

Michelle R. Shero, PhD



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Overview

I am a tenure-track Assistant Scientist at Woods Hole Oceanographic Institution's Biology Department, with expertise in **physiological ecology of marine mammals**. I study how animals are able to "make a living" at the ends of the earth, and why some animals are more robust than others – i.e., stay in better condition and attain higher reproductive rates. I take an **integrative, systems-biology approach**, using a diverse toolset to assess the processes driving intra- and inter-specific variation in animal life history cycles. In doing so, I have acquired skills in genomic sequencing, ultrasonography, diving and exercise physiology, isotopic dilution, endocrinology, unmanned aerial systems, and utilizing telemetric relay loggers to analyze behavior. My goals are to elucidate when animals are most vulnerable to climate and anthropogenic perturbations and to further understand how these mechanisms translate to the population-level, such that conservation management protocols can be tailored and made most effective.

I aim to inspire and foster the next generation of biologists, and have taught undergraduate/graduate level Comparative Physiology and Marine Biology courses. I work to **relay my research** to the scientific community (>40 national/international meeting abstracts and symposia), and to the public (outreach as TEDx speaker, through *PolarTREC*, *She Flies* addressing gender equality in STEM, and local events).

Professional Appointments

2018-present	Assistant Scientist, <i>tenure-track</i> : Woods Hole Oceanographic Institution, Dept. of Biology
2018-present	Affiliate Associate Professor: Univ. of Alaska Anchorage, Dept. of Biological Sciences
2018	Post-Doctoral Researcher: Duke University, Marine Laboratory
2015-2018	Post-Doctoral Researcher: University of Alaska Anchorage, Dept. of Biological Sciences
2015-2016	Visiting Researcher: Univ. of Saskatchewan, Western College of Veterinary Medicine
2012-2015	National Science Foundation Graduate Research Fellow
2011-2015	Graduate Research Assistant: University of Alaska Fairbanks, SFOS Marine Biology
2011	Phi Beta Kappa National Honor Society
2009-2010	NSF Research Experience for Undergraduates Intern: Univ. of Alaska Anchorage
2008	Research Assistant: Johns Hopkins School of Medicine

Education

Post-Doctoral Researcher, Duke University, Nicholas School of the Environment

2018, Advisor: Dr. David Johnston

Research project: Marine mammal conservation using unmanned aircraft systems (UAS)

Post-Doctoral Researcher, Univ. of Alaska Anchorage, Biological Sciences

2015-2018, Advisors: Dr. Jennifer Burns (co-advised with Gregg Adams, U. Saskatchewan)

Research project: Minimally-invasive ultrasonography reveals energetic constraints have shaped the Weddell seal's reproductive cycle, and challenges that all pinnipeds have embryonic diapause

- Pilot project: A genetic basis for intra-specific variation in Weddell seal reproductive rates, using next-generation sequencing

Ph.D., Univ. of Alaska Fairbanks (joint with Anchorage campus), Marine Biology

2011-2015, Advisors: Dr. Jennifer Burns (co-advised with Dr. Jo-Ann Mellish, UAF)

Dissertation: To pup or not to pup? Using physiology and dive behavior to answer the Weddell seal's overwinter question. GPA: 4.0

St. Mary's College of Maryland, B.A. Biology with minor in Environmental Studies

2007-2010. Overall GPA: 3.95, *summa cum laude*, Phi Beta Kappa

Academic Awards, Honors, and Associations

Fellowships

2012-2015 NSF Graduate Research Fellowship **\$127,500**
2009-2010 NSF Research Experience for Undergraduates Internship

Research & Travel Awards

2017 NSF Office of Polar Programs award ANT-1246463 (project *PI*, while Dr. Burns at NSF)
2017 Alaska INBRE Bioinformatics award (*PI*) – Metabolomics **\$15,120**
2016-2017 Alaska INBRE Bioinformatics award (*Co-PI*) – Next Generation Sequencing **\$24,411**
2011-2017 Alaska INBRE Travel Award **\$12,000**
2016 Scientific Committee on Antarctic Research, Travel Award **\$2,250**
2016 Federation of American Societies for Experimental Biology, Travel Award **\$1,000**
2016 Royal Saskatchewan Museum, Travel Award **\$1,700**
2015 Society of Marine Mammalogy Travel Award **\$200**
2014 LGL Alaska Graduate Ecology Research Award **\$800**
2014 University of Alaska Fairbanks, Robert and Kathleen Byrd Research Competition **\$800**
2013 University Center in Svalbard Scholarship and Travel Award **\$3,000**
2013 LGL Alaska Graduate Ecology Research Award **\$2,000**
2013 ENRI Graduate Student Research Award **\$5,000**
2012 Center of Global Change Student Research Grant Competition **\$9,910**
2012 LGL Alaska Graduate Student Research Award **\$1,600**
2011 Alaska INBRE Graduate Student Research Award **\$2,998**

Honors

TEDx Fairbanks Speaker
Early career oral presentation award, *Scientific Committee on Antarctic Research* international meeting
New Phytologist Award, best student poster at *Ecological Society of America* national meeting
Antarctic Service Medal
Phi Beta Kappa National Honor Society
Beta Beta Beta National Biological Honor Society (*President in 2010*)
St. Mary's College Academic Achievement Award Scholarship

Associations

American Physiological Society
Animal Behavior Society
Ecological Society of America
Society for Experimental Biology
Scientific Committee on Antarctic Research
Society of Marine Mammalogy
Society of Integrative & Comparative Biology

Peer-Reviewed Publications

In Print

- [1] Smeele, Z.E., J.M. Burns, K. Van Doorsaler, R.S. Fontenele, K. Waits, D. Stainton, **M.R. Shero**, R.S. Beltran, A.L. Kirkham, R. Bergartt, S. Kraberger, A. Varsani. 2018. Diverse papillomaviruses identified in Weddell seals. *Journal of General Virology*. 99(4): 549-557.

- [2] **Shero, M.R.**, D. Bergfelt, J.W. Testa, and G.P. Adams. 2018. Pairing ultrasonography with endocrinology to elucidate underlying mechanisms of successful pregnancy in the northern fur seal (*Callorhinus ursinus*). *General and Comparative Endocrinology*. 255: 78-89. Doi: 10.1016/j.ygcen.2017.10.007.
- [3] Fahsbender, E., J.M. Burns, S. Kim, S. Kraberger, A. Eilers, **M. Shero**, R. Beltran, A. Kirkham, R. McCorkell, R. Bergartt, M.F. Male, K. Rosario, G. Ballard, D.G. Ainley, M. Breitbart, A. Varsani. 2017. Diverse and highly recombinant anelloviruses associated with Weddell seals in Antarctica. *Virus Evolution* 3(1): vex017. Doi: 10.1093/ve/vex017.
- [4] Goetz, K.T., J.M. Burns, L. Hückstädt, **M.R. Shero**, and D.P. Costa. 2016. Temporal variation in isotopic composition and diet of Weddell seals in the western Ross Sea. *Deep Sea Research II*, doi: 10.1016/j.dsr2.2016.05.017.
- [5] **Shero, M.R.**, G.P. Adams, and J.M. Burns. 2015. Field use of ultrasonography to characterize the reproductive tract and early pregnancy in a phocid, the Weddell seal (*Leptonychotes weddellii*). *Anatomical Record* 298(12): 1970-1977.
- [6] **Shero, M.R.**, D.P. Costa, and J.M. Burns. 2015. Scaling matters: Incorporating body composition into Weddell seal seasonal oxygen store comparisons reveals maintenance of aerobic capacities. *Journal of Comparative Physiology B* 185(7): 811-824.
- [7] **Shero, M.R.**, R.T. Krotz, D.P. Costa, J.P. Avery, and J.M. Burns. 2015. How do overwinter changes in body condition and hormone profiles influence Weddell seal reproductive success? *Functional Ecology* 29(10): 1278-1291.
- [8] **Shero, M.R.**, L.E. Pearson, D.P. Costa, and J.M. Burns. 2014. Improving the precision of our ecosystem calipers: A modified morphometric technique for estimating marine mammal mass and body composition. *PLoS ONE* 9(3): e91233.
- [9] **Shero, M.R.**, R.D. Andrews, K.C. Lestyk, and J.M. Burns. 2012. Development of the aerobic dive limit and muscular efficiency in northern fur seals (*Callorhinus ursinus*). *Journal of Comparative Physiology B* 182(3): 425-436.
- [10] Sun, H., A. Swaim, J.E. Herrera, D. Becker, L. Becker, K. Srivastava, L.E. Thompson, **M.R. Shero**, A. Perez-Tamayo, B. Suktitpat, R. Mathias, A. Contractor, N. Faraday and C.N. Morrell. 2009. Platelet kainate receptor signaling promotes thrombosis by stimulating cyclooxygenase activation. *Circulation Research* 105: 595-603.

In Preparation / Submitted

- [1] **Shero, M.R.**, K.T. Goetz, D.P. Costa, and J.M. Burns. Temporal changes in Weddell seal dive behavior over winter: Are females changing foraging tactics to support gestation? *Accepted at Ecology & Evolution*.
- [2] **Shero, M.R.**, P. Reiser, L. Simonitis, and J.M. Burns. Life history is linked with muscle phenotype: Development in precocial and altricial pinniped pups. *In Prep*.
- [3] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. Weddell seal reproductive phenology challenges the notion that all pinnipeds have embryonic diapause. *In Prep*.

*And other on-going work from post-doctoral project & collaborations in preparation.

Invited Talks

TED

TEDx Fairbanks Event. What the southernmost mammal can tell us about living through change. Presented April 2017, <https://www.youtube.com/watch?v=13hZcQhBx2Q>.

Academic Institutions, Meetings, and Seminar Series

Duke University, Ecology Program seminar series, Durham, NC. December 2018 TBD.

Woods Hole Oceanographic Institution, Woods Hole, MA. Presented “From cells to behavior of marine mammal life history: Finding ‘tipping points’ in a changing world.” 2018

The 18th International Congress on Animal Reproduction, in *Tours, France*. Presented “Ultrasonography reveals a pinniped that may not have an embryonic diapause” 2016

The Smithsonian Conservation Biology Institute, Center for Species Survival, in *Front Royal, VA*. Presented “Reproductive ecology of Weddell seals in McMurdo Sound, Antarctica.” 2015

University of Saskatchewan’s One Reproductive Health seminar series, in *Saskatoon, Canada*. Presented “Reproductive biology of Weddell seals in Antarctica.” 2015

The 52nd Annual Conference of the Animal Behavior Society, Symposium Speaker, in Anchorage, AK. Presented “Weddell seal overwinter dive behavior in the Ross Sea: Do foraging efforts increase to support gestation?” 2015

Peer-Reviewed Conference Abstracts

National & International Meetings

Oral Presentations

- [1] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, K.T. Goetz, D.P. Costa, and J.M. Burns. From “-omics” to behavior of reproduction in a top Antarctic predator. *Polar 2018 conference (Scientific Committee on Antarctic Research/Arctic Summit dual meeting) in Davos, Switzerland, June 2018.*
- [2] Costa, D.P., L. Hückstädt, K.T. Goetz, **M.R. Shero**, and J.M. Burns. Dive behavior and stable isotopes: index of foraging specialization in seals. *Polar 2018 conference (Scientific Committee on Antarctic Research/Arctic Summit dual meeting) in Davos, Switzerland, June 2018.*
- [3] **Shero, M.R.**, A.L. Kirkham, D.P. Costa, and J.M. Burns. 2018. Iron mobilization during lactation draws from aerobic dive capacities in Weddell seals: A previously unexplored cost to a capital-breeding system. *Accepted for presentation at the Society for Integrative and Comparative Biology, January 2018.*
- [4] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. 2017. Minimally-invasive ultrasonography reveals a pinniped that may not have an embryonic diapause. Society for Marine Mammalogy Biennial Meeting, *presented October 2017 in Halifax, Nova Scotia.*
- [5] Burns, J.M., **M.R. Shero**, and R.S. Beltran. 2017. Maternal constraints on the timing of weaning in Weddell seals. Society for Marine Mammalogy Biennial Meeting, *presented October 2017 in Halifax, Nova Scotia.*
- [6] Kirkham, A.L., **M.R. Shero**, G.P. Adams, R.B. McCorkell, R.S. Beltran, D.L. Thompson Jr. and J.M. Burns. Serum prolactin concentrations in an Antarctic phocid: sharp declines in midsummer and links to reproduction and molt. Society for Marine Mammalogy Biennial Meeting, *presented October 2017 in Halifax, Nova Scotia.*
- [7] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. 2017. Weddell seal reproductive phenology challenges the notion that all pinnipeds have embryonic diapause. XIIth Scientific Committee on Antarctic Research Biology Symposium, *July 2017 in Leuven, Belgium.*
- [8] Burns, J.M., **M.R. Shero**, R.S. Beltran. 2017. Maternal constraints on the timing of weaning in Weddell seals. XIIth Scientific Committee on Antarctic Research Biology Symposium, *presented July 2017 in Leuven, Belgium.*

- [9] Kirkham, A.L., J. Avery, **M.R. Shero**, R.S. Beltran, J.M. Burns. 2017. Endocrine regulation of body stores varies with reproductive status in female Weddell seals. XIth Scientific Committee on Antarctic Research Biology Symposium, *presented July 2017 in Leuven, Belgium*.
- [10] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. 2016. Do Weddell seals “freeze” pregnancy? Intra-specific variation in gestation of a top Antarctic predator. XXXIV Scientific Committee on Antarctic Research Open Science Conference, August 2016 in Kuala Lumpur, Malaysia (***best early career oral presentation award***).
- [11] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. 2015. Timing is everything: Minimally-invasive ultrasonographic techniques shows intra-specific variation in the initiation and probability of pregnancy in the Weddell seal. The 21st Biennial Conference on the Biology of Marine Mammals, San Francisco, California.
- [12] Beltran, R.S., **M.R. Shero**, A.L. Kirkham, J.W. Testa, and J.M. Burns. 2015. Diving deeper into the over-summer foraging behavior of a top polar predator, the Weddell seal. The 52nd Annual Conference of the Animal Behavior Society, Anchorage, Alaska.
- [13] **Shero, M.R.**, G.P. Adams, A.L. Kirkham, and J.M. Burns. 2014. Breaking Diapause: Successful use of ultrasonography shows intra-specific variation in the probability and timing of embryo implantation in Weddell seals. American Physiological Society Intersociety Meeting: Comparative Approaches to Grand Challenges in Physiology, San Diego, California.
- [14] Burns, J., J. Prewitt, **M. Shero**, D. Freistroffer, S. Karpovich, and G. Blundell. 2014. Size matters: The impact of body mass on biochemical and structural properties in harbor seal muscles. American Physiological Society Intersociety Meeting: Comparative Approaches to Grand Challenges in Physiology, San Diego, California.
- [15] Goetz, K., P. Robinson, **M. Shero**, J. Burns, and D. Costa. 2014. Seasonal habitat preference and foraging behavior of a top Antarctic predator, the Weddell seal. The 5th International Biologging Science Symposium, Strasbourg, France.
- [16] Goetz, K., P. Robinson, **M. Shero**, J. Burns, and D. Costa. 2014. Location, location, location: Seasonal movement patterns and foraging behavior of Weddell seals in the Ross Sea, Antarctica. XXXIII Scientific Committee on Antarctic Research Biennial Meeting, Auckland, New Zealand.
- [17] **Shero, M.R.**, K.T. Goetz, L.E. Pearson, P.W. Robinson, L.A. Hückstädt, D.P. Costa, and J. M. Burns. 2013. Aerobic capacities and seasonal differences in diving behavior of Weddell seals. The Society for Experimental Biology Annual Main Meeting, Valencia, Spain.
- [18] **Shero, M.R.**, L.E. Pearson, K.T. Goetz, P.W. Robinson, L.A. Hückstädt, D.P. Costa, and J. M. Burns. 2013. How Weddell seals stay in shape: using morphometric and isotopic dilution techniques to assess seasonal changes in body condition. Annual Conference of the Society for Integrative and Comparative Biology, San Francisco, California.
- [19] Goetz, K., P. Robinson, **M. Shero**, J. Burns, and D. Costa. 2012. O’séal where art thou? Overwinter movement, habitat, and navigation of Weddell seals in the Ross Sea. The Scientific Committee on Antarctic Research Conference, Portland, Oregon.
- [20] Burns, J., K. Goetz, **M. Shero**, D. Costa, and J.W. Testa. 2012. Does twenty years make a difference? Weddell seal diving behavior in the Ross Sea, 1990 vs 2010. The Scientific Committee on Antarctic Research Conference, Portland, Oregon.
- [21] Burns, J.M., M.O. Hammill, **M.R. Shero**, K.C. Lestyk, J.P. Richmond, and S. Geiseler. 2012. Physiological development of juvenile marine mammals: implications for the transition to independent foraging. The Society of Experimental Biology Annual Meeting, Salzburg, Austria.
- [22] **Shero, M.R.**, L.E. Pearson, K.T. Goetz, P.W. Robinson, L.A. Hückstädt, D.P. Costa, and J.M. Burns. 2011. What makes a year-round athlete?: seasonal changes in Weddell seal (*Leptonychotes weddellii*) physiological condition and links with diving behavior. The Society of Marine Mammalogy’s (SMM) 19th Biennial Conference, Tampa, Florida.

- [23] **Shero, M.R.**, K.C. Lestyk, R.D. Andrews, and J.M. Burns. 2010. Development of oxygen stores and muscle in Northern fur seals (*Callorhinus ursinus*): limits on juvenile foraging ability? Annual Conference of the Society for Integrative and Comparative Biology, Seattle, Washington.

Poster Presentations

- [1] **Shero, M.R.**, A.L. Kirkham, G.P. Adams, R.B. McCorkell, and J.M. Burns. Metabolomics profiles reveal that upregulation of protein degradation and nicotinamide pathways are linked with successful pregnancy in Weddell seals. *Submitted for presentation at the American Physiological Society Intersociety meeting in New Orleans, October 2018.*
- [2] Kirkham, A.L., R.S. Beltran, S.M. Walcott, **M.R. Shero**, D. Thompson, J. Avery, and J.M. Burns. How do hormones and the skin transcriptome influence molt in a polar pinniped? *Polar 2018 conference (Scientific Committee on Antarctic Research/Arctic Summit dual meeting) in Davos, Switzerland, June 2018.*
- [3] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. 2016. Probing for answers in Weddell seals: Ultrasonography reveals a pinniped that may not have an embryonic diapause. The 18th International Congress of Animal Reproduction, June 2016 in Tours, France.
- [4] Kirkham, A.L., **M.R. Shero**, G.P. Adams, R.B. McCorkell, S. Atkinson, and J.M. Burns. 2016. Circulating concentrations of progesterone and estrogen in Weddell seals during the breeding period and early pregnancy. Experimental Biology Conference, San Diego, California.
- [5] Kirkham, A.L., **M.R. Shero**, R.S. Beltran, R.B. McCorkell, G.P. Adams, and J.M. Burns. 2015. Female Weddell seals prioritize protein deposition while recovering from lactation and beginning molt and gestation. The 21st Biennial Conference on the Biology of Marine Mammals, San Francisco, California.
- [6] Goetz, K.T., L.A. Hückstädt, **M.R. Shero**, J.M. Burns, and D.P. Costa. 2015. The foraging ecology and diet of Weddell seals in the western Ross Sea, Antarctica. The 21st Biennial Conference on the Biology of Marine Mammals, San Francisco, California.
- [7] **Shero, M.R.**, G.P. Adams, R.B. McCorkell, A.L. Kirkham, and J.M. Burns. 2015. Breaking diapause: Using minimally-invasive ultrasonographic techniques reveals intra-specific variation in the probability and timing of pregnancy in Weddell seals. The 100th Ecological Society of America Annual Meeting, Baltimore, Maryland (**winner of New Phytologist Award for best student poster in Physiological Ecology**).
- [8] **Shero, M.R.**, R.T. Krotz, D.P. Costa, J.P. Richmond, and J.M. Burns. 2014. Overwinter changes in Weddell seal body condition and hormone profiles: Implications for pregnancy? American Physiological Society Intersociety Meeting: Comparative Approaches to Grand Challenges in Physiology, San Diego, California.
- [9] Kirkham, A.L., R.S. Beltran, **M.R. Shero**, and J.M. Burns. 2014. Opposite trends in over-summer mass change: post-parturient Weddell seals gain weight while non-reproductive females lose mass and condition. American Physiological Society Intersociety Meeting: Comparative Approaches to Grand Challenges in Physiology, San Diego, California.
- [10] **Shero, M.R.**, K.T. Goetz, D.P. Costa, and J.M. Burns. 2014. Weddell seal overwinter dive behavior in the Ross Sea: Are animals approaching physiological limits to support gestation? The 5th International Bio-logging Science Symposium, Strasbourg, France.
- [11] Beltran, R.S., A.L. Kirkham, **M.R. Shero**, K.T. Goetz, D.P. Costa, J.W. Testa, and J.M. Burns. 2014. Using simple biologging metrics to inform dynamic bioenergetics models: a case study with Weddell seals. The 5th International Bio-logging Science Symposium, Strasbourg, France.
- [12] Goetz, K., P. Robinson, **M. Shero**, J. Burns, and D. Costa. 2014. Assessing the accuracy of animal-borne CTD tags under laboratory and in situ conditions. The 5th International Bio-logging Science Symposium, Strasbourg, France.

- [13] Krotz, R.T, **M.R. Shero**, D.P. Costa, J.M. Burns, and J.P. Richmond. 2014. Linking metabolic hormones to nutritional status in Weddell seals (*Leptonychotes weddellii*). Annual conference of the Society for Integrative and Comparative Biology, Dallas, Texas.
- [14] Goetz, K., L. Hückstädt, P. Robinson, **M. Shero**, L. Pearson, J. Burns, and D. Costa. 2013. Eat, prey, assimilate: stable isotopes and tracking data reveal the foraging ecology of Weddell seals in the Ross Sea, Antarctica. The Society of Marine Mammalogy's (SMM) 20th Biennial Conference, Dunedin, New Zealand.
- [15] **Shero, M.R.**, L.E. Pearson, K.T. Goetz, P.W. Robinson, L.A. Hückstädt, D.P. Costa, and J. M. Burns. 2013. Seasonal changes in Weddell seal body condition: links with diving behavior. Scientific Committee on Antarctic Research Biology Symposium, Barcelona, Spain.
- [16] Burns, J.M., **M.R. Shero**, J.W. Testa, and J.J. Rotella. 2013. Interactions between reproduction and molt in Weddell seals in Erebus Bay, Antarctica. Scientific Committee on Antarctic Research Biology Symposium, Barcelona, Spain.
- [17] Goetz, K.T., L.A. Hückstädt, P.W. Robinson, **M.R. Shero**, L.E. Pearson, J.M. Burns, and D.P. Costa. 2013. Combining movement and diving behavior with stable isotopes to examine the foraging ecology of a top predator in the Ross Sea, Antarctica. Scientific Committee on Antarctic Research Biology Symposium, Barcelona, Spain.
- [18] **Shero, M.**, L. Pearson, K. Goetz, P. Robinson, L. Hückstädt, D. Costa, and J. Burns. 2012. How a Weddell seal "PQs" [physically qualifies]: resistance to physiological wasting after prolonged inactivity. The Scientific Committee on Antarctic Research Conference, Portland, Oregon.
- [19] Robbins, K.A.*, **M.R. Shero**, T. Stevenson, K. Duddleston, C.L. Buck, and J.M. Burns. 2012. Hematological development in young arctic ground squirrels: a model for natural resistance to iron deficiency. Annual Conference of the Society of Integrative and Comparative Biology, Charleston, South Carolina. * = REU undergraduate student mentored
- [20] **Shero, M.**, L. Pearson, K. Goetz, P. Robinson, D. Costa, and J. Burns. 2010. Post-molt condition of Weddell seals and links with overwinter diving behavior. American Physiological Society Meeting: Global Change and Global Science: Comparative Physiology in a Changing World, Westminster, Colorado.

Professional Experience

Laboratory Skills & Training

2018 **Post-Doctoral Researcher**, in the laboratory of Dr. David Johnston, Ph.D.
Duke University Marine Laboratory, Nicholas School of the Environment

Lab research focus: 1) Drones in marine science and conservation,
2) Advancing applications, platforms, and sensors

- FAA Part 107 Remote Pilot licensed
- Training on fixed-wing and multicopter unmanned aerial systems (i.e., drones),
- Using drones for remote sensing and photogrammetry as part of the Long Term Ecological Research program at Palmer Station, Antarctica

2015-2018 **Post-Doctoral Researcher**,

2011-2015 **Graduate Student Researcher**,

2009-2010 **National Science Foundation REU Intern**, in the laboratory of Dr. Jennifer Burns, Ph.D.
University of Alaska, Anchorage, Department of Biological Sciences

Lab research focus: 1) *Physiological plasticity of pinnipeds*, 2) *its impacts on performance (dive abilities)*, and 3) *reproductive phenology*

- Determined animal body composition using radioisotope dilution techniques and morphometric measurements. Developed novel technique for accurate mass estimates using morphometrics.
- Validated commercial Radio-Immunoassays (RIAs) and Enzyme-Linked ImmunoSorbent (ELISA) assays for use in pinnipeds and measured hormone levels
- Determined total body oxygen stores for marine mammals by: hemoglobin and Evan's Blue protocols from blood and plasma samples; muscle myoglobin concentrations
- Examined different myosin heavy chain composition in neonate and adult pinniped skeletal muscle biopsies by separating isoforms with SDS-PAGE protein gels. Performed kinetic assays for catabolic enzyme activities in muscle biopsies
- Performed ultrasound examinations on pinnipeds to visualize the entire reproductive tract for determination of pregnancy status, viability, and ovarian dynamics.
- Analyzed diving behavior collected from satellite-linked recorders deployed on marine mammals, utilizing R programming tools (GLMMs, GAMMs).
- Started a pilot project using Next-Generation Sequencing to assess genetic linkages to intra-specific variability in pinniped reproductive rates (with Dr. Brandon Briggs, 2016-2017). Performed DNA extractions, PCR for amplification of 100kbp genes, gel electrophoresis, multiplexing and barcoding of genes, and MiSeq use.

2015-2016 **Visiting Researcher**, In the laboratory of Dr. Gregg Adams, D.V.M., Ph.D.
University of Saskatchewan, Western College of Veterinary Medicine

Lab research focus: *Ovarian follicle development, ovulation, and fertility in cattle, cervids, camelids, and humans*

- Gained experience utilizing ultrasonography to visualize the entire reproductive tract and follicular development in llamas, wood bison, horses, and cattle.
- Assisted with ongoing projects in the lab including in-vitro fertilization of bovine embryos & imaging, ovarian synchronization and superstimulation in wood bison, for IVF treatment
- Audited Western College of Veterinary Medicine courses in: Theriogenology and Embryology

2008 **Research Assistant**, in the laboratory of Dr. Craig Morrell, D.V.M., Ph.D.
The Johns Hopkins School of Medicine, Department of Molecular & Comparative Pathobiology

Lab research focus: 1) *Pathways of platelet activation and thrombosis,*
2) *Immune regulatory role of platelets*

- Performed in-vivo leukocyte rolling experiments for autoimmune disease and thrombosis studies.
- Performed skin transplant rejection experiments, which included performing Enzyme-Linked ImmunoSorbent Assays (ELISAs), bone marrow and T-cell isolation techniques, and Western blots.
- Maintained cell cultures and performed transfections, genotyped mice, and flow cytometry assays
- Maintained data spreadsheets. Worked with veterinarians to achieve best practice care of laboratory animals. Observed surgical veterinary procedures, and given opportunity for hands-on learning of laparoscopic techniques.

Fieldwork and Expeditions

Planned 2019 **Researcher**

Ross Sea Research and Monitoring Programme: is the world's largest MPA Effective?
Scott Base, Antarctica (New Zealand Program)

Collaborators: Kimberly Goetz, Ph.D.

- Leading physiological sampling effort, pregnancy examinations, and unmanned aerial surveys (UAS) for 3-dimensional models of Weddell seals. Efforts focused on late summer, to pair physiologic data with diving behaviors with satellite tags, for the first time in post-partum females.
 - Prepared CONOPS for drone work, and a NMFS Marine Mammal Permit (under review)
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2018 **Post-Doctoral Researcher**, with Drs. David Johnston and Ari Friedlaender, Ph.D.

*Late-season summer condition of Humpback whales along the Western Antarctic Peninsula
(as part of an ongoing Long-Term Ecological Research Project)*

- Worked as a post-doctoral researcher on the Antarctic field team based on the *R/V Laurence M. Gould* to acquire images of humpback whale for photogrammetric analysis, using a custom built unmanned aerial system (e.g., drone)
 - Collected cetacean skin/blubber biopsies
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2013-2017 **Post-Doctoral Researcher**, with Drs. Jennifer Burns, Ph.D., Gregg Adams D.V.M., Ph.D., Robert McCorkell D.V.M., Ph.D.

*The cost of a new fur coat: Interactions between molt and reproduction in Weddell seals.
McMurdo Station, Antarctica*

- Made seven deployments to McMurdo Station as a graduate & post-doctoral researcher on the Antarctic field team to survey the local Weddell seal population and take physiological samples (blood, biopsies) to assess overall health and condition. Trained new graduate students in animal handling and lab techniques.
 - Experience testing and preparing all electronic tags for deployment: time-depth recorders, satellite tags, VHF tags and searching for tagged study animals via helicopter support.
 - Worked with veterinarians Dr. Gregg Adams and Robert McCorkell to learn techniques utilizing ultrasonography for early pregnancy detection (size: < 3 mm), embryo viability, and ovarian status.
 - Played large role in permit applications for this project.
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2014 **Field Assistant**, with Drs. Jo-Ann Mellish, Markus Horning, and Allyson Hindle, Ph.D.

Reproduction, survival and depredation of Steller sea lions from the declining western Aleutian Islands in relation to the stable eastern Gulf of Alaska region: LHX-2

- Assisted with capturing yearling/juvenile Steller sea lions via boat capture for health assessments and implantation of life history loggers.
 - Assisted with Steller sea lion health assessments on-board the research vessel and also back at the Alaska SeaLife Center.
 - Analyzed blood samples to obtain metabolite levels and other physiological measurements.
-

2012 **Field Assistant**, for NOAA/NMML under Dr. J. Ward Testa, Ph.D.

Northern fur seal population study. St. George Island, Alaska

- Resighted flipper-tagged female northern fur seals, and assessing tag loss rates
 - Documented adult behavioral interactions with pups to assess reproductive rates
 - Performed animal counts along rookery to determine peak time of rookery utilization
 - Assisted with juvenile male round-ups for counting purposes and population estimates
-

2011-2012 **Graduate Student Researcher**, with Drs. Jennifer Burns and Daniel Costa, Ph.D.

*Weddell seals as autonomous sensors of the winter oceanography of the Ross Sea.
McMurdo Station, Antarctica*

- Made three deployments to McMurdo Station as a member of the Antarctic field team to restrain and weigh Weddell seals before deploying satellite-linked dive recorders on the animals to collect information on overwinter diving behavior, movements, and oceanography of the Ross Sea
- Collected blood samples, muscle and blubber biopsies, and measured blubber depth with an ultrasound to assess seasonal differences in physiological parameters
- Responsible for all physiology procedure preparations, radioisotope use and records while in the field, post-collection sample processing, and data management

Organizational / Funding Proposals

Research Proposal, NSF Office of Polar Programs Full-Proposal Submission

2018

As Lead Project PI, with Co-PI's Dr. Brandon Briggs Ph.D. and Allyson Hindle, Ph.D.

Senior Personnel: Drs. Gregg Adams and Rob McCorkell, D.V.M., Ph.D., Alex Eilers (Jennifer Burns, Ph.D.)

Physiological and Genetic Correlates of Reproductive Success in High- versus Low-Quality Weddell seals

Request ~\$1.7million

- Stemming from post-doctoral project (NSF ANT-1246463), formulated project design and experiments, designed new graduate student projects, performed literature searches, wrote proposal, included preliminary data, planned logistical aspects, determined all budgetary requirements
- Weddell seals have substantial heterogeneity in reproductive rates with the most *high-quality* females producing >2x the number of pups per decade, as compared to *low-quality* females. This project aims to elucidate whether the ability to successfully produce pups year-after-year hinges on *robust* females being better able to balance energetic costs of current offspring, such that there are fewer carry-over effects that would impede reproductive effort for future offspring. To address these issues, we propose integrating (1) organismal energetics and (2) genome to phenome approaches.

Research Proposal, NSF Office of Polar Programs

2013-2018

Served as PI, distributing award for Dr. Jennifer Burns (while NSF program officer)

with Dr. J. Ward Testa as Co-PI, and Senior Personnel: Drs. Gregg Adams & Rob McCorkell, D.V.M., Ph.D.

The Cost of a New Fur Coat: Interactions between Molt and Reproduction in Weddell seals

Awarded: \$1,249,867; NSF OPP: 1246463

- Distributing this award as PI, while Dr. Jennifer Burns is a rotating program manager at NSF. Budgeting expenditures, and overseeing graduate students and activities in the U. of Alaska Anchorage Marine Mammal Physiological Ecology laboratory.
- This project has monitored Weddell seal physiological condition, pregnancy status, and behavior throughout the year to determine if molt timing is influenced by prior reproductive outcome, and if it, in turn, influences future reproductive success. These data have been used to address the demographic consequences of trade-offs between critical life history events in Weddell seals.
 - Worked as post-doctoral researcher, and taken the role as project PI to distribute the award.
 - Prepared applications for MMPA permits required for marine mammal handling

Research Proposal, Alaska INBRE Bioinformatics Call

2017

As Project PI, with Dr. Jennifer Burns, Ph.D. (Co-PI)

Distinguishing successful pregnancy versus implantation failure at the metabolomic level in Weddell seals

– Awarded \$15,120

- Formulated project design, budget, and wrote proposal
 - Project aims to elucidate the metabolic pathways that are up- or down-regulated during the embryo implantation window in Weddell seals, critical to successful pregnancy. In combination with ultrasound examination and animal re-sight efforts, study female pregnancy

status was verified, and it was known whether females carried the embryo to term or experienced intra-uterine loss.

Research Proposal, Alaska INBRE Bioinformatics Call

2016-2017

As Project Co-PI, with Drs. Brandon Briggs (PI) and Jennifer Burns (Co-PI), Ph.D.

A Genetic Basis for Intra-Specific Variation in Weddell seal Reproductive Rates

Awarded \$24,411

- Formulated project design, utilizing archived blood and tissue samples for next generation sequencing (NGS) and bioinformatics investigation of genetic correlates with reproductive success in the Erebus Bay population of Weddell seals. There exists dramatic heterogeneity of reproductive rates in this population, with “robust” individuals producing >2x the number of pups as compared with their “frail” counterparts (robust: producing 9 pups out of 10 years; frail: 4 pups/decade).
 - Project aims to elucidate whether Weddell seal “robustness” has a genetic correlate with reproductive hormone receptor genes.
- Performed DNA extractions, amplification, multiplexing, and MiSeq Next-Generation sequencing.

Research Proposal, Center for Global Change, UA Fairbanks

2012-2014

As Project PI

*Weddell seal (*Leptonychotes weddellii*) physiological and behavioral plasticity: mechanisms to meet the demands of a changing world?*

Awarded \$9,910

- This project aimed to determine physiological changes during energetically-costly life history events in the Weddell seal life such as pupping and the molt. We accomplished this by assessing seasonal changes in (1) body condition (lipid stores), (2) stress hormone levels, and hormones known to impact energy allocation. To identify physiological factors important to reproductive success, between seals that returned the following year (t+1) and skipped reproduction versus females that gave birth.
- We deployed satellite-linked tags to assess whether females leave the breeding colonies to forage and regain some mass in-between the lactation and molt periods. Animals that did not pup during the study year, did not forage before the annual molt. In contrast, post-partum females in poor condition after lactation tended to stay local, but did indeed leave the immediate areas of the breeding colonies to forage after weaning their pups and gained ~75 kg between weaning and the annual molt.

Research Fellowship Proposal, National Science Foundation

2012-2015

As Project PI

*What makes a year-round athlete?: Seasonal changes in Weddell seal (*Leptonychotes weddellii*) physiology and links with diving behavior*

Awarded \$127,500

- Pinnipeds must extensively dive and forage efficiently directly following a prolonged period of inactivity associated with lactation and the annual molt, such that they can quickly recuperate energy stores. Therefore, this project aimed to determine whether the Weddell seal is resistant to the negative impacts associated with inactivity such as is typical of terrestrial mammals.
- The primary goals are to (1) assess changes in Weddell seal physiological condition before and after prolonged inactivity, and (2) to evaluate how strongly physiological condition correlates with physical activity and behavior.

Teaching Experience & Training

Teaching & Mentoring Experience

- 2017 **Lead Instructor, Undergraduate Upper-Level Marine Biology Lecture**, *University of Alaska Anchorage, Department of Biological Sciences*, lecture for the upper level semester course in Marine Biology for ~20 students. Designed syllabus and curriculum – incorporating primary literature and popular media, guiding students to evaluate literature and communicate marine science to the public – particularly with human impacts on our marine environment in Alaska.
- 2016 **Co-Instructor, Undergraduate/Graduate Level Comparative Animal Physiology Lecture**, *University of Alaska Anchorage, Department of Biological Sciences*, lectures for the 415/615 upper level semester course. Designed syllabus and curriculum – incorporating primary literature and popular media, developed quizzes and exams, designed classroom discussions and hands-on activities.
- 2012 **Biology Teaching Assistant**, *University of Alaska Anchorage, Department of Biological Sciences*, Undergraduate Introductory Biology Laboratory
- 2011,2013,2014 **Undergraduate Mentor**, Trained *NSF Research Experience for Undergraduate* intern in lab techniques, data analysis, and preparation of presentations. Invited speaker to present research at REU meetings to help students prepare their own oral presentations.
- *Students*: Jessica Espinosa; “The impacts of reproductive status on Weddell seal condition and aerobic capacity across the austral summer”
 - Lauren Simonitis; “Difference in muscle fiber types in harp and hooded seals of different age classes”; Student is co-author on manuscript in preparation.
 - Katie Robbins; “Hematological development in young Arctic Ground Squirrels: A model for natural resistance to iron deficiency?”
- 2008 **Biology Teaching Assistant**, *St. Mary’s College of Maryland, Biology Department*, Teaching Assistant for undergraduate Principles of Biology Laboratory

Guest Lectures

- 2015 **Guest Lecturer**, *University of Alaska Anchorage, Department of Biological Sciences*, Undergraduate lower-division Principles of Biology, “Action Potentials- Nerves to Muscles”
- 2013 **Guest Lecturer**, *University of Alaska Anchorage, Department of Biological Sciences*, Lectured for upper-level undergraduate marine biology course, “Oceanography and Climate Change”

Curriculum Development & Training

- 2016 **Course Participant, Mentor Training Program**, *National Research Mentoring Network* Research mentor training course covering: effective communication, promoting professional development, establishing expectations, assessing understanding, exploring cultural awareness, fostering independence, addressing diversity, cultivating ethical behavior, promoting mentee research self-efficacy
- 2016 **Course Participant**, *University of Alaska Anchorage, Center for Advancing Faculty Excellence*
- Creating an Inclusive Classroom Workshop
 - Team Based Learning (Flipped Classroom) Workshop

- 2015 **Course/Curriculum Development Course Participant**, *University of Alaska Fairbanks, Science Teaching and Outreach Program, Course in Instructional Design*. Class end goal of developing a course and syllabus for an upper-level Comparative Animal Physiology class.
- 2012 **Course/Curriculum Development Course Participant**, *University of Alaska Anchorage, Department of Biological Sciences*. Developed undergraduate class lectures as the main focus of Adv. Vertebrate Endocrinology graduate coursework, with Dr. Loren Buck, Ph.D.

Outreach, Service, Media, & Volunteer Work

Outreach

- 2018 ***She Flies Instructor***. Organized an instructor training workshop that brought Dr. Karen Joyce to Duke University to train local school teachers, graduate students, and post-doctoral researchers in effective outreach methods. The *She Flies* program (<https://sheflies.com.au/>) uses drones as a platform to address gender equality in STEM, while simultaneously building leadership skills and exposing students to science and engineering technologies.
- 2018 **Panelist, Girls Exploring Science and Technology event**. Outreach event to inspire excitement for fields in which women are under-represented. ~200 middle school girls from North Carolina attended.
- 2017 **Speaker, STEM Day** at University of Alaska Anchorage, College of Arts and Sciences.
- 2017 **Volunteer, Alaska Native Science and Engineering Program**. Performed northern sea otter necropsies with Alaska native 6-8th grade students, and taught them about marine mammal physiology.
- 2017 **Speaker at the University of Alaska Anchorage's Kids-2-College event**. Presentation encouraged 5th and 6th graders from low-income areas in Anchorage to pursue higher education. Spoke to ~150 students.
- 2016 **Speaker McMurdo Science Lecture Series**, presented "The Cost of a New Fur Coat: Interactions between Molt and Reproduction in Weddell seals."
- 2015 **Speaker at Matanuska-Susitna College wildlife lecture series**, to all age groups. "Fur seals and Weddell seals: From Open Oceans to Icy Shores."
- 2014,2016 **Speaker, Live-Connect PolarTREC event**, from McMurdo Station, Antarctica. Relayed current research to ~8,000 K-12 participants.
- 2012,2014,2016 **Editor**. Checked and added scientific content to PolarTREC education & outreach journals entitled "Weddell seals in the Ross Sea" project, in collaboration with Ms. Alex Eilers from the Pink Palace Museum in Tennessee See:
 – <https://www.polartrec.com/expeditions/weddell-seals-in-the-ross-sea-2016/journals/2016-01-26>
 – <http://www.polartrec.com/expeditions/weddell-seals-in-the-ross-sea-2014>
 – <http://www.polartrec.com/expeditions/weddell-seals-in-the-ross-sea/journals>
- 2014 **Speaker at Opportunities for Lifelong Education program** in Anchorage, Alaska. Presented on-going research on Northern fur seals and Weddell seals, to an adult education group.
- 2013 **Speaker, K-12 Teacher workshop on "real world" mathematical applications**. Presented "Weddell seal morphometrics" activity for a teacher workshop focusing on "real-word" mathematical examples in collaboration with Ms. Lynn Reed, Einstein Fellow in NSF Polar Programs.

- 2012 **Speaker**, “Weddell seal research in McMurdo Sound, Antarctica,” Lecture for Pribilof Marine Science Camp children, St. George Island, Alaska.
- 2012 **Speaker** “How do Weddell seals dive and stay warm in the Antarctic?”. Workshop for Women of Science & Technology Day, Anchorage, Alaska
- 2010 **High School Science Fair Judge**, Volunteered as judge at the Sherwood High School (Montgomery County, MD) science fair.

Service

- 2017 **Session Convener, Scientific Committee on Antarctic Research International Meeting**, Co-convener for session “Adaptation and processes in top predators” for biennial biology symposium for the Scientific Committee on Antarctic Research, held July 2017 in Leuven, Belgium. – Reviewed abstracts, organizing oral and poster sessions, chairing sessions.
- 2016 **Session Convener, Scientific Committee on Antarctic Research International Meeting**, Co-convener for session “Physiological adaptations, plasticity, and the stress response in Antarctic organisms” for biennial open science meeting for the Scientific Committee on Antarctic Research, to be held August 2016 in Kuala Lumpur, Malaysia. – Developed session goals, reviewed abstracts, organized oral and poster sessions, chaired sessions, and judged presentations.
- 2013 **Chair, Scientific Committee on Antarctic Research Biology Symposium, Barcelona, Spain**. Integrated perspectives on Antarctic Marine Ecosystems session.
- 2010 **President, Beta Beta Beta National Biological Honors Society**, St. Mary’s College of Maryland chapter

Reviewer

North Pacific Research Board Core Program RFP; Ecology and Evolution; Canadian Journal of Zoology; PlosOne; Global Change Biology; Anatomical Record; Marine Ecology Progress Series; Australian Journal of Zoology; Environmental Research

Media

Featured, WNCT9 News. Duke Marine Lab Drone Research

https://www.wnct.com/news/local-news/duke-marine-lab-drone-research_20180412214501/1119330591

Featured, Fairbanks News-Miner. “TEDx Fairbanks introduces its next series of speakers”

“Success Story” feature for the NSF BIO Research Experience for Undergraduates program website
<http://bioreu.org/content/success-story?sid=581>

Featured, Green & Gold news, University of Alaska Anchorage, “UAA graduate student Michelle Shero awarded National Science Foundation fellowship for 3-year study of Weddell seals”

http://greenandgold.uaa.alaska.edu/blog/9386/uaa_graduate_student_michelle_shero_awarded_national_science_foundation_fellowship_for_3year_study_of_weddell_seals/?option=com_content&view=article&id=9386.

Featured, University of Saskatchewan WCVM Today, “Ultrasound sheds light on seal reproduction”

Volunteer Work

- 2012 **International Wolf Center Pup Care Volunteer**, Provided care for two wolf pups and helped with animal conditioning for wolf care staff. Assisted with public lectures.

- 2007-2010 **Worked with Equine Veterinarian, Dr. Peter Radue, D.V.M. (over 300 hours).** Assisted with vaccinations, ultrasounds, x-rays, diagnostic tests, blood draws. Handled animals undergoing medical procedures
- 2008 **Volunteer at Washington Animal Rescue League Veterinary Clinic.** Assisted with veterinary check-ups for animals in the shelter, provided general animal care, handled animals undergoing medical procedures, and observed surgical procedures
- 2008 **Medical Mission to Honduras.** Participated in medical mission with volunteer physicians to medically-underserved areas in Honduras.