ONCORHYNCHUS

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UAF graduate student Trevor Haynes trapping blackfish in the upper Kuskokwim River basin in Denali National Park & Preserve. Photo by Mac Campbell.

Alaska Blackfish — A Mysterious Member of Alaska's Freshwater Fish Fauna

J. Andrés López

The Alaska blackfish (*Dallia pectoralis*) have long attracted the attention of biologists, partly as a product of anecdotes pointing to a unique ability to survive extensive freezing of their tissues. Varied accounts of direct observation of that ability, combined with the fact that blackfish populations are found in locations where the entire water column can be assumed to freeze, fueled interest in identifying the biology behind the trait. However, this trait has not been reproducible under controlled conditions and the physiological characteristics that blackfish draw on to overwinter remain unknown. As intriguing as freeze-tolerance is, there is another fascinating aspect of blackfish biology that currently commands the attention of biologists, and more specifically, the attention of students in my lab at the University of Alaska Museum and the Fisheries Division at the University of Alaska Fairbanks (UAF).

All modern populations of blackfish are exclusively found in the biogeographic region known as Beringia. Beringia, broadly defined by the effects of the rise and fall of the Bering land bridge on the ecology and diversity of animal and plant populations, geographically extends from Kamchatka and Chukotka in Asia to Alaska in North America. Over the last several hundred thousand years, glacial cycles repeatedly reshaped this region and altered the abundance and distribution of habitats suitable for a strictly freshwater species like the blackfish. In my lab, we are interested in understanding how those cycles of change affected blackfish populations over their history and shaped their current distribution and genealogical relationships. Similar questions apply to all species with a presence in Beringia. However, blackfish offer a particularly interesting case because they are not known to venture into coastal waters or move over large distances within drainages. Thus, blackfish may be expected to be affected by historical changes in river networks to a greater degree than a migratory diadromous species.

Matthew Campbell, a UAF graduate student, led the first study of blackfish biogeography, testing initial expectations of the degree of similarity between populations found across the geographic range of the genus *Dallia*. The study revealed geographically patterned distributions of genetic variation and shed new light on the role that the Bering land bridge and

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The President's Corner

Phil Loring

Phil Loring, AFS Alaska Chapter President.

It is summer in Alaska, which means that most of our readership is likely scattered across the state's many land and seascapes, wearing waders or Xtratufs and checking beach seines or tagging and counting fish. Summer is the best time to be in fisheries research (with our annual chapter meeting in the fall being a close second!); I've not yet met a fish person who doesn't revel in the time they get to spend outdoors for their "job." Having grown up in coastal Maine, I'll happily admit that working in fisheries is one way that I've coped with living in land-locked Fairbanks (and now Saskatchewan!).

So, I am willing to wager that it is unlikely that those of you reading this column are eagerly searching for the next great technical read in fisheries science. Nevertheless, the parent society has recently released a new publication, *Foundations of Fisheries Science* (Sass and Allen 2014), and I feel compelled to share my take on the volume here. And when I say volume I mean it, in the sense that this 801 page tome does not lend itself to being stuffed into your gear bag.

Rather, *Foundations* is a collection that one keeps on a shelf in their office, to be referred to rarely when one is in the mood to revisit a classic, and when the harsh sheen of PDF-on-LCD just won't do. It is an impressive collection of papers, published over the last several decades from multiple disciplines and commented on by a team of expert subject editors that include Daniel Schindler of the University of Washington and Carl Walters at the University of British Columbia, among others. These are works that you know by name and date: Ricker 1954, Larkin 1977, Jentoft 1989, and so on.

Continued on next page

Alaska Blackfish, continued

the Bering Sea played in the history of these populations (*Campbell and López 2014*). Before describing the findings of that work, it is useful to summarize current understanding of the taxonomy and distribution of the genus.

Three species have been assigned to the genus *Dallia*. Two of these are only found in the eastern and northern coastal plains of the Chukchi Peninsula. The third, *D. pectoralis*, has a broad native distribution in Alaska, Bering Sea islands, and eastern Chukotka Peninsula, and has been introduced in several locations around the Cook Inlet area. Regardless of whether the three taxa currently included in *Dallia* represent distinct biological species, the distribution of the genus on the Asian and North American coasts of the Bering Sea points to opportunities to improve our knowledge of the ecological consequences of the emergence of the land bridge. Analyses of mitochondrial genetic variability among modern populations of blackfish revealed close genealogical relationships between Asian and North American populations of blackfish. Unexpectedly, the strongest degrees of differentiation we observed were not between samples from Asia and North America but between interior and coastal Alaskan populations. The degree of genetic variation present in the mitochondrial genomes of modern blackfish populations is consistent with blackfish lineages surviving repeated periods of glacial cycling in

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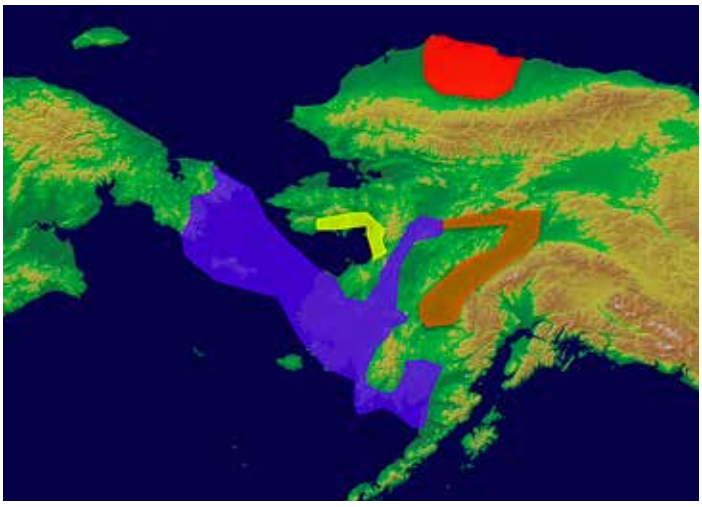

The UAF phylogeographic study revealed distinct mitochondrial lineages of blackfish, represented here by different polygons, with a near-complete absence of shared mitochondrial lineages across the Beringia region. Figure from J. Andrés López.

The President's Corner, continued

Foundations is organized in five sections: managing fish stocks, managing people, managing fish habitat, managing fish communities and ecosystems, and managing fisheries enhancements. Each section offers eight full papers, reprinted with their original typesetting which gives the collection an additional, curated character. Each section begins with a crisp and well-composed introduction that synthesizes the impact the papers have had on the science and practice of fisheries, and ends with an "honorable mention" list with citations and full abstracts of papers that did not make the cut. The compendium concludes with the lead editors' reflective comments on the challenges of crafting the volume, and some pressing questions that future research should address.

Still, there are some key omissions: no papers directly address climate change, for example. The Sumalia et al. 2011 paper in *Nature Climate Change* would have been an obvious choice, though I think that Allison et al.'s 2009 paper that examined vulnerability to climate change impacts on fisheries at the national scale would have been a more inspired choice. Despite its omissions, though, *Foundations* does provide an effective cross section of the "state of the art" in fisheries science and management.

Foundations also provides an effective illustration of the current weaknesses of fisheries science and management: preoccupation with quantification and efficiency, overconfidence in models, including economic models of human behavior, and failure to incorporate qualitative aspects of the human dimensions of fisheries. The section on managing people is indicative, even though the editors "hang a lantern" on the section's shortcomings by admitting that it emphasizes perspectives from economics and excludes "papers from fisheries sociology and anthropology…[on] topics such as artisanal fishing, communities, livelihoods, social networks, power relations, spiritual value of fisheries, religion, culture, ethics and gender issues" (p. 281). Their stated rationale was to focus on papers that address "management-oriented issues," which they admit biases the section to quantitative work. Yet, arguments have been made for decades that all fisheries management issues are deeply embedded in power, values, ethics, and gender, and in ways that economic and ecological models cannot capture. Inclusion of Bonnie McCay's seminal 1981 paper "Optimal Foragers or Political Actors" alone would have improved this section immeasurably.

More generally, however, the problems with the human dimensions section reveal that, while the omnibus is an effective milepost for how far fisheries science has come, it fails to provide a foundation for future innovation in the field. Emerging interdisciplinary approaches lack representation, such as the literature on social well-being, as do counter-narratives that challenge overly-quantitative approaches. As just one final example of the latter, either of James Acheson and James Wilson's two papers on parametric fisheries management, papers which currently go largely ignored, are in my opinion likely to be considered classics in the decades to come. Assuming, that is, that fisheries scientists and managers continue to seek innovative ways to better understand people and their motivations.

Despite its shortcomings, I still highly recommend the volume. It introduced me to papers that I was disappointed not to have seen earlier. It also provides an excellent reference for developing a syllabus, or for peer-reviewing papers that are just outside one's wheelhouse.

The book is currently available for $89 from the AFS website (select "Shop AFS" from the bottom of the left-hand menu). At very least, it will give you something new and interesting to flip through when the ephemeral Alaska summer is over.

ONCORHYNCHUS

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Deadline for materials for the fall issue of *Oncorhynchus* is Sept. 10.

Alaska Blackfish, continued

multiple locations in large populations. This is in contrast with the expectation of survival outside of Beringia in a single refuge followed by rapid post-glacial re-colonization of the current range. The degree of similarity between Asian and coastal Alaskan samples suggests that the Bering land bridge historically provided a suitable home for extensive populations of blackfish.

A specimen of the Alaska blackfish captured near Bethel, Alaska. Photo from U.A. Museum of the North.

Another significant insight gained from the UAF research concerns the distinctive place of blackfish populations in the North Slope relative to blackfish taxonomic and genetic diversity. Populations of blackfish on the Arctic coastal plains are separated from other members of the genus by the Brooks Range. A comparison of chromosome arrangements in blackfish from the North Slope and Galena had previously identified a genetic difference between these two areas (*Crossman and Ráb 1996*). Our work corroborated that finding and, in addition, revealed that living North Slope populations of blackfish host the lowest levels of mitochondrial genetic diversity of all the regions examined in our study. This pattern is an indication of past and ongoing biogeographic isolation of this region and strong historical fluctuation in the size of blackfish populations in that region.

While mitochondrial genetic variation is an important aspect of biodiversity and a powerful tool in biogeographical research, it provides only a narrow window into the consequences of past geological and ecological events on standing diversity. To extend our knowledge of blackfish diversity, UAF researchers worked in collaboration with Sandra Talbot and Kevin Sage from the Alaska Science Center of the U.S. Geological Survey. Through this collaboration, we identified a set of variable microsatellite loci that will serve as a resource for characterizing nuclear genetic variation in *Dallia*. Initial results show that populations in the Yukon-Kuskokwim Delta host a greater amount of genetic diversity than populations in Interior Alaska (*Campbell et al. 2014*). We expect that future extensions of these observations to other populations will help clarify the questions that research on mitochondrial phylogeography first identified.

An improved understanding of the history of blackfish populations in Beringia will serve as a foundation to research other poorly known aspects of blackfish biology. While it is known that blackfish move to shallow spawning habitats in late spring and summer, the mechanism by which juvenile blackfish disperse across the landscape remains unknown. From phylogeographic research we learned that deep river channels with narrow floodplains appear to be persistent barriers to blackfish dispersal. In the Kuskokwim drainage for example, populations sampled downstream and upstream of the Kuskokwim Mountains show no shared mitochondrial genetic diversity. In addition, blackfish along the Yukon drainage do not occur in the Yukon flats, suggesting that the river's passage through the Yukon-Tanana Uplands prevents upstream blackfish dispersal.

Blackfish have been introduced outside their native range in the vicinities of Anchorage and Kenai. In both locations, introduced populations have become established and are relatively abundant. The effects that blackfish may have on communities outside their native range are not yet known. Blackfish diet consists primarily of aquatic macroinvertebrates and only rarely includes fish. Dona Eidam, a graduate student at the University of Alaska Anchorage, is examining diet composition of the introduced blackfish and is finding snails and fly larvae as dominant prey taxa. Predation on native fish species is evident and seems to occur more frequently than in the blackfish's native range.

Combining these insights with studies of blackfish movement and life history will generate a more complete picture of how shifting climates, geography, and biology interact to determine the distribution and abundance of different species, and how introduced populations will influence their new ecosystems.

J. Andrés López earned a doctorate degree from Iowa State University studying molecular evolution in sharks and bony fishes. He is an assistant professor in the Fisheries Division at the University of Alaska Fairbanks and curator of the fish collection at the University of Alaska Museum of the North.

Tackling Invasive Species

The Aquatic Nuisance Species (ANS) Task Force is an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. Mandates were later expanded under the 1996 National Invasive Species Act (NISA). The ANS Task Force consists of 13 federal agency representatives and 12 ex-officio members, and is co-chaired by the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration. Following over three years of effort by subcommittees and staff, the ANS Task Force approved final preventive guidelines for recreational activities and water gardening. These guidelines are voluntary as issued by the ANS Task Force, although specific state or local regulations (e.g., the prohibition of felt-soled waders) may be used to implement some of these measures. Please share these guidelines broadly to inform the public and stakeholders about how to avoid introducing or spreading aquatic invasive species. The guidelines may be found at *http://www.anstaskforce.gov/documents.php*.

2014 Annual Meeting of the Alaska Chapter of the American Fisheries Society

Organizers have announced a Call for Abstracts for the 41st annual meeting of the Alaska Chapter of the American Fisheries Society (AFS). This meeting is in Juneau during October 20–24, 2014, and will be held jointly with the annual Alaska Chapter meetings of the American Water Resources Association (AWRA) and the Southeast Alaska Fish Habitat Partnership (SEAKFHP). The theme of the meeting is "Bridging Disciplines to Solve Today's Challenges in Resource Management." This will be an exciting meeting and include continuing education courses, plenary speakers, contributed talks, and special sessions. A variety of social events, including a welcome social, short film festival, poster session, and banquet, will provide opportunities for getting to know, and discussing ideas with, your colleagues and building collaborations across organizations. A total of 35 special sessions will be presented with themes in marine and freshwater fisheries, habitat, hydrology, human dimensions, climate, and data collection and management. Please submit abstracts for both special sessions and contributed talks through the AFS Alaska chapter meeting website (*http://www.afs-alaska.org/*) where a list of full sessions is available. The Abstract Deadline is September 15, 2014! Questions may be sent to Program Chair Jennifer Stahl (*jennifer.stahl@alaska.gov*).

2014 Continuing Education Courses

Sara E. Miller

The Continuing Education Committee has lined up six great workshops to be provided in association with the 41st annual meeting of the Alaska Chapter of the American Fisheries Society in Juneau during October 20–24, 2014. Two-day workshops during Monday–Tuesday, October 20-21, include: A Mesh is a Mesh — Basic Net Construction and Repair; Fish Passage; Stock Synthesis: Fisheries Stock Assessment Software; and An Introduction to ArcGIS. Also offered are Technical Writing, a full-day workshop on Monday, October 20, and Power-Based Standardization in Electrofishing, a half-day workshop on the afternoon of Tuesday, October 21. All Continuing Education Classes have a minimum enrollment that must be met by October 1, so be sure to sign up early. Fees are also reduced for early registration. Additional information and registration forms can be found at *http://www.afs-alaska.org/annual-meetings/2011-2/continuing-education-courses.*

Share the Experience Photo Contest

The 2014 Share the Experience Photo Contest is accepting entries through December 31. If you're an amateur photographer, this is your chance to submit inspiring images of America's federal lands, national parks, forests, waterways and historical sites. The 2014 contest features many prizes and a brand new submission category — Night Skies. Share the Experience showcases amazing photography that highlights the endless recreation opportunities and breathtaking scenery offered by our federal lands. The 2014 Grand Prize package includes $10,000, and the winning image will be featured on the 2016 America the Beautiful - The National Parks and Federal Recreational Lands Pass. For a full listing of prizes and rules, or to submit a photo, please visit *www.sharetheexperience.org*.

Student Subunit Happenings

Emily Whitney

In April, the Juneau student group hosted the 18th Annual Student Symposium, where 22 graduate students in Juneau and Fairbanks presented their research and received feedback from peers and faculty. Awards were given to four students for outstanding presentations: Ellen Chenoweth, Thomas Farrugia, Kevin Fraley, and Jordan Watson. Thank you to the 10 anonymous alumni and agency judges. A big thank you as well to this year's organizers, Suzie Teerlink and Kari Fenske in Juneau and Stacy Vega in Fairbanks, and to our funding sources, the Alaska Chapter of the American Fisheries Society and UAF School of Fisheries and Ocean Sciences.

Twenty two students presented their research at this year's Alaska Student Symposium held on April 4. Photo by Kari Fenske.

The Juneau student group also took the opportunity to get outside at an Earth Day beach clean-up and BBQ at Auke Rec. Students also participated in the Big Brothers Big Sisters' Bowling for Kids event, where our group raised over $1,600 for the cause! Thank you to Maggie Chan for organizing this event and helping our group get involved in the community.

The semester also brought changes in student leadership. In Juneau, student group representative, Karson Coutre, passed on the duties to Jane Sullivan. Stacy Vega in Fairbanks also passed the baton on to Kevin Fraley. Thank you, Karson and Stacy, for your commitment and hard work. We look forward to another great year ahead!

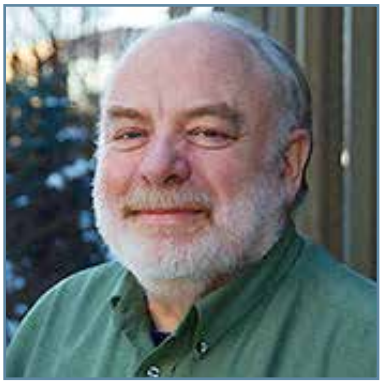
Students in Anchorage are staying busy with the continued meeting of the University of Alaska Anchorage student group and the establishment of a new student group. We welcome students at Alaska Pacific University (APU) to the Alaska AFS Chapter. Sabrina Larson is the student representative and Brad Harris is the faculty advisor at APU.

This spring, AFS student members from APU participated for a fourth consecutive year on an Alaska Department of Fish and Game razor clam abundance survey. This project surveys the relative abundance of razor clams on the Lower Cook Inlet area beaches. Students helped survey razors clams, and also assisted in the installation of a sockeye weir on the Anchor River and the stocking of Chinook in the Nick Dudiak Fishing Lagoon in Homer.

Students from Alaska Pacific University participated in ADF&G razor clam abundance surveys in Lower Cook Inlet during April and May. Photo by Sabrina Larsen.

Expertise Supports International Management of Pacific Salmon Stocks

AK Sea Grant



Marine Advisory agent and AFS Alaska Chapter member Gary Freitag.

During his 28 years of leadership on the Pacific Salmon Commission, Marine Advisory agent Gary Freitag has worked to inform international fisheries catch allocations. This has helped ensure sustainable Pacific salmon stocks and acceptable harvest levels. The Pacific Salmon Commission plays a major role in managing transboundary salmon stocks between the United States and Canada, based on an international treaty.

Management agencies in Alaska, Washington, Oregon, and British Columbia provide data on the conduct of fisheries, preseason expectations, and enhancement activities, which is analyzed by binational technical committees. Freitag is a member of the Chinook Technical Committee that meets about five times per year to provide biological, management modeling, and enhancement expertise and to write recommendations to the commission panels. Freitag's contributions to the commission are appreciated by his colleagues. Dale Kelly, executive director of the Alaska Trollers Association, said, "Gary has a talent for distilling complex theories and an array of data into practical, easy to understand materials. He is approachable, informative, and helpful to those of us who seek his counsel on issues."

Composed primarily of Alaska harvests, United States salmon fisheries are valued at more than $400 million ex-vessel annually, and British Columbia fisheries produce $22 million. In 2013, allocations resulted in 176,000 Chinook salmon for Alaska fisheries, over 258,000 Chinook salmon to Canadian fisheries, and a coast-wide landed catch of over 1.4 million salmon valued in excess of $45 million.

Pursuit of the Fishy Film

The Southeast Alaska Fish Habitat Partnership (*www.seakfhp.org*) will be hosting the first annual Alaska Fish Film Festival during the annual meeting of the Alaska Chapters of the American Fisheries Society and American Water Resources Association in Juneau (October 20–24, 2014). We are soliciting fish-related videos for the Festival and encourage you to capture footage this summer and/or edit footage you already have! To be considered, submissions must: (1) be filmed in Alaska; (2) detail or have a linkage to some aspect of fish conservation and/or fish habitat conservation; and (3) be less than 10 minutes in length. If you have any questions please contact Mark Kaelke, Trout Unlimited's Southeast Alaska Project Director (*mkaelke@tu.org*). The deadline for video submissions is October 1, 2014, but earlier submissions are encouraged. The film festival will take place at the welcoming social for the AFS/AWRA conference on Tuesday, October 21, 2014. Film submitters are encouraged to attend the conference and film festival and share insights into the presented film. Film submission guidelines and the online submission form can be found on the SEAKFHP website at: *http://www.seakfhp.org/1st-annual-alaska-fish-film-festival-october-21st-2014/*.

Alaska Waters Part of National Fish Habitat Partnership

Alaska has two of the ten national "*Waters to Watch*" this year: Twelvemile Creek watershed in Southeast Alaska and Montana Creek (a tributary to the Susitna River) in Southcentral Alaska. The 10 Waters to Watch list, assembled by the nation's leading authorities on aquatic conservation, is representative of freshwater to marine waters across the country that are improving through the conservation efforts of a national network of partnerships operating under the banner of the *National Fish Habitat Partnership*. Alaska has four recognized partnerships: Mat-Su Basin Salmon Habitat Partnership, Southwest Alaska Salmon Habitat Partnership, Kenai Peninsula Fish Habitat Partnership, and the Southwest Alaska Fish Habitat Partnership.

Recognition for U.S. FWS Engineer

On January 21, 2014, Bill Rice was recognized by the U.S. Fish and Wildlife Service (USFWS) for improving fish passage and increasing community resilience to flood events in Alaska. Bill has worked with local Alaskan communities for over a decade to design and install fish-friendly road-stream crossings that also reduce the risk of flood damage,

Continued on next page

Meetings and Events

International Congress on the Biology of Fish

August 3–7, 2014: This meeting will be held in Edinburgh, Scotland. For more information, visit *http://icbf2014.sls.hw.ac.uk/*.

144th Annual Meeting of the American Fisheries Society Symposium

August 17–21, 2014: This meeting will be held in Québec, Canada with the theme "From Fisheries Research to Management: Think and Act Locally and Globally." For more information, see *http://afs2014.org/*.

Annual Conference of the Alaska Chapter of American Statistical Association

August 18–20, 2014: This conference, to be held at the Chena Hot Springs Resort near Fairbanks, will feature a two-day workshop on mixed-effect models (Dr. Ben Bolker, professor of Math and Statistics at McMaster University). For more information, visit *http://community.amstat.org/AlaskaChapter/Meetings/2014/AnnualMeeting2014*. The conference contact is Anna-Marie Benson (*Anna-Marie_Benson@fws.gov*).

2nd World Small-Scale Fisheries Congress

September 21–25, 2014: This meeting will be held in Merida, Mexico with the theme "Options and Opportunities for Small-Scale Fisheries." For more information, see *http://toobigtoignore.net/*.

41st Annual Meeting of the American Fisheries Society Alaska Chapter

October 20–24, 2014: This meeting will be held in Juneau, AK with the theme "Bridging Disciplines to Solve Today's Challenges in Resource Management." The meeting chair and program contact is Jennifer Stahl (*jennifer.stahl@alaska.gov*).

FWS Engineer, continued

support construction jobs and help sustain the community and economic benefits associated with salmon. One of only seven USFWS fish passage engineers nationwide, Bill has a rare combination of hydrologic, engineering, and interpersonal skills that he uses to build lasting and active partnerships to improve fish passage in Alaska. His expertise is also exported outside Alaska—he just returned from special assignment in Colorado where he worked side-by-side with representatives from the Federal Emergency Management Agency, local and state officials, and other USFWS staff to ensure that responses to recent major flood events consider the needs of both fish and communities.

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Feel free to contact the Executive Committee members.