
RUTH HERROLD CARMICHAEL

Senior Marine Scientist, Dauphin Island Sea Lab
Associate Professor of Marine Science, University of South Alabama
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EDUCATION

- 2004 Ph.D. Marine Biology, B.U. Marine Program, Marine Biological Laboratory
2000 Shellfish Aquaculture Proficiency Certificate, Sea Grant Fisheries Program
1998 M.A. Marine Biology, B.U. Marine Program, Marine Biological Laboratory
1993 B.A. Biology with honors, University of Chicago
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PROFESSIONAL ACTIVITIES

- 2006-present Senior Marine Scientist, Dauphin Island Sea Lab, AL
2013-present Associate Professor of Marine Science, University of South Alabama, Mobile, AL
2007-2013 Assistant Professor of Marine Science, University of South Alabama, Mobile, AL
2004-2006 Assistant Professor of Marine Biology, University of Maine at Machias, ME
2003-2004 Research Associate/Consultant, Cape Cod, MA
1995-2004 Teaching Fellow/Research Assistant, Boston University Marine Program, MA
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RESEARCH INTERESTS

My research focuses on place-based applied studies that define and seek mechanistic understanding of anthropogenic effects on coastal ecosystems by quantifying effects on habitat, food resources, and the biology and physiology of target organisms.

SELECTED PUBLICATIONS

Peer reviewed journals and books:

- In press Hieb, E., **R. H. Carmichael**, A. Aven, C. Nelson-Seely, N. Taylor. Sighting demographics of the West Indian manatee (*Trichechus manatus*) in the north central Gulf of Mexico supported by publicly-sourced data. *Endanger. Species Res.* (T)
- 2017 Fauquier, D. A., J. Litz, S. Sanchez, K. Colegrove, L. Schwacke, L. Hart, J. Saliki, C. Smith, T. Goldstein, S. Bowen-Stevens, W. McFee, E. Fougères, B. Mase-Guthrie, E. Stratton, R. Ewing, S. Venn-Watson, **R. H. Carmichael**, C. Clemons-Chevis, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, N. Wingers, T. Rowles. Evaluation of Morbillivirus Exposure in Cetaceans from the Northern Gulf of Mexico 2010-2014. *Endanger. Species Res.* 33:211-220. doi:10.3354/esr00772
- 2017 Hohn, A., L. Thomas, **R. H. Carmichael**, C. Booth, J. Litz, D. Shannon, S. Shippee, C. Sinclair, S. Smith, T. R. Speakman, M. Tumlin, E. Zolman. Assigning Stranded Dolphins to Stock using Stable Isotope Ratios following the Deepwater Horizon Oil Spill. *Endanger. Species Res.* 33:235-252. doi:10.3354/esr00783
- 2017 Darrow, E. S., **R. H. Carmichael**, C. F. T. Andrus, H. E. Jackson. Organic stable isotopes in ancient oyster shell trace pre-colonial nitrogen sources. *Geochim Cosmochim Ac.* <http://dx.doi.org/10.1016/j.gca.2016.12.023> (G)

- 2016 Darrow, E. S., **R. H. Carmichael**, K. R. Calci, W. Burkhardt III. Land-use related changes to sedimentary organic matter in tidal creeks of the northern Gulf of Mexico. *Limnol. Oceanogr.* 10.1002/lno.10453 (G)
- 2016 Patterson H. K. and **R. H. Carmichael**. The effect of lipid extraction on carbon and nitrogen stable isotope ratios in oyster tissues: Implications for glycogen-rich species. *Rapid Commun. Mass Sp.* 30(24): 2594-600. (G)
- 2016 Aven, A., **R. H. Carmichael**, E. Hieb, M. Ross. West Indian manatee movements reveal novel occupancy and distribution patterns in the northern Gulf of Mexico. *PeerJ Preprints* 4 (2016): e2072v1. (G)
- 2016 Oczkowski, A., T. Gumbley, B. Carter, **R. Carmichael**, A. Humphries. Establishing an anthropogenic nitrogen baseline using Native American shell middens. *Frontiers Mar Sci.* DOI:10.3389/fmars.2016.00079.
- 2016 Colegrove, K., S. Venn-Watson, J. Litz, M. J. Kinsel, K. A. Terio, E. Fougères, Ruth Ewing, D. A. Pabst, W. A. McLellan, S. Raverty, J. Saliki, S. Fire, G. Rappucci, S. Bowen-Stevens, L. Noble, A. Costidis, M. Barbieri, C. Field, S. Smith, **R. H. Carmichael**, C. Chevis, W. Hatchett, D. Shannon, M. Tumlin, G. Lovewell, W. McFee, T. Rowles. Fetal distress and *in utero Brucella* pneumonia in perinatal bottlenose dolphins (*Tursiops truncatus*) during the Northern Gulf of Mexico unusual mortality event: 2010 through 2013. *Dis. Aquat. Org.*
- 2015 Estes, M. G., Jr., **R. H. Carmichael**, P. D. M. Macdonald, A. Brady, J. McFadyen. Molts reveal life-history patterns for juvenile American horseshoe crabs in fringe habitats. *In R. H. Carmichael*, M. Botton, P.K.S. Shin, S.G. Cheung [eds.], *Changing Global Perspectives on Biology, Conservation, and Management of Horseshoe Crabs*, Springer, New York. (G)
- 2015 Botton, M., **R. H. Carmichael**, P. Shin, S. Cheung. Emerging issues in horseshoe crab conservation: A perspective from the IUCN species specialist group. *In R. H. Carmichael*, M. Botton, P. K. S. Shin, S. G. Cheung [eds.], *Changing Global Perspectives on Biology, Conservation, and Management of Horseshoe Crabs*, Springer, New York.
- 2015 **Carmichael, R. H.***, E. Hieb, G. Gauvry, C.N. Shuster, Jr. Examination of large exuviae with mating scars: Do female American horseshoe crabs, *Limulus polyphemus*, molt after sexual maturity? *In R. H. Carmichael*, M. Botton, P.K.S. Shin, S.G. Cheung [eds.], *Changing Global Perspectives on Biology, Conservation, and Management of Horseshoe Crabs*, Springer, New York.
- 2015 Hieb, E. E., J. Baggett, A. Aven, **R. H. Carmichael***. Effects of sediment type and tank shape on horseshoe crab (*Limulus polyphemus*) growth and survival in culture. *In R. H. Carmichael*, M. Botton, P.K.S. Shin, S.G. Cheung [eds.], *Changing Global Perspectives on Biology, Conservation, and Management of Horseshoe Crabs*, Springer, New York. (T)
- 2015 Gauvry, G., **R. H. Carmichael**. Young Voices: Through the Arts, Future Environmental Stewards Have a Global Voice. *In R. H. Carmichael*, M. Botton, P.K.S. Shin, S.G. Cheung [eds.], *Changing Global Perspectives on Biology, Conservation, and Management of Horseshoe Crabs*, Springer, New York.

- 2015 Mortazavi, B., A. Ortmann, L. Wang, R. Bernard, C. Staudhammer, D. J. Dalrymple, **R. H. Carmichael**, A. Kleinhuizen. Evaluating the impact of oyster (*Crassostrea virginica*) gardening on sediment nitrogen cycling in a subtropical estuary. *Bull. Mar. Sci.* 91:323-341(19).
- 2015 Dalrymple, J. D. and **R. H. Carmichael***. Effects of age class on N removal capacity of oysters and implications for bioremediation. *Mar. Ecol. Progr. Ser.* 528:205-220. (G)
- 2015 Venn-Watson, S., K. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, **R. H. Carmichael**, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougères, T. Rowles. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the Deepwater Horizon Oil Spill. *PLoS ONE*. 10(5): e0126538.
- 2015 Venn-Watson, S., L. Garrison, J. Litz, E. Fougères, B. Mase, G. Rappucci, E. Stratton, **R. H. Carmichael**, D. Odell, D. Shannon, S. Shippee, S. Smith L. Staggs, M. Tumlin, H. Whitehead, T. Rowles. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) unusual mortality event: January 2010- June 2013. *PLoS ONE*. 10(2): e0117248.
- 2015 D'Ambra, I., W. M. Graham, **R. H. Carmichael**, F. J. Hernandez, Jr. Fish rely on scyphozoan hosts as a primary food source: evidence from stable isotope analysis. *Mar. Biol.* 162:247-252. Feature Article, Highlighted in Harrod 2015 *Mar. Biol.* Editorial 162:245-246. (G)
- 2015 Aven, A., **R. H. Carmichael**, M. Ajemian, S. Powers. Passive acoustic monitoring mitigates GPS tag loss by tracked manatees. *Mar. Freshwater Res.* 66: 371-374. (G)
- 2014 Kellogg, L., A. Smyth, M. Luckenbach, **R. H. Carmichael**, B. Brown, J. Cornwell, M. Piehler, M. S. Owens, D. J. Dalrymple, C. Higgins. Use of oysters to mitigate eutrophication in coastal waters. *Est Coast Shelf Sci.* 151:156-168.
- 2014 Litz, J., M. Baran, **R. H. Carmichael**, K. Colegrove, S. Fire, E. Fougères, R. Hardy, S. Holmes, W. Jones, B. Mase-Guthrie, D. Odell, P. Rosel, D. Shannon, J. Saliki, S. Shippee, S. Smith, E. Stratton, S. Bowen-Stevens, M. Tumlin, H. Whitehead, G. Worthy, T. Rowles. A review of historical unusual mortality events in the Gulf of Mexico (1990-2009): providing context for the complex and long-lasting Northern Gulf of Mexico Cetacean UME. *Dis. Aquat. Org.* 112:161-175.
- 2014 Patterson H. K., A. Boettcher, **R. H. Carmichael**. Biomarkers of dissolved oxygen stress in oysters: A tool for restoration and management efforts. *PLoS ONE* 9(8): e104440. DOI:10.1371/journal.pone.0104440. (G)
- 2014 Martin, J., H. Edwards, F. Bled, C. Fannesbeck, J. Dupuis, B. Gardner, S. Koslovsky, A. Aven, L. Ward-Geiger, **R. H. Carmichael**, D. Fagan, M. Ross, and J. Royle. Maximum number of manatees in areas potentially affected by the Gulf oil spill. *PLoS ONE* 9(3): e91683. DOI:10.1371/journal.pone.0091683.

- 2014 D'Ambra, I., **R. H. Carmichael**, W. M. Graham. Determination of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ and trophic fractionation in jellyfish: implications for food web ecology. *Mar. Biol.* 161:473-480. (G)
- 2013 D'Ambra, I., W. M. Graham, **R. H. Carmichael**, A. Malej, V. Onofri. Predation patterns and prey quality of medusae in a semi-enclosed marine lake: implications for food web energy transfer in coastal marine ecosystems. *J. Plankton Res.* 35:1305-1312. DOI: 10.1093/plankt/fbt065. (G)
- 2012 **Carmichael, R. H.*** A. Jones, H. Patterson, W. Walton, A. Pérez-Huerta, E. Overton, M. Dailey, K. Willett. Assimilation of oil-derived elements by oysters due to the Deepwater Horizon oil spill. *Environ. Sci. Technol.* 46:12787-12795. DOI: 10.1021/es302369h Featured by Gulf of Mexico Research Initiative <http://gulfresearchinitiative.org/studies-indicate-that-oyster-tissue-and-shell-were-similar-in-pre-and-post-oil-spill-conditions/>
- 2012 Prado, P., **R. H. Carmichael**, S. Watts, J. Cebrian, and K. L. Heck, Jr. Diet-dependent $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ fractionation among sea urchin (*Lytechinus variegatus*) tissues: Implications for food web models. *Mar. Ecol. Prog. Ser.* 462:175-190.
- 2012 **Carmichael, R. H.***, W. Graham, A. Aven, G. Worthy, S. Howden. Were multiple stressors a 'perfect storm' for northern Gulf of Mexico bottlenose dolphins in 2011? *PloS ONE* 7(7): e41155. doi:10.1371/journal.pone.0041155. Featured in Nature News <http://www.nature.com/news/perfect-storm-hit-gulf-of-mexico-dolphins-1.11011>
- 2012 **Carmichael, R. H.***, W. Walton, H. Clark. Bivalve enhanced N removal from coastal estuaries. *Can. J. Fish. Aquat. Sci.* 69:1131-1149.
- 2012 **Carmichael, R.H.***, A. Shriver, and I. Valiela. Bivalve response to estuarine eutrophication: The balance between enhanced food supply and habitat alternations. *J. Shellfish Res.* 31: 1-11.
- 2012 **Carmichael, R. H.*** and E. Brush. Three decades of horseshoe crab rearing: A review of conditions for captive growth and survival. *Rev. Aquac.* 4: 32-43.
- 2012 Biancani, P. J., **R. H. Carmichael***, J. H. Daskin, K. R. Calci, W. Burkhardt III. Seasonal and spatial effects of wastewater effluent on growth, survival, and accumulation of microbial contaminants by oysters in Mobile Bay, Alabama. *Est Coasts.* 35:121-131. CESN highlight article. (G)
- 2012 Drymon, J. M., S. P. Powers, **R. H. Carmichael**. Trophic plasticity in the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) from the north central Gulf of Mexico. *Environ. Biol. Fish.* 95:21-35.
- 2010 Graham, W., R. H. Condon, **R. H. Carmichael**, I. D'Ambra, H. K. Patterson, F. J. Hernandez, Jr. Oil carbon entered the coastal planktonic food web during the Deepwater Horizon oil spill. *Environ. Res. Lett.* 5(045301):1-6. 2010 Highlight.
- 2010 Kovacs, C., J. Daskin, H. Patterson, **R. H. Carmichael***. *Crassostrea virginica* shells record local variation in wastewater inputs to a coastal estuary. *Aquatic Biol.* 9:77-84. (U)

- 2009 Pabody, C., **R. H. Carmichael***, L. Rice, M. Ross. West Indian manatees in Mobile Bay, Alabama: A new sighting network adds to twenty years of historical data on extralimital populations. *Gulf Mexico Sci.* 27:52-61. (T)
- 2009 **Carmichael, R. H.***, E. Gaines, Z. Sheller, A. Tong, A. Clapp, I. Valiela. Diet composition of juvenile horseshoe crabs: Implications for growth and survival of natural and cultured stocks, p. 521-534. *In* J. Tanacredi, M. Botton, D. Smith [eds.], *Biology and Conservation of Horseshoe Crabs*. Springer, New York.
- 2009 Smith, D., M. Millard, **R. H. Carmichael**. Status and assessment of *Limulus polyphemus* along the western Atlantic. p. 361-386. *In* J. Tanacredi, M. Botton, D. Smith [eds.], *Biology and Conservation of Horseshoe Crabs*. Springer, New York.
- 2008 **Carmichael, R. H.***, T. Hattenrath, I. Valiela, R. H. Michener. Nitrogen stable isotopes in the shell of *Mercenaria mercenaria* trace wastewater inputs from watersheds to estuarine ecosystems. *Aquatic Biol.* 4:99-111. [Feature Article](#).
- 2008 Daskin, J. H., K. Calci, W. Burkhardt, III, **R. H. Carmichael***. Use of N stable isotope and alternative microbial analysis to define wastewater influence in Mobile Bay, AL. *Mar. Pollut. Bull.* 56:860-868. (U)
- 2007 Bowen, J., K. Kroeger, G. Tomasky, W. J. Pabich, , M. L. Cole, **R. H. Carmichael**, I. Valiela. A review of land-estuary coupling by groundwater discharge to New England estuaries: Mechanisms and effects. *Applied Geochemistry*. 22:175-191.
- 2005 **Carmichael, R. H.*** and I. Valiela. Coupling of near-bottom seston and surface sediment composition: Changes with nutrient enrichment and implications for estuarine food supply and biogeochemical processing. *Limnol. Oceanogr.* 50:97-105.
- 2004 **Carmichael, R. H.***, A. Shriver, I. Valiela. Changes in shell and soft tissue growth, tissue composition, and survival of quahogs, *Mercenaria mercenaria*, and softshell clams, *Mya arenaria*, in response to eutrophic-driven changes in food supply and habitat. *J. Exp. Mar. Biol. Ecol.* 313: 75-104.
- 2004 Rutecki, D., **R. H. Carmichael**, I. Valiela. Magnitude of harvest of Atlantic horseshoe crabs, *Limulus polyphemus*, in Pleasant Bay, MA. *Estuaries* 27:179-187. (G)
- 2004 **Carmichael, R. H.***, B. Annette, I. Valiela. N loading to Pleasant Bay, Cape Cod: Application of models and stable isotopes to detect incipient nutrient enrichment of estuaries. *Mar. Pollut. Bull.* 48: 137-143.
- 2004 **Carmichael, R. H.*** Effects of eutrophication on *Mya arenaria* and *Mercenaria mercenaria*: Growth, survival, and physiological responses to changes in food supply and habitat in estuaries receiving different N loads. Ph.D. Thesis, Boston University.
- 2004 **Carmichael, R. H.***, D. Rutecki, B. Annett, E. Gaines, I. Valiela. Position of horseshoe crabs in estuarine food webs: N and C stable isotopic study of foraging ranges and diet composition. *J. Exp. Mar. Biol. Ecol.* 299: 231-253.

- 2003 **Carmichael, R. H.***, D. Rutecki, I. Valiela. Abundance and population structure of the Atlantic horseshoe crab, *Limulus polyphemus*, in Pleasant Bay, Cape Cod. *Mar. Ecol. Prog. Ser.* 246:225-239.
- 2003 O'Connell, C. W., S. P. Grady, A. S. Leschen, **R. H. Carmichael**, I. Valiela. Stable isotopic assessment of site loyalty and relationships between size and trophic position of the Atlantic horseshoe crab, *Limulus polyphemus*, in Cape Cod estuaries. *Biol. Bull.* 205:254-255.
- 2002 Weiss, E., **R. H. Carmichael**, I. Valiela. The effect of nitrogen loading on growth of quahogs and softshell clams through changes in food supply. *Aquaculture* 211:275-289.
- 2002 Shriver, A. C., **R. H. Carmichael**, I. Valiela. Growth, condition, reproductive potential, and mortality of bay scallops, *Argopecten irradians*, in response to eutrophic-driven changes in food resources. *J. Exp. Mar. Biol. Ecol.* 279:21-40.
- 2002 Gaines, E., **R. H. Carmichael***, S. P. Grady, I. Valiela. Stable isotopic evidence for changing nutritional sources of juvenile horseshoe crabs. *Biol. Bull.* 203:228-230. (U)
- 2002 Suggs, D., **R. H. Carmichael**, S. P. Grady, I. Valiela. Effects of individual size on pairing in horseshoe crabs. *Biol. Bull.* 203: 225-227. (U)
- 2001 Grady, S., D. Rutecki, **R. H. Carmichael**, I. Valiela. Age structure of the Pleasant Bay population of *Crepidula fornicata*: A possible tool for estimating horseshoe crab age. *Biol. Bull.* 201:296-297. (U)
- 2001 Fila, L., **R. H. Carmichael**, A. Shriver, I. Valiela. Stable N isotopic signatures in Bay scallop tissue, feces, and pseudofeces in Cape Cod estuaries subject to different N loads. *Biol. Bull.* 201: 294-296. (U)
- 1996 **Herrold R. E.**, A. Marchini, S. Fruehling, R. Longnecker. Glycoprotein 110 (gp110), the Epstein-Barr Virus homolog of Herpes Simplex Virus Glycoprotein B (gB), is essential for Epstein-Barr replication in vivo. *J Virol.* 70: 2049-2054.
- 1996 Fruehling S., S. K. Lee, **R. E. Herrold**, B. Frech, G. Laux, E. Kremmer, F. A. Grasser, R. Longnecker. Identification of Latent Membrane Protein 2A (LMP2A) domains essential for the LMP2A dominant-negative effect on B-lymphocyte surface immunoglobulin signal transduction. *J Virol.* 70: 6216-6226.

*Carmichael is corresponding author. *This information is provided as an additional indicator of Carmichael's contribution to manuscripts and mentorship because significance of author order can vary with field, student participation, collaborator preference, and journal standards.* T, G, U = Technician, graduate student, or undergraduate student as first author.

Popular journals and comments:

- 2015 **Carmichael, R.H.** and E. Hieb. Alabama manatees: The states marine mammal makes a big splash. *Outdoor Alabama.* July 2015: 16-19.
- 2012 **Carmichael, R. H.**, A. Aven, J. Lewis. West Indian Manatee Update. Alabama Nongame Wildlife Green Books, Vol. 1-4. University of Alabama Press.

- 2011 Ross, M., **R. H. Carmichael**, A. Aven, J. Powell, N. Adimey. 2011. Manatee Aerial Surveys in Mississippi, Alabama and Louisiana under the Natural Resource Damage Assessment Program (NRDA): Results of the proposed data collection plan to assess injury to West Indian manatees outside of Florida from the Deepwater Horizon Oil Spill.
- 2010 **Carmichael, R. H.*** and C. Kovacs. Comment on Watanabe et al. 2009. *Mar. Pollut. Bull.* 60:314-315.
- 2009 **Carmichael, R. H.** and C. Pabody. Manatees in Alabama waters. *Alabama Wildlife.* 73:24-26.
- 2008 **Carmichael, R. H.** Threatened & Endangered Species—Manatees. *In* State of Mobile Bay: A status report on Alabama’s coastline from the Delta to our coastal waters. Mobile Bay National Estuary Program. November.

AWARDS AND DISTINCTIONS

- 2010 University of South Alabama, Junior Faculty Award for Scholarship and Academic Achievement, Nominated
- 2004 Dissertations Initiative for the Advancement of Limnology and Oceanography (DIALOG) VI, Dauphin Island Sea Lab, AL, Selected Participant
- 2001-2002 Boston University Marine Program, Palmer-McLeod Fellowship
- 1996, 2000 Boston University Marine Program, Humes Alumni Award for Outstanding Research
- 1996 American Museum of Natural History, Lerner-Gray Marine Research Fund

AFFILIATIONS

- Alabama Fisheries Association (AFA-Regional)
- American Association for the Advancement of Sciences (AAAS-International)
- American Fisheries Society (AFS-National)
- American Society of Limnology and Oceanography (ASLO-International)
- Coastal and Estuarine Research Federation (CERF-National)
- Gulf Estuarine Research Society (GERS-Regional)
- National Shellfisheries Association (NSA-National)
- New England Estuarine Research Society (NEERS-Regional)
- Society of Environmental Toxicology and Chemistry (SETAC-International)
- The Society for Marine Mammalogy (SMM-International)

SELECTED SYNERGISTIC ACTIVITIES

- 2015-present DISL Coordinator, DISL/ FDA joint graduate fellowship program
- 2014-present Coordinator, DISL’s Research Experience for Undergraduates (REU) program
- 2013-present Member, Horseshoe crab Species Specialist Group, IUCN
- 2012-present Editorial Boards; Estuarine Coastal & Shelf Science (Associate Editor, 2013-present; PLoS ONE (Academic Editor, 2013-2016; Coastal and Estuarine Science News (2012-2015); Aquatic Biology (Review Editor, 2012-present)
- 2011-present Governing Board, Coastal and Estuarine Research Federation; Member-at-Large, 2015-present; Chair, Publications Committee, 2015-present
- 2014-present Chair, Science Advisory Committee, Mobile Bay National Estuary Program