

**Center for Marine Sciences and Technology
Annual Report -- 2006-2007**

Submitted by Dr. David B. Eggleston, Director
June 2007

The principal mission of the Center for Marine Sciences and Technology (CMAST) is to discover innovative solutions to questions and problems in marine systems and provide effective communication of these discoveries, by promoting multidisciplinary studies among research scientists, educators and extension specialists from the participating NC State University colleges, enhancing interaction with other educational institutions and agencies concerned with marine sciences and coastal natural resources, and providing a focal point for citizen contact with NC State University's marine science and extension faculty. A description of CMAST research, extension and education activities and programs may be found on our web-site (www.cmast.ncsu.edu/) and via our newsletters.

1. Opportunities

- UNC President Bowles is trying to leverage the talent and expertise of marine sciences in NC via the Bowles Marine Science Task Force.
- Recreational Saltwater Fishing License will generate ~ \$25 million annually, providing new funding opportunities in fisheries.

2. Constraints

- Lack of critical mass for teaching and research.
- Lack of housing for visiting students, faculty and staff.

3. Two most significant items

- Dr. David Eggleston became new CMAST Director effective October 1, 2006
- Submission of an initiative with UNC-IMS and NC Sea Grant, and in partnership with the Marine Science and Education Partnership, Duke University, and other marine science campuses in the UNC system, entitled "North Carolina Partnership for Coastal Sustainability", for consideration of funding in the response to UNC President Erskine Bowles' Marine Science Task Force.

4. Changes in Service Environment

- Three initiatives are pending which could more than double the size of our faculty and staff:
- North Carolina Partnership for Coastal Sustainability, which, in partnership with UNC-IMS and NC Sea Grant, could add 5 new faculty and support staff
- NC Quantitative Fisheries Institute, in partnership with the NC Division of Marine Fisheries, could add two new faculty and support staff.
- NC Aquapark, in partnership with the NCSU Department of Zoology, could add one new faculty member support staff, and new facilities in Carteret County, NC.

5. Compact Plan

- CMAST did not submit a Compact Plan, however, Eggleston communicated with Deans Solomon, Arden and Wynne the need to consider linkages between PAMS, Vet. Med., and CALS and CMAST-based programs.

6. Diversity

- CMAST is an equal opportunity employer
- Information about CMAST programs and employment opportunities are freely available through our web-site and newsletter.
- CMAST faculty strive to integrate high school, community college, undergraduate and graduate students into research and extension programs.

7. Instructional Program Advances

- CMAST faculty offer a variety of hands-on workshops at CMAST or in the field.
- Provide educational opportunities to students and employees at Carteret Community College, UNC Chapel Hill's Institute of Marine Science, Duke University's Marine Lab, NC Division of Marine Fisheries, and NOAA's Beaufort Laboratory.
- CMAST faculty offer in-house and teleconferenced courses to NCSU's main campus.
 - MEA 493/593 Biological Oceanography
 - ZO 624 – Chemistry as a tool in fisheries
 - ZO/MEA 695 - Thesis Research
 - ZO/MEA 699 - Thesis Preparation
 - ZO/MEA 895 – Dissertation Research
- CMAST hosts residents from the NCSU College of Veterinary Medicine and teaches a variety of short courses and workshops in support of the Veterinary Medicine Program.
 - Teach in MarVet 3 (<http://www.marvet.org/index.htm>) and Aquavet I.
 - Involve DVM students in research and marine animal pathology activities: dolphin rodeo, sea turtle laparoscopies, sea turtle trawl census, summer research mentoring, marine mammal strandings.
 - Dolphin and sea turtle health assessments (17 veterinary students and 3 residents involved in dolphin captures in April 2006; 25 veterinary students, 3 residents and 2 graduate students involved in sea turtle laparoscopies in May and October 2006), and strandings necropsies done; sea turtle trawl census and new summer research mentoring not done (but continuing with Hope Valentine's sea turtle bartonella work from 2 summers ago).
 - Manage small Support for Aquatic Animal Medicine Fund for veterinary student and resident aquatic research projects. (Supported iguana ketoprofen pharmacokinetic study (Tuttle), shark propofol study (Cavin), shark parasitology investigation (Maclean) including medical illustration by veterinary student (Mehalick).
 - Facilitate provision of sea turtle and marine mammal carcasses for exotic animal pathology selective, marine mammal medicine elective, and WAAZM and/or Patheads workshops.
 - Conducted second sea turtle medicine senior block for full block of 6 students.
 - Updated and revised sea turtle and marine mammal lectures and labs for VMC953 based on current literature, additional clinical experience and student evaluations.

- New lecture on fish diagnostics, anesthesia and euthanasia for Carteret Community College aquaculture program, class of 12 community college students.
- Lectures in support of NCSU courses TOX 701 unit on Liver and Kidney toxicity, TOX 495 unit on Endocrine Disruption, TOX 401 unit on Liver and Kidney toxicity, 715 unit on Pharmaceuticals and Personal Care Products.
- FS322 (39 students). Guest lecture and laboratory on aquatic muscle food quality and safety.
- ZO586 (20 students) Guest lecture on post-harvest handling and quality of aquatic fishery products.
- Presentation at NC State University's Continuing Education Sportfishing School (Hatteras, NC) entitled "Fishery Management and Conservation" (June 2006; 40 students)
- Poster, program article, newspaper reports, and local television reports on scientific sampling of pelagic game fish at Big Rock Blue Marlin tournament, Morehead City, NC (June 2006)
- Fisheries Biology laboratory for Grey Ezzard's Craven Community College Environmental Biology class (CMAST: April 2006; 7 students)
- Hosted 12 undergraduate NCSU students for Coastal Processes course (MEA459).
- Hosted ~ 15 undergraduate NCSU students for Ecology of Fishes field trip.
- Mentoring Activities
 - Mentor for American Fisheries Society Hutton Fellow (high school minority student) – Morrell Fox (6/06-8/06)
 - Mentor for *Marine Fisheries Management Fellow* – Warren Mitchell, (8/06 – present)
 - Mentor for post-doctoral fellow – J. Christopher Taylor (5/06- present)
 - Mentor for Fisheries and Wildlife undergraduate interns – Amos Williams and Tyler Averett (summer 2006)
 - Mentor for *Marine Fisheries Management Fellow* – Summer Burdick, (6/05 – 6/06)
 - Mentor for CMAST and NC Sea Grant Fellows
 - Arni Vitus Petersen (Visiting Scholar). Seafood traceability: a practical guide for the seafood industry.
 - Durita Nielsen (Post-doc Research Scientist). Sensory evaluation of fish using the QIM technique.

8. Research

Publications

1. Rudershausen, P.J., **J.A. Buckel**, and E.H. Williams. in press. Discard composition and release fate in the snapper-grouper commercial hook and line fishery, North Carolina. *Fish. Manag. Ecol.*
2. Tuomikoski, J.E., P.J. Rudershausen, **J.A. Buckel**, and J.E. Hightower. in press. Effects of age-1 striped bass predation on juvenile fishes in Albemarle Sound. *Trans. Am. Fish. Soc.*

3. Slater, J.J., T.E. Lankford, and **J.A. Buckel**. in press. Winter energetics of young-of-the-year bluefish (*Pomatomus saltatrix*): effects of ration and cohort of origin on survival. Mar. Ecol. Prog. Ser.
4. Morley, J.W., **J.A. Buckel**, and T.E. Lankford. in press. Winter energy storage dynamics and cohort structure of young-of-the-year bluefish (*Pomatomus saltatrix*) off North Carolina. Mar. Ecol. Prog. Ser.
5. **Buckel, J.A.**, R.J. Hines, and T.C. McArthur, Jr. 2006. Incidental catch and discard of red drum, *Sciaenops ocellatus*, in a large mesh Paralichthyidae gillnet fishery: experimental evaluation of a fisher's experience at limiting bycatch. Fish. Manag. Ecol. 13:113-119.
6. Bethea, D.M., J.K. Carlson, **J.A. Buckel**, and M. Satterwhite. 2006. Ontogenetic and site related trends in the diet of the Atlantic sharpnose shark *Rhizoprionodon terraenovae* from the Northeast Gulf of Mexico. Bull. Mar. Sci. 78:287-307.
7. LeBlanc, L.A., **J.A. Buckel**, D.O. Conover, and B.J. Brownawell. 2006. Tests of bioaccumulation models for polychlorinated biphenyl compounds: a study of young-of-the-year bluefish in the Hudson River estuary, USA. Env. Tox. Chem. 25:2067-2076.
8. Scharf, F.S., **J.A. Buckel**, K.A. Rose, F. Juanes, and J.H. Cowan Jr. 2006. Effects of variable prey and cohort dynamics on growth of young-of-the-year estuarine bluefish: evidence for interactions between spring- and summer-spawned cohorts. Trans. Am. Fish. Soc. 135:1266-1289.
11. Johnson AK, **Harms CA**, Levine JF, Law JM. 2006. A quantitative real-time RT-PCR assay to measure TGF-beta mRNA and its correlation with hematologic, plasma chemistry and organo-somatic indices responses in triamcinolone-treated Atlantic menhaden, *Brevoortia tyrannus*. Dev Comp Imm 30: 473-484.
12. Stamper MA, **Harms CA**, Epperly SP, Braun-McNeill J, Avens L, Stoskopf MK. 2006. Relationship between barnacle epibiotic load and hematologic parameters in loggerhead sea turtles (*Caretta caretta*), a comparison between migratory and residential animals in Pamlico Sound, North Carolina. J Zoo Wildl Med 36: 635-641.
13. Kelly TK, **Harms CA**, Lemons C, McClellan C, Hohn AA. 2006. Influence of preoperative oxytetracycline administration on community composition and antimicrobial susceptibility of cloacal bacterial flora of loggerhead sea turtle, *Caretta caretta*, post-hatchlings. J Herp Med Surg 16(1): 9-14. *First author resident trainee
14. Tuttle AD, Law JM, **Harms CA**, Lewbart GA, Harvey SB. 2006. Evaluation of the gross and histologic tissue reactions in the skin of the African clawed frog (*Xenopus laevis*) to five commonly used suture materials. J Am Assoc Lab Anim Sci 45: 22-26.
15. Tuttle AD, Papich M, Lewbart GA, Christian S, Gunkel C, **Harms CA**. 2006. Pharmacokinetics of ketoprofen in the green iguana (*Iguana iguana*) following single intravenous and intramuscular injections. J Zoo Wildl Med 37: 567-570.
16. Choi K, Law JM, **Harms CA**, Lehman W. Hypoxia-reperfusion triggers immunocompromise in tilapia (*Oreochromis niloticus*). J Aquat Anim Health, in press.
17. Birkenheuer AJ, **Harms CA**, Neel J, Marr HS, Tucker MD, Acton A, Tuttle AD, Stoskopf MK. The identification of a genetically unique Piroplasma in North American river otters (*Lontra canadensis*). Parasitology, in press.
18. **Harms CA**, Eckert SA, Kubis SA, Campbell M, Levenson DH, Crognale MA. Field anaesthesia of leatherback sea turtles (*Dermodochelys coriacea*). Vet Rec, in press.
19. Braun-McNeill J, Epperly SP, Owens DW, Avens L, Williams E, **Harms CA**. Seasonal reliability of testosterone radioimmunoassay (RIA) for predicting sex ratios of juvenile

- loggerhead (*Caretta caretta*) turtles. *Herpetologica*, in press.
20. **Harms CA**, Stoskopf MK. Outcomes for adult laboratory ferret adoptions following gonadectomy in a veterinary student teaching exercise. *J Am Assoc Lab Anim Sci*, in press.
 21. Maclean RA, Fatzinger MH, Woolard KD, **Harms CA**. 2006. Clearance of a dermal *Huffmanella* sp. in a sandbar shark (*Carcharhinus plumbeus*) using levamisole. *Dis Aquat Org* 73: 83-88. *corresponding author, first author resident trainee
 22. **Harms CA**, Lewbart GA, McAlarney R, Christian LS, Geissler KA, Lemons C. 2006. Surgical excision of mycotic (*Cladosporium* sp.) granulomas from the mantle of a cuttlefish (*Sepia officinalis*). *J Zoo Wildl Med* 37: 524-530.
 23. Tuttle AD, **Harms CA**, Van Wettere AJNJ, Grafinger MS, Lewbart GA. 2006. Splenic hemangiosarcoma in a corn snake, *Elaphe guttata*. *J Herp Med Surg* 16 (4): 140-143. *corresponding author, first author resident trainee
 24. Saliki JT, Cooper EJ, Rotstein DS, Caseltine SL, Pabst DA, McLellan WA, Govett PD, **Harms CA**, Smolarek KA, Romero CA. 2006. A novel gammaherpesvirus associated with genital lesions in a Blainville's beaked whale (*Mesoplodon densirostris*). *J Wildl Dis* 42: 142-148.
 25. Rostein DS, **Harms CA**, Lovewell GN, Hohn AA. Gastric leiomyoma in a free-ranging Atlantic bottlenose dolphin (*Tursiops truncatus*). *Vet Rec*, in press.
 26. Hartman KH, Yanong RPE, **Harms CA**, Lewbart GA. 2006. The future of training for aquatic animal health veterinarians. *J Vet Med Educ* 33: 389-393.
 27. **Harms CA**. 2006. Echinoderms. In: Lewbart GA (ed). *Invertebrate Medicine*. Ames, Iowa: Blackwell, pp. 245 – 256.
 28. **McClellan-Green, Patricia.**, Romano, Jocelyn and Eva Oberdörster. (2006) Does gender really matter in contaminant exposure? A case for invertebrate risk assessment. *Environ. Res.* doi: 10.1016/j.envres.2006.09.008.
 29. **McClellan-Green, Patricia**, Romano, Jocelyn and Daniel Rittschof (2006). Imposed Induction in the Mud Snail, *Ilyanassa obsoleta* By Three Tin Compounds. *Bull. Environ. Cont. Toxicol.* 76: 581-588.
 30. Oberdörster, Eva, Zhu, Shiqian, Blickley, T. Michelle, **McClellan-Green, Patricia** and Mary L. Haasch (2006). Ecotoxicology of Carbon-Based Engineered Nanoparticles: Effects of Fullerene (C60) on aquatic organisms. *Carbon* 44:1112-1120.
 31. Keller, Jennifer M., **McClellan-Green, Patricia D.**, Kucklick, John R., Keil, Deborah E. and Margie M. Peden-Adams (2006) Effects of Organochlorine Contaminants on Loggerhead Sea Turtle Immunity: Comparison of a Correlative Field Study and In Vitro Exposure Experiments. *Environ. Hlth. Prespec.* 114(1): 70-76.
 32. **McClellan-Green, Patricia D.**, Oberdörster, Eva, Zhu, Shiqian, Blickley T. Michelle and Mary L. Haasch (submitted for publication). Impact of Nanoparticles on Aquatic Organisms. TFI Informa.
 33. Oberdörster, Eva, **McClellan-Green, Patricia** and Mary Haasch (2006). Ecotoxicity of engineered nanomaterials. In Wiley-VCH Book Series on Nanotechnology for Life Sciences, Vol. 5.
 34. Lipcius, R.N., **D.B. Eggleston**, K.L. Heck, Jr., R.D. Seitz and J. van Montfrans. 2006. Ecology of postlarval and young juvenile blue crabs. In *The Blue Crab, Callinectes sapidus* (Eds. Victor S. Kennedy and L. Eugene Cronin), pp. 535-564. University of Maryland Sea Grant Press, 800 pp.

35. Drew, C. A. and **D. B. Eggleston**. 2006. Currents, landscape structure, and recruitment success along a passive-active dispersal gradient. *Landscape Ecology* 21:917-931.
36. Reynolds, N. B., **D. B. Eggleston** and R. A. Luettich. (2006). Secondary dispersal of early juvenile blue crabs within a wind-driven estuary. *Limnology and Oceanography* 51; 1982-1995.
37. Nunoo, F. K. E., **D. B. Eggleston** and C. J. Vanderpuye. 2006. Abundance, biomass and species composition of nearshore fish assemblages in Ghana, West Africa. *African Journal of Marine Science* 28(3&4): 689–696.
38. Taylor, J. C., **D. B. Eggleston**, P. S. Rand. 2006. Nassau grouper (*Epinephelus striatus*) spawning aggregations: hydroacoustic surveys and geostatistical analysis. In *Emerging Technologies in Reef Fisheries Management*, J. C. Taylor (ed.), p. 18-25. NOAA Professional Paper NMFS 5, Seattle, WA, USA.
39. Rand, P. S., J. C. Taylor, and **D. B. Eggleston**. 2006. A video method for quantifying size distribution, density and three dimensional spatial structure of fish spawning aggregations. In *Emerging Technologies in Reef Fisheries Management*, J. C. Taylor (ed.), p. 4-9. NOAA Professional Paper NMFS 5, Seattle, WA, USA.
40. Parsons, D. M. and **D. B. Eggleston**. (2006). Human disturbance, natural predators and unobserved mortality in a spiny lobster, *Panulirus argus*, fishery. *Journal of Experimental Marine Biology and Ecology* 334:196-205.
41. Parsons, D. M. and **D. B. Eggleston**. 2007. Potential population and economic consequences of sub-lethal injuries in the spiny lobster fishery of the Florida Keys. *Marine and Freshwater Research* 58(2) 166-177.
42. Reynolds, N. B., **D. B. Eggleston**, and R. A. Luettich. 2007. Dispersal dynamics of postlarval blue crabs, *Callinectes sapidus*, within a wind-driven estuary. *Fisheries Oceanography* 16(3): 257-272.
43. Searcy, S., **D. B. Eggleston**, J. Hare. Environmental influences on the relationship between juvenile and larval growth for Atlantic croaker, *Micropogonias undulates*. *Marine Ecology Progress Series* (in press).
44. Searcy, S. P., **D. B. Eggleston**, J. A. Hare. Is growth a reliable indicator of habitat quality and Essential Fish Habitat? *Canadian Journal of Fisheries and Aquatic Sciences* (in press).
45. **Eggleston, D. B.**, G. W. Bell, Sp. Searcy, E. G. Johnson, T. Alphin, G. Plaia, M Posey. 2006. Field Assessment of Spawning Sanctuaries and Possible Migration Corridors for the Blue Crab Spawning Stock in North Carolina. Report 01-POP-08 to the NC Blue Crab Research program, NC Sea Grant, Raleigh, NC, 44 pp.
46. Nielsen, D., **Green, D.** 2007. Developing a quality index grading tool for hybrid striped bass (*Morone saxatilis x Morone chrysops*) based on the Quality Index Method. *Intl. J. Food Science and Technology*. 42(1):86-94.
47. Drake, S.L., Elhanafi, D., Bang, W., Drake, M.A., **Green, D.P.**, Jaykus, L.A. 2006. Validation of a green fluorescent protein labeled strain of *Vibrio vulnificus* for use in the evaluation of post-harvest strategies for handling of raw oysters. *Applied Environmental Microbiology*. 72:7205-7211.
48. Petersen, A.V., **Green, D.P.** 2006. *Seafood traceability: a practical guide for the U.S. industry*. NC Sea Grant. UNC-SG-06-04. 37pp.
49. Petersen, A., **Green, D.** 2006. Traceability in aquaculture: bar codes, RFID systems quickly transfer data. *Global Aquaculture Advocate*. 9(4):34-37.

50. **Green, D.**, Tom, P. 2006. Measuring, maintaining freshness in aquaculture products. *Global Aquaculture Advocate*. 9(5):40-42.
51. **Stoskopf MK.** Current Perspectives on Curriculum Needs in Zoological Medicine. *Journal of Veterinary Medical Education* 2006; 33(3):331-337.
52. Willens, S., **M.K. Stoskopf**, R.E. Baynes, G.A. Lewbart, S.K. Taylor and S. Kennedy-Stoskopf. Percutaneous Malathion Absorption by Anuran Skin in Flow-through Diffusion Cells. *Environmental Toxicology and Pharmacology* 22 (2006) 255–262.
53. Willens, S., S.H. Dupree, **M.K. Stoskopf**, G.A. Lewbart, S.K. Taylor, and S. Kennedy-Stoskopf. Measurements of Common Iliac Arterial Blood Flow in Anurans Using Doppler Ultrasound. *Journal of Zoo and Wildlife Medicine* 2006; 37(2): 97–101.
54. Willens, S. **M.K. Stoskopf**, R.E. Baynes, G.A. Lewbart, S.K. Taylor, and S. Kennedy-Stoskopf Percutaneous Malathion Absorption in the Harvested Perfused Anuran Pelvic Limb. *Environmental Toxicology and Pharmacology* 2006; 22: 263–267.
55. Acton, A.E., A.B. Beale, B.C. Gilger, **M.K. Stoskopf**. Sustained Release Cyclosporine Therapy for bilateral Keratoconjunctivitis Sicca in a Red Wolf (*Canis rufus*). *Journal of Zoo and Wildlife Medicine*. 2006; 37(4): 562-564.
56. **Stoskopf, M.K.** and L. Posner Fish Anesthesia. In: *Anesthesia and Analgesia for Laboratory Animals*, edited by Richard Fish, Marilyn Brown, Peggy Danneman, and Alicia Karas. Elsevier (submitted 2006)
57. **Stoskopf, M.K.** Coelenterates . In: *Invertebrate Medicine*. G. Lewbart (editor) Iowa State University Press. 2006
58. Burger, Joanna, Fossi, Cristina, **McClellan-Green, Patricia** and Edward F. Orlando (submitted). Assessment of approaches and methodologies for gender-related differences in wildlife and the environment. (*Environ. Res.*)
59. Romano, Jocelyn A., Joshua S. Osterberg, Daniel Rittschof, and **Patricia D. McClellan-Green**. Effects of diuron and copper pyriithione on adults, gametes and embryos of the sea urchin, *Lytechinus variegates* (*Aquatic Toxicology*).

Grants

1. Development and Validation of Recruitment Indices For Multiple Recreational Fish From Long-Term Ichthyoplankton Data Collected From Beaufort Inlet, North Carolina. **J.A. Buckel** and J.C. Taylor. NC Department of Environment & Natural Resources. \$18,000. 1/07-12/07. (I mentor the fellow and administer the budget for this project).
2. Coastal patterns of juvenile bluefish recruitment in the Middle- and South-Atlantic Bights. Bluefish Research Program (NOAA/NMFS/CMER) at Rutgers University, \$90,000 (\$36,000 to NCSU). Thomas Lankford, Jr. (UNCW) and **Jeffrey Buckel** (NCSU). 6/06-5/07. (I advise the student and administer the budget for this project).
3. Fishery Indices for the Southeast Atlantic: Biological indicators of coastal and estuary-dependent fishery production in the US South Atlantic. G.B. Martin, K. Shertzer, **J.A. Buckel**, and J.C. Taylor. 5/06-4/08. NOAA Fisheries and the Environment (FATE). \$124,729. (I advise the student and administer the budget for this project).
4. Marine Fisheries Management Fellowship: A cooperative agreement between North Carolina Division of Marine Fisheries and North Carolina Sea Grant. 2/06-1/08. \$55,000. **Jeffrey Buckel** and Ron Hodson. (I mentor the fellow and administer the budget for this project).

5. Factors influencing escapement of red drum in North Carolina: a conventional tag and telemetry approach. 2/06-1/08. North Carolina Sea Grant. **Jeffrey Buckel**, Joe Hightower, and Ken Pollock. \$166,668. (I am co-advisor for the graduate student on this project and administer the budget).
6. Quantitative Analyses of Mark and Recapture Data for Adult Red Drum (*Sciaenops ocellatus*) in North Carolina. NC Department of Environment & Natural Resources. 1/1/06-12/31/06. \$18,000.
7. David Green and **Jeff Buckel**. CALS Small Equipment Grant. 2006. Minolta Chroma Meter CR400/Data Processor DP400. Chromameter for fish tissue color measurements. \$3,675.
8. Jack Thigpen (NC Sea Grant) and **Jeffrey Buckel** (NCSU).. Enhancing the quality of North Carolina's Fisheries Extension and Applied Research Products. 5/1/04-6/30/09. National Sea Grant. \$169,130.
9. **Jeffrey Buckel**, Jack Cox, and Alex Ng. Atlantic bluefin tuna feeding ecology and potential ecosystem effects during winter in North Carolina waters. NC North Carolina Sea Grant Fisheries Resource Grant. 9/1/04-8/31/07. \$57,887.
10. **Harms CA**, Maggi RG, Breitschwerdt EB. Bartonella prevalence in stranded marine mammals along the North Carolina coast: bacterial load, tissue localization. (NOAA National Marine Fisheries Service, Prescott Grant Program) \$99,392. pending
11. **Harms CA**. Sub-contract to UNC-Wilmington, Koopman, H. Development of Assessment and Screening Tools for Acoustically-Associated Physiological Trauma in Odontocetes (Office of Naval Research) \$8216. pending
12. **Harms CA**. Survey of Near-shore Loggerhead Sea Turtles (*Caretta caretta*) in North Carolina for Evidence of Infection with *Chlamydia/Chalmydophila* spp., *Mycoplasma* spp. and *Mycobacterium* spp. (CVM State Research Grant) \$3200. not funded
13. **Harms CA**. Dolphin necropsy contract. 2006-2007 (NOAA National Marine Fisheries Service) \$24,898.
14. **Harms CA**. Field anesthesia of leatherback sea turtles for the purpose of conducting electroretinograms. 2006 (WIDECAS—Wider Caribbean Sea Turtle Conservation Network) \$8456.
15. **Harms CA**, Lewbart GA, Stoskopf MK. 2006-2007. Improving live marine mammal stranding response in North Carolina through rapid diagnostic capability and short term holding capacity. (NOAA, National Marine Fisheries Service, Prescott Grant Program) \$56,930.
16. Stoskopf MK, **Harms C**, Lewbart G, Kennedy-Stoskopf S. 2005-2007. Aquarium health management. North Carolina Aquariums, North Carolina Department of Environment and Natural Resources. \$156,095.
17. Lewbart GA, Christian LS, **Harms CA**. 2005-2008. Veterinary medical services rendered to the Museum of Natural Sciences. North Carolina Department of Environment and Natural Resources. \$60,000.
18. **McClellan-Green, P**. University of North Carolina at Charlotte (North Carolina Sea Grant Sub-Contract), "Hypoxia Impacts on Sustainable Oyster Populations," \$99,997(17,000), March 2006-April 2008.
19. **McClellan-Green, P**. NOAA, "MultiStress 07 - A multidisciplinary approach to quantify multiple stressors resulting in reproductive failure of queen conch (*Strombus gigas*), a keystone species in coral-reef ecosystems." \$4,857,662, (Sub-Contract) July 1, 2007-June 30, 2012. (Pending).

20. **McClellan-Green, P.** NOAA, “CHRP 2007-Cellular Biomarker Responses for Diagnosing Hypoxia Stress”
\$2,497,871, September 1, 2007 – August 30, 2012 (Pending)
21. **McClellan-Green, P.** NCBC, “Molecular-Based Arrays for the Detection and Quantification of Toxicogenic Histamine-Producing Bacteria in Fish Products” \$66, 671, July 1, 2007-December 31, 2008 (pending).
23. **Eggleston, D. B.** National Science Foundation. “Collaborative: estuarine crab transport: linking post-settlement dispersal, bio-physical mechanisms and hydrodynamic corridors”. 5/02-7/07, \$470,542 (PI w/ T. Hopkins and R. Forward co-PIs). (5-33468)
24. **Eggleston, D. B.** Univ. MD/Center for Marine Biotechnology/Blue Crab Advanced Research Consortium. “Ecological feasibility of blue crab stock enhancement: field and laboratory experiments in NC”. C, 11/02-11/07, \$240,000 (PI) (5-22032 & 5-25822).
25. **Eggleston, D. B.** Univ. MD/Center for Marine Biotechnology/Blue Crab Advanced Research Consortium. “Blue crab (*Callinectes sapidus*), an integrated research program of basic biology, hatchery technologies, and potential for replenishing stocks”. 12/06-11/07, \$125,000 (PI). (5-27220).
26. **Eggleston, D. B.** NC Sea Grant/ Fisheries Resource Grant Program. “Oyster Dispersal and Metapopulation Dynamics in Pamlico Sound: Settlement, Survival and Spawning Potential” 5/06-7/08, \$51,000 (PI) (5-26245).
27. **Eggleston, D. B.** NC Sea Grant/ Fisheries Resource Grant Program. “Oyster Dispersal and Metapopulation Dynamics in Pamlico Sound: Settlement, Survival and Spawning Potential” 6/07-12/08, \$72,000 (PI) (approved for funding, FAS # pending).
28. **Eggleston, D. B.** NC Sea Grant. “Oyster Dispersal and Metapopulation Dynamics in Pamlico Sound: Part I, Larval Dispersal and Connectivity” 6/06-12/08, \$102,029 (co-PI w/ C. Cudaback PI and L. Xie co-PI) (5-26552).
29. **Eggleston, D. B.** NC Sea Grant/Blue Crab Research Program. “Economic and biological feasibility of blue crab pond culture”. 6/03-12/06, \$100,000 (PI) (5-33328 & 5-33454).
30. **Eggleston, D. B.** NC Sea Grant/Blue Crab Research Program. “Blue crab stock enhancement: further progress in freshwater pond-rearing”. 6/07-12/08, \$19,000 (PI) (approved for funding, FAS# pending).
31. **Eggleston, D. B.** NC Sea Grant/Blue Crab Research Grant Program. “Blue crab dependence on SRV nurseries in Albemarle Sound”. 6/05-12/06, \$42,479, (PI) (5-25033).
32. **Eggleston, D. B.** NC Sea Grant/Blue Crab Research Grant Program. “Blue crab dependence on SRV nurseries in Albemarle Sound”. 6/07-12/08, \$72,000 (PI) (approved for funding, FAS# pending).
33. **Green, D. P.** Cornell University “*An internet training program on sanitation, good manufacturing and hygienic practices for food processors, wholesalers and warehouses*” (\$8,970 sub-award of \$444,655 prime, USDA-CSREES Integrated Research, Education and Extension Grants Program, 9/1/05-8/31/2008).
34. **Green, D. P.** Fresher Than Fresh Inc. “*On-going verification of a U.S. Food and Drug Administration (FDA) approved Hazard Analysis and Critical Control Point (HACCP) plan for modified atmosphere packaging (MAP) of fresh fish*” (\$15,132, 3/1/2004-2/28/2008).
35. **Green, D. P.** NCSU Internationalization Seed Grant “*American-Danish collaboration for the advancement of trans-Atlantic fisheries research and academic exchanges in the North Atlantic region*” (\$4,000, 9/12006-6/30/2007)

36. **Green, D. P.** NC Sea Grant Program “*Development of Marine Industries and Processing Systems: Seafood Science and Technology Program*” (\$78,078, 2/1/2006-5/31/2007).
37. **Green, D. P.** NC Sea Grant Program “*Assisting coastal processors add value to North Carolina seafood*”. (\$8,117, 2/1/06-5/30/07).
38. **Green, D. P.** NC Sea Grant Program “*Enhancing quality of wild-caught shrimp in batch-process handling*” (\$6,748, 5/1/2006-6/30/2007).
39. **Green, D. P.** NC Sea Grant Program “*Producing farmed hybrid striped bass for year round markets*” (\$19,643, 5/1/2006-10/31/2007).
40. **Stoskopf, M.K.** Non-lethal Molecular Diagnostics Sampling of Captive Red wolves. US Geological Survey \$11,786
41. Harms CA, Lewbart GA, **Stoskopf MK.** Improving Live Marine Mammal Stranding Response in North Carolina through Rapid Diagnostic Capability and Short-term Holding Capacity. National Marine Fisheries Service. \$56,930
42. **Stoskopf, M. K.** Evaluation of the Red Wolf Adaptive Management Plan Project. U.S. Geological Survey. \$33,018
43. **Stoskopf, M.** The geographic relationship of mortality events of carp species in North America and its association with cofactors of water quality, temporal factors and viral and bacterial diseases. U.S. Dept. of Interior \$84,906
44. **Stoskopf, M.,** Macdonald, J. 4.7 T MRI Magnet Upfit. NC Biotechnology Center \$160,000
45. **Stoskopf, M.,** Harms, H., Lewbart, G., Kennedy-Stoskopf, S. Aquarium Health Management DENR ~\$ 88,000
46. **Stoskopf, M.** Red Wolf Adaptive Management USDI, Geo Sur. ~\$20,000
47. **Stoskopf, M.,** Acton A. Noninvasive wildlife health Morris, ~\$49,000
48. **Stoskopf, M.,** Acton, A. Noninvasive wildlife health EPA ~\$ 49,000

9. Extension

In addition to presentations by faculty, staff and students within the US and on the international stage, CMAST has numerous recent and exciting extension programs, including:

- **Marine Science and Education Partnership (MSEP)**
CMAST is a key member of MSEP, which is a coalition of directors of marine science institutions and agencies, and other leaders in Carteret County, whose goal is to use science, technology and education to enhance the climate for marine-related businesses and industry in rural areas of NC. MSEP contributed \$127 million and 3,162 jobs to Carteret County in 2004.
- **Seafood Technology**
The Seafood Technology Program provides: (i) short courses to meet the needs of the NC seafood industry, public health agencies and general public that helps North Carolina businesses use functional ingredients to add value to seafood for improving nutrition, shelf-life, safety and convenience, and (ii) assistance to businesses developing new products, and marketing assistance for those products. Technology transfer from the Seafood Technology Program has led to start-up businesses in eastern NC.

- National Seafood HACCP Alliance Education and Training HACCP Workshop, 2006. Participated in one workshop with 32 individuals receiving their HACCP certification from the Association of Food and Drug Officials (AFDO).
 - NC CES Carteret County-ServSafe Workshop, 2006. Participated in three workshops; presentation given on “*Managing Seafood Safety for Operators of Food Service and Retail Establishments*” for 80 participants.
 - UNC Seafood Quality and Safety for Environmental Health Specialists. 2006. Participated in one workshop; presentation given on “*Seafood-borne parasites as potential pathogens of humans*” for 40 participants
- Fisheries and Aquaculture Research
Demand for fisheries products is increasing rapidly while supplies decline. Fisheries and aquaculture research has identified (i) information leading to sustainable fisheries and habitat management in NC, (ii) novel techniques for aquaculture of fish and blue crabs, and the technology transfer of these techniques for commercialization and job growth, and (iii) technical support and education for commercial and recreational fishers in NC.
- Environmental and molecular toxicology
Escalating coastal development brings the need for novel and rapid means of detecting degraded habitat and water quality, and the technology to reduce negative impacts. Environmental and molecular toxicology has identified novel techniques for rapidly assessing water quality and the health of marine organisms, as well as the source of bacterial contaminants. For example, rapid bacterial source tracking is critical in helping to maintain swimming beaches that support coastal tourism economies.
- Veterinary Medicine
CMAST provides the only veterinary college in the U.S. with a coastal presence and, in addition to training students, provides innovative surgical repair and medical treatment to injured sea turtles and marine mammals in support of the mission of NOAA, the NC Aquarium System and the Sea Turtle hospital on Topsail Island. In addition, veterinary medicine provides novel techniques that support the detection and treatment of disease in NC’s aquaculture industry.
 - Innovations in clinical service (new techniques, methods, clinical trial protocols): Unit attending veterinarian for CMAST and PAFL.
 - Primary clinical contact for 3 NC Aquariums with monthly site visits and continuing, facilitated Aquariums’ successful 5-year re-accreditation with the American Zoos and Aquariums Association (AZA).
 - Primary clinical contact for Karen Beasley Sea Turtle Rescue and Rehabilitation Center with monthly site visits.
 - On call to NMFS for marine mammal strandings conducted about 34 marine mammal necropsies, including some beach responses with euthanasia.
 - Sloth annual physicals for Museum of Natural Sciences.
 - Clinical support for NMFS sea turtle health assessments and NMFS lionfish research facility.
- Distance Education and high-speed internet communications

CMAST provides high speed internet service (1 gigabyte/sec.) that supports teleconference and distance education activities in the Carteret County area from the community college to our research university partners.

- K-12 Education
Research on the blue crab and oysters has provided hands-on research experiences and teacher support for fifth-grade to high school students throughout eastern NC. These hands-on research opportunities have benefited students from economically depressed areas with little opportunity for hands-on research and jobs in science.

10. Initiatives and public service activities

CMAST Research & Extension Activities help eastern NC by:

- Supporting tourism by keeping the animals at the NC Aquariums healthy and responding to the health needs of sea turtles and marine mammals on our coast.
- Supporting eastern North Carolina businesses by conducting and supporting conferences and meetings that draw people to the coast.
- Providing high speed internet backbone that supports education in the Carteret County area from the community college to our research university partners.
- Supporting NC by reaching out to the nation and the world through collaborative efforts to solve problems that occur not only in our backyard but on every corner of this planet.
- Employing eastern North Carolina citizens in both permanent and temporary positions; the training provided to temporary employees has allowed them to secure permanent jobs in related fields (e.g., NC Division of Marine Fisheries).
- Providing recreational and commercial fishers in eastern NC with assistance on Fishery Resource Grant projects and outreach products that extend research results.

11. Faculty: Honors, awards and recognition

CMAST faculty serve on numerous editorial boards for scientific journals, as well as national and international scientific advisory committees.

CMAST faculty were awarded recognition for outstanding extension and teaching.

12. Students

Kristín Björnsdóttir (Ph.D. student, NCSU, D. Green advisor).

Ray Mroch (MS student, NCSU, D. Eggleston advisor)

Michelle Moorman (MS student, NCSU, D. Eggleston advisor)

Christina Durham (MS student, NCSU, D. Eggleston advisor)

Geoff Bell (Ph.D. student, NCSU, D. Eggleston advisor)

Brandon Puckett (Ph.D. student, NCSU, D. Eggleston advisor)

Mary Radlinksy (Ph.D. student, NCSU, D. Eggleston advisor)

Chip Collier (Ph.D., UNCW-2006-present; Major advisor: Dr. Tom Lankford)

Julie Harris (Ph.D., NCSU-2006-present; Major advisor: Dr. Joe Hightower)
Kevin Magowan (M.S., NCSU-2006-present; Major advisor: Dr. Joe Hightower)
Adam Branson (M.S., UNCW-2005-present; Major advisor: Dr. Tom Lankford)
Felix Del-Toro Silva (Ph.D., NCSU-2004-present; Major Advisor: Dr. John Miller)
Tim Ellis (M.S., NCSU-2005-present; Major advisor: Dr. John Miller)
Lori Davias (M.S., NCSU-2004-2006; Major advisor: Dr. Jim Rice)
Warren Mitchell (M.S., NCSU-2004-2006; Major advisor: Dr. Joe Hightower)

13. Fund-Raising: Private fund-raising successes

- Two fund-raising campaigns were targeted: (1) license plate program for “Sustainable Fisheries” and (2) donor for CMAST student/faculty housing.
 - Obtained over 600 signatures in support of our license plate campaign were obtained during the Raleigh Salt Water Fishing & Boat Shows during January-February 2007. Local delegates were ready to sponsor bills introducing these plates to state legislature. License Plate Program stalled by UNC-GA. because of concerns that others would follow.
 - Two prospective donors were contacted via NCSU College Relations.
 - Both fund-raising opportunities advertised on web-site and in various presentations to local civic groups by Director.

14. Administration: Achievements and staff changes

Key administrative achievements include (1) new web-site, (2) hiring of communications specialist (Jill Fournier), (3) publication of newsletter, (4) increased operating budget, (5) increased IT budget, training and security, (5) CMAST building signs, (6) annual activity report, (7) safety plans and procedures on-line, (8) funding for upgrades and security of Fisheries & Oceans warehouse, (8) Open House, (9) new architectural renderings and design of CMAST housing.

15. Recommendations and concerns for the future

- Three major concerns and recommendations for CMAST remain:
 - Funding of student /faculty housing to provide visiting faculty, staff and students economical, safe and convenient accommodations which, in turn, will increase use of the facility, interaction with main-campus, and promote educational activities.
 - Increase resident faculty, which will increase the critical mass necessary to promote multi-disciplinary research programs, economic growth via biotechnology, and provide courses for undergraduate and graduate students.
 - Provide state-appropriated operating budget.

16. Providing world leaders

All faculty at CMAST interact with and are recognized for their excellent scholarly activities by colleagues throughout the world.

17. Impacting energy and the environment

The principal mission of the Center for Marine Sciences and Technology (CMAST) is to discover innovative solutions to questions and problems in marine systems and provide effective

communication of these discoveries. An emerging mission is to become a model for the latest technology in sustainable coastal building and alternative energy.

Examples of CMAST support for sustaining the environment may be found in the research, education and extension/outreach examples found throughout this report.

An example of our commitment to energy may be found in the revised design of the CMAST student/faculty house, which has been approved by NCSU as a LEED building, and through the planned use of wind turbines from PacWind Inc. to generate electrical power and as a demonstration facility.

18. Improving health and well-being

- CMAST researchers are improving (1) seafood safety, (2) water quality, (3) aquatic animal health, as well as providing research in support of (4) sustainable coastal ecosystems and fisheries through the research described throughout this report.
- Seafood safety and quality workshops provide North Carolina businesses, regulatory personnel and citizens with science-based technical information and training. Our programs were expanded to include new rules and record-keeping requirements under the Bioterrorism and Preparedness Act of 2002. Education programs continue to be offered in HACCP compliance, traceability and authenticity, quality control and value-added product development. Impacts of these programs are greater compliance with current state and federal health regulations, dollars saved due to improved processes, market growth and job creation. Participants are able to make more informed decisions based on up-to-date information provided. The NCSU Seafood Lab has provided training for over 700 individuals in HACCP since 1997 who receive non-degree certificates from the Association of Food and Drug Officials (AFDO). The demand for seafood safety and quality education and training programs remains strong; with growing interest in areas of value-added product development and traceability.
- Provide cutting edge clinical expertise that raises the national standards for veterinary care. Develop and improve telemedicine and record systems to support our clinical management of the NC Aquariums. Improve the standard of care in the practicing community of North Carolina, the USA, and the World by providing professional development opportunities for veterinarians. Provide a leadership role in Department, CVM, VTH, NCSU, and national and international organizations. Contribute time and talents to the wider community.

19. Creating educational innovation

CMAST faculty, staff and students are creating educational innovation through hands-on, inquiry-based education, (2) web-based teaching tools, and (3) providing hands-on experience for young people.