

William K. Oestreich

Monterey Bay Aquarium Research Institute

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EDUCATION

Stanford University

Pacific Grove, CA, USA

Doctor of Philosophy (PhD) in Biology

2022

Advisors: Dr. Larry Crowder and Dr. Jeremy Goldbogen

PhD Thesis: Animal migration and behavioral flexibility in an era of rapid global change

Northwestern University

Evanston, IL, USA

Master of Science (MS) in Environmental Engineering

2015

Advisor: Dr. Luisa Marcelino

BS/MS Thesis: Variability in coral bleaching severity: Insights from application of Bleaching Response Index (BRI) to global and Caribbean bleaching records

Northwestern University

Evanston, IL, USA

Bachelor of Science (BS) in Environmental Engineering

2015

SELECT PROFESSIONAL EXPERIENCE

Monterey Bay Aquarium Research Institute

June 2022 - present

Moss Landing, CA, USA

Postdoctoral Research Fellow

Stanford University

Aug 2017 - June 2022

Pacific Grove, CA, USA

Graduate Research Fellow

Woods Hole Oceanographic Institution

Aug 2015 - July 2017

Woods Hole, MA, USA

Research Assistant III, Computational Biogeochemistry Group (PI: Dr. Scott Doney)

Jal Bhagirathi Foundation + Northwestern University

June 2015 - Aug 2015

Jodhpur, Rajasthan, India

Water Quality Research Technician

Natural Resources Defense Council

Jan 2015 - June 2015

Chicago, IL, USA

Litigation Team Intern

PEER-REVIEWED PUBLICATIONS

(* denotes equal contributions; ^ denotes undergraduate mentee)

19. **Oestreich, WK**, ^Aiu, KM, Crowder, LB, McKenna, MF, Berdahl, AM, and Abrahms, B (2022). The influence of social cues on timing of animal migrations. *Nature Ecology and Evolution* (In press). ^undergraduate mentee
18. **Oestreich, WK**, Abrahms, B, McKenna, MF, Goldbogen, JA, Crowder, LB, and Ryan, JP (2022). Acoustic signature reveals blue whales tune life history transitions to oceanographic conditions. *Functional Ecology* 36, 882-895.

17. Ryan, JP, Benoit-Bird, K, **Oestreich, WK**, Leary, P, Smith, K, Waluk, C, Cade, D, Fahlbusch, J, Southall, B, Joseph, J, Margolina, T, Calambokidis, J, DeVogelaere, A, and Goldbogen, JA (2022). Oceanic giants dance to atmospheric rhythms: Ephemeral wind-driven resource tracking by blue whales. *Ecology Letters* (In press).
16. Blondin, H, Armstrong, K, Hazen, E, Santos, BS, **Oestreich, WK**, Haulsee, D, Mikles, CS, Knight, C, Bennett, A, and Crowder, LB (2022). Land-dependent marine species face climate-driven impacts on land and at sea. *Marine Ecology Progress Series* (In press).
15. Segre, PS, Gough, WT, Roualdes, EA, Cade, DE, Czapanskiy, MF, Fahlbusch, J, Kahane-Rapport, SR, **Oestreich, WK**, Bejder, L, Bierlich, KC, Burrows, JA, Calambokidis, J, Chenoweth, EM, di Clemente, J, Durban, JW, Fearnbach, H, Fish, FE, Friedlaender, AS, Hegelund, P, Johnston, DW, Nowacek, DP, Oudejans, MG, Penry, GS, Potvin, J, Simon, M, Stanworth, A, Straley, JM, Szabo, A, Videsen, SKA, Visser, F, Weir, CR, Wiley, DN, and Goldbogen, JA (2022). Scaling of maneuvering performance in baleen whales. *Journal of Experimental Biology* 225, jeb243224.
14. McKenna, MF, Baumann-Pickering, S, Kok, ACM, **Oestreich, WK**, Adams, JD, Barkowski, J, Fristrup, K, Goldbogen, JA, Joseph, JE, Kim, EB, Kugler, A, Lammers, MO, Margolina, T, Peavey Reeves, LE, Rowell, TJ, Stanley, JA, Stimpert, AK, Zang, EJ, Southall, BL, Wall, CC, Van Parijs, S, and Hatch, LT (2021). Advancing the interpretation of shallow water marine soundscapes. *Frontiers in Marine Science* 8.
13. Cade, DE, Fahlbusch, JA, **Oestreich, WK**, Ryan, J, Calambokidis, J, Findlay, KP, Friedlaender, AS, Hazen, EL, Seakamela, SM, and Goldbogen, JA (2021). Social exploitation of extensive, ephemeral, environmentally controlled prey patches by super-groups of rorqual whales. *Animal Behaviour* 182, 251-266.
12. Kitzes, J, Blake, R, Bombaci, S, Chapman, M, Duran, SM, Huang, T, Joseph, MB, Lapp, S, Marconi, S, **Oestreich, WK**, Rhinehart, TA, Schweiger, AK, Song, Y, Surasinghe, T, Yang, D, and Yule, K (2021). Expanding the National Ecological Observatory Network (NEON) biodiversity surveys with new instrumentation and machine learning models. *Ecosphere* 12, e03795.
11. Cade, DE, Gough, WT, Czapanskiy, MF, Fahlbusch, JA, Kahane-Rapport, SR, Linsky, JMJ, Nichols, RC, **Oestreich, WK**, Wisniewska, DM, Friedlaender, AS, and Goldbogen, JA (2021). Tools for integrating inertial sensor data with video bio-loggers, including estimation of animal orientation, motion, and position. *Animal Biotelemetry* 9, 34.
10. *Chapman, MS, ***Oestreich, WK**, Frawley, TH, Boettiger, C, Diver, S, Santos, BS, Scoville, C, Armstrong, K, Blondin, H, Chand, K, Haulsee, DE, Knight, CJ, and Crowder, LB. (2021). Promoting equity in the use of algorithms for high seas conservation. *One Earth* 4, 790-794. **equal contributions*
9. Cade, DE, Seakamela, SM, Findlay, K, Fukunaga, J, Kahane-Rapport, S, Warren, J, Calambokidis, J, Fahlbusch, JA, Friedlaender, AS, Hazen, EL, Kotze, D, McCue, S, Meyer, M, **Oestreich, WK**, Oudejans, M, Wilke, C, Goldbogen, JA (2021). Predator-scale spatial analysis of intra-patch prey distribution reveals energetic drivers of rorqual whale super-group formation. *Functional Ecology* 35, 894-908.
8. Green, KM, Selgrath, JS, Frawley, TH, **Oestreich, WK**, Mansfield, EJ, Urteaga, J, Swanson, SS, Santana, FS, Green, SJ, Naggea, J, and Crowder, LB (2021). How adaptive capacity shapes the Adapt, React, Cope Response to climate impacts: insights from small-scale fisheries. *Climatic Change* 164, 1-22.
7. **Oestreich, WK**, Fahlbusch, JA, Cade, DE, Calambokidis, J, Margolina, T, Joseph, J, Friedlaender, AS, McKenna, M, Stimpert, AK, Southall, BL, Goldbogen, JA, and Ryan, JP (2020). Animal-borne metrics enable acoustic detection of blue whale migration. *Current Biology* 30, 4773-4779.
6. Haver, SM, Rand, Z, Hatch, LT, Lipski, D, Dziak, RP, Gedamke, J, Haxel, J, Heppell, SA, Jahncke, J, McKenna, MF, Mellinger, DK, **Oestreich, WK**, Roche, L, Ryan, JP, and Van Parijs, SM, (2020). Seasonal trends and primary contributors to the low frequency soundscape of the Cordell Bank National Marine Sanctuary. *Journal of the Acoustical Society of America* 148, 845-858.
5. **Oestreich, WK**, Chapman, MS, and Crowder, LB (2020). A comparative analysis of dynamic management in marine and terrestrial systems. *Frontiers in Ecology and the Environment* 18, 496-504.
4. **Oestreich, WK**, Frawley, TH, Mansfield, EJ, Green, KM, Green, SJ, Naggea, J, Selgrath, JC, Swanson, SS, Urteaga, J, White, TD, and Crowder, LB (2019). The impact of environmental change on small-scale fishing

- communities: Moving beyond adaptive capacity to community response. In Cisneros-Montemayor, AM, Cheung, W, and Ota, Y (ed). *Predicting future oceans: Sustainability of social-ecological systems under climate change*. Elsevier. New York, NY.
3. Glover, DM, Doney, SC, **Oestreich, WK**, and Tullo, A (2018). Geostatistical analysis of mesoscale spatial variability and error in SeaWiFS and MODIS/Aqua global ocean color data. *Journal of Geophysical Research: Oceans* 123, 22-39.
 2. Swain, TD, Vega-Perkins, JB, **Oestreich, WK**, Triebold, C, DuBois, E, Henss, J, Baird, A, Siple, M, Backman, V, and Marcelino, L (2016). Coral Bleaching Response Index: a new tool to standardize and compare susceptibility to thermal bleaching. *Global Change Biology* 22, 2475-2488.
 1. **Oestreich, WK**, Ganju, NK, Pohlman, JW, and Suttles, SE (2016). Colored dissolved organic matter in eutrophic estuaries: relationships between carbon sources and light attenuation. *Biogeosciences* 13, 583-595.

MANUSCRIPTS IN REVIEW AND SUBMISSION

(Manuscript drafts available; * denotes equal contributions; ^ denotes undergraduate mentee)

*^Pearson, E, ***Oestreich, WK**, Ryan, JP, Haver, SM, Gedamke, J, Dziak, RP, and Wall, CC. Widespread passive acoustic monitoring reveals spatio-temporal patterns of blue and fin whale song vocalizations in the Northeast Pacific Ocean. (*In revision*). *equal contributions; ^undergraduate mentee

Kim, E, Frasier, K, McKenna, M, Kok, A, Peavey-Reeves, L, **Oestreich, WK**, Arrieta, G, Wiggins, S, and Baumann-Pickering, S. SoundScape Learning (SSL): An Automatic Method for Separating Fish Chorus in Complex Marine Soundscapes. (*In review*).

Ryan, JP, et al. including **Oestreich, WK**. Foraging ecology in the mysticete symphony: Baleen whale song as an ecosystem indicator. (*In submission*).

Dodson, S, **Oestreich, WK** et al. Animal communication enables collective migration in a dynamic seascape. (*In submission*).

Barlow, D, Bierlich, KC, **Oestreich, WK** et al. Shaped by their environment: Comparing blue whale morphology, life history, and regional oceanography in three productive coastal ecosystems. (*In submission*).

FELLOWSHIPS, GRANTS, AND RESEARCH AWARDS

○ Monterey Bay Aquarium Research Institute Postdoctoral Research Fellowship (\$125,000)	2022
○ Predator-Prey Interactions Gordon Research Conference Invited Speaker Travel Funds (\$750)	2022
○ Myers Oceanographic and Marine Biology Trust Grant (\$3000)	2021
○ Bio Futures Fellowship - Stanford Ethics, Society, and Technology Hub (\$3000)	2020-2021
○ NSF Graduate Research Fellowship (\$138,000)	2018-2021
○ David & Lucile Packard Foundation Stanford Graduate Fellowship (\$275,000)	2017-2020
○ SPICE (Student Projects for Intellectual Community Engagement) Grant (\$10,000)	2019-2021
○ Fieldwork Grant - California Ocean Alliance (\$1000)	2019
○ Best Research Talk - Stanford Woods Institute Young Environmental Scholar Conference (\$250)	2019
○ Conference Travel Grants - Stanford Univ. Office of Graduate Education (\$1800)	2018-2019
○ Whelan Grant - Woods Hole Oceanographic Institution (\$1000)	2016
○ Jimmie E. Quon Memorial Award for Env. Eng. Senior - Northwestern Univ. (\$1000)	2015
○ Conference Travel Grant - Woods Hole Oceanographic Institution (\$1000)	2014
○ Summer Student Fellowship - Woods Hole Oceanographic Institution & US Geological Survey	2014

TEACHING EXPERIENCE

As lead instructor:

- o Fellowship Application and Proposal Writing, *CSU Monterey Bay Summer REU Program* 2019, 2020

As guest instructor:

- o Evolution, Systematics, and Ecology, *Foothill College* 2022
- o Ocean Conservation: Pathways to Solutions, *Stanford University* 2022
- o Sensory Ecology of Marine Animals, *Stanford University* 2021, 2022

As teaching assistant:

- o Marine Conservation Biology, *Stanford University* 2019
- o Intro to Research in Ecology and Evolutionary Biology, *Stanford University* 2018
- o Public and Environmental Health, *Northwestern University* 2015

STUDENTS ADVISED

- o Natalie Cross, Stanford University Undergraduate Honors Thesis (co-advised) 2021-2022
- o Emma Pearson, CU Boulder Undergraduate Honors Thesis (co-advised) 2021-2022
- o Kanoe Aiu, Stanford University Undergraduate MUIR Fellow (co-advised) 2021
- o Mackenzie Perillo, Cal State University Monterey Bay REU Program Fellow (co-advised) 2021
- o Mojca Seban, Stanford University guest student from University of Ljubljana 2020
- o Stephanie Cortes, Salinas High School - Hopkins Marine Station Internship Program 2020
- o Alex Khieu, Salinas High School - Hopkins Marine Station Internship Program 2019

ACADEMIC JOURNAL REVIEWING

Reviewer for the following journals: *Ecology*, *Proceedings of the Royal Society B*, *Marine Ecology Progress Series*, *Scientific Reports*, *Marine Mammal Science*, *Integrative Zoology*, *BMC Biology*, *Frontiers for Young Minds*

ACADEMIC SERVICE, VOLUNTEER, AND OUTREACH ACTIVITIES

- o Stanford University Biology PhD Preview Program, *Co-organizer* 2020-2021
- o Salinas High School - Hopkins Marine Station Internship Program, *Co-director* 2019-2022
- o Pacific Grove Museum of Natural History Science Saturdays, *Volunteer* 2019
- o Hopkins Marine Station Open House, *Volunteer* 2018-2020
- o Pacific Grove Public Schools Marine Science Curriculum, *Guest Speaker* 2018
- o Mt. Pleasant Elementary School (DE), *Marine Science Pen Pal* 2017-2019
- o Stanford High School to PhD (HyPE), *Volunteer* 2017
- o Bourne (MA) High School Science and Engineering Expo *Volunteer Judge* 2016
- o North Branch Restoration Project (Chicago, IL), *Prairie restoration volunteer* 2013-2015

ACADEMIC LEADERSHIP EXPERIENCE

- o Friends of Hopkins Marine Station Board, *Graduate student representative* 2019-2021
- o Stanford Biology Dept. Surf 'n' Turf Research Symposium, *Treasurer & co-organizer* 2018-2020
- o Monterey Area Research Institutions Network for Education (MARINE), *Institution representative* 2018-2020

WORKSHOPS AND WORKING GROUPS

- o OceanHackWeek, University of Washington 2019
- o ACKME Mathematical Ecology Working Group, Woods Hole Oceanographic Institution 2017
- o MARINE Ocean Policy Course, Stanford University Center for Ocean Solutions 2017
- o Structured Population Models, Woods Holes Oceanographic Institution 2017
- o Modeling Methods for Marine Science, Woods Hole Oceanographic Institution 2016
- o Satellite Remote Sensing for Biological Oceanography, Cornell University 2016

SEMINARS: INVITED, CONFERENCE PROCEEDINGS, AND OUTREACH

Invited Academic Seminars

Animal behavior in dynamic and changing oceanic ecosystems. *UC Santa Barbara Dept. of Ecology, Evolution, and Marine Biology*. November 2022.

Socially-mediated group behavior of predators and prey in a vast and dynamic oceanic ecosystem. *Predator-Prey Interactions Gordon Research Conference*. October 2022.

The social lives of blue whale predators and their krill prey. *American Cetacean Society Monterey Bay Chapter*. December 2022.

Foraging and migration in a vast and dynamic seascape: Population-level insights from acoustic study of the blue whale. *Monterey Bay Aquarium*, June 2021.

Understanding blue whale behaviors through combination of acoustic and tagging technologies. *American Cetacean Society Monterey Bay Chapter*. January 2020.

Coral reefs and climate change: Understanding drivers and patterns of coral bleaching. *Natural Resources Defense Council Chicago Litigation Team Retreat*. May 2015.

Invited Panel Discussions

Opportunities for ocean-climate action in the United States. *Monterey Bay Aquarium Research Institute*. October 2021. **Oestreich, WK** as part of a panel discussion led by H Luddeman and M Michelin.

Discussion of sound related research in Monterey Bay National Marine Sanctuary. *Monterey Bay National Marine Sanctuary Research Activity Panel*. May 2021. (As part of presenting group including Southall, BL, Ryan, JP, McKenna, MF, Joseph, JE, **Oestreich, WK**, and Barkowski, J)

Discussion of sound related research in Monterey Bay National Marine Sanctuary. *Monterey Bay National Marine Sanctuary Research Activity Panel*. Nov 2018. (As part of presenting group including Southall, BL, Ryan, JP, **Oestreich, WK**, Urmy, SS, Joseph, JE, Stimpert, AK, Cline, DE, Cade, DE, Goldbogen, JA)

General Audience and Outreach Seminars

Various public seminars and outreach events with the following organizations: *California Ocean Alliance, Pacific Grove Museum of Natural History, Santa Museum of Natural History, Whalefest Monterey, etc.*

Conference Presentations (*presenting author)

Oestreich, WK, Aiu, KM*, Crowder, LB, McKenna, MF, Berdahl, AM, and Abrahms, B. "The influence of social cues on timing of animal migrations." Ecological Society of America Annual Meeting, Aug 2022. Oral presentation.

Oestreich, WK*, Abrahms, B, Dodson, S, McKenna, MF, Goldbogen, JA, Crowder, LB, and Ryan, JP. "An acoustic ecosystem indicator: Patterns in song reveal blue whales tune life history transitions to oceanographic conditions." Ocean Sciences Meeting, March 2022. Oral presentation.

Ryan, JP* and **Oestreich, WK***. "The sounds of giants." Monterey Bay Aquarium Research Institute (MBARI) Board of Directors Meeting, June 2021. Oral presentation.

Oestreich, WK* "Environmental and social drivers of flexible migration phenology in blue whales." Stanford-UC Santa Cruz Species Interactions Workshop, Dec 2020. Oral presentation.

Oestreich, WK, Cline, DE, Cade, DE, Calambokidis, J, Fahlbusch, JA*, Joseph, JE, Margolina, T, Southall, BA, Goldbogen, JA, and Ryan, JP "Temporal variation in blue whale call types in the Northeast Pacific at diel, seasonal, and interannual time scales with tag-derived behavioral context." Ocean Sciences Meeting, San Diego, CA, Feb 2020. Oral presentation.

Oestreich, WK*, Cade, DE, Calambokidis, J, and Goldbogen, JA "Context of blue whale vocalizations as determined via tag-mounted accelerometers." World Marine Mammal Conference, Barcelona, Spain, Dec 2019. Oral presentation.

Oestreich, WK*, Cline, DE, Cade, DE, Calambokidis, J, Goldbogen, JA, Crowder, LB, and Ryan, JP "Synthesis of acoustic, biologging, and machine learning methods enhances monitoring of blue whales from individual to population scales." Joint Meeting of the American Fisheries Society and The Wildlife Society, Reno, NV, Sept 2019. Oral presentation.

Oestreich, WK*, Chapman, MS, and Crowder, LB "Scales of forecasting for dynamic management: gaps in marine and terrestrial systems." Joint Meeting of the American Fisheries Society and The Wildlife Society, Reno, NV, Sept 2019. Oral presentation.

Oestreich, WK*, Frawley, TH, Mansfield, EJ, Green, KM, Green, SJ, Naggea, J, Selgrath, JC, Swanson, SS, Urteaga, J, White, TD, and Crowder, LB "The impact of environmental change on small-scale fishing communities: Moving beyond adaptive capacity to community response." Nippon Foundation Nereus Science Conference, Princeton, NJ, Sept 2019. Oral presentation.

Oestreich, WK* "Connecting behavior across individual, population, and ecosystem scales: ecological and management implications for the blue whale." Monterey Area Research Institutions Network for Education (MARINE) Annual Colloquium, Moss Landing, CA, May 2019. Oral presentation.

Oestreich, WK* "Enhancing cetacean monitoring using a novel synthesis of passive acoustics, machine learning, and biologging." Bay Area Conservation Biology Symposium, Berkeley, CA, Apr 2019. Oral presentation.

Oestreich, WK* "Listen up: Learning about whale and human behavior in the oceans using acoustics and machine learning." GenerationSci Conference, Stanford University, Palo Alto, CA, April 2018. Oral presentation.

Glover, DM, Doney, SC, **Oestreich, WK***, and Tullo, A "Geostatistical Analysis to Quantify Mesoscale Spatial Variability, Patchiness, and Error in SeaWiFS and MODIS/Aqua Global Ocean Color Data." Ocean Sciences Meeting, Portland, OR, February 2018. Poster.

Oestreich, WK*, Ganju, NK, Pohlman, JW, and Suttles, SE "Colored dissolved organic matter in shallow estuaries: the effect of source on quantification." American Geophysical Union Fall Meeting, San Francisco, CA, December 2014. Poster.