Christopher S. Murray, Ph.D.

CONTACT INFORMATION

Biology Department, MS 32
Woods Hole Oceanographic Institution
Woods Hole, MA

Email: christopher.murray@whoi.edu
Phone: (631) 943-2982
Website: www2.whoi.edu/staff/cmurray

INTERESTS

Marine Biology, Fish Ecology, Ecophysiology, Molecular Biology, Fisheries Oceanography, Climate Change, Ecotoxicology, Ocean Acidification, Hypoxia

APPOINTMENTS

Woods Hole Oceanographic Institution, Research Associate III
Biology Department
Dates: 2024 - current

Woods Hole Oceanographic Institution, Postdoctoral Investigator
Biology Department
Dates: 2022 - 2024

University of Washington, Postdoctoral Research Associate
School of Marine and Environmental Affairs, Washington Ocean Acidification Center
Dates: 2019 - 2022

AFFILIATIONS

USGS Western Fisheries Research Center, Visiting Scientist
Marrowstone Marine Field Station
Dates: 2020 - 2021

Western Washington University, Visiting Scientist
Shannon Point Marine Center
Dates: 2019 - 2021

EDUCATION

University of Connecticut, *PhD* Oceanography
Department of Maine Sciences
Emphasis: Fish Ecophysiology
Dates: 2014 - 2019

Stony Brook University, *MSc* Marine and Atmospheric Science
School of Marine and Atmospheric Sciences
Dates: 2011 - 2014

University of Richmond, *BScBA* Management
Dates: 2006 - 2010

FUNDING

2024 – Cooperative Institute for the North Atlantic Region (NOAA Fisheries): Assessing Risks from Contaminant Exposure to Coastal and Estuarine Living Marine Resources Using Transcriptomics (anticipated award: $435,841)

2023 – National Science Foundation: Organismal Response to Climate Change: Collaborative Research: Mechanisms Underpinning the Unusual, High CO_2 Sensitivity of Sand Lances, Key Forage Fishes on the Northwest Atlantic Shelf (award: $260,613, award number: 2307814)

2022 – National Science Foundation: Division of Ocean Sciences Postdoctoral Fellowship: Detecting Signatures of Multigenerational Plasticity in a Marine Forage Fish (award: $378,315, award number: 2126533)

MANUSCRIPTS

19. Aluru, N., Venkataraman, Y.R., **Murray, C.S.,** DePascuale, V., (2025) Gene expression and DNA methylation changes in response to hypoxia in toxicant-adapted Atlantic killifish (*Fundulus heteroclitus*). *Biology Open* 14 (1): BIO061801

18. **Murray, C. S.,** Mays, A., Long, M. and Aluru, N. (2024). Cross-generational plasticity in Atlantic silversides (*Menidia menidia*) under the combined effects of hypoxia and acidification. *bioRxiv*, 2024.05.22.595394.

17. **Murray, C.S.,** Gregg, J.L., Mackenzie, A.H., Jayasekera, H, Hall, S., Klinger, T., Hershberger, P.K., (2024) The effects of elevated pCO_2 on bioenergetics and disease susceptibility in Pacific herring (*Clupea pallasii*). *Marine Ecology Progress Series* 738:225-242

16. Singh, N.R*., Love, B., **Murray, C.S.,** Sobocinski, K.L., Cooper, J.W., (2023) The combined effects of acidification and acute warming on the embryos of Pacific herring (*Clupea pallasii*). *Frontiers of Marine Science* 10:2023 (*student manuscript)

15. Jones, L., Lou, N.R., **Murray, C.S**., Robert, D., Bourne, C.M., Bouchard, C., Carlon, D., Wiley, D.N., Therkildsen, N.O., and Baumann, H. (2023) Whole genome sequencing reveals two large population clusters of *Ammodytes dubius* on the Northwest Atlantic shelf. *ICES Journal of Marine Science* 80:122-132

14. **Murray, C.S.,** Klinger, T., (2022) High pCO_2 does not alter the thermal plasticity of developing Pacific herring embryos during a marine heatwave**.** *Journal of Experimental Biology 225 (5): jeb243501*

13. Baumann, H., Jones, L.F., **Murray, C.S.,** Siedlecki, S.A., Alexander, M., Cross, E.L. (2022) Impaired hatching exacerbates the high CO2 sensitivity of embryonic sand lance, *Ammodytes dubius*. *Marine Ecology Progress Series* 687:147-162

12. Concannon, C., Cross, E., Jones, L, **Murray, C.S.,** Matassa, C., McBride, R., & Baumann, H. (2021) Temperature-dependent effects on fecundity in a serial broadcast spawning fish after whole-life high-CO_2 exposure. *ICES Journal of Marine Science* fsab217

11. Schwemmer, T.S., Baumann, H., **Murray, C.S.**, Molina, A.I., and Nye, J. (2020) Acidification and hypoxia interactively affect metabolism in embryos, but not larvae, of the coastal forage fish *Menidia menidia*. *Journal of Experimental Biology* 223:jeb228015

10. **Murray, C.S** and Baumann, H. (2020) Are long-term growth responses to elevated pCO_2 sex-specific in fish? *PLOS ONE* 15(7): e0235817

9. Cross, E.L., **Murray, C.S.**, and Baumann, H. (2019) Diel and tidal $pCO_2 \times O_2$ fluctuations provide physiological refuge to a coastal forage fish. *Scientific Reports* 9:18146

8. **Murray, C.S.,** Wiley, D., and Baumann, H. (2019) High sensitivity of a keystone forage fish to elevated CO_2 and temperature. *Conservation Physiology* 7:1-12

7. Baumann, H., Cross, E., and **Murray, C. S.** (2018) Robust quantification of fish early life CO_2 sensitivities via serial experimentation. *Biology Letters* 14:11

6. **Murray, C.S.** and Baumann, H. (2018) You better repeat it: complex temperature × CO_2 effects in Atlantic silverside offspring revealed by serial experimentation. *Diversity* 10:69

5. Baumann, H., Parks, E.M., and **Murray, C.S.** (2018) Starvation rates in larval and juvenile Atlantic silversides (*Menidia menidia*) are unaffected by high CO_2 conditions. *Marine Biology* 165:75-83

4. Snyder, J.T., **Murray, C.S.,** and Baumann, H. (2018) Potential for maternal effects on offspring CO_2 sensitivities in the Atlantic silverside (*Menidia menidia*). *Journal of Experimental Marine Biology and Ecology* 499:1-8

3. **Murray, C.S.,** Fuiman, L., and Baumann, H. (2017) Consequences of elevated CO_2 exposure across multiple life stages in a coastal forage fish. *ICES Journal of Marine Science* 74:1051-1061

2. Malvezzi, A.J., **Murray, C.S.,** Feldheim, K.A., Dibattista, J.D., Garant, D., Gobler, C.J., Chapman, D.D., and Baumann, H. (2015) A quantitative genetic approach to assess the evolutionary potential of a coastal marine fish to ocean acidification. *Evolutionary Applications 8: 352-362*

1. **Murray, C.S.,** Malvezzi, A., Gobler, C.J., and Baumann, H. (2014) Offspring sensitivity to ocean acidification changes seasonally in a coastal marine fish*. Marine Ecology Progress Series 504: 1-11* (Feature Article)

MANUSCRIPTS IN REVIEW

1. **Murray, C.S.,** Mays, A., Long, M., Aluru, N., Cross-generational plasticity in Atlantic silversides (*Menidia menidia*) under the combined effects of hypoxia and acidification. (in review)

2. Paris, J., Criss, M., Walsh, J., Obiol, J.F., Boone, J., **Murray, C.S.,** Chambers, R.C., Petersen, A. Two genomes of the white perch (*Morone americana*), an emerging pollution bioindicator. (in review).

3. Lukas Marx, Jennie E. Rheuban, Daniel C. McCorkle, **Christopher S. Murray**, Yiming Guo, Z. Aleck Wang, Anna P. M. Michel, Ke Chen, Heather H. Kim, Adam V. Subhas. Development of the ecological activity index as a site selection criterion for ocean alkalinity enhancement. (in review)

CHRISTOPHER S. MURRAY, Ph.D.

AWARDS & FELLOWSHIPS

2019 - Provost Commendation for Excellence in Teaching, University of Connecticut College of Liberal Arts and Science

2019 - Saul B. Saila Best Student Paper Award, Southern New England Chapter of the American Fisheries Society ($100)

2018 - William A. Lund, Jr. Award in Marine Sciences Fund, UConn Department of Marine Sciences Fellowship ($350)

2018 - Predoctoral Travel Award, UConn Department of Marine Sciences ($430)

2017 - George Burlew Scholarship Grant, Manasquan River Marlin and Tuna Club ($2,000)

2017 - UConn Graduate School Doctoral Dissertation Fellowship ($2,000)

2017 - Grace Klein-MacPhee Travel Award, AFS Larval Fish Conference ($300)

2017 - William A. Lund, Jr. Award, UConn Department of Marine Sciences ($500)

2016 - CLAS Dean Predoctoral Travel Award, UConn Department of Marine Sciences ($1,082)

2014 - Gordon Research Conference Student Travel Fellowship ($500)

TEACHING EXPERIENCE

Biology of Fishes (UConn EEB), Instructor, Spring 2019

General Ecology (UConn EEB), Teaching Practicum, Fall 2018

Fish Ecology (UConn Marine Sciences), Guest Lecturer, 2015 - 2018

Principles of Biology (UConn Biology), Guest Lecturer, 2015 - 2018

Introduction to Oceanography (UConn Marine Sciences), Teaching Assistant, Spring 2015

Principles of Biology (UConn Marine Sciences), Teaching Assistant, Fall 2014

MENTORING ACTIVITIES

University of Washington
Jacob Williams (2025), Capstone Faculty Advisor

Woods Hole Partnership in Education Program
Ayanna Mays (2022 - 2023), Research Mentor

Western Washington University
Nicole Singh (2021-2023), Thesis Committee Member

Western Washington University

Onil Nicolau (summer 2021), NSF-REU Advisor

University of Washington
Cassidy Pearson (2020-2021), Faculty Advisor for Independent Research

University of Connecticut, Baumann Lab Undergraduate Research Mentees: Lucas Jones (2018), Mia Dupuis (2018), Gere Johnson (2018), Isaiah Mayo (2017 - 2018), Charles Dyke (2017 - 2018), Elle Parks (NSF REU student 2017), Rainer Moy-Huwyler (2016 - 2017), Rafeed Hussain (2016), James Harrington (2016 - 2017), Tyler Clouthier (2016 - 2017), Elizabeth Karamavros (2015 - 2016), Wes Huffman (2015 - 2016), Megan Barry (f2015 - 2016), Molly Hughes (2015 - 2016)

INVITED SEMINARS

2023 - UMass Dartmouth School for Marine Science & Technology, New Bedford, MA

2022 - California Current Acidification Network, Online Presentation

2022 - Woods Hole Oceanographic Institution Biology Seminar, Woods Hole, MA

2021 - Puget Sound Ecosystem Monitoring Program: Steering Committee Joint Meeting, Online Presentation

2021 - Shannon Point Marine Center, Western Washington University, Anacortes, WA

2021 - UConn Department of Marine Sciences, Groton, CT

2020 - Washington State Marine Resources Advisory Council Meeting, Online Presentation

2019 - Olympic Coast National Marine Sanctuary Annual Science Meeting, Bremerton, WA

2018 - UConn Department of Marine Sciences. Biannual Feng Symposium, Groton CT

2017 - James J. Howard Marine Sciences Laboratory, Northeast Fisheries Science Center, Sandy Hook, NY

CONFERENCE PRESENTATIONS

Murray, C.S., Jones, L., Siegfried, E., Zavell, M.D., Baumann, Z., Wiley, D., Therkildsen, N., Aluru, N., Baumann, H. Examining the effect of ocean acidification on hatching enzyme gene expression in Northern sand lance (*Ammodytes dubius*). Larval Fish Conference. 13-16 May 2024, Huron, OH

Murray, C.S., Aluru, N., Molecular mechanisms of cross-generational plasticity under combined hypoxia and ocean acidification in a coastal forage fish. Society of Comparative and Integrative Biology, 2-6 January 2024, Seattle, WA

Mays, A.*, **Murray, C.S.,** Aluru, N., Hypoxia tolerance in *Menidia menidia*.

Annual Biomedical Research Conference for Minoritized Scientists. 15-18 November 2023, Phoenix, AZ (*student presentation)

Murray, C.S., Gregg, J., Mackenzie, A., Jayasekera, H., Richards, W., Malloy, A., Hershberger, P. Does ocean acidification affect susceptibility to disease in Pacific herring? Salish Sea Ecosystem Conference, 26-28 April 2022

Murray, C.S. Developmental plasticity of Pacific herring under combined heatwave and high pCO_2 conditions. Western Society of Naturalists Conference, 5-8 November 2020

Murray, C.S., Cross, E.L., and Baumann H. A factorial evaluation of the combined effects of acidification and hypoxia in Atlantic silverside offspring. 43rd Annual Larval Fish Conference, 20-25 May 2019, Palma de Mallorca, Spain

Murray, C., Wiley, D., and Baumann H. 2019**.** High sensitivity of the Northern Sand Lance (*Ammodytes dubius*) to ocean acidification and warming. Winter meeting of the Southern New England Chapter of the American Fisheries Society, 17 January 2019. Storrs CT

Murray, C.S., Wiley, D., and Baumann, H. Northern sand lance embryos show high sensitivity to near-future CO_2 levels. 30th Anniversary Connecticut Sea Grant Research Forum, 7 September 2018, Avery Point, CT

Murray, C.S., Wiley, D., and Baumann, H. Early life stages of the northern sand lance *Ammodytes dubius* show high sensitivity to combined effects of acidification and warming**.** Gordon Research Conference on Ocean Global Change Biology, 15-20 July 2018, Waterville Valley, NH

Murray, C.S., Wiley, D., and Baumann, H. Early life stages of the northern sand lance *Ammodytes dubius* show high sensitivity to combined effects of acidification and warming. 42nd Annual Larval Fish Conference, 24-28 June 2018, Victoria, BC

Murray, C.S., Wiley, D., and Baumann, H. A preliminary study testing the effects of high CO_2 on the early life stages of the northern sand lance *Ammodytes dubius*. 2017 RARGOM Annual Science Meeting, 12 October 2017, Portland

Murray, C.S., Wiley, D., and Baumann, H. A preliminary study testing the effects of high CO_2 on the early life stages of the northern sand lance *Ammodytes dubius*. ICES Annual Science Conference, 18-21 September 2017, Ft. Lauderdale, FL

Murray, C.S. and Baumann, H. Growth costs of high CO_2 environments in a marine fish: Importance of life stage and feeding methodology. ICES Annual Science Conference, 18-21 September 2017, Ft. Lauderdale, FL

Murray, C.S., Snyder, J., and Baumann, H. Temperature dependent CO_2-effects in a coastal forage fish. Joint Meeting of Ichthyologists and Herpetologists, 12-16 July 2017, Austin, TX

Murray, C.S., Fuiman, L., and Baumann, H. Consequences of elevated CO_2 exposure across multiple life stages in a coastal forage fish. 40th Annual Larval Fish Conference, 19-23 June 2016, Chesapeake Biological Station, Solomons, MD

Murray, C.S., and Baumann, H. The performance of a fully automated system for testing the combined effects of acidification and hypoxia on fish early life stages. 145th Annual Meeting of the American Fisheries Society, 16-20 August 2015, Portland, OR

Murray, C.S., Malvezzi, A., Gobler, C.J., and Baumann, H. Offspring sensitivity to ocean acidification changes seasonally in a coastal marine fish. Gordon Research Conference on Ocean Global Change Biology, 6-11 July 2014, Waterville Valley, NH

Murray, **C.S.,** Malvezzi, A., Depasquale E., Gobler, C., and Baumann, H. Seasonal variability in CO_2 sensitivity in early life stages of a coastal marine fish: A case of transgenerational plasticity? CERF Bi-annual Meeting, 3-7 Nov 2013, San Diego, CA

Murray, C.S., Malvezzi, A., Depasquale, E., Gobler, C.J., and Baumann, H. Survival and growth at elevated CO_2 conditions in Atlantic Silverside eggs and larvae: evidence for seasonal variability. ASLO Annual Meeting, 17-22 February 2013, New Orleans, LA

WORKSHOPS

2022 - EpiMAR (Epigenetics in Marine and Aquatic Research), Woods Hole, MA

2018 - 4th U.S. Ocean Acidification PI Meeting, Portland, OR

2018 - Larval Fish ID Workshop, University of Victoria, BC

INSTITUTIONAL SERVICE

2020 - 2021 – Faculty Editor for Currents (Student Blog), University of Washington

2017 - 2019 – Organizer, UCONN Marine Science Day: Community Outreach

2016 - 2017 – President, Graduate Student Organization**,** Department of Marine Sciences, University of Connecticut

2016 - Steering Committee, Biannual Feng Colloquium, Department of Marine Sciences, University of Connecticut

2015 - 2016 – Faculty Liaison, Graduate Student Organization, Department of Marine Sciences, University of Connecticut

PROFESSIONAL SERVICE

Grant Reviews:
NOAA Acidification Program, NSF Biological Oceanography Program, NSF Molecular Biology – Genetic Mechanisms Program, The Icelandic Research Fund

Journal Reviews:
Behavioral Processes, BMC Genomics, Biogeosciences, Comparative Biochemistry and Physiology Part A, Conservation Physiology, Elementa, Diversity, Evolutionary

Applications, Global Change Biology, Journal of Experimental Marine Biology, Marine Biology, Marine and Coastal Fisheries, PLOS One

Conference Session Chair:
Society of Comparative and Integrative Biology Annual Meeting 2024: Adjusting to a Changing World

PROFESSIONAL REFERENCES

Dr. Neel Aluru
Biology Department
Woods Hole Oceanographic Institution
MS #32, 266 Woods Hole Road, Woods Hole, MA 02543-1050
(508) 289-3607, naluru@whoi.edu
Relationship to applicant: postdoc supervisor (2022 - current)

Dr. Hannes Baumann
Department of Marine Sciences
University of Connecticut
1080 Shennecossett Road, Groton, CT, 06340-6048
(860) 405-9297, hannes.baumann@uconn.edu
Relationship to applicant: MSc & PhD supervisor (2012 - 2019)

Dr. Terrie Klinger
School of Marine and Environmental Affairs
University of Washington
Box 355685, Seattle, WA 98105-6715
(206) 685-2499, tklinger@uw.edu
Relationship to applicant: postdoc supervisor (2019 - 2022)