



Halley E. Froehlich

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PERSONAL

Place of Birth: Albuquerque, New Mexico, USA

RESEARCH INTERESTS

aquaculture; fisheries; marine ecology; climate change; environmental physiology; ecological modeling; perceptions & policy

EDUCATION

2015 Ph.D. (Marine Ecology and Fishery Sciences) – *University of Washington, Seattle WA*

2009 B.S. (Animal Biology) – *University of California, Davis, Davis CA*

DISSERTATION TITLE

The non-lethal threat of hypoxia: ecological effects and physiological responses of estuarine species

CURRENT APPOINTMENT

2024 – Present Associate Professor – *Department of Ecology, Evolution, & Marine Biology/Environmental Studies Program, University of California, Santa Barbara.*

2019 – 2024 Assistant Professor – *Department of Ecology, Evolution, & Marine Biology/Environmental Studies Program, University of California, Santa Barbara.*

PROFESSIONAL EXPERIENCE

2015 – 2019 Postdoctoral Scholar – *National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara, Ben Halpern, PhD*

2010 – 2015 Ph.D. Candidate – *School of Aquatic & Fishery Sciences, University of Washington, Timothy E. Essington, PhD*

2008 – 2010 Junior Specialist – *Wildlife, Fish, & Conservation Biology Department, University of California, Davis, Joseph J. Cech, PhD, Nann Fangué, PhD, and Lisa Thompson, PhD Center for Aquatic Biology & Aquaculture*

2008 – 2009 Research Technician – *Wildlife, Fish, & Conservation Biology Department, University of California, Davis, Joseph J. Cech, PhD Center for Aquatic Biology & Aquaculture*

AWARDS & FUNDING

- 2025 California Sea Grant: Assessing the seasonal efficacy of three California marine biostimulants and their farm-to-field applications for local strawberries production and drought tolerance (lead PI, \$100,000 – 2 yrs)
- 2025 ScholarGPS 2024 Top Scholar (top 0.5% of all scholars worldwide)
- 2025 Conservation aquaculture for a threatened California rockweed species (lead PI, \$49,220)
- 2024 Nominated by UCSB Deans for 2025 Blavatnik National Award for Young Scientists
- 2024 Highly Cited Researcher, Clarivate
- 2024 California Sea Grant: Assessment of seaweed harvest as a value-added product associated with shellfish aquaculture (co-PI, subaward \$64,142 – 2 yr)
- 2024 NSF Evaluating whether the sequence of human impacts to tropical reefs erodes resilience of short algal turf and drives the emergence of alternate algal communities (co-PI, subaward \$281,658 – 3 yrs)
- 2023 CNSI Climate Innovation Proof-of-concept & Postdoctoral Fellowship funds (lead PI, \$85,000 – 2 yrs)
- 2023 Highly Cited Researcher, Clarivate
- 2022 DOE ORISE MHK Grad Student Fellowship Research Program (Claire Gonzales): Energy and Aquaculture Co-location Potential in California Federal Waters (salary & tuition - 1yr)
- 2021 Zegar Family Foundation: Opportunities and vulnerabilities of aquaculture in North America under climate change (co-lead PI, \$298,463 – 3yrs)
- 2021 Schmidt Family Foundation Mentorship Award (Claire Gonzales & Samantha Chen): Understanding Co-location Opportunities in our Oceans (\$8,000)
- 2021 Grad student California Coastal Fund Award (Claire Gonzales): Understanding Co-location Opportunities in our Oceans (\$1,000)
- 2020 Ocean Protection Council/California Sea Grant: California Aquaculture Action Plan (co-PI, \$401,570 – 2yrs)
- 2020 The Nature Conservancy: Synthesis and Modelling Species Recovery/Conservation Aquaculture (lead PI, \$122,467 – 2yrs, 1 yr extension)
- 2019 Best Early Career Scientist, International Council of Exploration of the Seas 2019 Conference (total award equivalence \$800 USD)
- 2019 National Sea Grant: Hidden Interactions of Marine Aquaculture & Fisheries in the US (lead PI, \$199,727– 2yrs)
- 2019 OceanKind: Cell-based Seafood Conservation Potential (co-lead PI, \$1,978,686 – 3yrs)
- 2018 Grantham Foundation: Seaweed Aquaculture Mitigation Potential (co-PI, \$188,0752 – 2yrs)
- 2017 Zegar Family Foundation: Environmental Impact and Sustainability of Global Food Systems (co-PI, \$424,149 – 3 yrs)
- 2017 Zegar Family Foundation: Anticipating Climate Change Impacts on Ocean Aquaculture (co-PI, \$317,560 – 2 yrs)
- 2014 Northwest Scientific Association Student Research Grant (\$1,500 research only)
- 2011 National Science Foundation: GRFP Award (\$96,000 & tuition cost – 3yrs)
- 2009 Graduated with Highest Honors, University of California, Davis

PUBLICATIONS

Symbols indicate type of contribution: * idea, ^δ data-collection, ^α analysis, ^ω writing, [§] funding

In Print & Press

1. Gonzales, C. ^{*δαω§}, G. Wu ^{δαω}, and H.E. Froehlich ^{*δαω§}. 2026. Finding Common Ground: Assessing the Co-Location Potential of California's Blue Food and Clean Energy Sectors. *Ocean & Coastal Management* 272: 108009.
2. Sierra Castillo, L.S. ^{*δαω}, H.E. Froehlich ^{*ω}, J.R. Wilson ^ω, J.A. Gephart ^ω, E. Aceves-Bueno ^{*ω}, S.D. Gaines ^{ω§}. 2026. Revisiting Small Scale Aquaculture. *Reviews in Aquaculture*. 18(1): e70110.

3. **Froehlich, H.E.**^{*δ_{αω}}, J.A. Gephart^{*ω}, G. Clawson^{δ_ω}, J.L. Blanchard^ω, T.E. Essington^ω, C.D. Golden^ω, B.S. Halpern^ω, R.W. Hardy^{δ_ω}, R.L. Naylor^{δ_ω}, M. Troell^{δ_ω}. 2026. No free lunch: sustainable aquaculture requires recognizing past science, improvements, and comparative assessment. *Reviews in Aquaculture*. 18(1): e70098.
4. Castillo, L.S.^{*δ_{αω}}, C.E. Ferguson Irlanda^{*δ_{αω}}, E. Aceves Bueno^{*ω}, **H.E. Froehlich**^ω, C. Mancilla^ω, A. Rivera^ω, S.D. Gaines^{ω§}. Aquaculture isn't always the answer: rethinking blue transitions through justice and community experience. *Global Environmental Change*. 94: 103046.
5. **Froehlich, H.E.**, and J.A. Gephart. 2025. Uncertain United States Seafood Sustainability in a Manufactured Crisis. *Marine Policy* 180: 106795.
6. Morris Jr^{*δ_{αω}}, J.A., L.C. Wickliffe^{*δ_{αω}}, S.J. Theuerkauf^{*δ_{αω}}, A.C. Shamaskin^{*ω}, J. Jossart^{*ω}, A.L. Randall^{*ω}, **H.E. Froehlich**^{*ω}, and K.L. Riley^ω. 2025. Marine Spatial Planning and Best Siting Practices to Achieve an Ecosystem Approach to Aquaculture in the United States. *Bulletin of Marine Science*. 101(2): 861-880.
7. Kebede, E.A.^{*δ_{αω}}, H.A. Ali^{*δ_{αω}}, T. Clavelle^ω, **H.E. Froehlich**^{δ_{αω}}, J.A. Gephart^{δ_{αω}}, S. Hartman^ω, M. Herrero^ω, H. Kerner^ω, P. Mehta^ω, C. Nakalembe^ω, D.K. Ray^ω, S. Siebert^ω, P. Thornton^ω, K.F. Davis^{*δ_{αω}}. 2024. Assessing and addressing the global state of food production data scarcity. *Nature Reviews earth & environment*. 5: 95–311.
8. Fong, C. R.^{*δ_{αω}}, J. DeCesaro^{δ_{αω}}, G. Clawson^{δ_{αω}}, M. Frazier^{αω}, H. Epperly^{δ_{αω}}, B. S. Halpern^{*ω§}, and **H. E. Froehlich**^{*δ_{ω§}}. 2024. Downscaled climate change threats to United States freshwater finfish aquaculture. *Science of the Total Environment*. 957, 177596.
9. Fong, C. R.^{*δ_{αω}}, J. DeCesaro^{δ_{αω}}, G. Clawson^{δ_{αω}}, M. Frazier^{αω}, B. S. Halpern^{*ω§}, and **H. E. Froehlich**^{*δ_{ω§}}. 2024a. Winners and Losers in U.S. Marine Aquaculture under Climate Change. *Environmental Research Letters* 19, 11: 114024.
10. **Froehlich, H.E.**^{*αδ_{ω§}}, D. Mizuta^{*δ_ω} J. Wilson^{*ω§}. 2024. Public conservation connection and support between ocean and terrestrial systems in the United States. *PloS one*, 19(7): e0307431.
11. Lester^{*δ_{αω§}}, S.E., R.R. Gentry^{*δ_{αω}}, and **H.E. Froehlich**^{*δ_{ω§}}. 2024. The role of marine aquaculture in contributing to the diversity and stability of U.S. seafood production. *Marine Policy*, 160: 105994.
12. Gonzales, C.M.^{*αδ_{ω§}}, S. Chen^{δ_ω}, and **H.E. Froehlich**^{*ω§}. 2024. Synthesis of Multinational Marine Aquaculture and Clean Energy Co-Location. *Frontiers in Aquaculture*, 3.
13. Fong, C.R.^{*δ_{αω}}, C.M. Gonzales^ω, M. Rennick^ω, H.J. Lahr^ω, L.D. Gardner^ω, B.S. Halpern^{ω§}, and **H.E. Froehlich**^{*δ_{ω§}}. 2024b. The structure and function of a coastal state aquaculture plan. *Aquaculture*: 741164.
14. White, D.D., E.H. Elias, K.A. Thomas, C.E. Bradatan, M.W. Brunson, A.M. Chischilly, C.A.F. Enquist, L.R. Fisher, **H.E. Froehlich**, E.A. Koebele, M. Méndez, S.M. Ostojka, C. Steele, and J.K. Vanos, 2023: Ch. 28. Southwest. In: *Fifth National Climate Assessment*. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. <https://doi.org/10.7930/NCA5.2023.CH28>.
15. Fong, C.R.^{*δ_{αω}}, C.M. Gonzales^ω, M. Rennick^ω, H.J. Lahr^ω, L.D. Gardner^ω, B.S. Halpern^{ω§}, and **H.E. Froehlich**^{*δ_{ω§}}. 2023a. Conflict and alignment on aquaculture among Californian communities. *Aquaculture* 580 (2024): 740230.

16. Fong, C.R.^{*δαω}, C.M. Gonzales^ω, M. Rennick^ω, H.J. Lahr^ω, L.D. Gardner^ω, B.S. Halpern^{ω\$}, and **H.E. Froehlich**^{*δω\$}. 2023b. Global yield from aquaculture systems. *Reviews in Aquaculture*. 6(3): 1021-1029.
17. **Froehlich, H.E.**^{*δαω\$}, J. Afflerbach^{δαω}, D. Williams^{*ω}, C. O'Hara^ω, C. Kuempel^{*ω}, B. Halpern^{*ω\$}. Biological Life-history and farming scenarios of marine aquaculture to help reduce wild marine fishing pressure. 2023. *Fish and Fisheries*. 24.6: 1034-1047.
18. Halpern, B.S.^ω, M. Frazier^{ωδ}, P.E. Rayner^ω, G. Clawson^ω, J.L. Blanchard^ω, R.S. Cottrell^ω, **H.E. Froehlich**^ω, J.A. Gephart^ω, N. Sand Jacobsen^ω, C.D. Kuempel^ω, D. Moran^ω, K.L. Nash^ω, & D.R. Williams^ω. 2023. Reply to: The environmental footprint of fisheries. *Nature Sustainability*, 1-2.
19. Ridlon, A.D.^{*δαω}, E.D. Grosholz, ^{*ω} B.T. Hancock^{*ω}, M.W. Miller^{*ω}, A.R. Bickel^{*ω}, **H.E. Froehlich**^{*ω}, D. Lirman^{*ω}, F.J. Pollock^{*ω}, H. Putnam^{*ω}, M. Tlusty^{*ω}, T. Waters^{*ω}, K. Wasson^{*δαω}. 2023. Culturing for conservation: the need for timely investments in reef aquaculture. *Frontiers in Marine Science - Marine Fisheries, Aquaculture and Living Resources*.
20. Kuempel, C. ^{*δαω}, M. Frazier^{*δαω}, J. Verstaen^{*δαω}, P. Rayner^{*δαω}, J.L. Blanchard^{*ω}, R.S. Cottrell^{*ω}, **H.E. Froehlich**^{*ω}, J.A. Gephart^{*ω}, N. Sand Jacobsen^{*ω}, P.B. McIntyre^{*ω}, M. Metian^{*ω}, D. Moran^{*ω}, K.L. Nash^{*ω}, J. Többen^{*ω}, D.R. Williams^{*ω}, B.S. Halpern^{*ω\$}. 2023. Feed drives land-sea overlap of the global cumulative environmental pressure of farmed chicken and salmon. *Current Biology*. 33.5: 990-997.
21. Fujita, R. ^{*δω\$}, P. Brittingham^{*δαω}, L. Cao^ω, **H.E. Froehlich**^{δω}, M. Thompson^{δω}, T.M. Voorhees^{δω}. 2023. Toward an Environmentally Responsible Offshore Aquaculture Industry in the United States: Ecological risks, Remedies, and Knowledge Gaps. *Marine Policy*. 147: 105351.
22. Mizuta, D. ^{*αδω}, **H.E. Froehlich**^{*αδω\$}, J. Wilson^{*αω\$}. 2023. The changing role and definitions of aquaculture for environmental purposes. *Reviews in Aquaculture*. 15.1: 130-141.
23. Hicke, J.A., S. Lucatello, L.D., Mortsch, J. Dawson, M. Domínguez Aguilar, C.A.F. Enquist, E.A. Gilmore, D.S. Gutzler, S. Harper, K. Holsman, E.B. Jewett, T.A. Kohler, and K.A. Miller, et al. **H.E. Froehlich**. 2022. North America. In: *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1929–2042, doi:10.1017/9781009325844.016.
24. Halpern, B.S.^{*αω\$}, M. Frazier^{*δαω}, J. Verstaen^{δαω}, P. Rayner^{δαω}, G. Clawson^{δαω}, J.L. Blanchard^{*ω}, R.S. Cottrell^{*ω}, **H.E. Froehlich**^{*ω}, J.A. Gephart^{*ω}, N. Sand Jacobsen^{*ω}, C.D. Kuempel^{*ω}, P.B. McIntyre^{*ω}, M. Metian^{*ω}, D. Moran^{*ω}, K.L. Nash^{*ω}, J. Többen^{*ω}, D.R. Williams^{*ω}. 2022. The cumulative environmental footprint of global food production. *Nature Sustainability*. 1-13.
25. Free, C.M.^{*δαω}, R.B. Cabral^{*δαω}, **H.E. Froehlich**^{δω}, W. Battista^ω, E. Ojea^ω, E. O'Reilly^ω, J.E. Palardy^ω, J. Garcia Molinos^ω, K.J. Siegel^ω, R. Arnason^ω, M.A. Juinio-Meñez^ω, K. Fabricius^ω, C. Turley^ω, S.D. Gaines^{*ω\$}. 2022. Expanding ocean food production under climate change. *Nature*. 1-7.
26. **Froehlich, H.E.**^{*δαω\$}, R.R. Gentry^{*δαω}, S.E. Lester^{*δαω\$}, H.R. Lemoine^{*δαω}, M. Rennick^{δω}, L. Gardner^{*δω}, K.D. Thompson^{*ω}. 2022a. Piecing together the data of the U.S. marine aquaculture puzzle. *Journal of Environmental Management*. 308, 114623.

27. **Froehlich, H.E.**^{*δαω\$, J.Z. Koehn^ω, K.K. Holsman^ω, B.S. Halpern^{*ω\$}. 2022b. Emerging trends in science and news of climate change threats to and adaptation of aquaculture. *Aquaculture*. 549: 737-812.}
28. Clawson, G.^{δαω}, C.D. Kuempel^{δω}, M. Frazier^{δαω}, G. Blasco^ω, R.S. Cottrell^{δω}, **H.E. Froehlich**^{*δω\$, M. Metian^{δω}, K.L. Nash^ω, J. Többen^ω, J. Verstaen^ω, D.R. Williams^ω, B.S. Halpern^{*ω\$}. 2022. Mapping the Spatial Distribution of Global Mariculture Production. *Aquaculture*. 738066}
29. Fong, C.R.^{*δαω}, C.M. Gonzales^ω, M. Rennick^ω, H.J. Lahr^ω, L.D. Gardner^ω, B.S. Halpern^{ω\$}, and **H.E. Froehlich**^{*δω\$}. 2022. California Aquaculture in the Changing Food Seascape. *Aquaculture*. 553, 738009.
30. Ferraro, D.M.^{*δαω\$, R.S. Cottrell^{*δαω}, G.D. Blasco^{δαω}, **H.E. Froehlich**^{*ω\$, and B.S. Halpern^{*ω\$}. 2021. Historical Food Consumption Declines and the Role of Alternative Foods. *Environmental Research Letters*. 17(1), 014020}}
31. Lester^{*δαω\$, S.E., R.R. Gentry^{*δαω}, H.R. Lemoine^{*δαω}, M. Rennick^{δω}, L. Gardner^{*δω}, **H.E. Froehlich**^{*δαω\$, K.D. Thompson^{*ω}, and E.O. Ruff^{δω}. 2022. Diverse State-Level Marine Aquaculture Governance in the United States: Opportunities and Barriers for Industry Development. *Reviews in Aquaculture*. 14(2), 890-906}}
32. Cottrell, R.S.^{*δαω}, J. Maier^{*δαω}, D.M. Ferraro^ω, G.D. Blasco^ω, R. Geyer^ω, **H.E. Froehlich**^{ω\$, B.S. Halpern^{*αω\$}. 2021. The overlooked importance of food disadoption for the environmental sustainability of new foods. *Environmental Research Letters*. 16(10), 104022}
33. Ridlon^{*δαω\$, A.D., K. Wasson^{*δαω\$, T. Waters^{*δαω\$, J. Adams^ω, J. Donatuto^ω, G. Fleener^ω, **H.E. Froehlich**^ω, R. Govender^ω, A. Kornbluth^ω, J. Lord^ω, B. Peabody^ω, G. Pinchot^ω, S.S. Rumrill^ω, E. Tobin^ω, C.J. Zabin^ω, D. Zacherl^ω, E.D. Grosholz^ω. 2021. Conservation aquaculture as a tool for imperiled marine species: Evaluation of opportunities and risks for Olympia oysters, *Ostrea lurida*. *PLoS ONE*. 6(16): e0252810}}}
34. Love, DC^{*δαω\$, F. Asche^{*δαω\$, R. Young^{*δαω}, E.M. Nussbaumer^{*δαω}, J.L. Anderson^ω, R. Botta^ω, Z. Conrad^ω, **H.E. Froehlich**^ω, T.M. Garlock^ω, J.A. Gephart^ω, A. Ropicki^ω, J.S. Stoll^ω, A.L. Thorne-Lyman^ω. 2021. An Overview of Retail Sales of Seafood in the United States, 2017-2019. *Reviews in Fisheries Science and Aquaculture*. 1-12.}}
35. **Froehlich, H.E.**^{*δαω}, R. Gentry^{*ω}, S.E. Lester^{*ω}, R.S. Cottrell^ω, G. Fay^{*ω}, T.A. Branch^{*ω}, J.A. Gephart^ω, E.R. White^{*ω} and J.K. Baum^{*ω}. 2021. Securing a sustainable future for US seafood in the wake of a global crisis. *Marine Policy*. 124, 104328.
36. Kuempel, C.D.^{*δαω}, **H.E. Froehlich**^{*δω\$, B.S. Halpern^{ω\$}. 2021. An informed thought experiment exploring the potential for a paradigm shift in aquatic food production. *Ocean and Coastal Management*. 206: 105574.}
37. Cottrell, R.S.^{*δαω}, D.M. Ferraro^{δαω}, G.D. Blasco^{δαω}, B.S. Halpern^{ω\$}, and **H.E. Froehlich**^{*ω\$}. 2021. The Search for Blue Transitions in Aquaculture-Dominant Countries. *Fish and Fisheries*.
38. Couture, J.L.^{*δαω}, **H.E. Froehlich**^{*δω}, B.H. Buck^{*ω}, K.R. Jeffery^{*ω}, G. Krause^{*ω}, J.A. Morris Jr^{*ω}, M. Perez, G.D.^{*ω}. Stentiford^{*ω}, H. Vehvilainen^{*ω}, B.S. Halpern^{*ω}. 2021. Scenario analysis can guide aquaculture planning to meet sustainable future production goals. *ICES Journal of Marine Science* 78(3), 821-831.
39. Racine, P.^{*δαω}, A. Marley^{*δαω}, **H.E. Froehlich**^{*ω\$, S.D. Gaines^{*ω\$, I. Ladner^{δαω}, I. MacAdam-Somer^{δαω}, D. Bradley^{*δαω\$}. 2021. A case for seaweed aquaculture inclusion in U.S. nutrient pollution management. *Marine Policy*. 129: 104506}}
40. Cottrell, R.S.^{*δαω}, M. Metian^{*δω}, **H.E. Froehlich**^{*δω\$, J.L. Blanchard^{*ω}, N. Sand Jacobsen^{*δαω}, P.B. McIntyre^{*ω}, K.L. Nash^{*ω}, D.R. Williams^{*ω}, L. Bouman^{*ω}, J.A. Gephart^{*ω}, C.D. Kuempel^{*ω}, Daniel D. Moran^{*ω}, M. Troell^{*δω}, B.S.}

- Halpern^{*ω\$}. 2021. Time to rethink trophic levels in aquaculture policy. *Reviews in Aquaculture*. 13 (3), 1583-1593 ***selected as the editorial Sena De Silva paper of the year**
41. Love, D.^{*δαω}, E.H. Allison^{*δαω}, F. Asche^{*δαω}, B. Belton^{*δαω}, R.S. Cottrell^{*δαω}, **H.E. Froehlich**^{*δαω}, J.A. Gephart^{*δαω}, C.C. Hicks^{*δαω}, et al. 2021. Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system. *Global food Security*. 100494.
 42. Halpern, B.S.^{*ω\$}, J. Maier^{*δαω}, H.J. Lahr^ω, G. Blasco^{δαω}, C. Costello^{*ω\$}, R.S. Cottrell^{*δαω}, O. Deschenes^{*ω\$}, D.M. Ferraro^{δαω}, **H.E. Froehlich**^{*ω\$}, and G.G. McDonald^{*δαω}. 2021. The Long and Narrow Path for Novel Cell-Based Seafood to Reduce Fishing Pressure for Marine Ecosystem Recovery. *Fish and Fisheries* 22(3): 652–64.
 43. White, E.R.^{*δαω\$}, **Froehlich, H.E.**^{*δαω}, J.A. Gephart^{*δαω}, R.S. Cottrell^ω, G. Fay^ω, T.A. Branch^ω, and J.K. Baum^{*ω}. 2021. Effects of COVID-19 on US fisheries and seafood consumption. *Fish and Fisheries*. 22(1): 232-239
 44. Costello, C.^{*ω\$}, L. Cao^{*ω}, S. Gelcich^{*ω}, M.Á. Cisneros-Mata^{*ω}, C.M. Free^{δ,α,ω}, **H.E. Froehlich**^{δ,ω}, C.D. Golden^ω, G. Ishimura^ω, J. Lubchenco^ω, J. Maier^{δ,α,ω}, I. Macadam-Somer^{δ,α,ω}, T. Mangin^{δ,α,ω}, M.C. Melnychuk^ω, M. Miyahara^ω, C.L. de Moor^ω, R. Naylor^ω, L. Nøstbakken^ω, E. Ojea^ω, E. O'Reilly^{δ,ω}, A.M. Parma^ω, A.J. Plantinga^ω, and S.H. Thilsted^ω. 2020. The Future of Food from the Sea. *Nature*. 588, 95-100.
 45. Blasco, G. D., D.M. Ferraro, R.S. Cottrell, B.S. Halpern, **H.E. Froehlich**. 2020. Substantial gaps in the current fisheries data landscape. *Frontiers in Marine Science*, 1088.
 46. Stentiford, G.D.^{*ω\$}, I.J. Bateman^{*ω} S. Hinchliffe^ω, D. Bass R^ω. Hartnell^ω, E.M. Santos^ω, M. Devlin^ω, S.W. Feist^ω, N. Taylor^ω, D. Verner-Jeffreys^ω, R. van Aerle^ω, E.J. Peeler^ω, W.A. Higman^ω, L. Smith^ω, R. Baines^ω, D. Behringer^ω, I. Katsiadaki^ω, **H.E. Froehlich**^ω, C.R. Tyler^{*ω}. 2020. Sustainable aquaculture through the One Health lens. *Nature Sustainability*. 1(8): 468-74.
 47. Halpern, B.S.^{*δω\$}, E. Berlow^{*δαω}, R. Williams^{*δαω}, E.T. Borer^{*ω}, F.W. Davis^{*ω}, A. Dobson^{*ω}, B.J. Enquist^{*ω}, **H.E. Froehlich**^{*ω}, L.R. Gerber^{*ω}, C. J.Lortie^{*ω}, M. O'Connor^{*ω}, H. Rega^{*ω}, D.P. Vázquez^{*ω}, G. Willard^{*ω}. 2020. Ecological synthesis and its role in advancing knowledge. *BioScience*. 70(11): 1004-17.
 48. Kuempel, C.D.^{*δ,α,ω}, M.Frazier^{*δ,α,ω}, K.L. Nash^{*ω}, N. Sand Jacobsen^{*ω}, D.R. Williams^{*ω}, J.L. Blanchard^{*ω}, R.S. Cottrell^{*ω}, P.B. McIntyre^{*ω}, D. Moran^{*ω}, L. Bouwman^{*ω}, **H.E. Froehlich**^{*ω,ω\$}, J.A. Gephart^{*ω}, M. Metian^{*ω}, J. Tobben^{*ω}, B.S. Halpern^{*ω,ω\$}. (Accepted) Integrating life-cycle and impact assessments to map food's cumulative environmental footprint. *One Earth*. 3(1): 65-78.
 49. Gephart, J.A.^{*ω}, C.D. Golden^{*ω\$}, F. Asche, B.Belton^ω, C. Brugere^ω, **H.E. Froehlich**^ω, J.P. Fry^ω, et al. 2020. Scenarios for Global Aquaculture and Its Role in Human Nutrition. *Reviews in Fisheries Science & Aquaculture*: 1–17.
 50. **Froehlich, H.E.**^{*δαω}, J. Couture, L. Falconer, G. Krause, J.A. Morris, M. Perez, G.D. Stentiford, H. Vehviläinen, B.S. Halpern. 2020. Mind the gap between ICES nations' future seafood consumption and aquaculture production. *International Council of Exploration of the Seas (ICES) Journal of Marine Science*.
 51. Cottrell, R.S.^{*δαω}, J.L. Blanchard^{\$ω}, B.S. Halpern^{\$ω}, M. Metian^{δω}, **H.E. Froehlich**^{*ω}. Global adoption of novel aquaculture feeds could substantially reduce forage fish demand by 2030. 2020. *Nature Food*. 1(5): 301-308.
 52. Rose, K.A.^ω, D. Gutierrez^ω, D. Breitburg^ω, D. Conley^ω, J.K. Craig^ω, **H.E. Froehlich**^ω, R. Jeyabaskaran^ω, V. Kripa^ω, B.C. Mbaye^ω, K.S. Mohamed^ω, S. Padua^ω, and D. Prema^ω. 2019. Ocean deoxygenation: everyone's problem,

Causes, impacts, consequences and solutions. IUCN: Impacts of Ocean Deoxygenation on Ecosystem Services: Fisheries, Chapter 9.2.

53. Costello, C.*^ω\$, L. Cao, S.^ω, Gelcich^ω, M.A. Cisneros^ω, C. M. Free^{δ^αω}, **H.E. Froehlich**^ω, E. Galarza^ω, C.D. Golden^ω, G. Ishimura^ω, J. Maier^ω, I. Macadam-Somer^{δ^ω}, T. Mangin^ω, M.C. Melnychuk^ω, M. Miyahara^ω, C. de Moor^ω, R. Naylor^ω, L. Nøstbakken^ω, E. Ojea^ω, E. O'Reilly^ω, G. Chato Osio^ω, A.M. Parma^ω, F.P. Amargos^ω, A.J. Plantinga^ω, A. Tacon^ω, and S.H. Thilsted^ω. 2019. The future of food from the sea. Washington, DC: World Resources Institute. Available online: www.oceanpanel.org/future-food-sea.
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59. Clavelle, T.*^{δ^αω}, S.E. Lester*^{δ^αω}, R.R. Gentry*^{δ^αω}, **H.E. Froehlich**^ω. 2019. Interactions and management for the future of marine aquaculture and capture fisheries. *Fish & Fisheries*. 10.1111/faf.12351
60. Davies, I.P.*^{δ^αω}, V. Carranza*^{δ^αω}, **H.E. Froehlich***^ω, R.R. Gentry*^ω, P. Kareiva*^ω, B.S. Halpern*^ω\$\$. 2019. Governance of Marine Aquaculture: Pitfalls, Potential, and Pathways Forward. *Marine Policy*. 104: 29-36. 10.1016/j.marpol.2019.02.054
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70. **Frøehlich, H.E.**^{*δαω}, R.R. Gentry^{δαω}, M.B. Rust^{ωδ}, D. Grimm^{*ω\$}, B.S. Halpern^{*ω\$}. 2017. Public perceptions of aquaculture: spatiotemporal patterns of sentiment around the world. *PLoS ONE*. 12(1): e0169281. doi:10.1371/journal.pone.0169281.
71. **Frøehlich, H.E.**^{*δαω}, R.R., Gentry^ω, B.S., Halpern^{ω\$}. 2016. Synthesis and comparative analysis of physiological tolerance and life-history growth traits of marine aquaculture species. *Aquaculture*. 460: 75–82. doi:10.1016/j.aquaculture.2016.04.018.
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78. Miller, E.A.^{δ_{αω}}, **H.E. Froehlich**^{δ_ω}, D.E. Cocherell^{*δ_{αω}}, M.J. Thomas^{*δ_{αω}}, J.J. Cech, Jr.^{*δ_ω\$}, A.P. Klimley^{*δ_ω\$}, N.A. Fangue^{*δ_ω\$}. 2014. Effects of acoustic tagging on juvenile green sturgeon incision healing, swimming performance, and growth. *Environ. Biol. Fish.* 97:647–658. 10.1007/s10641-013-0167-x
79. Gräns, A.^{*δ_{αω}}, C. Olsson, K. Pitsillides^{*δ_{αω}}, **H.E. Nelson (Froehlich)**^{δ_ω}, J.J. Jr. Cech^{\$}, M. Axelsson^{*\$}. 2010. Effects of feeding on thermoregulatory behaviours and gut blood flow in white sturgeon (*Acipenser transmontanus*) using biotelemetry in combination with standard techniques. *J. of Exp. Biol.* 213: 3198-3206.

PRESENTATIONS

**2022-23: invited speaker or panelist for 18 conferences and an additional 4 as Keynote, but could not attend due to COVID-19, pregnancy, and/or scheduling conflicts*

- 2025 University of Helsinki, Biological and Environmental Sciences (**Invited Speaker**)
Scaling Aquaculture Sustainability in a Changing Climate, Helsinki, Finland. August
- 2025 University of Washington, School of Aquatic & Fishery Science Bevan Series (**Invited Speaker**)
Scaling U.S. Aquaculture Sustainability in a Changing Climate, Seattle, Washington. February
- 2025 Annual Maine Aquaculture Research, Development & Education Summit (**Keynote Speaker**)
Marine aquaculture in a changing climate. Castine, Maine. January
- 2024 National Climate Assessment Panel Discussion (**Invited Speaker**)
Southwest Chapter, Los Angeles, California. May
- 2024 NOAA Northwest Fisheries Science Center Monster Seminar Jam, Remote (**Invited Speaker**)
Climate change and Aquaculture: Impacts, Threats, and Adaptation. September
- 2023 Scripps Institution of Oceanography Seminar Series (**Invited Speaker**)
Climate change and Aquaculture: Impacts, Threats, and Adaptation, Ja Jolla, California. November.
- 2023 28th Annual Cold Harvest Conference & Trade Show (**Keynote & Session Speaker**)
Sustainability and Marine Aquaculture in a Changing Climate
Climate Change Adaptation and Mitigation Potential of Marine Aquaculture, Newfoundland, CA. September.
- 2021 National Sea Grant Conference, Remote
Marine Aquaculture Data and Policy to Support Sustainable Development in the U.S. October.
- 2021 Expert (State & Federal) Workshops on National Sea Grant Project, Remote (**Organizer & Moderator**)
1) Data Workshop; 2) Policy Workshop. June.
- 2021 Webinar on National Sea Grant Project, Remote (**Organizer & Presenter**)
First Look: Study on Marine Aquaculture Data and Policy to Support Sustainable Development in the U.S. June.

- 2021 The Nature Conservancy Aquaculture Seminar Series (**Invited Speaker**)
Aquaculture in a Changing Climate. August.
- 2021 Ocean Visions Summit, Marine Circular Bioeconomy: Sustainable Food, Bioenergy, and Biomaterials from the Sea (**Keynote Speaker**)
Future of Aquaculture & Food from the Sea. May.
- 2021 Congressional Briefing, Washington D.C., Capital Hill (**Invited Speaker**)
Aquaculture and Climate Change. February.
- 2021 Nation Academy of SEM Ocean-based Carbon Dioxide Opportunities and Challenges (**Invited Speaker**)
Seaweed aquaculture in a changing climate. February.
- 2020 Department of Natural Resources and the Environment Seminar, Cornell University (**Invited Speaker**)
Aquaculture potential & limitations in a sea of change. October.
- 2020 UCSB/OPC/OST/Sea Grant California Science Flash Talks (**Invited Speaker**)
Marine Aquaculture in a Changing Climate. October.
- 2020 RARGOM - Opportunities and Challenges for Aquaculture in the Gulf of Maine (**Keynote Speaker**)
Marine Aquaculture in a Changing Climate. October.
- 2020 State of the Science Symposium, Seafood Nutrition Partnership (**Invited Speaker**)
The future of US seafood in a rapidly changing world, virtual symposia. September.
- 2020 Bren's Women's Caucus (**Invited Speaker**)
Women in the Scientific Workforce: Interviewing & Negotiation, Santa Barbara, California. February.
- 2019 Aquarium of the Pacific Event and Discussion on Aquaculture (**Invited Panelist**)
Why David E. Kelly Bought a Fish Farm, Long Beach, California. October.
- 2019 Pacific Shellfish Association Conference (**Keynote Speaker**)
Local to global threats of anthropogenic stressors to shellfish fisheries & aquaculture, Portland, Oregon. September.
- 2019 International Council for the Exploration of the Sea Conference (**ICES Session Organizer; Best EC Award**)
Marine aquaculture under climate change impacts, Gothenburg, Sweden. September.
- 2019 COMPASS Aquaculture and Policy Roundtable (**Invited Panelist**)
Washington DC. July.
- 2019 Capitol Hill Ocean Week Briefing (**Invited Speaker & Panelist**)
Aquaculture Siting as Tool to Minimize Environmental Impact, Washington DC. June.
- 2019 UW SAFS Centennial Bevan Symposium (**Invited Speaker**)
Global Aquaculture Issues, Seattle, WA, USA. April.
- 2019 Fish Free Feed (F3) Conference (**Keynote Speaker**)
Avoiding the ecological limits of forage fish for fed aquaculture, San Francisco, CA, USA. February.

- 2019 Seafood in a Changing World (**Guest Lecture**)
EEMB 242 Marine Ecology & Conservation, Santa Barbara, CA, USA. March.
- 2018 International Council for the Exploration of the Sea Aquaculture Working Group
Copenhagen, Denmark. November.
- 2018 Aquarium of the Pacific Master Class (**Invited Speaker**)
Short course on sustainable aquaculture, Long Beach, CA, USA. November.
- 2018 Columbia University Guest Lecturer (**Invited**)
Lecture on Aquaculture & Fishing, New York, NY, USA. October.
- 2018 NOAA Science Seminar (**Invited Speaker**)
Avoiding the ecological limits of forage fish for fed aquaculture, Remote presentation. September.
- 2018 Ecological Society of America 2018 (**Invited Presenter & Panelist**)
Synthesis science for conservation and human well-being: Sustainable Open-Ocean Aquaculture, New Orleans, LA, USA. August.
- 2018 World Aquaculture Conference: Aquaculture America 2018 (**Presenter & Panelist**)
Public Perceptions of Aquaculture, Las Vegas, NV, USA. April.
- 2017 Future of Seafood: Nourishing the World conference (**Invited Speaker**)
Mapping the potential for marine aquaculture, Boston, MA, USA. Dec.
- 2017 UCSB Blue Horizons Seminar (**Invited Speaker**)
The future of (sea)food is farmed. Santa Barbara, CA, USA. July.
- 2017 UCLA IoES and Aquarium of the Pacific Joint Event (**Invited Speaker**)
'Will Farmed Fish Save Our Oceans, Delight Our Palates, and Provide Healthy Food for All?'. Long Beach, CA, USA, May.
- 2017 XXIII Conference of the European Association of Fisheries Economists (EAFFE)
Public Perceptions of Aquaculture Around the World. Dublin, Ireland, April.
- 2017 University of Alaska Fairbanks Fisheries Department Spring Seminar Series (**Invited Speaker**)
What is marine aquaculture's role in sustainable food production? An offshore perspective. Juneau, AK, USA, April.
- 2017 West Valley College 5th annual Earth Stewardship Symposium (**Invited Speaker**)
Marine Offshore Aquaculture and Sustainable Fisheries. Saratoga, CA, USA, April.
- 2017 Expert Panelist for SNAPP & California Academy of Science Aquaculture Event (**Invited Speaker**)
Aquaculture: Future of Sustainable Food. San Francisco, CA, USA, March.
- 2017 Anacapa School (grades 7-12) 2017 Synthesis Unit Ocean Health (**Invited Speaker**)
Marine Aquaculture & the Future of Sustainable Food. Santa Barbara, CA, USA, January.
- 2016 University of California Santa Barbara Foundation Board of Trustees (**Invited Speaker**)
Opportunities and uncertainties of sustainable offshore aquaculture. Santa Barbara CA, USA, October.

- 2016 A Bren Seminar, University of California Santa Barbara (**Invited Speaker**)
Potential and Barriers of Offshore Aquaculture. Santa Barbara CA, USA, October.
- 2016 International Marine Conservation Congress
Aligning conservation and seafood production: potential and barriers of offshore aquaculture expansion. St. John's NL, August.
- 2015 Northwest Scientific Association 86th Annual Meeting
*Evaluating hypoxia-inducible factor-1a mRNA expression in a pelagic fish, Pacific Herring *Clupea pallasii*, as a biomarker for hypoxia exposure. Pasco WA, April.*
- 2014 99th Ecological Society of American Annual Meeting
*1) Spatial & temporal variation of nearshore community structure in a seasonally hypoxic estuary.
2) Perceptions, requirements, and reality: Barriers to full integration of citizen science in professional science. Sacramento CA, August.*
- 2014 2014 Salish Sea Ecosystem Conference
Is hypoxia restricted to the deep? Spatial & temporal variation of nearshore community structure in a seasonally hypoxic estuary. Seattle WA, April.
- 2013 22nd Biennial Conference of the Coastal and Estuarine Research Federation
Distributional shifts and species composition during seasonal hypoxia. San Diego CA, November.
- 2012 97th Ecological Society of American Annual Meeting
*Movement patterns and distributional shifts of Dungeness crab (*Cancer magister*) in response to hypoxia. Portland OR, August.*
- 2011 141th American Fisheries Society Annual Meeting
*Movement patterns and distributional shifts of Dungeness crab (*Cancer magister*) in response to hypoxia. Seattle WA, September.*
- 2010 44th Annual American Fisheries Society Cal-Neva Conference
*Preliminary Physiological and Behavioral Analysis of Green Sturgeon (*Asipenser medirostris*) Fish-Screen Interactions. Redding CA, March.*

FORMAL REVIEWER

Journals: Nature Communications; Fish and Fisheries; Reviews in Aquaculture; UN Seaweed Aquaculture Report; WIREs Climate Change; Integrated Environmental Assessment and Management; BioSci, One Earth; Global Change Biology; Aquaculture; Ecosystem Services; Nature Eco Evo; PLoS ONE; Conservation Letters; ICES Journal of Marine Science; Frontiers in Marine Science; Canadian Journal of Fisheries and Aquatic Sciences; Royal Proceedings B; Biological Conservation; Ecology; Journal of Fish Biology; Open Fish Science Journal

Proposals: Hawaii Sea Grant, NOAA NCCOS Coastal Hypoxia Research Program 2018; Wisconsin Sea Grant Proposal 2017; National Science Foundation Biological Oceanography 2016 proposal; Oregon Sea Grant 2015 Resilience Research Special Call Proposal

MENTORING

As professor
Current

Postdocs: Dr. Lauren Smith
Grad students: Ann Bishop (IGPMS PhD)
Undergrads: Briana Le (EEMB)

Past

Postdocs: Dr. Cat Fong, Dr. Rich Cottrell, Dr. Rebecca Gentry, Dr. Caitie Kuempel, Dr. Darien Mizuta
Grad students: Dr. Claire Gonzales (National Knauss Fellow), Mae Rennick (now data scientist for NHL), Ryan Anderson (MESM summer 2024 intern)
Undergrads: Sky Krainer (ES), Zay Chonnad (ES 2024 Senior Thesis), Abby Van Sklyke (EEMB), Andi McNeil (ES); Sedona Domino (ES Senior Thesis), Jayne Campbell (ES 2024), Samantha Chen (EEMB 2021), Mariam Ziauddin (ES 2021 ELI Program), Alyssa Jain (ES 2022 Senior thesis)

Committee member

12 EEMB and Bren School committees; 1 Geography; 1 External

As graduate student & postdoc

2016-2018 Undergrad Mentor – UCLA and UW undergraduate interns
2016-2017 External Advisor – Bren School of Environmental Science & Management, UCSB
2015-2017 MSc and PhD Latin American Fisheries Fellow's Mentor – NCEAS, UCSB
2014-2015 1st Year Grad Peer Mentor – School of Aquatic Fishery Sciences, UW
2014 Created & Instructed 'Advance Marine Ecology' grad course – School of Aquatic Fishery Sciences, UW
2014 NSF Mentor – School of Aquatic Fishery Sciences, UW

TEACHING EXPERIENCE

At or above average teaching scores. Employ Universal Design Learning using Student Centered & Threshold Pedagogy approach.

2023-present Instructor for EEMB/IGPMS 595 (20 students): Contentious Topics in Fisheries and Aquaculture
2020-present Instructor for ENV5/EEMB 130C (80-114 students): Aquatic Food and Resource Management
2020-present Co-instructor for EEMB/ENV5 142C (80 students) and 142CL (25 students): Conservation, Resource Management, and Food Production of Marine Systems
2014-present Guest lectures at UW, UCSB, SJSU
2014 Created & Instructed 'Advance Marine Ecology' grad course – School of Aquatic Fishery Sciences, UW

LEADERSHIP

2025 Invited expert on the U.S. Aquaculture Society Strategic Planning committee
2025 Expert on nominated Site Review Team for NOAA USC Sea Grant
2024-present Vice Chair/Grad Advisor of Interdepartmental Graduate Program in Marine Science
2024-present Chair for EEMB Federal Uncertainty and Chaos Committee
2024-present Environmental Studies Manley Lecture Organizer
2024-present International Council for the Exploration of the Seas (ICES) Working Group on Offshore Aquaculture
2024-present Editorial Board of *Fish and Fisheries*
2023-2025 Editorial Board of *Reviews in Aquaculture*
2023-present Scientific advisor for Actea
2019-present Science communication - Podcasts ([Aquademia](#), [The Intertidal Podcast](#), [Real Assets](#)), shows (Netflix Bill Nye Saves the World Ep. 3, PBS Hope on the Water Ep. 2 & 3) and popular magazines ([Scientific American](#), [World Aquaculture Magazine](#), [Time Magazine](#))

2021-2024	Contributing author to the 5th US National Climate Assessment (NCA), Southwest Chapter
2020-2024	Co-chair of EEMB Diversity, Equity, and Inclusion Ad hoc Committee/Working Group
2019-2021	AR6 Intergovernmental Panel on Climate Change (IPCC) – North America Ch 14 contributing author
2019	Expert participant in TNC Conservation Aquaculture in California planning group
2019	Expert request and submission of formal letter for US Senate briefing on AQUAA Act bill
2019-2022	Aquaculture Stewardship Council (ASC) Scientific Advisory Board
2018-2021	International Council for the Exploration of the Seas (ICES) Working Group on Scenario Planning on Aquaculture
2018	Future Aquaculture Network – WWF and Global Salmon Initiative working group
2018	Aquaculture Expert – Sea Legacy Green Aquaculture Initiative
2017-2022	Scientific expert – Collaborations with the Aquarium of the Pacific
2017	Seafood Summit Expert – science contributor for 2018 Planning Committee
2017-present	Co-founded CART – Conservation Aquaculture Research Team (CART) at NCEAS, UCSB
2015	Organized & led modeling workshop – Washington Department of Fish & Wildlife

COMPUTATIONAL PLATFORMS

R programming; ArcGIS; Microsoft Office

PROFESSIONAL SOCIETIES

American Fisheries Society

World Aquaculture Society (U.S. Chapter)