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THE Open Reading Frame

Newsletter of the
Genetics Section of the American Fisheries Society

In this issue

President's Message

Dr. Andrew Whiteley
AFSGS President

Welcome to the winter 2018 edition of the Genetics Section newsletter. This is my first President's Message since I took the reigns from Wendylee Stott. The rest of our new executive committee consists of Marlis Douglas, Wes Larson, and Wendylee. On behalf of the executive committee, we are looking forward to a new year with opportunities to facilitate communication among the 214 members of the Genetic Section and between the Section and the Parent Society.

During 2018, the Genetics Section co-hosted the Coastwide Salmonid Genetics Conference, supported student travel, upgraded the website, and awarded excellence and achievements across the career spectrum. This included awards for: graduate student achievement (through two Wright Awards), excellence in a paper contributed to AFS journals (through the Phelps Award), excellence in early career contributions (through the Early Career Award), and for overall career achievements (through an induction to the Hall of Excellence). We are grateful to all the volunteers that helped select winners of these awards and, in thinking about next year's round of awards, for their continued service to the section. It's worth pointing out that two 'above and beyond' type issues cropped up in the last year, that of moving the website to the parent society hosted platform and working through financial complexities of Section co-sponsorship of the Coastwide meeting. Kristen Gruenthal deserves a special thinks for her efforts on both of these. We also all owe thanks to Wendylee for her service as the President for the last two years.

Looking ahead, the next national AFS meeting will be held in Reno Nevada and will be held jointly from September 29 – October 3 with The Wildlife Society (note the later than usual date). We have all been tasked with trying to come up with symposia or workshops that will draw in members (both presenters and audience members) from both societies. So, start thinking of ideas and please reach out to executive committee members if you need any help with plan a symposium.

Feature Article

Inconsistent genetic and phenotypic variation among isolated populations of Brook Trout in Great Smoky Mountains National Park

T. Casey Weathers and John E. Carlson
Penn State University, Department of Ecosystem Science and Management

Matt A. Kulp
National Park Service, Resource Management and Science Division, Great Smoky Mountains National Park

Dave C. Kazyak
U.S. Geological Survey, Leetown Science Center, Aquatic Ecology Laboratory

Great Smoky Mountains National Park (GRSM) harbors hundreds of miles of Brook Trout (*Salvelinus fontinalis*) habitat, but the effects of historical habitat disturbances (logging, invasive trout stocking, and acid deposition) has led to the fragmentation and isolation of many populations. Isolated populations tend to be demographically small and are challenging to manage and conserve. Such populations are particularly vulnerable to genetic drift, allelic fixation, inbreeding, and might exhibit reduced phenotypic variability. Moreover, such populations could be on independent evolutionary paths, and in the absence of active intervention they will need to adapt in place to changing conditions if they are to persist.

Great Smoky Mountains Brook Trout angler catch
Credit: Pete Yoemans

To better understand how isolation has influenced present-day phenotypic (i.e., shape and appearance) and genetic variation, we partnered with biologists from the National Park Service and the U.S. Geological Survey to look at whether Brook Trout collected from 35 isolated headwater streams in Great Smoky Mountains National Park display markedly different neutral genetic profiles and/or morphometric and meristic characters.

Given the spatial isolation and fragmentation of these populations, we hypothesized that populations might have significant genetic and morphometric differences. As we expected, there were significant genetic differences among populations across all spatial scales (e.g., between populations, subwatersheds, and watersheds). These results were consistent with expectations of neutral genetic drift in small, isolated populations. However, we observed contrasting patterns of morphometric and meristic variation (i.e., phenotypic variation). We observed substantial phenotypic variation, but it primarily consisted of variation among individuals within each population and to a lesser extent among populations within subwatersheds) rather than broader structure at larger spatial scales. Interestingly, we did not observe a significant relationship between the amounts of genetic and phenotypic variation within the surveyed populations—however our power to detect an effect was restricted by the limited range of microsatellite diversity observed among the examined study sites. These results suggest unmeasured variables may be influencing intrapopulation phenotypic variation between individual Brook Trout. Our results suggest that managers could generally capture substantial phenotypic diversity from modest numbers of individuals collected from isolated source populations for restoration, but the substantial levels of genetic structure and limited genetic diversity observed in the region warrant consideration.

Obtaining an adipose-fin tissue sample for genetics
Credit: Ian and Charity Rutter

Continued on page 4

Genetics Section awards presented at 2018 business meeting

The **James E. Wright Graduate Award** is given in the memory of Jim Wright, one of the founders of fish genetics research and education in North America. The work of Jim Wright and his students combined classical chromosome studies with allozyme inheritance and helped shape our understanding of the salmonid genome. This award is presented annually at the Genetics Section Business Meeting during the AFS Annual Meeting to recognize excellence in graduate level work in fisheries genetics, as well as assist graduate students with travel to the national meeting. Our awardees for 2018 are Shannon White, PhD Student, Penn State University and Nathaniel Marshall, PhD Student, University of Toledo.

The **Genetics Section Early Career Award** is given annually and recognizes the contribution of early-career researchers to the field of fisheries genetics. The goal of this award is to promote innovative and particularly applicable genetics research, increase interest in fisheries genetics careers, and enhance professional connections among fisheries geneticists. Our awardee for 2018 is Dr. Wes Larson, Assistant Unit Leader, USGS Wisconsin Cooperative Fishery Research Unit. Learn more about Dr. Larson's research here.

The **Stevan Phelps Memorial Award** was created in 2000 as a perpetual memorial to Steve who died from cancer in 1999. The award, honoring Steve's strong commitment to publication of applied genetic research in fisheries, will be given annually for the best genetics paper published in an AFS journal the preceding year. Selection is typically made by the Phelps Award Committee in mid-June of each year. Our awardees for 2018 include A. F. Muttray, D. Sakhrani, J. L. Smith, I. Nakayama, W. S. Davidson, L. Park, R. H. Devlin for their paper, "Deletion and copy number variation of Y-chromosomal regions in coho salmon, chum salmon, and pink salmon populations" in Transactions of the American Fisheries Society.

Now Open

Hutton Student and Mentor Applications for Summer 2019

More information at hutton.fisheries.org

Hutton Junior Fisheries Biology Program

American Fisheries Society

2018 Genetics Section Hall of Excellence Induction

Dr. Tim King

Dr. Tim King earned his doctorate from North Texas State University conducting stock and species identification for selected marine fishes and shellfishes. Starting in 1993, Tim served as a Conservation Genomicist/Research Fishery Biologist with the USGS-Leetown Science Center, Aquatic Ecology Branch, where he oversaw a group that performed wide-ranging studies in applied population genetics and genomics of fish and wildlife species. Tim's group conducted cutting-edge ecological and evolutionary molecular genetics and genomics research, focusing on threatened and endangered species. His group also assessed microevolutionary responses to climate change and developed methods for metagenomics and environmental genomics research. Results from Tim's research program have had a significant impact on federal regulatory decisions and the management of high-profile species, including Atlantic salmon, Prebles meadow jumping mouse, brook trout, and several sturgeon species. Tim was always in great demand as a collaborator, generous with his time and expertise, and a tremendous ambassador for science who readily shared his enthusiasm with many students and colleagues.

Great Smokey Mountain Brook Trout cont'd

Our study highlights some of the challenges associated with managing and conserving isolated Brook Trout populations and emphasizes the importance of conducting genetic studies on fragmented populations to inform management and conservation decisions. Most populations of Brook Trout within Great Smoky Mountains National Park are very small and have little opportunities for genetic exchange. Despite the small effective population sizes and low levels of genetic diversity we observed, these populations continue to persist and show substantial phenotypic variability. Therefore, more emphasis should be placed on population genomics to provide a better understanding of the adaptive potential of populations to future perturbations such as climate change, disease, competition with invasive species and other stochastic events

Moving forward, the USGS Leetown Science Center (LSC) is continuing to explore the conservation genetics of Brook Trout populations in the southern Appalachians. In collaboration with many other agencies, LSC is developing a broad-scale synthesis based on over 800 stream collections from across the eastern range of Brook Trout. LSC also is engaged with state agencies to provide genetics data to support Brook Trout restoration and reintroduction projects.

Read Weathers et al. in is its entirety in TAFS at https://afspubs.onlinelibrary.wiley.com/doi/10.1002/tafs.10115

Symposium announcement

Application of genomic tools to inform management of the Great Lakes

IAGLR 2019
Brockport, NY

Over the past few years, many geneticists studying the Great Lakes have begun to transition from traditional genetic tools to genomics. Currently, a number of these initial genomics projects are under way or nearing completion. The goal of this session is to provide a forum to discuss the initial results of genomics research in the Great Lakes and to brainstorm a road map for how genomics can be best integrated into management in the future.

If interested in giving a talk in the symposium, send your talk title to:
Wendylee Stott - wstott@usgs.gov
Wes Larson - wes.larson@uwsp.edu

Sights from AFS 2018 in Atlantic City

Photos provided by AFS Flickr Photostream

In case you missed it...

Recent genetics papers from AFS journals and beyond

Hybridization and genetic structure in phenotypic spotted bass in Texas. D. J. Lutz-Carrillo, M. Husemann, P. T. Bean, et al. TAFS 147:891-905.

Historical and contemporary gene flow and genetic structure of muskellunge in the Ohio River drainage. M.M. White, B.A. Kohli, P.E. Converse. TAFS 147:1067-1077.

Development of a standardized molecular tool and estimation of genetic measures for responsible aquaculture-based fisheries enchancement of American shad in North and South Carolina. E.L. Cushman, H.K. Evans, G.R. Moyer, et al. TAFS, in press.

Genetic assignment of brook trout reveals rapid success of culvert restoration in headwater streams. D.M. Wood, A.B. Welsh, J.T. Petty. NAJFM 38:991-1003.

Hybridization and genetic structure of Neosho smallmouth bass in the Ozark Highlands. A.T. Taylor, J.M. Long, M.R. Schwemm, and S.K. Brewer. NAJFM, in press.

Evidence of a genetiaclly distinct population of striped bass within the Saint John River, New Brunswick, Canada. N.M.Leblanc, S.N. Andrews, T.S. Avery, et al. NAJFM, in press.

Genetic divergence of nearby walleye spawning groups in central Lake Erie: Implications for management. C.A. Stepien, M.R. Snyder, C.T. Knight. NAJFM 38:783-793.

Chromosomal fusion and life history-associated genomic variation contribute to within-river local adaptation of Atlantic Salmon. K. Wellband, C. Merot, T. Linnansaari, et al. Molecular Ecology, in press.

How quantitative is metabarcoding: A meta-analytical approach. P.D. Lamb, E. Hunter, J.K Pinnegar, et al. Molecular Ecology, in press.

Genomics and conservation units: The genetic basis of adult migration timing in Pacific salmonids. R.S. Waples and S.T. Lindley. Evolutionary Applications 11:1518-1526.

Comparing genomic signatures of domestication in two Atlantic salmon (Salmo salar L) populations with different geographical origins. M.E. Lopez, L. Benestan, J.-S. Moore, et al. Evolutionary Applications, in press.

Improving conservation policy with genomics: A guide to integrating adaptive potential into U.S. Endangered Species Act decisions for conservation practitioners and geneticists. W.C. Funk, B.R. Forester, S.J. Converse. Conservation Genetics, in press.

Recent paper you'd like to promote?

Send a synopsis or citation to jaredhomola20@gmail.com for inclusion in the next newsletter

Environmental DNA time series in ecology. M. Balint, M. Pfenninger, H.-P. Grossart et al. Trends in Ecology and Evolution 33:945-957.

Local and system-wide adaptation is influenced by population connectivity. P. Nosil, V. Soria-Carrasco, J.L. Feder et al. Conservation Genetics, in press.

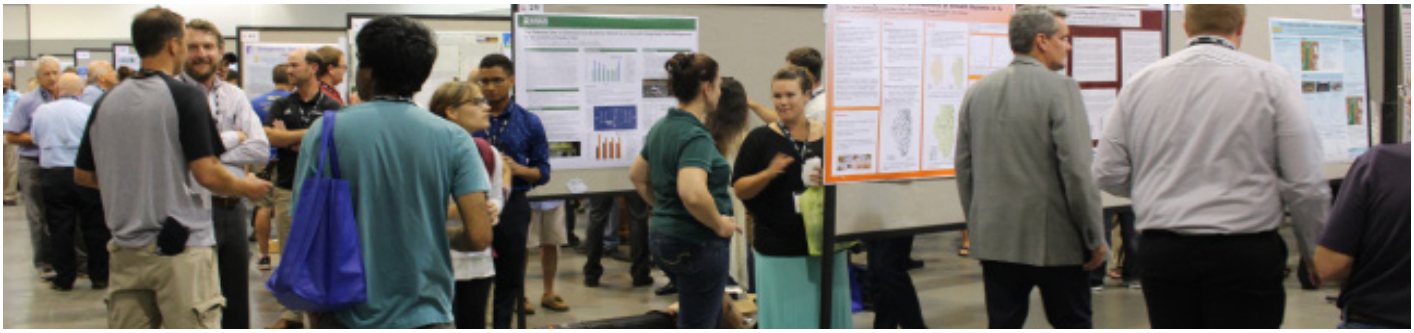


Photo by Beth Beard, AFS

Calendar

January 2019

3rd - 6th: Canadian Conference for Fisheries Research, London, Ontario

27th - 30th: 79th Midwest FIsh and Wildlife Conference, Cleveland, Ohio

February 2019

19th: Deadline for AFS-TWS Meeting Symposia and Training Program proposals.

24th - March 1st: Association for the Sciences of Limnology and Oceanography 2019 Aquatic Sciences Meeting, San Juan, Puerto Rico

March 2019

13th - 17th: Citizen Science 2019 Raleigh, North Carolina

April 2019

1st: Deadline for AFS Society-wide awards. Click here for more information.

June 2019

2nd - 4th: AGA Symposium, Sex and Asex: The Genetics of Complex Life Cycles, Portland, Oregon

10th - 14th: 62nd International Association of Great Lakes Research Annual Conference Brockport, New York

24th - 28th: 5th International Conference on Fish Telemetry, Arendal, Norway.

21st - 25th: Evolution Meeting, Providence, Rhode Island

July 2019

21st - 25th: Annual Meeting of the Society for Molecular Biology and Evolution, Manchester Central, England

August 2019

11th - 16th: 104th Annual Meeting of the Ecological Society, Louisville, Kentucky

September 2019

8th - 13th: International Society for River Science Biennial Symposium, Vienna, Austria

9th - 12th: ICES Annual Science Conference, Gothenbug, Sweden

29th - October 3rd: American Fisheries Society and The Wildlife Society 2019 Joint Annual Conference, Reno, Nevada

January 2020

3rd - 7th: American Society of Naturalists Stand-Alone Meeting, Asilomar, California

To find dates and information for AFS chapter meetings, visit fisheries.org/about/units/chapters/

Help Wanted!

The Section's logo is in need of rejuvenation.

Volunteer designer being sought to make unique contribution to the Section by creating a new logo.

Contact Section President Andrew Whiteley at andrew.whiteley@umontana.edu for more information

Tenure Track Professional Positions

Assistant Professor, University of Louisville - Louisville, Kentucky. The Department of Biology at the University of Louisville (http://louisville.edu/biology) invites applications for a tenure-track position in the area of Genetics at the Assistant Professor level to begin August 2019. We are particularly interested in individuals with research in the broad areas of Genetics and Cell Biology, using modern molecular genetic approaches to investigate a variety of questions across the biological spectrum; we also encourage candidates who can take advantage of collaborative opportunities in the Department and on-campus. The successful candidate is expected to contribute to the department's teaching mission in large-enrollment Biology core courses (Genetics and Molecular Biology and/or Cellular and Molecular Biology) and upper-level or graduate-level course(s) in the area of interest of the candidate. Moreover, the candidate must maintain an excellent record of research productivity and external funding. The position requires postdoctoral research experience, a solid publication record, and demonstration of high potential for maintaining an externally funded, independent research program. The University of Louisville strives to foster and sustain an environment of inclusiveness that empowers us all to achieve our highest potential without fear of prejudice or bias. We commit ourselves to building an exemplary educational community that offers a nurturing and challenging intellectual climate, a respect for the spectrum of human diversity, and a genuine understanding of the many differences that enrich a vibrant metropolitan research university. We expect every member of our academic family to embrace the underlying values of this vision and to demonstrate a strong commitment to attracting, retaining, and supporting students, faculty, and staff who reflect the diversity of our larger society. The University of Louisville is an equal opportunity, affirmative action employer, and is committed to providing employment opportunities to all qualified applicants without regard to race, sex, age, color, national origin, ethnicity, creed, religion, disability, genetic information, sexual orientation, gender, gender identity and expression, marital status, pregnancy, or veteran status. Apply: Interested candidates must apply online and attach one document containing a curriculum vita that includes statements of research and teaching interests and contact information for three references. Review of applications will begin January 7, 2019, and continue until the position is filled. Link: https://www.higheredjobs.com/details.cfm?JobCode=176866711 (or go to http://higheredjobs.com and search "36235").

Assistant Professor, Tenure Track, University of North Carolina at Chapel Institute of Marine Sciences - Chapel Hill, North Carolina. Marine Conservation / Fisheries Ecology – The University of North Carolina at Chapel Hill invites applications for two tenure-track faculty positions at the Assistant Professor level at the Institute of Marine Sciences (http://ims.unc.edu/). We seek emerging leaders in interdisciplinary marine conservation ecology and fisheries. Areas of desired expertise include quantitative tools/approaches, ecological economics, climate change dynamics/effects, food-web ecology, zooplankton, and molecular tools. Expectations include leading externally funded research programs, publishing in peer-reviewed journals, teaching field-site courses, advising graduate students, as well as engaging stakeholders. Preference will be given to applicants who would include field research leveraging IMS's location, infrastructure, and interdisciplinary nature. Applicants should submit a cover letter, CV, research/teaching statements, and the names/contact information of three references via: http://unc.peopleadmin.com/postings/152135. Application review will begin 1/16/2019 and continue until the positions are filled. UNC-CH is an equal opportunity employer. Women and racial/ethnic minority. http://unc.peopleadmin.com/postings/152135.

Assistant Professor of Marine Biology, Fisheries, University of Alaska Fairbanks - Kodiak, Alaska. Research, education and service that support Alaska's ocean resources and the human communities that rely upon them. The successful candidate will be expected to teach core courses and/or develop specialty mariculture-related courses for the graduate and undergraduate academic programs, develop a vigorous externally funded mariculture-related research program, and mentor graduate students. *This position will be stationed in Kodiak, Alaska at the Kodiak Seafood and Marine Science Center. Qualifications: Ph.D. in mariculture/aquaculture, marine biology, fisheries, oceanography, or closely related discipline and preferably have post-doctoral and teaching experience. Applications must be submitted via the UA Careers website by January 8, 2019 by 11:55 PM Alaska Standard Time to ensure full consideration. This position will remain open until filled. Contact: Dr. Brenda Konar, Search Committee Chair, at (907) 474-5028 or at bhkonar@alaska.edu

Miss this year's Section business meeting?

Meeting minutes available on the AFSGS website and by clicking here

Non-Tenure Track Professional Positions

Visiting Assistant Professor, St. Edward's University - Austin, Texas. Starting in mid-August, 2019. Applicants with a background in Evolutionary Biology are desired. Responsibilities: Teaching our core Evolution course, BIOL 4344 Teaching majors first year biology lecture and labs, with the possibility of additional opportunities in first year biology courses for non-majors. Ability to teach courses in Anatomy is especially preferred. The teaching load is 4 courses per semester (12 hours). Qualifications: Ph.D. in biological sciences required. A strong commitment to and demonstrated potential for excellence in undergraduate teaching. Excellent interpersonal and communication skills. Successful candidate must complete an employment and/or criminal history background check About St. Edward's University: St. Edward's University serves a diverse population of 3,700 undergraduate and 500 graduate students on its campus in South Austin. Recognized as a minority serving institution and a Hispanic serving institution, St. Edward's seeks dedicated teachers who employ active pedagogy to engage a diverse student population. The School of Natural Sciences has experienced significant growth in the last decade attributable to its distinguished faculty, new facilities including >110,000 ft. of teaching and laboratory space, and our approach to engaging undergraduates in the classroom and in research. The Department of Biological Sciences offers B.A. and B.S. degrees in biology, B.S. degrees in Bioinformatics and Medical Laboratory Science, and a 3+2 BA in Biology and MS in Clinical Lab Science in partnership with the University of Texas Medical Branch, in Galveston. Read more about the Dept. of Biological Sciences by visiting https://www.stedwards.edu/undergraduate/biology. Application Process: Applications will be accepted and reviewed until the position is filled, with full consideration given to those received by Dec 5, 2018. Applicants should submit application and all requested documentation online through http://stedwards.applicantpro.com/jobs/. A complete application packet (single pdf preferred) will include: -Cover letter, addressing why the applicant is a good fit for the position and indicating a commitment to the university's mission (http://www.stedwards.edu/about/mission) and to serve a diverse student body and prepare them for a global community. Cover letter should also address the applicant's ability and interest in teaching Human Anatomy and other courses related to their area of expertise. -Curriculum Vitae -Teaching Statement -Undergraduate and Graduate transcripts (unofficial) -The names and contact information for three references Visit https://stedwards.applicantpro.com/jobs/936223.html for the full job listing. St. Edward's University is an equal opportunity employer. We encourage women and minorities to apply to our vacancies and hire only U.S. Citizens and documented workers. We do not offer sponsorship at this time.

Research Scientist Engineer, University of Washington - University of Washington. This JISAO/UW research scientist will work in the new Genetics and Genomics Group (G3 Lab) at the NOAA Pacific Marine Environmental Laboratory, Sand Point in Seattle under Dr. Carol Stepien (NOAA/PMEL) and with Dr. Kim Andrews (JISAO/UW). The G3 lab uses cutting-edge techniques such as multi-locus metabarcoding, RADseq, and mitogenome sequencing to study oceanic biological community diversity and responses to physical and chemical oceanographic parameters. Component species and population genetic relationships for invertebrates and fishes are identified and assessed using environmental DNA (eDNA), plankton, sediment samples, and whole organisms collected with plankton tows, CTD casts, ROVs, and sediment cores. Study regions include the west coast of North America, Salish Sea, Gulf of Alaska, Bering Sea, and U.S. Arctic, as well as deep sea vents and seeps across the Pacific. Physical, chemical and biological oceanographic parameters are considered to predict the effects on marine ecosystems of environmental change including acidification, warming, hypoxia, and deep sea mining. This position involves using environmental DNA and Next-generation sequencing data collection and analysis from water and plankton samples from the Pacific Northwest, Alaska, Arctic and the deep sea in concert with physical and chemical oceanographic conditions to understand marine ecology. Job duties: •Perform, trouble-shoot, and analyze results of various molecular biology techniques including quantitative RT-PCR, Next-Generation Sequencing library preparation (e.g., metabarcoding, RADseq, mitogenomes), Sanger sequencing, DNA/RNA/protein extractions, tissue and sample acquisition •Interpret results and maintain complete and accurate records of experiments conducted and data obtained in a laboratory notebook and in computer databases •Assist PI with grant-related paperwork, data analyses, literature reviews and preparation of manuscripts and presentations •Train and help oversee laboratory graduate and undergraduate student researchers in conducting molecular biology experiments, when specified by the PI •Maintain laboratory equipment, cleanliness, autoclaving, buffer preparation, etc. Inventory and order supplies •Conduct at-sea experiments and sampling of plankton, fishes and invertebrates. Required education/skills: •BS Degree in molecular biology, life sciences, genetics, chemistry or related field •Minimum of one to three years of job-related experience •Careful attention to detail and record keeping, strong laboratory chemistry techniques to avoid contamination, skilled in molecular biology/genetics techniques, statistical analysis skills and experience •Strong organizational skills. Excellent interpersonal communication skills (oral and written) •Familiarity with MS Word, PowerPoint, Excel, and Adobe Acrobat/Illustrator •Working knowledge of molecular biology and sterile techniques, including PCR, DNA extraction, DNA sequencing •Must be physically able to work at sea and lift boxes of samples or equipment weighing 50 pounds. For full job post, visit: https://uwhires.admin.washington.edu/ENG/Candidates/default.cfm?szCategory=jobprofile&szOrderID=162196

Non-Tenure Track Professional Positions

Assistant Professor, Limited Term Appointment, University of Toronto - Toronto, Ontario, Canada. The Department of Ecology and Evolutionary Biology in the Faculty of Arts and Science at the University of Toronto invites applications for a Contractually Limited Term Appointment (CLTA) in the area of Ecology and Evolutionary Biology. The appointment will be at the rank of Assistant Professor, Teaching Stream for a two-year term, beginning July 1, 2019 and ending June 30, 2021. Applicants must have earned a PhD degree in Ecology and Evolutionary Biology or in a related field by the time of appointment, or shortly thereafter. We seek candidates whose teaching interests complement and strengthen the programs in the Department: www.eeb.utoronto.ca. Candidates must have teaching expertise in a degree granting program at the undergraduate level, including lecture preparation and delivery, development of innovative labs and course materials in ecology and evolution, and development of online materials/lectures. Additionally, candidates must possess a demonstrated commitment to excellent, novel, and impactful pedagogical methods and a demonstrated interest in teaching-related scholarly activities. Evidence of excellence in teaching and pedagogical inquiry can be demonstrated through teaching accomplishments, grants, awards, and accolades, presentations at significant conferences, the teaching dossier submitted as part of the application including a strong statement of teaching philosophy and pedagogical research interests, sample syllabi, course materials (lecture slides, lab manuals), teaching evaluations, and a demonstration of a commitment to collaboration or engagement with the broader community of teaching. Also required are strong letters of reference from referees of high standing highlighting excellence in teaching and long-term commitment to pedagogical inquiry and teaching innovation, particularly in the context of courses with large enrolments. The successful candidate will be expected to teach core courses, primarily upper-year courses, across a range of subjects within ecology and evolutionary biology. Responsibilities may include undergraduate teaching, managing and training teaching assistants, developing course materials including ongoing development of course laboratory exercises, and curriculum development. In addition, the successful candidate will have some responsibility for departmental administration and may have opportunities for student supervision, e.g. undergraduate research projects. The successful candidate must also possess strong interpersonal skills, including the ability to collaborate effectively with colleagues on our undergraduate courses and programs. Salary will be commensurate with qualifications and experience. Applicants must also arrange to have three confidential letters of recommendation (signed and on letterhead), including at least one primarily addressing the candidate's teaching, sent directly by the referee to Professor Donald Jackson, Chair, Department of Ecology and Evolutionary Biology, University of Toronto by email to [log in to unmask] by the closing date. Submission guidelines can be found at http://uoft.me/how-to-apply. We recommend combining attached documents into one or two files in PDF format. If you have any questions about this position, please contact Liz Rentzelos at [log in to unmask] or (416) 946-3340. For further information on the Department of Ecology and Evolutionary Biology, please visit our website at www.eeb.utoronto.ca. All application materials, including reference letters, must be received by January 8, 2019. The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from racialized persons / persons of colour, women, Indigenous / Aboriginal People of North America, persons with disabilities, LGBTQ persons, and others who may contribute to the further diversification of ideas. As part of your application, you will be asked to complete a brief Diversity Survey. This survey is voluntary. Any information directly related to you is confidential and cannot be accessed by search committees or human resources staff. Results will be aggregated for institutional planning purposes. For more information, please see http://uoft.me/UP. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

Visiting Assistant Professor, College of Wooster - Wooster, Ohio. The Department of Biology at The College of Wooster seeks to fill a one-year visiting position starting in August 2019 to teach introductory biology and upper level courses in evolutionary biology. Ability to teach a sophomore-level course in statistics and experimental design is a plus. Will also mentor undergraduates in our nationally recognized senior research program. Applicants should have a PhD; postdoctoral research and/or teaching experience preferred. The College of Wooster enrolls a diverse student body (21% domestic students of color and 15% international students); applicants should have experience with diverse student populations. To apply, upload a cover letter, curriculum vitae, unofficial undergraduate and graduate transcripts, statement of teaching philosophy, description of research program, a diversity statement, and three letters of reference to (http://apply.interfolio.com/58037). The diversity statement should speak to the candidate's ability to engage with issues of diversity in the classroom and the curriculum, as well as on campus and in the broader community. Interfolio accounts are free to applicants – simply press "apply." Questions regarding the position should be addressed to Rick Lehtinen. Application deadline is January 8, 2019 for full consideration. The College of Wooster is an independent college of the liberal arts and sciences with a commitment to excellence in undergraduate education. The College values diversity, strives to attract qualified women and minority candidates, and encourages individuals belonging to these groups to apply. Wooster seeks to ensure diversity by its policy of employing persons without regard to age, sex, color, race, creed, religion, national origin, disability, veteran status, sexual orientation, gender identity and expression, or political affiliation. The College of Wooster is an Equal Opportunity/Affirmative Action Employer. Employment is subject to federal laws requiring verification of identity and legal right to work in the United States as required by the Immigration Reform and Control Act. The College of Wooster is a drug-free workplace.

Postdoc Positions

Postdoctoral Fellowship in Ecology & Evolution, Dartmouth College - Hanover, New Hampshire. We seek applicants for an independent postdoctoral fellowship in the Ecology, Evolution, Ecosystems, and Society (EEES) Graduate Program at Dartmouth College. The ideal candidate will possess a PhD in the natural sciences by the time of the appointment and will work specifically in the field of ecology and evolutionary biology but will engage with the broader EEES community. The successful candidate will be expected to pursue independent and collaborative research projects in ecology and evolutionary biology. In addition, the fellow will be responsible for enhancing undergraduate and graduate student education and will lead a graduate seminar course or working group dedicated to developing a research product. The ideal candidate will be a strong contributing member of the vibrant EEES community at Dartmouth and will foster productive discourse both within and beyond the program. EEES is a diverse community of scholars who conduct innovative research in the natural sciences and interdisciplinary environmental social sciences, including ecology, evolution, anthropology, environmental economics, geography and earth sciences. Applicants should identify in their cover letter one or more faculty with whom their research interests align as sponsors from the EEES program and describe how their research interests fit within current or future projects with their sponsors at Dartmouth. We encourage applicants to contact one or more faculty members in advance. We welcome all applicants regardless of sexual orientation/gender identity/gender expression. Program website: http://sites.dartmouth.edu/EEES/ Deadline: Review of applications will begin January 1, 2019 Starting date: Earliest July 1, 2019 (sometime summer 2019) Salary: $50,000 and competitive benefits package. Additional resources for research and professional development. Term: up to 2 yrs pending satisfactory annual performance Qualifications: PhD in the natural sciences by the time of the appointment Application Instructions: Please submit the following application materials through Interfolio: https://apply.interfolio.com/38997 -Cover letter (1-2 pages) describing your research interests and future directions -Curriculum vitae (with list of publications) -PDF copies of up to five representative publications or manuscripts -Three confidential letters of recommendation (submitted before the January 1, 2019 deadline) -Prospectus (1-2 pages) for an interdisciplinary graduate seminar or working group, including a hypothetical timeline of what will be accomplished when. Application link: https://apply.interfolio.com/38997

Postdoctoral Researcher, University Laval - Quebec City, Quebec, Canada. The Bernatchez's Lab at University Laval (Quebec City, Canada) is currently searching for a postdoctorate researcher to be involved in a new research project entitled: Brook charr aquaculture production adapted to climate change; the importance of transgenerational epigenetics factors. This is a an ambitious project funded for 3 years by the NSERC (Canada) Strategic Partnership Grants program which will be conducted in collaboration with colleagues Celine Audet (Ecophysiologist, University of Rimouski) and Dany Garant (Quantitative geneticist, University of Sherbrooke). The selected candidate will also join Bernatchez' 30-member team of the Canadian Research Chair in Genomics and Conservation of Aquatic Resources which aims to enhance fundamental knowledge pertaining to the evolutionary processes responsible for generating and maintaining genetic diversity within populations of aquatic animals, with relevance for management and conservation. CONTEXT AND GOALS: The objective of this research project is to provide the scientific basis for the establishment of fish production methods aiming to support the brook charr recreational fisheries (Salvelinus fontinalis), which will be adapted to the new environmental context resulting from climate change. Three objectives integrating the study of epigenetic variation and gene expression combined with the acquisition of physiological information and components of phenotypic fitness and interpreted in the conceptual framework of evolutionary quantitative genetics are targeted: 1) testing the effect of thermal regime during adult sexual maturation and offspring incubation on epigenetic (methylation) changes that may affect survival, growth and resistance to thermal variation during development of young stages of life; 2) estimating, through a factorial crossing design, the heritability and gene-environment interactions of transgenerational plasticity effects on the variation of these phenotypic traits as well as the expression of genes involved in epigenetic mechanisms and physiological performance; 3) assessing the effects of changes in the thermal regime during the production of brook charr on the persistence of methylation patterns, growth, survival and heritability of these traits following stocking in the wild. This project will also contribute to a deeper understanding of the mechanisms underlying epigenetic processes, in particular to elucidate which phenotypes respond to trans-generational epigenetic transmission and thus clarify the importance of these mechanisms in the adaptive potential of aquatic species. Ultimately, this knowledge will help better predict adaptation potential to climate change. Required Qualifications: As the recruited person will mainly be in charge of the methylation aspects of the project, we are primarily searching for a prospective candidate with strong and demonstrated bioinformatics and analytical skills to analyse genomic and epigenome (methylation) data sets. The position is for two years, potentially renewable for a third year and to be filled as soon as possible. The salary is established according to local University standards. To apply, please send a cover letter describing your research interests and qualifications, a complete CV and names of three references by e-mail to Louis.Bernatchez@bio.ulaval.ca Do not hesitate to contact me directly for any further details or questions.

Graduate Student Positions

Graduate Research Opportunities, Washington State University, Pullman, Washington. Graduate school research opportunities in Ecology and Evolutionary Biology The School of Biological Sciences at Washington State University invites motivated applicants for graduate training and research in ecology & evolutionary biology. Research opportunities in both plant and animal systems are diverse. Research focus areas include disease and community ecology, ecosystem ecology, evolutionary genetics, ecological and evolutionary physiology, genomics, evolutionary theory, and phylogenetics and systematics. Our faculty and a brief description of research interests: Jesse Brunner: Disease ecology Jeremiah Busch: Population genetics, plant evolution Patrick Carter: Quantitative genetics, animal physiology Omar Cornejo: Genomics, host-pathogen evolution Erica Crespi: Animal developmental physiology Wes Dowd: Animal evolutionary physiology Mark Dybdahl: Evolutionary ecology, adaptation, phenotypic plasticity Dave Evans: Ecosystem ecology and nutrient cycling Richard Gomulkiewicz: Evolutionary genetics and theory Joanna Kelley: Genomics, adaptation to extreme environments Eric Roalson: Plant phylogenetics and systematics Elissa Schwartz: Disease dynamics and virus-host interactions Andrew Storfer: Landscape genomics, disease evolution Heather Watts: Animal behavior and physiology For more information, please visit their websites, available via sbs.wsu.edu Our graduate training program offers many opportunities for excellence. Every SBS student is fully funded with generous stipends through teaching or research assistantships, accompanying tuition waivers, and health benefits. Plus, SBS endowments provide over $100,000 per year in student awards to facilitate research, training, and professional travel. PhDs receive up to $10,000 in guaranteed support for research-related travel and MS students receive up to $5,000 in guaranteed support. The campus houses outstanding facilities, including plant and animal growth chambers, managed field sites, a modern genomics core and a campus-wide computer cluster. Washington State University is located in Pullman, WA, a friendly mid-sized town on the rolling hills of the unique Palouse region in eastern Washington. The campus is only eight miles from the University of Idaho in Moscow, ID. The two towns and campuses provide an academically and culturally rich community. The area offers great parks, bike paths, restaurants, farmer's markets and unbeatable opportunities for recreation in the adjacent mountains, rivers, and wilderness. For more information regarding the Graduate School applications at WSU, see: gradschool.wsu.edu If you have any questions regarding the application process, please contact: Ms. Audrey Van Nuland (sbs.gradstudies@wsu.edu) The deadline for application of prospective students is January 10, 2019, but students are encouraged to apply anytime.

PhD Student, Environmental DNA, University of Laval - Quebec City, Quebec. The Bernatchez's Lab at University Laval (Quebec City, Canada) is currently searching to fill 2 positions: i) a postdoctorate researcher and ii) a Ph.D. candidate to be involved in a new research program entitled: Environmental DNA as a novel tool for freshwater fish management and conservation in Quebec, Canada. This is a an ambitious project funded for 3 years by the NSERC (Canada) Strategic Partnership Grants program which will be conducted in close collaboration with the Government of Quebec (Fisheries and Wildlife Department and SEPAQ). The selected candidate will also join Bernatchez' 30-member team of the Canadian Research Chair in Genomics and Conservation of Aquatic Resources which aims to enhance fundamental knowledge pertaining to the evolutionary processes responsible for generating and maintaining genetic diversity within populations of aquatic animals, with relevance for management and conservation. CONTEXT AND GOALS: In Quebec (Canada), the MFFP (Fish & Wildlife Department) must ensure the conservation and harrmonious development of wildlife exploitation while the S PAQ, the largest recreational fishing network, must manage and develop wildlife reserves in a conservation perspective. Sound management of aquatic resources requires reliable estimates of community composition and then whether environmental disturbances or over-exploitation result in community changes below acceptable levels. Environmental DNA Analysis (eDNA) is a revolutionary tool for detecting traces of DNA in water without manipulating the organisms studied and offering a low-cost alternative to traditional sampling that disrupts the species studied. Our general objective is to develop eDNA analysis protocols to optimize the current use of this approach for the management of aquatic species. Five objectives are targeted in this project; i) Evaluate the effect of biotic and abiotic factors on the persistence and diffusion of eDNA, ii) Evaluate the effect of the bioinformatic sampling and analytical strategy on the estimation of species richness, iii) Document the correspondence between the quantity of eDNA and biomass in exploited lakes and build a predictive model of relative abundance from eDNA information; iv) develop a user-friendly software to handle eDNA data adapted to the needs of our partners ; v) Compare the cost savings of cDNA analysis with traditional monitoring methods and assess the perception of managers and resource users about the advantages and disadvantages of eDNA analysis for the management of recreational fishing. The results of this project could allow our partners to revolutionize the way they manage the 'fish resource' and optimize their operations by fully integrating the cDNA tool into their management practices. Required Qualifications: We are primarily searching for one postdoctorate and one Ph.D. prospective candidates who are excited and passionate about the use of eDNA for management and conservation, and with strong and demonstrated skills in laboratory work and data analyses pertaining to eDNA, and bioinformatics (scripting and programming). The two positions are available now and for three years, and to be filled as soon as possible. Both postdoctorate and Ph.D. salaries are established according to local University standards. To apply, please send a cover letter describing your research interests and qualifications, a complete CV and names of three references by e-mail to Louis.Bernatchez@bio.ulaval.ca Do not hesitate to contact me directly for any further details or questions.

Workshops

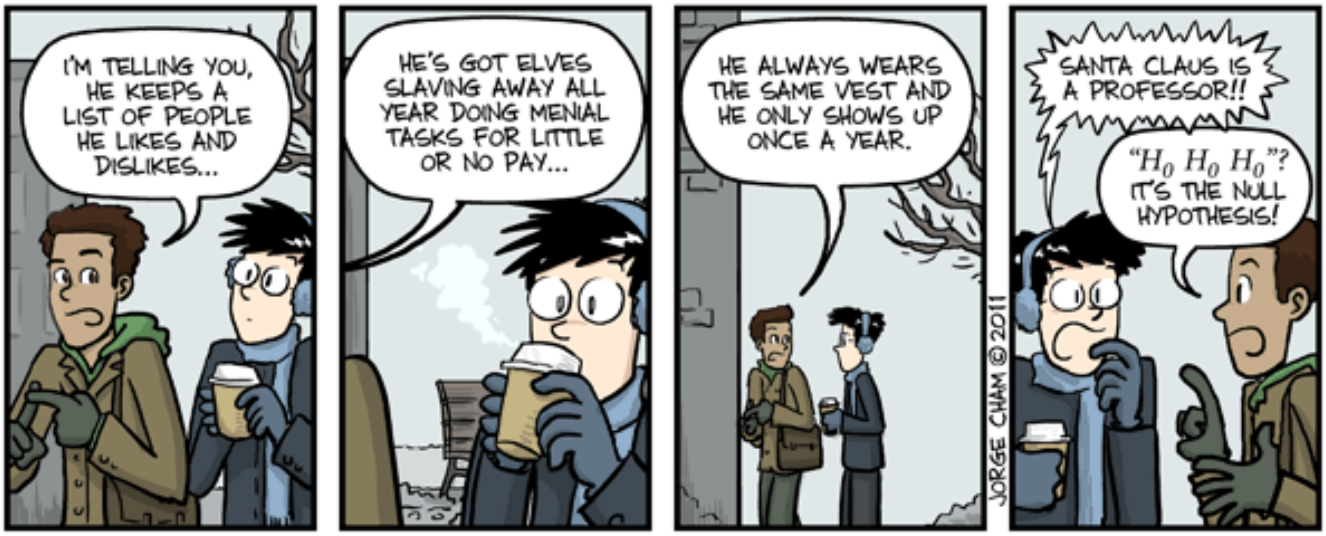
Mapping Trait Evolution, June 3-7th, 2019 - Barcelona, Spain. Instructor: Dr. Jeroen Smaers (Stony Brook University, USA) and Carrie Mongle (Stony Brook University, USA). PROGRAM: Monday. (R packages: ape, Geiger). Morning: Phylogenetic data. * What is the basic structure of phylogenetic data? * How to visualize and manipulate phylogenetic data? Afternoon: Models of evolution. * What are models of evolution? * What are the assumptions of the different models of evolution? * How are models of evolution utilized? Tuesday. (R packages: ape, nlme, caper, evomap). Morning: Phylogenetic regression. * Assumptions, properties, and applications of the phylogenetic regression. Afternoon: Phylogenetic ancova. * Testing for grade shifts using the phylogenetic regression. Wednesday. (R packages: phytools, motmot, geiger, ape, evomap, BayesTraits). Morning: Ancestral estimation. * Using models of evolution to estimate values of ancestral nodes. Afternoon: Analysis of rates of evolution. * Estimation of rates of evolution. * Testing hypothesis about rates of evolution. Thursday. (R packages: bayou, phylolm, surface, OUwie, mvMORPH). Morning: Inferring the structure of a macroevolutionary landscape. * Using Ornstein-Uhlenbeck models to map macroevolutionary patterns. Afternoon: Testing the structure of a macroevolutionary landscape. * Applications and assumptions of OU models. * Using OU models to test macroevolutionary hypotheses. Friday. (R packages: geomorph). Morning: Modularity and integration. * What is 'phylogenetic' modularity and integration? * Applications and assumptions. Afternoon: Case study. MORE INFO: https://www.transmittingscience.org/courses/evolution/mapping-trait-evolution/

Practical DNA Training Program - Thunder Bay, Ontario, Canada. A two-week (9 business days) intensive laboratory-based training program designed to teach participants the fundamentals of molecular techniques including DNA extraction, amplification (using PCR), sequencing and interpretation. This training program is offered at various times throughout the year and we will work with you to find a suitable time for training. The next scheduled times for the Practical DNA Training Program are: April 23 - May 3, 2019, May 7 - 17, 2019, May 27 - June 6, 2019, June 17 - 27, 2019 For more information please contact us at 807-343-8877 or email paleodna@lakeheadu.ca or visit our website at www.ancientdna.com and click on 'Training Programs'.

Assembly and Annotation of Genomes, February 11-15th, 2019 - Berlin, Germany Instructor: Dr. Thomas D. Otto (University of Glasgow, UK; https://www.physalia-courses.org/instructors/t28/) Assistant instructor: Mr. Maximilian Driller (Begendiv, Germany; http://bit.ly/2zcwmQT). Overview: This course will introduce biologists and bioinformaticians to the concepts of de novo assembly and annotation. Different technologies, from Illumina, PacBio, Oxford Nanopoor and maybe 10X will be used mixed with different approaches like correction, HiC scaffolding to generate good draft assemblies. Particular attention will be given to the quality control of the assemblies and to the understanding how errors occur. Further, annotation tools using RNA-Seq data will be introduced. An outlook of potential analysis is given. In the end of the course the students should be able to understand what is needed to generate a good annotated genome. Targeted Audience & Assumed Background: The course is aimed at researchers interested in learning more about genome assembly and annotation. It will include information useful for both the beginner and the more advanced user. We will start by introducing general concepts and then continue to step-by-step describe all major components of a genome assembly and annotation workflow, from raw data all the way to a final assembled and annotated genome. There will be a mix of lectures and hands-on practical exercises using command line Linux. Attendees should have a background in biology. We will dedicate one session to some basic and advanced Linux concepts. Attendees should have also some familiarity with genomic data such as that arising from NGS sequencers. For more information about the course, please visit our website: https://www.physalia-courses.org/courses-workshops/course20/

Midwest Workshop in Phylogenetic Comparative Methods, June 3-9th, 2019 - Lake Itasca, Minnesota. The general scope of this workshop is learning about macroevolution by analyzing phylogenetic trees. We will emphasize probabilistic models, including intuition for how they work and how their processes leave signal in phylogenetic data. Our goal as teachers is that you will learn about the logic of phylogenetic comparative methods. We also hope to build connections among researchers in the Midwest US. Instructors: * Cécile Ané, Univ Wisconsin, Madison * Heath Blackmon, Texas A&M Univ * Emma Goldberg, Univ Minnesota, Twin Cities * Amanda Grusz, Univ Minnesota, Duluth * Tracy Heath, Iowa State Univ * Mark Holder, Univ Kansas * Boris Igić, Univ Illinois, Chicago * Dan Rabosky, Univ Michigan * Rick Ree, Field Museum * Graham Slater, Univ Chicago * Rosana Zenil-Ferguson, Univ Hawaii, Manoa Please see the workshop website for more information on course content, logistics, and how to apply. https://phylosdd.github.io/MidwestPhylo2019/

Comic



"Piled Higher and Deeper" by Jorge Cham www.phdcomics.com

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