Alexandra Kaye Fraik

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Education

2015-Present Washington State University, Pullman, WA
Title: Characterizing the genomic variation underlying locally adapted populations following rapid environmental change
Ph.D. Candidate, Biology Advisor: Joanna Kelley

2011-2015 North Carolina State University, Raleigh, NC
Title: The impacts of inbreeding on fitness and different life history traits of *Culex pipiens form molestus*
B.S. Zoology Advisor: Fred Gould Suma Cum Laude

Grants and Financial Awards ($441,829)

2020 National Science Foundation Graduate Research Internship Program ($5,000)
The NSF-GRIP supports NSF GRFP fellows with opportunities to enhance their professional development through internships with partner agencies in the federal government to continue research in a non-academic environment.

2020 Washington State University's School of Biological Sciences Exceptional Research as a graduate student Award ($100)

2020 Washington State University Graduate Professional Student Association Research Exposition Poster Award ($800)

2019 National Science Foundation Non-Academic Internships for Graduate Students ($37,400)
The NSF-INTERN provides graduate students that have the potential to make important contributions outside of academia with the opportunity to augment their research with an internship that will provide professional development and research training opportunities that will complement their academic research training in a non-academic setting. (PI: Joanna Kelley)

2018 Elling Foundation Grant Recipient ($1,000)

2017 Elling Foundation Grant Recipient ($1,190)

2016 National Science Foundation-Graduate Research Fellowship ($132,000)
The NSF-GRFP recognizes and supports outstanding graduate students in NSF supported science, technology, engineering, and mathematics disciplines who are pursuing research-based Master's and doctoral degrees at accredited United States institutions.

2016 Elling Foundation Grant Recipient ($3,339)

2015 Washington State University College of Arts and Sciences Recruitment Grant ($2,000)

2014 Park Foundation Enrichment Grant Recipient ($1,000)

2014 Harkema Foundation Grant Recipient ($2,000)

2012 Park Foundation Enrichment Grant Recipient ($1,000)

2011 Park Scholar Class of 2015 ($250,000)
The Park Scholarship is a full, four-year scholarship to North Carolina State University funded by famous North Carolina State University Alumnae Roy Park.

2011 Proctor & Gamble Scholarship ($5,000)

Awards and Recognitions

2020 Washington State University's School of Biological Sciences Exceptional Research Award

2020	First place winner of the Physical and Social Science poster competition at Washington State University's Graduate Professional Student Association (GPSA) Research Exposition, Pullman, WA (Virtual Presentation)
2020	Finalist for the American Genetics Association Ecological, Evolutionary, and Conservation Genomics (EECG) Research Award
2018	Best Graduate Student Poster Award at Evolution in Washington, Idaho, British Columbia and Oregon (EVO-WIBO), Port Townsend, WA

Publications

In Review

C. P. Kozakiewicz, **A. K. Fraik**, A. H. Patton, M. R-Aravena, D. G. Hamilton, R. Hamede, H. McCallum, P. A. Hohenlohe, M. J. Margres, M. Jones, A. Storfer. Gene expression of Tasmanian devil facial tumor disease varies across host populations. *Genome Biology*. (In Prep)

A. K. Fraik, A. N. Facka, and R. Powell. Food, cover, and the importance of resource value of small mammal abundances on a logged landscape in the Sierra Nevada. *Northwest Science*. (In Review)

A.K. Fraik, G. McKinney, A. Wells, M.L. McHenry, T. Bennett, J.R. McMillan, M. Liermann, G. Winans, G.R. Pess, J.L. Kelley, K.M. Nichols. Contemporary dam removal alleviates reduction in genetic variation of steelhead (*Oncorhynchus mykiss*) populations across the Elwha River watershed. *Genes*. (In Review)

A.R., Stahlke, B. Epstein, S. Barbosa, A. H. Patton, S. Hendricks, S.A. Veillet, **A. K. Fraik,** B. Schonfeld, H. McCallum, R. Hamede, M. E. Jones, A. Storfer, P. Hohenlohe. Historical and contemporary signatures of selection in response to transmissible cancer in the Tasmanian Devil (*Sarcophilus harrisii*). *Evolution*. (In Revision)

Published

7. M. J. Margres, M. R-Aravena, R. Hamede, K. Chawla, A. Patton, M. F. Lawrance, **A. K. Fraik**, B. W. Davis, E. A. Ostrander, M. E. Jones, H. McCallum, P. J. Paddison, Paul A. Hohenlohe, D. Hockenbery, A. Storfer. Spontaneous tumor regression in Tasmanian devils associated with RASL11A activation. *Genetics.* (2020).

6. **A. K. Fraik**, M. J. Margres, B.Epstein., M. Jones., S. A. Hendricks, B. Schonfeld, A. Stahlke, R. Hamede, H. McCallum, E. Lopez-Contreas, S. J. Kallinen, B. Lazenby, C. Hawkins, S. Fox, S. Lachish, S. Huxable, P. A. Hohenlohe, J. L. Kelley, A. Storfer. Disease swamps molecular signatures of genetic-environmental associations to abiotic factors in Tasmanian devil (*Sarcophilus harrisii*) populations. *Evolution*. (2020).

5. **A.K. Fraik**, C. Quackenbush, M. J. Margres, S. Comte, D. G. Hamilton, C. P. Kozakiewicz, M. E. Jones, R. Hamede, P. A. Hohenlohe, A. Storfer, J. L. Kelley. Transcriptomics of Tasmanian Devil (*Sarcophilus harrisii)* Ear Tissue Reveals Homogeneous Gene Expression Patterns across a Heterogeneous Landscape. *Genes* 10.10 (2019)

4. S. James, G. Jennings, Y. M. Kwon, M. Stammnitz, **A. K. Fraik**, A. Storfer, S. Comte, D. Pemberton, R. Pye, G. Woods, P. A. Hohenlohe, H. McCallum, H. Siddle, F. Thomas, B. Ujvari, E. P. Murchison, M.

Jones, R. Hamede. Tracing the rise of malignant cell lines: distribution, epidemiology and evolutionary interactions of two transmissible cancers in Tasmanian devils. *Evolutionary Applications*. 12.9 (2019)

3. A. Storfer, A. Patton and **A. K. Fraik**. Navigating the transition from landscape genetics to landscape genomics. Frontiers in Genetics. *Frontiers in Genetics* 9.68 (2018)

2. A. Storfer, P. A. Hohenlohe, M. Margres, H. I. McCallum, A. Patton, **A. K. Fraik**, M. Lawrance, A. Stahlke, M. E. Jones, L. Ricci. The devil is in the details: Genomics of transmissible cancers in Tasmanian devils. *PLOS Pathogens* 14.8 (2018)

1. M. J. Margres, M. Jones, B. Epstein, S. Comte, S. Fox, **A. K. Fraik**, S. A. Hendricks, S. Huxtable, S. Lachish, B. Lazenby, S. M. O'Rourke, A. R. Stahlke, C. G. Wiench, R. Hamede, B. Schönfeld, H. McCallum, M. R. Miller, P. A. Hohenlohe, A. Storfer. Large-effect loci affect survival and tumor growth in Tasmanian devils infected with a transmissible cancer. *Molecular Ecology* 27.21 (2018)

Technical Publications

A**.K. Fraik**, J.R**.** McMillan**,** K.N. Nichols and G.R. Pess. The re-emergence of summer steelhead in the Elwha River following dam removal? *Report to the Northwest Fisheries Science Center in Montlake, WA for the National Oceanic Atmospheric Administration* (2020)

Fraik, A.K., K.N., Nichols and G. Pess. Are there reproductive fitness differences between the integrated hatchery-born fish and natural-born fish in the Elwha River watershed? *Report to the Northwest Fisheries Science Center in Montlake, WA for the National Oceanic Atmospheric Administration* (2019)

Facka, A.N., **A.K. Fraik** and M. Schroeder. Fisher (*Pekania pennanti*) prey availability and habitat use on managed timberlands in Northern Sierra Nevada. *Report to California Department of Fish and Wildlife* (2016)

Invited Presentations

"Elwha River steelhead Population genetics and population estimate". Annual Elwha River watershed Monitoring Meeting, Port Angeles, WA; November 9th 2020.

"Genetic diversity following dam removal and recolonization of Steelhead in the Elwha River". Lower Elwha Klallam Tribe, Port Angeles, WA; April 6th 2020.

"Characterizing genomic and transcriptomic variation of Tasmanian devil populations across a heterogeneous landscape". Department of Biology, Seattle University, Capitol Hill, WA; October 31st 2019.

"Characterizing genomic and transcriptomic variation of Tasmanian devil populations across a heterogeneous landscape". Conservation Biology Division, National Oceanic and Atmospheric Administration (NOAA) Northwest Fisheries Science Center, Montlake, WA; August 6th 2019.

Conference Attendances and Presentations

A.K. Fraik, G. McKinney, D. Kuligowski, A. Wells, M. L. McHenry, J. McMillan, G. Pess, J. L. Kelley, K. M. Nichols. Genetic and ecological life history diversity following dam removal and recolonization of steelhead in the Elwha River. EVO-WIBO, Port Townsend, WA; 2020. (Conference Cancelled)

A.K. Fraik, G. McKinney, D. Kuligowski, A. Wells, M. L. McHenry, J. McMillan, G. Pess, J. L. Kelley, K. M. Nichols. Genetic diversity following dam removal and recolonization of Steelhead in the Elwha River. Northwest Fisheries Science Center Symposium, Montlake, WA; 2020. (Talk- Virtual Presentation)

A.K. Fraik, G. McKinney, D. Kuligowski, A. Wells, M. L. McHenry, J. McMillan, G. Pess, J. L. Kelley, K. M. Nichols. Genetic diversity following dam removal and recolonization of Steelhead in the Elwha River. Graduate Professional Student Association (GPSA) Research Exposition, Pullman, WA; 2020. (Poster- Virtual Presentation)

A.K. Fraik, G. McKinney, D. Kuligowski, A. Wells, M. L. McHenry, J. McMillan, G. Pess, J. L. Kelley, K. M. Nichols. Genetic and ecological life history diversity following dam removal and recolonization of steelhead in the Elwha River. School of Biological Sciences Graduate Student Association Research Symposium, Moscow, ID; 2020. (Poster)

A. K. Fraik, C. Passow, M. Tobler, J. L. Kelley. Do different species respond similarly to hydrogen sulfide exposure? Washington State University Research Showcase, Pullman, WA; 2019. (Poster)

A. K. Fraik, C. Quackenbush, M. J. Margres, M. Jones, R. Hamede, P. A. Hohenlohe, A. Storfer, J. L. Kelley. Variation in the environment drives differential expression in a species of conservation concern. EVO-WIBO, Port Townsend, WA; 2018. (Poster)

A. K. Fraik, C. Quackenbush, M. J. Margres, M. Jones, R. Hamede, P. A. Hohenlohe, A. Storfer, J. L. Kelley. Variation in the environment drives differential expression in a species of conservation concern. School of Biological Sciences Graduate Student Association Research Symposium, Moscow, ID; 2018 (Poster)

A. K. Fraik, M. J. Margres, B. Epstein., M. Jones., B. Schonfeld, R. Hamede, H. McCallum, E. Lopez-Contreas, S. J. Kallinen, P. A. Hohenlohe, J. L. Kelley, A. Storfer. Characterizing potential adaptations in Tasmanian devil populations in the face of a transmissible cancer. American Society of Mammalogists Annual Meeting, Moscow, ID 2017. (Oral)

A. K. Fraik, M. J. Margres, B. Epstein., M. Jones., B. Schonfeld, R. Hamede, H. McCallum, E. Lopez-Contreas, S. J. Kallinen, P. A. Hohenlohe, J. L. Kelley, A. Storfer. Characterizing potential adaptations in Tasmanian devil populations in the face of a transmissible cancer. Evolution, Portland, OR; 2017. (Oral)

A. K. Fraik, M. J. Margres, B. Epstein., M. Jones., B. Schonfeld, R. Hamede, H. McCallum, E. Lopez-Contreas, S. J. Kallinen, P. A. Hohenlohe, J. L. Kelley, A. Storfer. Characterizing potential adaptations in Tasmanian devil populations in the face of a transmissible cancer. School of Biological Sciences Graduate Student Association Research Symposium, Moscow, ID; 2017. (Oral)

A. K. Fraik, B. Epstein., M. Jones., B. Schonfeld, R. Hamede, H. McCallum, P. A. Hohenlohe, J. L. Kelley, A. Storfer. Characterizing potential adaptations in Tasmanian devil populations in the face of a

transmissible cancer. Characterizing the Adaptive Potential of Tasmanian devils (*Sarcophilus harrisii*) across their geographic range. EVO-WIBO, Port Townsend, WA; 2016. (Poster)

A. K. Fraik, B. Epstein., M. Jones., B. Schonfeld, R. Hamede, P. A. Hohenlohe, J. L. Kelley, A. Storfer. Characterizing potential adaptations in Tasmanian devil populations in the face of a transmissible cancer. Characterizing the Adaptive Potential of Tasmanian devils (*Sarcophilus harrisii*) across their geographic range. School of Biological Sciences Graduate Student Association Research Symposium, Moscow, ID; 2016. (Poster)

A. K. Fraik, M. Fritz, F. Gould. The Impacts of Inbreeding on the Fitness of *Culex pipiens form molestus*. North Carolina State University Research Symposium, Raleigh, NC; 2015. (Poster)

Teaching Experience

2020 BIO 106: Introduction to Biology
Laboratory Teaching Assistant at Washington State University

2019 BIO 352: Cell Biology
Guest Lectured course on extracellular structures at Washington State University

2016,2017 BIO 106: Introduction to Biology
Laboratory Teaching Assistant at Washington State University.

2015 BIO 428: Mammalogy
Laboratory Teaching Assistant at Washington State University.

2013,2014 BIO 233: Human-Animal Interaction
Head Lecture Teaching Assistant at North Carolina State University.

2013 LSC 101: Introduction to Critical and Creative Thinking in the Sciences
Lecture Teaching Assistant at North Carolina State University.

Field and Lab Experience

2014-2020 Northern Sierras California Fisher Reintroduction Project, Paradise, CA
Data analyst and research assistant working on small mammal habitat modelling and resource selection for Dr. Roger Powell (North Carolina State University) and Dr. Aaron Facka (Oregon State University).

2019 National Oceanic and Atmospheric Administration, Montlake, WA
Data analyst and research assistant working on population genetic and demographic analyses of recolonizing *Oncorhynchus mykiss* in the Elwha River watershed following dam removal for Dr. Krista Nichols (NOAA) and Dr. George Pess (NOAA).

2014-2015 Sierra Pacific Industries, Paradise, CA
Small mammal field research technician for the northern sierras California fisher reintroduction project based out of North Carolina State University.

2013-2015 Undergraduate lab research assistant, Raleigh, NC
Undergraduate lab research assistant in Dr. Fred Gould's lab working on genetic pest management in species in the *Tribolium* and *Culex* genera at North Carolina State University.

2013 Undergraduate field research assistant, Perth, Western Australia
Undergraduate field research assistant working in Dr. Nicola Walker's lab on Logger head sea turtle climate ecology at the University of Western Australia.

2012 Mohololoholo Wildlife Rehabilitation Center, Hoedspruit, South Africa
Student intern and field assistant working on conservation biology and animal husbandry with the non-profit the Mohololoholo Wildlife Rehabilitation Center.

2011 Undergraduate lab research assistant, Raleigh, NC
Undergraduate lab research assistant in Rob Dunn's lab working on species identification and range mapping on the "School of Ants Citizen Science Project" at North Carolina State University.

Outreach

2020 Missouri Flat Creek Restoration Project, Pullman, WA
Volunteer in the weekly riparian work for the maintenance and restoration of a threatened, urban watershed. Outreach volunteer for development and implementation of educational resources and activities for K-university aged students including the creation of online video content and a dichotomous key.

2020 Lecture on conservation of salmonids for non-biology majors, Moscow, ID
Invited presentation for non-major students in the Core Science course (CORS 231) at the University of Idaho on my research on Steelhead recovery in the Elwha River watershed following removal of two dams. This lecture was given to three separate course sections and involved generating a lecture that would be recorded and taught live via zoom for three course sections. The content included both my research and the history of salmonid conservation efforts in the Elwha River watershed. The course was a flipped classroom that I also created in-class discussion questions, pre-class assignments and an exit quiz for students.

2020 Meet an Evolutionary Biologist, Spokane, WA
Invited presentation to a Gonzaga University advanced evolution class to discuss my conservation and landscape genomics work on Tasmanian devils, Atlantic mollies, hydro-thermal vent shrimp, and Rainbow trout to university students.

2017-2020 Manuscript Reviewer
Reviewed articles for **Journal of Evolutionary Biology** and **Molecular Ecology**.

2017-2020 Project Manager at the Phoenix Conservancy, Pullman, WA
Grant writing instructor and research project mentor (current) as well as fundraising, communications and social media director (2017-2018) for the Phoenix Conservancy. The Phoenix Conservancy is a local 501(c)3 conservation non-profit dedicated to restoring degraded ecosystems to maximize conservation of biodiversity in threatened habitats.

2019 Featured in "Saving the Tasmanian Devil" book chapter

Interviewed and collaborated on a book chapter with renowned scientific children's writer Dorothy Hinshaw Patent regarding my experiences as a female biologist in the field and PhD dissertation work on Tasmanian devils. https://dorothyhinshawpatent.com/saving-the-tasmanian-devil/

2019 Skype a Scientist
Invited presentation to 6th grade classroom in MA entitled, "What we can learn about infectious diseases from studying animals"
Invited presentation to the Connections Academy STEM classroom entitled, "Why adapt? Life in extreme environments"

2019 Science After Hours Presentation, Moscow, ID
Invited research presentation to the general public for a local scientific communication and environmental non-profit the Palouse Clearwater Environmental Institute. Presentation entitled: **"**Do different species respond similarly to hydrogen sulfide exposure"

2018-2019 Martes Scientific Working Group, Pullman, WA
Contributing member of the social media and science communication committees for the international Martes Scientific Working Group.

2018 WSU Scientista Club, Pullman, WA
Invited panelist for a graduate school panel for young female scientists interested in advanced education post bachelor's degree in STEM disciplines.

2017 Science After Hours Presentation, Moscow, ID
Invited research presentation to the general public for a local scientific communication and environmental non-profit the Palouse Clear Water Environmental Institute. Presentation entitled: "The devil we know: characterizing adaptive potential in Tasmanian devils in the response to an infectious cancer"

2016 Zoology club, Pullman, WA
Invited presentation of my research to the students in the Washington State University Zoology Cub Presentation entitled: "Characterizing adaptive potential in Tasmanian devils in the response to an infectious cancer"

Mentorship

2019 Use of microbial mycology as a tool for ecological restoration
Mentorship of an undergraduate student at the University of Idaho (Jordan Hawley) on a restoration ecology project to benefit restoration work on the Palouse prairie. The goal of this project was to synthesize published literature to develop a protocol that could be used by untrained field technicians for gathering samples, sending them to the lab and interpreting the results from 16s sequencing of microbial mycological communities in soil samples. She presented this protocol and the findings of her research to the executive director and board of the Phoenix Conservancy 501(c)3.

2018 Validation of candidate genes for local adaptation through transcriptomics
Mentorship of an undergraduate students at Washington State University (Samantha Kallinen) for analyzing Tasmanian devil transcriptomic data. She compared gene expression differences in a subset of genes between male and female Tasmanian devils and presented her findings at SURCA at Washington State University.

2017 Variance in disease prevalence of Tasmanian devils across a heterogeneous environment

Mentored two undergraduates (Samantha Kallinen and Elisa Lopez-Contreras) on a computational disease ecology for the Tasmanian devil research project that calculated disease prevalence across Tasmania. The results from this research were used in a Tasmanian devil landscape genomics paper and were summarized and presented by the undergraduates in a joint poster presentation at the Showcase for Undergraduate Research and Creative Activities (SURCA) at Washington State University.