# Utah Chapter of the American Fisheries Society

## 2020 Annual Meeting



Photo Credits: Virgin River Program and George Weekley

- St. George, Utah
- February 25<sup>th</sup>-27<sup>th</sup>, 2020

**Meeting Program** 





## AMERICAN FISHERIES SOCIETY 150<sup>th</sup> Annual Meeting COLUMBUS, OHIO, AUG 30 - SEPT 3, 2020

The Ohio Chapter invites you to attend the 150th Annual Meeting of the American Fisheries Society in Columbus, Ohio from August 30th to September 3rd, 2020. Come celebrate 150 years of fisheries ecology, conservation, and management with fisheries students and professionals from across the world. There will be special exhibits and activities that highlight the achievements from all those who have contributed to the AFS mission over the past century and a half. The city of Columbus is the perfect location to commemorate this occasion. Join us at one of the hundreds of restaurants or breweries within walking distance of the convention center or take a stroll down the Scioto Mile and enjoy one of the many parks along Ohio's longest river. From shows and sports to drinks and cuisine, Columbus has something fun and exciting for everyone. We look forward to seeing you there!

### CONTRIBUTED PAPERS AND POSTERS

Those who wish to present in Contributed Papers or Poster sessions at the 2020 AFS Annual Meeting are required to submit abstracts by **March 20, 2020**. This includes Student Presentations.

Confirmation of acceptance or refusal of abstracts will be communicated by **April 17, 2020**.

Student presentations will be considered for a "best presentation" award if the student fills out additional application paperwork available at https://education.fisheries.org/awards/best-student-presentation-and-poster/.

FOR MORE INFORMATION VISIT https://fisheries.org

#### **2020 PRESIDENTS WELCOME**

On behalf of the Utah Chapter of the American Fisheries Society Executive Committee, we would like to extend you a warm welcome to our 42nd Annual Meeting in St. George, Utah! A special thanks goes out to the Hilton Garden Inn, and the Zion Brewery for hosting us and providing a comfortable atmosphere.

It has been a pleasure to serve on the Utah AFS EXCOM and I am honored to be your President. I would like to thank those that agreed to run for office this year. For those that will not be elected this year, please don't be afraid to put your name back in the hat in the near future. We struggle more than we should getting folks to run for office, so keep trying – PLEASE! If you haven't run for an office yet, please consider doing so. The First/Second Year Committee members and the Secretary/Treasurer are great positions to jump into when you are early in your career. We are all busy and the time will never be perfect to run for office. If serving on the Utah EXCOM is just not for you, then consider serving on a subcommittee. We will be looking for additional help this year to serve on subcommittees helping organize the 2021 WDAFS meeting in Ogden.

I wanted to continue Paul Thompson's efforts last year to give more back to Society members. We have continued offering student scholarships to this meeting. This year, we gave four student scholarships this year – including one scholarship to a high school student! In addition, we have started a small project grant for students to help fund their research. We know how hard it is for students to get funding for research and we are offering one grant of \$500 to a deserving student to help finish their important work.

I hope that you enjoy this years' meeting – I am excited for the great symposium and contributed papers! The Virgin River Symposium and the Fish Passage, Screens, and Barriers are highlights for this year's meeting. The Virgin River Symposium is the second year in a row that we have had a high-level symposium with presenters coming from across the West to participate. Thanks to these researchers for taking the time out of their schedule to attend our annual meeting. In addition, we have a short session on Innovative Techniques in Fisheries and a morning of excellent Contributed Papers.

I would like to personally thank my fellow EXCOM (Paul Thompson, Sarah Seegert, Paul Burnett, Jim DeRito, Natalie Boren, and Dale Fonken), webmaster Chante Lundskog, and Lisa Graham for helping this year. They are a great group and have worked very hard to make this a successful meeting. Thank you for your continued support of Utah AFS. If you have questions, please don't hesitate to ask one of our EXCOM members for help.

George Weekley President Utah Chapter of the American Fisheries Society

## Utah Chapter of the American Fisheries Society Officers and Meeting Sub-Committees 2018-2019

Past President	Paul Thompson	utafspp@gmail.com
President	George Weekley	utafsprez@gmail.com
President Elect	Sarah Seegert	utafspe@gmail.com
Vice President	Paul Burnett	utafsvp@gmail.com
Secretary/Treasurer	Jim DeRito	utafstreasurer@gmail.com
2 <sup>nd</sup> Year Committee Member	Dale Fonken	utahafs2@gmail.com
1 <sup>st</sup> Year Committee Member	Natalie Boren	utahafs1@gmail.com
Webmaster	Chante Lundskog	clundskog@utah.gov
Paper/Poster Judging	Eric McCulley	eric.mcculley@riverrestoration.org
Annual Meeting Planning	Lisa Graham	lisagraham@utah.gov

A special thank you to the USU AFS sub-chapter for volunteering their time and equipment to the meeting!



### \*\*2019 Utah Chapter AFS Best of Show Winners\*\*

The Utah AFS Executive Committee is proud to announce the 2019 Best of Show winners from the 2019 Annual Meeting in Provo!

#### **BEST STUDENT POSTER PRESENTATION**

Adam Johnson; USU

Presentation Title: Testing Macroinvertebrate Sampling Method Bias as a Biomonitoring Tool in Utah Lake

#### **BEST STUDENT ORAL PRESENTATION**

Ryan Dillingham; USU

Presentation Title: Monitoring Ecosystem Response to Whole-Lake Biomanipulation in a Shallow, Eutrophic, Utah Lake

#### **BEST PROFESSIONAL ORAL PRESENTATION**

Chris Penne; UDWR

Presentation Title: Fishing for Answers: Using Citizen Science to Study the Population Dynamics of Tiger Muskellunge in Pineview Reservoir

### 2019 Awards

The Utah Chapter of the American Fisheries Society is pleased to congratulate the following 2018 award winners:

#### LIFETIME ACHIEVEMENT

Mark Holden

#### PROFESSIONAL OF THE YEAR

Trina Hedrick & Natalie Boren

#### **AWARD OF MERIT**

Gary Theide, Dan Abeyta, Steve Doudy, Don Duff, and Bryce Nielson

#### PARTNER of the YEAR

Mountain West Muskies

#### LEAKY BOOT

Justin Jimenez

#### HATCHET THROW CHAMPION

**Brook Watt** 

### **Meeting Sponsors**

Virgin River Chub Sponsors (\$2,000 or greater)



Bluehead Sucker Sponsors (\$1,000 or greater)



**Colorado River Cutthroat Sponsors (\$500 or greater)** 



## **Meeting Sponsors**

### **Colorado River Cutthroat Sponsors (\$500 or greater; continued)**



### **Bonneville Cisco Sponsors (\$200 or greater)**



## Thank You to our Donors!

The following people/companies donated/discounted items or their services for the meeting in some way:

Deer Valley Resort	Brandon Ivory	Dick's Sporting
Kent Sorenson	Camp Chef	Goods
Trout Unlimited	Montana Fly	My Patriot Supply
Melissa Trammel	Company	Zane Olsen
Utah's Hogle Zoo	Black Bear Diner	Rajeff Sports - Echo
John Schultz - High	Sunfish Farms	Flyfishing
Country Fly Fishers	Loveland Living	Wish for Fish
George Weekley	Planet Aquarium	Jersey Plates Art
Western Native	Travis Sylvester	Desert Star Theater
Trout Initiative	Lifetime	Tuacahn Center for
Natural History	Angler's Den	the Arts
Museum of Utah	Blue Halo Flyrods	Mystery Escape
Christenson's	The Nature	Room, St. George
Lakeshore Tackle	Conservancy	A-Core Concrete
BioWest, Inc.	Rosenbruch	Specialists
Hale Centre	Wildlife Museum	
Theatre	Jaimi Butler	
Sundance	Hovt	
Mountain Resort		
Tracy Aviary	larget	
Utah Jazz	Big 5 Sporting Goods	

### Fundraising Event Break-down

#### **General Raffle**

\$1/ticket or wingspan of tickets for \$20

- Blue Halo 4wt Flyrod
- Trout Unlimted Fly Boxes, Coffee Mugs, Beanies
- WNTI Bonneville cutthroat trout hat
- Bonneville Cisco Prints
- Handmade (Brandon Ivory) Knife
- Flybox and flies tied by John Shultz and donated by the High Country Fly Fishers
- Natural History Museum of Utah tickets
- Ice fishing rods and tackle donated by Christenson's Lakeshore Tackle
- BioWest Sage Fly Rod
- The Nature Conservancy hat and water bottle
- Tracy Aviary tickets
- Hogle Zoo 2 person day passes
- Montana Fly Company fly-fishing gear and hats
- Blackbear Diner gift certificate
- Sunfish Farms flyrod and reel
- Loveland Living Planet Aquarium tickets

#### **Silent Auction**

- Utah Hogle Zoo Tickets
- Hale Center Theater tickets to Mary Poppins
- Desert Star Theater tickets to any play
- Utah Jazz Tickets
- Tuacahn Center for the Arts tickets to Annie
- Book donated by The Nature Conservancy
- Set of 4 Vouchers at Mystery Escape Room, St. George
- Native fish pendant by Melissa Trammel
- Floy Tags 500 tags, tagging gun, and ruler
- Sundance Ski Resort 2 lift tickets
- Deer Valley Ski Resort 4 lift tickets

#### **Deck of Cards Game**

<u>Card Game 1 (\$25/card)</u> - 8 wt Orvis flyrod donated by George Weekley. <u>Card Game 2 (\$15/card)</u> - Outcast float tube with fins and pump from Angler's Den. <u>Card Game 3 (\$15/card)</u> - Camp Chef 3 Burner Big Gas Grill with additional griddle for the third burner. <u>Card Game 4 (\$10/card)</u> - Lifetime 80 gallon black composter <u>Card Game 5 (\$5/card)</u> - Lifetime 55 qt high performance cooler

- Rosenbruch Wildlife Museum tickets
- Sundance Mountain Resort Ski lift tickets
- Tim Johnson print by Trout Unlimited
- Megaplex Theater tickets
- Utah Museum of Fine Arts tickets
- The Great Great Salt Lake Monster Mystery book
- Target gift card
- Big 5 Sporting Goods gift card
- Dick's Sporting Goods gift cards
- Travis Sylvester prints
- Coffee mugs, pint glasses, water bottles and flask engraved by Zane Olsen
- Echo 2 wt and 5 wt flyrods by Rajeff Sports
- Hat, sling pack, and hip pack by Wish For Fish
- Utah Licence Plate fish by Jersey Plates
   Art

### **Conference Center Information**

#### Hilton Garden Inn

Address: 1731 S Convention Center Dr, St. George, UT 84790

Phone: (435) 634-4100

Website: https://www.hilton.com/en/hotels/sgugigi-hilton-garden-inn-st-george/?SEO\_id=GMB-GI-SGUGIGI

**Parking:** Parking is available at the hotels.

### **Opening Social Information**

#### **Zion Brewery Firehouse Station 2**

Address: 142 N. Main St, St. George, UT 84770

Phone: (435) 772-0404

Website: https://www.zionbrewery.com/station-2

Transportation: A shuttle van will be available between the shuttle and the social venue. Times are listed below. If you drive your own vehicle, free street parking is available. There is also free parking available in the parking lot across the street.

Shuttle departure (from Hilton Garden Inn): 5:20 pm, 5:50, 6:20 pm

Shuttle departure (from Firehouse Station 2): 9:00 pm, 9:30 pm, 10:00 pm

For questions about the shuttle: 385-251-5923

### **Motel Information**

#### **Hilton Garden Inn**

Address: 1731 S Convention Center Dr, St. George, UT 84790

Phone: (435) 634-4100

Website: https://www.hilton.com/en/hotels/sgugigi-hilton-garden-inn-stgeorge/?SEO\_id=GMB-GI-SGUGIGI

#### Hyatt Place St. George

Address: 1819 S 120 E, St. George, UT 84790

Phone: (435) 656-8686

Website: <u>https://www.hyatt.com/en-US/hotel/utah/hyatt-place-st-george-convention-center/sguzs?src=corp\_lclb\_gmb\_seo\_nam\_sguzs</u>

### Schedule at a Glance

Tuesday, February 25 <sup>th</sup>			
<u>Time</u>	<u>Event</u>	<u>Location</u>	
1:00 pm – 5:00 pm	Continuing Education – How to write and	Sego Lilly	
	publish a manuscript in a scientific journal		
1:00 pm – 5:00 pm	Continuing Education – Telling our story –	Sage	
	working with media and developing our own		
	media content		
1:00 pm – 5:00 pm	Virgin River Tour	UDWR Washington	
		County Field Office,	
		451 N SR-318,	
		Hurricane, UT 84737	
12:00 pm – 5:30 pm	Registration	Ballroom Lobby	
6:00 pm – 10:00 pm	Opening Social	Zion Brewery	
		Firehouse Station 2	
Wednesday, February	26 <sup>th</sup>	1	
7:00 am – 8:00 am	Continental Breakfast	Ballroom Lobby	
7:00 am – 5:30 pm	Registration	Ballroom Lobby	
7:00 am – 5:00 pm	Presentation Download	Ballroom	
8:00 am – 8:15 am	Opening Remarks – George Weekley	Ballroom	
8:15 am – 8:30 am	Western and National AFS Message – Travis	Ballroom	
	Rehm		
8:30 am – 11:50 pm	Plenary Session – Virgin River Symposium	Ballroom	
12:00 pm – 1:30 pm	Lunch – provided by AFS	Ballroom Lobby	
12:30 pm – 1:30 pm	Utah AFS Business Luncheon	Ballroom	
1:30 pm – 4:30 pm	Fish Passage, Screens, and Barriers	Mariposa	
1:30 pm – 4:30 pm	Virgin River Symposium	Cliffrose	
4:30 pm – 5:45 pm	Poster Session	Ballroom Lobby	
6:00 pm – 10:00 pm	Banquet/Awards/Raffle	Ballroom	
Thursday, February 27	th		
7:00 am – 8:00 am	Continental Breakfast	Ballroom Lobby	
7:30 am – 10:00 am	Presentation Download	Ballroom	
8:30 am – 10:10 am	Contributed Papers	Cliffrose	
10:30 am – 12:10 pm	Contributed Papers and Innovative	Cliffrose	
	Techniques		
8:30 am – 12:30 pm	Fish Passage, Screens, and Barriers	Mariposa	
8:30 am – 9:10 am	Virgin River Symposium	Indigo	
12:10 pm - 12:30 pm	Lunch – provided by AFS/Adjourn	Ballroom Lobby	
1:00 pm – 5:00 pm	Virgin River Fishes Recovery Team meeting	Cliffrose	
1:30 pm – 3:30 pm	Trap Shoot	Purgatory Gun	
		Range	



### Wednesday, February 25<sup>th</sup>

Plenary Session

Room: Ballroom

Moderator: George Weekley

8:00 - 8:15	George Weekley – Opening Remarks and Presidential Message		
8:15 - 8:30	Travis Rehm – National and Western D	Division AFS Message	
8:30 - 9:00	<b>Rick Fridell</b> – Collaborative partnerships: the key to successful conservation		
	planning in Utah's fastest growing and	most biologically diverse county	
9:00 - 9:30	James Greer – Utah Water Rights and	Instream Flow Mechanisms	
9:30 - 10:00	Corey Cram – Water for People and Fi	shes- Making it Work in Washington	
	County		
10:00 - 10:20	BREAK – Lobby		
10:20 - 10:50	Steve Meismer – Virgin River Program	: Cooperation for Conservation	
10:50 - 11:20	Elaine York – Virgin River - Efficient Water Management for People and		
	Wildlife		
11:20 - 11:50	Rick Fridell – Twenty-five years of coo	perative actions implemented under	
	the Virgin Spinedace Conservation Agreement		
12:00 - 1:30	LUNCH – Lobby		
12:30 - 1:30	Utah AFS Business Luncheon		
	Session 1A: Fish Passage, Screens, Session 1B: Virgin River Symposium		
	and Barriors	Dears, Cliffrage	
	and Darners	Room: Cillirose	
TIME	Room: Mariposa	Moderator: Rick Fridell	
TIME	Room: Mariposa Moderator: Jim DeRito	Moderator: Rick Fridell	
<b>TIME</b> 1:30 – 1:50	Room: Mariposa Moderator: Jim DeRito Suzanne Huhta – Fish Passage	Moderator: Rick Fridell Mike Schwemm – Recovery efforts	
<b>TIME</b> 1:30 – 1:50	Room: Mariposa Moderator: Jim DeRito Suzanne Huhta – Fish Passage Challenges in the Intermountain	Moderator: Rick Fridell Mike Schwemm – Recovery efforts and conservation on the lower Virgin	
<b>TIME</b> 1:30 – 1:50	Room: Mariposa Moderator: Jim DeRito Suzanne Huhta – Fish Passage Challenges in the Intermountain West	Moderator: Rick Fridell Mike Schwemm – Recovery efforts and conservation on the lower Virgin River system	
<b>TIME</b> 1:30 – 1:50 1:50 – 2:10	Room: Mariposa Moderator: Jim DeRito Suzanne Huhta – Fish Passage Challenges in the Intermountain West Don Wiley – Utah Wildlife Migration	Moderator: Rick Fridell Mike Schwemm – Recovery efforts and conservation on the lower Virgin River system Christian Edwards - Virgin River	
<b>TIME</b> 1:30 – 1:50 1:50 – 2:10	Room: Mariposa Moderator: Jim DeRito Suzanne Huhta – Fish Passage Challenges in the Intermountain West Don Wiley – Utah Wildlife Migration Initiative	Moderator: Rick Fridell Mike Schwemm – Recovery efforts and conservation on the lower Virgin River system Christian Edwards - Virgin River Riparian Habitat Restoration and Wildlife Conservation	
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TIME	Session 2A: Fish Passage, Screens, and Barriers Room: Mariposa	Session 2B: Virgin River Symposium Room: Cliffrose Moderator: Sarah Seegert	
	Moderator: Jim DeRito		
3:10 - 3:30	<b>Eric McCulley</b> – Restoration of longitudinal connectivity of the Price River for the benefit of native fish species and people	Izzie Spear – Virgin River Red Shiner Eradication – A History of Endangered Species Habitat Recovery through Non -Native Removal	
3:30 - 3:50	<b>Paul Burnett</b> - Restoring Habitat Connectivity on the lower Weber River - A ten year update	Kody Callister – Long term monitoring of Virgin River Chub	
3:50 – 4:10	<b>Eve Davies</b> – PacifiCorp's Weber Hydroelectric Project: Fisheries benefits resulting from the hydro relicensing process	<b>Melinda Bennion</b> – Limiting Factors and Recovery of Woundfin in the Virgin River	
4:10 – 4:30	<b>Chance Broderius</b> – Reconnecting The Raft River and its tributaries in Northwest Utah	Martin Schijf - Establishing Population Maintenance Flows and Restoring Virgin Spinedace Populations to the Santa Clara River Below Gunlock Reservoir	
4:30 – 5:45	POSTER PRESENTATION – Ballroom Lobby		
	<b>Daison Weedop</b> – Beyond the Lakes: Fishes of Streams in an Open Lake System		
	Kate Holcomb – Conservation Agreement and Strategy for Springsnails in Nevada and Utah		
	Andrew Helfrich – Determining Growth Dynamics of Northern Pike in Utah Lake With Implications for Invasive Species Management		
	Manny May – Characterizing the foraging behavior of June sucker among different habitat types in Utah Lake		
	Nathan St. Andre – Effects of Quagga Mussels on the Lake Powell Fishery measured by Isotopes		
	<b>Nicole Grob</b> – Are sculpin too slimy to count? An estimation of the abundance of Cottus cognatus in two arctic lakes		
	<b>Ryan West</b> – Diet overlap between two top predators in Pyramid Lake, Nevada.		
	Julia Sluiter – Exploring Environmental and Genetic Influences on Walleye Growth		
6:00 - 10:00	Banquet/Awards/Raffle – Ballroom		

#### Thursday, February 27<sup>th</sup>

<b>TIME</b> 8:30 – 8:50	Session 3A: Fish Passage, Screens, and Barriers Room: Mariposa Moderator: Chante Lundskog Michael Partlow – Connectivity with flows and exclusion with screens: managing Stewart Lake, a nursery habitat for Razorback Sucker, Xyrauchen texanus, on the Green	Session 3B: Contributed Papers Room: Cliffrose Moderator: Paul Thompson Kevin Landom – Zooplankton, macroinvertebrate, and fish community response to common carp removal and lake level fluctuations in a large shallow Utah	Session 3C: Virgin River Symposium Room: Indigo Moderator: George Weekley Erik Woodhouse - Nonnative fish management in the Virgin River Basin, Utah
	River, Utah, in the presence of nonnative fishes.	reservoir	
8:50 – 9:10	<b>Trina Hedrick</b> – The use of screens to protect fisheries resources in northeastern Utah	<b>Dale Fonken</b> – Evaluating Recovery Actions of an Endemic Lake-Sucker	Sarah Siefken - There are fish in that river? Virgin River native fishes educational outreach program
9:10 - 9:30	Peter MacKinnon – Entrainment of endangered fish in the Green River Canal, Utah, 2013-2019	Josh Verde – Phylogenetic relationships of the Paiute sculpin (Cottus beldingii)	
9:30 – 9:50	Jim DeRito – Protecting Trout with Fish Screens for Irrigation Canals	Timothy Walsworth – Hydrologic drivers of distribution and abundance of the extremely imperiled Rio Grande silvery minnow	
9:50 - 10:10	Nic Braithwaite – Vertical drop barriers as part of Bonneville and Colorado River Cutthroat Trout restoration and recovery efforts in southern Utah: lessons learned.	Peter Searle – Comparative Analysis of Morphometric and Gene-Expression Patterns in larval June Sucker and Utah Sucker	

### Thursday, February 27th

TIME	Session 4A: Fish Passage, Screens,	Session 4B: Contributed Papers and
	and Barriers	Innovative Techniques
	Room: Mariposa	Room: Cliffrose
	Moderator: Dale Fonken	Moderator: Trina Hedrick
10:30 - 10:50	Matt McKell – Fish migration barriers: success and failure	<b>Timothy Walsworth</b> – Harnessing Process-Based Restoration to Improve In-Stream and Riparian Habitat in the Price River, Utah
10:50 - 11:10	<b>Bryan Engelbert</b> – Barriers with brawn: experience constructing multiple hardy fish barriers in a remote area	Steven Bennett – Restoring riverscape productivity: an evaluation of habitat and fish responses to installation of high- densities of simple hand-built wood structures
11:10 - 11:30	<b>Tyler Coleman</b> – Fishing success goes with the flow: correlation between stream flow and temperature and angler catch rates.	Matt Breen – Assessment of age-0 Colorado Pikeminnow survival in backwater nursery habitats of the middle Green River, Utah
11:30 - 11:50	Madison Alger - Lateral Return Flows Control Summer Stream Temperature Patterns in Irrigation- Depleted Streams	Kenen Goodwin – First line of defense: Exploring temporal dynamics of bacteria and fungi in the skin-associated microbiome of a Rocky Mountain salamander
11:50 - 12:10	Natalie Boren – Red Fleet Reservoir Fisheries Management Update	Kate Holcomb – Improving mollusk conservation using iNaturalist
12:10 - 12:30		Peter MacKinnon - Using Wagon- Wheel Antennas to Pioneer the West: How New PIT Detection Technology Has Expanded Our Knowledge on Imperiled Fish Conservation and Management
12:30	Lunch/Adjourn – Ballroom Lobby	
1:30 - 3:30	Trap Shoot Competition – Purgatory Gun Range	

#### Utah Chapter of the American Fisheries Society

#### **Business Meeting Agenda**

February 26, 2020 12:30-1:30 p.m. Hilton Garden Inn Ballroom

#### <u>AGENDA</u>

- 1. Determination of a Quorum
- 2. President's Welcome/opening remarks: George Weekley
  - Training
  - 2020 Student Scholarships
  - AFS 150<sup>th</sup> Anniversary
  - Recovering Americas Wildlife Act
  - AFS National membership and Utah membership
- 3. Treasurer's Report: Jim DeRito
- 4. President Elect Message: Sarah Seegert
- 5. 2022 and Beyond Meeting Plans: Paul Burnett
- 6. Annual Meeting Timing accommodating statewide spawning activities and legislative session?
- 7. Small Project Grants Voting
- 8. Election Results: Natalie Boren
- 9. Question and Discussion from Membership





2020 Utah Chapter of the American Fisheries Society Contributed Paper Abstracts (alphabetical order)

## Lateral Return Flows Control Summer Stream Temperature Patterns in Irrigation-Depleted Streams

**Madison Alger:** Utah State University, Logan, UT, 84321; <u>madison.alger@aggiemail.usu.edu</u> Belize Lane; <u>belize.lane@usu.edu</u> Bethany Neilson; <u>bethany.neilson@usu.edu</u>

Abstract: Over 80% of water in the western U.S. is used for agriculture, and thousands of stream miles are now chronically depleted over the summer low flow season to supply irrigation. Depleted streams are much more susceptible to heating, and excessive temperatures are often cited as a population bottleneck for western aquatic species. At the same time, in depleted streams, even small amounts of colder water such as lateral return flows from irrigation seepage can moderate temperatures and provide critical thermal refugia. To improve understanding of the role of irrigation diversions and lateral return flows on summer stream temperature patterns, we monitored flow and temperature along a diversion-depleted reach of the Blacksmith Fork River in northern Utah over both a wet and a dry summer. During wet years this reach hosts over 1000 fish per mile, while dry years can lead to massive fish kills due to little or no water left instream. Findings from this study are relevant for water resources management to understand how to more efficiently allocate water for instream needs, especially during dry years. Lateral return flows sourced from unlined canals were found to be critical for maintaining suitable river temperatures along the study reach in dry years. Temperatures were more variable and had higher daily maxima in braided than channelized reaches, particularly under highly depleted conditions. More generally, we identified minimum streamflows below which weather and lateral return flows become significant controls on stream temperature. Study results are being used to inform local and regional water managers of the importance of lateral return flows and the unintended consequences of irrigation efficiency projects that reduce lateral return flows. This approach could be applied to help define minimum streamflows across the many depleted streams in Utah and the Intermountain West.

Presentation Format: Oral

Presentation Type: Student

Restoring riverscape productivity: an evaluation of habitat and fish responses to installation of high-densities of simple hand-built wood structures Stephen Bennett: Utah State University, Logan, UT 84321; <a href="mailto:stephen.bennett@usu.edu">stephen.bennett@usu.edu</a> Nick Bouwes; <a href="mailto:nbouwes@gmail.com">nbouwes@gmail.com</a>

#### Joseph Wheaton; <u>Joe.Wheaton@usu.edu</u> Andrew Hill; <u>andrewhill@ecologicalresearch.net</u>

Abstract: The scope of riverscape degradation across the west has been well documented but a vision for what recovery will look like has been less well articulated. Further, traditional restoration approaches that focus on stability are not well suited to address the scope of degradation or promote the physical and biological processes required to sustain healthy riverscapes. A common symptom of riverscape degradation is structural starvation – loss of large wood and beaver dams that leads to simplified stream channels, loss of floodplain connection, and reduction of riparian extent and productivity. In 2008, we implemented a robust experimental design and intensive monitoring program where we tagged over 50,000 juvenile steelhead with passive integrated transponder (PIT) tags and conducted extensive habitat surveys in three sub-watersheds with different flow regimes in Asotin Creek, WA. The goal of the experiment is to evaluate a low-tech process-based restoration approach to address structural starvation and determine how effective it is at increasing fish habitat complexity and ultimately riverscape function and productivity. The approach uses high-densities (~ 4-5 PALS/100 m) of simple hand-built post-assisted log structures (PALS) to mimic, promote, and sustain wood accumulations and ultimately healthy riverscapes. We constructed almost 700 PALS over 14 km of stream and use another 16 km as controls. The structures were installed between 2012-2016. To date, we have documented increases in geomorphic diversity, frequency of overbank flow, natural LWD recruitment, and juvenile steelhead abundance (from 12-44%). We will also provide a summary of riverscape and restoration principles we have developed to guide restoration practitioners when they use this method.

#### Presentation Format: Oral

Presentation Type: Student

#### Limiting Factors and Recovery of Woundfin in the Virgin River Melinda R.M. Bennion: Utah Division of Wildlife Resources, Hurricane, UT 84737; <u>melindabennion@utah.gov</u> Richard A. Fridell; <u>richardfridell@utah.gov</u> Martin A. Schijf; <u>martinschifj@utah.gov</u>

**Abstract:** Woundfin (*Plagopterus argentissimus*) have been federally listed as an endangered species since 1970. Successful reproduction and recruitment of woundfin is limited to a 16.3 mile reach in the upper Virgin River in Utah. Until recently, only a small portion of woundfin live to be greater than 1-year old in the wild; the persistence of woundfin is dependent on the survival and reproductive success of these young fish. Woundfin abundance and distribution has been limited by multiple factors including non-native fish, drought, altered streamflow regimes, diversions, elevated water temperature, decreased turbidity, water management events, and a decline of spawning and rearing habitat.

Since 2000, the Utah Division of Wildlife Resources has worked through the collaborative Virgin River Program to identify and evaluate these factors limiting woundfin persistence and

recruitment. This presentation will highlight the creative ways we have addressed these limiting factors and discuss how woundfin populations have responded.

#### Presentation Format: Oral

Presentation Type: Professional

#### **Red Fleet Reservoir Fisheries Management Update**

Natalie Boren: Utah Division of Wildlife Resources, Vernal, Utah 84078; natalieboren@utah.gov

**Abstract:** Red Fleet Reservoir's fishery has undergone a complete transformation following an illegal introduction of Walleye that was first discovered in 2008. In response to this illegal introduction and in conjunction with the Red Fleet Management planning team, Utah Division of Wildlife Resources aquatics staff has worked to complete multiple large scale projects. This presentation is a fishery management update covering these specific projects; a lake-wide rotenone treatment completed in October of 2015. Development of a complete restocking plan for multiple warm and cool water species with help from our angling public. Planning and implementing a deep water habitat installation project for forage fish. Working with multiple federal partners to plan and construct a lower fish screen below Red Fleet Reservoir to protect critical habitat for endangered fish, this screen is set for construction in April 2020. In partnership with Utah State parks, small scale angler access improvements have been made to the north side of the reservoir. Lastly, a multi-phase stream enhancement project on Brush Creek above the reservoir has been funded with Trout Unlimited as the lead.

Presentation Format: Oral

Presentation Type: Professional

Vertical drop barriers as part of Bonneville and Colorado River Cutthroat Trout restoration and recovery efforts in southern Utah: lessons learned.

**Nic Braithwaite:** Utah Division of Wildlife Resources, Cedar City, UT 84720; <u>nicolasbraithwaite@utah.gov</u>

**Abstract:** Vertical drop barriers on small streams have become a ubiquitous, integral part the efforts to restore and recover native Bonneville Cutthroat Trout and Colorado River Cutthroat Trout populations in southern Utah. Non-native fishes can hybridize, out-compete, consume, or otherwise displace native species and their permanent removal is often required to reestablish native fish populations. However, complete removal of all problem fishes from an entire drainage is typically not possible or necessary, making removal from only a targeted portion of a drainage ideal. In these cases, a vertical drop barrier to prevent reinvasion can be useful. There are many examples of drainages in southern Utah where native Cutthroat Trout populations have been reestablished and protected by removing undesirable non-native fishes from only the headwater sections and constructing vertical drop barriers at the downstream end of the recovery section to prevent reinvasion. We have found these barriers require a minimum drop of 5 feet, a concrete pad to prevent pool formation, and redundancy (i.e., two or more barriers in close proximity) to be effective over the long-term. Furthermore, constructing vertical drop barriers in narrow, steep, rocky locations with interlocking concrete

blocks whenever possible maximizes the likelihood for sustained function with minimal additional work. Regular annual monitoring and immediate monitoring after major discharge events will greatly reduce the extent to which vertical drop barriers can be compromised. We provide case studies from across southern Utah to highlight our findings.

Presentation Format: Oral

Presentation Type: Professional

## Assessment of age-0 Colorado Pikeminnow survival in backwater nursery habitats of the middle Green River, Utah

Matthew J. Breen: Utah Division of Wildlife Resources, Vernal, Utah 84078; mattbreen@utah.gov M. Tildon Jones; <u>tildon\_jones@fws.gov</u>

Abstract: Despite consistent Colorado Pikeminnow (Ptychocheilus lucius; CPM) reproductive success, first year survival remains poor in the middle Green River, Utah. In 2012, we examined factors impeding age-0 CPM survival in nursery backwater habitats. Presence and arrival of larval CPM was verified by drift netting conducted in Dinosaur National Monument (river mile [RM] 310) and larval seining that took place in downstream backwaters. Twelve randomly selected backwaters (RM 305–273.5) were blocked off and depleted of nonnative fishes by seining (mean=94.8% depletion), then assigned one of three treatments: (1) four backwaters that were not blocked after initial depletions, (2) four backwaters blocked by 1/4" mesh block nets, and (3) four backwaters blocked by 1/2" mesh block nets. Experimental backwaters were revisited every other week for six occasions (10 July–25 September) to monitor fish community response over time; changes in fish community composition were analyzed using a Repeated Measures ANOVA. Dry hydrologic conditions and deteriorating habitat quality were not conducive to CPM larval drift, arrival in nursery areas, or age-0 recruitment in 2012, therefore other age-0 native fishes provided helpful insights on the effects of our experimental design. Abundance of both native and nonnative fish (mainly small-bodied cyprinids) was greatest in 1/2" mesh blocking treatments. Moreover, native fish were completely absent from unblocked backwaters before the fourth sample period (20-22 August) and nearly eliminated from 1/4" mesh blocking treatments before the fifth sample period (4-5 September). Additionally, unblocked backwaters contained the lowest abundance of all species, suggesting that predation by nonnative piscivores coming from riverine habitats may be a significant threat to smallbodied fishes and blocking treatments can positively influence survival in nursery areas. By blocking backwater nursery areas, we created predator free habitats that benefited most species of small-bodied fishes. Despite higher abundance of small-bodied cyprinids in 1/4" and 1/2" mesh blocking treatments throughout our experiment, age-0 native fishes were also more abundant. We do not discount that competition between age-0 native fishes and nonnative cyprinids can be intense in backwaters, but if we can control for predation by blocking backwaters, survival can be positively influenced despite ongoing competition for resources in nursery habitats.

#### Presentation Format: Oral

Presentation Type: Professional

#### Reconnecting The Raft River and its tributaries in Northwest Utah

Chance Broderius: Utah Division of Wildlife Resources, Ogden, UT 84405; cbroderius@utah.gov

**Abstract:** The Raft River is a tributary to the Snake River in Idaho. The portions of the Raft River and its tributaries (South Fork Junction Creek, Basin Creek, and Junction Creek) that occur within Utah are extremely fragmented due to agricultural practices. In 2017 the UDWR, in conjunction with BLM and TU performed a barrier assessment, which identified eleven structures that were impassable by the two key management species (Yellowstone Cutthroat Trout and Bluehead Sucker) within the Raft River drainage. We have begun working to remove a core group of these barriers that will ultimately reconnect two sub populations of Bluehead Sucker as well as open up more stream to the current population of Yellowstone Cutthroat. Covered in this presentation will be results from the initial barrier assessment, work completed to date, and plans for the future.

Presentation Format: Oral

Presentation Type: Professional

Restoring Habitat Connectivity on the lower Weber River - A ten-year update Paul Burnett: Trout Unlimited, Ogden, UT 84405; <u>pburnett@tu.org</u> Eve Davies; <u>eve.davies@pacificorp.com</u> Clint Brunson; <u>cbrunson@utah.gov</u>

**Abstract:** Over the past ten years a variety of partners have collaborated to restore habitat connectivity for Bonneville cutthroat trout and bluehead sucker in the lower Weber River. The impetus for this work began with anecdotal sightings of cutthroat trout in the river in the Morgan Valley in the 2000's. A more detailed analysis completed by USU and the UDWR during 2011-2013 identified the remnants of a fluvial cutthroat trout population persisting in a highly fragmented river system. Over time, we have used movement data to help guide us with project priorities. Now ten years later we report on our restoration successes on the lower Weber River, where we have removed 2 mainstem barriers, and restored fish passage at 4 sites on small tributary streams. We are currently working with PacifiCorp on hydro power relicensing of their Weber Hydropower Facility, another water user on the Lower Weber River to restore fish passage on their channel-spanning irrigation diversion and restoring fish passage on Dalton Creek a small spawning tributary for cutthroat trout. Moving forward we hope to begin looking at detailed fish movement patterns, as well assess the broader fish population response to our efforts.

Presentation Format: Oral

Presentation Type: Professional

#### Long term monitoring of Virgin River Chub

**Kody Callister:** Utah Division of Wildlife Resources, Hurricane, Utah, 84737; <a href="mailto:kcallister@utah.gov">kcallister@utah.gov</a>

**Abstract:** The Virgin River Chub (*Gila seminuda*) is an endangered fish species currently inhabiting about 16 miles of the Virgin River in Utah. Factors threatening Virgin River Chub include competition with non-native species – specifically Red Shiner, drought, elevated water temperature, decreased turbidity, alteration of natural flow regimes, and fluctuations in spawning and rearing habitat. Capture rates of Virgin River Chub age classes vary with sampling methodology; therefore, the Utah Division of Wildlife Resources (UDWR) has developed a monitoring program for adult Virgin River Chub to supplement previously established fish monitoring programs that effectively sample young chub. Since 2006, UDWR has conducted population monitoring for adult Virgin River Chub using hoop nets set overnight at five sampling stations between Pah Tempe Hot Springs and the Washington Fields Diversion on the Virgin River, with the addition of a station downstream at above Webb Hill barrier in 2014.

After a steep decline between 2006 and 2007, the number of Virgin River Chub captured during monitoring has varied, but the population appears to be stable. Years with high spring run-off tend to produce a lot of young chub and those young chub persist to maintain a stable population. Since 2016, chub monitoring results have shown an increase with 2019 being a big reproduction year.

#### Presentation Format: Oral

Presentation Type: Professional

## Fishing success goes with the flow: correlation between stream flow and temperature and angler catch rates

Tyler Coleman: Trout Unlimited/ Utah State University, Logan, UT 84321; <u>tyler.coleman.fisheries@aggiemail.usu.edu</u> Jim DeRito; <u>james.derito@tu.org</u> Chris Penne; <u>chrispenne@utah.gov</u> Gary Thiede; <u>gary.thiede@usu.edu</u> Phaedra Budy; <u>Phaedra.budy@usu.edu</u>

**Abstract:** Summer base flows for rivers are critical for maintaining water quality, healthy fish populations, and a functional aquatic ecosystem. Low summer base flows can increase water temperatures and reduce dissolved oxygen levels. These conditions can stress Brown Trout (Salmo trutta) energetically and thus result in lower angler catch. The goal of our study was to determine if low river flows and higher water temperatures influence angler catch rates of Brown Trout on the lower Logan River, Utah. We performed a creel survey on approximately 6.4 km (4 miles) of the lower Logan River from 1 April to 31 October 2019, during which we recorded angler effort and catch data to calculate mean monthly catch rates. We used continuous collection of stream temperature and flow from a river gage within the survey reach to calculate monthly means. Total angling effort for the survey period was 2,147 hours with 1,481 fish caught for an overall catch rate of 0.69 fish per hour (fph). June was the highest for angler catch rate (1.2 fph) as well as the highest discharge at 16 m<sup>3</sup>/s while also having the

lowest average water temperature (9.6 °C). Our data from September demonstrated the lowest angler catch (0.41 fph) in addition to the lowest discharge (2.12 m<sup>3</sup>/s), and highest average water temperature (11.2°). Collectively these data demonstrate a positive correlation between high flow rates and angler catch rates (R2 = 0.37, p = 0.15), and a negative correlation between higher water temperatures and angler catch rates (R2 = 0.42, p = 0.12); however, time of year can be a confounding factor for angler behavior. Our data suggest that even on a higher-than-average runoff year, angler success is impacted by low summer base flows. Maintaining increased river flow during typical summer low-flow time periods could increase angler catch rates and, ultimately, even greater satisfaction with this Blue Ribbon fishery.

#### Presentation Format: Oral

#### Presentation Type: Student

#### Water for People and Fishes- Making it Work in Washington County Corey Cram: Washington County Water Conservancy District, St. George, Utah 84737; corey@wcwcd.org

**Abstract:** Washington County is one of the fastest growing places in the United States. The Washington County Conservancy District has taken on the responsibility of providing water supply for the future, even for a future that could be half a million people as is projected to be here in 2065. The Water District started early and began collected data to understand the Virgin River fishes and the habit. The District recognized the benefits of native fish recovery and was instrumental in establishing the Virgin Spinedace Conservation Agreement, one of the first of its kind. The District helped establish the Virgin River Program, an endangered species recovery program which also provides for water for people. The District believes that recovery can be accomplished when federal, state and local partners come together to solve problems. Corey will provide examples through time of how the District has partnered to solve problems pursuant to recovery of native fish in the Virgin River.

#### Presentation Format: Oral

#### Presentation Type: Professional

## PacifiCorp's Weber Hydroelectric Project: Fisheries benefits resulting from the hydro relicensing process

Eve Davies: PacifiCorp Renewable Resources, SLC, UT 84124; eve.davies@pacificorp.com

**Abstract:** Fish passage is increasingly being looked at to mitigate the effects of dams on rivers, although the expense of retro-fitting passage may decrease its potential use. The construction of PacifiCorp's Weber Hydroelectric Project was completed in 1910, on the Weber River near the mouth of Weber Canyon, approximately 9 miles southeast of Ogden, UT. The project was last licensed, as required under the Federal Power Act, in 1990; the current license expires in May of 2020. Although the Weber Project was originally built with fish passage as integral part of the dam (quite unusual for its time), it is clear that it never functioned to pass fish through the structure, and has been used for the last almost 70 years to pass a minimum stream flow through the Project, and to allow winter ice buildups to move past the dam. Following high Weber runoff flows in 2011, PacifiCorp became aware that the Project reach contains both

extant fluvial Bonneville cutthroat trout (unknown prior to the 2011 high flows), as well as a population of increasingly rare bluehead sucker; as a result, this reach was rated as the highest priority in Utah for restoration of fish passage. Since starting the current Weber relicensing process in 2013-2014, PacifiCorp has worked collaboratively with agency and NGO stakeholders to relicense the project, including proposing 18 Protection, Mitigation, and Enhancement (PM&E) measures agreed to by all relicensing stakeholders. A number of the measures are designed to improve habitat and provide passage for BCT and bluehead sucker. The presentation will focus on PM&Es related to proposed fishery and aquatic habitat improvements, including fish passage for both species of concern at the Project, and specifically on the collaborative fish passage design process and outcomes.

#### Presentation Format: Oral

Presentation Type: Professional

### Protecting Trout with Fish Screens for Irrigation Canals

James DeRito: Trout Unlimited, Providence, UT; <u>iderito@tu.org</u> Matthew Mayfield Matthew Woodard Paul Burnett; <u>pburnett@tu.org</u>

**Abstract:** Fish screens are increasingly being used in inland waterways to prevent trout entrainment into irrigation canals. This has been the case in southeast Idaho, western Wyoming, and northern Utah where numerous fish screens have been installed by several organizations during about the past 20 years. These fish passage projects are an investment of millions of dollars. However, there had been no attempt to compile and share basic screening information. In 2017, we began the development of a fish screen database and inventory methodology. To date, eighty-five fish screens have been inventoried: 48 in the Bonneville Basin and 37 in the Snake River Basin. Most of these screens are drum types on small canals (less than 5 cfs) that have been installed during about the past 10 years. Other types of screens include vertical, horizontal, and cone - each with several subtypes. Fish screens on six canals exceed 50 cfs design capacity. Several screens are the second or third generation of fish screens on canals. These projects have reduced or eliminated fish entrainment and improved upstream fish passage, reconnecting several hundred miles of trout streams. It's intended that the inventory and database will facilitate information sharing and the continued improvement of fish screening efforts in the Intermountain West.

#### Presentation Format: Oral

Presentation Type: Professional

**Virgin River Riparian Habitat Restoration and Wildlife Conservation Christian Edwards:** Utah Division of Wildlife Resources, Hurricane, UT, 84737; <u>christianedwards@utah.gov</u> Richard Fridell; <u>richardfridell@utah.gov</u>

**Abstract:** The Virgin River originates from headwaters north and east of Zion National Park and travels southwest approximately 150 miles through Utah, Arizona, and Nevada before emptying into Lake Mead. In the St George area, the river meanders through a wide floodplain, which

supports wetlands and associated riparian woodlands. In addition to providing water for urban development and agriculture, the Virgin River supports hundreds of wildlife species including six native fish species and five aquatic and riparian conservation species. Three general actions are included in the preservation of the Virgin River 100-year floodplain: 1) land acquisition and floodplain protection, 2) species monitoring and recovery, and 3) habitat restoration. The Virgin River Program has worked in a collaborative effort to acquire and conserve hundreds of acres of the Virgin River floodplain below Zion National Park. The Utah Division of Wildlife Resources (UDWR) has conducted extensive monitoring of Virgin River fish species since the 1990s and annual monitoring of the Southwestern Willow Flycatcher since early 2000s. UDWR monitoring efforts include population surveys, nest monitoring, cowbird control, and nest microhabitat/vegetation sampling. In addition to flycatcher habitat enhancement (e.g. selective tamarisk removal), general Virgin River floodplain restoration efforts have been conducted throughout the Virgin River Basin and include floodplain protection, riparian habitat maintenance, non-native removal (e.g. tamarisk, Russian Olive), and native revegetation.

#### Presentation Format: Oral

Presentation Type: Professional

## Barriers with brawn: experience constructing multiple hardy fish barriers in a remote area

Bryan Engelbert: Utah Division of Wildlife Resources, Vernal, UT 84078; <u>bengelbert@utah.gov</u>

**Abstract:** The needs for fish passage versus population isolation are well documented. In some active restoration projects, isolating a population to prevent re-invasion is necessary to secure the species' persistence into the future. Our project focuses on permanently isolating 90 miles of trout stream and dozens of high alpine lakes by creating two fish barriers as part of a native Colorado River cutthroat trout restoration project. This presentation will describe the relationship with state and federal partner agencies and how we were able to plan, fund and construct these barriers in very remote areas. We compare and contrast the methods used on each barrier and discuss what we learned from this project. We further discuss the context of these fish barriers and what it means as we pursue native trout recovery on this project toward a status as the largest meta-population of Colorado River cutthroat trout that have no interspecific species competition.

#### Presentation Format: Oral

Presentation Type: Professional

#### **Evaluating Recovery Actions of an Endemic Lake-Sucker**

**Dale Fonken:** Utah State University and Utah Division of Wildlife Resources, Springville, UT 84663; <u>dfonken@utah.gov</u> Mary Conner; <u>mary.conner@usu.edu</u> Tim Walsworth; <u>timothy.walsworth@usu.edu</u>

**Abstract:** Anthropogenic disturbances to freshwater ecosystems have been associated with negative impacts to native biodiversity, and endemic species are particularly vulnerable due to their limited range. The June Sucker (*Chasmistes liorus*), an endangered species endemic to

Utah Lake (Utah), is emblematic of the pressures facing many endemic species in degraded ecosystems. Introduction of non-native species, habitat modification, and water development have crippled natural recruitment. At the time of listing under the Endangered Species Act in 1986 an estimated 300 adults remained in the wild. In response, a hatchery program was created to mitigate the effects of these stressors, and approximately 25,000 June Suckers from various hatchery facilities, grow-out ponds, and refuge populations are stocked annually. While all stocked fish are tagged to identify origin, a surprisingly large number of adult June Suckers without identifying tags are encountered during monitoring surveys, indicative of either natural recruitment or tag-shedding. Here, I propose a study to evaluate survival of hatchery fish based on origin, size-at-stocking, and season of stocking, as well as determine the level of natural recruitment occurring. Recovery efforts to date, including the removal of 73% of Utah Lake's Common Carp biomass and restoration of a major spawning tributary, present improved conditions to support natural recruitment, and an increasing June Sucker population suggests natural recruitment may be occurring at a meaningful level. Evidence of significant natural recruitment could indicate that recovery actions have been successful. The results of this study can inform improved hatchery production practices, as well as evaluate the effectiveness of recovery actions, better equipping managers to solve future conservation challenges.

#### Presentation Format: Oral

Presentation Type: Professional

## Collaborative partnerships: the key to successful conservation planning in Utah's fastest growing and most biologically diverse county.

Rick Fridell: Utah Division of Wildlife Resources, Hurricane, UT 84737; <u>richardfridell@utah.gov</u> Melinda Bennion; <u>melindabennion@utah.gov</u> Kody Callister; <u>kcallister@utah.gov</u> Christian Edwards; <u>christianedwards@utah.gov</u> Martin Schijf; <u>martinschijf@utah.gov</u> Sarah Siefken; <u>sarahnsiefken@utah.gov</u> Izzie Speer; <u>ietween@utah.gov</u> Kevin Wheeler; <u>kevinwheeler@utah.gov</u> Erik Woodhouse; <u>ewoodhouse@utah.gov</u>

**Abstract:** Washington County has been the fastest growing county in Utah over the previous 30 years and one of fastest growing areas by percentage in the United States. This rapid population growth is projected to continue well into the foreseeable future. Washington County lies at the intersection of the Mohave Desert, Great Basin, and Colorado Plateau leading to a diverse mosaic of habitats and making it the most biological diverse area in Utah. Land and water development to accommodate rapid growth coupled with this unique biological diversity has led to the potential for conflicts between economic development and sensitive / endangered species conservation. Several largescale collaborative programs between local, state, and federal entities have been established to manage these potential conflicts. We will provide a summary of many of these long-term cooperative planning efforts including the Virgin River Resource Management and Recovery Program and the Washington County Habitat Conservation Plan. Thoughtful land use and water development planning is instrumental in continuing to find solutions to maintain quality of life for the human population while enhancing sensitive wildlife and aquatic species habitat.

Presentation Format: Oral

Presentation Type: Professional

## Twenty-five years of cooperative actions implemented under the Virgin Spinedace Conservation Agreement

**Rick Fridell:** Utah Division of Wildlife Resources, Hurricane, UT 84737; <u>richardfridell@utah.gov</u> Martin Schijf; <u>martinschijf@utah.gov</u> Christian Edwards; <u>christianedwards@utah.gov</u>

**Abstract:** The Virgin Spinedace (*Lepidomeda mollispinis*) is a minnow endemic to the Virgin River Basin. By 1994, threats to the species reduced Virgin Spinedace populations to approximately 60% of their historic distribution. As a result of these threats, the Virgin Spinedace was proposed for listing in 1994 as a threatened species under the Endangered Species Act (ESA). The Virgin Spinedace Conservation Agreement and Strategy (VSCAS) was developed in 1995 in accordance with the ESA to improve conditions resulting in the decline of Virgin Spinedace, enhance habitat, and re-establish locally extirpated populations throughout the Virgin River Basin (Lentsch et al. 1995). When implemented, management actions outlined in the VSCAS would alleviate factors warranting listing under the ESA. The primary goal of the VSCAS is to increase the range of the species from 60% to at least 80% of its historically occupied habitat. Conservation measures by local, state, and federal partners have restored flows and spinedace habitat to the Santa Clara River, Beaver Dam Wash, Quail Creek and other tributaries in the Virgin River Basin. We will summarize the conservation actions implemented over the last twenty-five years to successfully restore the Virgin Spinedace throughout their range.

#### Presentation Format: Oral

Presentation Type: Professional

The U.S. Fish and Wildlife Service's National Fish Passage Program in Utah Mark Fuller: U.S. Fish and Wildlife Service, Vernal, UT 84078; <u>mark h fuller@fws.gov</u>

**Abstract:** The Service's National Fish Passage Program (NFPP) strengthens native fisheries by reconnecting fragmented habitats. A fish passage project is any activity that improves the ability of fish or other aquatic species to move into historic habitat that has been obstructed by barriers. The NFPP is contingent upon partnerships and their participation, these include individuals, organizations, local governments and agencies. Program participants and fish passage improvements in Utah will be showcased and discussed. In appreciation to our partners and their devoted work, many NFPP projects in Utah have been credited to this program. These have benefited many species by reconnecting hundreds of river miles of habitat in local streams. The streams and fishes benefited will be highlighted. Application criteria, process and current projects will be shown. The U.S. Fish and Wildlife Service, and its Utah Fish

and Wildlife Conservation Office in Vernal, Utah extends its consideration to all interested, for information, contact Project Leader Mark Fuller at 435-789-0351.

#### Presentation Format: Oral

Presentation Type: Professional

## First line of defense: Exploring temporal dynamics of bacteria and fungi in the skin-associated microbiome of a Rocky Mountain salamander

**Kenen Goodwin:** Utah State University, Logan, UT 84322; <u>urodelan@gmail.com</u> Zachariah Gompert; <u>zach.gompert@usu.edu</u>

**Abstract:** Host-associated microbiomes play important roles in host health and pathogen defense. In amphibians, the skin-associated microbiome serves as an innate immune defense and has the potential to reduce disease mortality through probiotic bioaugmentation, which involves inoculating amphibian skin with antifungal bacteria. Selecting effective bacteria for probiotic bioaugmentation requires knowledge of the interactions between amphibians, their skin-associated microbiomes, and the local microbiota. The amphibian skin-associated microbiome varies spatially, is species-specific, and has microbial community structure distinct from environmental microbiomes. Few studies have examined temporal variation in the amphibian skin-associated microbiome, and the interactions between bacteria and microeukaryotes in the amphibian skin-associated microbiome remain poorly understood. Our study aims to 1) characterize temporal variation in the amphibian skin-associated microbiome with regards to both bacteria and microeukaryotes between sites and across life history stages, 2) test for correlations between amphibian skin-associated microbiomes, environmental microbiomes, and abiotic water quality parameters, and 3) examine whether temporal variation in the amphibian skin-associated microbiome influences antifungal function using the Western Tiger Salamander (Ambystoma mavortium) as a model amphibian. Skin-associated microbiome samples were collected from over 200 salamanders at two high alpine Rocky Mountain lakes throughout the summer and fall of 2018, and over 120 additional microbiome samples were collected from lake water and lake substrate. Work is currently underway to sequence the 16S rRNA and ITS regions using next-generation Illumina sequencing to determine the relative abundances of bacterial and microeukaryotic operational taxonomic units. Similarities and trends in microbial communities will be examined through Dirichlet multinomial regression modeling using a Bayesian framework. This study will provide an early look into temporal variation and the interactions between bacteria and microeukaryotes in the amphibian skin-associated microbiome.

#### Presentation Format: Oral

Presentation Type: Student

#### **Utah Water Rights and Instream Flow Mechanisms**

James Greer: Utah Division of Water Resources, Salt Lake City, Utah, 84114; jamesgreer@utah.gov

**Abstract:** This presentation will cover the role of the State Engineer and how water is administered in the State of Utah. It will highlight current instream flow laws and the existing and possible future mechanisms for instream flow protections in Utah.

Presentation Format: Oral

Presentation Type: Professional

## Are sculpin too slimy to count? An estimation of the abundance of Cottus cognatus in two arctic lakes

**Nicole Grob:** Utah State University, Logan, UT 84322; <u>nicolegrob17@gmail.com</u> Justin Kilmer; <u>justin.kilmer27@gmail.com</u> Gary Thiede; <u>gary.thiede@usu.edu</u> Phaedra Budy; <u>Phaedra.budy@usu.edu</u>

Abstract: The survival and growth of a piscivorous fish species is dependent on the abundance of lower trophic level fish species, many of which feed primarily on benthic invertebrates. Quantifying the abundance of these lower trophic level species like the Slimy Sculpin (Cottus cognatus; hereafter Sculpin) helps us to determine what factors influence their population abundance and allow us to better understand predator-prey dynamics within arctic lakes. The goal of our study was to estimate Sculpin abundance in two typical arctic lakes (Lakes Fog1 and Fog3) as well as to explore biotic and abiotic factors that may be driving Sculpin abundance across lakes. Employing mark-recapture techniques, we trapped, marked, then recaptured Sculpin in both lakes over a 2-month period in summer 2019. Using a modified Lincoln-Peterson method we estimated the population of Sculpin in Lake Fog3 to be 6,545 (95% CI = 1,834 – 11,255) and the population in Lake Fog1 to be 19,223 (95% CI= 0 – 40,809). The number of Sculpin recaptured in our second trapping events were very low (5 in Lake Fog3, 1 in Lake Fog1); making our variance very high. Very low recapture rates may indicate we need to modify our approach. Nonetheless all estimates indicated that Sculpin are extremely abundant in these arctic lakes and therefore likely provide an abundant prey fish source for Arctic Char (Salvelinus alpinus), the only other fish species found in these lakes. In additional analyses, we will explore the role of biotic factors such as the density of the primary prey (benthic macroinvertebrates) or predators (Arctic Char) as well physical factors such as lake size and littoral area. Knowing the abundance of lower trophic level fish like the Sculpin can help us determine the trophic structure of these lakes and eventually gauge the effects of a disturbance (e.g., thermokarst) on piscivorous fish species of important ecological status and high recreational value like the Arctic Char.

#### Presentation Format: Poster

Presentation Type: Student

## Spatial and Temporal Variation in Fish Assemblages of the lower Virgin River in Arizona, 2018-2019

Mark Grover: Arizona Game and Fish Department, Flagstaff, AZ, 86001; mgrover@azgfd.gov

**Abstract:** Single-pass seining surveys were conducted at monitoring reaches on the lower Virgin River from the upper Virgin River Gorge to below the Mesquite Diversion in Arizona

during 2018-2019 to assess spatial and temporal variation in the composition of fish assemblages before and after a rotenone treatment in the upper gorge. In addition, habitat data from the four 2.5 km-long monitoring reaches surveyed in 2019 were collected and mapped prior to fish monitoring to guide the 2019 sampling effort and to provide information to assess between-reach habitat differences. Native fish, including endangered Woundfin and Virgin River Chub, were widely distributed but were much less common than nonnative Red Shiners during both years, except at the uppermost monitoring reach in the Virgin River Gorge. In general, the relative abundance of native fish and numbers of young-of-the-year juveniles (YOY) increased from downstream to upstream reaches, whereas Red Shiners became increasingly common with downstream distance. The exceptions to this pattern were Flannelmouth Suckers, which were most common in the reach downstream from the Mesquite Diversion, and Speckled Dace, which were most abundant near the confluence with the Beaver Dam Wash. Virgin River Chub rapidly recolonized the monitoring reach in the upper gorge following the 2018 rotenone treatment, but catch-per-unit-effort of other native fishes in this reach declined significantly after the treatment and the vast majority of the chub captured were YOY. Monitoring reaches exhibited significant differences in habitat characteristics, with the reaches in the lower Gorge and Beaver Dam area having greater average and maximum water depths and a higher diversity of habitat types and substrates than the upstream and downstream reaches in the upper gorge and below the Mesquite Diversion, respectively. The reach below the Mesquite Diversion was dominated by shallow sandy runs, consisted of <1% pool habitat by volume, and yielded samples of fish in which Red Shiners were more than 50 times more abundant than all species of native fish combined. These patterns were consistent with the notion that a combination of simplified habitat, stemming at least in part from altered flow regimes downstream from diversions, and colonization of native fish from upstream reaches creates opposing gradients in abundances of native fishes and Red Shiners in the lower Virgin River of Arizona.

#### Presentation Format: Oral

#### Presentation Type: Professional

The use of screens to protect fisheries resources in northeastern Utah Trina Hedrick: Utah Division of Wildlife Resources, Vernal, UT 84078; <u>trinahedrick@utah.gov</u>

**Abstract:** Fisheries managers use screens for a variety of purposes, though mainly to protect a fishery, whether upstream or downstream of the screen. In northeastern Utah, we have used them increasingly over the last few years. In fact, in the last decade, the Utah Division of Wildlife Resources (UDWR) has built three screens with one additional screen slated for installation in spring 2020. The purpose of these screens is predominantly to protect downstream waterbodies, but in one instance, to keep fish within a waterbody. Despite similarities in purpose, each screen design is different and therefore each one presents its own challenges, drawbacks, costs, and benefits. This talk will review the history of each screen constructed in the UDWR's northeastern region and present considerations for moving forward with a fish screen from design considerations, construction, cost, water management, etc. It will end with recommendations on how to proceed if a fish screen is the prescribed treatment for a waterbody.

#### Presentation Format: Oral

## Determining Growth Dynamics of Northern Pike in Utah Lake With Implications for Invasive Species Management

**Andrew Helfrich:** Utah State University, Logan, Utah, 84341; <u>ahelfrich1997@aggiemail.usu.edu</u> Kevin Landom; <u>kevinlandom@gmail.com</u> Timothy Walsworth; timothy.walsworth@usu.edu

Abstract: Invasive species often produce negative ecological and economic impacts, including declines in native biodiversity. Effective management to mitigate invasive species impacts can be difficult, particularly with newly introduced species, as they are inherently difficult to capture due to low abundances. Northern Pike (Esox lucius) have recently been introduced and are successfully reproducing in Utah Lake, UT. Recent studies have shown Pike prey upon and thus pose a threat to the endangered June Sucker (Chasmistes liorus), emphasizing the need for effective management of this recent invader. Here, we examined the age-structure and yearclass strength within the Utah Lake Northern Pike population to inform our understanding of the population and recruitment dynamics. We aged cleithra from Pike captured in Utah Lake from 2012 to 2019, and constructed two age-length keys, one assigning age in proportion to observations and one incorporating probabilistic uncertainty in age-at-length. We then applied both keys to achieve age estimates for all available Utah Lake Pike data and compared yearclass strength estimates developed from each age-key. The age keys demonstrated that the majority of Pike caught were between ages 0 and 2. Both age-length key approaches produced similar results, demonstrating increasing recruitment through time with 2015 being the most productive year for Pike thus far. However, the model incorporating probabilistic uncertainty differed in the range of possible year classes. In response to our observed increase in recruitment, a more active management strategy may be required to control the Pike population and limit their potential impact on the endangered June sucker in Utah Lake.

Presentation Format: Poster

Presentation Type: Student

#### Improving mollusk conservation using iNaturalist

**Kate Holcomb:** Utah Division of Wildlife Resources, Salt Lake City, UT 84114; <u>kholcomb@utah.gov</u>

**Abstract:** Mollusks are one of the most imperiled groups of organisms in North America. Mollusk populations face many threats, such as water diversions and pollution, but there are also knowledge gaps that prevent effective conservation of these animals. One of these knowledge gaps is taxonomy; it is difficult to manage an animal when its genus or species name is unclear. To improve our understanding of mollusk taxonomy in Utah, more surveys are needed to collect genetic information, shells, specimens for animal anatomy, and distribution information. Biologist and researchers across Utah have made progress toward collecting this information, but the public can also help by using iNaturalist. This online citizen science project is a fun, free, easy-to-use website and mobile application that allows anyone to share observations of plants and animals across the world. The public is encouraged to become involved in iNaturalist and submit pictures and location data for mollusks across Utah. This information will help improve our understanding of mollusk taxonomy and will ultimately contribute to more effective conservation of mollusks in Utah.

#### Presentation Format: Oral

Presentation Type: Professional

Conservation Agreement and Strategy for Springsnails in Nevada and Utah Kate Holcomb: Utah Division of Wildlife Resources, Salt Lake City, UT 84114; <u>kholcomb@utah.gov</u> Chris Crookshanks Jon Sjoberg Jeri Sjoberg Kevin Wheeler; <u>kevinwheeler@utah.gov</u>

**Abstract:** Mollusks are one of the most imperiled groups of organisms in North America. Mollusk populations face many threats, such as water diversions and pollution, but there are also knowledge gaps that prevent effective conservation of these animals. One of these knowledge gaps is taxonomy; it is difficult to manage an animal when its genus or species name is unclear. To improve our understanding of mollusk taxonomy in Utah, more surveys are needed to collect genetic information, shells, specimens for animal anatomy, and distribution information. Biologist and researchers across Utah have made progress toward collecting this information, but the public can also help by using iNaturalist. This online citizen science project is a fun, free, easy-to-use website and mobile application that allows anyone to share observations of plants and animals across the world. The public is encouraged to become involved in iNaturalist and submit pictures and location data for mollusks across Utah. This information will help improve our understanding of mollusk taxonomy and will ultimately contribute to more effective conservation of mollusks in Utah.

Presentation Format: Poster

Presentation Type: Professional

**Fish Passage Challenges in the Intermountain West Suzanne Huhta:** OneFish Engineering, LLC, Fort Collins, CO 80521; <u>suzanne@onefishengineering.com</u> Craig Huhta; <u>craig@onefishengineering.com</u>

**Abstract:** Historically, the majority of fish passage work in the United States has been focused on salmonids in regions like the Pacific Northwest, and fish passage designs have been geared towards these strong swimming species. In recent years, there has been an increasing focus on providing fish passage in the Intermountain West. This region presents a number of new challenges including non-salmonid species as well as a deficiency of funding when compared to other regions. We will discuss the challenges of providing passage for a variety of non-salmonid fish species. These species are often of particular conservation concern, but there is limited information and experience about the most effective methods of providing fish passage. Additionally, many of these species are much weaker swimmers and utilize a different

swimming modality than salmonids. We will review some of the current available science about the swimming abilities and the most effective means of providing upstream fish passage. This includes adapting traditional ladder designs as well as more novel approaches. We will present two recent successful projects including a modified vertical slot and a roughed ramp. Additionally, we will consider approaches to reducing fish passage costs. The two projects presented will include a modular ladder that provides cost effective passage under an interstate and a reduced size fish ladder with an auxiliary water supply system.

#### Presentation Format: Oral

#### Presentation Type: Professional

#### Lower Virgin River Long-term Fish Community Monitoring

**Ron Kegerries:** BIO-WEST, Inc., Logan, UT 84321; <u>rkegerries@bio-west.com</u> Brandon Albrecht; <u>balbrecht@bio-west.com</u> Ron Rogers; <u>rrogers@bio-west.com</u> Aaron Ambos

Abstract: From 1993 through 2017, BIO-WEST, Inc., with funding and support from various agencies, monitored the lower Virgin River to assess the long-term fish community dynamics and the success of stocking efforts to establish and enhance Woundfin (Plagopterus argentissimus) populations. Native fish relative abundance increased in the upper study reaches following flood events, while nonnative fish abundance declined during these post-flood periods. Reaches above the Bunkerville Diversion were considered the source of all native fishes within the lower Virgin River. A historical comparison of both native and nonnative fish species captured in the lower Virgin River since 1998 showed species composition to be similar across years indicating that positive trends associated with flooding are short-lived. Long-term catch rate analysis for the lower Virgin River shows that native fish abundance has not significantly changed, but nonnative fish abundance declined significantly over the last two decades. This monitoring yielded a long-term perspective to assess fish populations within the lower Virgin River by providing Virgin River Chub (Gila seminuda) population estimates and provided a holistic understanding of the fish community in anticipation of future nonnative fish species removal. Consistent data collection and continued monitoring efforts will be important for understanding the rare fishes of the lower Virgin River and meeting recovery goals, particularly given the growing water demand in the region.

#### Presentation Format: Oral

#### Presentation Type: Professional

Zooplankton, macroinvertebrate, and fish community response to common carp removal and lake level fluctuations in a large shallow Utah reservoir Kevin Landom: Utah State University, Logan, UT 84322; <u>kevinlandom@gmail.com</u> Timothy Walsworth; <u>timothy.walsworth@usu.edu</u>

**Abstract:** Invasive species removal efforts aim to initiate desired ecosystem responses, yet additional concurrent sources of degradation and variation can challenge our ability to ascribe

an ecosystem level effect to invasive species control. Large-scale mechanical removal of invasive common carp (Cyprinus carpio) has been implemented in Utah Lake, UT, to drive ecosystem-level changes hypothesized to improve recovery opportunities for endangered June sucker (Chasmistes liorus) as well as improve water quality. However, Utah Lake has experienced dramatic changes in lake level over this same time period due to combined impacts of drought and water management practices. We explored monitoring data from 2012-2019 to examine whether the zooplankton, benthic macroinvertebrate, and fish communities responded to carp removal in Utah Lake, while accounting for potential lake level fluctuation effects. Our initial hypotheses were that the biomass of small-bodied zooplankton would decrease, and the biomass of large-bodied zooplankton, benthic macroinvertebrates, and sport fish would increase in response to a significant reduction in carp. Our results suggested all initial hypotheses held true, with the exception of experiencing an increase in sport fish biomass. Sport fish biomass did not increase, despite a significant reduction in carp biomass from mechanical removal efforts. We found no correlation between lake level fluctuations and largebodied zooplankton, or benthic macroinvertebrates, or sport fish biomass. However, we did find a strong correlation between lake levels and changes in small-bodied zooplankton biomass. Interestingly, small-bodied zooplankton biomass decreased at a faster rate than would be predicted by lake level fluctuations alone in the most recent years. We postulate the potential for a delayed response in sport fish, as it may take several years for larger-bodied predator fishes to fill the open niche created by carp removal. Ecosystem level changes are likely to continue to develop as long as carp are maintained at low biomass, and continued monitoring and assessment will be able to highlight whether desired ecosystem changes are being achieved or if additional environmental stressors are limiting restoration success.

#### Presentation Format: Oral

Presentation Type: Professional

#### Using Wagon-Wheel Antennas to Pioneer the West: How New PIT Detection Technology Has Expanded Our Knowledge on Imperiled Fish Conservation and Management

Peter MacKinnon: Utah State University/Biomark Inc., Logan, Utah, 84322; <u>pdmackinnon@gmail.com</u> Mark McKinstry; <u>mckinstry@usbr.gov</u> Casey Pennock Richard Wilkison Travis Francis

**Abstract:** Radio Frequency Identification was first introduced into Pacific Northwest fisheries science in the mid-1980's with the introduction of the Passive Integrated Transponder (PIT) tag. PIT-tags were first used to evaluate survival of anadromous fish through hydroelectric projects. Innovations such as multiplexing antenna readers, smaller high-performance tags, and larger more robust antennas broadened fisheries applications of PIT-tag technology. Traditionally, PIT-tag antennas were fixed arrays that detected PIT-tagged fish moving through a specific point in a river or facility. However, the need for alternative detection techniques and methods has become apparent. Various river basins and fish species present unique challenges to fish

detection; such as fish longevity, unpredictable movement tendencies, and diverse use of complex and remote habitats. New fish detection antennas – tailored to the needs of field biologists – have been developed, tested, and adopted in long-term studies where biologists can "actively" detect fish instead of "passively" waiting for them. These innovative methods expand the use of PIT-tag data from traditional mark-recapture studies to habitat use and movement studies. We present data from several successful projects where smaller, temporary, submersible, and floating PIT-Tag antennas have been successfully used to detect PIT-tagged fish where traditional sampling methods have been less effective.

#### Presentation Format: Oral

Presentation Type: Professional

Entrainment of endangered fish in the Green River Canal, Utah, 2013-2019 Peter MacKinnon: Utah State University/Biomark Inc., Logan, Utah, 84322; pdmackinnon@gmail.com Dave Speas; dspeas@usbr.gov Julie Stahli; julie\_stahli@fws.gov Kevin McAbee; Kevin\_mcabee@fws.gov

Abstract Entrainment of endangered fish in the Green River Canal near Green River, UT has been monitored through operation of PIT-tag antennas since 2013. Observed entrainment rates of endangered fish since that time have been variable among years but considerable owing to a lack of fish excluding structures at the canal intake. Prior to the 2019 irrigation season, the top of the Green River Canal was reconfigured to include an innovative fish exclusion structure comprised of a weir wall with horizontal, fine-aperture screens at its crest which diverts entrained fish back to the Green River while also delivering the canal's full capacity (ca. 85 cfs) to water users downstream. The screen was fitted with several PIT detection antennas, include two loops immediately above the screen intake, two loops in the fish return channel to the Green River, and two loops in the canal immediately below the screen. Whereas endangered fish entrainment rates in the canal varied during 2013-2018 from 118 to 695 fish per irrigation season (in 2018 and 2013, respectively), no PIT-tagged endangered fish were detected in the canal below the newly-completed screen during the 2019 irrigation season. At total of 1,077 PIT-tagged fish was detected, however, on the intake and/or return channel antennas, indicating continued visitation of the canal by native fish at various times of the year. Of these fish, 364 (34%) were detected both on the intake and return channel antennas, 181 (17%) were detected on return channel antennas only, and 532 (49%) fish were detected on the intake antennas only. Since antenna systems are known to have detection efficiencies which are less than 100% under most conditions, we cannot rule out the possibility that entrainment didn't occur with the presence of the canal screen. However, despite caveats it seems clear that entrainment rates are now markedly reduced over levels observed in 2013 through 2018.

Presentation Format: Oral

Presentation Type: Professional

## Characterizing the foraging behavior of June sucker among different habitat types in Utah Lake

**Manny May:** Utah State University, Hyrum, UT 84319; <u>manny 1988@live.com</u> Kevin Landom; <u>kevinlandom@gmail.com</u> Timothy Walsworth; timothy.walsworth@usu.edu

**Abstract:** Understanding foraging behavior can aid the conservation of endangered fish species by informing managers of the conditions driving survival and growth. Exposure to multiple anthropogenic disturbances has driven dramatic population declines of June sucker (Chasmistes *liorus*), an endangered fish endemic to Utah Lake, UT. Management agencies tasked with preventing extinction and promoting recovery of June sucker are challenged by the limited available knowledge about the foraging behavior of adult June sucker in Utah Lake. Here we explored differences in June sucker diet composition among habitats in Utah Lake, and compared the effectiveness of non-lethal and lethal diet extraction methods. Macroinvertebrates and Daphnia spp. were the most prominent diet items overall, yet diet composition varied among habitats. June sucker diets from pelagic habitat contained primarily macroinvertebrates, terrestrial insects, and large zooplankton, while diets collected from vegetated littoral habitat contained mainly small zooplankton and chironomids. Our results suggest diet composition reflects habitat use, which could affect foraging behavior and June sucker growth. Additionally, our results demonstrated that sampling June sucker diets by nonlethal intestinal flushing captured greater diversity and total biomass than sampling via esophageal flush or extracting whole stomachs from mortalities. Our study indicated adult June sucker in Utah Lake have a broader diet composition than was previously assumed, specifically demonstrating a greater contribution of macroinvertebrates. Our improved understanding of June sucker foraging behavior may provide managers insight in future efforts to restore habitats essential for June sucker growth and population recovery.

#### Presentation Format: Poster

Presentation Type: Student

## Restoration of longitudinal connectivity of the Price River for the benefit of native fish species and people

Eric McCulley: River Restoration, Salt Lake City, UT 84105; eric.mcculley@riverrestoration.org

**Abstract:** Helper City has been working on the enhancement of the Price River through the city in a multi-phase program called the Helper River Revitalization Project since 2013. One of the key objectives of the project has been to improve the longitudinal aquatic habitat connectivity of the Price River through this reach by removing obsolete irrigation infrastructure and replacement of grade control structures with more fish passage friendly instream structures. Five out of six phases of the project have been completed, connecting approximately two miles of river, which had significant connectivity issues due to historical alteration. The results of fish sampling of the river through Helper City in 2016 and 2019 indicate that naturally recruiting Bluehead sucker and stocked Colorado River cutthroat trout are thriving in the newly connected reaches. Further study on the fish movement patterns is planned for the future, but preliminary results of sampling have shown that fish can move up and downstream through the system, where baseline results indicated the absence of these important Utah species in previously isolated reaches.

Presentation Format: Oral

Presentation Type: Professional

#### Fish migration barriers: success and failure

Matt McKell: Utah Division of Wildlife Resources, Ogden, UT 84405; matthewmckell@utah.gov

**Abstract:** Projects undertaken to restore or enhance populations of native fish often involve construction of migration barriers, which are intended to protect the restored populations from re-invasion by undesirable species. There are a multitude of barrier types, and the type of barrier needed for one stream may not function effectively in another stream. For two separate restoration projects, the same type of temporary barrier was constructed in each stream to temporarily isolate fish in upper reaches from those in lower reaches. In one case the barrier worked just as intended; in the other case, the barrier was fraught with issues and failed multiple times. The details of each case will be discussed. The presentation will also cover briefly the successful enhancement of existing natural drop structures into permanent barriers to fish migration.

Presentation Format: Oral

Presentation Type: Professional

#### Virgin River Program: Cooperation for Conservation

Steve Meismer: Virgin River Program, Saint George Utah 84770; steve@wcwcd.org

**Abstract:** The Virgin River Program has been working in southwestern Utah since 2002 to protect, conserve and enhance native species populations while working with local communities to meet their needs for water, transportation and other services. Cooperation and communication are key to achieving success in a rapidly growing area. The Program is consensus driven and meets goals by completing recovery activities in areas of habitat protection, public outreach, population monitoring, limiting factor mitigation, water acquisition, native community enhancement, broodstock maintenance and program management.

#### Presentation Format: Oral

Presentation Type: Professional

# Connectivity with flows and exclusion with screens: managing Stewart Lake, a nursery habitat for Razorback Sucker, Xyrauchen texanus, on the Green River, Utah, in the presence of nonnative fishes.

Michael S. Partlow: Utah Division of Wildlife Resources, Vernal, Utah 84078; <u>mpartlow@utah.gov</u> Matthew J. Breen; <u>mattbreen@utah.gov</u> **Abstract:** Since 2013, Stewart Lake, a gated wetland on the middle Green River near Jensen, Utah, has served as a promising model for the re-coupling of larval Razorback Suckers with productive off-channel wetland nursery habitat. In a cooperative multi-year effort by Federal and State agencies called the Larval Trigger Study Plan, light trapping is used to detect the presence of larval razorback suckers in the river, triggering increased releases from Flaming Gorge Reservoir, temporally matching peak flows to the period of larval drift. By filling the wetland during this period and maintaining entrainment until early autumn, multiple year-classes of wild-spawned Razorback Suckers have been returned to the Green River. Here we consider the challenges of providing connectivity to a floodplain wetland for larval native fishes while excluding large bodied nonnative fishes with screens, nets, and weirs. As different nonnative species predominate from year to year, fine-tuning of our management strategy is necessary to maximize Razorback Sucker survival and further disadvantage nonnative fishes.

#### Presentation Format: Oral

Presentation Type: Professional

#### Establishing Population Maintenance Flows and Restoring Virgin Spinedace Populations to the Santa Clara River Below Gunlock Reservoir

Martin Schijf: Utah Division of Wildlife Resources, Hurricane UT 84737; <u>martinschijf@utah.gov</u> Rick Fridell; <u>richardfridell@utah.gov</u> Melinda Bennion; <u>melindabennion@utah.gov</u> Kody Callister; <u>kcallister@utah.gov</u> Christian Edwards; christianedwards@utah.gov

**Abstract:** The Virgin Spinedace is a minnow endemic to the Virgin River Basin. In 1994, the species was proposed for federal listing under the Endangered Species Act due to population declines resulting from habitat loss and degradation. At the time of the listing proposal Virgin Spinedace distribution was estimated to have declined to 60% of its historic distribution within the Virgin River Basin. In response to the proposed federal listing, the Virgin Spinedace Conservation Agreement and Strategy (VSCAS) was initiated in 1995 (Lentsch et al. 1995). Signatories to the VSCAS included the Arizona Game and Fish Department (AZGFD), Bureau of Land Management (BLM), National Park Service (NPS), Nevada Department of Wildlife (NDOW), U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), Utah Division of Wildlife Resources (UDWR), and Washington County Water Conservancy District (WCWCD). One of the primary goals of the VSCAS was to increase the range of Virgin Spinedace from 60% to at least 80% (~ 185 km; 115 mi of linear riverine habitat) of its historically occupied habitat by protecting and expanding extant populations and re-establishing extirpated populations. The U.S. Fish and Wildlife Service determined that full implementation of management actions outlined in the VSCAS would alleviate the factors that led to the decline in Virgin Spinedace populations, and eliminate the necessity for an ESA listing. The VSCAS outlines conservation actions intended to reverse declines and enhance Virgin Spinedace by protecting and expanding extant populations and reestablishing extirpated populations. A primary goal of the VSCAS is the restoration of population maintenance flows to reestablish viable Virgin Spinedace populations in dewatered or depleted stream reaches. The Santa Clara River below Gunlock

Reservoir was identified as a key reach to restore population maintenance flows and Virgin Spinedace populations.

#### Presentation Format: Oral

Presentation Type: Professional

#### Recovery efforts and conservation on the lower Virgin River system

Michael R. Schwemm: USFWS Las Vegas, NV 89130; michael schwemm@fws.gov

Abstract: Here, we will review the status of native fishes and conservation actions occurring on the lower Virgin River and its tributaries. Included within this report will be a summary of the annual monitoring of the lower Virgin River from the lower end of the Virgin River Gorge in Arizona to Halfway Wash in Nevada, with special attention to the maintenance of the endangered Virgin River Chub. Also reviewed will be the status of fishes in the Muddy River tributary, including the endangered Moapa dace upstream and Virgin River Chub downstream. Over the recent past, significant attention has been given to the Muddy River, but relatively little effort specific to the lower mainstream Virgin River. This was due to a combination significant nonnative fishes occurring upstream in the recent past, and the relative unsuitability for construction of fish barriers downstream. Positive developments in recent years are gaining momentum to improve habitat of the mainstream lower Virgin River in other ways via a new partnership among river stakeholders, called the Virgin River Coalition. Work from this group has resulted in both regular communication among disparate parties, as well as funding new research to examine temperature and other habitat variables for the suitability of native fishes. Although the habitat challenges to recover the lower Virgin River are significant and require long-term solutions, the emerging support for improving the river seems optimistic.

#### Presentation Format: Oral

Presentation Type: Professional

## Comparative Analysis of Morphometric and Gene-Expression Patterns in larval June Sucker and Utah Sucker

Peter C. Searle: Brigham Young University, Provo, UT 84117; <u>petersearle94@gmail.com</u> Mark C. Belk; <u>Mark\_Belk@byu.edu</u> Dennis Shiozawa; <u>shiozawa@byu.edu</u> Paul Evans; <u>evansp@byu.edu</u> Arminda Suli Michael Stark; <u>michael\_stark@byu.edu</u>

**Abstract:** Epigenetic modifications to gene expression can lead to heritable phenotypic variation between genetically similar organisms. Epigenetic effects may explain the confounding evolutionary and phylogenetic status of June sucker (*Chasmistes liorus*). June sucker are endemic to Utah Lake, UT and have terminal mouths adapted for pelagic feeding. Utah suckers (*Catostomus ardens*) also reside in Utah Lake, but have subterminal mouths adapted for benthic feeding. Despite morphologic and behavioral differences, June and Utah

suckers are genetically similar. This project's objectives include: (1) Performing transcriptome analysis of orthologous genes to confirm that June and Utah suckers are genetically similar but epigenetically different, and, (2) investigating how epigenetic effects lead to differential expression of orthologous genes associated with mouth formation during larval development of June and Utah suckers. We present preliminary data on the geometric morphometric analysis of June and Utah suckers. During their initial development, these sucker larvae have terminal mouths. However, within the first 15 weeks of development, the Utah sucker's mouth shifts ventrally. We used geometric morphometric analysis to bracket the time period when this shift occurs. Our final objective is to develop tissue-specific tools that integrate techniques from the fields of evolutionary ecology, molecular biology, and developmental biology to examine epigenetic processes in June sucker and other species which exhibit morphological plasticity.

#### Presentation Format: Oral

Presentation Type: Student

## There are fish in that river? – Virgin River native fishes educational outreach program

Sarah N. Siefken: Utah Division of Wildlife Resources, Hurricane UT 84737; sarahnsiefken@utah.gov Melinda R.M. Bennion; melindabennion@utah.gov Richard A. Fridell; richardfridell@utah.gov

**Abstract:** Fish species in the Virgin River basin are fairly small and cryptic, and it can be difficult for Washington County residents to form a personal connection to these aquatic resources. In order to increase local awareness of the diverse species assemblages in southern Utah, the Utah Division of Wildlife Resources (UDWR) partnered with the Virgin River Program and the Washington County School District to implement its Education Outreach program. The main goal of this program is educate the community about local aquatic resources, thereby fostering public stewardship and engagement. UDWR's Education Outreach program also encourages young people to become more aware of local conservation issues while gaining an interest in natural resources. This presentation will highlight the various outreach programs implemented by the UDWR Washington County Field Office and its partners. Event profiles will feature the Color Country Natural Resource Camp, the Virgin River Student Conservation internships, curriculum-based school outreach programs, printed media, volunteer efforts, and the urban wildlife program. This presentation will summarize the accomplishments of outreach efforts and suggest strategies for other agencies that want to connect the public with natural resources.

#### Presentation Format: Oral

Presentation Type: Professional

**Exploring Environmental and Genetic Influences on Walleye Growth Julia Sluiter:** Utah State University, Logan, UT 84321; <u>jules.l.sluiter@gmail.com</u> Timothy E. Walsworth; <u>timothy.walsworth@usu.edu</u> Abstract: As nonnative species often cause negative impacts on native biodiversity, fisheries managers can stock triploid sport fishes to promote angling opportunities for nonnative species without risk of reproduction and population expansion. However, the potential growth advantages of triploid fishes raise concerns about competition with native species and other sport fishes for resources. Following chemical treatment to remove illegally introduced walleye (Sander vitreus) from Red Fleet Reservoir (Utah), managers stocked triploid walleye to promote recreational fishery without the potential of uncontrolled population growth. Due to the possibility of incomplete eradication of diploid walleye, managers are concerned about the different ecological impacts of the two strains in Red Fleet Reservoir, as well as different reservoirs across the state. Here, we compare growth rates of triploid and diploid walleye within Red Fleet Reservoir, as well as five additional reservoirs across Utah. Walleye were sampled by gill netting and electrofishing, and ploidy was determined through blood sampling. We determined age-at-capture by counting annuli in cross-sections of otoliths and fit a Von Bertalanffy growth model to analyzed growth rate differences by ploidy and reservoir. Our results indicated substantial growth rate differences among reservoirs, potentially caused by different growing season lengths in reservoirs at different elevations. No differences in growth rate were detected between triploid and diploid walleye within Red Fleet Reservoir. The continued presence of diploid walleye in Red Fleet Reservoir after chemical treatment may require further intervention if the population begins to grow. Increased understanding of reservoir-specific growth rates will allow for more targeted management of nonnative walleye, informing stocking strategies as well as potential for negative impacts on native species through predation and competition.

Presentation Format: Poster

Presentation Type: Student

#### Virgin River Red Shiner Eradication – A History of Endangered Species Habitat Recovery through Non -Native Removal

**Izzie E.L. Speer:** Utah Division of Wildlife Resources, Hurricane UT 84737; <u>ietween@utah.gov</u> Rick Fridell; <u>richardfridell@utah.gov</u>

**Abstract:** The Red Shiner (*Cyprinella lutrensis*), a small minnow native to the Mississippi River Basin, has been identified as the greatest threat to the recovery of native fish in the Virgin River, since their introduction into Lake Mead in the 1980s. Following their colonization of 86 miles of the Virgin River mainstem, and subsequent losses of native fish in these reaches, a six phase eradication plan has been implemented since 1996. Five of these six phases have since been successfully completed, clearing 40 miles of the Virgin of Red Shiner for native fish recovery. The final phase is ongoing, with the latest chemical treatment in the Virgin River Gorge having taken place in June 2018. This presentation will highlight the successful endeavors to remove Red Shiner over the past 24 years, give an update on the current situation of Phase 6, with results of the most recent treatment, and outline the next steps needed to continue to pursue Red Shiner eradication and resulting native fish recovery in the Virgin River.

#### Presentation Format: Oral

#### Presentation Type: Professional

**Utah DWR Standardized Fish Trap Design - Fish Passage, Barriers, and Screens Aaron Spencer, PE**: Pleasant Grove City (Formerly Div. of Water Resources & Horrocks Engineers), Pleasant Grove, UT 84062; <u>aspencer@pgcity.org</u>

**Abstract:** In a collaborative effort with the Utah Division of Wildlife Resources, I developed a standardized design for fish trap and egg collection facilities for use across the state in conjunction with their hatchery operations. This presentation will examine the diversion, fish passage, screening, barriers, and related concepts that had to be incorporated and accounted for in the design of the facilities. We will examine the design and installation of several of these facilities, as well as the issues that prevented their installation in other locations. A general overview of available methods and resources will be provided.

A fish trap must address all concerns related to diversions, fish passage, and barriers. A successful fish trap must simultaneously prevent fish passage up the natural stream channel, attract the fish to the trap, permit passage to the trap, maintain healthy conditions for the fish, and address variable stream flow, bedload, and debris. A good design will also provide good working conditions, as well as flexibility and ease in its operation. When not in operation, natural stream flow conditions should govern, and the facility must be safe from misuse or vandalism while not in active use.

For these reasons, an offstream structure was developed, into which water was diverted from the stream. Controls within the structure ensure the proper flow depth and velocity, while returning enough flow to the stream to attract the fish. Diversion and fish barrier facilities were utilized in the natural stream to divert flow and direct the fish into the trap. In order to allow natural flow conditions, and prevent vandalism, all the components were designed to be removable, or to promote natural flow conditions and fish passage permanently. Multiple approaches were investigated to achieve these ends.

Presentation Format: Oral

Presentation Type: Professional

Effects of Quagga Mussels on the Lake Powell Fishery measured by Isotopes Nathan St. Andre: Brigham Young University, Provo, Utah 84601; <u>nst\_andre@live.com</u>

**Abstract:** Quagga Mussels invaded Lake Powell near the Utah Arizona border around 2012. From that initial detection they rapidly colonized the lower portion of the lake then spread northwards. By 2017 they had colonized much of the northern reaches of the lake effectively covering all available habitat. Because Quagga Mussels are filter feeders, targeting the pelagic energy pathways by consuming phytoplankton they have the potential to drastically alter an ecosystem through bottom up trophic cascades. In order to understand their effect on Lake Powell, we used stable isotopes to measure changes in trophic positions and energy pathways over the course of three years using six sports fish species in two different regions of the lake. Sampling began in 2017 and ended in 2019. Preliminary results so far have revealed a divergence in the lake with the northern region shifting towards pelagic energy pathways and the southern shifting towards littoral pathways. Additionally, trophic positions of fish are beginning to diverge as well. In essence, Lake Powell is dividing in half with the northern end possibly being supported by the Colorado River and the southern end being depleted in nutrients.

#### Presentation Format: Poster

Presentation Type: Student

#### Phylogenetic relationships of the Paiute sculpin (Cottus beldingii)

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**Abstract:** The Paiute sculpin (*Cottus beldingii*), the Wood River sculpin (*Cottus leiopomus*), and the Shoshone sculpin (*Cottus greenei*) have often been found as a monophyletic group in phylogenetic analyses. However, these analyses have only included one or two individuals from each of these species, possibly resulting in an oversimplification of the relationships among these species and among the populations of Paiute sculpin inhabiting different drainage basins. We sought to produce a more comprehensive phylogenetic analysis of the relationships between these species using three mitochondrial genes acquired from 4 Wood River sculpin, 5 Shoshone sculpin, and 41 Paiute sculpin from locations across the Lahontan, Bonneville, Colorado River, and Upper Snake River basins. We also included 9 shorthead sculpin (*Cottus cognatus*), 10 torrent sculpin (*Cottus rhotheus*), and 12 mottled sculpin (*Cottus baridi*) in the analysis to test the monophyly of our focal group. The monophyly of the Paiute sculpin, Wood River sculpin, and Shoshone sculpin was confirmed in our analysis. We also found that the relationships among the populations of Paiute sculpin agree with the geologic history of connections between basins in which they are found.

Presentation Format: Oral

Presentation Type: Student

#### Hydrologic drivers of distribution and abundance of the extremely imperiled Rio Grande silvery minnow

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**Abstract:** Increasing water demand and the resultant water development have driven extensive changes to the hydrology, geomorphology and biology of arid-land rivers. As many native desert fishes have experienced dramatic declines in abundance and distribution, there is an increasing need to understand how annual hydrologic conditions affect the distribution and abundance of their populations. Here, we present an analysis exploring the relationship

between annual hydrologic conditions (i.e., spring flooding, summer drying) and the distribution and abundance of the endangered Rio Grande silvery minnow (RGSM) in the Middle Rio Grande, New Mexico. We fit a twenty-five year data set of sampling site catch-perunit-effort to hurdle models predicting both the presence and density of RGSM as a function of annual hydrologic metrics. Presence was positively related to a PCA-derived integrated metric of annual flow (influenced by spring flood magnitude and duration as well as summer low flow conditions), and negatively related to summer drying, depending on the model explored. When RGSM were present, their density was strongly positively related to the integrated flow metric. The model with the best support predicted both presence and density as a function of the integrated flow metric. Additionally, a latent trend included in the presence model component suggests the strong influence of an unobserved driver demonstrating decadal scale periodicity, an area rich for future exploration. Simulations suggest annual flow conditions at or near the maximum observed in the data set would be required to produce sufficient RGSM to meet recovery goals in all reaches with 95% confidence in a single year; however, recovery goals require sustaining these higher densities over time, such that large floods with limited summer drying would need to recur more frequently across multiple years. The results of these analyses can both inform current management actions, as well as be used to explore alternative water management approaches for future adaptive management that considers trade-offs between recovery and other management goals.

#### Presentation Format: Oral

Presentation Type: Professional

### Beyond the Lakes: Fishes of Streams in an Open Lake System.

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Abstract: Fishes of open lake systems, series of lakes open to migration and movement, in the Arctic could be negatively affected by increasing temperatures and fragmentation. Arctic grayling (Thymallus arcticus; hereafter, grayling) use rivers and streams for migration amongst complimentary habitats and for foraging throughout the summer (June-August), and as such, changes to streams (e.g., drying) could be harmful to this important arctic species. Since information regarding grayling stream use in open lake systems is scarce, the goal of our study was to describe grayling movement and use of streams in arctic open systems to determine the potential effects of fragmentation. To do this, we captured grayling both within the headwater lakes of an open system and in delineated reaches of their outlets and used passive integrated transponder (PIT) tags and semi-permanent and mobile PIT-tag antennae to detect tagged grayling. We also collected genetic samples to determine the degree of genetic mixing between populations in these potentially connected but separate lakes. Our results demonstrate a wide size distribution (29-339 mm, and thus ages) of grayling use small streams between lakes. Our antennae detected a previously captured grayling moving from one lake to another and thirteen individuals moving from the lake and to the outlet streams. Genetic analyses are not complete, but we built models displaying both genetically-similar and dissimilar genetic clusters to demonstrate possible results. Since we captured many grayling (91) within the streams,

detected a grayling moving between lakes, and detected multiple grayling in the outlet streams, we can conclude there is considerable grayling movement throughout the lakes in these systems. These results suggest there could be important ecological implications of fragmentation including demographic population effects as well as genetic variation. Our study highlights the potential indirect effects of climate change and the potential challenges to the persistence of grayling.

#### Presentation Format: Poster

Presentation Type: Student

#### Diet overlap between two top predators in Pyramid Lake, Nevada

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Abstract: Lahontan Cutthroat Trout (Oncorhynchus clarkii henshawi, hereafter LCT) populations have experienced dramatic decreases over the last century, and currently occupy approximately 10% of their historic native river habitat and about 0.4% of their native lake habitat. Pyramid Lake, Nevada, is one of the last remaining lakes where LCT populations, despite having very little natural recruitment, are thriving via stocking and extremely high growth and survival rates. Sacramento Perch (Ambloplites interruptus, hereafter SAP) are naturalized to Pyramid Lake and have the potential to compete for food resources with LCT. Both fishes are highly piscivorous and largely rely on native Tui Chub (Gila bicolor) as their primary prey. We determined autumn diets and diet overlap between small LCT, large LCT, and SAP. We collected fish and fish diets in October 2020 and compared them to summer, spring, and winter in 2011-2013. Prey of LCT and SAP were primarily Tui Chub (51% and 100%, respectively) with lesser proportions of aquatic invertebrates (26% and 0%, respectively). We noted significant diet overlap for small LCT and large LCT (68%), and small LCT and SAP (68%). Previous work similarly demonstrated spring, summer, and winter diets for these three species, on average, overlapped by 63 – 79%. These results improve our understanding of trophic interactions between these two natives and non-native piscivores. High diet overlap between these fishes suggests that if SAP abundance were to increase due to changing lake conditions (e.g., lake levels) or other factors, or if food resources become scarce, competition for food between large LCT and SAP could increase.

#### Presentation Format: Poster

Presentation Type: Student

#### **Utah Wildlife Migration Initiatve**

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**Abstract:** Many wildlife species in Utah migrate seasonally in response to changes in the natural environment. For example, cutthroat trout in Utah may move over 20 miles to locate suitable habitat to lay their eggs. Native fish in the Colorado River move hundreds of miles

between summer and winter seasons. Utah, however, is undergoing significant changes as it is the fastest growing state in the United States, and the population is projected to increase by 80% in the next 50 years. Rapid human population growth is increasing demands for water, housing, energy, and transportation, which can negatively affect wildlife. Currently is it critical to understand how species move and use their habitats, so those movements and habitats can be preserved as the infrastructure is expanded to accommodate the growing human population. The Utah Migration Initiative was founded in 2017 as a statewide campaign to identify, preserve, and enhance movement pathways for fish and wildlife. The Initiative is using state-of-the-art GPS tracking technology to monitor the movements of a wide variety of species in the state from bison to frogs. It is also developing tools to analyze and share movement data, so the information can be put into the hands of biologist, planners and decision makers. By documenting movement of patterns of fish and wildlife species across the state, we hope to preserve the movements of species and keep their populations healthy and abundant.

Presentation Format: Oral

Presentation Type: Professional

Non-native fish management in the Virgin River Basin, Utah Erik Woodhouse: Utah Division of Wildlife Resources, Hurricane, UT, 84737; erikwoodhouse@utah.gov Richard Fridell; richardfridell@utah.gov

**Abstract:** The Virgin River, located in southwestern Utah, supports two federally endangered fish species including Woundfin (*Plagopterus argentissimus*) and Virgin River Chub (*Gila seminuda*). Additionally, four other native species inhabit the Virgin River Basin, including Virgin Spinedace (*Lepidomeda mollispinis*), Speckled Dace (*Rhinichthys osculus*), Desert Sucker (*Catostomus clarkii*), and Flannelmouth Sucker (*Catostomus latipinnis*). The introduction of many non-native fish species in the Virgin River Basin has greatly reduced native fish populations basin-wide through predation, competition for resources, and disease. The management of non-native fish species through intensive monitoring, chemical and mechanical eradication efforts, and public outreach are key components to the recovery and conservation of these native fish species. This presentation will highlight the efforts of the Utah Division of Wildlife Resources in collaboration with local and federal partners through the Virgin River Program to manage non-native species in the Virgin River Basin summarizing current and historical non-native fish species, non-native monitoring and eradication efforts, and public outreach are key components.

#### Presentation Format: Oral

Presentation Type: Professional

Virgin River - Efficient Water Management for People and Wildlife Elaine York: The Nature Conservancy, Salt Lake City, Utah 84102; <u>eyork@tnc.org</u> **Abstract:** Virgin River partners including the Virgin River Program, Utah Div. of Wildlife Resources, Washington County, Washington County Water Conservancy District, The Nature Conservancy, NRCS and others are funding 3 projects on the Virgin River, Utah. The projects provide more efficient water management in a critically water-limited area and will result in direct benefits to agricultural producers and the local community while also addressing vital habitat needs for wildlife such as the endangered woundfin.

Presentation Format: Oral

Presentation Type: Professional