

Kenneth W. Zillig

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EDUCATION

Ph.D. Ecology, **University of California, Davis**, Davis, CA 95616
2015 – 2022

B.A. Biology, Magna Cum Laude, **Carleton College**, Northfield, MN
2009 – 2013

RESEARCH EXPERIENCE

Postdoctoral Research

2021 – Present Effects of Rationing on Thermal Performance
Advisor: Dr. Nann Fangué University of California, Davis
Proposed and received funding to conduct a three-year study on the effect of food rationing on Chinook salmon thermal tolerance; including a 14-week laboratory study and an 8-week field study.

Doctoral Research

2015-2022 Dissertation: Interpopulation Variation in Thermal Physiology in Chinook salmon
Advisor Dr. Nann Fangué, University of California, Davis
Designed and conducted one of the largest metabolic experiments conducted upon teleosts.
Published a literature review compiling thermal performance data for California salmonids

2020-2022 Fundamental Thermal Physiology and Predation Risk of Juvenile Salmon in the Sacramento-San Joaquin River Delta
Advisor Dr. Nann Fangué, University of California, Davis
Tested a novel hypothesis of Thermal Metabolic Advantage by conducting paired predation and physiological experiments on Chinook salmon and three species of predator fish

2020-2022 Laser Timed System for Measuring Burst Performance in Fish
Advisor Dr. Nann Fangué, University of California, Davis
Designed, built and tested a laser-timed burst-swim performance tunnel to access traits anaerobic performance
Presented at International Congress on the Biology of Fishes (2022), manuscript in preparation.

2018 Global Change Biology of Antarctic Fishes
Advisor: Anne Todgham, McMurdo Station, Antarctica
Studied the combined effects of ocean warming and acidification on Antarctic Fish
Presented at International Congress on the Biology of Fishes (2022), multiple manuscripts in preparation.

- 2016** Assessment of Multiple Stressors on Juvenile Green Sturgeon Metabolism
Advisor: Dr. Nann Fangue, University of California, Davis
Implemented the largest metabolic study and upon green sturgeon and the first
to quantify aerobic scope
Presented at American Fisheries Society Conference (2019), manuscript in
preparation.
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PUBLICATIONS

- Zillig, K. W.**, FitzGerald, A. M., Lusardi, R. L., Cocherell D. E., Fangue, N. A., (*In Review*) Intraspecific variation among Chinook salmon populations indicates physiological adaptation to local environmental conditions. Proceedings of the National Academy of Sciences.
- 2023** **Zillig, K. W.**, Lusardi, R. L., Cocherell D. E., Fangue, N. A., Interpopulation variation in thermal physiology among seasonal runs of Chinook salmon. Canadian Journal of Fisheries and Aquatic Sciences.
- 2022** McInturf, A. G., **Zillig, K. W.**, Cook, K.*, Fukumoto, J. A.*, Jones, A.A*, Patterson, E.*, Cocherell, D. E., Michel, C., Caillaud, D., Fangue, N. A. In hot water? Assessing the link between fundamental thermal physiology and predation risk of juvenile Chinook salmon. Ecosphere.
- 2021** **Zillig, K.W.**, Lusardi, R.A., Moyle, P., Fangue, N.A. One-size does not fit all: variation in thermal eco-physiology among Pacific salmonids. Reviews in Fisheries and Fish Biology.
- Siefert, A., Friesen, M.L., **Zillig, K.W.**, Aguilar, J., and Strauss, S.Y. An experimental test of stabilizing forces in the field niche. Ecology. 102 (4) e03290
- 2020** **Zillig, K. W.**, Cocherell, D. E., & Fangue, N. A. *Interpopulation Variation among Juvenile Chinook Salmon from California and Oregon*. San Francisco, CA: The United States Environmental Protection Agency Region 9 - Pacific Southwest Region.
- Dai, J.*, Degtyarev, D.*, Gao, J.*, Wang, A.*, Burman, S., **Zillig, K.**, & Ghosal, D. Design and Implementation of RAP - a Randomized Asynchronous Protocol for Data Aggregation in Wireless Sensor Networks. In 2020 International Conference on Computing, Networking and Communications (ICNC) pp. 980–986 Big Island, HI, USA: IEEE.
- Hansen, M. J., Ligocki, I. Y., **Zillig, K. W.**, Steel, A. E., Todgham, A. E., & Fangue, N. A. Risk-Taking and Locomotion in Foraging Threespine Sticklebacks (*Gasterosteus Aculeatus*): The Effect of Nutritional Stress Is Dependent on Social Context. Behavioral Ecology and Sociobiology, 74, 12.
- 2019** Siefert, A., **Zillig, K.W.**, Friesen, M.L., and Strauss, S.Y. Mutualists stabilize coexistence of congeneric legumes. *American Naturalist*. 193:2 200-2012.

2018 **Zillig, K. W.**, Lusardi, R. A., & Fangué, N. A. *Variation in Thermal Eco-Physiology among California Salmonids: Implications for Management*. Sacramento, California: California State Water Resources Control Board. 39.

Siefert, A., **Zillig, K.W.**, Friesen, M.L., and Strauss, S.Y. Soil microbial communities alter conspecific and congeneric competition consistent with patterns of field coexistence in three *Trifolium* congeners. *Journal of Ecology* 106:5 1876–1891

* Undergraduate Mentee Author

GRANTS

2021 – Present Assessing population-level impacts of drought operations on early life stage survival of Winter-run Chinook Salmon using otolith-based temperature reconstructions

Principal Investigators: Rachel Johnson, Malte Willmes, Eric Danner, Levi Lewis, Nann Fangué, **Kenneth Zillig**, Carson Jeffres

University of California, Davis

Award Amount: \$470,992.00

Role: Designed exposure regime and sampled tissues for foundational dataset.

2021 - Present Flow, Water Quality, and Aquatic Species in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary Watershed

Principal Investigators: Jay Lund, Nann Fangué

University of California, Davis

Award Amount: \$749,981.00

Role: Lead Researcher on bioenergetics study; designed experiment, conducted research, mentored graduate students

2017 – 2021 Thermal Physiological Assessment of Lower Yuba River (CA) Salmonids

Principal Investigators: Nann Fangué

University of California, Davis

Award Amount: \$100,000.00

Role: Lead Researcher; designed experiment, conducted research, managed grant deliverables, and authored MS and reports.

2017 – 2019 Exploring Thermal Performance in Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) Populations

Principal Investigators: Nann Fangué

University of California, Davis

Award Amount: \$160,000.00

Role: Lead Researcher; designed experiment, conducted research, managed grant deliverables and authored MS and reports.

2017 – 2018 California State Water Board Review of Literature regarding Thermal Tolerances of California Salmonids

Principal Investigators: Nann Fangué, Robert Lusardi

University of California, Davis

Award Amount: \$184,032.00

Role: Lead researcher and author of published MS and grant deliverables.

AWARDS

2021	Lloyd Swift Endowment Award – \$3,000.00
2020	Henry A. Jastro Research Fellowship – \$1,625.00
2019	Horodas Grant – \$5,000
2018	Henry A. Jastro Research Fellowship – \$1000.00
2017	Graduate Group in Ecology Fellowship – University of California, Davis Henry A. Jastro Research Fellowship – \$2,640.00
2016	Marin Rod & Gun Club Scholarship – \$2,000.00 Ecology Student Endowment Award – \$11,864.00

UNIVERSITY SERVICE

2017-2019	<u>Chapter President, Society for Conservation Biology, Davis Chapter</u> University of California, Davis Coordinated the 18 th Bay Area Conservation Biology Symposium with a panel discussion on translating science to diverse audiences
2015-2017	<u>Treasury Officer, Society for Conservation Biology, Davis Chapter</u> University of California, Davis Organized a non-academic career panel to highlight career paths outside academia for graduate or undergraduate students
2015-2016	<u>Graduate Student Peer Mentor,</u> University of California, Davis Mentored incoming graduate students to assist in moving and living in Davis and navigating the University system
2013-2015	<u>Graduate Student Mentor, Strategies for Ecology Education, Diversity and Sustainability (SEEDS)</u> University of California, Davis Provided mentorship to undergraduate students from diverse backgrounds interested in pursuing degrees in ecology

REVIEWED PUBLICATIONS

2022	Journal of Applied Ichthyology
2021	Conservation Physiology
2020	Nature Climate Change
2019	Integrative Zoology

INVITED TALKS

Conservation EcoFishiology	2022
Conservation of Wildlife Populations (WILD 470) University of Montana Delivered a lecture on ecophysiology, intraspecific variation and conservation of salmonids.	
Title	2022
Hatfield Marine Science Center Research Seminar Oregon State University	

Presented my recent and ongoing research studying the thermal physiology of juvenile Chinook salmon.

TEACHING EXPERIENCE

Seminar on College Teaching, Spring 2022
Center for Education Effectiveness, University of California, Davis
Participated in a hands-on course for professors to develop active learning pedagogical techniques and inclusive course design.

Teaching Assistant, University of California, Davis Winter 2016
Physiological Ecology of Wildlife (WFC 130)
Led multiple discussion and review sections, provided feedback on student presentations, graded exams.

Lab Instructor, University of California, Davis Fall 2016
Biology and Conservation of Fishes (WFC 120L)
Managed the teaching specimen collection, guided students through hands-on identification of species, led two field trips and designed the lab practicum exams where students interacted with specimens.

Teaching Assistant, University of California, Davis Fall 2015, Spring 2016, Fall 2019
Wildlife Ecology and Conservation (WFC 010)
In each instance of this course I led multiple discussion sessions, graded student papers and exams, and delivered a once-per-semester guest lecture.

MENTORING EXPERIENCE

Andrew Naslund, University of California, Davis Undergraduate

Current Status: Marine Research Technician at Scripps Institution of Oceanography

Heather Bell, University of California, Davis Undergraduate

Current Status: Staff Research Associate, Fange Lab University of California, Davis

Cassidy Cooper, University of California, Davis Graduate Student

Current Status: Ph.D. Student, Fange Lab, University of California, Davis

Frederick Nelson, Howard University EEGAP Intern

Current Status: PhD Candidate, Todgham Lab, University of California, Davis

Melissa Crews, University of California, Davis Undergraduate

Current Status: Masters Student, Fleishman Lab, Oregon State University

Trinh Nguyen: University of California, Davis, Junior Specialist

Current Status: Environmental Scientist, California Department of Fish and Wildlife

Alexandra McInturf, University of California, Davis, Ph.D. Student

Current Status: CICOES Postdoctoral Research Fellow, Oregon State University

Sarah Baird, University of California, Junior Specialist

Current Status: Staff Research Associate, University of California, Davis

Jacqueline Fukumoto, University of California, Davis Undergraduate

Current Status: University of California, Davis Undergraduate

Gabriella Mukai, University of California, Davis, Undergraduate

Current Status: Graduate Student, Moran Lab, University of Hawaii

SCIENTIFIC PRESENTATIONS

- 2022** **Zillig, K.W.**, Lusardi, R. A., Cocherell, D.E., and Fangue, N.A. Local Adaptation in Thermal Performance of Chinook Salmon, *Oncorhynchus tshawytscha*, from eight hatchery populations. International Congress on the Biology of Fish, Montpellier, France.
- Zillig, K.W.**, McInturf A.G., Burman, S.G., Cocherell, D.E., and Fangue, N.A. Role of metabolism in structuring trophic interactions across temperatures. International Congress on the Biology of Fish, Montpellier, France.
- Todgham, A. E., Frazier, A.J., Naslund A.N., **Zillig, K.W.**, Mandic, M. An integrative framework for understanding the resilience of Antarctic fishes to climate change. International Congress on the Biology of Fish, Montpellier, France.
- Cooper, C.J., **Zillig, K.W.**, and N.A. Fangue, Influences of thermal variation and feed restriction on growth and thermal physiology of early life-stage Chinook salmon (*Oncorhynchus tshawytscha*). International Congress on the Biology of Fish, Montpellier, France.
- 2021** **Zillig, K.W.**, Lusardi, R. A., Cocherell, D.E., and Fangue, N.A. Physiological variation in thermal traits among eight populations of Chinook salmon from the West Coast. Bay-Delta Science Conference.
†Awarded 2nd Prize for a Contributed Talk
- McInturf, A.G., **Zillig, K.W.**, Cocherell, D., Michel, C., and Fangue, N.A. Thermal metabolic advantage: A mechanism for understanding the effect of temperature on predator-prey interactions in the Sacramento-San Joaquin River Delta System. American Fisheries Society Conference. Virtual Presentation.
- 2020** **Zillig, K.W.**, Lusardi, R. A., Cocherell, D.E., and Fangue, N.A. Intraspecific variation in thermal physiology of West-Coast Chinook salmon. Ecological Society of America. Virtual Conference.
- 2019** **Zillig, K.W.**, Lusardi, R. A., Cocherell, D.E., and Fangue, N.A. Eco-physiological patterns in thermal performance among populations of Chinook salmon, *Oncorhynchus tshawytscha*. American Fisheries Society Conference. Reno, NV.
- 2018** **Zillig, K.W.**, Lusardi, R. A., Cocherell, D.E., and Fangue, N.A. Differences in thermal performance between populations of Chinook salmon, *Oncorhynchus tshawytscha*. Bay-Delta Science Conference, Sacramento, CA.
- Zillig, K.W.**, Lusardi, R. A., Cocherell, D.E., and Fangue, N.A. Interpopulation variation in the thermal performance of Chinook salmon, *Oncorhynchus tshawytscha*. International Congress on the Biology of Fishes. Calgary, AB.
- 2013** **Zillig, K.W.** Mother Nature in Australia with a Dry Spell: How Climate Change caused the Australian Megafauna Extinction Event. 2013. Senior Thesis Presentation, Carleton College. Northfield, MN

* Undergraduate Mentee Author

POSTER PRESENTATIONS

- 2022** **Zillig, K.W.**, Frazier, A.M., Naslund, A.N.*, Fangue N.A., and A.E. Todgham. Temperature preference of juvenile Antarctic fishes. International Congress on the Biology of Fish, Montpellier, France.
- Zillig, K.W.**, McInturf, A.G., Fukumoto, J.A.*, Burman, S.G., Steel A.E., Cocherell, D.E., and N.A. Fangue. Bursted! Using Raspberry Pi's and lasers to measure fish burst swim performance. International Congress on the Biology of Fish, Montpellier, France.
- Frazier, A.J., Naslund, A.N., Mandic, M, **Zillig, K.W.**, and A.E. Todgham. An examination of the baseline metabolic status among four juvenile Antarctic fishes. International Congress on the Biology of Fish, Montpellier, France.
- 2021** **Zillig, K.W.**, McInturf, A.G., Burman, S.G., and N.A. Fangue. Disco-dash, a DIY laser timed system for measuring burst performance in fish. Society for Experimental Biology. Virtual Conference.
†Awarded 2nd Prize for Poster Presentation
- Zillig, K.W.**, McInturf, A.G., Burman, S.G., and N.A. Fangue. Development of a laser-timed swim tunnel for measuring anaerobic swim performance across species. Bay-Delta Science Conference.
- McInturf, A.G., **Zillig, K.W.**, Cocherell, D., Michel, C., and Fangue, N.A. The effect of temperature on trophic interactions between largemouth bass and juvenile Chinook salmon in the Sacramento-San Joaquin River Delta System. 11th Biennial Bay-Delta Science Conference.
†Awarded 1st Prize for Poster Presentation
- 2019** **Zillig, K.W.**, Todgham, A. E., Baird S.E., Nguyen T.X., Cocherell D.E., and N.A. Fangue. The effect of feed restriction and acclimation temperature on aerobic metabolism in green sturgeon, *Acipenser medirostris*. American Fisheries Society Conference. Reno, Nevada.
- Bell, H.*, **Zillig K.W.**, Cocherell D.E., Steel A.E., Todgham A.E., Fangue N.A. Thermal acclimation and heat hardening's effect on thermal tolerance in Chinook salmon populations from California and Oregon. Salmonid Restoration Federation, Santa Rosa, California.
- Bell, H.*, **Zillig K.W.**, Cocherell D.E., Steel A.E., Todgham A.E., Fangue N.A. How does prior thermal experience affect subsequent thermal tolerance in Chinook salmon? American Fisheries Society/The Wildlife Society Joint Conference, Reno, Nevada.
- 2018** **Zillig, K.W.**, Todgham, A. E., Baird S.E., Nguyen T.X., Cocherell D.E., and N.A. Fangue. The effect of feed restriction and acclimation temperature on aerobic metabolism in green sturgeon, *Acipenser medirostris*. Bay-Delta Conference. Sacramento, California.
- Zillig, K.W.**, Todgham, A. E., Baird S.E., Nguyen T.X., Cocherell D.E., and N.A. Fangue. The effect of feed restriction and acclimation temperature on aerobic metabolism in green sturgeon, *Acipenser medirostris*. International Congress on the Biology of Fishes. Calgary, AB.

2012 **Zillig, K.W.,** Dai, Z., Xue-fei, H. and W. Overwijk. Addition of anti-VEGF shows no positive or negative synergistic effects against melanoma tumor when combined with covax vaccine. CPRIT Internship Program Presentation, MD Anderson Cancer Center. Houston, TX

* Undergraduate Mentee Author

OTHER RESEARCH EXPERIENCE

2013-2015 Dimensions of Coexistence among Trifolium Species at Bodega Bay, CA
Advisor Dr. Sharon Strauss, University of California, Davis
Studied the coexistence of native *Trifolium* species with large, paired laboratory and field experiments
Research yielded three publications in American Naturalist, Journal of Ecology and Ecology

2013 Effect of Vaccine Adjuvants on Treatment of Melanoma
Advisor Dr. Willem Overwijk, MD Anderson Cancer Center, Houston TX.
Studied the immunological response of mice treated with different varying vaccine formulations