishes: the relative genetic isolation of Burmdian shorefishes. Principal investigators: John E. Graves and Jan R. McDowell, Department of Fisheries Science, VIMS. Graduate student participant: Kelly Johnson.

Sequence analysis of the mitochondrial control region and the nuclear ITS1 region was performed to investigate the question of Bermudian phylogeography in seven species of common tropical shorefishes. Mitochondrial control region divergence values corresponding to mean divergence times of 2,000 to 21,500 years suggested some species colonized Bermuda following the last glacial period 18,000 years ago, where as other species appear to have colonized during an interglacial warming period approximately 120,000-130,000 years ago. Other results suggested that the origin of Bermudian colonists does not lie in the Caribbean, but in populations along the southeastern Atlantic coast of the United States.

Assessing the economic impact of regulating and managing northwest Atlantic fisheries: An input/output framework for estimating the economic impacts in the mid-Atlantic Region. Principle Investigator: James E. Kirkley, Department of Fisheries Science, VIMS. Graduate student participants: Tara Scott and Winnifred Ryan

This project developed input/output (economic impact) models of mid-Atlantic fisheries to support NMFS regulatory impact requirements. It also facilitated analysis of economic impacts, in terms of changes in sales or output, income, and full-time employment, associated with fisheries management and regulation.

Evaluating three methods for estimating gear efficiency of towed dredges: When do the patch, criss-cross, and zipper methods work? Principle Investigator: John Hoenig, Department of Fisheries Science, VIMS

The setting of catch quotas for some shellfish stocks is done on the basis of an intended mortality rate. The process involves estimating an index of abundance from a dredge survey and then dividing by an estimate of the gear efficiency to obtain an estimate of standing stock. This allows the managers to estimate what quota will result in a given fraction of the population being harvested. For sea scallops, the process was contentious because of uncertainty in the efficiency of the dredge. This project proposed two new approaches to estimating efficiency and proposed evaluating a third method by simulation.

Adding methods to the FACT software package. Principle Investigator: John Hoenig, Department of Fisheries Science, VIMS

This project added length based, transitional Z, and pseudo-cohort analysis assessment tools to FACT toolbox software package.

FY 2000 Projects

Population Structuring of Western Atlantic Fishes: The Relative Genetic Isolation of Bermudian Populations. Principal investigators: John E. Graves and Jan R. McDowell, Department of Fisheries Science, VIMS. Graduate student participant: Kelly Johnson.

Analysis of Marine Recreational Fisheries Statistics Survey Data on Subsistence Fisheries in the Northeast Region. Principle Investigator: Thomas J Murray, VIMS

Development of Length-based Stock Assessment Tools. Principle Investigator: John Hoenig, Department of Fisheries Science, VIMS

Spatial and temporal distribution of newly-settled juvenile tautog (*Tautoga onitis*) from the lower Chesapeake Bay and seaside Eastern Shore south of Wachapreague, VA. Principal investigator: Deborah Bodolus, Department of Marine Science, HU.

Graduate degrees received by students supported under the VIMS-HU CMER Program

Kelly Johnson. 2003. A genetic analysis of the intraspecific relationships of tropical marine shorefishes common to Bermuda and the southeastern Atlantic coast of the United States. M.S. Thesis, VIMS

Winnifred Ryan. 2004. Socioeconomic effects of area management and the potential for community-based co-management. Ph.D. dissertation, VIMS

Kurtis Grey. 2005. A molecular phylogeny of the Echeneoidea (*Perciformes: Carangoidei*) and an investigation of population structuring within the *Echeneidae*. M.S. Thesis, VIMS.

Andrea Maniscalco. 2005. Eye pathologies found in several decapod crustaceans. M.S. Thesis, VIMS.

Tara Scott. 2005. An economic assessment of reducing incidental capture of sea turtles in the Northwest Atlantic Pelagic Longline fishery. M.S. Thesis, VIMS.

Adriana Veloza. 2005. Transfer of essential fatty acids by marine plankton. M.S. Thesis, VIMS

Katherine Mansfield. 2006. Sources of mortality, movements and behavior of sea turtles in Virginia. Ph.D. dissertation, VIMS

Melissa Paine. 2006. A molecular technique for specific identification of Western Atlantic Ocean scombrids and an analysis of a larval scombrid assemblage off the Kona coast of Hawaii. M.S. thesis. VIMS

Adriana Picariello. 2006. The effects of climate change on the population biology of the Atlantic surf clam, Spisula solidissima, in the Middle Atlantic Bight. M.S. Thesis, VIMS

Conference Presentations by CMER Program-supported students:

Veloza, A. Food quality in marine ecosystem: The role of fatty acids", CMER Annual Meeting, Virginia, March 2004.

Taal, M. The effects of trophic upgrading on egg production rate and egg hatching success of the copepod *Acartia tonsa*", ASLO Summer Meeting, Georgia, June 2004.

Veloza, A. Trophic transfer of essential fatty acids by heterotrophic protozoans", Atlantic Estuarine Research Society Fall Meeting, New Jersey, October 2004.

Taal, M. Trophic modification of food quality by heterotrophic protists: species-specific effects on copepod egg production and hatching", DREAMS research seminar, Hampton University, October 2004.

Mansfield, K. Sea turtle surfacing behavior and aerial census: how seasonal turtle "sightability" affects juvenile density estimates in Virginia. 25th Annual International Symposium on Sea Turtle Biology and Conservation in Savannah, GA., 2005.

Paine, M. Application of molecular markers for identification of Scombrid larvae off the coast of Hawaii". American Fisheries Society annual meeting, Anchorage, Alaska September 2005

Pemberton, R. A. The reproduction and demopgraphics of black sea bass in the Mid-Atlantic Bight. American Fisheries Society annual meeting, Anchorage, Alaska September 2005

Veloza, A. Trophic modification of essential fatty acids by heterotrophic protists and its effects on the fatty acid composition of the copepod *Acartia tonsa*". Estuarine Research Federation Conference, October 2005.

McNamee, Kathleen. Estimating caloric intake by diseased and non-diseased striped bass (*Morone saxatilis*) in Chesapeake Bay. American Fisheries Society Annual Meeting. Lake Placid, NY. September 2006.

Pemeberton, R.A. The reproduction and demographics of black sea bass in the Mid-Atlantic Bight: the fisheries perspective. American Fisheries Society annual meeting, Lake Placid, New York. September 2006.

Picariello, M, R. Mann and J. M. Harding. 2006. The effects of climate change on the distribution and growth of the Atlantic surf clam, Spisula solidissima. National Shellfisheries Association, May 2006.

Awards to CMER-sponsored graduate students:

Katherine Mansfield, Environmental Protection Agency - Science To Achieve Results (STAR) Doctoral Research Fellowship, 2001-2004.

Katherine Mansfield, National SEASPACE Scholarship; Houston Underwater Club; 2004 to 2005.

Adriana Veloza, Sigma-Xi GIAR award, Title: "Trophic Upgrading in Marine Food Webs", 2004.

Adriana Veloza, Hispanic Scholarship Fund Scholar 2003-2004.

Maiyai Taal, ASLO-SAML Outstanding Student Presentation Award (4th place), 2004.

Kurtis Grey, Best Student Poster at annual meeting of the American Society of Ichthyologists and Herpetologists, 2005.

Katherine Mansfield, John M. and Marilyn Zeigler Student Achievement Award, VIMS, 2005.

Katherine Mansfield, Runner-Up, Best Student Poster (Conservation), 25th Annual International Symposium on Sea Turtle Biology and Conservation in Savannah, GA., Title: Sea turtle surfacing behavior and aerial census: how seasonal turtle "sightability" affects juvenile density estimates in Virginia. 2005.

Adriana Veloza, ERF conference "Top 50 Students" award, 2005.

Adriana Veloza VIMS Best Student Paper for: Veloza AJ; Chu F-LE, Tang KW. Trophic modification of essential fatty acids by heterotrophic protests and its effects on the fatty acid composition of the copepod *Acartia tonsa*. Mar. Biol. 148: 779-788, 2005

Katherine Mansfield, National SEASPACE Scholarship; Houston Underwater Club. 2005-2006,

NOAA reports, contract reports and Technical Memorandums:

Mansfield, K. L. and J. A. Musick. 2005. Sea Turtle Surfacing Behavior and Aerial Census: How Seasonal Turtle 'Sightability' Affects Juvenile Density Estimates in Virginia. In: Proceedings of the 25th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Tech. Memo.

Kirkley JE, McCay B, Oles B, Ryan W, Takahashi S, Weisman W. National Standard Eight and Processing Labor: An Assessment of Processors in The Mid-Atlantic Region. NOAA/CMER.

Kirkley JE, Ryan W, Duberg J. Assessing the Economic Importance of Commercial Fisheries in the Mid-Atlantic Region: A User's Guide to the Mid-Atlantic Input/Output Model. NOAA/CMER.

Publications in the peer reviewed literature:

Maniscalco, A.M. and J.D. Shields. 2006. Histopathology of idiopathic lesions in the eyes of *Homarus americanus* from Long Island Sound. Journal of Invertebrate Pathology 91: 88-97.

Maniscalco AM, Shields JD. Histopathology of idiopathic lesions in the eyes of *Homarus americanus* from Long Island Sound. J. Invert. Pathol. 91:88–97.

Tang KW, Taal M. Trophic modification of food quality by heterotrophic protists: species-specific effects on copepod egg production and egg hatching. J. Exp. Mar. Biol. Ecol. 318:85–98.

Veloza AJ; Chu F-LE, Tang KW. Trophic modification of essential fatty acids by heterotrophic protests and its effects on the fatty acid composition of the copepod *Acartia tonsa*. *Mar. Biol.* 148: 779-788.