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THE Open Reading Frame

Newsletter of the Genetics Section of the American Fisheries Society

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Sunset illuminating the Himalayas in Bhutan (December 2016), Marlis Douglas

President's Message

Welcome to the Winter 2020 edition of the Genetics Section newsletter. As we near the end of this most unusual year, there are clear indicators many aspects will improve in 2021, though the challenges and pressures brought upon us by the pandemic and socio-economic inequities will have reverberations for many years

to come. But such difficult times also offer opportunities to explore new and better approaches to professional activities and interpersonal interactions. Therefore, it seems timely to evaluate how the American Fisheries Society and the Genetics Section can serve our members.

A key role for AFS sections is to transcend the limitations of geographic and institutional boundaries so as to provide a community built on shared interests. Traditionally, this network has been reinforced during in-person conferences and workshops, where students and early career professionals could introduce themselves as scientists by presenting their research and be welcomed into the professional fabric during networking events. Certainly, digital communications and social media have expanded these options, but we should explore possibilities that extend beyond. The necessity to move so many of our daily activities to virtual platforms has forced us to learn, adapt and explore new communication skills, and these can now be brought to the fore in different venues.



Dr. Marlis Douglas
AFSGS President

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President's Message, cont'd

For example, virtual defense seminars no longer limit attendance to a specific geographic location and an in-person format. Instead, former lab members now pursuing a postdoc half way across the country can 'zoom in' and not only participate in familiar research topics/projects, but also reinforce prior relationships with graduate colleagues and mentors. Here, the AFS Genetics Section could fulfill a role as a 'switchboard' for such seminars, offering a simple but consistent mechanism for informing a much larger audience about opportunities to stay abreast of ongoing research by our new generation of fish geneticists.

The AFS Genetics Section could also be a platform from which to exchange materials developed for teaching and mentoring amongst colleagues within an established network. Here I see great opportunities for engagement by our students and early career professionals. They are not only facile with digital media, but also rather innovative and not burdened by '... having done PowerPoints for the last 20 years...'

Even in these difficult times, I try and remain optimistic with a penchant to see illumination in the pervading dark. The year 2020 is for sure a defining moment – let us collaborate so as to convert those challenges into meaningful opportunities for gaps to be bridged with the end-result being an inclusive, diverse community of fish geneticists. We have many potential avenues for strengthening our professional network, broadening our participatory base, and providing equal opportunities to a broader range of participants. To achieve these goals, the AFS Genetics Section seeks your input! Please convey to us your ideas, concerns, dreams, and worries so that we can seize opportunity and reconstruct our professional community for 2021 and beyond.

On behalf of the executive committee (Andrew Whitley, Garrett McKinney, and Mary Peacock), I extend our gratitude and appreciation to all for being part of our professional network. We seek to facilitate the communication amongst AFS Genetics Section members, and your active participation is ground zero.

Happy (socially distanced) Holidays,

Marlis

What's the Plan?

Dr. Marlis Douglas, AFSGS President

The American Fisheries Society is a large, complex network of professionals with a long tradition (~150+ years), and a scaffold of elected officers and appointed committees has been developed to focus activities and ensure goals are defined and procedures set in motion to make it all happen.

Within this context, workplans are developed by AFS presidents in consultation with executive groups. So, how does this process impact the Genetics Section?

Our goals align well with those defined by AFS President Brian Murphy – to include:

- (1) broadening inclusiveness and diversity
- (2) promoting students and early career professionals
- (3) strengthening outreach and education.

Okay – for sure, lofty goals, but how will these be implemented? The AFS Genetics ExComm will discuss specific activities and initiatives in upcoming conference calls, but in the interim, here are some ideas:

- **Developing student-driven 'digital-content' modules for the AFS 150th Celebration.**

Develop memes, short videos, or infographics to explain concepts in fish genetics. To be featured at the 2021 Conference (Columbus, OH) as well as on our Genetics Section website. Student chapters compete for 'best' & 'most innovative' digital memes for outreach and teaching.

- **Recognizing Diversity in Excellence**

Traditional metrics primarily focus on scholarly accomplishments, such as published research, methodological innovations, or new analytical approaches. Yet other criteria can also define 'excellence,' particularly if criteria were broadened to include (for example) the introduction of genetic approaches to diverse communities or new demographics. ExComm will explore how best to accomplish this, and for sure your input is solicited.

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Genetics Section Executive Committee Election Results

President-elect Dr. Garrett McKinney



AFS Genetics Section
President-elect
Dr. Garrett McKinney

I'm excited to be the new president-elect for the AFS genetics section. From a young age I have been interested in oceans and fish. Like many kids, my desire was to be a marine biologist studying coral reefs but in graduate school my interests were increasingly drawn to genetics and conservation. Throughout graduate and post-doctoral work, much of my research has focused on using genetics and genomics to address conservation questions in salmon. I have been fortunate to work in a field that I am passionate about, and to be doing science in an era with such rapid advancement. It is truly exciting to see how quickly the field of conservation genetics is progressing.

With the current pace of progress, it is especially important to keep abreast of current analytical methods and computational programs. As AFSGS president-elect, a key priority for me is to promote scientific training by striving to expand workshop and travel opportunities for AFS genetics section members. I realize that for many, travel is not an option now due to COVID, but this has also brought greater opportunities for remote meetings and training. Importantly, these remote opportunities can increase accessibility to scientific training for all of our members. We also have an amazing resource in the skills and knowledge spread throughout our members and I am interested in exploring ways to facilitate knowledge sharing within our group.

Thank you for the opportunity to expand my involvement and service with AFS and help to lead the Genetics Section towards an even brighter future.

Secretary-Treasurer Dr. Mary Peacock

It is my honor to have been elected Secretary-Treasurer for the Genetics Section of the American Fisheries Society for 2020-2022. I have been a member of AFS since 1996 and have rarely missed a national meeting. I am also active with the Western Division and Cal-Neva chapters of AFS. The American Fisheries Society is the premier scientific organization for fisheries biologists not only here in the United States but internationally as well. In my experience, fisheries geneticists are typically on the cutting edge of our discipline, for not only new laboratory methodologies but new analysis approaches as well. As Secretary-Treasurer one of my goals is to increase funding for student travel to national meetings and for pilot projects for graduate students. I thank the section members for electing me and hope to see you all at the next AFS national meeting whether in person or on ZOOM. Keep up the good work!



AFS Genetics Section
Secretary-Treasurer
Dr. Mary Peacock

Stevan Phelps Memorial Award

Distinct Phenotypes of Native Cutthroat Trout Emerge under a Molecular Model of Lineage Distributions

Kevin R. Bestgen, Kevin B. Rogers, Robert Granger

Transactions of the American Fisheries Society 148:442-463

Myself, Kevin Rogers, and Robert Granger, authors of the subject paper “Distinct Phenotypes of Native Cutthroat Trout Emerge under a Molecular Model of Lineage Distributions” are pleased to accept the Stevan Phelps Memorial Award from the Genetics Section of the American Fisheries Society (AFS) for the paper we published in *Transactions of the American Fisheries Society*. In that paper, we studied the taxonomically obscure group of cutthroat trout *Oncorhynchus clarkii* found in portions of Colorado, New Mexico, Utah, and Wyoming by marrying genetic relationships with morphological data for 744 specimens from 49 locations, and discovered congruent and clear relationships among populations. The lineages of diversity we defined may eventually be considered for formal taxonomic designation, but more importantly, provide the basis for conservation actions by managers now to preserve these rare populations of native cutthroat trout in the Southern Rockies landscape. One of the four lineages is greenback cutthroat trout, *O. c. stomias*, the state fish of Colorado, which is also listed by the U. S. Fish and Wildlife Service as a threatened species. Our work continues as a lineage thought extinct in the San Juan River drainage was recently rediscovered in Colorado (pictured).



San Juan River native Cutthroat trout (Grayhackle Lake, CO),
Photo credit: Kevin B. Rogers, Colorado Parks and Wildlife

We are especially proud of this work because it brings to a more full circle, the life work of Dr. Robert Behnke (pictured, circa 2008), who wrote a monograph on the Trout of Western North America (Behnke 1992), then the definitive work on the subspecies of cutthroat trout. Research in the 6 years before Doc's death in 2013, using



Dr. Behnke

(image permission from Sally Behnke, Fort Collins, CO)

molecular genetics, called into question some of his traditional taxonomy. This led to some tension among Dr. Behnke and us prior to his death in 2013, as we tested some of the conclusions of the contentious genetics work. This was difficult because both Bestgen and Rogers were mentored by Dr. Behnke and we deeply respected and valued his views and friendship. A key part of our analysis confirmed that even though various subspecies had been stocked outside their native ranges, once you knew their origin (using genetic techniques) the lineages Dr. Behnke designated are still discernible using external characteristics (i.e., traditional taxonomy) on which most species identification is based. Thus, with some modifications, including redefinition of some lineage distributions, our work confirmed many of Doc's conclusions made without the benefit of all the tools we had at our disposal. Although he may not have necessarily agreed with all the details of our work, we carry pieces of his enormous wisdom and philosophy forward, along with his love for native cutthroat trout, the fish he worked so hard to champion. Although the story is not yet finished, the richer and deeper understanding we now have of native cutthroat throughout the southern Rocky Mountains will advance their conservation, a point we could all support.

Early Career Award

Dr. Kerry Reid

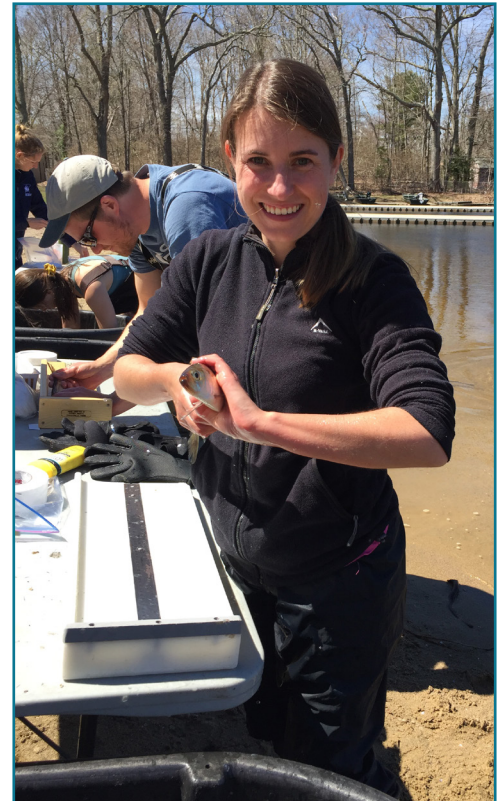
Postdoc, Department of Ecology and Evolution, Stony Brook University

I am currently a postdoc at Stony Brook University where my research is aimed at elucidating the underlying genomic mechanisms that facilitate rapid adaptation in threespine stickleback. Prior to this position, I was a postdoc with Dr. Eric Palkovacs and Dr. John Carlos Garza at University of California Santa Cruz where our focus was to develop and implement genetic and genomics tools to address conservation and management questions in river herring along the east coast of North America.

River herring (alewife and blueback herring) have shown massive declines in abundance and are no longer caught commercially but are still caught as bycatch in Southern New England (SNE) Fisheries. To address questions on the origin of river herring bycatch we developed species-specific SNP panels and genotyped thousands of fish across both species distributions to provide comprehensive range-wide genetic baselines for each species. Next, we implemented these genetic baselines to study patterns of bycatch proportions and mortality in SNE fisheries over 4 years. This research has been included in ESA petitions in efforts to protect river herring.

In addition, restoration efforts through the removal of dams and building of fishways has been ongoing in the Northeast US to allow anadromous species access to previous spawning habitat. A consequence of this is that alewife are now coming into secondary contact with a landlocked alewife ecotype. To address questions on the consequences of secondary contact and restoration, we developed a GT-seq microhaplotype panel that is suitable for large-scale parentage studies. We sequenced >7000 anadromous adults stocked and >6000 juveniles produced in the lake. Findings from this study include characterizing hybridization between ecotypes, rapid directional introgression into the landlocked population and even returning mature anadromous alewife born in the lake from stocked parents, indicating how successful the restoration effort is despite introgression in the lake environment. Both these projects indicate the utility of genetic and genomic tools to inform fisheries science.

It is a great pleasure to be selected for this award, I would like to thank the AFS genetics section for continuously highlighting how genetic and genomics approaches are complementary and necessary in fisheries science. I would also like to thank my previous supervisors and colleagues who provided the opportunity and support to work on these important projects.



Dr. Kerry Reid

What's the Plan? (cont'd from page 2)

• Strengthening and Extending Connections

The virtual environment opens many avenues to engage fish geneticists across the globe. While the AFS International Fisheries Section (IFS) already does a fabulous job in this regard, the Genetics Section could partner with the IFS to promote the AFS Genetics Section as a component of the global community. Co-sponsored symposia could be such an effort.

• Improving Communications and Public Trust in Science

The complexity of science can often be bewildering to lay audiences, and disciplines employing highly technical approaches at a particular disadvantage. Here, genetics and genomics are no exception. But, as the previous year has shown, it has never been more important for scientists to interpret and communicate facts to a skeptical public, be it how the pandemic is evolving or how climate change contributes to devastating wildfires and storm surges. AFS and its partners already sponsor various activities such as our Climate Ambassador Program (funded by NOAA and co-sponsored by other aquatic societies and granting agencies), but the Genetics Section could for example contribute by jointly offering a virtual book club on how to develop effective narratives within complex topics by employing the ABT framework (i.e., "And," "But," "Therefore") in collaboration with the AFS Science Communication Section.

These are just some ideas. Please let us know what you think, what other options we should consider, and most importantly, how you can contribute!

James E. Wright Graduate Award

Seth Smith

PhD Student, Michigan State University

As a graduate student in the Department of Integrative Biology at Michigan State University, my dissertation research centers around the development of genomic resources for lake trout (*Salvelinus namaycush*) and the identification of loci associated with variation in fitness between hatchery strains that were used to restore Great Lakes populations following functional extirpation. Previous research has found evidence for differences in fitness between lake trout hatchery strains in the contemporary Great Lakes environment, with one strain originating from Seneca Lake in New York outperforming others. We have identified multiple candidate adaptive genomic regions exhibiting high levels of divergence between the Seneca strain and hatchery strains from the Great Lakes; however, it is unclear which of these loci, if any, are associated with variation in survival and reproductive success in recovering wild populations. For this reason, we are also using local ancestry inference methods to identify genomic regions with an excess of haplotypes originating from the Seneca strain in later generation hybrids that were spawned in the wild. It has been hypothesized that the success of the Seneca strain is associated with an ability to avoid or survive predation by invasive sea lamprey. If this is the case, then we expect to observe high levels of allele frequency divergence between hatchery strains and an excess of Seneca origin alleles in hybridized wild individuals near genes, or regulatory regions, that have previously been found to be associated with transcriptional responses to lamprey parasitism.

In terms of genomic resource development, I have designed a 60,000 locus RAD-capture genotyping panel for lake trout, constructed a high-density linkage map, and am currently working on a collaborative project to assemble a chromosome-scale reference genome for the species. I'm also currently working to develop a smaller RAD-capture panel targeting approximately 5000 loci that are highly informative for genetic stock identification, parentage analysis, sex determination, and monitoring variation at candidate adaptive loci in future generations. The research projects described above have been carried out in collaboration with researchers and mentors at the University of Montana (Gordon Luikart and Steve Amish), Université Laval (Louis Bernatchez and Eric Normandeau), the Ontario Ministry of Natural Resources (Chris Wilson), and Michigan State University (Kim Scribner).

I'd like to extend my deepest thanks to AFS Genetics Section. Receiving the James E. Wright Award was a huge breath of fresh air during a year that's been highly unusual to say the least. It was a pleasure to have the opportunity to share my work at the AFS national meeting, co-organize my first symposium, and interact with so many fantastic fisheries geneticists.



Seth Smith

James E. Wright Graduate Award

Savannah LaBue

PhD Student, Florida International University

As a PhD student at Florida International University (Miami, FL), my research focuses on the population structure of Pacific herring (*Clupea pallasii*) in Southeast Alaska. Although eight of ten established Pacific herring stocks in Southeast Alaska have been closed since the early 1980s, managed stocks have experienced declines that prolonged closures have failed to reverse. There are many hypotheses suggesting the failure of stocks to recover to historic abundances observed in the 1970's are related to a combination of increased predation by humpback whales, parasitic infestation, transmission of viruses, thermal intolerance and habitat alterations however, few studies have examined relations to genomic components. Previous work using microsatellites indicated genetic differentiation between winter aggregations of herring suggesting these aggregations are composed of individuals from various spawning stocks.

The goal of my current work is to examine individuals from these aggregations to find further evidence of metapopulations. Additionally, I would like to compare members of the Southeastern Alaskan herring stocks to other stocks across Alaska, Washington state and British Columbia to examine degrees of genetic differentiation. Lastly, I plan to conduct an examination to illuminate indicators of adaptive potentials in order to address the failures of recovery and recruitment. In order to facilitate these goals, I am going to conduct RADseq analyses following the protocols of Etter et al. (2011) and create reference databases according to the methods of Briec et al. (2014) with some alterations. The James E. Wright Award was a huge help in allowing me to attend the virtual national AFS meeting. It provided me with a unique opportunity to learn from other fish geneticists and researchers. I have not had the opportunity to attend many genomic conferences and this meeting was a fantastic opportunity to network, learn, and build my web of collaborators. Further, receipt of this award has given me a sense of accomplishment and confidence in my abilities as both a student and young researcher. I would like to extend a heartfelt thank you to the American Fisheries Society Genetics Section and to all of my collaborators and mentors—particularly Dr. Andres Lopez, Dr. Wes Larson, Dr. Kevin Boswell, Dr. Heather Bracken-Grissom, Dr. Jacek Maselko, John Moran, Johanna Vollenweider, Dr. Ron Heintz and Bonita Nelson.



Savannah LaBue

In case you missed it...

Recent genetics papers from AFS journals and beyond

Editor's note: Click citations for link to papers

Evaluation of Genetic Structuring within GIS-Derived Brook Trout Management Units. L.R. Nathan, Y. Kanno, B.H. Letcher, et al., TAFS, Early View

Using Genetic Data to Estimate Capture Rate of Wisconsin and Leech Lake Strains of Muskellunge Stocked in Four Wisconsin Lakes. W.A. Larson, T. Hill, D. Rowe, et al., NAJFM 40:1302-1312.

Steelhead (*Oncorhynchus mykiss*) lineages and sexes show variable patterns of association of adult migration timing and age-at-maturity traits with two genomic regions. S.C. Willis, J.E. Hess, J.K. Fryer et al., Evolutionary Applications, Early View.

Genomic analysis reveals neutral and adaptive patterns that challenge the current management regime for East Atlantic cod *Gadus morhua* L. T. Johansen, F. Besnier, M. Quintela et al., Evolutionary Applications, Early View.

Comparison of anadromous and landlocked Atlantic salmon genomes reveals signatures of parallel and relaxed selection across the Northern Hemisphere. E. Kjærner-Semb, R.B. Edvardsen, F. Ayllon et al., Evolutionary Applications, Early View.

Multispecies models reveal that eDNA metabarcoding is more sensitive than backpack electrofishing for conducting fish surveys in freshwater streams. E.F. McColl-Gausden, A.R. Weeks, R.A. Coleman, et al., Molecular Ecology, Early View.

Detecting population declines via monitoring the effective number of breeders (N_b). G. Luikart, T. Antao, B.K. Hand et al., Molecular Ecology Resources, Accepted Article.

Genome-wide diversity and habitat underlie fine-scale phenotypic differentiation in the rainbow darter (*Etheostoma caeruleum*). D.R. Oliveira, B.N. Reid, S.W. Fitzpatrick, Evolutionary Applications, Early View.

Strong population differentiation in lingcod (*Ophiodon elongatus*) is driven by a small portion of the genome. G.C. Longo, L. Lam, B. Basnett, et al., Evolutionary Applications, Early View.

Copy number variants outperform SNPs to reveal genotype–temperature association in a marine species. Y. Dorant, H. Cayuela, K. Wellband, et al., Molecular Ecology, Early View.

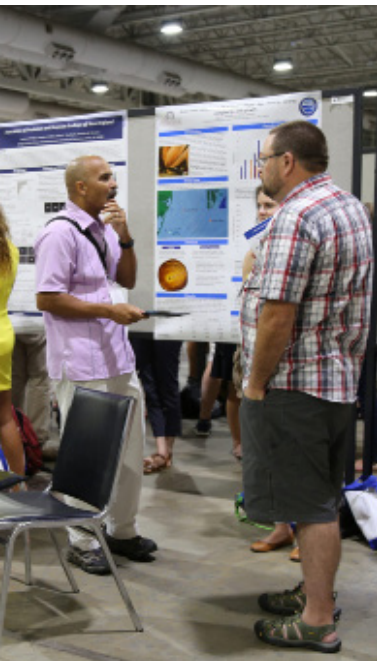
Thermal stratification and fish thermal preference explain vertical eDNA distributions in lakes. J.E. Littlefair, L.E. Hrenchuk, P.J. Blanchfield, et al., Molecular Ecology, Early View.

Conservation and Management of Salmon in the Age of Genomics. R.S. Waples, K.A. Naish, and C.R. Primmer. Annual Review of Animal Biosciences 8:117-143.

Rapture-ready darters: choice of reference genome and genotyping method (whole-genome or sequence capture) influence population genomic inference in *Etheostoma*. B.N. Reid, R.L. Moran, C.J. Kopack, and S.W. Fitzpatrick. Molecular Ecology Resources, Accepted Articles.



Calendar



January 2021

4th-8th: Canadian Conference for Fisheries Research. Virtual Conference.

February 2021

1st-3rd: 81st Midwest Fish and Wildlife Conference. Virtual Conference.

1st-5th: FAO Committee on Fisheries. Virtual Conference.

15th-19th: Canadian Conference for Fisheries Research & Society of Canadian Limnologists. Virtual Conference.

April 2021

6th-9th: AFS Southern Division Annual Meeting. Virtual Conference.

May 2021

10th-14th: AFS Western Division Annual Meeting. Virtual Conference.

17th-21st: International Association for Great Lakes Research. Virtual Conference.

July 2021

5th-9th: Fisheries Society of the British Isles 2021 Symposium. Leuven, Belgium.

6th-9th: 14th International Congress on the Biology of Fish. Montpellier, France.

12th-15th: Joint Meeting of the Northeast Fish Health Committee and the AFS Fish Health Section. Burlington, VT.

25th-30th: 12th Symposium on European Freshwater Sciences. Virtual Conference.

August 2021

8th-12th: 151st Annual Meeting of the American Fisheries Society. Baltimore, Maryland.

To find dates and information for AFS chapter meetings, visit [fisheries.org/about/units/chapters/](https://www.fisheries.org/about/units/chapters/)

Job Postings

Vrije Universiteit Amsterdam, Netherlands - Tenure Track.

We are looking for expertise in next-generation sequencing genome analysis, population genomics, detection of genomic signatures of local adaptation and demography, and its application to research questions in the field of conservation biology, preferably applied to multiple study systems. Other areas of research expertise may include vulnerability to climate change, genomics of inbreeding, genetic load, or genomics of small endangered or captive populations.

SUNY Binghamton - Tenure Track. We especially encourage applicants who are working at the level of genomes, transcriptomes, proteomes, metabolites, and/or cell populations to investigate genetic interactions, gene expression regulation, biological networks, and/or their evolution.

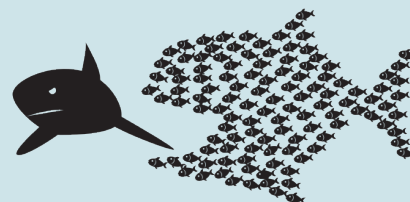
Loyola University - Tenure Track. Inviting applications for a full-time tenure-track position at the rank of Assistant Professor for academic year 2021-22. The new faculty member is expected to participate in teaching Genetics and/or Genomics to a wide variety of science students in addition to Biology majors.

Michigan State University - Fish Production Tech.

Technicians will assist in ongoing lake sturgeon research. Field work includes conducting an annual adult census on the Upper Black River, larval sturgeon drift collection, late-summer juvenile sturgeon census, and assisting with field research as assigned. Hatchery work includes rearing fall fingerling lake sturgeon using standardized aquaculture methodology.

Clemson University - Wet Lab Technician. The Clemson University College of Science Genomics and Bioinformatics Facility (CUGBF) is searching for a wet lab technician. This is an initiative started by the College of Science to support the research programs of our faculty, postdocs and graduate students. The researcher will assist in day-to-day lab management duties, carryout DNA/RNA isolations, NGS library construction, run our Illumina NextSeq, carryout basic bioinformatic analyses, and conduct other genomic-related research activities.

Upper Midwest Environmental Sciences Center (UMESC) - Supervisory Ecologist. We are seeking a dynamic leader to serve as the Chief of the Branch of Ecological Sciences. This position leads, plans and coordinates efforts to identify and develop science programs. The Ecological Sciences Branch is one of five branches within the U.S. Geological Survey's Upper Midwest Environmental Sciences Center (UMESC). The mission of UMESC is to support Department of the Interior's science needs in the upper Midwest. UMESC also coordinates its research with other USGS Science Centers, other Federal and state agencies, universities, and non-governmental organizations to broadly address ecological and societal issues of concern throughout the Nation's heartland.





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