

**Dawn P. Noren, Ph.D.**  
**Research Fishery Biologist, NOAA NMFS Northwest Fisheries Science Center**  
**Affiliate Assistant Professor, School of Aquatic and Fishery Sciences, University of Washington**  
**2725 Montlake Blvd. East**  
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**(206) 302-2439**

**Education**

2002 University of California, Santa Cruz. Ph.D. Ecology and Evolutionary Biology  
1999 University of California, Santa Cruz. M.A. Ecology and Evolutionary Biology  
1997 University of California, Santa Cruz. M.S. Marine Sciences  
1994 University of Maryland, College Park. B.S. Biology, Honors Citation, Magna Cum Laude

**Research and Professional Experience**

Have experience living in remote field camps and conducting research on pinnipeds and cetaceans from small boats and large ships for extended periods of time. Proficient in handling, restraining, and weighing marine mammals, including harbor seals, northern elephant seals, Steller sea lions, and bottlenose dolphins. Proficient in using ultrasound to measure blubber thickness of harbor seals, northern elephant seals, Steller sea lions, and bottlenose dolphins. Skilled in taking blood and blubber samples from phocids and otariids, measuring body composition using tritium and the hydrogen isotope dilution method, determining lipid content and fatty acid composition of blubber biopsies, recording behavior of cetaceans and pinnipeds, and measuring metabolism using flow-through respirometry (seals, dolphins) and submerged oxygen sensors (salmon). Adept in collecting behavioral data via scan sampling and focal follow methods. Capable of identifying marine mammal species and individual members of the Southern Resident killer whale population from land and ship based platforms. Conducted research on Southern Resident killer whales for the most recent 13.5 years and have worked with the team to satellite tag whales, collect biopsies samples, collect prey remains following foraging events, and collect fecal material.

**Teaching Experience**

9/95 - 3/00 **UCSC Teaching Assistant**, Dep. of Ocean Sciences and Biology, University of California, Santa Cruz. Taught sections of students; graded papers, quizzes, and tests; prepared and ran labs; and conducted review sessions. Courses included: Field Methods in Animals Biology, Biology of Marine Mammals, Exercise Physiology, Comparative Vertebrate Physiology, Development and Physiology, Structure and Functions of Organisms, and Life in the Sea (head teaching for one quarter).  
9/99 - 12/99 **UCSC Reader**, Dep. of Ocean Sciences, University of California, Santa Cruz. Graded exams for Life in the Sea undergraduate class.  
9/96 - 6/97 **UCSC Ocean Sciences Board Student T.A. Coordinator**, Dep. of Ocean Sciences, University of California, Santa Cruz. Led meetings to inform teaching assistants of their responsibilities and resources available to them, gave advice on being a proficient T.A., and acted as a liaison between teaching assistants and the Ocean Sciences Board.

**Research and Related Work Experience**

6/09-pres. **Affiliate Assistant Professor**, School of Aquatic and Fishery Sciences, University of Washington, Seattle, WA. Serve on thesis committees, supervise student interns, and advise undergraduate Capstone projects.  
5/03-pres. **Research Fishery Biologist**, NOAA NMFS Northwest Fisheries Science Center. Develop research programs for marine mammals, particularly Southern Resident killer whales (SRKWs), in the Pacific Northwest. Organize and participate in scientific workshops and meetings on pertinent SRKW research and management issues. Write statements of work to be filled by government contractors and review research proposals and permit applications. Collaborate with other NMFS Science Centers, NMFS Headquarters, NMFS West Coast Regional Office, Washington Department of Fish and Wildlife (WDFW), University of CA Santa Cruz, University of WA, NGOs, and independent researchers on killer whale research projects and management issues. Monitor program budget and research project budgets. Drafted outreach documents, including research updates and a document describing the first 10 years of our program's research on Southern Resident killer whales. Investigated habitat use patterns in the core summer critical habitat, examined relationships between energetic parameters (swim speed, dive durations, etc.) and different activity states (forage, travel, rest, and social) and assessed geographic variability of these parameters and activity

states in the core summer critical habitat. Investigated the relationship between surface active behaviors and vessel presence, examined the acoustic response of killer whales to ambient noise, and estimated daily energy expenditure and prey requirements in Northern and Southern Resident killer whales. Studying the distribution and habit use of Southern Resident killer whales in their full range and investigating killer whale behavioral responses to vessels and the energetic consequences of disturbance. Conducted research on other marine species, including measuring the energetic costs of surface active behaviors, social sound production, and echolocation clicks in bottlenose dolphins in collaboration with UCSC scientists to better understand the energetic cost of responses to disturbance from vessels and noise. Investigated the domoic acid tissue load and metabolic changes in coho salmon that have consumed domoic acid and modeling the potential domoic acid dose to killer whales that consume salmon during a bloom in collaboration with other NWFSC scientists. Determining the myoglobin content and acid buffering capacities of muscle from Pacific Northwest cetaceans to compare diving capabilities and the development of diving with age across species to assess limitations in habitat use. Conducting a study in collaboration with the US Navy Marine Mammal Program to investigate contaminant transfer from mothers to their calves during lactation in bottlenose dolphins. Investigating contaminant transfer from mothers to their calves during lactation in killer whales in collaboration with SeaWorld. Currently conducting research on the comparative and cumulative energetic costs of odontocete (killer whales, beaked whales, harbor porpoise, and bottlenose dolphins) responses to anthropogenic disturbance, which is funded by the Office of Naval Research.

- 4/02 – 4/03 **National Research Council (NRC) Postdoctoral Research Associate**, National Marine Mammal Laboratory, NOAA NMFS Alaska Fisheries Science Center, Seattle, Washington. Conducted research on Steller sea lion diving and foraging ecology. Participated in tagged and branded animal re-sight cruises and underwater captures of Steller sea lion juveniles. Assisted with morphometric measurements, including ultrasonic measurements of blubber thickness, and collected physiological samples, including blood and blubber. Developed a model that assessed how individual juvenile Steller sea lions utilize their energy reserves during fasting, how long individuals of differing body condition can survive until they must successfully find prey, and how the proportion of time spent in the water influences energy reserve utilization patterns and maximum fasting duration. Participated in an interdisciplinary modeling workshop with investigators that are modeling Steller sea lion bioenergetics, population structure, and prey dynamics. Participated in an interdisciplinary workshop on fatty acids in marine mammals and their prey.
- 9/95 - 3/02 **Graduate Student Research**, Dep. of Marine Sciences and Dep. of Biology, University of California, Santa Cruz. **Body energy reserve utilization during the postweaning fast of northern elephant seals (*Mirounga angustirostris*) pups: implications for survival (9/97 - 3/02)**. Project resulted in a Ph.D. degree in Ecology and Evolutionary Biology. Conducted research at Año Nuevo, CA on northern elephant seals. Wrote proposals and budgets for research grants. Acquired multiple grants to fund the project, ordered supplies, and maintained budget for research expenses. Field duties included: tagging northern elephant seal weaned pups, population censuses of Año Nuevo rookery, reading tags and maintaining tag records, monitoring animal behavior, performing necropsies and collecting tissue samples, manually restraining pups, chemically sedating pups (utilizing Ketamine and Valium), weighing animals, taking morphometric measurements, measuring blubber thickness with a portable ultrasound unit, measuring body composition with tritium, taking blood samples, taking blubber biopsies, and translocating animals to Long Marine Laboratory in Santa Cruz, CA to measure oxygen consumption using flow-through respirometry. Trained and supervised field teams of undergraduates (approximately 50 students total for two years of research). Laboratory duties included: blood serum distillations for calculating body composition using the hydrogen isotope dilution method, bomb calorimetry to determine energy density of muscle and blubber samples from elephant seals, lipid extraction from blubber samples, transesterification of lipids, and determining fatty acids in blubber samples with gas chromatography. **Balancing the conflicting physiological demands of thermoregulation and diving in the Atlantic bottlenose dolphin, *Tursiops truncatus* (9/95 - 6/97)**. Project resulted in a M.S. degree in Marine Sciences. Duties included: setting up experimental design to compare the effects of exercise on the dive response of bottlenose dolphins in the Bahamas, measuring blubber thickness with a portable ultrasound unit, and taking heat flow and skin temperature of dolphins at the water surface and at depth. Most of the work for this project was done underwater using SCUBA. **Other research experiences:** assisted cetacean necropsies, assisted experiments on how apnea affects blood gas parameters of captive Pacific white sided dolphins, surveyed Monterey Bay for marine birds and mammals, assisted harbor seal captures, and assisted handling and chemically sedating adult female elephant seals for

physiological studies.

- 9/95 -3/02 **Stranding Program Volunteer**, Long Marine Laboratory, University of California, Santa Cruz. Assisted necropsies and sample collections on dolphins, pinnipeds, and beaked whale. Assisted rescue efforts for live stranding of gray whale calf.
- 10/00 - 12/00 **Marine Mammal Observer**, SRS Technologies, Systems Development Division, Newport Beach, California. Counted and observed behaviors of marine mammals, primarily CA sea lions and harbor seals, from land and boat based platforms for the San Francisco-Oakland Bridge pile installation demonstration. Primary focus of project was to quantify pinniped disturbance from the pile driving operations.
- 9/99 - 6/00 **Graduate Research Assistant**, Dep. of Biology, University of California, Santa Cruz. Collaborated with researchers at California State University, Monterey Bay to develop interactive web-site on elephant seals (<http://kibak.monterey.edu/~seal>) to be used nationwide in high school science curricula. Reviewed curricula drafts and student activities, researched elephant seal facts, answered questions about elephant seal research, provided details about my research project, and conducted interviews with other researchers. Provided information and assistance to an undergraduate from Cal State Monterey, and trained her with hands-on northern elephant seal research at Año Nuevo.
- 6/97 - 7/97 **Graduate Research Assistant**, Dep. of Biology, University of California, Santa Cruz. Assisted Steller sea lion conservation research at a remote island field camp in southeast Alaska (Forester Island) in collaboration with the Alaska Dept. of Fish and Game. Duties included: manually restraining pups, taking morphometric measurements of adult females and pups, taking blubber thickness measurements of adult females and pups using portable ultrasound unit, taking heat flow and skin temperature data, performing necropsies, and collecting tissue samples.
- 11/93 - 7/94 **Marine Animal Rescue Program Volunteer**, National Aquarium, Baltimore, Maryland. Trained in rescue and revival methods for stranded sea turtles, pinnipeds, and cetaceans. Aided rehabilitation efforts of pygmy sperm whale and loggerhead sea turtle. Fed and gave medications to animals. Maintained sanitary environment.
- 9/93 - 6/94 **UMCP Undergraduate Research Assistant**, Dr. Susan Carter-Porges' behavioral endocrinology lab, University of Maryland, College Park. Cared for animals, injected hormones and sedatives, performed surgeries, ran choice experiments with Illinois prairie voles, collected data for studies on effects of hormones on sex behaviors and parental care in voles.
- 9/93 - 12/93 **Mammalogist Intern**, National Aquarium, Baltimore, Maryland. Prepared food, fed animals, aided in medical drills and procedures on pinnipeds and cetaceans, kept record of animal behaviors, evaluated dolphin shows, observed and assisted training exercises.
- 1/93 **Aquarist Intern**, National Aquarium, Baltimore, Maryland. Prepared food, fed animals, helped maintain and repair exhibits and tanks, operated filtration systems, kept records, accompanied supervisor on collecting trip.

#### **Honors, Awards, Scholarships, and Grants**

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| 2016 | National Fish and Wildlife Federation (NFWF) Grant (PI, \$114,856.92 over 2 years)  |
| 2014 | The Office of Naval Research (ONR) Grant (co-PI, \$382,074 over 3 years)  |
| 2012 | The Office of Naval Research (ONR) Grant (co-PI, \$437,645 over 2 years)  |
| 2010 | The Office of Naval Research (ONR) Grant (co-PI, \$506,280 over 2 years)  |
| 2009 | NOAA NMFS Office of Protected Resources Supplemental Internal Funds Grant for Marine Sound Effects Research (co-PI, \$25,000)   |
| 2008 | NOAA Group Bronze Medal Award for executing a biopsy and prey sampling program for endangered Southern Resident killer whales in the Puget Sound after attaining broad public support |
| 2008 | NOAA NMFS Education Internal Funds Grant (collaborator, \$10,000)   |
| 2008 | NOAA NMFS Office of Protected Resources Supplemental Internal Funds Grant for Marine Sound Effects Research (co-PI, \$45,000)   |

2007	NOAA NMFS Northwest Fisheries Science Center Internal Grant for Scientific Research (PI, \$44.4 K)
2005	NOAA NMFS Northwest Fisheries Science Center Internal Grant for Scientific Research (co-PI, \$30 K)
2002	SICB: Physiology of Plasticity Symposium Award (one of five \$300 grad student and post-doc awards)

### **Publications in peer-reviewed journals**

- Noren D.P.**, Holt M.M., Dunkin R.C., Thometz N.M., Williams T.M. (in press) Comparative and cumulative energetic costs of odontocete responses to anthropogenic disturbance. *Proceedings of Meetings on Acoustics*
- Holt M.M., **Noren D.P.**, Dunkin R.C., Williams T.M. (2016) Comparing the metabolic costs of different sound types in bottlenose dolphins. *Proceedings of Meetings on Acoustics* 27, 010019. <http://dx.doi.org/10.1121/2.0000274>
- Chasco B., Kaplan I.C., Ward E.J., Thomas A., Acevedo-Gutierrez A., **Noren D.P.**, Ford M.J., Hanson M.B., Scordino J., Jeffries S.J., Pearson S.F., Marshall K.N. (in press) Estimates of Chinook salmon consumption in Washington State inland waters by four marine mammal predators from 1970-2015. *Canadian Journal of Fisheries and Aquatic Sciences*.
- Senigaglia V., Christiansen F., Bejder L., Gendron D., Lundquist D., **Noren D.P.**, Schaffar A., Smith J.C., Williams R., Martinez E., Stockin K., Lusseau D. (2016) Meta-analyses of whale-watching impact studies: comparisons of cetacean responses to disturbance. *Marine Ecology Progress Series* 542:251-263. (Note: excluding the first and final three authors, authors are listed alphabetically, and the order does not reflect level of author contribution).
- Noren D.P.** and Hauser, D.D.W. (2016) Surface-based observations can be used to assess behavior and fine-scale habitat use by an endangered killer whale (*Orcinus orca*) population. *Aquatic Mammals* 42:168-183.
- Holt M.M., **Noren D.P.**, Dunkin R.C., Williams T.M. (2015) Vocal performance affects metabolic rate in dolphins: implications for animals communicating in noisy environments. *The Journal of Experimental Biology* 218:1647-1654.
- Noren S.R., **Noren D.P.**, Gaydos J.K. (2014) Living in the Fast Lane: rapid development of the locomotor muscle in immature harbor porpoises (*Phocoena phocoena*). *Journal of Comparative Physiology B* 184:1065-1076.
- Noren D.P.**, Budge S.M., Iverson S.J., Goebel M.E., Costa D.P., Williams T.M. (2013) Characterization of blubber fatty acid signatures in northern elephant seals (*Mirounga angustirostris*) over the postweaning fast. *Journal of Comparative Physiology B* 183:1065-1074.
- Noren D.P.**, Holt M.M., Dunkin R.C., Williams T.M. (2013) The metabolic cost of communicative sound production in bottlenose dolphins (*Tursiops truncatus*). *The Journal of Experimental Biology* 216:1624-1629.
- Holt M.M., **Noren D.P.**, Emmons C.K. (2013) An investigation of sound use and behavior in a killer whale (*Orcinus orca*) population to inform passive acoustic monitoring studies. *Marine Mammal Science* 29:E193-E202.
- Mongillo T.M., Holmes E.E., **Noren D.P.**, VanBlaricom G.R., Punt A.E., O'Neill S.M., Ylitalo G.M., Hanson M.B., Ross P.S. (2012) Predicted polybrominated diphenyl ether (PBDE) and polychlorinated biphenyl (PCB) accumulation in Southern Resident killer whales. *Marine Ecology Progress Series* 453:263-277.
- Noren D.P.** and Mocklin J.A. (2012) Review of cetacean biopsy techniques: Factors contributing to successful sample collection and physiological and behavioral impacts. *Marine Mammal Science* 28:154-199.
- Holt M.M., **Noren D.P.**, Emmons C.K. (2011) The effects of noise levels and call types on the source levels of killer whale calls. *Journal of the Acoustical Society of America* 130:3100-3106.
- Williams R., Krkošek M., Ashe E., Branch T.A., Clark S., Hammond P.S., Hoyt E., **Noren D.P.**, Rosen D., Winship A. (2011) Competing conservation objectives for predators and prey: estimating killer whale prey requirements for Chinook salmon. *PLoS ONE* 6(11): e26738. doi:10.1371/journal.pone.0026738.
- Noren D.P.** (2011) Estimated field metabolic rates and prey requirements of resident killer whales. *Marine Mammal Science* 27:60-77.
- Ashe E., **Noren D.P.**, Williams R. (2010) Animal behaviour and marine protected areas: Incorporating behavioural data into the selection of marine protected areas for an endangered killer whale population. *Animal Conservation*. 13:196-203.
- Noren D.P.**, Rea L., Loughlin T. (2009) A model to predict fasting capacities and utilization of body energy stores in weaned Steller sea lions (*Eumetopias jubatus*) during periods of reduced prey availability. *Canadian Journal of Zoology* 87:852-864.
- Noren D.P.**, Johnson A.H., Rehder D., Larson A. (2009) Close approaches by vessels elicit surface active behaviors by Southern Resident killer whales. *Endangered Species Research* 8:179-192.
- Williams R. and **Noren D.P.** (2009) Swimming speed, respiration rate and estimated cost of transport in adult killer whales. *Marine Mammal Science* 25: 327-350.
- Holt M.M., **Noren D.P.**, Veirs V., Emmons C., Veirs S. (2009) Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. *Journal of the Acoustical Society of America Express Letters* 125:EL27-EL32.

- Krahn M.M., Hanson M.B., Baird R.W., Boyer R.H., Burrows D.G., Emmons C.K., Ford J.K., Jones L.L., **Noren D.P.**, Ross P.S., Schorr G.S., Collier T.K. (2007) Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. *Marine Pollution Bulletin* 54(12):1903-1911.
- Lefebvre K.A., **Noren D.P.**, Schultz I.R., Bogard S.M., Wilson J., Eberhart B-T.L. (2007) Uptake, tissue distribution and excretion of domoic acid after oral exposure in coho salmon (*Oncorhynchus kisutch*). *Aquatic Toxicology* 81:266-274.
- Sherman-Cooney R.A., Ortiz R.M., **Noren D.P.**, Pagarigan L., Ortiz C.L., Talamantes F. (2005) Estradiol and Testosterone Concentrations Increase with Fasting in weaned pups of the northern elephant seal (*Mirounga angustirostris*). *Physiological and Biochemical Zoology* 78(1):55-59.
- Noren D.P.** and Mangel M. (2004) Energy reserve allocation in fasting northern elephant seal pups: Interrelationships between body condition and fasting duration. *Functional Ecology* 18: 233-242.
- Ortiz R.M., **Noren D.P.**, Ortiz C.L., Talamantes F. (2003) GH and ghrelin and growth hormone increase with fasting in a naturally adapted species, the northern elephant seal (*Mirounga angustirostris*). *Journal of Endocrinology* 178: 533-539.
- Noren D.P.**, Crocker D.E., Williams T.M., Costa D.P. (2003) Energy reserve utilization in northern elephant seal (*Mirounga angustirostris*) pups during the postweaning fast: Size does matter. *The Journal of Comparative Physiology (B)* 173: 443-454.
- Noren D.P.** (2002) Thermoregulation of weaned northern elephant seal (*Mirounga angustirostris*) pups in air and water. *Physiological and Biochemical Zoology* 75: 513-523.
- Ortiz R.M., **Noren D.P.**, Litz B., Ortiz C.L. (2001) A new perspective on adiposity in a naturally obese mammal. *American Journal of Physiology - Endocrinology and Metabolism* 281: E1347-E1351.
- Noren D.P.**, Williams T.M., Berry P., Butler E. (1999) Thermoregulation during swimming and diving in bottlenose dolphins, *Tursiops truncatus*. *The Journal of Comparative Physiology (B)* 169: 93-99.
- Williams T.M., **Noren D.**, Berry P., Estes J.A., Allison C., Kirtland J. (1999) The diving physiology of bottlenose dolphins (*Tursiops truncatus*) III. Thermoregulation at depth. *The Journal of Experimental Biology* 202: 2763-2769.

#### **Book Chapters**

- Noren D.P.**, Dunkin R.C., Williams T.M., Holt M.M. (2012) Energetic cost of behaviors performed in response to vessel disturbance: one link in the population consequences of acoustic disturbance model. In: Anthony Hawkins and Arthur N. Popper, Eds. *The Effects of Noise on Aquatic Life*, pages 427-430.
- Holt M.M., **Noren D.P.**, Emmons C.K. (2012) Does vessel noise affect the use of sound by foraging *Orcinus orca* (killer whales)? In: Anthony Hawkins and Arthur N. Popper, Eds. *The Effects of Noise on Aquatic Life*, pages 327-330.

#### **Tech Memos**

- Mongillo T. M., Ylitalo G.M., Rhodes L.D., O'Neill S.M., **Noren D.P.**, Hanson M.B. (2016) Exposure to a mixture of toxic chemicals: Implications for the health of endangered Southern Resident killer whales. U.S. Dept. Commer., NOAA Tech. Memo. NMFSNWFS-135, 107 p. doi:10.7289/V5/TM-NWFS-135

#### **Thesis and Dissertation**

- Noren D.P.** (2002) Body energy reserve utilization during the postweaning fast of northern elephant seals *Mirounga angustirostris*: implications for survival. Ph.D. Dissertation, University of California, Santa Cruz, 151pp.
- Noren D.P.** (1997) Balancing the conflicting demands of thermoregulation and diving in the Atlantic bottlenose dolphin, *Tursiops truncatus*. M.S. Thesis, University of California, Santa Cruz, 49pp.

#### **Papers submitted**

- Noren D.P.**, Marla M.M., Dunkin R.C., Williams T.M. Echolocation is cheap for some mammals: dolphins conserve oxygen while producing high-intensity clicks (in revision).

#### **Contract Reports (list available upon request)**

#### **Select Scientific Meeting Presentations and Abstracts Published in Symposium Proceedings**

- Noren, D.P.**, Holt, M.M., Dunkin, R.C., Williams, T.M. 2016. Echolocation is cheap for one vertebrate: Dolphins conserve oxygen while producing high-intensity clicks at depth. Oral presentation Annual Conference for the Society of Integrative and Comparative Biology.

- Thometz, N.M., Dunkin, R.C., **Noren, D.P.**, Holt, M.M., Williams, T.M. 2016. Aerobic and anaerobic capacities of sound production muscles in two Odontocetes. Oral presentation Annual Conference for the Society of Integrative and Comparative Biology.
- Dunkin, R.C., **Noren, D.P.**, Holt, M.M., Williams, T.M. 2015. Using CT scans to estimate the mass of sound producing muscles in odontocetes: implications for scaling the cost of vocal modification. Oral presentation 21st Biennial Conference on the Biology of Marine Mammals.
- Noren, D.P.**, Holt, M.M., Dunkin, R.C., Williams, T.M. 2015. Echolocation is cheap: Dolphins conserve oxygen while clicking at depth. Oral presentation 21<sup>st</sup> Biennial Conference on the Biology of Marine Mammals.
- Noren, D.P.**, Noren, S.R., Gaydos, J.K. 2014. Assessing limitations to harbor porpoise (*Phocoena phocoena*) habitat utilization through the quantification of physiological adaptations for diving. Poster Puget Sound Georgia Basin Conference.
- Noren D.P.**, Hanson B., Ward E., Ford M., O'Neill S., Balcomb K. 2014. Factors affecting Southern Resident killer whale growth and recovery. Oral Presentation Puget Sound Georgia Basin Conference.
- Noren D.P.**, Holt M.M., Dunkin R.C., Williams T.M. 2014. Energetic Impacts of delphinid behavioral responses to vessel disturbance quantified via oxygen consumption measurements. Oral presentation NOAA NWFSC Science Symposium.
- Noren, D.P.** and Hauser, D.D.W. (2012) Using behavioral data to identify potential marine protected areas for the endangered Southern Resident killer whale. Oral presentation NOAA NWFSC Science Symposium.
- Noren, D.P.** and Hauser, D.D.W. (2012) Using behavioral data to identify potential marine protected areas for the endangered Southern Resident killer whale. Oral presentation Annual Conference for the Society of Integrative and Comparative Biology.
- Noren, D.P.**, Jensen, E., Boyd, D., Ylitalo, G. (2011) The dynamics of persistent organic pollutant (POP) transfer from female bottlenose dolphins (*Tursiops truncatus*) to their offspring during gestation and lactation. 19<sup>th</sup> Biennial Conference on the Biology of Marine Mammals.
- Holt, M.M., **Noren, D.P.**, Williams, T.M. (2011) Metabolic cost of sound production in dolphins: assessing the energetic impact of vocal compensation in noisy habitats. 19<sup>th</sup> Biennial Conference on the Biology of Marine Mammals.
- Emmons, C.K., Hanson, M.B., Holt, M.M., **Noren, D.P.**, Lammers, M.O. (2011) Sound production of resident killer whales throughout their range: a tool for conservation and critical habitat refinement. 19<sup>th</sup> Biennial Conference on the Biology of Marine Mammals.
- Holt, M.M., **Noren D.P.**, Williams, T.M. (2011) Metabolic rates during sound production in bottlenose dolphins (*Tursiops truncatus*) and evaluating costs of noise-induced vocal compensation. 3<sup>rd</sup> Symposium on Acoustic Communication by Animals. 1-5 August, Cornell University, Ithaca, NY. p. 60-61.
- Noren, D.P.**, Holt, M.M., and Williams, T.M. 2011. Assessing long term impacts of vocal compensation to ambient noise by measuring the metabolic cost of sound production in bottlenose dolphins. 161st Meeting of the Acoustical Society of America, 23-27 May. Seattle, WA. *Journal of Acoustical Society of America* 129: 2397.
- Emmons, C. K., Hanson, M.B., Holt, M.M., **Noren, D.P.**, Lammers, M.O. (2011) Monitoring southern resident killer whale behavior on the outer coast of Washington using passive acoustics. 161st Meeting of the Acoustical Society of America.
- Noren, D.P.**, Dunkin, R.C., Williams, T.M., Holt, M.M. (2010) The energetic cost of behaviors performed in response to vessel disturbance: one link in the PCAD Model. Oral presentation Second International Conference on the Effects of Noise on Aquatic Life.
- Holt, M.M., Noren, D.P., Emmons, C.K. (2010) Source levels of killer whale calls: Differences among call types and noise levels. 2nd Pan-American/Iberian Meeting on Acoustics/160<sup>th</sup> Meeting of the Acoustical Society of America.
- Holt, M.M., **Noren, D.P.**, Emmons, C.K. (2010) Does vessel noise affect the use of sound by foraging killer whales? Second International Conference on the Effects of Noise on Aquatic Life.
- Diehl, B. and **Noren, D.** (2010) Behavioral responses to and success rates of different biopsy methods in cetaceans. 13<sup>th</sup> Annual UW Undergraduate Research Symposium.
- Noren, D.P.**, Dunkin, R.C., Williams, T.M. (2010) The energetic cost of surface active behaviors in dolphins. Oral presentation Annual Conference for the Society of Integrative and Comparative Biology.
- Noren, D.P.**, Dunkin, R.C., Williams, T.M. (2009) The energetic cost of surface active behaviors: one link in the PCAD model. 18<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy.
- Holt, M.M., **Noren, D.P.**, Emmons, C.K., Seibert, A. (2009) Bridging the gap between behavioral responses and sound exposure from vessels. 18<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy.
- Mongillo, T., Holmes, E.E. **Noren, D.**, VanBlaricom, G., Punt, A., Hanson, M.B. (2009) Estimated polybrominated diphenyl ether (PBDE) accumulation in the Southern Resident killer whale (*Orcinus orca*): sex and age no longer

- matter. 18<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy.
- Holt, M.M., **Noren, D.P.**, Emmons, C.K., Seibert, A. (2009) Sound production and behavior in an eastern North Pacific killer whale population: Implications for autonomous remote monitoring. 157<sup>th</sup> Meeting of the Acoustical Society of America.
- Holt, M.M., **Noren, D.**, Veirs, V., Emmons, C., and Veirs, S. (2009) Speaking up: Killer whales (*Orcinus orca*) call louder in response to vessel noise. Puget Sound Georgia Basin Ecosystem Conference
- Pierszalowski, S. and **Noren, D.** (2009) The role of activity state and gender on diving and swimming parameters in Southern Resident killer whales. 12<sup>th</sup> Annual UW Undergraduate Research Symposium.
- Noren, D.P.** and Hauser, D. (2009) Using behavioral data to assess risk factors and address data gaps for the conservation of Southern Resident killer whales: a case study on habitat use. Oral presentation Puget Sound Georgia Basin Ecosystem Conference.
- Holt, M.M., **Noren, D.P.**, Emmons, C.K., Seibert, A. (2008) Behavioral correlates of sound production in Southern Resident killer whales (*Orcinus orca*). Second International Conference on Acoustic Communication by Animals.
- Noren, S.R. and **Noren, D.P.** (2008) Development of Muscle Diving Physiology in Marine Mammals. American Physiological Society Meeting. The FASEB Journal 22:1239.1
- Noren, D.P.** and Noren, S.R. (2008) The development of muscle biochemistry in a diving marine endotherm, the harbor porpoise (*Phocoena phocoena*). Oral presentation Society for Integrative and Comparative Biology Annual Meeting and Exhibition.
- Noren, D.P.** (2007) Estimating daily energetic needs of Southern Resident killer whales. Workshop: Southern Resident Killer Whales and Fisheries.
- Noren D.P.**, Johnson A., Rehder D., Larson, A. (2007) Close approaches by vessels elicit surface active displays by Southern Resident killer whales. 17<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy.
- Mongillo T., Holmes E., **Noren D.**, Hanson B., VanBlaricom G., Punt, A. (2007) Polychlorinated biphenyl (PCB) and polybrominated diphenyl ether (PBDE) exposure effects and accumulation in Southern Resident killer whale (*Orcinus orca*). 17<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy.
- Johnson, A. and **Noren, D.** (2007) The effect of vessel presence on Southern Resident killer whale (*Orcinus orca*) behavior in San Juans Islands. 10<sup>th</sup> Annual UW Undergraduate Research Symposium.
- Noren, Dawn P.** (2006) Behavior of Southern Resident killer whales in the presence of vessels in San Juan Islands, Washington. NOAA NMFS Northwest Fisheries Science Symposium.
- Noren, Dawn P.** (2005) Behavior of Southern Resident killer whales in the presence of vessels in San Juan Islands, Washington, USA. 16<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy, 207.
- Noren, Dawn P.** and Ortiz, Rudy M. (2005) Plasma metabolites indicate variation in energy reserve utilization in fasting northern elephant seal pups. The FASEB Journal 19(4): A192 (Abstract 131.11).
- Norris, Thomas; Hanson, Brad; **Noren, Dawn**; Jones, Linda (2004) Acoustic surveys of killer whales during winter along the Pacific Northwest coast. The Journal of the Acoustical Society of America 116: 2589.
- Noren, Dawn P.** (2003) Fasting capabilities of weaned juvenile Steller sea lions: Influence of body condition and daily foraging duration. Oral presentation 15<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy, 120.
- Jones, Linda; Hanson, M. Bradley; **Noren, Dawn P.** (2003) Research on Southern Resident population of killer whales in the Pacific Northwest of the United States. 15<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy, 81.
- Sherman, Rebecca A.; Pagarigan, Lauren; **Noren, Dawn P.**; Ortiz, C. Leo; Ortiz, Rudy M.; Talamantes, Frank. (2003). Reproductive hormone concentrations in fasting, postweaned northern elephant seal (*Mirounga angustirostris*) pups. 15<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy, 150.
- Noren, D.P.** (2003) Fasting capabilities in weaned juvenile Steller sea lions: Influence of body condition and activity. Oral presentation Marine Science in the northeast Pacific: Science for Resource Dependent Communities Pacific Joint Scientific Symposium.
- Noren, D.P.** (2003) Differential energy reserve utilization during the postweaning fast of northern elephant seals: Implications for the first year of life. Society for Integrative and Comparative Biology Annual Meeting and Exhibition, Phenotypic Plasticity Symposium, 261-262 (Abstract MS2.1).
- Sherman, R.A.; Pagarigan, L.; **Noren, D.P.**; Ortiz, R.M.; Ortiz, C.L.; Talamantes, F. (2003) Reproductive hormone concentrations in fasting, postweaned northern elephant seal (*Mirounga angustirostris*) pups. Experimental Biology '03 Meeting, San Diego, CA, April 11-15.
- Sherman, R.A.; Pagarigan, L.; **Noren, D.P.**; Ortiz, R.M.; Ortiz, C.L.; Talamantes, F. (2003) Reproductive hormone

concentrations in fasting, postweaned northern elephant seal (*Mirounga angustirostris*) pups. Society for Integrative and Comparative Biology Annual Meeting and Exhibition, 302 (Abstract P2.129).

**Noren, D.P.**; Williams, T.M.; Crocker, D.E.; Costa, D.P. (2001) Energy reserve utilization in northern elephant seal pups during the postweaning fast: does size matter? 14<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy, 156-157.

**Noren, D.P.** and Williams, T.M. (2001) Effects of environmental regime and body condition on resting metabolic rates in northern elephant seal pups: does RMR measured in ambient air represent true RMR? Society for Integrative and Comparative Biology Annual Meeting and Exhibition, 321 (Abstract P1.66B).

**Noren, D.P.**; Williams, T.M.; Haun, J.E.; Pabst, D.A. (1999) The effect of exercise on heat flow from the extremities and thermoregulation of the intra-abdominal testes of the bottlenose dolphin (*Tursiops truncatus*). 13<sup>th</sup> Biennial Conference on the Biology of Marine Mammals, the Society for Marine Mammalogy, 135-136.

**Noren, Dawn P.** and Williams, Terrie M. (1996) Balancing thermoregulatory and exercise demands during diving in the Atlantic bottlenose dolphin, *Tursiops truncatus*. APS Intersociety Meeting, the Integrative Biology of Exercise, The Physiologist 39(5): A-28 (Abstract 10.17).

### **Synergistic Activities**

#### **Select Invited Presentations**

- 3/17 Office of Naval Research Marine Mammals and Biology Program Review, Arlington, VA: *Comparative and Cumulative Energetic Costs of Odontocete Responses to Anthropogenic Disturbance*
- 2/17 ACS Puget Sound Chapter Lecture: *Comparative and Cumulative Energetic Costs of Odontocete Responses to Anthropogenic Disturbance*
- 7/15 NOAA NMFS Review of Science on Marine Mammals and Turtles: *Effects of Vessels on Southern Resident Killer Whale Behavior*
- 10/14 Salish Sea Association of Marine Naturalists (SSAMN) Gear-Down Meeting: *Endangered Southern Resident killer whales: 10 Years of Research and Recovery Efforts*
- 6/14 U.W. Marine Mammal Class Lecture: *Endangered Southern Resident killer whales: 10 Years of Research and Recovery Efforts*
- 6/14 ACS Puget Sound Chapter Lecture: *Endangered Southern Resident killer whales: 10 Years of Research and Recovery Efforts*
- 3/14 Orca Whale Protection Zone Conceptual Design Workshop hosted by Orca Relief, Seattle, WA: *Using Behavioral Data to Identify Potential Marine Protected Areas for Endangered Southern Resident Killer Whales*
- 4/13 Meeting of the working group on Toxicological Thresholds for the Protection of Southern Resident Killer Whales, Seattle, WA: *The dynamics of persistent organic pollutant (POP) transfer from female dolphins to their offspring during lactation*
- 9/12 3<sup>rd</sup> NMFS/DFO Bilateral Workshop to Evaluate the Effects of Salmon Fisheries on Southern Resident Killer Whales, Seattle, WA: *Energy Requirements and Salmon Consumption by Southern Resident killer whales in their Summer Range*
- 4/12 Office of Naval Research Marine Mammals and Biology Program Review, Arlington, VA: *The Metabolic Costs of Sound Production in Odontocete Cetaceans*
- 9/11 1<sup>st</sup> NMFS/DFO Bilateral Workshop to Evaluate the Effects of Salmon Fisheries on Southern Resident Killer Whales, Seattle, WA: *Energetic Needs and Prey Consumption Rates of Southern Resident killer whales*
- 2/10 Conservation Biology, NWFSC division meeting: *The energetic cost of surface active behaviors in dolphins*
- 9/09 The Whale Museum, Friday Harbor, Lecture Series: *Behavioral and bioenergetic impacts of vessel presence in Southern Resident killer whales*
- 6/09 Recovering Puget Sound: Progress in Marine Environmental Modeling Open House: *Energetic needs and prey consumption rates of southern resident killer whales*
- 2/09 Population Consequences of Acoustic Disturbance (PCAD) to Marine Mammals ONR Workshop, Washington, DC: *Bioenergetics models for use in assessing potential bioenergetic impacts of vessel disturbance to cetaceans*
- 2/09 NOAA NMFS NWFSC Monster Jam: *Habitat use and bioenergetics of Southern Resident killer whales*
- 11/08 American Cetacean Society, Puget Sound Chapter: *Using behavioral data to gain insight into habitat use and bioenergetics of Southern Resident killer whales*
- 8/08 Guest lecture for U.W. FISH/OCEAN/BIOL 250 Marine Biology: *Marine Mammals: What Are They and How Do They Live in Their Environment?*
- 4/08 International Whaling Commission and Murdoch University (Australia) hosted Large-Scale Whalewatching Research Initiative Workshop: *Review of marine mammal bioenergetics and field methods to estimate FMRs for use in assessing potential bioenergetic impacts of vessel disturbance to whales*



- 4/07 Keynote speaker for the 11<sup>th</sup> Annual Meeting of the Northwest Student Chapter of the Society for Marine Mammalogy, University of Washington, Seattle, WA: *Bioenergetics of Marine Mammals: Physiological Capacities and Responses to Environmental Pressures*
- 9/06 Beam Reach Marine Science and Sustainability School: *Behavioral Energetics of Southern Resident Killer Whales in the Presence of Vessels*
- 7/06 U.W. Friday Harbor Laboratories Lecture Series Guest Lecture: *Behavioral Energetics of Southern Resident Killer Whales in the Presence of Vessels*
- 4/06 2006 Symposium on Southern Resident killer whales: *Behavioral Energetics of Southern Resident Killer Whales in the Presence of Vessels*
- 3/05 American Cetacean Society, Puget Sound Chapter, *Marine Mammal Tricks: How are they Specialized to Live in the Marine Environment?*
- 9/04 US-Russia Marine Mammal Meeting, *Killer Whales of the Pacific Northwest, USA*
- 4/04 Highline Community College Marine Science and Technology (MaST), *Killer Whales of the Pacific Northwest*.
- 6/03 American Meteorological Society's Series of Programs on Ocean and Fisheries Topics for Pre-College Teachers, *Marine Mammals: What Are They and How Do They Live in Their Environment?*
- 2/03 Northwest Fisheries Science Center, NMFS Seminar, *Bioenergetics of Cetaceans and Pinnipeds: Physiological Capacities and Responses to Environmental Pressures*.
- 10/02 National Marine Mammal Laboratory, NMFS Seminar, *Body Energy Reserve Utilization During the Postweaning Fast of Northern Elephant Seals (Mirounga angustirostris): Implications for Survival*.
- 11/99 Docent Training Seminar, Año Nuevo, California State Park, *Body Reserve Utilization Strategies During the Postweaning Fast of Northern Elephant Seals (Mirounga angustirostris): Implications for Survivorship*.

#### **Select Committees and Working Groups**

- 2012-present California Current Integrated Ecosystem Assessment (IEA) marine mammal working group – identified indicator species, provide information on status and trends of marine mammal populations, and defined risks to marine mammals in the CA current
- 2009-present NOAA International Marine Mammal Action Plan Working Group – developed an action plan to provide context and justification for current NOAA actions, short-term recommendations of specific actions the agency should continue or initiate in the next 3-5 years, and long-term strategic guidance for threats facing marine mammals in international and foreign waters.
- 2005-2008 NOAA Northwest Fisheries Center Research Planning Team - developed a strategic science and research plan for the NOAA Northwest Fisheries Science Center.

#### **Student Mentoring**

##### **Ph.D. Dissertation and M.S. Thesis Committees**

- 2009-2013 Deborah Giles, Ph.D. student, Wildlife, Fish and Conservation Biology, University of California, Davis
- 2007- 2009 Teresa Mongillo, M.S. student, School of Aquatic and Fisheries Sciences, University of Washington, Seattle

##### **Undergraduate Interns/Volunteers**

- 2016 Emily Mazur, University of Miami, NOAA Hollings Undergraduate Scholar Intern
- 2014-15 Jessica Knoth, School of Aquatic and Fisheries Sciences, University of Washington
- 2014 Sage Mitchell, Richard Stockton College of NJ, NOAA Hollings Undergraduate Scholar Intern
- 2011 Derek Somo, Arizona State University, NOAA Hollings Undergraduate Scholar Intern
- 2010-11 Juliana Houghton, School of Aquatic and Fisheries Sciences, University of Washington
- 2009-10 Bethany Diehl, School of Aquatic and Fisheries Sciences, University of Washington
- 2008-09 Sophie Pierszalowski, School of Aquatic and Fisheries Sciences, University of Washington
- 2006-07 Amy Johnson, University of Washington, Bothell
- 2006 Dara Rehder, University of Alaska, Fairbanks, NOAA Hollings Undergraduate Scholar Intern
- 2005 Ron Taylor, New Mexico State University, Las Cruces, NM, ENTRY POINT! Undergraduate Intern
- 2005 Erin Beardsley, Western Washington University
- 2003 Ann Larson, Department of Biology, University of Washington

##### **Graduate Interns/Volunteers**

- 2004 Teresa Mitchell, School of Marine Affairs, University of Washington

#### **Professional Organizations**

American Cetacean Society

Society for Integrative and Comparative Biology

Society for Marine Mammalogy (chaired one physiology session at the 2011 Society for Marine Mammalogy Conference)

### **Reviewer**

#### **Journals**

Journal of Thermal Biology

Aquatic Mammals

Biological Conservation

Canadian Journal of Zoology

Comparative Biochemistry and Physiology

Endangered Species Research

Journal of Applied Ecology

Journal of Comparative Physiology - B

Journal of Experimental Biology

Marine Ecology Progress Series

Marine Mammal Science

Physiological and Biochemical Zoology

Scientific Reports (Nature Publishing Group)

#### **Agencies, Programs, Societies**

National Science Foundation, Office of Polar Programs, grant proposals

North Pacific Research Board, grant proposals

National Oceanic and Atmospheric Administration, Section 7 consultations, management documents, grant proposals

Society for Integrative and Comparative Biology, student presentations 2008 and 2010 meetings

Society for Marine Mammalogy, abstract submissions 2007, 2009, 2011, 2013, 2015 meetings

### **Research in the press (select examples)**

September 2015, "Sound waves: dolphins in a noisy ocean", Brittney G. Borowiec, Oceanbites

July 2015, killer whale contaminant transfer study featured in video and story on SeaWorld Cares website

(<http://seaworldcares.com/2015/07/groundbreaking-killer-whale-study>)

July 2015, press coverage on killer whale contaminant transfer study, San Diego local television news reports, including Fox 5, CBS 8, CW 6

May 2015 "Dolphins use more energy in noisy oceans", Emily Tripp, Marine Science Today

May 2015 "Calling over boat noise is making orcas hungry", Steve Curwood, Public Radio International (PRI), Living on Earth

April 2015 "Dolphins are 'putting their health at risk' because they are forced to shout over sound of passing ships research reveals", dailymail.co.uk, UK

April 2015 "Dolphins have to 'shout' about noise of passing ships to communicate says study", MIRROR.CO.UK, UK

April 2015 "Orcas Are Shouting Over Boat Noise – And It Might be Making Them Hungry", Ashley Ahearn, NPR Earthfix, KUOW, Seattle, WA

January 2013 "One Endangered Species Eats Another: Killer Whales and Salmon", Featured Stories, NOAA Fisheries website

February 2012 "Researchers on Hunt for Killer Whales' Winter Hideout", Tom Banse, NPR, KUOW, Seattle, WA

April 2012 "EarthFix Conversations: Catching Up With Orcas", Ashley Ahearn, NPR Earthfix, KUOW, Seattle, WA

December 2009 "Zoning the Ocean May Help Endangered Whales to Recover", Press Release in Animal Conservation

January 2009 "Study: Orcas raising their voices to talk above racket of vessel traffic", Lynda Mapes, Seattle Times

September 2009 "Orcas vs. Boat Noise", NPR, KUOW, Seattle, WA

September 2009 "Killer Whales Strain to Talk Over Ship Noise?", Christine DellAmore, National Geographic News.

March 1997 "The Dolphin Strategy", Carl Zimmer, Discover Magazine