

# Brandyn M. Lucca

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<b>Research Interests</b>	Theoretical acoustic scattering models representing typically observed taxa in the water column. Using various remote sensing, statistical, and machine learning methods to automate the classification of habitats and biological community composition in the water column.
<b>Education</b>	<p><b>Stony Brook University</b>, Stony Brook, NY <b>Ph.D.</b>, Marine and Atmospheric Science, GPA 3.96 Dissertation title: <i>“Improving acoustic target classification and density estimates of epi- and mesopelagic organisms”</i>. Advisor: Dr. Joseph D. Warren (School of Marine and Atmospheric Sciences) <b>2017-2023</b></p> <p><b>Stony Brook University</b>, Stony Brook, NY <b>M.Sc.</b>, Marine and Atmospheric Science, GPA 4.00 Thesis title: <i>“Quantifying Atlantic menhaden in estuarine and coastal waters of Long Island, New York using acoustic methods.”</i> Advisor: Dr. Joseph D. Warren (School of Marine and Atmospheric Sciences) <b>2014-2016</b></p> <p><b>University of Rhode Island</b>, Kingston, RI <b>B.Sc.</b>, Marine Biology, GPA 3.72, <i>summa cum laude</i> Honors Thesis title: <i>“The utility of planning and other spatial concepts in marine spatial management.”</i> Advisor: Dr. William Gordon (Department of Landscape Architecture) <b>2009-2012</b></p>
<b>Academic Experience</b>	<p><b>Postdoctoral Scholar</b> Applied Physics Laboratory, University of Washington <b>2023-present</b></p> <p><b>Research/Graduate Assistant</b> School of Marine and Atmospheric Sciences, Stony Brook University <b>2014 - 2023</b></p> <p><b>Coastal Fellow</b> College of the Environment and Life Sciences, University of Rhode Island <b>2010</b></p>
<b>Publications</b>	<p><b>Lucca B.M.</b> and Warren J.D. 2024. Experimental target strength measurements of pteropods and shrimp emphasize the importance of scattering model inputs. ICES J Mar Sci, 0: 0-17. <a href="https://doi.org/10.1093/icesjms/fsad211">https://doi.org/10.1093/icesjms/fsad211</a></p> <p><b>Lucca B.M.</b>, Ressler P.H., and Warren J.D. 2023. Individual sub-Arctic target strength measurements have frequency-dependent differences relative to scattering model predictions. J Acoust Soc Am, 154: 3374-3387. <a href="https://doi.org/10.1121/10.0022459">https://doi.org/10.1121/10.0022459</a></p> <p>Besnard L., <b>Lucca B.M.</b>, Shipley O.N., Croizier G.L., Octavio Rincon R.O.M., Sonke J., Point, D., Galván-Magaña F., Kraffe, E., Kown S.Y., and Schaal, G. 2023. Mercury isotope clocks predict coastal residency and migration timing of hammerhead sharks. J Anim Ecol, 60: 803-813. <a href="https://doi.org/10.1111/1365-2664.14384">https://doi.org/10.1111/1365-2664.14384</a></p> <p><b>Lucca B.M.</b>, Ressler P.H., Harvey H.R., and Warren J.D. 2021. Variations in sub-Arctic krill material properties, lipid composition, and other scattering model inputs affect acoustic estimates of their population. ICES J Mar Sci, 78: 1470-1484. <a href="https://doi.org/10.1093/icesjms/fsab045">https://doi.org/10.1093/icesjms/fsab045</a></p> <p><b>Lucca B.M.</b> and Warren J.D. (2019). Fishery-independent estimates of Atlantic menhaden (<i>Brevoortia tyrannus</i>) in the coastal waters south of New York. Fish Res, 218: 229-236. <a href="https://doi.org/10.1016/j.fishres.2019.05.016">https://doi.org/10.1016/j.fishres.2019.05.016</a></p>

	<p><b>Lucca B.M.</b> and Warren J.D. (2018). Acoustically-measured distribution and abundance of Atlantic menhaden (<i>Brevoortia tyrannus</i>) in a shallow estuary in Long Island, N.Y. <i>Estuaries Coast</i>, 41: 1436-1447. <a href="https://doi.org/10.1007/s12237-018-0367-x">https://doi.org/10.1007/s12237-018-0367-x</a></p>
<p><b>Papers in Preparation</b></p>	<p><b>Lucca B.M.</b>, Warren J.D., <i>et al.</i> <i>Target strength models for North Atlantic and Pacific pelagic fish and squid demonstrate strong agreement with validation experiments.</i></p> <p><b>Lucca B.M.</b>, Warren J.D., <i>et al.</i> <i>Scattering properties and validated target strength models specific for mesopelagic fish from the Northwest Atlantic.</i></p> <p><b>Lucca B.M.</b>, Warren J.D., Keiling, T.D., <i>et al.</i> <i>Quantifying spatiotemporal distributions of fish and zooplankton in the New York Bight using active acoustics.</i></p> <p>Warren J.D. and <b>Lucca B.M.</b> <i>Species-specific material property and experimental broadband backscatter measurements can improve target strength models of California Current euphausiids.</i></p>
<p><b>Conference Talks</b> (* indicates speaker)</p>	<p>Warren J.D.*, <b>Lucca B.M.</b>, Escalante M., and Lyons A.P. <i>A year in the life of zooplankton and fish in the Gulf of Maine: Long (and short) term monitoring of pelagic organisms using bottom-mounted, upward-looking, multifrequency echosounders.</i> Underwater Acoustics International Conference and Exhibition. Kalamata, Greece, June 2023.</p> <p>Warren, J.D.* and <b>Lucca B.M.</b> <i>Material properties and broadband backscatter measurements of individual euphausiids from the California Current coastal ecosystem.</i> 184th Meeting of the Acoustical Society of America (ASA). Chicago, IL, May 2023.</p> <p><b>Lucca B.M.*</b> and Warren J.D. <i>One size does not fit all: experimental target strength measurements of pteropods and shrimp emphasize the importance of scattering model inputs.</i> ICES Fisheries and Plankton Acoustic Symposium. Portland, ME, March 2023.</p> <p><b>Lucca B.M.*</b>, Keiling T.D., and Warren J.D. <i>Active acoustic surveys of fish and zooplankton in the New York Bight.</i> 57th Annual Meeting of the New York Chapter of the American Fisheries Society (NYCAFS). Stony Brook, NY. February 2023.</p> <p><b>Lucca B.M.*</b>, Lyons A.P., and Warren J.D. <i>Variability in zooplankton and fish abundance in the Wilkinson Basin from Feb 2021 to Jan 2022 as measured by a multi-frequency bottom-mounted echosounder.</i> Regional Association for Research on the Gulf of Maine Annual Science Meeting. Online, December 2022.</p> <p><b>Lucca B.M.*</b>, and Warren J.D. <i>Experimentally validated target strength models for northwest Atlantic mesopelagic fish.</i> Northeast Regional Environmental Acoustic Symposium. Dover, NH, May 2022.</p> <p>Keiling T.D.*, Blair H.B., <b>Lucca B.M.</b>, Heywood E.I., Menz T.C., and Warren J.D. <i>Active acoustics, net tows, and fish trawls: Monitoring the offshore ecosystem of the New York Bight.</i> 56th Annual Meeting of the New York Chapter of the American Fisheries Society (NYCAFS). Riverhead, NY/Online, February 2022.</p> <p>Besnard L.*, Shipley O.N., <b>Lucca B.M.</b>, Croizier G.L., Sonke J., Galván-Magaña F., Kraffe E., Point D., Rincon R.O.M., Ketchum J., and Schaal G. <i>Mercury isotope clocks estimate dispersal timing from natal area in hammerhead shark species.</i> 24th Meeting of the European Elasmobranch Association (EEA). Leiden, Netherlands, November 2021.</p> <p>Miksis-Olds J.*, Warren J.D., Blair H.B., and <b>Lucca B.M.</b> <i>Atlantic deepwater ecosystem observatory network: Patterns of acoustic backscatter and community structure of the U.S. Outer Continental Shelf.</i> 180th Meeting of the Acoustical Society of America (ASA). Online, June 2021.</p> <p><b>Lucca B.M.*</b>, Blair H.B., and Warren J.D. <i>Seasonal variations in multi-year active acoustic surveys of fish and zooplankton in the New York Bight.</i> 180th Meeting of the Acoustical Society of America</p>

	<p>(ASA). Online, June 2021.</p> <p>Warren J.D.* , <b>Lucca B.M.</b>, and Blair H.B. <i>Development of a pelagic zooplankton and nekton acoustic survey in the New York Bight</i>. Annual Meeting of the ICES Working Group on Fishing Technology Fisheries, Acoustics, Science and Technology (ICES WGFAST). Online, April 2021.</p> <p>Warren J.D.* , Blair H.B., and <b>Lucca B.M.</b> <i>Pelagic fish and zooplankton abundance and distribution in the New York Bight</i>. State of the Science Workshop on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts. Online, November 2020.</p> <p>Ressler P.H., Warren J.D.* , <b>Lucca B.M.</b>, Harvey H.R., and Gibson G.A. <i>How many krill are there in the eastern Bering Sea and Gulf of Alaska?</i> Alaska Marine Science Symposium (AMSS), Anchorage, AK, January 2019.</p> <p>Ressler P.H.* , Warren J.D., <b>Lucca B.M.</b>, Harvey H.R., and Gibson G.A. <i>How many krill are there in the eastern Bering Sea and Gulf of Alaska?</i> Interim Report of the Working Group on Fisheries Acoustics, Science, and Technology (ICES WGFAST). Seattle, WA, March 2018.</p> <p><b>Lucca B.M.*</b>, Blair H., and Warren J.D. <i>Acoustic quantification of abundance, biomass, and size class of Atlantic menhaden (<i>Brevoortia tyrannus</i>) in a shallow estuary in Long Island, New York</i>. 173rd Meeting of the Acoustical Society of America (ASA). Boston, MA, June 2017.</p> <p><b>Lucca B.M.*</b>, Martin S.* , and Gordon W. <i>The application of planning, design, and other spatial/seascape concepts within spatial management</i>. University of Rhode Island (URI) Honors Undergraduate Research Conference. Kingston, RI, May 2012.</p>
<p><b>Conference Posters</b> (* indicates speaker)</p>	<p>Warren J.D.* and <b>Lucca B.M.</b> <i>Species specific material property measurements improve the agreement of experimental measurements and scattering model predictions of krill target strength</i>. ICES Fisheries and Plankton Acoustic Symposium. Portland, ME, March 2023.</p> <p>Keiling T.D.* , Blair H.B., <b>Lucca B.M.</b>, Carlowicz R.M., Heywood E.I., Menz T.C., and Warren J.D. <i>From baby fish to large pelagics: Gathering baseline data for offshore fish and zooplankton in the New York Bight</i>. 57th Annual Meeting of the New York Chapter of the American Fisheries Society (NYCAFS). Stony Brook, NY. February 2023.</p> <p>Warren J.D.* , Keiling T.D., Blair H.B., <b>Lucca B.M.</b>, Carlowicz R.M., and Leone M. <i>Monitoring surveys of pelagic fish and zooplankton in the New York Bight</i>. NYSERDA State of the Science Workshop on Wildlife and Offshore Wind Energy. Tarrytown, NY, July 2022.</p> <p><b>Lucca B.M.*</b> and Warren J.D. <i>Measuring abundance, biomass, and distribution of fish using active acoustics in the coastal waters of Long Island, New York</i>. Northeast Regional Environmental Acoustics Symposium, Brown University, Providence, RI. May 2019.</p> <p><b>Lucca B.M.*</b>, Warren J.D., Ressler P.H., Harvey H.R., and Gibson G.A. <i>An improved target strength model for sub-Arctic krill validated by ship-board backscatter and material property measurements from individual animals</i>. AMSS. Anchorage, AK, January 2019.</p> <p>Harvey H.R.* , Warren J.D., Ressler P.H., Gibson G.A., <b>Lucca B.M.</b>, McMahon R., and Pleuthner R. <i>Target strength calibration through parallel measures of intact lipid classes and acoustic profiles of individual euphausiids</i>. AMSS. Anchorage, AK, January 2019.</p> <p>Warren J.D.* , <b>Lucca B.M.</b>, Ressler P.H., Harvey H.R., and Gibson G.A. <i>How many krill are there in the Bering Sea and Gulf of Alaska? Field observations and acoustic calibration of krill and their composition in 2016 and 2017</i>. AMSS. Anchorage, AK, January 2018.</p> <p>Warren J.D.* , Ressler P.H., Harvey H.R., Gibson G.A., and <b>Lucca B.M.</b> <i>How many krill are there in the Bering Sea and Gulf of Alaska? Preliminary field observations from summer 2016 and implications for ecosystem-wide measurements</i>. AMSS. Anchorage, AK, January 2017.</p>

	<p><b>Lucca B.M.*</b> and Warren J.D. <i>Acoustic measurements of the distribution and abundance of Atlantic menhaden (<i>Brevoortia tyrannus</i>) in the Peconic River and Estuary in Long Island, NY.</i> 50th Annual Meeting of the New York Chapter of the American Fisheries Society (NYCAFS). Cooperstown, NY, February 2016.</p> <p><b>Lucca B.M.*</b> and Rynearson T. <i>The rate of growth in <i>Thalassiosira rotula</i> and <i>Thalassiosira gravida</i> as a result of phosphorus limitation.</i> URI Coastal Fellows Presentation. Kingston, RI, December 2010.</p>	
<b>Invited Seminars</b>	<p>Applied Physics Laboratory, University of Washington, Seattle, WA. January 2024.</p> <p>Applied Physics Laboratory, University of Washington, Seattle, WA. January 2023.</p> <p>Center for Coastal and Ocean Mapping/NOAA-UNH Joint Hydrographic Center, University of New Hampshire, Durham, NH. January 2022.</p> <p>Marine Environmental Education Center, Halmos College of Arts and Sciences, Nova Southeastern University, Hollywood, FL. January 2021.</p> <p>Farallon Institute, Petaluma, CA. April 2020.</p>	
<b>Technical Reports &amp; Book Chapters</b>	<p>Baggeroer A.B. and <b>Lucca B.M.</b> Sonar Systems. In: <i>Encyclopedia of Ocean Sciences</i> (Third Edition), edited by JH Steele, Academic Press, 2019.</p> <p>Urmy S.S., <b>Lucca B.M.</b>, Blair H., and Warren J.D. (2017). <i>Seafloor habitat characterization around Montauk Point</i>, submitted to Seatuck Environmental Association, pp. 1-57.</p>	
<b>Workshop Participation</b>	<p>Invited Participant. ICES Workshop on Acoustic Backscattering Models (WKABM). Online. 7-8 April 2021.</p>	
<b>Open Source Software</b>	<p><b>isoclockR</b> R-package for empirically residence time of animal tissues using stable and bulk isotope samples. When turn-over rates of tissues are known, empirical residence time estimates can be modeled to infer migrations of different organisms. <a href="https://github.com/brandynlucca/isoclockR">https://github.com/brandynlucca/isoclockR</a></p> <p><b>soundshapes</b> Matlab-compiled software used for extracting body length, shape, and other morphometrics from digital photographs important for parameterizing theoretical scattering models. <a href="https://github.com/brandynlucca/soundshapes">https://github.com/brandynlucca/soundshapes</a></p> <p><b>acousticTS</b> R-package consisting of physics-based and analytical models, approximation methods, and exact solutions used for calculating the theoretical target strength (TS, dB re. 1 m<sup>2</sup>) of different scatterers (e.g. fish with gas-filled swimbladders). <a href="https://github.com/brandynlucca/acousticTS">https://github.com/brandynlucca/acousticTS</a></p>	<p><b>2021-present</b></p> <p><b>2020-present</b></p> <p><b>2018-present</b></p>
<b>Teaching</b>	<p><b>Guest Lecturer, Stony Brook University</b> Bioacoustics (MAR 395) Long Island Marine Habitats (MAR 303)</p> <p><b>Teaching Assistant, Stony Brook University</b> Supervised boat-based field labs aboard the <i>R/V Shinnecock</i>, <i>R/V Paumanok</i>, and <i>R/V Peconic</i>, and additional land-based activities; led computer labs; A/V troubleshooting; grading homework assignments, essays, quizzes, and exams (ENS 301, MAR 303, MAR 352).</p> <p><b>Professional Water Safety and Lifeguard Instructor</b></p>	<p><b>2014-present</b></p> <p><b>2015-2020</b></p> <p><b>2009-2014</b></p>

	American Red Cross certified instructor (LGI, WSI). Taught swim lessons to clients ranging from 6 months to 50 years in age; specialized working with students with physical and developmental disabilities; taught professional first aid, CPR, AED, oxygen administration, and lifeguarding courses ranging from preschool teachers to municipal lifeguards.	
<b>Societies</b>	Acoustical Society of America (ASA) New York Chapter of the American Fisheries Society (NYAFS) <b>Founding Member</b> of the SBU American Fisheries Society (AFS) subunit	
<b>Honors &amp; Awards</b>	SEED Postdoctoral Fellowship (APL-UW) ICES Fisheries & Plankton Acoustics Symposium Early Career Scientist Travel Award Jerry R. Schubel Graduate Fellowship (SBU) Maze-Landau Travel Award (SBU) School of Marine and Atmospheric Sciences Travel Award (SBU) South Windsor Town Council Commendation & Citation SWRPD "Above the Call of Duty" Award Omicron Delta Kappa National Leadership Honor Society Phi Eta Sigma National Honors Society Fraternity National Society of Collegiate Scholars URI Coastal Fellowship URI Dean's List Robbins Barstow Marine Science Book Award Pleasant Valley School PTO Orville C. Rowley Scholarship	<b>2023-2025</b> <b>2023</b> <b>2022</b> <b>2017</b> <b>2016</b> <b>2014</b> <b>2013</b> <b>2012</b> <b>2010</b> <b>2010</b> <b>2010</b> <b>2009-2012</b> <b>2009-2012</b> <b>2009</b>
<b>Outreach</b>	<b>Montauk Historical Society Summer Talk Series</b> A lecture part of the summer talk series at the Montauk Point Lighthouse. <a href="https://montaukhistoricalsociety.org/event/the-secret-life-of-offshore-scientists/">https://montaukhistoricalsociety.org/event/the-secret-life-of-offshore-scientists/</a>  <b>Letters to a Pre-Scientist</b> Volunteer for a 501(c)3 organization; engage in a pen pal program that connects STEM professionals with K-12 students across the country. <a href="https://www.prescientist.org">https://www.prescientist.org</a>  <b>Skype A Scientist</b> Volunteer for a 501(c)3 organization; engage in Q&A sessions with classrooms (K-12, College) around the United States (40+ classrooms around North America). <a href="https://www.skypeascientist.com">https://www.skypeascientist.com</a>  <b>North Country Middle School Science Fair</b> Outreach event coordinated by the Stony Brook University Geosciences Department at the North Country Middle School.  <b>WAC Lighting Foundation Invitational Science Fair</b> High school science fair judge at Manhasset High School. <a href="https://www.researchassociation.org">https://www.researchassociation.org</a>  <b>Biotweeps</b> Curated a Twitter account presenting research to a broad and diverse audience (15,000+ followers) discussing acoustics, life at sea and during fieldwork, inclusivity in STEM fields, and graduate student mental health. <a href="https://www.biotweep.wordpress.com/2018/08/090718-brandynluca/">https://www.biotweep.wordpress.com/2018/08/090718-brandynluca/</a>  <b>The MVP of Long Island Fish (Atlantic menhaden)</b> Public talk series presented at Moustache Brewing (Riverhead, NY), Long Island Paddlers Inc. (Bay Shore, NY), and Smithtown Public Library (Nesconset, NY).  <b>Media Quotes</b>	<b>2022</b>  <b>2020-present</b>  <b>2017-present</b>  <b>2019</b>  <b>2018-2019</b>  <b>2018</b>  <b>2017-2018</b>  <b>2016</b>

Photograph quoted in: “Shinnecock Canal Fish Kill Wipes Out Thousands of Bunker”, by Clyde Hughes, 15 November 2016, <https://www.newsmax.com/>

Quoted in: “Bunker Die in Doves Monday at Shinnecock Locks”, by Beth Young, 14 November 2016, <https://www.eastendbeacon.com/>

**Research Experience**  
(active projects in bold)

**Quantifying relationships between blue, fin, and beaked whales and their prey in Southern California 2022**

Process EK80 broadband acoustic backscatter measured from upward-facing Simrad WBATs at various depths in Southern California. Quantify spatiotemporal distributions of prey fields. Leverage pulse-compressed broadband measurements to develop a classification and target detection algorithm to infer scattering properties of individual scatterers and community composition of scattering layers.

**General acoustic backscatter modeling 2021**

Ongoing work following the ICES Workshop on Acoustic Backscatter Models (WKABM) in April 2021 that convened to review commonly used acoustic scattering models and their respective parameterization.

**Acoustic and Environmental Observation Network (AEON) 2021**

Design a platform to mount ES60 and EK80 narrow- and broadband echosounders for fine-scale active acoustic surveys in the Gulf of Maine. Develop methods and dataflows for processing survey, AZFP, and WBAT backscatter measurements.

Sea days: *R/V Hugh R. Sharp* (6), *M/V Warren Jr* (10)

**Stable isotope ratios as molecular clocks 2020**

Develop the isoclockR R-package to examine migratory behaviors of animals based on staple isotope ratios and tissue turnover rates using a validated ‘isotope molecular clock’.

**Target strength modeling of krill in the California Current 2019**

Process zooplankton collected from Bongo and Methot net tows. Measure acoustic material property and other TS model parameters of captured animals; shipboard empirical TS measurements of tethered animals; analyze photographs to extract animal morphometrics; evaluate model performance by comparing empirical and theoretical TS measurements.

Sea days: *R/V Reuben Lasker* (10)

**Atlantic Deep Water Ecosystem Observing Network (ADEON) 2017**

Measure acoustic material properties and other theoretical TS model parameters of mesopelagic zooplankton and nekton. Design a platform to mount ES60 and EK80 narrow- and broadband echosounders for fine-scale active acoustic surveys along the eastern seaboard of the United States. Collect zooplankton using Bongo ring nets and a Isaacs-Kidd Midwater Trawl; shipboard empirical TS measurements of tethered animals.

Sea days: *R/V Armstrong* (63), *R/V Endeavor* (37)

**Ecosystem Monitoring Program for the New York Bight (NYOS) 2017**

Conduct an active acoustic survey along the entire continental shelf south of Long Island. Collect zooplankton using rint net tows. Extract dissolved and whole nutrients, and chlorophyll, from surface water samples. Process ES60 and EK80 narrow- and broadband backscatter to acoustically characterize spatiotemporal trends in biological activity.

Sea days: *R/V Paumanok* (2), *R/V Seawolf* (14)

**Target strength modeling of Alaskan sub-Arctic krill 2017**

Collect and process krill, other zooplankton, and small nekton captured from Methot net tows.

	<p>Measure acoustic material properties and other theoretical TS model parameters. Collect shipboard experimental TS measurements of tethered animals. Process <i>in situ</i> stereocamera images of krill to estimate tilt distributions. Statistically compare experimental measurements with modeled predictions.  <u>Sea days: R/V Oscar Dyson (43)</u></p> <p><u>Seafloor habitat characterization around Montauk Point 2017</u>  Deploy a drop camera quadrat to correlate bottom imagery with processed sidescan sonar backscatter. Create a multinomial classification tree to identify portions of survey transects containing mussel beds.  <u>Sea days: R/V Parker (2)</u></p> <p><u>Acoustic Atlantic menhaden surveys in Long Island waters 2014-2019</u>  Plan and conduct active acoustic surveys in the Peconic River and off the south shore of Long Island to characterize spatiotemporal distributions of Atlantic menhaden (<i>Brevoortia tyrannus</i>). Collect hydrographic profiles of the water column using CTDs and a handheld YSI, depending on depth. Process sidescan sonar, ES60 and EK60, and ADCP backscatter.  <u>Sea days: R/V Paumanok (13), R/V Parker (15)</u></p> <p><u>Characterizing artificial reef usage of fish and zooplankton 2014-2016</u>  Plan and conduct active acoustic surveys at two artificial reef sites off the south shore of Long Island. Collect zooplankton using ring net tows and vertical hydrographic profiles using CTDs. Identify preserved zooplankton specimens. Process sidescan sonar, ES60 and EK60, and ADCP backscatter.  <u>Sea days: R/V Paumanok (13)</u></p>
<b>Professional Skills &amp; Training</b>	<p>Total of <b>225 sea days</b> aboard oceanographic vessels (2014-present)  <i>R/Python/Matlab/Echoview/Julia/Microsoft Office/LibreOffice</i> (Daily/Frequent use)  <i>SQL/Octave/ODV/HTML/LaTeX/Java/Go/C/C++/Cython/Git/Batch</i> (Recurring/Occasional use)  <i>Ruby/Fortran/Java/JavaScript/Tensorflow/PyTorch/PHP/Perl/CUDA</i> (Infrequent/Enthusiast use)  Jupyter Notebook Bootcamp (AMSS, 2019, Axiom Data Sciences)  Metadata 411 (AMSS, 2019, Axiom Data Sciences)  PADI Open-water, Advanced, Rescue, and Nitrox (83 hours diving experience)  AAUS Scientific Diving (2011-2014)</p>
<b>References</b>	<p><b>Dr. Joseph D. Warren</b> Associate Professor, Stony Brook University  <a href="mailto:joe.warren@stonybrook.edu">joe.warren@stonybrook.edu</a></p> <p><b>Dr. Jennifer L. Miksis-Olds</b> Research Professor, University of New Hampshire  <a href="mailto:jmiksissolds@com.unh.edu">jmiksissolds@com.unh.edu</a></p> <p><b>Dr. Oliver N. Shipley</b> Research Assistant Professor, Stony Brook University  <a href="mailto:oliver.shipley@stonybrook.edu">oliver.shipley@stonybrook.edu</a></p> <p><b>Dr. Anthony P. Lyons</b> Research Professor, University of New Hampshire  <a href="mailto:anthony.lyons@unh.edu">anthony.lyons@unh.edu</a></p>