

KC (Kevin) Bierlich

Geospatial Ecology of Marine Megafauna (GEMM) Lab, Marine Mammal Institute,
Department of Fisheries, Wildlife, & Conservation Sciences, Oregon State University
Hatfield Marine Science Center, 2030 SE Marine Science Drive, Newport, OR 97365
(949) 680-9883 ~ kevin.bierlich@oregonstate.edu

CURRENT POSITION

2021 – present

Postdoctoral Scholar

Marine Mammal Institute, Dept. of Fisheries, Wildlife, & Conservation
Sciences, Hatfield Marine Science Center, Oregon State University
Geospatial Ecology of Marine Megafauna ([GEMM](#)) Lab
Supervisor: Dr. Leigh Torres

EDUCATION

2016 – 2021

Ph.D., Marine Science and Conservation

Duke University, Nicholas School of the Environment
Advisor: Dr. David W. Johnston, [Marine Robotics and Remote Sensing Lab](#)
Dissertation Title: Incorporating Photogrammetric Uncertainty in UAS-
based Morphometric Measurements of Baleen Whales

2016

M.E.M., Coastal Environmental Management

Duke University, Nicholas School of the Environment/Duke Marine Lab
Advisor: Dr. David W. Johnston

2014

B.S., Biology w/ minor in Environmental Science

Sonoma State University, *Cum Laude*
Advisor: Dr. Dan Crocker

PUBLICATIONS

Cade, D.E., Kahane-Rapport, S.R., Gough, W.T., **Bierlich, K.C.**, Linksy, J.M.J., Johnston, D.W.,
Goldbogen, J.A., Friedlaender, A.S. (*in review*). Ultra-high feeding rates of Antarctic minke whales
imply a lower limit for body size in engulfment filtration feeders. *Nature Ecology and Evolution*

Bierlich, K.C., Hewitt, J., Schick R.S., Pallin, L., Dale, J., Friedlaender, A.S., Christiansen, F.,
Sprogis K.R., Dawn, A.H., Bird, C.N., Larsen, G., Nichols, R., Shero, M., Goldbogen, J.A., Read,
A., Johnston, D.W. (2022). Seasonal gain in body condition of foraging humpback whales along the
Western Antarctic Peninsula. *Frontiers in Marine Science*. 9, 1–16. doi:10.3389/fmars.2022.1036860
<https://www.frontiersin.org/articles/10.3389/fmars.2022.1036860/full>

Pallin, L., **Bierlich, KC**, Durban, J. Fearnbach, H., Savenko, O., C.S. Baker, E. Bell, Double, M.C.,
de la Mare, W. , Goldbogen, J. , Johnston, D., Kellar, N., Nichols, R., Nowacek, D., Read, A.J.,
Steel, D., Friedlaender, A. (2022) Demography of an ice-obligate mysticete in a region of rapid
environmental change. Royal Society of Open Science. 9(11). <https://doi.org/10.1098/rsos.220724>

Gough, W.T., Cade, D.E., Czapanskiy, M.F., Potvin, J., Fish, F.E., Kahane-Rapport, S.R., Savoca, M.S., **Bierlich, K.C.**, Johnston, D.W., Friedlaender, A.S., Szabo, A., Bejder, L., Goldbogen, J.A., (2022). Fast and Furious: Energetic tradeoffs and scaling of high-speed foraging in rorqual whales. *Integrative Organismal Biology*, 4(1) obac038, <https://doi.org/10.1093/iob/obac038>

Nazario EC, Cade DE, **Bierlich KC**, Czapanskiy MF, Goldbogen JA, Kahane-Rapport SR, van der Hoop JM, San Luis MT, Friedlaender AS. (2022). Baleen whale inhalation variability revealed using animal-borne video tags. *PeerJ*10:e13724 <https://doi.org/10.7717/peerj.13724>

Torres, L.G., Bird, C., Rodrigues-González, F., Christiansen F., Bejder, L., Lemos, L., Urbán Ramírez, J., Swartz, S., Willoughby, A., Hewitt, J., **Bierlich, K.C.** (2022). Range-wide comparison of gray whale body condition reveals contrasting sub-population health characteristics and vulnerability to environmental change. *Frontiers in Marine Science*. 9:867258. <https://doi.org/10.3389/fmars.2022.867258>

Segre P.S., Gough, W.T., Roualdes, E.A., Cade, D.E., Czapanskiy, M.F., Fahlbush, J., Kahane-Rapport, S.R., Oestreich, W.K., Bejder, L., **Bierlich, K.C.**, Burrows, J.A., ... Goldbogen, J.A. (2022). Scaling of maneuvering performance in baleen whales: larger whales outperform expectations. *Journal of Experimental Biology*. 225 (5): jeb243224. <https://doi.org/10.1242/jeb.243224>

Bierlich, K.C., Hewitt, J., Bird, C.N., Schick R.S., Friedlaender, A.S., Torres, L.G., Dale, J., Goldbogen, J.A., Read, A., Calambokidis J., Johnston, D.W. (2021). Comparing uncertainty associated with 1-, 2-, and 3D aerial photogrammetry-based body condition measurements of baleen whales. *Frontiers in Marine Science*. 8:749943. doi: [10.3389/fmars.2021.749943](https://doi.org/10.3389/fmars.2021.749943)

Savoca, M. S. Czapanskiy, M. F., Kahane-Rapport, S. R., Gough, W. T., Falhbusch, J. A., **Bierlich, K. C.**, Segre, P. S., Di Clemente, J., Penry G. S., Wiley, D. N., Calambokidis, J., Nowacek, D. P., Johnston, D. W., Pyenson, N. D., Friedlaender, A. S., Hazen, E. L., & Goldbogen, J.A. (2021). Baleen whale prey consumption based on high-resolution foraging measurements. *Nature*, 599, 85–90. <https://doi.org/10.1038/s41586-021-03991-5>

Bierlich, K.C., Schick, R.S., Hewitt, J., Dale, J., Goldbogen, J.A., Friedlaender, A.S., Johnston D.J. (2021). A Bayesian approach for predicting photogrammetric uncertainty in morphometric measurements derived from UAS. *Marine Ecology Progress Series*. DOI: <https://doi.org/10.3354/meps13814>

Gough, W. T., Smith, H. J., Savoca, M. S., Czapanskiy M. F., Fish, F. E., Potvin, J., **Bierlich, K.C.**, Cade, D. E., Di Clemente, J., Kennedy, J., Segre, P., Stanworth, A., Weir, C., & Goldbogen, J. A. (2021). Scaling of oscillatory kinematics and Froude efficiency in baleen whales. *Journal of Experimental Biology* 224 (13): jeb237586. doi: <https://doi.org/10.1242/jeb.237586>

Kahane-Rapport, S.R., Savoca, M.S., Cade, D.E., Segre, P.S., **Bierlich, K.C.**, Calambokidis, J.A., Dale, J., Friedlaender, A.S., Johnston, D.W., Werth, A.J. and J.A. Goldbogen. (2020). Lunge filter feeding biomechanics constrain rorqual foraging ecology across scale. *Journal of Experimental Biology*. 223(20). <https://doi.org/10.1242/jeb.224196>

Bird, C.N., and **Bierlich, K.C.** (2020). CollatriX: A GUI to collate MorphoMetriX outputs. *Journal of Open Source Software*, 5(51), 2328. <https://doi.org/10.21105/joss.02328>

Torres, W.I., & **Bierlich, K.C.** (2020). MorphoMetriX: a photogrammetric measurement GUI for morphometric analysis of megafauna. *Journal of Open Source Software*, 5(45), 1825. <https://doi.org/10.21105/joss.01825>

Segre, P.S., Potvin, J., Cade, D.E., Calambokidis, J., Di Clemente, J., Fish, F.E., Friedlaender, A.S., Gough, W.T., Kahane-Rappoport, S.R., Oliveira, C., Parks, S.E., Penry, G.S., Simon, M., Stimpert, A.K., Wiley, D.N., **Bierlich, K.C.**, Madsen, P.T., Goldbogen, J.A. (2020). Energetic and physical limitations on the breaching performance of large whales. *eLife*, 9, p.e51760. <https://doi.org/10.7554/eLife.51760>

Gough, W.T., Segre, P.S., **Bierlich, K.C.**, Cade, D.E., Potvin, J., Fish, F. E., Dale, J., di Clemente, J., Friedlaender, A.S., Johnston, D.W., Kahane-Rappoport, S.R., Kennedy, J., Long, J.H., Oudejans, M., Penry, G., Savoca, M.S., Simon, M., Videsen, S.K.A., Visser, F., Wiley, D.N., Goldbogen, J.A. (2019). Scaling of swimming performance in baleen whales. *Journal of Experimental Biology*, 222(20). <https://doi.org/10.1242/jeb.204172>

Gray, P. C., **Bierlich, K. C.**, Mantell, S. A., Friedlaender, A. S., Goldbogen, J. A., & Johnston, D. W. (2019). Drones and convolutional neural networks facilitate automated and accurate cetacean species identification and photogrammetry. *Methods in Ecology and Evolution*, 10(9), 1490-1500. <https://doi.org/10.1111/2041-210x.13246>

Bierlich, K. C., Miller, C., DeForce, E., Friedlaender, A. S., Johnston, D. W., & Apprill, A. (2018). Temporal and regional variability in the skin microbiome of humpback whales along the Western Antarctic Peninsula. *Applied and environmental microbiology*, 84(5), e02574-17. <https://doi.org/10.1128/aem.02574-17>

Technical Reports:

Bierlich, K.C. & Torres, L.G. (2021). Quick-guide to UAS-based photogrammetry of whales.

Bierlich, K.C., Johnston, D.W. (2016). Using Unoccupied Aerial Systems (UAS) for Surveying Shorebirds in North Carolina; Marine Conservation Ecology Unoccupied Systems Facility; Duke University Marine Lab; Beaufort, NC USA. Cited by doi:10.3390/drones4020012

Open-source datasets and code:

Bierlich, K. C., Schick, R. S., Hewitt, J., Dale, J., Goldbogen, J. A., Friedlaender, A. S., & Johnston, D. W. (2020). Data and scripts from: A Bayesian approach for predicting photogrammetric uncertainty in morphometric measurements derived from UAS. Duke Research Data Repository. V2 <https://doi.org/10.7924/r4sj1jj6s>

Acknowledged in:

Sykora-Bodie, S. T., & Morrison, T. H. (2019). Drivers of consensus-based decision-making in international environmental regimes: Lessons from the Southern Ocean. *Aquatic Conservation: Marine and Freshwater Ecosystems*. <https://doi.org/10.1002/aqc.3200>

Johnston, D. W. (2019). Unoccupied aircraft systems in marine science and conservation. *Annual review of marine science*, 11, 439-463. <https://doi.org/10.1146/annurev-marine-010318-095323>

Lindkvist, E., Basurto, X., & Schlüter, M. (2017). Micro-level explanations for emergent patterns of self-governance arrangements in small-scale fisheries—A modeling approach. *PLoS one*, 12(4). <https://doi.org/10.1371/journal.pone.0175532>

RESEARCH AWARDS, GRANTS, & FELLOWSHIPS

2021 **Oregon License Plate Fund**, Marine Mammal Institute (\$9,000)
2021 **Postdoctoral Scholar**, Marine Mammal Institute, Oregon State University
2016 – 2021 **Duke University Graduate Research/Teaching Assistantship Fellowship**
2020 **Nicholas School Dean’s Award for Outstanding Graduate Student Manuscript, Honorable Mention**, Duke University
2020 **Graduate Research Patent Royalties Quasi Endowment Fund** (\$5,500)
2020 **Graduate Research Assistantship**, NSF Award #1644209
2019 **Student Travel Grant**, World Marine Mammal Conference, Barcelona, Spain
2019 **Summer Research Fellowship for PhD Students**, Duke University (\$5,500)
2018 **Data Expeditions Teaching Grant**, Duke University (\$1,500)
2017 **Student Travel Grant**, SMM Biennial Conference, Halifax, Nova Scotia, Canada
2017 **Graduate Student Research Grant**, Duke University Wetland Center (\$5,000)
2017 **The Explorer’s Club** (\$1,000)
2015 **Whale Bacterial Buddies Project**, WHOI crowdfunding campaign (\$5,000)
2015 **Michael K. Orbach Enrichment Fund**, (\$500)
2015 **Edna Bailey Sussman Fund** (\$4,550)
2014 – 2016 **Academic Scholarship**, Duke University (\$14,000)
2014 – 2016 **Research Assistantship**, Duke University (\$6,000)
2012 **Council of Ocean Affairs, Science, and Technology (COAST)** (\$2,500)

CONFERENCE & WORKSHOP PRESENTATIONS

First Author Presentations

Bierlich, K.C., Kane, A., Hildebrand, L., Hildebrand, I., Bird, C.N., Fernandez-Ajo, A., Stewart, J. Hewitt, J., Sumich, J., Torres, L.T. Are PCFG gray whales morphologically smaller than the ENP population? **The Pacific Coast Feeding Group Consortium (PCFG) Annual Meeting**, Hatfield Marine Science Center, Newport, Oregon, USA, Nov. 10-11, 2022

Bierlich, KC, Dale, Julian, Friedlaender, Ari, Goldbogen, Jeremy, Johnston, David. Dwarf minke whales along the Antarctic Peninsula: Evidence of climate migration or historic misidentification? **Society for Integrative and Comparative Biology (SICB) Annual Meeting**, Austin, Texas, USA, Jan. 3-7, 2020

Bierlich, KC, Dale, Julian, Friedlaender, Ari, Goldbogen, Jeremy, Johnston, David. Guess who’s coming to dinner. Dwarf minke whales along the Antarctic Peninsula: Evidence of climate migration

or historic misidentification? **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020

Bierlich KC, Miller C, DeForce E, Friedlaender A, Johnston D, Apprill A. Seasonal and regional variability in the skin microbiome of humpback whales along the Western Antarctic Peninsula **Society for Marine Mammalogy (SMM) Biennial Conference**, Halifax, Nova Scotia, Oct 23 – 27th, 2017. *Video Presentation – selected as 1 of 8*

Bierlich, KC, Dale, Julian, Friedlaender, Ari, Goldbogen, Jeremy, Johnston, David. The morphology and external characters of Antarctic minke whales. **NSF Minke Whale Data Analysis & Synthesis Meeting**, Long Marine Lab, UC Santa Cruz, Santa Cruz, July 29, 2020

Bierlich KC, Johnston D, Miller C, DeForce E, Friedlaender A, Apprill A. Seasonal shifts in the core bacterial members on the skin of humpback whales, **The Ecology Symposium, Duke University**, December 2016

Bierlich KC, Johnston D, Miller C, DeForce E, Friedlaender A, Apprill A. The Whale Microbiome, **Palmer Antarctica Long Term Ecological Research Project (PAL-LTER) Annual Meeting**, New Brunswick, NJ, September 2016

Co-authored Presentations (Oral and Poster)

Hewitt, J., **Bierlich, K.C.** Modeling Measurement and Classification Uncertainty in Drone-Based Images Used to Estimate Physical Characteristics and Shapes of Whales. **American Statistical Association, JSM**, Washington DC, Aug. 6 – 11, 2022. *Invited oral presentation*

Bierlich, KC, Hewitt, J., Schick, R., Pallin, L., Dale, J., Friedlaender, A., Christiansen, F., Sprogis, K.R., Dawn, A., Bird, C.N., Larsen, G., Nichols, R., Goldbogen, J., Read, A.J., Johnston, D.W. Seasonal gain in body condition of foraging humpback whales along the Western Antarctic Peninsula. **Society for Marine Mammals (SMM) Biannual Conference**, Miami, Florida. Aug. 1-5, *Oral speed presentation*

Torres, L.T., Bird, C.N., Bierlich, K.C., Christiansen, F., Bejder, L., Hewitt, J., Lemos, L., Urban, J.R., Rodriguez-Gonzalez, F., Willoughby, A., Hildebrand, L. Range-wide comparison of gray whale body condition and prey quality reveals contrasting sub-population health characteristics and vulnerability to environmental change. **Society for Marine Mammals (SMM) Biannual Conference**, Miami, Florida. Aug. 1-5, *Oral presentation*

Adams, D.S., **Bierlich, K.C.**, Dale, J., Johnston, D.W., Goldbogen, J.A., Friedlaender, A.S., Segre, P., Fish, F.E., Blob, R.W., Price, S.A. Control surface-body size relationship in toothed and baleen whale species. **Society for Marine Mammals (SMM) Biannual Conference**, Miami, Florida. Aug. 1-5, *Poster presentation*

Adams, D.S., **Bierlich, K.C.**, Dale, J., Johnston, D.W., Goldbogen, J.A., Friedlaender, A.S., Segre, P., Fish, F.E., Blob, R.W., Price, S.A. Control surface-body size relationship in toothed and baleen whale species. **Society for Integrative and Comparative Biology (SICB) Annual Meeting**, *Virtual*, Jan 3 – Feb 28, *Oral presentation*

Smith, H.; Gough, W.; Goldbogen, J.A.; Savoca, M.S.; Czapanskiy, M.; Fish, F.; Potvin, J.; **Bierlich, KC**; Kennedy, J. The Physics of Whale Movement: Drag and Thrust Production to Measure Whale Propulsive Efficiency. **Ocean Sciences Meeting, 2020**, San Diego CA, Feb. 19, 2020. *Poster Presentation*

Kahane-Rapport, SR; Savoca, MS; Cade, DE; Segre, PS; **Bierlich, KC**; Calambokidis, J; Friedlaender, AS; Johnston, DW; Werth, AJ; Goldbogen, JA. From Feast Mode to Least Mode: How lunge Filter Feeding Biomechanics Constrain Rorqual Foraging Ecology Across Scale. **Society for Integrative and Comparative Biology (SICB) Annual Meeting**, Austin, Texas, USA, Jan. 3-7, 2020. *Oral Presentation*

Smith, HJ; Gough, WT; Savoca, MS; Czapanskiy, MF; Fish, Fe; Potvin, J; Cade, DE; **Bierlich, KC**; Kennedy, J; Goldbogen, JA. The Physics of Whale Movement: Drag and Thrust Production to Measure Whale Propulsive Efficiency. **Society for Integrative and Comparative Biology (SICB) Annual Meeting**, Austin, Texas, USA, Jan. 3-7, 2020. *Poster Presentation*

Dale, Julian; **Bierlich, K.C.**; Johnston, David. This is not the drone you are looking for.... The challenges of adopting new UAS technologies in marine science. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Gray, Patrick; **Bierlich, K.C.**; Mantell, Sydney; Friedlaender, Ari; Goldbogen, Jeremy; Johnston, David. Automated cetacean identification and measurement using drones and deep learning. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Bird, Clara; **Bierlich, K.C.**; Dale, Julian; Friedlaender, Ari; Goldbogen, Jeremy; Johnston, David. A comparison of percent dorsal scar cover between populations of humpback whales (*Megaptera novaeangliae*) off California and the Western Antarctic Peninsula. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Poster Presentation*

Gough, William; Segre, Paolo; **Bierlich, K.C.**; Cade, David; Potvin, Jean; Fish, Frank; Dale, Julian; Di Clemente, Jacopo; Friedlaender, Ari; Johnston, David; Kahane-Rapport, Shirel; Kennedy, John; Long, John; Oudejans, Machiel; Penry, Gwenith; Savoca, Matthew; Simon, Malene; Videsen, Simone; Visser, Fleur; Wiley, David; Goldbogen, Jeremy. Scaling of swimming performance in the largest animals. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Nazario, Emily; Cade, David; **Bierlich, K.C.**; Calambokidis, John; Dale, Julian; Goldbogen, Jeremy; Johnston, David; Kahane-Rapport, Shirel; Visser, Fleur; Friedlaender, Ari. Measuring nares expansion reveals variability in breath area and duration. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Nichols, Ross; Cade, David; **Bierlich, K.C.**; Cimino, Megan; Larson, Greg; Modest, Michelle; Pallin, Logan; Pickett, Erin; Swaim, Zachary; Johnston, David; Nowacek, Doug; Read, Andy; Friedlaender, Ari. Humpback whale foraging in the Antarctic Summer. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Kahane-Rapport, Shirel; Savoca, Matthew; Cade, David; Segre, Paolo; **Bierlich, K.C.**; Calambokidis, John; Czapanskiy, Max; Dale, Julian; Di Clemente, Jacopo; Fahlbusch, James; Friedlaender, Ari; Johnston, David; Nowacek, Doug; Penry, Gwenith; Werth, Alexander J.; Goldbogen, Jeremy. From

feast mode to least mode: How lunge filter feeding biomechanics constrain rorqual foraging ecology across scale. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Savoca, Matthew; Kahane-Rapport, Shirel; Cade, David; Czapanskiy, Max; Fahlbusch, James; Segre, Paolo; Calambokidis, John; Nowacek, Doug; Johnston, David; **Bierlich, K.C.**; Dale, Julian; Hazen, Elliott L.; Friedlaender, Ari; Goldbogen, Jeremy. Rorqual ingestion estimates based on direct measures of feeding rates and prey quality. **World Marine Mammals Conference (WMMC)**, Barcelona, Spain, Dec. 9– 12, 2020. *Oral Presentation*

Workshops – planning committee

Research Summit on Collaboration, Hatfield Marine Science Center, Newport, OR
October 19, 2021

Future of Remote Sensing Workshop for Tropical Conservation, Duke University Marine Laboratory, March 19 – 22, 2017

Workshops/Trainings

Building a Better Fieldwork Future – An Interactive Workshop Addressing Sexual Harassment and Assault in the Field, *Developed by UC Santa Cruz*
Hatfield Marine Science Center, Oregon State University, May 20, 2022

Reckoning with Race, Anti-racism Training

Nicholas School of the Environment
Duke University, September 18, 2020

Living While Black

Office for Institutional Equity
Duke University, June 16, 2020

The Effects of Climate Change on Marine Mammals

World Marine Mammal Conference
Barcelona, Spain, December 7, 2020

Introduction to R and Tidyverse

John Little, Center for Data and Visualization Sciences
Duke University, March 18, 2020

Visualization in R using ggplot

Angela Zoss, Center for Data and Visualization Sciences
Duke University, September 9, 2019

Reproducible Research Workshop – R, R Studio, Git, GitHub

Dr. Robert Schick
Duke University Marine Laboratory, Dec. 3, 2018

Exuding Confidence When Communication Science

April Dudash
Duke University Marine Laboratory, April 23, 2018

Pursuing Respect, Inclusion, Diversity & Equity (PRIDE) Training
Duke University Center for Sexual and Gender Diversity, February 15 & 16, 2017

Designing a Lesson Plan for NC K-12 educators
SciREN (Scientific Research and Education Network)
Duke University Marine Laboratory & NC Aquarium at Pine Knoll Shores, January – February 2017

Marine Planning Advancement Training Workshop
Nicholas School of the Environment, Executive Education Program
Duke University, January 11 – 12, 2016

Unmanned Aerial Systems: Powerful and Cost-Effective Tools for Marine Science and Conservation
Society for Marine Mammalogy (SMM), Biennial Conference, San Francisco, CA, December 12, 2015.

SMRU Consulting – Impact Assessment
Society for Marine Mammalogy (SMM), Biennial Conference, San Francisco, CA
December 11, 2015.

Conferences – participation

The Waterbird Society, Annual Meeting, New Bern, NC September 20 – 23, 2016

OCEANOISE2015, Vilanova i la Geltrú, Barcelona, May 11–15, 2015

Watkins Memorial Marine Mammal Bioacoustics Symposium
New Bedford Whaling Museum, March 27 – 29, 2015

The American Cetacean Society, 14th Annual Meeting, Newport Beach, Ca, November 7 – 9, 2014

PROFESSIONAL EXPERIENCE

Fieldwork & Expeditions

2021-present **Marine Mammal Researcher**, Kodiak Island, AK USA
Geospatial Ecology of Marine Megafauna Lab, Marine Mammal Institute, Hatfield Marine Science Center, Oregon State University
Led scouting expedition to assess feasibility of establishing research project evaluating gray whales off of Kodiak Island, AK. Led shore- and boat-based fieldwork team scanning for gray whales. Piloted DJI Inspire 2 to collect video for behavioral observations and still images for photogrammetry analysis of gray whales to evaluate body condition. Collected photo ID to match unique individuals, fecal samples for hormone analysis, and benthic sampling to evaluate prey type.

- 2021-present **Marine Mammal Researcher & UAS Pilot**, Oregon Coast, USA
 Geospatial Ecology of Marine Megafauna Lab, Marine Mammal Institute, Hatfield Marine Science Center, Oregon State University
 Piloting DJI Inspire 2 to collect video for behavioral observations and still images for photogrammetry analysis of gray whales to evaluate body condition in response to anthropogenic stress (e.g. vessel traffic, ocean noise, seismic exploration) and environmental variability (changing prey availability). Collecting photo ID to match samples to unique individuals. Collecting fecal samples for hormone analysis. Prey sampling for identification and caloric content analysis. This work is part of the [GRANITE](#) Project: Gray whale Response to Ambient Noise Informed by Technology and Ecology
- 2017 – 2020 **Marine Mammal Researcher & UAS Pilot**, Western Antarctic Peninsula
 Duke University, University of California Santa Cruz, Stanford University, California Ocean Alliance, WWF Antarctica, NSF Long-Term Ecological Research Project Palmer Station.
 Led small-team UAS operations for seven research excursions along the Western Antarctic Peninsula. Piloted a LemHex-44 hexacopter (>200 flights) to collect aerial images of humpback whales for photogrammetry analysis to evaluate early, mid, and late-season body condition. Successfully collected UAS images of >400 humpbacks whales. Also collected Photo ID to match individuals and collected skin/blubber biopsy samples for hormone, sex, and genetic analysis.
Advisors: Dr. Ari Friedlaender, Dr. David Johnson, Dr. Jeremy Goldbogen
Vessels: R/V Laurence M. Gould (NSF), RCGS Resolute (One Ocean Expeditions) Akademik Ioffe (One Ocean Expeditions)
- 2018 -2019 **Marine Mammal Ecologist & UAS Pilot**, Western Antarctic Peninsula
 R/V Laurence M. Gould, NSF
 Led small team UAS operations. Piloted a LemHex-44 hexacopter (>70 flights) to collect aerial imagery for photogrammetry analysis on the external characters, morphology, and body condition of Antarctic minke whales (>50). Collected skin/blubber biopsy samples for hormone, sex, and genetic analysis and Photo ID. Assisted in tagging efforts (CATS tags) to better understand biomechanics and ecological role.
- 2017 - 2018 **Marine Mammal Researcher & UAS Pilot**, Santa Barbara & Monterey, CA
 Hopkins Marine Station, Stanford University, Monterey, CA
 Piloted a LemHex-44 hexacopter and controlled gimbal and camera on the FreeFly Alta 6 hexacopter to collect images of blue (n>32), humpback (n>60), and fin (n>3) whales tagged with CATS tags for photogrammetry analysis of morphology and body condition to relate to the kinematic and locomotion data collected from the tags.
- 2016 - 2018 **Cetacean Exhumation Field Team**
North Carolina Maritime Museum, Beaufort, NC
 Led small teams in exhuming cetacean skeletons that have been buried for two years after animal stranded. Exhumations included two bottlenose dolphins, one

Atlantic spotted dolphin, one white-beaked dolphin, and one short-finned pilot whale. Full skeletons used for research and display at the NC Maritime Museum.

2012 – 2014 **Field/Lab Technician**, Año Nuevo, CA
Sonoma State University, Dr. Dan Crocker Lab
Behavioral analysis, chemical immobilization, serum and biopsy collection, tagging, measuring weight and girth, collecting hair and whisker samples, and attaching satellite instruments of Northern elephant seals at. Analyzed samples in lab with colorimetric and fluorometric assays, radioimmunoassays, and ELISAs to determine different hormone concentrations.

2012 **Field Assistant**, Northern California Coast
UC Davis Bodega Bay Marine Lab, Dr. Laura Rogers-Bennett Lab
Ecosystem analysis of decimated habitat from a virulent red tide in Northern California. Organized dive cruises and managed transect routes and collection of coralline algae covered rock samples for evaluation of larval recruitment. Assisted in regrowth experiments for the endangered white abalone. Research supported by Dept. Fish & Wildlife and Council of Ocean Affairs, Science, and Technology (COAST).

2011 **Scientific Aid**, Northern California Coast & SF Bay Area
California Department of Fish and Wildlife, Santa Rosa, CA
Surveyed angler effort along Northern California coast, San Francisco Bay, and Farallon Islands. Species identification, sample collections, data entry, and proficiency in fishing regulations.

Additional Research Experience

2020 **Research Assistantship**, Dr. Doug Nowacek & Dr. David Johnston
Duke University Marine Lab, Beaufort, NC
Photogrammetry analysis on the morphology and external characters of humpback and Antarctic minke whales in images collected from UAS.

2015 – 2018 **Guest Student Investigator**, Dr. Amy Apprill Lab
Woods Hole Oceanographic Institution, Woods Hole, MA
Examined the skin microbiome of over 200 skin samples from humpback and minke whales to identify a shared core group of microbial members on the skin. Created a DNA library using molecular techniques such as DNA extraction, DNA isolation, PCR, electrophoresis, and DNA sequencing. Analyzed sequenced data using mothur, PRIMER 7, and R.

2017-2021 **Photogrammetry Analyst**, Marine Robotics and Remote Sensing Lab
Duke University Marine Lab, Beaufort, NC
Photogrammetry analysis on the morphology, external characters, and body condition of humpback and Antarctic minke whales in images collected from UAS.

2017 – 2018 **Photogrammetry Analyst**, Dr. Jeremy Goldbogen Lab
Stanford University, UC Santa Cruz, Cascadia Research Collective

Photogrammetry and morphometric analysis of tagged blue, fin, and humpback whales off the coast of California to study functional morphology.

- 2017 – 2018 **UAS Remote Sensing Analyst**
Duke University Wetland Center
Quantifying NIR reflectance error associated with variation in tidal height in salt marshes using fixed wing UAS equipped with multispectral sensors.
- 2015 – 2016 **Research Assistant, UAS in Shorebird Conservation**
Duke University Marine Lab, Marine Robotics and Remote Sensing Lab
Collaboration with NC Wildlife Resources Commission for developing a protocol to survey shorebirds using drones. Included UAS research design and implementation, flight planning, mission execution, generation of 3D orthomosaics, and data analysis.

INVITED TALKS

25th Annual Salmon Bowl, The National Oceanic Sciences Bowl (NOSB), *hosted by Oregon State University*, February 5, 2022

Keynote Presentation: Studying Earth's Largest Creatures in Changing Climates

Hatfield Marine Science Center Research Seminar, December 2, 2021

Presentation: Incorporating uncertainty associated with drone-based measurements to better monitor the health of whales. <https://www.youtube.com/watch?v=L846RZc0SIo>

Stanford University, Hopkins Marine Station, August 1, 2018

Presentation: Using drones to measure body condition changes in baleen whales

NSF RV Laurence M. Gould, Western Antarctic Peninsula, June 16, 2018

Presentation: Drones and whales in Antarctica

UNC Chapel Hill, Institute of Marine Sciences, September 21, 2017

Presentation: Sizing up! How drones can help measure whales

Oceana, Weekly Science Seminar Series, Washington DC, October 25, 2016

Presentation: Seasonal and geographic influences on the skin microbiome of humpback whales in Antarctica: Towards a health-diagnostic tool

Stories for People and Nature (SNAP), Duke University, October 17, 2016

Presentation: "ohSNAP!" Photoessay: Iceland and Yosemite National Park

SERVICE AS REVIEWER

Journal of Aquatic Mammals
Marine Ecology Progress Series

TEACHING EXPERIENCE

Aquaculture, Teaching Assistant

Dr. Zackary Johnson, Duke University Marine Laboratory (Fall 2019)

Measuring whales with drones, photogrammetry workshop

Drones in Marine Biology, Ecology, & Conservation, Duke University (Summer 2018 & 2019)

Comparative Physiology, Teaching Assistant

Dr. Josh Osterberg, Duke University Marine Laboratory (Spring 2019)

Coastal Watershed Science and Policy, Teaching Assistant

Dr. Dana Hunt, Duke University Marine Laboratory (Spring 2017 & 2018)

Molecular Biology, Teaching Assistant

Dr. Tom Schultz, Duke University Marine Lab (Fall 2017)

Drones in Marine Biology, Ecology and Conservation, Teaching Assistant

Dr. David Johnston, Duke University Marine Lab (Summer 2017)

SciREN (Scientific Research and Education Network) (2017)

Developing lesson plans that meet the North Carolina teaching standards for K-12 educators.

Marine Megafauna, Teaching Assistant

Dr. Andre Boustany, Duke University (Fall 2016)

STUDENTS MENTORED

Wally Fiori – undergraduate at Oregon State University

Ally Kane – masters student at Oregon State University

Abby Coffey – masters student at Oregon State University

Amanda Mayfield – undergraduate at Oregon State University

Clara Bird – Duke University (now a PhD Student at Oregon State University)

Anna Windle – MEM Duke University (now a PhD student at University of Maryland)

Allison Duprey – UNC Chapel Hill (now a masters student at Oregon State University)

Anne Harshbarger – Duke University (now a PhD student at Duke University)

SOCIETIES AND LEADERSHIP

AAAS/Science Program for Excellence in Science

Society for Marine Mammals

Society for Integrative and Comparative Biology

Arctic Boundaries Working Group – Co-founder

The Coastal Society – Event Coordinator, Duke Student Chapter

Academy of Model Aeronautics

American Cetacean Society

CERTIFICATES

FAA Part 107 US Commercial Drone Pilot

Experience piloting MikroKopter LemHex-44, DJI Inspire 2, SenseFly eBee plus, DJI Phantom 3, DJI Phantom 4 Pro, and DJI Mavic Pro, 3DR Iris, Parrot Disco, and Parrot Bebop 2

- >250 missions flown (~3780 minutes)
- Variety of cetacean species including bottlenose dolphins and blue, humpback, Antarctic minke, Dwarf minke, killer, and gray whales

Van Safety Driver, Duke University

Certificate in Marine Planning Advancement Training, Duke University

Advanced Scuba Diver, NAUI

Open Water Scuba Diver, PADI

OUTREACH

[Whale Ecology Homeschool Program](#), Oregon Sea Grant, 3/29/2022

Using drones to assess the body condition of gray whales.

New publication by GEMM Lab reveals sub-population health differences in gray whales

GEMM Lab Blog

<https://blogs.oregonstate.edu/gemmlab/2022/05/09/new-publication-by-gemm-lab-reveals-sub-population-health-differences-in-gray-whales/>

The many dimensions of a fat whale: Using drones to measure the body condition of baleen whales

GEMM Lab Blog

<https://blogs.oregonstate.edu/gemmlab/2022/04/04/the-many-dimensions-of-a-fat-whale-using-drones-to-measure-the-body-condition-of-baleen-whales/>

Drones with lasers: almost as cool as “sharks with laser beams attached to their heads”

GEMM Lab Blog

<https://blogs.oregonstate.edu/gemmlab/2022/02/07/drones-with-lasers-almost-as-cool-as-sharks-with-laser-beams-attached-to-their-heads/>

Memoirs from above: drone observation of blue, humpback, Antarctic minke, and gray whales.

GEMM Lab Blog

<https://blogs.oregonstate.edu/gemmlab/2021/11/01/memoirs-from-above-drone-observations-of-blue-humpback-antarctic-minke-and-gray-whales/>

Little whale, big whale, swimming in the water: A quick history on how aerial photogrammetry has revolutionized the ability to obtain non-invasive measurements of whales.

GEMM Lab Blog

<https://blogs.oregonstate.edu/gemmlab/2021/06/28/little-whale-big-whale-swimming-in-the-water-a-quick-history-on-how-aerial-photogrammetry-has-revolutionized-the-ability-to-obtain-non-invasive-measurements-of-whales/>

Scouting mission to Kodiak: Reconnaissance of potential gray whale research in Kodiak, Alaska.

GEMM Lab Blog

<https://blogs.oregonstate.edu/gemmlab/2021/10/11/scouting-mission-to-kodiak-reconnaissance-of-potential-gray-whale-research-in-kodiak-alaska/>

Science and Technology Summer Camp, Oregon SeaGrant, 7/20/21

Duke Marine Robotics and Remote Sensing Lab Facility Tours, 2016 - 2019

One Ocean Expeditions, March 2019

One Ocean Expeditions, December 2018

California Ocean Alliance, Marine Mammal Scientist in Training Camp, 8/2/2018

One Ocean Expeditions, November 2017

Down East Library, Beaufort, NC, 6/21/2017

Public lecture and demonstration of using UAS for local conservation.

Coastal Connections, NC State CMAST, 4/27/2017

Developed lesson plan for local K-12 educators to share with their classroom. Activity included exploring different drone images to count penguin colonies in Antarctica

Brewster Middle School, Camp Lejeune, 4/18/2017

Overview of how drones can be used for science and conservation. Interactive presentation followed by a demo.

SciREN Coast, 2/19/2017

Developed lesson plan for local K-12 Educators to use drones in science and conservation. Lesson plan included free downloadable PowerPoint embedded with interactive videos.

MEDIA COVERAGE

Journal of Experimental Biology, March 2, 2022

Gargantuan whales more maneuverable than they ought to be

<https://journals.biologists.com/jeb/article/225/5/jeb244075/274594/Gargantuan-whales-more-maneuverable-than-they>

LA Times December 17, 2021

Unprecedented die-offs, melting ice: Climate change is wreaking havoc in the Arctic and beyond

<https://www.latimes.com/environment/story/2021-12-17/north-pacific-arctic-ecosystem-collapse-climate-change>

News Times, November 30, 2021

Whales eat far more than thought

https://www.newportnewstimes.com/community/whales-eat-far-more-than-thought/article_df338c80-41b0-11ec-8176-4797ca6ecc6c.html

Duke Graduate School, April 8, 2020

PhD Students Create A Whale of A Program

<https://gradschool.duke.edu/about/news/phd-students-create-whale-program>

The Washington Post, December 28, 2019

We learned a lot about whales this year

<https://www.washingtonpost.com/science/2019/12/28/we-learned-lot-about-whales-this-year/>

Coastal Review Online, September 18, 2019

Researchers Automate Whale Data Collection

<https://www.coastalreview.org/2019/09/researchers-automate-whale-data-collection-2/>

ABC News, May 21, 2019

Scientists are 'racing against the clock' to collect crucial data on life in Antarctica

<https://abcnews.go.com/International/scientists-racing-clock-collect-crucial-data-life-antarctica/story?id=63150911>

World Wildlife Fund (WWF), May 21, 2019

New technology helps WWF and partners study whales in one of the most remote places on the planet

<https://www.worldwildlife.org/stories/new-technology-helps-wwf-and-partners-study-whales-in-one-of-the-most-remote-places-on-the-planet>

ABC Nightline, May 20, 2019

Part 1: Researchers brave brutal conditions to research climate change in Antarctica.

<https://abcnews.go.com/Nightline/video/researchers-brave-brutal-conditions-research-climate-change-antarctica-63167400>

Part 2: Antarctic whales an indicator for world environmental health.

<https://abcnews.go.com/Nightline/video/antarctic-whales-indicator-world-environmental-health-scientists-part-63167468>

World Wildlife Fund (WWF), May 8, 2019

The next generation of Antarctic scientists.

https://www.wwf.org.au/news/blogs/the-next-generation-of-antarctic-scientists?utm_source=Twitter&utm_medium=organic_social&utm_campaign=antarctica&utm_content=link-gs.i0cnw0

World Wildlife Fund (WWF), April 18, 2019

Soaring to new heights in Antarctica.

<https://www.wwf.org.au/news/blogs/in-photos-soaring-to-new-heights-in-antarctica-gs.i0cbrz>

PBS News Hour, July 3, 2017

Drones are revolutionizing how we study humpback whales (Video).

<https://www.pbs.org/newshour/show/drones-are-revolutionizing-how-we-study-humpback-whales>

National Centers for Coastal Oceans Science, January 17, 2018

Melting Antarctic Sea Ice Threatens Minke Whales. <https://coastalscience.noaa.gov/news/melting-antarctic-sea-ice-threatens-minke-whales-video/>

PBS News Hour, January 24, 2018

Finding a complete dolphin skeleton to study isn't easy, unless you have a dolphin graveyard.
<https://www.pbs.org/newshour/science/finding-a-complete-dolphin-skeleton-to-study-isnt-easy-unless-you-have-a-dolphin-graveyard>

PBS News Hour, January 17, 2018

This graveyard gives scientists insight into lives of stranded dolphins.

<https://www.pbs.org/newshour/show/this-graveyard-gives-scientists-insight-into-lives-of-stranded-dolphins>

Wetland Wire, Volume 16, Number 1, Summer 2017

<https://nicholas.duke.edu/wetland/WWsummer2017.pdf>

Duke University Wetlands Center Headlines, June 5, 2017

<https://nicholas.duke.edu/wetland/headline1702.htm>

Coastal Review Online February 23, 2017

Science Network Links Researchers, Teachers.

<http://www.coastalreview.org/2017/02/sciren-connects-researchers-teachers/>

REFERENCES

Dr. Leigh G. Torres

Associate Professor, Oregon Sea Grant
Marine Mammal Institute, Department of Fisheries, Wildlife, & Conservation
Oregon State University
Hatfield Marine Science Center, 2030 SE Marine Science Drive
Newport, OR 97365
(541) 867-0895
leigh.torres@oregonstate.edu

Dr. David W. Johnston

Associate Professor of the Practice of Marine Conservation Ecology
Duke University Marine Lab
135 Duke Marine Lab Rd, Beaufort, NC 28516
(252) 504-7593
david.johnston@duke.edu

Dr. Ari S. Friedlaender

Associate Researcher
Institute for Marine Sciences
University of California Santa Cruz
115 McAllister Way, Santa Cruz, CA 95060
(919) 672-0103
ari.friedlaender@ucsc.edu