



**Performance Report for Cooperative Agreement No: NA11SEC4810002
for the Period from July 1 to December 31, 2011**

University of Maryland Eastern Shore

Living Marine Resources Cooperative Science Center

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Executive Summary

The mission of the Center is “*To develop exemplary academic and research collaborations that prepare a diverse student body for careers in marine and fisheries sciences*”. Established in October, 2001, the LMRCSC was created as a cooperative agreement between NOAA Educational Partnership Program (NOAA EPP), the University of Maryland Eastern Shore (UMES), Delaware State University (DSU), Hampton University (HU), Savannah State University (SSU), the University of Miami (UM/RSMAS) and the University of Maryland Center of Marine Biotechnology now known as University of Maryland Center for Environmental Science Institute of Marine and Environmental Technology (UMCES-IMET). Oregon State University (OSU) was added to the consortium in 2011. UMES is the lead institution of the consortium.

The mission of the LMRCSC is accomplished by addressing the following goals:

Goal 1: *Prepare the future workforce for marine and fisheries sciences*

Goal 2: *Strengthen collaborations across universities to enhance academic programs in marine and fisheries sciences*

Goal 3: *Develop an exemplary capacity for scientific collaborations among partner institutions in the fields of marine and fisheries sciences*

The Center continues to be guided by two management tracks, A) Administrative and B) Programmatic. The Administrative component includes the Center Director, Program Manager, Executive Committee, Center Core Administration and the Board of Visitors, whereas the Programmatic component includes the Technical Advisory Board that reviews proposals submitted annually to the Center for funding.

To accomplish Goal 1, the Center hired two new staff using leveraged funds to assist in student recruitment, recruited 20 new students, and provided direct financial support to six MS students who received training in NOAA core science disciplines during this reporting period. This is in addition to 146 students supported by the Center using funds from the previous LMRCSC award from NOAA EPP under a no-cost extension agreement or through leveraged funds. Besides, more than 30 students who did not receive direct support from the Center benefited from center programs and infrastructure. Three students graduated (1 BS, 1 MS, 1 Ph.D.) from the Center during this reporting period, whereas eighteen (18) students interned at NOAA labs or labs of LMRCSC partner institutions. The Center also engaged the services of an external consultant with expertise in education, who conducted a Teaching Assistant Workshop that was attended by about 30 students, including LMRCSC and non-LMRCSC supported students. Furthermore, the Center linked students to professional networks and employment opportunities in marine and fisheries science by providing support for them to attend scientific meetings such as the 2011 American Fisheries Society where fifteen (15) center students presented results of their research work. One HU LMRCSC graduate was employed as a Fisheries Observer at the NOAA Alaska Fisheries Science Center.

In order to maintain a pipeline of students into the marine sciences, the Center began planning for activities that will be conducted in summer 2012 for students in grades K-12. Similar activities and programs conducted in summer 2011 collectively impacted more than 1000 students, including the Coast Camp for Youth at Savannah State University, CREST-CISCEP SEEL program at UMES, and the SciTech program at IMET in which 1000-2000 Baltimore area high school students participate annually, the Upward Bound Marine and Estuarine Science Program at UMES that reaches 25 high school students and activities in marine science conducted at local schools by LMRCSC faculty and graduate students.

To accomplish Goal 2, the Center used the Virtual Campus for curriculum development and seminars and expanded it to include courses which were offered online between Center partners and to students including a NOAA NEFSC contractor and a NOAA employee located in Woods Hole, MA enrolled in the Professional Science Master's (PSM) degree program at UMES. Seminars and several courses offered through the University of Maryland interactive video network (IVN) were made available to Center students during this reporting period. More than 29 NOAA scientific and administrative personnel were engaged in LMRCSC education and outreach, scientific research and administrative functions. For example, Dr. David Tomberlin (NOAA Headquarters, Silver Spring, MD) participated in teaching Risk and Decision Analysis for Natural Resources Management in fall 2011. Three courses (Fish Ecology, Risk and Decision Analysis in Natural Resources Management, and Fishery Survey Sampling) that are part of the “essential curriculum” recommended by NOAA Fisheries for training fisheries scientists were offered to students at the Center during fall 2011 semester. Plans were also

concluded for Marine Population Dynamics, and Bayesian Statistics to be taught in spring 2012 by Drs. David Die (RSMAS) and Elizabeth Babcock (RSMAS) using GoToMeeting. The Articulation Agreement document signed by six LMRCSC partners has led to cross registration between partners for these courses.

Eighteen (18) students including five graduate students in the PSM program at UMES interned at NOAA Science labs during the reporting period. Additionally, planning was conducted via a conference call between the LMRCSC (Brad Stevens and Andrea Johnson) and NOAA NEFSC (Vince Guida and Chuck Byrne) for the NOAA LMRCSC Winter Cruise to be held in January 2012. The purpose of the cruise is to provide at-sea experience to scientific personnel, graduate and undergraduate students of the LMRCSC, conduct research related to impacts of climate change on distribution of megafauna, and assess abundance of monkfish and red crabs in deep waters of the north Atlantic. Six LMRCSC graduate students signed up to participate in the cruise.

The LMRCSC continued its Seminar Series during this reporting period by featuring presentations by three LMRCSC scientists from UMES, HU and OSU. These seminars were made available to students and scientists at the Center using the Virtual Campus technology.

In support of Goal 3, twelve (12) collaborative projects were funded by the LMRCSC for 2011-2012 following the review of 18 proposals by the TAB, and are currently underway. These collaborative projects address various aspects of NOAA's Next Generation Strategic Plan Goal (NGSG): "*Healthy Oceans - Marine fisheries, habitats, and biodiversity sustained within healthy and productive ecosystems*", and objectives: (1) Improved understanding of ecosystems to inform resource management decisions, (2) Recovered and sustained marine and coastal species, (3) Healthy habitats that sustain resilient and thriving marine resources and communities, and (4) Sustainable fisheries and safe seafood for healthy populations and vibrant communities. They also address some of the goals, objectives and priorities listed in NMFS 2007 Strategic Plan for Fisheries, such as Seafood safety (e.g. Organic contaminants in monkfish, *Lophius americanus*), research on Abundance and Life History of fish stocks (e.g. Development of *in-situ* assessment and observation methods for black sea bass, *Centropristis striata*), sustainable and environmentally sound aquaculture through the development of alternative feeds such as plant-based proteins (e.g. Taurine – the missing ingredient for development of fish free diets for aquaculture), and impacts of anthropogenic factors and environmental change on species (e.g. Temperature preference of Atlantic Croaker under normoxic and hypoxic conditions). The on-going and future research projects at the Center are intended to meet the mission of NOAA Fisheries: "*Stewardship of living marine resources through science-based conservation and management and the promotion of healthy ecosystems*". The TAB and NOAA scientists' involvement also ensures that the LMRCSC has a strong linkage with the mission of NOAA: "*To understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social and environmental needs*".

The following are highlights of the results obtained for some of the TAB projects funded last year and have just been funded for the second year. The development of *in-situ* assessment and observation methods for black sea bass, a commercially important species, will allow for better understanding of the meaning of trap CPUE and how it relates to fish abundance, which will allow managers to interpret CPUE and landings data with greater accuracy. A major objective of NMFS is to develop alternate feeds for aquaculture. The study dealing with taurine as an ingredient in the development of fish free diets is helping to establish the minimum taurine requirement and its effects at different inclusion levels for many commercially important fish species. Taurine plays a major role in allowing the reduction and elimination of fishmeal from fish diets. Thus results from this study are useful for greatly enhancing the ability of the aquaculture industry to increase global fish production. Finally, the study on temperature preferences of Atlantic croaker under normoxic and hypoxic conditions has yielded some preliminary data that are useful for evaluating the effects of anthropogenic stressors and habitat degradation on habitat use and residency of scianids.

In the current reporting period, LMRCSC students and faculty made 37 presentations (oral and poster) at scientific meetings (28 of which were made by students), and published 13 articles in refereed journals, 5 of which were authored or co-authored by students or graduates of LMRCSC. An additional 7 articles were accepted for publication or are in press. Through its research activities in living marine resources the Center is addressing NOAA Fisheries mission goal, to: "*protect, restore, and manage the use of coastal and ocean resources through an Ecosystem Approach to Management*".

A total of \$2,492,003.01 was collectively awarded in grants to the LMRCSC institutions during this reporting period, which has directly impacted and will continue to have positive impacts on Center activities. These funds enhanced LMRCSC research through support of its faculty and students and by development/enhancement of infrastructure. Twelve (12) grant proposals totaling \$8,170,439.92 were submitted to funding agencies during the current reporting period.

The foregoing indicate that the LMRCSC educational, research and outreach activities are addressing three of the five essential activities NOAA has identified as being important for the success of its mission: (i) "*developing, valuing, and sustaining a world-class workforce*", (ii) "*ensuring sound, state-of-the-art research*", and (iii) "*promoting environmental*

literacy". Thus, the Center is making significant contributions to the training of a diverse body of students in NOAA related STEM disciplines that will help increase the competitiveness of the U.S. in global economy. The table below summarizes some of the LMRCSC accomplishments during this reporting period.

Summary of LMRCSC Performance Measures of Success (Education and Outreach Programs) for 2011 - 2012

	Proposed in the Implementation Plan	Accomplished (July. 1 – Dec. 31, 2011) 6 months
Activities/Programs	2011 - 2012	2011 - 2012
# K-12 Students participating in NOAA related science activities	1000	>500
# of students trained in NOAA related Sciences	84	>50
# B.S. Students who graduate in NOAA core Sciences	24	1
# M.S. Students who graduate in NOAA core Sciences	9	1
# Ph.D. Students graduating in NOAA core Sciences	4	1
# of internships at NOAA/other labs.	33	18
# of Courses to be offered via Virtual Campus or online	5	6
# of expected enrollments in each course	5–10	Average = 5
# of short courses to be offered at the Center during the summer	2	0
# of expected enrollments in each short course	5–10	N/A
Establish a B.S. degree concentration in Environmental & Resource Economics		Planning has begun
# participants in the UMES AFS Student Subunit Symposium	30	N/A, symposium will be held in April 2012
Amount of leveraged funds (\$) for education and outreach	500K	~600K
# of student presentations at conferences	80	28
# of NOAA/LMRCSC Fisheries Cruises	1	N/A, Cruise is planned for Jan. 2012
# of proposals submitted for educational/outreach programs	5	2
# of student co-authored publications	15	5
# of public outreach activities	8	5
# of individuals impacted by outreach activities	>1000	>500

Summary of LMRCSC Performance Measures of Success (Research Programs)

	Proposed in the Implementation Plan	Accomplished (July. 1 – Dec. 31, 2011) 6 months
Activities	2011/2012	2011 - 2012
1. Science Meeting date	March	To be held in March 2012
2. # of TAB Proposals funded	10 to 16	12
3. # of proposals submitted to other programs	16	12
4. # of proposals funded (leveraged funding)	10	41
5. # of scientific presentations at conferences	120 (80*)	37(28*)
6. # of theses & dissertations produced	10	2
7. # of peer-reviewed publications	15*-30	13(5*)
8. Amount of leveraged funds (\$)	\$3 million	~\$2.5 million

*Number presented or co-authored by students (minimum)

INTRODUCTION

The Living Marine Resources Cooperative Science Center (LMRCSC) was established in October 2001 as a cooperative agreement between NOAA Educational Partnership Program, the University of Maryland Eastern Shore (UMES), lead institution, Delaware State University (DSU), Hampton University (HU), Savannah State University (SSU), the University of Miami, Rosenstiel School of Marine and Atmospheric Sciences (UM/RSMAS) and the University of Maryland Biotechnology Institute Center of Marine Biotechnology (UMBI-COMB), now known as the University of Maryland Center for Environmental Science Institute of Marine and Environmental Technology (UMCES-IMET). With the addition of Oregon State University in 2011, the LMRCSC now has seven partner institutions. The mission of the Center is ***“To develop exemplary academic and research collaborations that prepare a diverse student body for careers in marine and fisheries sciences”***.

The following are the goals and objectives of the LMRCSC:

Education Goal 1. Prepare the future workforce for marine and fisheries sciences

Objective 1.1: Recruit students from under-represented groups into marine and fisheries science disciplines

Objective 1.2: Increase retention and degree completion rates for students in marine and fisheries sciences programs

Objective 1.3: Assess the value-added outcomes of degree programs in marine and fisheries sciences at the partner institutions

Objective 1.4: Link students to professional networks and employment opportunities in marine and fisheries sciences

Education Goal 2. Strengthen collaborations across universities to enhance academic programs in marine and fisheries sciences

Objective 2.1: Use state-of-the-art, research-based curricula to provide students with the highest quality education in marine and fisheries sciences

Objective 2.2: Use Virtual Campus technology to provide students with the opportunity to learn from some of the nation's leading scholars in marine and fisheries sciences

Objective 2.3: Ensure that curricula of degree programs at partner institutions address current challenges and emergent needs within the profession

Research Goal 3. Develop an exemplary capacity for scientific collaborations among partner institutions in the fields of marine and fisheries sciences

Objective 3.1: Integrate the Center's research agenda with NOAA Fisheries research priorities in four key thematic areas: quantitative fisheries, essential fish habitat, fisheries socioeconomics, and aquaculture.

Objective 3.2: Foster collaborative research programs to strengthen the research capacities of partner institutions by leveraging the significant strengths and resources of research universities as infrastructure for capacity building

Objective 3.3: Develop faculty recruitment and retention practices that ensure that the collective capacity of scholars affiliated with the Center represents significant concentrations of strength in the four key research thematic areas

SECTION I – STATUS OF AWARD TASKS (Goals and Objectives)

1. Status of Goals/Objectives Accomplished as Defined in the LMR CSC’s Proposal

For the period **July 1 to December 31, 2011**, the following tasks were accomplished in support of the goals and objectives of the LMR CSC:

Education Goal 1: Prepare the future workforce for marine and fisheries sciences

The **NOAA Education Strategic Plan (2009-2029)** assigns a high level of importance to the goal of developing a future workforce that reflects the diversity of the U.S. LMR CSC is an effective partner in NOAA’s efforts to develop the future scientific workforce. Collectively, the LMR CSC partner institutions offer a full range of degrees (bachelors, masters, and Ph.D.) in marine and fisheries sciences.

Objective 1.1: Recruit students from under-represented groups into marine and fisheries science disciplines

Our recruitment efforts advance specific workforce development outcomes identified in the NOAA Education Strategic Plan:

- “A diverse and qualified pool of applicants, particularly from underrepresented groups, pursues student and professional opportunities for career development in NOAA mission-critical disciplines.”
- “A diverse pool of students with degrees in science, technology, engineering, mathematics, and other fields critical to NOAA’s mission connect to career paths at NOAA and in related organizations.”

Activities and Accomplishments:

Recruitment into Marine Science Programs: Recruitment has been facilitated through increased outreach of LMR CSC using the following modalities: 1) LMR CSC web site and Facebook page, and Center institution web sites 2) LMR CSC newsletters and brochures, 3) Participation in meetings of American Fisheries Society (AFS), American Society of Limnology and Oceanography (ASLO), Society for the Advancement of Chicanos and Native Americans in Science (SACNAS), Coastal and Estuarine Research Federation (CERF) and other organizations which provide wide exposure, 4) Visits to universities/colleges and personal contact, 5) Internships at Center partner institutions and through instruction of pertinent courses by LMR CSC faculty.

- Program Manager Todd Christenson typically attends the annual meetings of AFS, ASLO, Hispanic Engineering, Science, and Technology Conference (HESTEC), and SACNAS. This has raised the profile of LMR CSC and led to increased interest in and applications to the LMR CSC institutions.
- P. Chigbu along with Dr. Jennifer Keane-Dawes (Dean of Graduate Studies, UMES) visited the University of the District of Columbia for Graduate Fair on October 13, 2011 to recruit students.
- Todd Christenson gave a presentation on the LMR CSC to the NOAA Undergraduate Scholars on the final day of the internship (Aug 5, 2011) at NOAA Headquarters in Silver Spring, MD.
- The presence of the REU programs at both UMES and SSU directed by Drs. P. Chigbu and M. Gilligan, respectively provide excellent recruiting opportunities for LMR CSC. For example, participation in the UMES REU has led to matriculation of two students at UMES during this reporting period.
 - T’Keyah Hines, a participant in the 2011 REU entered UMES as a freshman for fall, 2011.
 - James Lewis, a 2010 REU participant is currently an Advanced Special Status student at UMES, completing prerequisite courses for entrance to the MEES program in 2012.
- Drs. Dionne Hoskins and Matthew Ogburn hosted three interns (Michael Knowles, Lynnece King and Amarria Phillips) from the EDGE program during summer 2011 at SSU
- In late summer and fall 2011, Jessica Miller (OSU) actively recruited graduate students through numerous avenues including, but not limited to, the following:
Texas A&M website (<http://wfsc.tamu.edu/jobboard/>), University of Washington, SACNAS, Fish-Sci listserv, Ecolog_L listserv, University of Alaska, University of Texas, American Indian Science & Engineering Society (Pam@aises.org; info@aises.org), The Louis Stokes Alliance for Minority Participation program at Oregon State University, Alaska Native Knowledge Network (ANKN) fyankn@ankn.uaf.edu. Additionally, J. Miller and I. Cheung (Academic Program

Coordinator at Hatfield Marine Science Center, OSU) connected with HU undergraduates in December 2011 via videoconference to discuss undergraduate and graduate research opportunities at OSU.

- For the third year, SSU coordinated the Georgia-South Carolina Ocean Sciences Bowl competition with Dionne Hoskins and Greg Hunter as regional coordinators. During fall 2011, both worked with three predominately African American high schools (Groves, Johnson, and Beach) to develop a diversity team to compete at the February event.
- SSU Marine Science faculty and students manned a display in the SSU Open Campus Day (Oct. 15, 2011) and the Garden City Fall Festival (Oct. 22, 2011).
- Media coverage helps program recruitment significantly. Some of the items published during the current reporting period are available at the following links:
<http://www.connectsavannah.com/news/article/104859/>
http://ssuathletics.com/news/2011/12/8/MTRACK_1208111730.aspx?path=mtrack
- Using leveraged funds, the LMRCSO has hired two new staff to assist in recruitment of students. Ms. Judy Rose, Professional Science Master's Program Coordinator, was hired in fall 2011. She visited Spelman College (October 27, 2011) and Morehouse College, GA (October 28, 2011) and made presentations on the LMRCSO and leveraged programs: NSF CREST-CISCEP and PSM. Ms. Kerrie Bunting, CREST-CISCEP Program and Outreach Coordinator was hired in fall 2011 and has begun recruiting graduate and undergraduate students, as well as K-12 students and teachers for summer 2012 workshop and internship at the Center.

IMET Internships: The UMCES IMET hosts approximately 10 undergraduate interns annually. These students conduct guided research on LMRCSO projects alongside Center researchers in IMET's state-of-the-art aquaculture and biotechnology facilities. Many interns are drawn from Center institutions. However, the program is open to students nationwide, providing the opportunity to recruit future graduate students. Several past interns are now in IMET graduate programs as a result of their experience. Planning for the 2012 internship program began during this reporting period.

The LMRCSO currently supports 146 students through NOAA funding and through funds leveraged from other agencies via the efforts of Center researchers. Sixty-two (62) of the students are graduate students, including 22 Ph.Ds. Seventeen (17) of the students were recruited during this reporting period (Table 1).

Table 1. Students recruited into LMRCSO from July 1 to December 31, 2011

First Name	Last Name	Academic Institution	Degree
Briana	Jones	UMES	B.S.
Tiana	Jones	UMES	B.S.
Charniece	Whitaker	UMES	B.S.
Okeria	Jenkins	UMES	B.S.
Kingsley	Nkeng	UMES	B.S.
Jonathan	Garing	HU	B.S.
Matthew	Dill	HU	B.S.
Symone	Giles	HU	B.S.
Jeremy	Smith	HU	B.S.
Nakeisha	Johnson	HU	B.S.
Kristen	Lycett	UMES	M.S.
Joseph	Drummond	UMES	PSM
Michele	Traver	UMES	PSM
Cornelius	Chilaka	UMES	PSM
Emily	Tewes	UMES	M.S./Ph.D
Andrea	Stoneman	DSU	M.S.
Tiffany	Ward	SSU	M.S.
Michelle	Sherman	SSU	M.S.
LaTreese	Denson	OSU	M.S.
Smit	Vasquez-Caballero	OSU	Ph.D

Objective 1.2: Increase retention and degree completion rates for students in marine and fisheries sciences programs

Direct financial support is one key element in retaining students. But the LMRCSO also engages in instructional and student support practices that have been shown to increase retention rates. LMRCSO students are also highly involved in peer networks, on campus and across the nation, including regular involvement in national meetings of the American Fisheries Society.

Activities and Accomplishments:

Students who received financial support between July 1 and December 31, 2011 are listed in Table 2, whereas those that graduated are presented in Table 3. The number of students receiving direct support does not include students already in the LMRCSO who were supported with carryover funds from the previous LMRCSO award during this reporting period.

Table 2. Students who received direct support during the funding period (July 1 to December 31, 2011).

First Name	Last Name	Academic Institution	Degree	Type	Amount
Maryse	Leandre	HU	M.S.	Stipend	\$1,000.00
Cory	Janiak	DSU	M.S.	Tuition/Travel	\$3,265.00
Andrea	Stoneman	DSU	M.S.	Tuition/Travel	\$6,348.00
Noelle	Hawthorne	SSU	M.S.	Stipend/Tuition	\$17,208.00
Tiffany	Ward	SSU	M.S.	Stipend/Tuition	\$14,937.00
Dontrece	Smith	SSU	M.S.	Stipend	\$8,333.00
TOTAL					\$51,091.00

Table 3. Students who graduated from July 1 to December 31, 2011.

First Name	Last Name	Academic Institution	Degree	Date
Matthew	Taylor	HU	B.S.	12/2011
Maryse	Leandre	HU	M.S.	12/2011
Naomi	Montalvo	UMCES-IMET	Ph.D	12/2011

Retention and degree completion rates are higher in academic programs that engage students in collaborative research with faculty members. Studies funded by LMRCSO involve both undergraduate and graduate students as active research participants. Students work as research collaborators with faculty and scientists at NOAA facilities. During the academic year, students participate in research projects at their home institutions. During the summer, students are involved in research at their home institutions, at other LMRCSO campuses, or at NOAA laboratories. Table 4 shows students who worked at NOAA labs or LMRCSO partner institution labs.

Table 4. Students who worked at NOAA labs or LMRCSO partner institution labs (July 1 to December 31, 2011).

First Name	Last Name	Academic Institution	Degree	Facility	Time period
Malik	Breland	HU	B.S.	UMES	June 1 to Aug 5, 2011
Camren	Brown	HU	B.S.	SSU	June 1 to Aug 5, 2011
Coleman	Ewell	HU	B.S.	NOAA HQ, Silver Spring, MD	June 1 to Aug 5, 2011
Camille	Gaynus	HU	B.S.	UMES	June 1 to Aug 5, 2011
Cy'anna	Scott	UMES	B.S.	AFSC, Seattle, WA	June 1 to Aug 5, 2011
Kate	Fleming	DSU	M.S.	NMFS lab-Panama City, FL	Jan 2010 to present.
Noelle	Hawthorne	SSU	M.S.	Grays Reef NMS	Summer, 2011
Courtney	McGeachy	UMES	M.S.	NEFSC, Sandy Hook Lab	Aug 18-26, 2011
Belita	Nguluwe	UMES	M.S.	UMCES-IMET	July 1-31, 2011
Lonnie	Gonsalves	UMES	Ph.D	NOAA COL, MD (NOAA GSP)	June 1 to Present

Shari	Mullen	UMES	Ph.D	NOAA AFSC (NOAA GSP)	June 1 to Present
Dan	Cullen	UMES	Ph.D	NOAA Woods Hole Lab	August 11, 2011
William	Gardner	UMES	Ph.D	NEFSC, Sandy Hook Lab	October, 2009 to present

Students in the LMRCS C leveraged program, PSM, who interned at NOAA Labs are presented in Table 5. More than 30 students who did not receive direct support from the LMRCS C, benefited from the programs offered by the Center and/or infrastructure established by the LMRCS C during this reporting period. Names of some of them at UMES are listed in Table 6.

Table 5. Internships by students in UMES Professional Science Master's program

First Name	Last Name	Internship Assignment	Project Title	Mentor(s)
Jeffrey	Kipp	NOAA NMFS, Beaufort, NC	Simulated surplus production assessment of golden tilefish (<i>Lopholatilus chamaeleonticeps</i>) in the south Atlantic	Dr. Kate Andrews, Research Mathematical Statistician
Leo	Matthews	NOAA Northeast Regional Office, Gloucester, MA	Sector Management; Environmental assessment	Dr. Mark Brady
Evan	Lindsay	NOAA NMFS, NEFSC, Woods Hole, MA	Fecundity of goosfish, <i>Lophius americanus</i> , in the northeast United States	Dr. Richard S. McBride, Branch Chief, NEFSC Population Biology Branch & Dr. Andrea K. Johnson (UMES)
Andrew	Turner	NOAA Chesapeake Bay Office, Annapolis, MD	Evaluating Management Strategies to Mitigate the Effect of Increasing Blue Catfish, <i>Ictalurus furcatus</i> , Populations in Chesapeake Bay Tributaries	Dr. Howard Townsend & Dr. Bruce Vogt
Jessica	Blaylock	NOAA NMFS, NEFSC, Woods Hole, MA	Assessing the performance of New England groundfish stock assessment projections to be used for updated management catch advice	Dr. Elizabeth Brooks

Table 6. Students who did not receive direct support but benefited from the program offered or infrastructure established by the LMRCS C at UMES

First Name	Last Name	Classification/Institution
Efeturi	Oghenekaro	M.S. student, UMES
Ejiroghene	Mayor	M.S. student, UMES
Fred	Oseji	M.S. student, UMES
Baruck	Volkis	Ph.D. student, UMES
Michele	Traver	PSM student, UMES
Joseph	Drummond	PSM student, UMES
Cornelius	Chilaka	PSM student, UMES

Teaching Assistant Workshop: LMRCS C sponsored a workshop from September 16-17, 2011 at UMES aimed at providing graduate students with the leadership and instructional skills needed to be effective Teaching Assistants. The workshop was led by Dr. Phillip Mutisya, Professor of Education at North Carolina Central University. Approximately 30 students attended the workshop.

Career Development Assistance: It is critical for students to understand that editing and proofreading are critical aspects of the writing process and that even professional scientists have their work reviewed by supervisors, colleagues and co-authors prior to submission. Students are, therefore, expected to submit all applications for scholarships and fellowships, cover letters, and CVs for review by at least one faculty or staff member. Five LMRCS C students were assisted to identify and apply for NOAA scholarships and fellowships during this reporting period.

Build strong peer networks through student collaboration: The Center has a Facebook web page, where potential students and those interested in the LMRCSC participate in discussions on a range of topics, including research projects, employment opportunities, and postdoctoral fellowships. LMRCSC's strong collaboration with the AFS provides an exemplary structure for students to connect with peers, as well as obtain access to mentoring and networking opportunities. About 15 LMRCSC students participated in the AFS meeting held in Seattle, WA in August 2011.

Continually assess student performance and progress toward degree completion: Assessment of students' academic experiences is a critical component in fostering academic program improvement and high levels of retention and degree completion. LMRCSC has developed an extensive assessment system, which informs decisions regarding academic program improvement and future curriculum development.

- **LMRCSC Exit Evaluation:** No forms were completed during this reporting period
- **LMRCSC Cruise Evaluation:** No forms were completed this period
- **Evaluation Forms for interns and mentors:** Three forms were completed online by summer interns during this reporting period.

Preparation of Student Development Plan for the LMRCSC began during this reporting period and will be completed by the end of Feb. 2012.

Objective 1.3: Assess the value-added outcomes of degree programs in marine and fisheries sciences at the partner institutions

Involvement in scientific research, participation in internships at NOAA facilities, and engagement with the "essential curriculum" for marine and fisheries sciences have prepared LMRCSC graduates to enter the scientific and environmental management workforce. Participation in LMRCSC activities adds significant value to students' educational experiences, and prepares them to make important contributions to the scientific profession.

Activities and Accomplishments:

Students who did not receive direct student support, but who benefited from Center programs and infrastructure exceed 30 in number. Additionally, the infrastructure that the LMRCSC has provided for the Center MSIs has made a huge difference in the type of research that can be done which has enabled the Center to leverage funds from various agencies including, NSF, NIH, EPA, and other line offices in NOAA. The Center leveraged \$2,492,003.01 from external sources during this reporting period.

Monitoring the career paths of LMRCSC students is critical in determining the extent to which the Center is meeting NOAA's workforce development goals. Since the founding of LMRCSC in 2001, 348 students (267 bachelors, 71 masters, and 10 doctoral) have graduated in NOAA core science areas. The LMRCSC provides updates on graduates who have found employment or graduate opportunities as a result of their work at the Center to the Student Tracker database housed at NOAA EPP three times each year.

Since 2001, the LMRCSC has contributed significantly to the research and teaching infrastructure at the partner institutions, which has been detailed in previous reports. More recently, the presence of the LMRCSC has resulted in additional investment by the Universities and leveraged programs, indicative of the importance which the partner universities place on the Center.

New videoconference facility: About \$56,000 was leveraged through the Title III program to replace aging videoconferencing equipment in Carver Hall at UMES. This facility is used as part of the LMRCSC's Virtual Campus for distance learning courses, student committee meetings, seminars and research collaboration.

Research Fleet: At the request of LMRCSC, the UMES administration purchased a new 24 foot Carolina Skiff to support field research by the LMRCSC and CREST-CISCEP programs. In addition, an 18 foot John Boat was purchased through a USDA award to Dr. Eric May. This brings the total number of boats at UMES to four, enhancing the Center's research capacity and alleviating pressure on the two older vessels.

Monitoring student progress: LMRCSC utilizes the online Student Tracker database as prescribed by NOAA for tracking student progress and outcomes. The Center maintains a series of online evaluation forms for the LMRCSC program overall, which graduating students are requested to submit, and for specific recurring activities such as the LMRCSC research cruise.

Post Graduate Tracking: Collection of career information on LMRCSC alumni is a continuing activity at the Center. All three of LMRCSC's most recent doctoral graduates have been hired by NOAA: Larry Alade (UMES 2008) is currently a Research Fishery Biologist at the Northeast Fisheries Science Center in Woods Hole, MA. Ayeisha Brinson (University of

Miami RSMAS 2008) was hired as an Economist at the Northeast Fisheries Science Center in Woods Hole, MA. Jose Reyes-Tomassini (UMBI COMB 2009) was hired as a Research Fishery Biologist at the Northwest Fisheries Science Center in Manchester, WA). Other LMRCSC graduates currently employed at NOAA are Daniel Luers (M.S., UMES), Colette Cairns (M.S., DSU), Vivian Melendez-Matter (M.S., RSMAS), Matt Rhodes (B.S., UMES), Leonard Pace (B.S., HU), Alise Parrish (B.S., HU) and Jasmine Cousins (B.S., HU). A recent Ph.D. graduate of UMES, Bashiru Balogun, is currently employed as a postdoctoral fellow at UMES. Matthew Taylor (B.S., HU), a 2009 REU intern in the lab of P. Chigbu at UMES, was hired in 2011 as Fisheries Observer at the NOAA NMFS Alaska Fisheries Science Center.

Scholarship: Kendyl C. Crawford (B.S., HU) has been awarded a prestigious George C. Marshall Scholarship to pursue a M.S. degree in Environment, Science and Policy at the University College of London following her graduation from HU.

Objective 1.4: Link students to professional networks and employment opportunities in marine and fisheries sciences

Activities and Accomplishments:

The following are examples of what the Center did during the current reporting period to link students to professional networks and employment opportunities in marine and fisheries sciences. A list of presentations by Center scientists and students is available in Appendix I.

American Fisheries Society: LMRCSC PhD student and Graduate Sciences Program scholar Lonnie Gonsalves has taken on an active leadership role in AFS, having been nominated as President-Elect for the Equal Opportunity Section, a post he will assume at the 2012 national meeting. LMRCSC was extremely well represented at the 2011 meeting, September 4-8, 2011 in Seattle, WA, with 23 oral presentations and 13 posters by students, faculty and alumni. UMES-PSM student and NOAA contractor Michele Traver continues to serve as Chair for the AFS Equal Opportunity Section's Mentoring for Opportunity Section student travel award.

Marine Mammal Conference: Dr. Tara Cox (SSU) took a contingent of faculty, staff and students to the 19th Biennial Conference on the Biology of Marine Mammals in Tampa, Florida, November 27 to December 2, 2011. Graduate student Kelli Edwards and Dr. Carla Curran gave oral research presentations. Research poster presentations were offered by graduate students Carolyn Kovacs and Rebekah Hazelkorn and undergraduate students Lance Love and Ana Reyes.

Engagement with NOAA: All LMRCSC graduate students are required to have a NOAA scientist on their research committee and the most appropriate individuals are identified early in the student's academic program. Strong linkages with researchers within NOAA have not only fostered collaborative projects with LMRCSC scientists but have created natural advising and mentoring opportunities for the students involved in these projects.

- LMRCSC students were encouraged to apply for scholarships and fellowships. During this reporting period, 5 students applied for NOAA scholarships or fellowships. SSU M.S. student Sanya Compton who applied for a Knauss Fellowship for 2012 and was selected in the fall recruiting class.
- Fourteen (14) LMRCSC students worked at NOAA labs under the guidance of NOAA scientists.

The importance of graduate student involvement in NOAA Fisheries laboratories cannot be overstated, since this becomes one of the mechanisms by which students are introduced to prospective employers.

Education Goal 2: Strengthen collaborations across universities to enhance academic programs in marine and fisheries sciences

Strengthening administrative and programmatic components of the Center: The Center continued to be guided by two management tracks, Administrative and Programmatic. The Administrative component includes the Center Director, Program Manager, Executive Committee, Center Core Administration and the Board of Visitors.

Activities and Accomplishments:

Center Director and Staff: There were no changes in Center staff during this reporting period. However, using leveraged funds, three new staff were hired: Coordinator for the PSM Program, and Program and Outreach Coordinator for the NSF CREST-CISCEP. Both staff members are assisting with student recruitment to the Center. A Boat Captain was also hired to assist in field sampling for research.

Executive Committee (EC): The EC consists of the DRS, Project Directors from each Center institution and Center Director; Dr. Chigbu serves as chair of the EC. The EC met via conference call monthly from July to Nov. 2011. LMRCSC Strategic Plan, Implementation Plan, and Science Plan were developed and submitted to NOAA EPP during this reporting period.

Center Core Administration (CCA): The CCA, consisting of UMES' Vice President (V.P.) for Academic Affairs, UMES' V.P. for Administrative Affairs, a representative from the office of the President, UMES' Dean of the School of Agriculture and Natural Sciences, Chair of Department of Natural Sciences, LMRCSC Director, DRS, and Program Manager met during this reporting period. CCA members were briefed by Dr. Chigbu on Center accomplishments, challenges, and about the new LMRCSC award. As a result of this meeting, the University provided funds which were used to purchase a new research boat for the Center.

LMRCSC Board of Visitors (BOV): The BOV, consisting of the Presidents of the LMRCSC partner institutions or their designees, met at RSMAS on Nov. 2, 2011. The next BOV meeting is scheduled for Nov. 2012 and will be hosted by OSU.

Center Faculty and Staff Positions: No changes occurred in this reporting period.

Objective 2.1: Use state-of-the-art, research-based curricula to provide students with the highest quality education in marine and fisheries sciences

Activities and Accomplishments:

At SSU, marine science faculty determined that the current use of Thesis II (a required research core course) was not fulfilling many students' need to receive credit for research hours beyond the 3 contained in the course. The program submitted a revision that would allow students performing research in the later semesters of their degree to receive additional course credit.

Leveraging significant intellectual capital at partner institutions to advance educational programs and inform curriculum development: Through the LMRCSC collaboration, students have access to a broader range of curricular and research experiences. They have opportunities to take courses and engage in research with faculty at other LMRCSC partner institutions, and with NOAA scientists who serve as adjunct faculty, thesis or dissertation committee members, and professional mentors.

CSC Directors had several conference calls during the reporting period during which potential collaborative research and educational programs were discussed and developed. A major outcome is the development of a proposal to fund and implement a "network of CSCs and high schools to train high school students in geosciences.

- SSU used teleconferences and Skype to involve Woods Hole Oceanographic Institute (WHOI) scientist Porter Hoagland in Sanya Compton's thesis.
- To ensure that students and faculty are informed about current research within LMRCSC, the Center uses Adobe Connect to make its Seminar Series available to students and faculty at all partners via the web.

Ensuring that curricula delivered at each partner institution are highly coordinated with the "essential curriculum" for marine and fisheries sciences, as identified by NOAA-NMFS: Curricula at partner institutions are highly aligned with NOAA-NMFS priorities. Extensive collaboration between LMRCSC faculty and NOAA scientists ensures that curriculum development is informed by the current challenges and emergent needs in the marine and fisheries sciences. This level of collaboration extends to having NOAA scientists teach courses with LMRCSC faculty, and serve on dissertation committees. Internship experiences at NOAA laboratories and field research aboard NOAA vessels also ensure that students participate in a curriculum that is highly aligned with the needs of NOAA-NMFS. Each January or February, LMRCSC offers an educational and scientific cruise that introduces students to the use of oceanographic equipment and that trains them in "blue water" fisheries research. The cruise is conducted in collaboration with the NOAA Northeast Fisheries Science Center. Examples of NOAA scientists collaborating with scientists and students at the LMRCSC are presented in Appendix I.

Objective 2.2: Use Virtual Campus technology to provide students with the opportunity to learn from some of the nation's leading scholars in marine and fisheries sciences

Activities and Accomplishments:

Increased use of the Virtual Campus: The Virtual Campus was used to provide courses to students, hold student committee meetings, Executive Committee meetings, and thesis and dissertation defenses. The Virtual Campus concept was expanded during this reporting period to include not only courses offered through videoconferencing, but also in an online format.

Several University System of Maryland MEES courses were offered in fall 2011 to LMRCSC students and others at UMES. The Center has developed an Articulation Agreement to make it possible for students at non-University System of Maryland institutions to enroll in the courses via IVN. The document has been signed by LMRCSC partner institutions. Courses that were offered online at the Center in fall 2011 as part of the PSM degree program in quantitative fisheries and resource economics are presented in Table 7. Despite the execution of the LMRCSC Articulation Agreement, the students

who enrolled in these fisheries courses came only from UMES and DSU. It was expected that few students supported by the LMRCSC at HU would be enrolled in the courses because the Center supports many undergraduates at HU. The only graduate student supported at HU is not majoring in fisheries science and so was not required to take fisheries courses. We are currently investigating to determine why SSU students are not enrolling in the fisheries courses offered at UMES of RSMAS.

Table 7. Courses Offered Online at the LMRCSC during Fall Semester 2011 as Part of the PSM Degree Program

Course number	Course Title	Instructor	Students (online)
AGSC 605	Agricultural Statistics	Harter-Dennis	Cornelius Chilaka (UMES/PSM) Evan Lindsay (UMES/PSM) Andrew Turner (UMES/PSM) Leonardo Matthews (UMES/PSM) Jeffrey Kipp (UMES/PSM) Kristen Lycett (UMES/CREST)
MEES688	Fishery Survey Sampling	Stevens	Andrea Stoneman (DSU) Jessica Blaylock (NOAA/UMES/PSM) Michele Traver (NOAA/UMES/PSM)
MEES688P/ORLD617	Personnel Development	Costello	Joseph Drummond (UMES/PSM) Cornelius Chilaka (UMES/PSM) Evan Lindsay (UMES/PSM) Leonardo Matthews (UMES/PSM) Andrew Turner (UMES/PSM) Jeffrey Kipp (UMES/PSM)
MEES 688	Fish Ecology	Chigbu & May	Jessica Blaylock (NOAA/UMES/PSM) Andrea Stoneman (DSU) Courtney McGeachy (UMES) Whitney Dyson (UMES)
MEES 643	Risk and Decision Analysis in Natural Resources Management	Ali	Jessica Blaylock (NOAA/PSM) Joseph Drummond (UMES/PSM) Evan Lindsay (UMES/PSM) Leonardo Matthews (UMES/PSM) Andrew Turner (UMES/PSM) Jeffrey Kipp (UMES/PSM)

Through the special topics and directed research courses, SSU is able to readily avail its students of courses offered through the LMRCSC without going through the lengthy 4 tiered new course approval process at the university. SSU is working on the recommendations for the unified curriculum and examining how such a program can fit in the University System of Georgia's structure. During this funding period, the Marine Science and Environmental Science Degree programs were integrated into the Marine Science Degree curriculum.

Seminars: The LMRCSC Seminar Series continued in this reporting period. The presentations were made available at all LMRCSC partners via the Virtual Campus. Three sessions (Table 8) were held in Fall 2011.

Table 8. LMRCSC Seminar Series 2011-2012.

DATE	SPEAKER	TITLE
October 7, 2011	Dr. Bradley Stevens (UMES)	Discovering the Kad'yak, Alaska's oldest known shipwreck
November 4, 2011	Dr. Andrij Horodysky (HU)	Sensory ecophysiology of mid-Atlantic fishes: towards a mechanistic understanding of form-function-environment relationships
December 2, 2011	Dr. Jessica Miller (OSU)	A biogeochemical approach to fisheries ecology, conservation, and management

Objective 2.3: Ensure that curricula of degree programs at partner institutions address current challenges and emergent needs within the profession

Activities and Accomplishments:

- At SSU, the Marine Sciences faculty reviewed the undergraduate curriculum in fall 2011 and made higher level science electives for B.S. students more flexible and offering more marine science courses for non-majors.

Engage undergraduate and graduate students in cutting-edge research experiences in marine and fisheries sciences, including learning experiences at NOAA facilities with NOAA mentors: One of the defining characteristics of the student academic experience at LMRCSC is extensive participation in scientific research. Undergraduate and graduate students work alongside faculty as collaborators on a range of research projects related to NOAA-NMFS priorities. Many of the projects involve student research at NOAA facilities under the guidance of NOAA mentors.

- Eighteen (18) students worked at NOAA labs or at center institutions in summer 2011.
- Six students expressed interest in participating in the January 2012 LMRCSC research cruise.

Research Goal 3: Develop an exemplary capacity for scientific collaborations among partner institutions in the fields of marine and fisheries sciences

An important component of LMRCSC's mission is to conduct research that is congruent with the interests of NOAA fisheries, and that supports the sustainable harvest and conservation of our nation's living marine resources. Research at the Center focuses on estuarine and coastal ecosystems and on the continental shelf of three Large Marine Ecosystems (LME): the Northeast U.S. Continental Shelf LME, the Southeast U.S. Continental Shelf LME, and the U.S. Gulf of Mexico LME. The Center's research is grouped into the four key thematic areas, associated with NOAA's research priorities. This research agenda is implemented collaboratively among faculty and students across the seven partnering institutions. This level of collaboration strengthens the research capacity of each institution, and makes available a multitude of intellectual and scientific resources that the partner institutions could not offer if they operated independently.

Unite the Center's research agenda around the theme of ecosystem-based management: The Center's research is unified around the theme of "ecosystem-based management". This unifying theme provides a cohesive focus to LMRCSC research on quantitative fisheries, essential fish habitat, fisheries socioeconomics, and aquaculture. The aim of "ecosystem-based management" is to protect and rebuild ecosystems, including species and their habitats. This focus includes studies that increase our understanding of the relative importance of the many complex factors that influence fish populations, fish habitat, and fisheries, including the effects of climatic factors and human activities (e.g., pollution, habitat destruction, and fishing). The LMRCSC research agenda focuses on the coastal/estuarine environment, and complements NOAA's projects in the offshore marine environment.

Utilize a rigorous scientific review process to provide input into the research agenda of the Center:

Technical Advisory Board (TAB): LMRCSC research undergoes a rigorous scientific review process. Each year, LMRCSC convenes a Technical Advisory Board (TAB) to guide the Center in its research agenda. The TAB reviews and provides recommendations on the Center's research plan, and ensures that LMRCSC research is of high quality and aligned with NOAA-NMFS research priorities. The TAB comprises the following individuals selected from NOAA and the academic community:

- Dr. Kristy Wallmo (TAB Chair; NOAA Office of Science & Technology)
- Dr. Tom Noji (Director, J.J. Howard Marine Science Lab., Sandy Hook, NJ)
- Dr. Mike Rust (NOAA NWFSC, Seattle, WA)
- Dr. Ayeisha Brinson (NOAA NEFSC, Woods Hole, MA)
- Dr. Richard Brill (NOAA SEFSC, VIMS)
- Dr. James Berkson (NOAA SEFSC, Virginia Tech)
- Dr. Meka Laster (NOAA EPP Representative), as an observer

Specifically, the TAB consists of one scientist each for quantitative fisheries, essential fish habitat, fisheries socioeconomics, and aquaculture, as well as two additional scientists selected at large, and a NOAA-EPP representative who serves as an observer. Each year, LMRCSC issues a Request for Proposal (RFP) within the Center institutions, which seeks proposals for research projects that will be funded by the Center. Proposals are evaluated by the TAB, based on scientific merit, congruence with NOAA-NMFS research priorities, and level of involvement of students in the proposed research. An average of 12 research projects is selected for funding each year.

Activities and Accomplishments:

- A revised RFP for the 2011-12 project year was circulated to all partners as well as to NOAA Fisheries personnel on August 30, 2011 with a proposal due date of October 14, 2011.
- Nineteen (19) collaborative proposals were submitted to the LMRCSC and reviewed by the TAB in fall 2011 of which 12 were funded (Table 9).

These collaborative projects address various aspects of NOAA's Next Generation Strategic Plan Goal (NGSG): "Healthy Oceans - Marine fisheries, habitats, and biodiversity sustained within healthy and productive ecosystems", and objectives: (1) Improved understanding of ecosystems to inform resource management decisions, (2) Recovered and sustained marine and coastal species, (3) Healthy habitats that sustain resilient and thriving marine resources and communities, and (4) Sustainable fisheries and safe seafood for healthy populations and vibrant communities. They also address some of the goals, objectives and priorities listed in NMFS 2007 Strategic Plan for Fisheries, such as Seafood safety (e.g. Organic contaminants in monkfish, *Lophius americanus*), research on Abundance and Life History of fish stocks (e.g. Development of in-situ assessment and observation methods for black sea bass, *Centropristis striata*), sustainable and environmentally sound aquaculture through the development of alternative feeds such as plant-based proteins (e.g. Taurine – the missing ingredient for development of fish free diets for aquaculture), and impacts of anthropogenic factors and environmental change on species (e.g. Temperature preference of Atlantic Croaker under normoxic and hypoxic conditions). Additional information on how the 2011-2012 projects funded by the LMRCS address NOAA's NGSG and NMFS priorities are presented below in the section on "TAB Project Summary".

Table 9. Projects Funded by the LMRCS for 2011 - 2012

Principal Investigators	Proposal Title	Amount Approved
1. Andrea K. Johnson (UMES), Ashok Deshpande (NOAA)	Organic contaminants in monkfish, <i>Lophius americanus</i>	\$25,038.00
2. Jessica Miller (OSU), Deidre Gibson (HU), Tom Hurst (NOAA)	Temperature effects on pre- and post-settlement processes in Gulf of Alaska northern rock sole (<i>Lepidopsetta polyxystra</i>)	\$24,718.00
3. Bradley Stevens (UMES), Beth Babcock (RSMAS), Gary Shepard (NOAA)	Development of in-situ assessment and observation methods for black sea bass, <i>Centropristis striata</i>	\$47,915.00
4. Adam Tulu (UMES-Student), Ali Ishaque (UMES), Rosemary Jagus (IMET), Chris Chambers (NOAA)	Characterization of <i>Microgadus tomcod</i> CYP19A aromatase	\$25,340.00
5. Heather Wolfer (UMES-Student), Andrea K. Johnson (UMES), Andrij Horodysky (HU), Richard Brill (NOAA)	Temperature preferences of Atlantic croaker under hypoxic and normoxic conditions	\$38,580.00
6. Diego Lirman (RSMAS), Andrij Horodysky (HU), Joe Serafy (NOAA)	The role of seascape characteristics of submerged aquatic vegetation as fisheries habitat	\$46,922.00
7. Andrij Horodysky (HU), Andrea Johnson (HU), Richard Brill (NOAA)	Sensory ecology of Atlantic sturgeon: ecophysiological auditory and visual performance measures	\$18,763.00
8. Al Place (IMET), Tom Rippen (UMES), James Morris (NOAA)	Taurine – the missing ingredient for development of fish free diets for aquaculture	\$36,742.00
9. Deidre Gibson (HU), Andrij Horodysky (HU), David Elliot (IMET), Howard Townsend (NOAA)	Feeding and growth of doliolids as related to food concentration and temperature: Toward a model of doliolid population dynamics	\$28,708.00
10. Joseph Pitula (UMES), Feng Chen (IMET)	Diversity of <i>Hematodinium</i> sp. in the Maryland Coastal Bay ecosystem	\$35,965.00
11. Eric Schott (IMET), Dennis McIntosh (DSU), Gretchen Messick (NOAA)	Monitoring pathogens of blue crabs (<i>Callinectes sapidus</i>) along a climatological and latitudinal gradient	\$44,311.00
12. Stacy Smith (DSU), Eric May (UMES)	Using otolith elemental analysis to classify natal grounds of spawning summer flounder, <i>Paralichthys dentatus</i> , and spot, <i>Leiostomus xanthurus</i>	\$16,029.00

TAB Project Summary

1. Project Title: Organic contaminants in monkfish, *Lophius americanus*

Project Description: To establish a baseline for organic contaminants, the muscle, gonad and liver tissues of *L. americanus* from three sites in the northwest Atlantic Ocean will be analyzed for PCBs, DDTs, chlordanes, PBDE flame retardants and other chlorinated pesticides. Concentrations of each contaminant class will be correlated with lipids in each tissue and compared between the locations to understand the potential for any deleterious health effects. The utility of select

contaminants as tracers in the delineation of *L. americanus* habitats will also be examined. This proposal addresses the RFP's targeted research area of Essential Fish Habitat and will provide information that will help NOAA in assessing habitat quality and the impacts of contaminants on the health and safety of fishery resources.

Relevance to NOAA's Next Generation Strategic Plan Goal/Objectives (NGSG): Healthy Habitats, Healthy Species

Relevance to NOAA NMFS Research Priorities: Seafood Safety

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Andrea K. Johnson (UMES)

NOAA Collaborator(s): Ashok Deshpande (NOAA Sandy Hook Lab)

LMRCSC Collaborator(s): None

LMRCSC Research Student(s) trained: TBD

Start Date: Jan 2012

Planned End Date: Dec. 2012

2. Project Title: Temperature effects on pre- and post-settlement processes in Gulf of Alaska northern rock sole (*Lepidopsetta polyxystra*)

Project Description: A critical area of fisheries science is identifying the role of climate in regulating biological productivity. Northern rock sole supports a high value fishery for roe in the Gulf of Alaska. However our understanding of the factors regulating recruitment variation of this stock remains limited, as have the potential impacts of climate change. We propose to examine interannual variation in early life history characteristics in relation to regional climate variability. Otolith increment analysis of 8+ years of archived samples will be used to determine spawning and hatch date, hatch size, and growth rates during the larval and juvenile stages. We will quantify the relationships between these early life history characteristics and thermal regime throughout early life and recruitment variation.

Relevance to NGSG: Improved Understanding of Ecosystems

Relevance to NOAA NMFS Research Priorities: Abundance and life History; Impact of Anthropogenic factors and environmental change

Thematic Area Addressed: Quantitative Fisheries

Lead Scientist(s): Jessica Miller (OSU)

NOAA Collaborator(s): Tom Hurst (NOAA)

LMRCSC Collaborator(s): Deidre Gibson (HU)

LMRCSC Research Student(s): TBD

Start Date: Jan. 2012

Planned End Date: Dec. 2012

3. Project Title: Development of in-situ assessment and observation methods for black sea bass, *Centropristis striata*

Project Description: Black sea bass (*Centropristis striata*) support an important commercial and recreational fishery in the Mid Atlantic Bight. Fish live offshore near the continental shelf edge during winter, migrate to inshore habitats in the spring for spawning, and return offshore in fall. Trawl surveys conducted by NOAA are not effective in sampling the heterogeneous inshore habitats, so there is no acceptable index of abundance for adult black sea bass. To remedy this situation, we are developing methods for surveying abundance of black sea bass in inshore waters using in-situ video technology. The goals of the study will be to determine the best methods to observe and count fish, and determine the relationship between fish abundance, habitat, trap catch, and other conditions. In Year 1, we tested one camera type, compared baited vs unbaited systems, and observed fish behavior in and around traps. In Year 2, we will build a stand-alone video system, refine techniques for assessment, and develop standard video sampling procedures. This project will directly involve one PhD student, one or more M.S. students, and one or more undergraduate students. This proposal addresses two of the LMRCSC research themes including "Quantitative Fisheries" and "Essential Fish Habitat", as well as several NOAA Strategic Objectives including "improving stock assessments" (1.1), "new methods of data acquisition" (1.3), and delineating essential fish habitat (1.11).

Relevance to NGSG: Healthy Species

Relevance to NOAA NMFS Research Priorities: Abundance and life History

Thematic Area Addressed: Quantitative Fisheries; Essential Fish Habitat

Lead Scientist(s): Bradley G. Stevens, UMES

NOAA Collaborator(s): Gary Shepherd, National Marine Fisheries Service, NEFSC, Woods Hole, MA.; Vincent Guida, NEFSC, J.J. Howard Research Laboratory, Sandy Hook, NJ

LMRCSC Collaborator(s): Elizabeth Babcock, University of Miami, RSMAS

LMRCSC Research Student(s): Dan Cullen (Ph.D Student, UMES); Courtney McGeachy (MS Student, UMES).

Start Date: Jan 2012

End Date: December 2012

4. Project Title: Characterization of *Microgadus tomcod* CYP19A aromatase

Project Description: The Ishaque/Chambers laboratories have a joint project underway to assess the effects of polycyclic aromatic hydrocarbon (PAH) and polychlorinated biphenyl (PCB) contaminants in the estuarine species, *Microgadus tomcod*. As part of this larger body of work, the UMES graduate student, Adam Tulu (mentor Dr. Ishaque), has collaborated with Dr. Rosemary Jagus of UMCES-IMET to develop molecular tools and methodologies to assess the effects of PAH and PCB on the transcript levels of cytochrome 1A1 (CYP1A1) and cytochrome CYP19A (CYP19A). Under a previous LMRCSC TAB award, Mr. Tulu, under Dr. Jagus' guidance, was successful in generating and cloning a partial cDNA sequence for CYP19A and successfully evaluating CYP1A1 and CYP19A transcript levels in fish exposed to PAH, PCB, or both, using RT-qPCR. To complete this project, funds are requested to complete cloning of the 5'-UTR and 5' 10 % of coding region and characterize the expression of tomcod aromatase in different tissues and throughout the breeding cycle

Relevance to NGS: Healthy Habitats; Healthy Species; Improved Understanding of Ecosystems

Relevance to NOAA NMFS Research Priorities: Impact of Anthropogenic factors and environmental change

Thematic Area Addressed: Quantitative Fisheries

Lead Scientist(s): Adam Tulu, UMES; Dr. Rosemary Jagus, UMCES-IMET and Dr. Ali Ishaque, UMES

NOAA Collaborator(s): Dr. Chris Chambers, NOAA Fisheries Service (NMFS)

LMRCSC Research Student(s): Adam Tulu, UMES

Start Date: Jan. 2012

End Date: Dec. 2012

5. Project Title: Temperature preferences of Atlantic croaker under hypoxic and normoxic conditions

Project Description: Atlantic croaker (*Micropogonias undulatus*), an economically and ecologically important demersal species common in Chesapeake Bay, will be used as a model species to assess the mechanistic influence of normoxic and hypoxic conditions on temperature preference using a custom behavioral videography system. This study complements currently funded work (NSF-CREST) that assesses croaker movement in Chesapeake Bay via telemetry as part of a doctoral dissertation by UMES graduate student Heather Wolfer. Our intent is to provide a model approach which can be applied to other fish species. Coupled with habitat mapping of the Chesapeake Bay, we will provide important information on the spatial extent and duration of seasonal hypoxia in Chesapeake Bay and its effects on essential fish habitat (EFH).

Relevance to NGS: Healthy Habitats; Healthy Species; Improved Understanding of Ecosystems

Relevance to NOAA NMFS Research Priorities: Abundance and life history; Impact of anthropogenic factors and environmental change

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Heather Wolfer (UMES-Student), Andrea K. Johnson (UMES)

NOAA Collaborator(s): Richard Brill (NOAA)

LMRCSC Collaborator(s): Andrij Horodysky (HU)

LMRCSC Research Student(s): TBD (Undergraduate); Heather Wolfer (UMES-Student),

Other collaborators: None

Planned Start Date: Jan. 2012

Planned End Date: Dec. 2012

6. Project Title: The role of seascape characteristics of submerged aquatic vegetation as fisheries habitat

Project Description: The goals of this project are to: (1) document the patch-scale structure of submerged aquatic vegetation (SAV) seascapes, and (2) determine how SAV seascape patterns may have cascading effects on the abundance, distribution, and behavior of associated fish species. The proposed research consists of high resolution SAV seascape mapping to be used to quantify seascape characteristics that, in turn, will be related to key ecological metrics such

as fish and prey diversity and abundance, trophic niche breadth, species interactions, and fish predation pressure. Thus, this project will provide an increased understanding of the important relationship between SAV seascape characteristics and the role of SAV as fisheries habitat in Biscayne Bay, a heavily exploited shallow lagoon.

Relevance to NGSF: Healthy Habitats

Relevance to NOAA NMFS Research Priorities: Interdependence of fishes; Impact of anthropogenic factors and environmental change

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Diego Lirman (RSMAS)

NOAA Collaborator(s): Joe Serafy (NOAA)

LMRCSC Collaborator(s): Andrij Horodysky (HU)

LMRCSC Research Student(s): Rolando Santos (Graduate Student)

Start Date: Jan. 2012

End Date: Dec. 2012

7. Project Title: Sensory ecology of Atlantic sturgeon: ecophysiological auditory and visual performance measures

Project Description: The ecophysiological abilities of anadromous fishes to cope with environmental variability and anthropogenic stressors have received little attention. We therefore seek mechanistic insights into the ecology of auditory and visual systems of Atlantic sturgeon as a complementary project to our earlier studies on black sea bass and tautog. We will evaluate these ecophysiological performance measures as assays of essential fish habitat, aquaculture best practices, and anthropogenic stressors. This proposal responds directly to research priorities delineated in the LMRSCS RFP, and directly supports the mission of NOAA-Fisheries, and provides research experience for undergraduate students. This study will provide baseline data to support the submission of a leveraged multiyear NSF proposal involving graduate students to investigate the sensory and conservation ecology of primitive fishes in 2012.

Relevance to NGSF: Healthy Habitats

Relevance to NOAA NMFS Research Priorities: Abundance and life history; Impact of anthropogenic factors and environmental change

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Andrij Horodysky (HU),

NOAA Collaborator(s): Richard Brill (NOAA)

LMRCSC Collaborator(s): Andrea Johnson (HU),

LMRCSC Research Student(s): TBD

Planned Start Date: Jan. 2012

Planned End Date: Dec. 2012

8. Project Title: Taurine – the missing ingredient for development of fish free diets for aquaculture

Project Description: Besides environmental degradation another major issue with aquaculture is its feed source. Feed costs can comprise more than 50% of the total budget for raising fish to market size, which means even small fluctuations in ingredient costs can make the difference between profit and failure. We have recently developed a completely fish free diet that performs as well as commercial diets with only a 5% cost difference. During this development we discovered that the addition of taurine was required for marine teleosts. In the current proposal we will evaluate the fillet quality of fish (cobia) grown on a plant based diet compared to a fishmeal/fishoil diet. We will also evaluate whether taurine is an essential amino acid for sablefish (*Anaplopoma fimbria*) (Co-PI R. Johnson, NOAA) growth.

Relevance to NGSF: Sustainable Fisheries

Relevance to NOAA NMFS Research Priorities: Marine Aquaculture

Thematic Area Addressed: Aquaculture

Lead Scientist(s): Al Place (IMET),

NOAA Collaborator(s): James Morris (NOAA)

LMRCSC Collaborator(s): Tom Rippen (UMES),

LMRCSC Research Student(s): Aaron Watson (IMET, Graduate student)

Start Date: Jan. 2012

End Date: Dec. 2012

9. Project Title: Feeding and growth of doliolids as related to food concentration and temperature: Toward a model of doliolid population dynamics

Project Description: Episodic blooms of filter-feeding pelagic doliolids can restructure marine food webs and biogeochemistry, influencing phytoplankton and copepod populations that are prey for planktivorous fisheries resources. We will assay and model the effects of temperature and prey dynamics on doliolid population and feeding ecology. This study complements Gibson's current NSF-OCE funded research investigating variables driving doliolid bloom formation, and directly involves LMRCS graduate and undergraduate students. As a two year study, the second year will involve more extensive modeling work and collection of field data for model validation. This proposal responds to LMRCS Thematic Priorities in Quantitative Fisheries and Essential Fish Habitat and is consistent with the mission of NOAA-Fisheries.

Relevance to NGS: Improved Understanding of Ecosystems

Relevance to NOAA NMFS Research Priorities: Interdependence of fishes

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Deidre Gibson (HU),

NOAA Collaborator(s): Howard Townsend, NOAA NCCOS Cooperative Oxford Lab

LMRCS Collaborator(s): Andrij Horodysky (HU), David Elliot (IMET)

LMRCS Research Student(s): TBD

Start Date: Jan. 2012

End Date: Dec. 2012

10. Project Title: Diversity of *Hematodinium* sp. in the Maryland Coastal Bay ecosystem

Project Description: The blue crab (*Callinectes sapidus*) fishery is of critical importance to the economics of the Chesapeake Bay region. Stressing these populations is infection by the dinoflagellate parasite *Hematodinium* sp. Detection of free-living *Hematodinium* sp. from environmental samples will be important to understand how crabs may acquire infection, and what stages in the parasite life cycle influence infectivity. Using the most specific molecular technology available, this collaboration between UMES, IMET, NOAA, and the National Park Service (NPS) will investigate potential reservoirs of blue crab disease in the Maryland Coastal Bays. Our goal will be to develop an understanding of the community population structure among the various dinoflagellates within this ecosystem.

Relevance to NGS: Healthy Habitats; Healthy Species; Improved Understanding of Ecosystems

Relevance to NOAA NMFS Research Priorities: Interdependence of fishes

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Joseph Pitula (UMES),

NOAA Collaborator(s): Howard Townsend, NOAA NCCOS Cooperative Oxford Lab

LMRCS Collaborator(s): Feng Chen (IMET)

LMRCS Research Student(s): TBD

Start Date: Jan. 2012

End Date: Dec. 2012

11. Project Title: Monitoring pathogens of blue crabs (*Callinectes sapidus*) along a climatological and latitudinal gradient

Project Description: The world's changing climate is expected to raise the temperature of southern New England waters by up to 4.5 °C in this century, to temperatures similar to the current mid-Atlantic region. This may result in northward expansion of fishery species as well as their pathogens. Using sensitive quantitative molecular methods, we are assessing the prevalence of two fatal pathogens of blue crab, a reovirus and a protozoan parasite, from DE Bay to the south shore of MA. After a successful first year, we propose to extend disease monitoring for one more year, to establish a 2 year timeline and firm up the partnerships that will allow this survey to continue with external funding. This project, which involves both graduate and undergraduate students, can serve as a template for long-term studies of the effects of climate change and latitude on blue crab disease prevalence in the Northeast.

Relevance to NGS: Healthy Species

Relevance to NOAA NMFS Research Priorities: Impact of anthropogenic factors and environmental change
Thematic Area Addressed: Essential Fish Habitat
Lead Scientist(s): Eric Schott (IMET)
NOAA Collaborator(s): Gretchen Messick (NOAA)
LMRCSC Collaborator(s): Dennis McIntosh (DSU)
LMRCSC Research Student(s): Ammar Hanif (Graduate Student, IMET)

Start Date: Jan. 2012

End Date: Dec. 2012

12. Project Title: Using otolith elemental analysis to classify natal grounds of spawning summer flounder, *Paralichthys dentatus*, and spot, *Leiostomus xanthurus*

Project Description: The summer flounder, *Paralichthys dentatus*, and the spot, *Leiostomus xanthurus*, are seasonally migratory North Atlantic coast fish that inhabit estuarine and coastal waters in summer and move offshore to the continental shelf in winter. These two fish species are each managed as stock units from north to south despite the well-documented zoogeographical boundary at Cape Hatteras, N.C. The goals of the proposed research are to 1) test the theory that two or more stock subunits compose Atlantic coast summer flounder 2) investigate the stock structure of spot by utilizing otolith ageing techniques and otolith microchemical analysis.

Relevance to NGSG: Healthy Species; Improved Understanding of Ecosystems

Relevance to NOAA NMFS Research Priorities: Abundance and life history

Thematic Area Addressed: Essential Fish Habitat

Lead Scientist(s): Stacy Smith (DSU)

NOAA Collaborator(s): TBD

LMRCSC Collaborator(s): Eric May (UMES)

LMRCSC Research Student(s): TBD

Start Date: Jan. 2012

End Date: Dec. 2012

Objective 3.2: Foster collaborative research programs to strengthen the research capacities of partner institutions by leveraging the significant strengths and resources of research universities as infrastructure for capacity building

Activities and Accomplishments:

- Currently the LMRCSC is supporting research that is promoting collaboration between SSU and UMCES-IMET, UGA, SKIO, and the Smithsonian (SERC). This is being facilitated through the recent research appointment received by LMRCSC postdoc Matt Ogburn at Smithsonian Institute.
- Monthly meetings and discussions were held by the LMRCSC Research Committee that resulted in the development of a Science Plan that was submitted to NOAA EPP
- Discussions were held by CSC Distinguished Scientists and Center Directors to develop collaborative research projects among the four CSCs. Details are currently being finalized and will be submitted to NOAA EPP in May 2012.
- Several collaborative research projects between scientists at LMRCSC MSIs and scientists at Research Intensive institutions (RSMAS, IMET, OSU) are on-going.

Leverage multiple sources of funding to support the Center's research agenda:

Activities and Accomplishments:

- Leveraged funds during this reporting period totaled \$2,492,003.01 (Appendices II-IV)

Provide supportive networks and mentoring for early-career faculty, including faculty from underrepresented groups: LMRCSC provides a strong intellectual community for scholars in the marine and fisheries sciences. Faculty connections across institutions are important not only for research collaboration, but also for career support and mentoring.

- Among the early-career faculty who received funding from the LMRCSC for 2011-2012 to conduct research are: Eric Schott (UMCES-IMET), Joseph Pitula (UMES), Andrij Horodysky (HU), Andrea Johnson (UMES), Jessica Miller (OSU), and Stacy Smith (DSU).

Provide faculty development opportunities that enhance the quality of the academic work environment for faculty at the partner institutions:

- Andrea Johnson (UMES) made several short visits to NOAA NMFS Woods Hole Lab to conduct research. She has also concluded plans to spend two months (May and June, 2012) conducting research at NOAA NOS, Charleston, SC. She has also been provided opportunities to gain administrative experience by being appointed as Associate Director and Education Coordinator of the LMRCSO leveraged Center, CREST-CISCEP.

NOAA LMRCSO Scientific and Educational cruise aboard the NOAA Ship Delaware II LMRCSO Cruise Planning for 2012:

Activities and Accomplishments:

- Planning for the cruise was conducted in fall 2011 via a conference call between the LMRCSO (Drs. Stevens and Johnson) and NOAA Scientists (Dr. Vince Guida) and NEFSC operations (Chuck Byrne). The purpose of this cruise is to provide at-sea experience to scientific personnel, graduate and undergraduate students of the LMRCSO. The plan is to conduct three to four deepwater trawl hauls at depths ranging from 250 to 1,100 m in each of eight areas on the continental slope following a brief sonar survey to assess trawlability. In addition, twenty-three (23) stations, primarily on the continental shelf, will be surveyed using a 2 m beam trawl (single wire).
- Three studies will be conducted during the cruise: 1) Climate Change: use of trawl sampling off Virginia and Maryland to investigate northward progress of southern species previously encountered during LMRCSO winter cruises, 2) Ocean Acidification (OA) through the collection of deep sea fauna in known locations in Hudson Canyon for laboratory culture in support of the NEFSC OA and Habitats programs, and 3) Deep water stock assessment: to collect monkfish and deep sea red crabs on the mid-Atlantic shelf and slope from Southern New England and the mid-Atlantic sub-regions. Catches of the latter will include genetic sampling to define stock structure of monkfish and systematic collection of stock metrics and reproductive data for rarely-assessed deep sea red crab.
- Six LMRCSO graduate students expressed interest in participating in the cruise.

SCHOLARLY PRODUCTIVITY

In the current reporting period, LMRCSO students and faculty made 37 presentations (15 oral and 22 poster) at scientific meetings, published 13 articles in refereed journals with another 7 in press or accepted (Appendix V).

Grantsmanship: A total of \$2,492,003.01 (Appendix II and III) was collectively awarded to the LMRCSO partner institutions during the current reporting period which directly or indirectly impacted Center activities. Of the total amount of funds awarded to LMRCSO, \$776,721.07 came from NOAA, whereas \$1,715,281.94 was obtained from other agencies. The funds provided by these agencies were used to support faculty and students and develop/enhance infrastructure. Twelve proposals that total \$8,170,439.92 (Appendix IV) were submitted to various agencies during this reporting period.

SECTION II – EDUCATION AND OUTREACH ACTIVITIES

1. **How many students and faculty were recruited to participate in academic programs, training, workshops, conferences or seminars?**
Students Recruitment into Marine Science Programs: More than 50 students (Tables 1-6) participated in academic programs, training, workshops, conferences or seminars during this reporting period.
Faculty Recruitment into Marine Science Programs: Dr. Shari Wiley, an Applied Mathematician hired in fall 2011 by HU in the Department of Mathematics, has begun collaborations with LMRCSO faculty, particularly at HU. Dr. Wiley obtained a Ph.D. at Howard University and was jointly mentored by Dr. Abdul Aziz Yakubu (Howard University) and Dr. Mike Fogarty (NOAA NEFSC). Shari was one of several students who took part in the Fish Stock Assessment Program funded by NOAA EPP and organized by P. Chigbu, Ambrose Jearld (NOAA) and Mike Fogarty (NOAA) in 2002 before proceeding to graduate school. Her addition to the LMRCSO at HU will help strengthen quantitative fisheries research and student training at the Center.
2. **What are the new education programs (degree certificate programs, etc.)?** No new education programs were developed during this reporting period.
3. **Students receiving direct and indirect support from the LMRCSO.** Six students received direct support, whereas more than 30 students received indirect support from the LMRCSO during this reporting period.
4. **What outreach activities (e.g. workshops, conferences, seminars) have the Cooperative Science Center coordinated as part of the project?**

K-12 Education and Outreach Programs: The Center conducts several initiatives aimed at exposing students in grades K-12 to the marine sciences.

SSU Coast Camp for Youth: During this reporting period, LMRCSC offered its month-long summer marine science camp to 107 youth at SSU. The SSU Coast Camp, coordinated by Dr. Dionne Hoskins, is designed to teach students how to be better stewards of the marine environment using NOAA's 7 ocean literacy principles. Students are divided into 4 classes: lower elementary (7-8 years), higher elementary (9-10 years), middle school (11-13 years), and high school (14-18 years). Each class is taught by 3-4 counselors. By serving a broad age group and being affordable, the SSU Coast Camp offers strong, accessible science instruction and long term exposure to marine science for a diverse audience of youth. Planning for 2012 Coast Camp was conducted during this reporting period.

CREST CISCEP Student Enrichment and Experiential Learning (SEEL): LMRCSC faculty hosted and mentored 7 high school students from Worcester, Wicomico and Somerset county public schools in Maryland for 7 weeks during summer of 2011. Students conducted research along-side their mentors, LMRCSC graduate students and REU undergraduates and produced posters and Powerpoint presentations of their results. These were presented at a joint symposium of the REU interns and CREST-CISCEP SEEL students on August 5, 2011. Planning for the summer 2012 SEEL program was initiated during this reporting period.

- **Teacher Development Workshop:** UMES offered a workshop for K-12 teachers from July 11-22, 2011, designed to provide hands on lessons in lab and field research in marine and environmental science which can be infused into existing K-12 science curricula. The workshop offered 3 graduate credits (ENVS 612) for successful completion. One teacher (Patricia Benner of Crisfield High School) participated in the program. Ms. Benner conducted research under the guidance of Drs. Paulinus Chigbu, Andrea Johnson and other UMES faculty and produced a lesson plan for use in the classroom. Planning has begun for the summer 2012 Teacher Development Workshop, and recruitment of teachers into the program will occur nation-wide to ensure that the required number of 7 teachers is recruited into the program.
- **Upward Bound Marine and Estuarine Science Program:** This program offers lessons in marine science ecology to 20 – 25 students in grades 10-12 from Somerset, Worcester and Wicomico Counties, MD. The program draws on the expertise of UMES-LMRCSC faculty and staff as well as MD Coastal Bays Program, National Park Service (NPS) and MD Department of Natural Resources at the UMES Paul S. Sarbanes Coastal Ecology Lab. The program is conducted for 6 sessions during the summer and on four selected Saturdays (4 sessions) during the academic year. The 2010-11 academic year sessions focused on "Protecting, Restoring, and Sustaining Green Infrastructure". LMRCSC graduate Nick Clemons, a NPS employee, led or participated in sessions during the summer or academic year. Todd Christenson (UMES) and Dr. Andrea Johnson (UMES) continue to serve on the planning committee.
- Dr. Jagus coordinates many outreach activities including the placement of high school interns from Baltimore City and Howard County in faculty labs at IMET.
- LMRCSC student Lonnie Gonsalves has been nominated for President-elect of the AFS Equal Opportunity Section. If confirmed he will assume the two-year post in 2012.
- UMES-PSM student and NOAA employee, Michele Traver continues to serve as Chair for the AFS Equal Opportunity Section's Mentoring for Professional Diversity award committee.
- Dr. Stacy Smith (DSU) became a participant in the Connecting Generations Creative Mentoring Program at Dover High School. She works weekly with students. Dr. Smith is also working with mentor program leaders on developing a week-long science camp for high school students.
- DRS Dr. Brad Stevens serves on the editorial committee of the Journal of Shellfish Research.
- HU Marine Science club and LMRCSC scholars are planning the 2nd annual Youth Retro Green Environmental Conference at the Hampton Air and Space Museum on April 21, 2012.
- P. Chigbu (UMES) serves as a Technical Advisor to the Advisory Committee to the U.S. National Section to International Committee for the Conservation of Atlantic Tunas (ICCAT).
- HU's LMRCSC and Marine Science Club students organized the Teen Environmental Conference for Middle, High and HU College students in the City of Hampton. This event was leveraged by Dr. Gibson's NSF COSIA grant in Partnership with the VA Aquarium. The results of this event were presented at the AFS meeting in Seattle, WA on September 4-8, 2011.
- Dr. Stacy Smith (DSU) volunteered and participated in the annual Delaware Bay Horseshoe Crab Spawning Survey, conducted by the Delaware National Estuarine Research Reserve. Overharvesting of horseshoe crabs depleted the population, but spawning surveys from recent years show their numbers are rebounding.

- Dr. Eric Schott (IMET) serves as board member of Blue Water Baltimore, a 501c3 organization that works to revitalize Baltimore's streams and harbor, and thence the Chesapeake Bay and is a member of the Scientific and Technical Advisory Committee. Dr. Schott also serves on the Maryland Oyster Advisory Commission, appointed by Governor O'Malley. This body advises the Maryland Department of Natural Resources on oyster management in the state.
- Aaron Watson (M.S. IMET) was interviewed and filmed for a documentary on the current state of the oceans and aquaculture sustainability. The resulting documentary, *Oceans: Turning the Tide*, video, 26:40, created for national broadcast by LinkTV, San Francisco, was aired September 2011.
- **Website:** A major redesign of LMRCS C web site (www.umes.edu/lmrsc) intended to make the site more comprehensive and centralized was initiated during this reporting period with completion anticipated by February 2012. The new site will highlight Center accomplishments and make them more accessible to the user, and will be modified to include information on faculty and students at all partners. Each of the LMRCS C partner institutions also has its own website that is directly linked to the LMRCS C main web page. The web sites for the respective institutions are: DSU (<http://cars.desu.edu/aqua-sci/index.htm>); SSU (<http://www.ssufisheries.com/>); HU (<http://www.hamptonu.edu/academics/schools/science/marine/>); UMCS-IMET (<http://www.umces.edu/imet>) and RSMAS (http://cufer.rsmas.miami.edu/index.php?page_id=31).
- **Facebook:** LMRCS C Technical Monitor Jeanine Cody created an LMRCS C page on Facebook which went live on July 20, 2009. It provides students and others a forum to network and discuss marine and fisheries issues, funding and identify job opportunities, current events in marine science, etc. Two hundred forty-eight (248) individuals, including many students, have signed up as 'fans' of the site. The site is co-managed by Jeanine Cody and Todd Christenson.

SECTION III – SUCCESS STORIES (SCIENTIFIC AND STUDENT ACCOMPLISHMENTS)

- Dr. Brad Stevens (LMRCS C DRS) has established a histology laboratory at the UMES Paul Sarbanes Coastal Ecology Center. This lab has enhanced the Center's capacity to conduct life history studies of fish.
- LMRCS C's Professional Science Master's program in Quantitative Fisheries and Resource Economics accepted several additional students for Fall 2011 including Michele Traver (NOAA Employee, Population Dynamics branch, Woods Hole, MA). Through the program, students are being trained in two areas that NOAA NMFS is in critical need of scientists.
- During the summer of 2011, students in the PSM program worked for 8-12 weeks at NOAA facilities in order to fulfill the internship requirement of the program.
- In order to accommodate the two NOAA employees in the PSM program, online versions of several quantitative fisheries courses were developed and offered during the fall 2011 semester: 1) Fish Ecology, co-taught by Dr. Chigbu and Dr. Eric May (UMES). 2) Fishery Survey Sampling, taught by Dr. Bradley Stevens (UMES), and 3) Risk and Decision Analysis, taught by Dr. Mohammad Ali (UMES). The development of these courses is a significant step toward a full online program which can ultimately be made available nationwide.
- HU student, Kendyl Crawford has used her skills gained from LMRCS C to assist Dr. Daniel Pauly (Professor, University of British Columbia, Canada) in his program the Sea Around Us. She spent summer 2011 assessing fisheries data from small Pacific Islands.

1. What specific contributions have the projects made to the Center, NOAA and partners?

- The LMRCS C educational, research and outreach activities have resulted in several contributions during this reporting period. Fifty-nine (59) students from B.S. to doctoral levels were supported and trained in NOAA core sciences. Six MS students graduated. Twelve projects funded through the TAB are underway for 2011-12; \$2,492,003.01 in external funding is supporting Center-related activities.
- The Center's doctoral graduates, Larry Alade, Ayeisha Brinson and Jose Reyes-Tomassini, all NMFS employees, are continuing to collaborate with the Center particularly in teaching courses in support of its mission.
- Noelle Hawthorne's (M.S., SSU) work is helping to refine how GRNMS estimates utilization of Gray's Reef by commercially important migratory species. Tiffany Ward's (B.S., SSU) (with Eric Ransom) work on natural and artificial oyster reefs is allowing us to provide important data to the restoration center on the comparative value of restored oyster reefs.

2. How many students participated in Center projects or activities? Fifty-nine (59) students participated in the Center projects. The names of some of the students, their research projects and presentations they made during this reporting

period are presented in Appendix V. More than 1000 K-12 students participated in the Center educational and outreach activities.

3. What specific benefits were accrued to students, faculty members and the institution(s) by participating in the program? Students benefited from their participation in the projects through hands-on research experience, completion of theses in partial fulfillment of their degree requirements, stipend, and travel awards to conferences. Besides, some students secured employment after completion of their degree programs, or received scholarships for graduate studies.

Student Awards:

- Aaron Watson (M.S., UMCES- IMET) won the 2011 M.P. Mulvihill Aquaculture Scholarship and also awards for his poster presentations at the following conferences
 - ✓ Best Student presentation from the United States Aquaculture Society
 - ✓ Best Student presentation from the Sea Grant Association

Students who Received Employment as a Result of their Work at the Center:

- Nicholas Clemons (M.S., UMES) was offered a permanent (FTE) position as Ranger II with the National Park Service in Spring, 2011. He officially graduated in December, 2011.

Students who Received Scholarships for Graduate Degree Programs as a Result of their Work at the Center:

Xaymara Serrano and Rolando Santos (RSMAS) continued to receive support during this period from the McKnight Fellowship to support their PhD work.

Kendall Crawford (HU) received a two year Marshall Scholarship for graduate studies at University College, London.

Students who received Training at NOAA Laboratories or at Center Institutions

a) William Gardner has been conducting research in collaboration with Dr. Ashok Deshpande at the NOAA J.J. Howard Marine Science Lab at Sandy Hook continuously from April, 2009 to the present. William is analyzing the PCB content of Atlantic coast and Chesapeake Bay striped bass. He is expected to graduate in May 2012.

b) Courtney McGeachy worked with Dr. Beth Phelan at the NOAA J.J. Howard Marine Science Lab at Sandy Hook, NJ from Aug 18-26, 2011. She examined behavioral ecology of black sea bass in and around traps using *in situ* video monitoring.

c) Dan Cullen (Ph.D, UMES) worked with Dr. Anne Richards in summer 2011 conducting analysis of monkfish distribution and temperature data.

d) Adam Tulu collaborated with Dr. Rosemary Jagus. He conducted portions of his doctoral research on the effects of marine pollutants in the Atlantic tomcod, *Microgadus tomcod* at the IMET facility in Baltimore from June 1 to Aug. 30, 2011.

e) Jamila Payton (M.S. UMES) worked at UMCES-IMET (June 1 to August 30, 2011) under the supervision of Dr. Rose Jagus. Jamila's research examines the physiological effects of hypoxia on Atlantic croaker in the Chesapeake Bay.

f) Belita Nguluwe (M.S., UMES) analyzed DNA samples from monkfish collected in the Northern and Southern management areas under the supervision of Dr. Al Place at UMCES-IMET from July 1 to July 31, 2011.

g) Kristen Rybyzyske (B.S. UMES), Elizabeth Seagroves (B.S. HU) and Symone Johnson (B.S. HU) worked with Drs. Richard Brill (NOAA) and Andrij Horodysky (HU) at the Virginia Institute of Marine Science Eastern Shore Laboratory at Wachapreague, VA. The students participated in all phases of collaborative projects being conducted by HU and UMES on sensory ecology of black sea bass and the effects of hypoxia on the behavior of Atlantic croaker.

h) Ten (10) students participating in the Research Experiences for Undergraduates in marine and estuarine science program at UMES during summer, 2011, visited UMCES-IMET on July 25, 2011. They were given a tour of the aquaculture laboratory by Drs. Sook Chung and Keiko Saito.

4. To what extent have the projects or activities enhanced and improved outreach, education, training and NOAA related research at the institutions? Students supported under the LMRCS have access to tools and training they would not have had were it not for the LMRCS. Several students at the Center institutions who are not directly funded by the LMRCS are benefiting from the infrastructure and equipment made available to the institutions by the LMRCS. The LMRCS has secured leveraged funding that has enabled the Center institutions to recruit and support more students than they would otherwise be able to support.

5. Did students participate in experiential research at, site visits to, or seminars at/with NOAA laboratories and/or facilities? Yes. Names of the student participants are listed in Tables 4 and 5.

6. In what specific NOAA science, service or stewardship activities (e.g. NOAA research cruises; weather forecast modeling, etc.) were students involved? NOAA LMRCS research cruise.

7. What significant impact(s) does the LMRCS research, education and outreach, and administrative functions have university-wide, for the local community, and at the local, state, regional or national level?

- The Center is having a significant positive impact on the number of students trained in NOAA-related STEM disciplines.
- SSU's marine sciences program was noted by state Senator Buddy Carter, chairman of the state Senate Higher Education Committee, (<http://m.savannahnow.com/news/2012-01-06/savannah-state-armstrong-atlantic-not-consolidation>) and Georgia Board of Regent's Chancellor Hank Huckaby as being respected for its degree offerings. This opinion significantly deterred discussions of merging SSU with Armstrong Atlantic State Univ. in Sept. 2011.
- LMRCSO supported graduate students participated in teaching STEM lab courses to more than 100 students enrolled each year in the Department of Natural Sciences at UMES.

SECTION IV – REVISIONS TO TASKS AS DESCRIBED IN GRANT AWARD AMENDMENTS AND THE IMPACT TO THE AWARD: There were no amendments to the award.

APPENDICES

Appendix I: Partial List of NOAA NMFS Scientists Collaborating with LMRCSO Scientists and Students

NOAA Scientists	NOAA Lab	Role at the LMRCSO
Larry Alade	NOAA NEFSC Woods Hole Lab, MA	UMES Adjunct Faculty. Participates in teaching the Fish Stock Assessment course at UMES
Ayeisha Brinson	NOAA NEFSC Woods Hole Lab, MA	Participated in teaching Intro. to Environmental and Resource Economics course at UMES
Ambrose Jearld	NOAA NEFSC Woods Hole Lab, MA	UMES Adjunct Faculty. Participated in teaching the Fish Stock Assessment course at UMES
Mike Fogarty	NOAA NEFSC Woods Hole Lab, MA	Participated in teaching the Fish Stock Assessment course at UMES. Member of LMRCSO External Advisory Committee
Dvora Hart	NOAA NEFSC Woods Hole Lab, MA	UMES Adjunct Faculty. Participated in teaching the Fish Stock Assessment course at UMES; Served on graduate student committee
Rich McBride	NOAA NEFSC Woods Hole Lab, MA	Collaborates with Andrea Johnson (UMES); Serves on graduate student committee; Works with Evan Lindsay (PSM graduate student during summer internship)
Ashok Deshpande	NOAA NEFSC, Sandy Hook Lab	Collaborates with Eric May; Will Gardner (UMES Ph.D. student) works in his lab at NOAA
Chris Chambers	NOAA NEFSC, Sandy Hook Lab	Collaborates with Ali Ishaque (UMES), Rose Jagus (IMET); Adam Tulu (UMES Ph.D. student) works in his lab at NOAA
Vince Guida	NOAA NEFSC, Sandy Hook Lab	Jacklyn James (UMES graduate student) worked in his lab at NOAA
Beth Phelan	NOAA NEFSC, Sandy Hook Lab	Collaborates with Brad Stevens; Courtney McGeachy (UMES M.S. student) worked with her at NOAA
Anne Richards	NOAA NEFSC Woods Hole Lab, MA	Collaborates with Andrea Johnson (UMES); Serves on graduate student committee; Worked with Dan Cullen (UMES graduate student) and Belita Nguluwe (UMES graduate student)
Elizabeth Brooks	NOAA NEFSC Woods Hole Lab, MA	Served as mentor of Jessica Blaylock (UMES PSM Graduate Student) during summer 2011 internship at NOAA
Kate Andrews	NOAA NEFSC Beaufort, NC	Served as mentor of Jeff Kipp (UMES PSM Graduate Student) during summer 2011 internship at NOAA
Richard Brill	NOAA NEFSC/VIMS	Collaborates with Andrea Johnson (UMES) & Andrij Horodysky (HU); Serves on graduate student committees
Bruce Vogt	NOAA Chesapeake Bay Office, MD	Served as mentor of Andrew Turner (UMES PSM Graduate Student) during summer 2011 internship at NOAA
Howard Townsend	NOAA Chesapeake Bay Office, MD	UMES Adjunct Faculty. Collaborates with P. Chigbu; Served as mentor of Andrew Turner (UMES PSM Graduate Student) during summer 2011 internship at NOAA
Doug Wilson	NOAA NEFSC Chesapeake Bay Office, MD	Serves as a member of External Advisory Committee of LMRCSO

Gary Wikfors	NOAA NEFSC Milford Lab	Collaborates with Eric Schott (IMET); Gulnihal Ozbay (DSU); Serves on Graduate Student committee
Gary Shepherd	NOAA NEFSC Woods Hole Lab, MA	Works with Brad Stevens (UMES) and Dan Cullen (UMES graduate student)
Kristy Wallmo	NOAA Headquarters, Silver Spring, MD	LMRCSC Technical Monitor; UMES Adjunct faculty. Participates in teaching Intro. to Environmental and Resource Economics course
David Tomberlin	NOAA Headquarters, Silver Spring, MD	UMES Adjunct Faculty. Participates in teaching Intro. to Environmental and Resource Economics course
Mark Brady	NOAA Northeast Regional Office, Gloucester, MA	Served as mentor of Leonardo Matthews (UMES PSM Graduate Student) during summer 2011 internship at NOAA
Kevin Chu	NOAA Southwest Regional Office	Member Employer Advisory Board of the Professional Science Masters degree Program that was leveraged with the LMRCSC.
Jim Nance	NOAA SEFSC Galveston, TX	Member, External Advisory Committee of the LMRCSC
Gretchen Messick,	NOAA NCCOS Cooperative Oxford Lab, MD	Collaborates with Eric Schott (IMET)
Bob Wood	NOAA NCCOS Cooperative Oxford Lab, MD	Serves as a member of Employer Advisory Board of the Professional Science Masters degree Program that was leveraged with the LMRCSC.
John Jacobs	NOAA NCCOS Cooperative Oxford Lab, MD	UMES Adjunct Faculty. Collaborates with Eric May (UMES), Serves on graduate thesis committee of UMES students (Lonnie Gonsalves and Candace Rodgers)
Frank Morado	NOAA NWFSC, Seattle, WA	Collaborates with Joseph Pitula (UMES)
Margaret Miller	NOAA SEFSC, Miami, FL	Collaborates with Daniel Benetti (RSMAS) and RSMAS graduate student (Dwight Ebanks)
Joe Serafy	NOAA SEFSC	Collaborates with Diego Lirman (RSMAS) and Rolando Santos (Graduate student, RSMAS)
Tom Hurst	NOAA AFSC	Collaborates with Jessica Miller (OSU)
Ed Farley	NOAA AFSC	Serves on graduate committee of Shari Mullen (UMES graduate student)
Jamal Moss	NOAA AFSC	Serves on graduate committee of Shari Mullen (UMES graduate student); Shari conducts her research at AFSC.

Appendix II. Current leveraged funding from NOAA to LMRCSC institutions

Author	Funding Agency	Title of Project	Start/End Date	Amount	Current 6 month period
Zohar, Y. (IMET)	NOAA	The blue crab <i>Callinectes sapidus</i> : an integrated research program of basic biology, hatchery technologies, and potential for replenishing stocks	12/01/06-11/30/11	\$4,095,099	\$409,509.90
Chen, Feng (UMCES-IMET)	NOAA	Metagenomic analysis of microalgae in the Chesapeake Bay	8/1/10-7/31/11	\$19,975	9987.5
Hill, Russell (UMCES-IMET)	NOAA	Metagenomic analysis of microalgae in the Chesapeake Bay	8/1/10-7/31/11	\$52,150	26075
Schott, E. (UMCES-IMET)	NOAA Sea Grant	Effects of toxic algae blooms on health and disease of blue crab: Defining thresholds for exposure	2/1/11-1/31/12	\$22,463	11231.5
Stevens, B.G.(UMES)	NOAA	Improving conservation of New England Whelks	2010-2012	\$75,688	12614.67
Hoskins, D. (SSU)	GA Sea Grant	Marine Resources Utilization in GA	2009-11	\$16,830	\$4,207.50
Gilligan, M. (SSU)	NOAA	Replacement of University's Major Marine Science Vessel	2010-11	\$449,550	\$224,775.00
Johnson, A.K (UMES) and R.A.	NOAA NMFS-Monkfish Set	Influence of temperature on the distribution and catch rates of	5/1/11-4/30/12	\$ 79,899	\$39,949.50

Richards (NOAA)	Aside Program	monkfish, <i>Lophius americanus</i> .			
Ozby, G. (DSU)	NOAA ECSC	Benthic diatom assemblages as environmental indicators in Blackbird Watershed, Delaware	6/1/2008-5/2011	\$146,895	\$24,483
Place, A.R. (IMET)	NOAA	Metagenomic Analysis of Microalgae in the Chesapeake Bay	08/01/10-07/31/11	\$27,775	\$13,887.50
TOTAL					\$776,721.07

Appendix III. Current leveraged funding to LMRCS institutions from sources and agencies other than NOAA (*Students)

Author	Funding Agency	Title of Project	Start/End Date	Amount	Current 6 month period
*Serrano, X. (RSMAS-Student)	McKnight Fellowship	Ecophysiology of corals	8/2008-7/2011	\$30,000	\$5,000.00
*Santos, R. (RSMAS-Student)	McKnight Fellowship	Multi-scale spatial variation of nearshore submerged aquatic vegetation seascapes at Biscayne National Park	8/2009-7/2012	\$30,000	\$5,000.00
Die, D.J. (RSMAS)	NTVI (*)	Center for independent experts	9/2007-8/2011	\$122,176	\$33,125.00
Chung, J.(COMB), Zmora, O.(COMB), & Sagi, A.	US-Israel BARD	Endocrine and Molecular Manipulations of the Crustacean Molt to Control Growth and Synchronize Ecdysis	2009-2011	\$150000	\$37,500.00
Schreier, H. (COMB) & Tal, Y.	US-Israel BARD.	Using a "Sulfide Loop" to control fish pathogens in marine recirculating aquaculture systems	2009-2011	\$150000	\$37,500.00
Schott, E. (UMCES-IMET)	Barbor FTD	Blue crab reo-like virus transmission study	3/25/11-3/35/12	\$12,568	\$6284
Schott, E. (UMCES-IMET)	FWRI	Impact of Hematodinium	9/1/10-8/31/11	\$3,975	\$1987.5
Frischer, M. (SKIO), Gibson, D.(HU) G. Paffenhöfer	NSF	Dolioid Blooms: What are the Driving Variables? Investigations of Trophic Interactions	1/1/09-12/21/12	\$75,688	\$12,614.67
Halverson, C., Gibson, D.(HU) and C. Witherspoon	NSF OCE ISE	Communicating Ocean Sciences to Informal Education Network (COSIEN)	10/1/10 – 9/1/12	\$32,281	\$8,070.25
Smith, S. (DSU), Ozby, G. (DSU)	USDA-NRCS	The efficacy of heavy use area protection (HUAP) pads to decrease runoff of nonpoint source pollution into the Chesapeake Bay watershed.	8/1/2011-8/1/2012	\$99,435.92	\$49717.96
Ozby, G. (DSU)	USDA-CBG	"Enhancing Geographic Information System Education and Delivery through Collaboration: Curricula Design, Faculty, Staff, and Student	9/1/2010-8/30/2013	\$299,996	\$49,999.33

		Training and Development, and Extension Services.			
Ozbay, G. (DSU)	USDA-AFRI	Inactivation of enteric foodborne viruses in high risk foods by non-thermal Processing technologies.	2/1/2011-1/31/2016	\$2,000,000	\$200,000
Ozbay, G. (DSU)	USDA Evans-Allen program	Monitoring aquatic health and habitat value of oyster (<i>Crassostrea virginica</i>) gardening and restoration through community-based oyster enhancement efforts.	9/1/2010-8/31/2012	\$209,750	\$52,437.50
Ozbay, G. (DSU)	DSU Center for School Change	Diverse Pathways to Success: Women in the Sciences and Social Sciences, Part 2	1/1/2010-12/30/2011	\$750	\$375
Ozbay, G. (DSU)	NSF	Research Experience for Undergraduates Site: Undergraduate Research in Molecular Genetics & Genomics at DSU	5/2010-9/2012	\$250,000	\$62,500
Ozbay, G. (DSU)	USDA-NRI	Persistence of Enteric Viruses in Oysters (<i>Crassostrea virginica</i>)	10/1/2008-9/30/2011	\$100,000	\$16,666.67
Ozbay, G. (DSU)	EPA	Mid-Atlantic Drinking Water Program: Drinking Water and Human Health. National Integrated Water Quality Program (NIWQP)	12/1/2009-11/30/2012	\$48,000	\$8,000
Ozbay, G. (DSU)	USDA-FSIS	Microbial and Chemical Contaminants in Processed Catfish for Food Safety.	09/25/09-09/24/11	\$555,550	\$138,887.50
Hoskins, D.(SSU)	COL	National Ocean Science Bowl (GA-SC) competition	2010-11	\$15,000	\$7,000.00
Hoskins, D. (SSU)	Ocean Leadership	Diversity Initiative	2010-11	\$10,000	\$5,000.00
Hintz, C. (SSU)	United Negro College Fund	Production of High Fidelity Lunar Stimulants for Exploration Risk Reduction and Systems Analysis Year 2	2009-11	\$66,000	\$16,500.00
Mayor Otis Johnson, Ph.D., Maria Procopio, Dionne Hoskins, and Horace Magwood, III	GA DNR	Sidewalk to the Sea Program	2009-11	\$191,580	\$47,895.00
Curran, C.(SSU)	USDOE	Training and research grant	2009-15	\$3,000,000	\$250,000.00
Gilligan, M.(SSU)	NSF	Research Experience for Undergraduates	2009-12	\$292,434	\$48,739.00
Pride, C.(SSU)	NSF	New GK12: Building Ocean Literacy in a Coastal Community Through Science	2009-14	\$2,214,884	\$221,488.40
P. Chigbu & J. Love (UMES)	NSF	University of Maryland Eastern Shore REU in Marine and Estuarine Science	6/1/09 – 5/31/12	\$231,521	\$38,586.83
P. Chigbu, J. Pitula, E. May, M. Mitra, & A. Johnson (UMES)	NSF	CREST Center for the Integrated Study of Coastal Ecosystem Processes and Dynamics	8/1/10 – 7/31/15	~\$5,000,000	~\$500,000
P. Chigbu, K. Wallmo (NOAA), J. Okoh, J. Keane-Dawes,	NSF	Professional Science Master's degree in Quantitative Fisheries and Resource Economics	5/1/10 – 4/30/13	~\$700,000	\$116,666

S. Tubene (UMES)					
E. May, A. Allen (UMES)	USDA Capacity Bldg Grant	Capacity Building Grants Program, Watershed Level Examination of Urea Use as Fertilizer and the Production of the Biotoxin Domoic Acid	10/1/10 – 9/30/13	\$499,950	\$83,325.00
A, Allen, E. May (UMES)	USDA Capacity Bldg Grant	Development of A Subsurface Application Technology for Dry Poultry Litter to Protect Air and Water Quality	10/1/10 – 9/30/13	\$599,000	\$99,833.33
Gibson, D., Horodysky, A., Cuker, B.	NSF (HRD- HBCU-UP)	Targeted Infusion Project: Educational Partnership in Climate Change and Sustainability (EPICCS)	9/1/11 – 8/31/14	\$300,000	\$50,000.00
Gibson, D.	NSF	Dolioid Blooms: What are the Driving Variables? Investigations of Trophic Interactions	January 2009 - December 2012	\$75,688	
TOTAL					\$1,715,281.94

Appendix IV. Grants submitted by LMRCS during this reporting period (July 1 to December 31, 2011)

Author	Funding Agency	Title of Project	Amount
Smith (DSU), Ozbay (DSU)	USDA-NRCS	The efficacy of heavy use area protection (HUAP) pads to decrease runoff of nonpoint source pollution into the Chesapeake Bay watershed.	\$99,435.92
Gibson, D. (HU)	NIST Construction Grants program	Atmospheric and Coastal Sciences Research Building (ACSRB)	\$5,000,000
Chung, J.S. (IMET)	US EPA	Uptake and effects of dispersed oil droplets and emulsified oil by estuarine crust	\$139,393
Chung, J.S. (IMET)	GRI	LSU Research Consortium: Effects of oil droplets	\$393,824
Chung, J.S. (IMET)	NSF	Functional roles of a novel crustacean female sex hormone in sex differentiation and developing secondary sex features of crustaceans	\$635,507
Place, A. (IMET)	NOAA	ECO HAB: Integrating cell and toxin cycles of karlodium veneficum with key environmental regulators: In situ studies of predictive determinants for bloom toxicity	\$74,375
Place, A. (IMET)	NOAA	ECO HAB: Sorting the fatty acid chaff from the toxin wheat or is it all wheat? – Assigning dinoflagellate PKS genes to toxin synthesis.	\$434,608
Place, A. (IMET)	BARD	Taurine: A potential key ingredient to reduce the dependence on fish meal in aquaculture	\$158,400
Place, A. (IMET)	NIH	The chemistry and biology of the karlotoxins	\$392,488
Place, A. (IMET)	NSF	Diversification along a salinity gradient: Genetic mechanisms and functional consequences	\$558,128
Stevens, B. (UMES)	NOAA Chesapeake Bay Office	Aerial estimation of cownose ray abundance in Chesapeake Bay	\$154,345
Stevens, B., J. Sook Chung (IMET), Larry Jacobson & Toni Chute (NOAA NEFSC)	NOAA FATE program	Biological baseline for potential impacts of climate change on reproduction and management of deep-sea red crabs (<i>Chaceon quinque-dens</i>)	\$129,936
TOTAL			\$8,170,439.92

Appendix V: Presentations and Publications

Oral Presentations (*Students, Presenter in bold)

- Babcock, E. Using marine reserves to inform fishery management. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Brady, M.* , Conn, P., Bailey, L., Fox, D. A., Shertzer, K. Why did the eel cross the creek: Understanding American eel behavior in an estuarine setting. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Breece, M.* , Fox, D.A., and T. Savoy. Factors influencing the coastal movements of Atlantic sturgeon in the Mid-Atlantic and along the eastern seaboard of the US. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Crawford, K.E.C.* , Horodysky, A, Brill, R., and A.K. Johnson. Ontogeny of visual ecophysiology in black sea bass (Serranidae: *Centropristis striata*). 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Curran, M.C., Aultman, T., and H. Schaffner. Developing ocean literate students using data from flounder research. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Fleming, K.M.* , Fox, D.A., and S. K. Bolding. Can humans and sturgeons coexist? Linking Gulf sturgeon habitat utilization and human development in Choctawhatchee Bay, FL. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Gonsalves, L.*. Jacobs, J.M., Johnson, A.K., and E.B. May. Predicting the impact of poor nutritional status on immune function in striped bass, *Morone saxatilis*. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Horodysky, A., Brill, R., Bushnell, P., Musick, J. A., and R. J. Latour. Comparative metabolic rates of common western North Atlantic Sciaenid fishes. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Hoskins, D. Stocking the pond: NOAA Living Marine Resources Cooperative Science Center's Coast Camp engages diverse youth. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Miller, J. A. and R.A. DiMaria. Factors influencing otolith elemental incorporation: Implications for field applications. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Miller, J. A., and L. Tomaro. Early marine residence of spring-run Chinook salmon: A comparison of growth and migration in two interior Columbia River populations. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Saul, S.* Die, D.J., Brooks, E., and J. Abbott. Modeling the effect of fisher behavior on CPUE in the Gulf of Mexico reef fish fishery. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Stevens, B.G. Sexual maturity of deep-sea red crabs *Chaceon quinque-dens* in the Mid-Atlantic Bight. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Tulu, A.* , Chambers, R.C., Ishaque, A.B., and R. Jagus. Development of molecular tools, cDNA cloning and sequence analysis of aromatase Cytochrome P450/19A in Atlantic tomcod, *Microgadus tomcod*. Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.
- Watson, A.* Taurine, the missing ingredient for fish-free diets for aquaculture. Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.

Poster Presentations (*Students, Presenter in **bold**)

- Bedu, P.* Using molecular methods to search for *Hematodinium* sp and Reolike virus of blue crab *Callinectes sapidus*. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Cannon, A.* , Ozbay, G. 2011. Monitoring aquatic health in wastewater discharge point source in Delaware Inland Bays Tidal Canal: a case study on heavy metal contaminants. 21st Biennial Conference of the Coastal and Estuarine Research Federation, Nov. 2011. Daytona, FL.

- Davis, J.* Bacterial symbionts of a marine invertebrate, *Elysia rufescens*. Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.
- Dyson, W.E*, Pitula, J.S., Schott, E., and A. Hanif. A PCR-based assay for detection of *Hematodinium* sp in sediment and water from the Maryland Coastal Bays. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Dyson, W.E*, Pitula, J.S., Schott, E., and A. Hanif. A PCR-based assay for detection of *Hematodinium* sp in sediment and water from the Maryland Coastal Bays. Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.
- Gibson, D., Crawford, K.C.*, Burns, K.P. Students, educators, researchers and the community unite! 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Hanif, A*. Using molecular methods to monitor pathogens in early life history of blue crabs (*Callinectes sapidus*). Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.
- Johnson, A.K., Bediako, B.* and E. Worth. Metal concentrations in American goosefish. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Kiser, R., and M.C. Curran. Distribution and abundance of flatfishes in Wyly Creek, GA. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Lindsay, E.*, Depass, C.*, Johnson, A.K. and R. McBride. Fecundity estimation of American goosefish *Lophius americanus* in the western North Atlantic. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Pavel, C*, Curran, M.C., Carroll, C.J., Meadows, A.W., Post, B., Norwood, C., Moak, J., and O. Filte. Movement patterns of shortnose sturgeon *Acipenser brevirostrum* in the Savannah River, GA. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Peemoeller, B.* and B.G. Stevens. Improving conservation of New England whelks, *Busycoptypus canaliculatus*: Size at maturity. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Peemoeller, B.* and B.G. Stevens. Improving conservation of New England whelks, *Busycoptypus canaliculatus*: Size at maturity. Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.
- Reckenbeil, B.* and Ozbay, G. 2011. Successful Spat Survival on Shell in the Delaware Inland Bays. 2011 Annual Meeting of the Mid-Atlantic Chapter of the American Fisheries Society, Nov. 2011. Manahawkin, N.J.
- Smith, D.*, Curran, M.C., C. N. Belcher. The distribution of shark species in relation to macrohabitat features off the coast of Georgia, USA. 141st Annual Meeting of the American Fisheries Society, September 4-8, 2011. Seattle, WA.
- Smith, S., Cherrier, J, Caffrey, J. Sarkodee-Adoo, J.* 2011. Dissolved Inorganic Carbon Dynamics in Two Subtropical Estuaries: Apalachicola Bay, FL, and St. Joseph Bay, FL. 96th Ecological Society of America Conference, August 7-12. Austin, TX.
- Smith, S.L. Economic impact of Deepwater Horizon oil spill on the FL Gulf Coast oyster industry. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Stoneman, A.,* Kocovsky, P., Kraus, R., Lee, C., and Plumb, R. 2011. Diet, Age, and Reproduction of Trout-perch in the Western Basin of Lake Erie. 141st Annual Meeting of the American Fisheries Society, Sept. 2011. Seattle, WA.
- Stoneman, A.,* and Smith, S. 2011. Effects of ocean acidification on otolith growth on the mummichog (*Fundulus heteroclitus*) and other Atlantic fish species. 2011 Annual Meeting of the Mid-Atlantic Chapter of the American Fisheries Society, Nov. 2011. Manahawkin, N.J.
- Tulu, A.*, Chambers, R.C., Ishaque, A.B., and R. Jagus. Development of molecular tools, cDNA cloning and sequence analysis of aromatase Cytochrome P450/19A in Atlantic tomcod, *Microgadus tomcod*. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.
- Vicente, J*. Bacterial Community Analysis of the Symbionts in Two Coexisting Cryptic Sponges *Xestospongia deweerdtiae* and *Plakortis* sp. Marine-Estuarine-Environmental Science Program Annual Symposium. October 14-15, 2011. Appalachian State University.
- Wolfer, H.* Physiological effects of sublethal hypoxia on Atlantic croaker in Chesapeake Bay. 141st Annual Meeting of the American Fisheries Society. September 4-8, 2011. Seattle, WA.

Publications (*Students)

Published

- Bowen-Stevens, S., Cox, T.M., and M.C. Curran. 2011. What are Bottlenose Dolphins Doing on Land? an Activity Teaching the Scientific Method through the Unique Behavior of Strand Feeding. *The American Biology Teacher*. 73(7): 407–411.
- Chung JS, Manor R, Sagi A., 2011. Cloning of an insulin-like androgenic gland factor (IAG) from the blue crab, *Callinectes sapidus*: implications for eyestalk regulation of IAG expression. *Gen. Comp. Endocrinol.* 147: 201-213.
- Hearne, J.L. and Pitula JS. 2011. Identification of Two Spliced Leader RNA Transcripts from *Perkinsus marinus*. *J. Eukaryot. Microbiol.* 58:266-268.
- Horodysky, A.Z., R.W. Brill, P.G. Bushnell, J.A. Musick, and R.J. Latour. 2011. Comparative metabolic rates of common western North Atlantic sciaenid fishes. *J. Fish. Biol.* 79:235-255
- Johnson A.K., Bediako, B.*, and E. Wirth. 2011. Metal concentrations in monkfish, *Lophius americanus* from the northeastern USA. *Environmental Monitoring and Assessment.* 177(1-4): 385-297.
- Montalvo N.F.*, Hill R.T., 2011. Sponge-Associated Bacteria are Strictly Maintained in Two Closely-Related but Geographically Distant Sponge Hosts. *Appl. Environ. Microbiol.* Aug. Epub.
- Ozbay, G., Holloway, F. Hughes, J., Ukaegbu, O.* and Dillard, C. (2010). Investigating Growth Responses, Survival, and Cellular Activities of Harmful Algal Species, *Karlodinium veneficum* and *Prorocentrum minimum* under Various Environmental Conditions: Students Harmful Algal Research Projects. *Journal of Environmental Monitoring & Restoration.* 6:178-192.
- Rittschof D, Darnell MZ, Darnell KM, Goldman M, Ogburn MB, McDowell R. 2010. Estimating relative abundance of the female blue crab spawning stock in North Carolina. In: GH Kruse, GL Eckert, RJ Foy, RN Lipcius, B Sainte-Marie, DL Stram, and D Woodby (eds.). *Biology and Management of Exploited Crab Populations under Climate Change*. Alaska Sea Grant, University of Alaska Fairbanks.
- Santos, R.O.*, Lirman, D., and J.E. Serafy. 2011. Quantifying freshwater-induced fragmentation of submerged aquatic vegetation communities using a multi-scale landscape ecology approach. *Marine Ecology Progress Series.* 427: 233-246.
- Serrano, X.* , Serafy, J. and M. Grosell, M. (2011). Osmoregulatory capabilities of the gray snapper, *Lutjanus griseus*: salinity challenges and field observations', *Marine and Freshwater Behaviour and Physiology*.
- Van Wagoner, R.M., Deeds, J.R., Tatters, A. O., Place, A.R., Tomas, C. R., and Wright, J.L.C. (2010) Structure and Relative Potency of Several Karlotoxins from *Karlodinium veneficum*. *J. Natural Products* 73(8): 1360–1365
- Weinbauer, M., F. Chen, S. Wilhelm. 2011. Virus mediated redistribution and partitioning of carbon in the global oceans. pp. 54-55. In: Jiao et al. (ed). *Microbial Carbon Pump in the Ocean*. *Science/AAAS*, Washington, DC.
- Zhang, R. and F. Chen. 2011. *The Largest Gene Engineering Factory - Microbial Gene Transfer in the Ocean*. The 10,000 Scientific Challenges. Scientific Publisher, Inc. Beijing, China.

In Press or Accepted

- Cai, W.W., H. Wang, F. Chen, T.L. Zheng. 2011. Bacteriophage influences the dynamics of toxic dinoflagellates by lysing algicidal bacteria. *Appl. Environ. Microbiol.* (Accepted).
- Huang, S., S.W. Wilhelm, H.R. Harvey, K. Taylor, N.Z. Jiao, and F. Chen. 2011. Novel lineages of *Prochlorococcus* and *Synechococcus* in the global oceans. *ISME J* (in press).
- Huang, S., K. Wang, N.Z. Jiao, and F. Chen. 2011. Genome sequences of four *Synechococcus* siphoviruses: a new insight into the diversity of marine cyanophage. *Environ. Microbiol.* (in press).
- Huang, S., Y.Y. Zhang, F. Chen, N.Z. Jiao. 2011. Complete genome sequence of a marine roseophage provides evidence into the evolution of gene transfer agent in alphaproteobacteria. *Virology Journal.* (in press).
- Jiao, N., G.J. Herndl, D.A. Hansell, R. Benner, G. Kattner, S.W. Wilhelm, D.L. Kirchman, M.G. Weinbauer, T.W. Luo, F. Chen, and F. Azam. 2011. The microbial carbon pump and the oceanic recalcitrant dissolved organic matter pool. *Nat. Rev. Microbiol.* (in press).

- Kan, J. T.E. Hanson, and F. Chen. 2011. Synchronicity between population structure and proteome profiles: A metaproteomic analysis of Chesapeake Bay bacterial communities. In: Frans J. de Bruijn (ed.). Handbook of Molecular Microbial Ecology I: Metagenomics and Complementary Approaches. (in press).
- Wang, K., K.E. Wommack, F. Chen. 2011. Inter-annual survey in the Chesapeake Bay: Abundance and distribution of *Synechococcus* and cyanophages. *Appl. Environ. Microbiol.* (in press).

Submitted

- Aultman, T.* and M.C. Curran. Move over! Studying flatfish travel patterns to profile fish behavior. The American Biology Teacher.
- Forrestal F., M. Coll, D.J. Die and V. Christensen. (in review). Ecosystem effects of Bluefin Tuna (*Thunnus thynnus thynnus*) aquaculture in the North-Western Mediterranean Sea. *Marine Ecology Progress Series*.
- Graves, J.E., A.Z. Horodysky, and D.W. Kerstetter. In review. Incorporating circle hooks into pelagic longline and recreational billfish fisheries: bottom-up versus top-down control. *Bull. Mar. Sci.*
- Hammerschlag, Neil, Lazzarre, Dominique M*, Rumbold Darren, Wasno Robert, Hammerschlag-Peyer Caroline M and Slonim Curt. In Review. Summer movement patterns of tiger sharks satellite-tagged off the Gulf Coast of Florida. *Marine Ecology*.
- Saul S., D.J. Die. (in review). An individual-based model of ontogenetic migration in reef fish using a biased random walk. *Transactions of American Fisheries Society*.
- Sukkestad, K* and M.C. Curran. Noodling for mollusks: Who knew that some mussels were endangered? The American Biology Teacher.
- Kalinowsky, C.A.,* M.C. Curran, and J. Smith. Fall 2010. Age and growth of the Cobia (Linnaeus 1776), in Port Royal Sound and adjacent waters of Beaufort County, South Carolina. *Fishery Bulletin*.
- Montalvo, N. F.* and R. T. Hill. Bacterial speciation in the marine sponges *Xestospongia muta* and *Xestospongia testudinaria*. Submitted to *Applied and Environmental Microbiology*. (In revision).
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Appendix VI. Acronym and LMRCSC Links

1. Link to the LMRCSC Performance Reports - <http://www.umes.edu/LMRCSC/Default.aspx?id=16024>
2. Link to LMRCSC Leveraged CREST-CISCEP - <http://www.umes.edu/crest/Default.aspx?id=31676>
3. Link to the LMRCSC Leveraged PSM Program - <http://www.umes.edu/psm/Default.aspx?id=30892>