

Education

University of Delaware, Lewes, DE: June 2007-January 2012

Ph.D., Marine Biosciences

- Dissertation: Biophysical Dynamics of Larval Fish Ingress into Chesapeake and Delaware Bays
- Supervised an undergraduate student internship
 - Brittany Schieler, Ph.D., 2009. Larval Fish Ingress and Vertical Distribution into Delaware Bay.

Stockton University, Galloway, NJ: September 2003-May 2007

B.S., Marine Science

- Senior thesis: Eastern Oyster settlement relative to temperature and salinity
- Graduated with academic honors and program distinction
- Received a teaching assistantship and informal lecturing experiences

Professional Experience

School of Marine Science & Policy, University of Delaware: December 2020-Present

Assistant Professor

- Participate in active collaborative research
- Engage in academic advisement, as well as actively serve on student committees, and/or consultation
 - Cristina Sandolo, P.S.M., University of New England. Ocean Food Systems. 2021. Analyzing the demographics of the oyster industries in Chesapeake Bay and Delaware Bay to determine opportunities for diversification within both oyster production and consumption.
 - Haley Oleynik, M.S., University of Delaware. 2020. Shifts in Fish and Invertebrate Assemblage and Overall Community Composition in Delaware Bay.
 - Alex DiJohnson, M.S., Delaware State University. 2019. Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Behavioral Responses to Vessel Traffic and Habitat Use in the Delaware River, USA.
- Teach courses to support the School of Marine Science & Policy, College of Earth, Ocean & Environment

Delaware Sea Grant Program, University of Delaware: July 2018-Present

Marine Advisory Specialist-Fisheries, Aquaculture & Seafood Technology

- Conduct extension and applied research on fisheries, aquaculture and seafood technology
- Work with planning committees and teams of agency representatives, industry representatives and academic research to guide significant topics in research related to the Sustainable Fisheries and Aquaculture program within Delaware Sea Grant
- Write funding proposals and reports that help members of the public and scientific researchers in the sustainable use of marine resources

- Supervise undergraduate student internships
 - Joseph Mathews, B.S. 2020. Oyster Aquaculture Exploration and Innovation Internship.

College of Arts & Sciences, University of Delaware: January 2020-June 2020

Adjunct Faculty Member

- Taught undergraduate course, “The Oceans” at the Delaware Technical Community College Owens Campus as part of the UD Associate in Arts Program
- Hybridized online format with digital lectures and online course discussion boards

Delaware Division of Fish & Wildlife: May 2014-July 2018

Biometrician

- Provided advanced statistical support to determine trends in population dynamics of managed fish species
- Worked with regional committees to help manage commercial and recreational fisheries for the State of Delaware and regional management groups
- Wrote proposals and technical reports to support research and monitoring programs the Division of Fish & Wildlife
- Supervised a graduate student internship project
 - Lane Johnston, M.S. 2018. Fisheries Management and Policy in the Mid-Atlantic region.

New Jersey Department of Environmental Protection: June 2013-May 2014

Natural & Historic Resources Interpretive Specialist

- Managed coastal science programs at Island Beach State Park, NJ
- Coordinated research activities and monitoring studies at the Park
- Wrote proposals and technical reports to support research and monitoring efforts

Georgian Court University: January 2014-May 2014

Adjunct Faculty Member

- Taught undergraduate course, “Anatomy and Physiology II-Laboratory Component” weekly to reinforce theoretical background
- Conducted laboratory demonstrations and investigations to explore the function of comparative anatomical systems in other mammals

Atlantic States Marine Fisheries Commission: May 2012-June 2013

New Jersey Fisheries Specialist

- Collected samples and analyze port and at-sea commercial fisheries landings
- Wrote funding proposals and technical reports
- Assisted the state coordinator in managing marine resources

Stockton University, Galloway, NJ: January 2013-May 2013

Adjunct Faculty Member

- Taught undergraduate course, “Fisheries in Crisis” and created open class discussions
- Helped students developed an understanding of the impact fisheries have on

state, regional, national and international scales

University of Delaware: August 2010-December 2010 & August 2011-December 2011

Teaching Assistant

- Lectured in the undergraduate course, “The Oceans” on Productivity, Fisheries, and the effect of ENSO on fish production
- Maintained grades for 180 students including daily extra credit, quizzes and tests
- Developed the mid-term exam

Stockton University, Galloway, NJ: January 2005-May 2005

Teaching Assistant

- Set up experiments in the undergraduate course, “Methods in Oceanography” including standardization and sample collection for chemical and physical oceanographic experimentation (bathymetry, elemental analysis of sea water) and assisted with student comprehension

Stockton University, Galloway, NJ: October 2004-June 2007

Field Station Technician

- Conducted field lectures on various topics for the undergraduate course, “Marine Biology”, “Methods in Oceanography” and “Coastal Ecology”
- Executed small vessel operations (including trawls, seines, dredges, and plankton nets)
- Taught taxonomic identification and preparation of collected specimens
- Demonstrated wet lab maintenance and fish husbandry

Professional Affiliations

Atlantic States Marine Fisheries Commission Advisory Panel on Shad & River Herring, 2020-present

American Fisheries Society, 2008-present

- Mid-Atlantic Chapter Member
 - President of the Mid-Atlantic Chapter of the American Fisheries Society, 2017
- Northeastern Division Member
 - President of the Northeastern Division of the American Fisheries Society, present
- Early Life History Section Member
- Marine Fisheries Section Member

Delaware Aquaculture Association, 2018-present

- Board member

State of Delaware Shellfish Advisory Council to the Governor, 2019-present

- Board member

World Aquaculture Society, 2019-present

Technical & Research Skills

Biophysical modelling techniques

- 3-D advection models
- Larval transport model

Fisheries Stock Assessment Methodology

- Catch curves
- Depletion corrected catch models
- Exponential mortality models
- Statistical catch at age models
- Stock synthesis model

Operation of otter trawls, tucker trawls, oyster dredges

Research and Cooperative Cruise Experience

- RV Hugh R. Sharp-Chesapeake Bay, Delaware Bay & Coastal Ocean-3 weeks, 2008
- Various cooperative commercial fishing day trips totaling 1 month, 2012

Univariate and Multivariate Statistical Modelling

- Abundance standardization
- Environmental data comparisons
- Time Series Analyses

Research Grants & Contracts

Hale, E.A., University of Delaware-Delaware Sea Grant. Aquaculture Exploration and Innovation Internship. National Oceanic and Atmospheric Administration, Delaware Sea Grant. 2020.

Award Amount: \$ 5,707

Carlisle, A., University of Delaware; Hale, E.A., University of Delaware-Delaware Sea Grant and D. Fox, Delaware State University. Characterizing the ecological role of apex predators in the Delaware Bay Ecosystem and their potential impacts on managed species. National Oceanic and Atmospheric Administration, Delaware Sea Grant. 2020-2022.

Award Amount: \$ 159,276

Hale, E.A., University of Delaware-Delaware Sea Grant; McIntosh, D., Delaware State University-Delaware Sea Grant and E. Lewandowski, University of Delaware-Delaware Sea Grant. Delaware Sea Grant COVID-19 Rapid Response Project. National Oceanic and Atmospheric Administration, National Sea Grant Office. 2020-2021.

Award Amount: \$ 100,000

Coyne, K., University of Delaware-Delaware Sea Grant; Wang, Y., University of Delaware; Pokrzywinski, K., United States Army Corps of Engineers; Whereat, E., University of Delaware-Delaware Sea Grant and E.A. Hale, University of Delaware-Delaware Sea Grant; DinoSHIELD: A slow-release natural algicide produced by *Shewanella* sp. IRI-160 for management of red-tide. National Oceanic and Atmospheric Administration/United States Army Core of Engineers. 2020.

Award Amount: \$ 954,590

Kaufman, G., University of Delaware-Water Resources Center; Narvaez, M., University of Delaware-Water Resources Center; Homesy, A. University of Delaware-Water Resources Center; Jacobs, K., University of Delaware-Water Resources Center; Redhead, K., University of Delaware-Water Resources Center and E.A. Hale, University of Delaware-Delaware Sea Grant. Brandywine Shad Restoration project (DE): Task 4: Fisheries Survey. National Fish & Wildlife Foundation. 2019-2020.

Award Amount: \$ 11,373

Fleming, K., University of Delaware-Delaware Sea Grant; Trembanis, A., University of Delaware and E.A. Hale, University of Delaware-Delaware Sea Grant. Impact assessment and community-based removal of derelict crab pots from a recreational blue crab fishery. National Oceanic and Atmospheric Administration, Office of Response & Restoration. 2020-2022.

Award Amount: \$ 225,080

Hale, E.A., University of Delaware-Delaware Sea Grant and D. McIntosh, Delaware State University-Delaware Sea Grant. Spurring economic growth and enhancing the environment through the development of an oyster remote setting system in Delaware. National Oceanic and Atmospheric Administration, National Sea Grant Office. 2020-2022.

Award Amount: \$ 135,722

Fox, D., Delaware State University; Hale, E.A., University of Delaware-Delaware Sea Grant and J. Sweka, United States Fish & Wildlife Service. Examination of Atlantic Sturgeon Vessel Strikes in the Delaware River Estuary. National Oceanic and Atmospheric Administration, Greater Atlantic Regional Fisheries Office. 2017-2019.

Award Amount: \$ 184,494

Oliver, M., University of Delaware, Bograd, S., National Marine Fisheries Service; Fox, D., Delaware State University; Hazen, E., National Marine Fisheries Service and E.A. Hale, Delaware Division of Fish & Wildlife. A Satellite-Based Mobile Warning System to Reduce Atlantic Sturgeon Interactions in Delaware Waters. National Aeronautics and Space Administration. 2017-2019.

Award Amount: \$ 464,650

Clark, J., Delaware Division of Fish & Wildlife, Park, I., Delaware Division of Fish & Wildlife and E.A. Hale, Delaware Division of Fish & Wildlife. Conservation and Recovery of Sturgeons in the Delaware River Estuary. National Oceanic and Atmospheric Administration, Office of Protected Resources. 2016-2019.

Award Amount: \$ 356,436

Clark, J., Delaware Division of Fish & Wildlife, Park, I., Delaware Division of Fish & Wildlife and E.A. Hale, Delaware Division of Fish & Wildlife. Delaware Estuary Striped Bass Telemetry Tagging Study. National Oceanic and Atmospheric Administration, Saltonstall-Kennedy Grant Program through the Atlantic States Marine Fisheries Commission. 2016-2017.

Award Amount: \$ 118,900

Baum, T., New Jersey Marine Fisheries Administration; Clark, P., New Jersey Marine Fisheries Administration and E.A. Hale, Atlantic States Marine Fisheries Commission. Continued Dealer Reporting, Trip Level Reporting, and Biological Sampling for Commercial Fisheries in NJ. Atlantic Coastal Cooperative Statistics Program Operations and Advisory Committees. 2012-2013.

Award Amount: \$ 237,890

Professional Communication

Mathewes, J. and **E. Hale**. 2020. "Exploring Trends in Abundance of Atlantic Croaker (*Micropogonias undulatus*), Black Drum (*Pogonias cromis*), Spot (*Leiostomus xanthurus*) and Weakfish (*Cynoscion regalis*) in Relation to Large Scale Climatic Signals in a Mid-Atlantic Estuary. Virtual Meeting of the Mid-Atlantic Chapter of the American Fisheries Society.

Hanson, F., Shanahan, J., **Hale, E.**, Hahn, S., Jones, Maynard and J. Mottolla. 2020. Engaging Youth on Shad Sampling on the Brandywine River. Partnership for Delaware Estuary Urban Water Webinar Series.

McGowan, A. and **E.A. Hale**. 2020. Population Dynamics of Common Forage Fish Species in the Delaware Inland Bays. National Coastal & Estuarine Virtual Summit.

Oliver, M., Breece, M., Fox, D., Hazen, E., Welch, H. Shatley, M., Bograd, S. and **E.A. Hale**. 2020. A satellite-based mobile warning system to reduce interactions with an Endangered Species. American Geophysical Union 2020. San Francisco, CA.

E.A. Hale. 2020. Aquaculture Leasing in the First State. World Aquaculture Society AQUACULTURE AMERICA 2020. Honolulu, HI.

Fox, D., **Hale, E.A.**, DiJohnson, A., Madsen, J., Breece, M.J. Sweka, Higgs, A. and I. Park. 2019. Sturgeon Soup; Balancing the Needs for Sturgeon Conservation and Industrial Users in the New York Bight 149th Annual Meeting of the American Fisheries Society. Reno, NV.

Breece, M.W., Fox, D.A., **Hale, E.A.**, Haulsee, D.E., Shatley, M. and M.J. Oliver. 2018. A satellite based mobile warning system to reduce Atlantic Sturgeon interactions in the Delaware Bay. 148th Annual Meeting of the American Fisheries Society. Atlantic City, NJ.

DiJohnson, A.M., **Hale, E.A.**, Breece, M.W., and D.A. Fox. 2018. Model Behavior: Comparing Atlantic Sturgeon movement to vessel traffic within the Delaware River. 148th Annual Meeting of the American Fisheries Society. Atlantic City, NJ.

Hale, E.A., Johnston, L.J., Breece, M.W., Oliver, M.J., Fox, D.A., Clark, J.H., Mathews, J.A. and D.E. Haulsee. 2018. Exploring New Communication Pathways in Fisheries. 148th Annual Meeting of the American Fisheries Society. Atlantic City, NJ.

- Mathews, J.A., **Hale, E.A.**, and I.A. Park. 2018. Effects of large-scale climatic signals on trends in abundance of Atlantic Croaker (*Micropogonias undulatus*), Black Drum (*Pogonias cromis*), Spot (*Leiostomus xanthurus*) and Weakfish (*Cynoscion regalis*) in a Mid-Atlantic estuary. 148th Annual Meeting of the American Fisheries Society. Atlantic City, NJ.
- Breece, M.W.; Fox, D.A.; **Hale, E.A.**; Haulsee, D.E.; Shatley, M. and M.J. Oliver. 2018. A satellite based mobile warning system to reduce Atlantic Sturgeon interactions in the Delaware Bay. *Ecological Society of America*. New Orleans, LA.
- Drew, K; Lee, L.; Anstead, K.; Appelman, M.; Celestino, M.; Curti, K.; Flowers, J.; Fox, D.; **Hale, E.A.**; Higgs, A.; Kazyak, D.; Loeffler, M.; Post, B.; Schneider, E and D. Secor. 2017. Assessing an Endangered Species in a Fisheries Framework. *Annual Meeting of the Mid Atlantic Chapter of the American Fisheries Society*. Dover, DE.
- Park, I.A.; **Hale, E.A.**; Zimmerman, J.; Clark, J.F. and M.T. Fisher. 2016. Age, Growth and Movements of Atlantic Striped Bass (*Morone saxatilis*) in the Delaware River Estuary. *The 72nd Annual Meeting of Northeast Association of Fish & Wildlife Agencies*. Annapolis, MD.
- Ribeiro, F.; **Hale, E.A.**; Hilton, E.J.; Clardy, T.R.; Deary, A.L.; Targett, T.E. and J.E. Olney. 2016. Composition and temporal patterns of larval fish communities in Chesapeake and Delaware Bays. *XV European Congress of Ichthyology*. Porto, Portugal.
- Hale, E.A.**; Park, I.A.; Fisher, M.T.; Wong, R.A.; Stangl, M.J.; Clark, J.C. 2015. An early juvenile (age 0-1) Atlantic Sturgeon abundance estimate and habitat usage within the Delaware River Estuary, USA. *Annual Meeting of the Mid Atlantic Chapter of the American Fisheries Society*. Cape May, NJ.
- Hale, E.A.**; North, E.; Long, W. and T. Targett. 2012. Biophysical transport processes of larval fish into Delaware Bay. *The 36th Annual Larval Fish Conference*. Bergen, Norway.
- Hale, E.A.**; North, E.; Long, W. and T. Targett. 2012. Biophysical dynamics of larval summer flounder ingress into Delaware Bay. 13th Annual Flatfish Biology Conference. Westbrook, CT.
- Hale, E.A.** and T. E. Targett. 2011. Vertical distribution of larval Atlantic menhaden (*Brevoortia tyrannus*) and Atlantic croaker (*Micropogonias undulatus*) in Delaware Bay: Implications for behavior and transport. *Annual Meeting of the Mid Atlantic Chapter of the American Fisheries Society*. Manahawkin, NJ.
- Ribeiro, F.; **Hale, E.A.**; Clardy, T.; Deary, A.; Hilton, E.J.; Targett, T.E.; Olney, J.E. 2011. The Ongoing Saga of Larval Fishes in Chesapeake and Delaware Bays. *The 25th Annual Meeting of the American Fisheries Society: Tidewater Chapter*. Virginia Institute of Marine Science, Gloucester Point, VA.

Ribiero, F.; **Hale, E.A.**; Clardy, T.; Deary, A.; Hilton, E.J.; Targett, T.E. and J. Olney. 2010. Patterns of Ingress of Larval Fishes into Delaware and Chesapeake Bays. *American Society of Ichthyologists and Herpetologists*. Providence, RI.

Schieler, B.; **Hale, E.A.** and T.E. Targett. 2010. Analyzing the Effects of Wind Pattern and Temperature on the Ingress of Off-Shore Spawned Early Stage Fishes into Delaware Bay. *University of Delaware Undergraduate Research and Service Symposium*. Newark, DE.

Hale, E.A.; Targett, T.E. and J.E. Olney. 2009. Examining recruitment variability and short-term vertical distribution patterns in early life stage fishes in response to physical conditions in Chesapeake and Delaware Bays. *Annual Meeting of the Mid Atlantic Chapter of the American Fisheries Society*. The Richard Stockton College of New Jersey, Galloway, NJ.

Schieler, B.; **Hale, E.A.** and T.E. Targett. 2009. Characterization of the Larval Fish Assemblage in Delaware Bay and the Effect of Vertical Distribution on Measured Larval Flux and Diversity. *University of Delaware Undergraduate Research Science Symposium*. Newark, DE.

Hale, E.A. and S. Evert. 2007. Comparing Spat Settlement of *Crassostrea virginica* with Temperature and Salinity in the Mullica River Great Bay Estuary. *The National Estuarine Research Reserve Meeting*. Myrtle Beach, SC.

Professional Publications & Reports

Publications

Breece, M., Oliver, M., Fox, D., **Hale, E.A.**, Haulsee, D., Shatley, M., Bograd, S., Hazen, E., and H. Welch. *In review*. A satellite-based mobile warning system to reduce interactions with an Endangered Species. *Ecological Applications*.

Mathews, J.A., **Hale, E.A.**, Clark, J.H., Park, I.A., Greco, M.J., Petrone, C.J., and H. Oleynik. *In review*. Exploring trends in abundance of Atlantic Croaker (*Micropogonias undulatus*), Black Drum (*Pogonias cromis*), Spot (*Leiostomus xanthurus*) and Weakfish (*Cynoscion regalis*) in relation to large scale climatic signals in a Mid-Atlantic estuary. *Transactions of the American Fisheries Society*.

McGowan, A., **Hale, E.A.**, and D. Bartow. *In review*. Population dynamics of common salt marsh forage fishes in the Delaware Inland Bays, USA. *Estuaries & Coasts*.

Hale, E. A. and T.E. Targett. 2018. Vertical distribution of larval Atlantic Menhaden (*Brevoortia tyrannus*) and Atlantic Croaker (*Micropogonias undulatus*): implications for vertical migratory behavior and transport. *Fisheries Oceanography*.

Hale, E. A., Park, I.A., Fisher, M.T., Wong, R.A., Stangl, M.J. and J. F. Clark. 2016. Abundance Estimate for and Habitat Use by Early Juvenile Atlantic Sturgeon within the Delaware River Estuary. *Transactions of the American Fisheries Society* 145 (6): 1193-1201.

Ribeiro F., **Hale E.A.**, Hilton E.J., Clardy T.R., Deary A.L., Targett T.E., Olney J.E. 2015. Composition and temporal patterns of larval fish communities in Chesapeake and Delaware Bays, USA. *Marine Ecology Progress Series* 527:167-180.

Schieler, B.E.; **Hale, E.A.**; Targett, T.E. 2014. Daily variation in ingress of fall-spawned larval fishes into Delaware Bay in relation to alongshore and along-estuary wind components. *Estuarine, Coastal and Shelf Science*, 151: 141-147.

Reports

NMFS. 2019. Status Review Report: Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*). Final Report to the National Marine Fisheries Service, Office of Protected Resources. 160 pp.

ASMFC. 2018. Striped Bass Benchmark Stock Assessment: Striped Bass Stock Assessment Report, Terms of Reference and Advisory Report, and Technical Committee Supplemental Material. Washington (DC): ASMFC.

ASMFCa. 2017. Atlantic Sturgeon Benchmark Stock Assessment: Atlantic Sturgeon Stock Assessment Report, Terms of Reference and Advisory Report, and Technical Committee Supplemental Material. Washington (DC): ASMFC.

ASMFCb. 2017. River Herring Stock Assessment Update: River Herring Stock Assessment Update Report, Terms of Reference and Advisory Report, and Technical Committee Supplemental Material. Washington (DC): ASMFC.

Hale, E.A. 2017. State of Delaware Atlantic Striped Bass Compliance Report to the Atlantic States Marine Fisheries Commission.

Hale, E.A. 2017. "Chapter 6.5 - Striped Bass" in the Technical Report for the Delaware Estuary and Basin. Partnership for the Delaware Estuary. PDE Report No. 17-07, pp. 241-246.

Zimmerman, J., **Hale, E.A.**, Smith, D. and S. Bennett. 2017. Horseshoe Crab Spawning Activity in Delaware Bay: 1999 – 2016, Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee.

ASMFC. 2016. Weakfish Benchmark Stock Assessment: Weakfish Stock Assessment Report, Terms of Reference and Advisory Report, and Technical Committee Supplemental Material. Washington (DC): ASMFC.

The Delaware River Basin Fish & Wildlife Management Cooperative. 2016. Delaware, Lehigh and Schuylkill Rivers American Shad, Hickory Shad and River Herring Annual Report for 2015. Submitted to: Atlantic States Marine Fisheries Commission to fulfill the requirements of the Interstate Fishery Management Plan for Shad and River Herring.

Hale, E.A. 2016. State of Delaware Atlantic Striped Bass Compliance Report to the Atlantic States Marine Fisheries Commission.

Zimmerman, J., **Hale, E.A.**, Smith, D. and S. Bennett. 2016. Horseshoe Crab Spawning Activity in Delaware Bay: 1999 – 2016, Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee.

Hale, E.A. 2015. State of Delaware Atlantic Striped Bass Compliance Report to the Atlantic States Marine Fisheries Commission.

Zimmerman, J., **Hale, E.A.**, Smith, D. and S. Bennett. 2015. Horseshoe Crab Spawning Activity in Delaware Bay: 1999 – 2015, Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee.

Hale, E.A. 2014. State of Delaware Atlantic Striped Bass Compliance Report to the Atlantic States Marine Fisheries Commission.

Zimmerman, J., **Hale, E.A.**, Smith, D. and S. Bennett. 2014. Horseshoe Crab Spawning Activity in Delaware Bay: 1999 – 2014, Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee.

Zimmerman, J., **Hale, E.A.**, Smith, D. and S. Bennett. 2013. Horseshoe Crab Spawning Activity in Delaware Bay: 1999 – 2013, Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee.