

# Halley E. Froehlich

Environmental Studies  
Ecology, Evolution, and Marine Biology  
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## PERSONAL

Date of birth: 20 December 1985  
Place of Birth: Albuquerque, New Mexico

## RESEARCH INTERESTS

Marine ecology; aquaculture; fisheries; climate change; ecological modeling; data science; environmental physiology and behavior; social science

## 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

2019 – Present Assistant Professor – *Ecology, Evolution, & Marine Biology/Environmental Studies, 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 Laboratory.*

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

2009 – 2010 Junior Specialist – *Wildlife, Fish, & Conservation Biology Department, University of California, Davis, Joseph J. Cech, PhD, Nann Fangué, PhD, and Lisa Thompson, PhD Laboratories.*

2008 – 2009 Junior Supervisor/Research Assistant III – *Wildlife, Fish, & Conservation Biology Department, University of California, Davis, Joseph J. Cech, PhD Laboratory.*

2008 Research Assistant II – *Wildlife, Fish, & Conservation Biology Department, University of California, Davis, Joseph J. Cech, PhD Laboratory & A. Peter Klimley, PhD Laboratory.*

## AWARDS & FUNDING

2020 Ocean Protection Council/California Sea Grant: California Aquaculture Action Plan

2020 The Nature Conservancy: Synthesis and Modelling Species Recovery/Conservation Aquaculture

2019 Best Early Career Presentation for the International Council of Exploration of the Seas 2019 Conference

2019 National Sea Grant: Hidden Interactions of Marine Aquaculture & Fisheries in the US

2019 OceanKind: Cell-based Seafood Conservation Potential

2018 Grantham Foundation: Seaweed Aquaculture Mitigation Potential  
 2017 Zegar Family Foundation: Environmental Impact and Sustainability of Global Food Systems  
 2017 Zegar Family Foundation: Anticipating Climate Change Impacts on Ocean Aquaculture  
 2014 Northwest Scientific Association Student Research Grant  
 2011 National Science Foundation: GRFP Award  
 2009 Graduated with Highest Honors, University of California, Davis

## PUBLICATIONS

Symbols indicate type of contribution: \* idea, <sup>δ</sup> data-collection, <sup>α</sup> analysis, <sup>ω</sup> writing, <sup>§</sup> funding

### *In Print & Press*

1. **Froehlich, H.E.**<sup>\*δ<sub>α</sub>ω</sup>, R. Gentry<sup>\*ω</sup>, S.E. Lester<sup>\*ω</sup>, R.S. Cottrell<sup>ω</sup>, G. Fay<sup>\*ω</sup>, T.A. Branch<sup>\*ω</sup>, J.A. Gephart<sup>ω</sup>, E.R. White<sup>\*ω</sup> and J.K. Baum<sup>\*ω</sup>. (*Accepted*). Securing a sustainable future for US seafood in the wake of a global crisis. *Marine Policy*.
2. White, E.R.<sup>\*δ<sub>α</sub>ω</sup>, **Froehlich, H.E.**<sup>\*δ<sub>α</sub>ω</sup>, J.A. Gephart<sup>\*δ<sub>α</sub>ω</sup>, R.S. Cottrell<sup>ω</sup>, G. Fay<sup>ω</sup>, T.A. Branch<sup>ω</sup>, and J.K. Baum<sup>\*ω</sup>. (*Accepted*). Effects of COVID-19 on US fisheries and seafood consumption. *Fish and Fisheries*.
3. Costello, C.<sup>\*ω</sup><sup>§</sup>, L. Cao<sup>\*ω</sup>, S. Gelcich<sup>\*ω</sup>, M.Á. Cisneros-Mata<sup>\*ω</sup>, C.M. Free<sup>δ,α,ω</sup>, **H.E. Froehlich**<sup>δ,ω</sup>, C.D. Golden<sup>ω</sup>, G. Ishimura<sup>ω</sup>, J. Lubchenco<sup>ω</sup>, J. Maier<sup>δ,α,ω</sup>, I. Macadam-Somer<sup>δ,α,ω</sup>, T. Mangin<sup>δ,α,ω</sup>, M.C. Melnychuk<sup>ω</sup>, M. Miyahara<sup>ω</sup>, C.L. de Moor<sup>ω</sup>, R. Naylor<sup>ω</sup>, L. Nøstbakken<sup>ω</sup>, E. Ojea<sup>ω</sup>, E. O'Reilly<sup>δ,ω</sup>, A.M. Parma<sup>ω</sup>, A.J. Plantinga<sup>ω</sup>, and S.H. Thilsted<sup>ω</sup>. 2020. The Future of Food from the Sea. *Nature*. 1-6.
4. Stentiford, G.D.<sup>\*ω</sup><sup>§</sup>, I.J. Bateman<sup>\*ω</sup>, S. Hinchliffe<sup>ω</sup>, D. Bass<sup>Rω</sup>, Hartnell<sup>ω</sup>, E.M. Santos<sup>ω</sup>, M. Devlin<sup>ω</sup>, S.W. Feist<sup>ω</sup>, N. Taylor<sup>ω</sup>, D. Verner-Jeffreys<sup>ω</sup>, R. van Aerle<sup>ω</sup>, E.J. Peeler<sup>ω</sup>, W.A. Higman<sup>ω</sup>, L. Smith<sup>ω</sup>, R. Baines<sup>ω</sup>, D. Behringer<sup>ω</sup>, I. Katsiadaki<sup>ω</sup>, **H.E. Froehlich**<sup>ω</sup>, C.R. Tyler<sup>\*ω</sup>. 2020. Sustainable aquaculture through the One Health lens. *Nature Sustainability*. 1(8): 468-74.
5. B.S. Halpern<sup>\*δ<sub>ω</sub>§</sup>, E. Berlow<sup>\*δ<sub>α</sub>ω</sup>, R. Williams<sup>\*δ<sub>α</sub>ω</sup>, E.T. Borer<sup>\*ω</sup>, F.W. Davis<sup>\*ω</sup>, A. Dobson<sup>\*ω</sup>, B.J. Enquist<sup>\*ω</sup>, **H.E. Froehlich**<sup>\*ω</sup>, L.R. Gerber<sup>\*ω</sup>, C. J.Lortie<sup>\*ω</sup>, M. O'Connor<sup>\*ω</sup>, H. Rega<sup>\*ω</sup>, D.P. Vázquez<sup>\*ω</sup>, G. Willard<sup>\*ω</sup>. 2020. Ecological synthesis and its role in advancing knowledge. *BioScience*. 70(11): 1004-17.
6. Kuempel, C.D.<sup>\*δ,α,ω</sup>, M.Frazier<sup>\*δ,α,ω</sup>, K.L. Nash<sup>\*ω</sup>, N. Sand Jacobsen<sup>\*ω</sup>, D.R. Williams<sup>\*ω</sup>, J.L. Blanchard<sup>\*ω</sup>, R.S. Cottrell<sup>\*ω</sup>, P.B. McIntyre<sup>\*ω</sup>, D. Moran<sup>\*ω</sup>, L. Bouwman<sup>\*ω</sup>, **H.E. Froehlich**<sup>\*ω,ω,§</sup>, J.A. Gephart<sup>\*ω</sup>, M. Metian<sup>\*ω</sup>, J. Tobben<sup>\*ω</sup>, B.S. Halpern<sup>\*ω,ω,§</sup>. (*Accepted*) Integrating life-cycle and impact assessments to map food's cumulative environmental footprint. *One Earth*. 3(1): 65-78.
7. Gephart, J.A.<sup>\*ω</sup>, C.D. Golden<sup>\*ω</sup><sup>§</sup>, F. Asche, B. Belton<sup>ω</sup>, C. Brugere<sup>ω</sup>, **H.E. Froehlich**<sup>ω</sup>, J.P. Fry<sup>ω</sup>, et al. 2020. Scenarios for Global Aquaculture and Its Role in Human Nutrition. *Reviews in Fisheries Science & Aquaculture*: 1–17.
8. **Froehlich, H.E.**<sup>\*δ<sub>α</sub>ω</sup>, 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*.
9. Cottrell, R.S.<sup>\*δ<sub>α</sub>ω</sup>, J.L. Blanchard<sup>§ω</sup>, B.S. Halpern<sup>§ω</sup>, M. Metian<sup>δω</sup>, **H.E. Froehlich**<sup>\*ω</sup>. Global adoption of novel aquaculture feeds could substantially reduce forage fish demand by 2030. 2020. *Nature Food*. 1(5): 301-308.
10. Rose, K.A.<sup>ω</sup>, D. Gutierrez<sup>ω</sup>, D. Breitburg<sup>ω</sup>, D. Conley<sup>ω</sup>, J.K. Craig<sup>ω</sup>, **H.E. Froehlich**<sup>ω</sup>, R. Jeyabaskaran<sup>ω</sup>, V. Kripa<sup>ω</sup>, B.C.

Mbaye<sup>ω</sup>, K.S. Mohamed<sup>ω</sup>, S. Padua<sup>ω</sup>, and D. Prema<sup>ω</sup>. 2019. Ocean deoxygenation: everyone's problem, Causes, impacts, consequences and solutions. IUCN: Impacts of Ocean Deoxygenation on Ecosystem Services: Fisheries, Chapter 9.2.

11. Costello, C.\*<sup>ω</sup>\$, L. Cao, S.<sup>ω</sup>, Gelcich<sup>ω</sup>, M.A. Cisneros<sup>ω</sup>, C. M. Free<sup>δ<sup>α</sup>ω</sup>, **H.E. Froehlich**<sup>ω</sup>, E. Galarza<sup>ω</sup>, C.D. Golden<sup>ω</sup>, G. Ishimura<sup>ω</sup>, J. Maier<sup>ω</sup>, I. Macadam-Somer<sup>δ<sup>ω</sup></sup>, T. Mangin<sup>ω</sup>, M.C. Melnychuk<sup>ω</sup>, M. Miyahara<sup>ω</sup>, C. de Moor<sup>ω</sup>, R. Naylor<sup>ω</sup>, L. Nøstbakken<sup>ω</sup>, E. Ojea<sup>ω</sup>, E. O'Reilly<sup>ω</sup>, G. Chato Osio<sup>ω</sup>, A.M. Parma<sup>ω</sup>, F.P. Amargos<sup>ω</sup>, A.J. Plantinga<sup>ω</sup>, A. Tacon<sup>ω</sup>, and S.H. Thilsted<sup>ω</sup>. 2019. The future of food from the sea. Washington, DC: World Resources Institute. Available online: [www.oceanpanel.org/future-food-sea](http://www.oceanpanel.org/future-food-sea).
12. Stewart Lowndes<sup>\*δ<sup>ω</sup>\$</sup>, J.S., **H.E. Froehlich**<sup>ω</sup>, A. Horst, N. Jayasundara<sup>ω</sup>, M.L. Pinsky<sup>ω</sup>, A.C. Stier<sup>ω</sup>, N.O. Therkildsen<sup>ω</sup>, C.L. Wood<sup>ω</sup>. 2019. Supercharge your research: a ten-week plan for open data science. *Nature Careers*. 10.1038/d41586-019-03335-4
13. Halpern, B.S.\*<sup>ω</sup>\$, R.S Cottrell<sup>\*δ<sup>α</sup>ω</sup>, J.L Blanchard<sup>δ<sup>α</sup>ω</sup>, L. Bouwman<sup>ω</sup>, **H.E. Froehlich**<sup>\*ω\$</sup>, J.A. Gephart<sup>ω</sup>, N. Sand Jacobsen<sup>ω</sup>, C.D. Kuempel<sup>ω</sup>, P.B. McIntyre<sup>ω</sup>, M. Metian<sup>ω</sup>, Dan Moran<sup>ω</sup>, K.L. Nash<sup>ω</sup>, J. Tobben<sup>ω</sup>, D.R. Williams<sup>ω</sup>. 2019. Putting all foods on the same table: Achieving sustainable food systems requires full accounting. *Proceedings of the National Academy of Sciences*. 116: 37. 10.1073/pnas.1913308116
14. **Froehlich, H.E.**<sup>\*δ<sup>α</sup>\$</sup>, J.C. Afflerbach<sup>δ<sup>α</sup>ω</sup>, M. Frazier<sup>δ<sup>α</sup>ω</sup>, B.S. Halpern<sup>ω\$</sup>. 2019. Blue Growth potential to mitigate Climate Change through seaweed offsetting. *Current Biology*. 10.1016/j.cub.2019.07.041
15. Gephart, J.A.\*<sup>δ<sup>α</sup>ω</sup>, **H.E. Froehlich**<sup>\*δ<sup>α</sup>ω</sup>, and T.A. Branch<sup>δ<sup>α</sup>ω</sup>. 2019. Opinion: To Create Sustainable Seafood Industries, the United States Needs a Better Accounting of Imports and Exports. *Proceedings of the National Academy of Sciences*. 116, 19:9142–46. 10.1073/pnas.1905650116
16. J.C. Afflerbach<sup>\*δ<sup>α</sup>ω</sup>, M. Frazier<sup>\*δ<sup>α</sup>ω</sup>, **H.E. Froehlich**<sup>\*δ<sup>ω</sup></sup>, S. Anderson<sup>δ<sup>α</sup>ω</sup>, B.S. Halpern<sup>\*ω\$</sup>. 2019. Quantifying uncertainty in the wild-caught fisheries goal of the Ocean Health Index. *Fish & Fisheries*, 104: 29-36. 10.1016/j.marpol.2019.02.054
17. Clavelle, T.\*<sup>δ<sup>α</sup>ω</sup>, S.E. Lester<sup>\*δ<sup>α</sup>ω</sup>, R.R. Gentry<sup>\*δ<sup>α</sup>ω</sup>, **H.E. Froehlich**<sup>ω</sup>. 2019. Interactions and management for the future of marine aquaculture and capture fisheries. *Fish & Fisheries*. 10.1111/faf.12351
18. Davies, I.P.\*<sup>δ<sup>α</sup>ω</sup>, V. Carranza<sup>\*δ<sup>α</sup>ω</sup>, **H.E. Froehlich**<sup>\*ω</sup>, R.R. Gentry<sup>\*ω</sup>, P. Kareiva<sup>\*ω</sup>, B.S. Halpern<sup>\*ω\$</sup>. 2019. Governance of Marine Aquaculture: Pitfalls, Potential, and Pathways Forward. *Marine Policy*. 104: 29-36. 10.1016/j.marpol.2019.02.054
19. **Froehlich, H.E.**<sup>\*δ<sup>α</sup>ω</sup>, R.R. Gentry<sup>\*δ<sup>α</sup>ω</sup>, B.S. Halpern<sup>\*ω\$</sup>. 2018. Global change in marine aquaculture production potential under climate change. *Nature Ecology & Evolution*. 10.1038/s41559-018-0669-1
20. **Froehlich, H.E.**<sup>\*δ<sup>α</sup>ω</sup>, N. Sand Jacobsen<sup>δ<sup>α</sup>ω</sup>, T.E. Essington<sup>αω</sup>, T. Clavelle<sup>ω</sup>, B.S. Halpern<sup>ω\$</sup>. 2018. Avoiding the Ecological Limits of Forage Fish for Fed Aquaculture. *Nature Sustainability*. 1: 298–303. 10.1038/s41893-018-0077-1
21. **Froehlich, H.E.**<sup>\*δ<sup>α</sup>ω</sup>, C.A. Runge<sup>\*ω</sup>, R.R. Gentry<sup>ω</sup>, S.D. Gaines<sup>ω</sup>, B.S. Halpern<sup>ω\$</sup>. 2018. Comparative terrestrial feed and land use of an aquaculture-dominant world. *Proceedings of the National Academy of Sciences*. 10.1073/pnas.1801692115
22. Clements, J.C.\*<sup>δ<sup>α</sup>ω</sup>, R.M. Daigle<sup>δ<sup>ω</sup></sup>, **H.E. Froehlich**<sup>δ<sup>ω</sup></sup>. 2018. Predator in the Pool? A Quantitative Evaluation

of Non-indexed Open Access Journals in Aquaculture Research. *Frontiers in Marine Science*. 5. 10.3389/fmars.2018.00106

23. **Froehlich, H.E.**<sup>\*ω</sup>, R.R. Gentry<sup>\*ω</sup>, B.S. Halpern<sup>ω\$</sup>. 2017. Conservation aquaculture: shifting the narrative and paradigm of aquaculture's role in resource management. *Biological Conservation*. 215: 162-168. 10.1016/j.biocon.2017.09.012
24. Gentry, R.R.<sup>\*δαω</sup>, **H. E. Froehlich**<sup>\*δαω</sup>, D. Grimm<sup>ω\$</sup>, P. Kareiva<sup>ω</sup>, M. Parke<sup>ω</sup>, M. Rust<sup>ω</sup>, S.D. Gaines<sup>ω</sup>, and B. S. Halpern<sup>\*ω\$</sup>. 2018. Mapping the Global Potential for Marine Aquaculture. *Nature Ecology & Evolution*. 10.1038/s41559-017-0257-9
25. Moriarty, P.E.<sup>\*δαω</sup>, E.E. Hodgson<sup>\*δαω</sup>, **H.E. Froehlich**<sup>\*δαω</sup>, S.M. Hennessey<sup>\*δαω</sup>, K. N. Marshall<sup>\*δαω</sup>, K.L. Oken<sup>\*δαω</sup>, M. C. Siple<sup>\*δαω</sup>, S. Ko<sup>\*δαω</sup>, L. E. Koehn<sup>\*δαω</sup>, B.D. Pierce<sup>\*δαω</sup>, C.C. Stawitz<sup>\*δαω</sup>. 2018. The need for validation of ecological indices. *Ecological Indicators*. 84: 546-552. 10.1016/j.ecolind.2017.09.028
26. **Froehlich, H.E.**<sup>\*δαω</sup>, A. Smith<sup>δω</sup>, R.R. Gentry<sup>ω</sup>, B.S. Halpern<sup>\*ω\$</sup>. 2017. Offshore aquaculture: I know it when I see it. *Frontiers in Marine Science*. 4: 154. 10.3389/fmars.2017.00154
27. **Froehlich, H.E.**<sup>\*δαω</sup>, T.E. Essington<sup>\*αω\$</sup>, P.S. McDonald<sup>ω</sup>. 2017. When does hypoxia affect management performance of a fishery? A Management Strategy Evaluation of Dungeness crab (*Metacarcinus magister*) fisheries in Hood Canal, Washington, U.S.A. *Canadian Journal of Fisheries and Aquatic Sciences*. 1-11. 10.1139/cjfas-2016-0269
28. **Froehlich, H.E.**<sup>\*δαω</sup>, R.R. Gentry<sup>δαω</sup>, M.B. Rust<sup>ωδ</sup>, D. Grimm<sup>\*ω\$</sup>, B.S. Halpern<sup>\*ω\$</sup>. 2017. Public perceptions of aquaculture: spatiotemporal patterns of sentiment around the world. *PLoS ONE*. 12(1): e0169281. doi:10.1371/journal.pone.0169281.
29. **Froehlich, H.E.**<sup>\*δαω</sup>, R.R., Gentry<sup>ω</sup>, B.S., Halpern<sup>ω\$</sup>. 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.
30. H. Burgess<sup>\*δαω</sup>, L.B. DeBey<sup>\*δαω</sup>, **H.E. Froehlich**<sup>\*δαω</sup>, N.R. Schmidt<sup>ω</sup>, E. J. Theobald<sup>\*δαω</sup>, A.K. Ettinger<sup>\*δω</sup>, J. HilleRisLambers<sup>\*ω</sup>, J. Tewksbury<sup>\*ω</sup>, and J.K. Parrish<sup>\*ω\$</sup>. 2016. The science of citizen science: exploring barriers to use as a primary research tool. *Biological Conservation*. 10.1016/j.biocon.2016.05.014
31. **Froehlich, H.E.**<sup>\*δαω\$</sup>, S.B. Roberts<sup>αω</sup>, T.E. Essington<sup>ω\$</sup>. 2015. Evaluating hypoxia-inducible factor-1α mRNA expression in a pelagic fish, Pacific herring *Clupea pallasii*, as a biomarker for hypoxia exposure. *Comp. Biochemistry and Physiology: Part A*. 198: 58-66. 10.1016/j.cbpa.2015.07.016
32. Essington, T.E.<sup>\*δαω\$</sup>, P. E. Moriarty<sup>δαω</sup>, **H. E. Froehlich**<sup>ω</sup>, E. E. Hodgson<sup>ω</sup>, L. E. Koehn<sup>ω</sup>, K. L. Oken<sup>αω</sup>, M. C. Siple<sup>ω</sup>, C. C. Stawitz<sup>αω</sup>. 2015. Fishing amplifies forage fish population collapses. *Proceedings of the National Academy of Sciences*. 112 (12): 6648-6652 10.1073/pnas.1422020112
33. Theobald<sup>\*δαω</sup>, E. J., A.K. Ettinger<sup>\*δαω</sup>, H. Burgess<sup>\*δαω</sup>, L.B. DeBey<sup>\*δαω</sup>, N.R. Schmidt<sup>\*δαω</sup>, **H.E. Froehlich**<sup>\*δαω</sup>, C. Wagner<sup>\*δαω</sup>, J. HilleRisLambers<sup>\*ω</sup>, J. Tewksbury<sup>\*ω</sup>, M.A. Harsch<sup>α</sup>, and J.K. Parrish<sup>\*ω\$</sup>. 2015. Global change and local solutions: Tapping the unrealized potential of citizen science for biodiversity research. *Biological Conservation*. 181, 236–244. 10.1016/j.biocon.2014.10.021

34. **Froehlich, H.E.**<sup>\*δ $\alpha\omega$</sup> , S.M. Hennessey<sup>δ $\alpha\omega$</sup> , T.E. Essington<sup>\*ω $\alpha$</sup> , A.H. Beaudreau<sup>\*ω $\alpha$</sup> , P.S. Levin<sup>\*ω $\alpha$</sup> . 2015. Spatial and temporal variation in nearshore macrofaunal community structure in a seasonally hypoxic estuary. *Marine Ecological Progress Series* 520:67-83. 10.3354/meps11105
35. **Froehlich, H.E.**<sup>δ $\alpha\omega$</sup> , T.E. Essington<sup>\*δ $\alpha\omega$</sup> , A.H. Beaudreau<sup>\*δ $\omega$</sup> , P.S. Levin<sup>\*ω $\alpha$</sup> . 2014. Movement patterns and distributional shifts of Dungeness crab (*Metacarcinus magister*) and English sole (*Parophrys vetulus*) during seasonal hypoxia. *Estuaries Coasts*. 37: 449-460. 10.1007/s12237-013-9676-2
36. Miller, E.A.<sup>δ $\alpha\omega$</sup> , **H.E. Froehlich**<sup>δ $\omega$</sup> , D.E. Cocherell<sup>\*δ $\alpha\omega$</sup> , M.J. Thomas<sup>\*δ $\alpha\omega$</sup> , J.J. Cech, Jr.<sup>\*δ $\omega$</sup> , A.P. Klimley<sup>\*δ $\omega$</sup> , N.A. Fangue<sup>\*δ $\omega$</sup> . 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
37. Gräns, A.<sup>\*δ $\alpha\omega$</sup> , C. Olsson, K. Pitsillides<sup>\*δ $\alpha\omega$</sup> , **H.E. Nelson (Froehlich)**<sup>δ $\omega$</sup> , J.J. Jr. Cech<sup>δ $\omega$</sup> , M. Axelsson<sup>\*δ $\omega$</sup> . 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.

#### *In Review*

1. R.S. Cottrell, M. Metian, **H.E. Froehlich**, J.L. Blanchard, N. Sand Jacobsen, P.B. McIntyre, K.L. Nash, D.R. Williams, L. Bouman, J.A. Gephart, C.D. Kuempel, Daniel D. Moran, M. Troell, B.S. Halpern. Time to rethink trophic levels in aquaculture policy. *Reviews in Aquaculture*.
2. Love, D., E.H. Allison, F. Asche, B. Belton, R.S. Cottrell, **H.E. Froehlich**, J.A. Gephart, C.C. Hicks, et al. Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system. *Global food Security*.
3. **Froehlich, H.E.**, J.C. Afflerbach, D.R. Williams, C. O’Hara, C.D. Kuempel, B.S. Halpern. The biological potential of aquaculture to reduce pressure on wild fisheries. *Aquaculture and Fisheries*.
4. D. Leadbitter, N.J. Aebischer, N.A. Auchterlonie, T.G. Benton, S. Durant, **H.E. Froehlich**, S. Hall, M.J. Kaiser, U. Palm, F. Ziegler j and R. Hilborn. Biodiversity and land-use impacts from changing diets and restricting fishing. *Conservation Letters*.
5. Kuempel, C.D., **H.E. Froehlich**, B.S. Halpern. An informed thought experiment exploring the potential for a paradigm shift in aquatic food production. *Ocean and Coastal Management*.
6. Free, C.M., R.B. Cabral, W. Battista, E. Ojea<sup>4</sup>, E. O’Reilly, J.E. Palardy, **H.E. Froehlich**, J. Garcia Molinos, K.J. Siegel, R. Arnason, M.A. Juinio-Meñez, K. Fabricius, C. Turley, S.D. Gaines. Impact of climate change and adaptation on the ocean ecosystem economy. *Nature*.

#### PRESENTATIONS

- 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 & Negation, 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 (EAFE)  
*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 99<sup>th</sup> 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 22<sup>nd</sup> 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: OneEarth; 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: 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

#### LEADERSHIP & TEACHING EXPERIENCE

- 2020 Member of the EEMB Diversity, Equity, and Inclusion Committee
- 2020 Co-instructor for EEMB 142C and 142L: Conservation, Resource Management, and Food Production of Marine Systems
- 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-present AR6 Intergovernmental Panel on Climate Change contributing author
- 2019-present Aquaculture Stewardship Council (ASC) Scientific Advisory Board
- 2018 Future Aquaculture Network – WWF and Global Salmon Initiative working group
- 2018 Aquaculture Expert – Sea Legacy Green Aquaculture Initiative
- 2017-present Science communication – 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
- 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
- 2015 Organized & led modeling workshop – Washington Department of Fish & Wildlife
- 2014-2015 1<sup>st</sup> Year Grad Peer Mentor – School of Aquatic Fishery Sciences, UW
- 2014 Created & Instructed ‘Advance Marine Ecology’ – School of Aquatic Fishery Sciences, UW



2014 NSF Mentor – School of Aquatic Fishery Sciences, UW  
2012-2014 Guest lecturer – School of Aquatic Fishery Sciences, UW  
2013 TA ‘Aquatic & Resource Management’ – School of Aquatic Fishery Sciences, UW  
2012 Paws-on Science Volunteer Scientist: Husky Weekend – Pacific Science Center  
2011-2012 Undergrad Mentor – School of Aquatic Fishery Sciences, UW

#### LABORATORY & FIELD EXPERIENCE

Designed and implemented aquatic laboratory experiments on Pacific herring  
Designed and implemented field data collection using underwater acoustic telemetry & video monitoring  
Comfortable trailering & operating vessels  $\leq 25\text{ft}$   
Comfortable with animal dissections, including tissue & otolith extraction  
Comfortable conducting conventional and quantitative PCR  
Comfortable operating aquatic flumes & swim chambers  
Comfortable with snorkeling surveys  
Experience with internal tagging and pit tagging

#### COMPUTATIONAL PLATFORMS

R programming; ArcGIS; Microsoft Office

#### PROFESSIONAL SOCIETIES

American Fisheries Society