Utah Chapter of the American Fisheries Society

2019 Annual Meeting

Photo Credits: Christopher Keleher

Provo, Utah

March 12th-14th, 2019

PROGRAM

AFS CALL FOR PAPERS

The American Fisheries Society extends a warm invite to attend the 149th AFS Annual Meeting in Reno, Nevada, Sept. 29–Oct. 3, 2019. This year The Wildlife Society and American Fisheries Society will come together for the first-ever joint national conference of these two organizations. The event will likely be the largest gathering of fish and wildlife professionals ever, and will provide unprecedented opportunities for science-sharing and potential collaboration. At this conference, we hope to give members opportunities to learn, connect, and engage in ways that will help propel their careers forward and inspire even better results in the areas of wildlife and fisheries science and management.

CONTRIBUTED PAPERS AND POSTERS

- Those who wish to present in **Contributed Papers** or **Poster** sessions at the 2019 AFS meeting are required to submit abstracts by **April 12, 2019**.
- Confirmation of acceptance or refusal of abstracts will be communicated by **April 25, 2019**.
- Student presentations will be considered for a “best presentation” award if the student fills out additional application paperwork available at https://education.fisheries.org

FOR MORE INFORMATION VISIT https://fisheries.org

2019 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 41st Annual Meeting in Provo, Utah! A special thanks goes out to the Utah Valley Convention Center, Hyatt Place, Marriot Springhill Suites, and the Balcony/Good Thyme Café for hosting us and providing a comfortable atmosphere.

As I sit here writing this message, I am again reminded at how fast time goes. I can't believe that I am more than half way through my tenure on the EXCOM and this coming summer I will transition into the Past President's role. What a rewarding experience it has been to serve on the Utah AFS EXCOM and this year has been especially exciting, being 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. I served as Secretary/Treasurer early on and that experience made me appreciate AFS on a different level and I met so many more people because of that experience. We are all busy and the time will never be perfect to run for office. I waited another 20 years for that "perfect" time to run for the Presidency. When I realized there was no perfect time, I decided to run before I retired – and I can't imagine completing my career without this experience! So when you are approached next year to serve on the EXCOM, I hope you take a moment, think hard, and say YES! 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 and helping put together a poster or presentation on our AFS Chapter for the 2020 AFS Annual Meeting in Ohio, where AFS will celebrate its 150th anniversary.

One area that I really wanted to focus on during my Presidency was to ensure the Utah Chapter was giving back to its members. After discussions during the 2018 Annual Business Meeting, we offered student scholarships to this year's meeting. In all, we gave seven student scholarships this year – all to undergraduate students! Many of these students are giving their first poster or presentation, so search them out and talk to them about their great work. In addition to student scholarships, our Chapter is going to co-host a 2.5 day electrofishing training class this summer that will be taught by Jim Reynolds. More details will follow on this class, but be sure to sign up early as there will only be 24 spots.

I hope that you enjoy this years' meeting – I am excited for the great symposium and contributed papers! The Lake Sucker Summit and Blue Ribbon Session are highlights this year. The Sucker Summit is a symposium that could easily be in a National AFS meeting as we have 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 Fire and a morning of excellent Contributed Papers.

I would like to personally thank my fellow EXCOM (Ben Brown, George Weekley, Sarah Seegert, Paul Burnett, Chance Broderius, and Dale Fonken) for serving with me this year. They are a great group and we have really clicked as a team. 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.

Paul Thompson, President, Utah Chapter of the American Fisheries Society

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

Past President	Ben Brown	utafspp@gmail.com
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President Elect	George Weekley	utafspe@gmail.com
Vice President	Sarah Seegert	utafsvp@gmail.com
Secretary/Treasurer	Paul Burnett	utafstreasurer@gmail.com
2nd Year Committee Member	Chance Broderius	utahafs2@gmail.com
1st Year Committee Member	Dale Fonken	utahafs1@gmail.com
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	Chante Lundskog	clundskog@utah.gov
Paper/Poster Judging	Gary Thiede	gary.thiede@usu.edu
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	Trina Hedrick	trinahedrick@utah.gov
	Randy Oplinger	randyoplinger@utah.gov
	James Whelan	jwhelan@fs.fed.us

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

AFS
UTAH STATE UNIVERSITY

2018 Best Presentation Awards

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

BEST PROFESSIONAL PAPER:

> **Scott Tolentino**; Utah Division of Wildlife Resources; Bear Lake Tributaries Fish Passage Improvement and Increase in Wild Cutthroat Trout

BEST STUDENT PAPER:

> **Ben Stout**; Utah State University; You Can Do It! Determining Fish Status from Mobile PIT Antenna Detections

BEST STUDENT POSTER:

> **Michael Sorenson**; Brigham Young University; Ecological Exchangeability of Dark and Dusky Rockfish in Southeast Alaska

2018 Awards

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

LIFETIME ACHIEVEMENT

> **Dave Behunin**

PROFESSIONAL OF THE YEAR

> **Randy Oplinger**

AWARD OF MERIT

> **Bryan Engelbert**

PARTNER of the YEAR

> **Alan Ward and Justin Robinson**

LEAKY BOOT

> **Chance Broderius and Cody Edwards**

A Special Thank You to our Meeting Sponsors!!

Virgin River Chub ($2000+)

UTAH DNR

JUNE SUCKER RECOVERY IMPLEMENTATION PROGRAM

Bluehead Sucker ($1000-$2000)

Biomark
SPECIALISTS IN IDENTIFICATION SOLUTIONS

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Colorado River Cutthroat ($500-$1000)

FOREST SERVICE
US
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TROUT UNLIMITED

AGGIEAIR

Sunfish Fish Farms

RIVER RESTORATION.ORG

UtahState University
ECOLOGY CENTER

USGS
science for a changing world

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SALT LAKE FISH & GAME FOUNDATION
A non-profit foundation dedicated
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Organized in 1921

DsP

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SALT LAKE CITY, UTAH

RUIN

Shades
BREWING

Thank You to our Donors!

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

Deer Valley Resort

Kent Sorenson

Trout Unlimited

Melissa Trammel

Utah's Hogle Zoo

Floy Tags

John Schultz

Falcon's Ledge

Gary Thiede

George Weekley

Red Rock Brewing

The Western Native Trout Initiative

Sportsman's Warehouse

Natural History Museum of Utah

Christenson's Lakeshore Tackle

BioWest, Inc.

Hale Centre Theatre, Sandy

Hale Center Theater, Orem

Sundance Mountain Resort

Tracy Aviary

Boondocks, Draper

Olive Garden

Utah Jazz

George Sommer

Brandon Ivory

Fish Tech Outfitters

D&H Custom Lures

Melissa Noakes

Camp Chef

Montana Fly Company

Black Bear Diner

Fish Pond

Yeti Coolers

Benelli

Travis Sylvester

Dave Scadden Paddlesports

Kiito's Brewing

Jump Around Utah

Thanksgiving Point

Fundraising Event Break-down

General Raffle

$1/ticket or wingspan of tickets for $20

- Deer Valley – Summer lift tickets
- WNTI – hat
- Hogle Zoo – 2 person day passes
- Montana Fly Company – fly-tying gear and nippers
- Scientific Anglers 5 weight fly line
- Boondocks (Draper) – 2 passes
- Handmade (Brandon Ivory) Filet Knife
- Camp Chef Stryker Propane Stove
- Christenson's Lakeshore Tackle
- Fishpond hats
- Fly combo and sling pack
- Hale Centre Theatre, Sandy – 4 ticket vouchers for "Matilda"
- Hale Center Theater, Orem – 2 ticket vouchers
- Olive Garden – coupons
- BioWest – Sage fly rod
- Sundance Mountain Resort – Ski lift tickets
- Trout Unlimited – beanies and water bottles
- Travis Sylvester 2019 calendars
- D&H Custom Lures tackle package
- Tackle package
- Sportsman's Warehouse items/gift card
- Jump Around Utah - Tickets
- Black Bear Diner gift card

Silent Auction

- Falcon's Ledge – 1 fishing membership
- June sucker native necklace by Melissa Trammel
- Floy Tags – 500 tags, tagging gun, and ruler
- Red Rock Brewing Company – gift certificates ($25 and $50)
- Bonneville cisco prints by Joseph Tomelleri
- Utah Jazz – 2 autographed pictures
- Wooden trout inlay
- Tracy Aviary package – 2 admission tickets, 2 "close encounter" vouchers, 1 feed the flamingos voucher
- Thanksgiving Point – 4 admission tickets to the Butterfly Biosphere
- Natural History Museum of Utah – admission tickets
- Kiito's Brewing – Gift basket

Deck of Cards Game

Package 1 ($20/card) - 5 wt Buglauncher Fly Rod package (rod and reel); John Schultz – box of hand-tied flies; Travis Sylvester – rainbow trout "Whiplash" canvas print; George Weekley – oak fly rod rack/table

Package 3 ($20/card) - Benelli Shotgun

Package 2 ($25/card) - Yeti – Hopper Flip 12 cooler; Dave Scadden Inflatable Paddleboard; Travis Sylvester – brown trout paper board print

Package 4 ($10/card) - Camp Chef – smoker

Package 5 ($15/card) - Yeti – Tundra 64 cooler

Conference Center Information

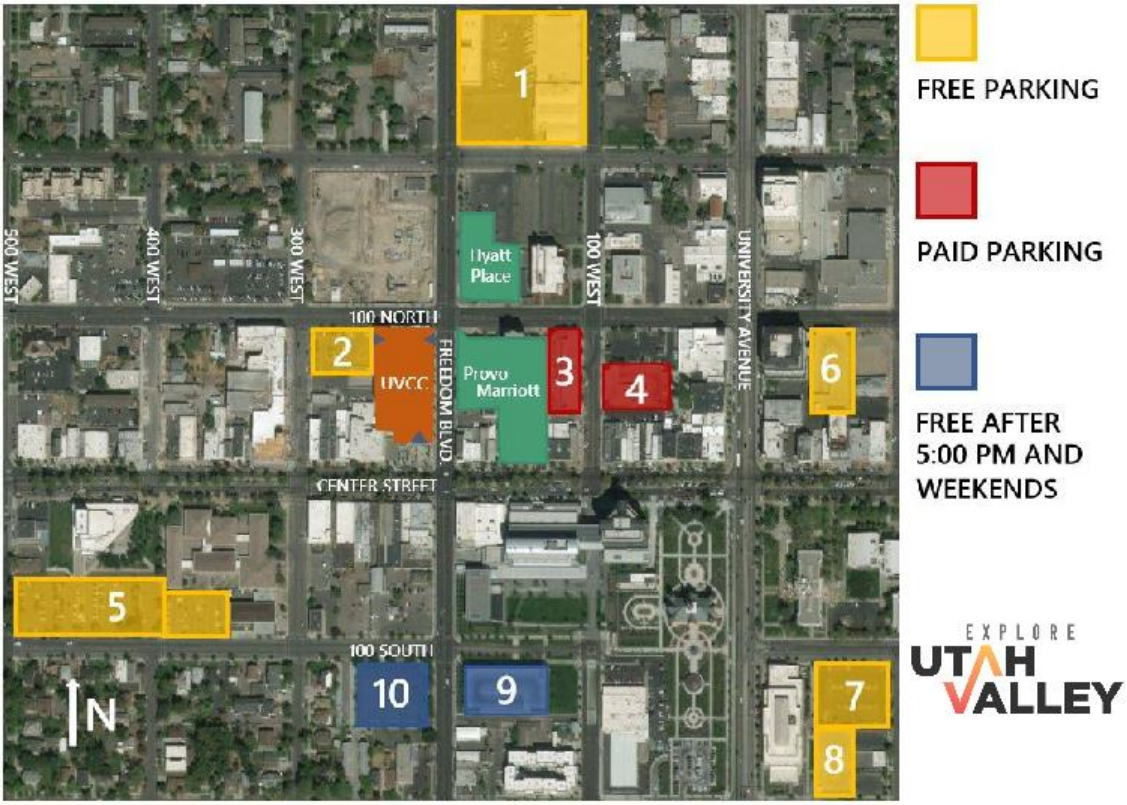
Utah Valley Convention Center

Address: (Main Entrance) 220 West Center Street, Provo, UT 84601; (North Entrance) 95 N Freedom Blvd

Phone: 801-851-2200

Website: www.utahvalleyconventioncenter.com

Parking: For those of you that are coming to the meeting on a daily basis, please refer to the map below for parking options at the conference center.



1 – Freedom Lot (Surface Parking), 225 N Freedom Blvd, Provo, UT 84601, Free – 400 spaces

2 – UVCC Lot (Surface Parking), 250 W 100 N, Provo, UT 84601, Free – 41 spaces

3 – Provo Marriott (Parking Garage), 70 N 100 W, Provo, UT 84601, $10/day (non-hotel guests) – 349 spaces, 6’6” Clearance

4 – Provo Town Square (Parking Garage), 60 N 100 W, Provo, UT 84601, $2/day (top level, unmarked) – 221 spaces

5 – City Center/Police Lot (Surface Parking), 400 W 100 S, Provo, UT 84601, Free – 216 spaces

6 – Wells Fargo Center (Parking Garage), 65 E 100 N, Provo, UT 84601, Free – 508 spaces, 7'8" Clearance

7 – Health & Justice (Surface Parking), 50 E 100 S, Provo, UT 84601, Free – 100 spaces

8 – Health & Justice (Parking Garage), 39 E 200 S, Provo, UT 84601, Free – 450 spaces, 7'0" Clearance

9 – Nu Skin Building (Parking Garage), 140 W 100 S, Provo, UT 84601, Free after 5:00 pm – 450 spaces

10 – Nu Skin Lot (Surface Parking), 257 W 100 W, Provo, UT 84601, Free after 5:00 pm – 127 spaces

For those of you staying at the Springdale Suites by Marriott, a shuttle will be available to get you to and from the Utah Valley Convention Center. The shuttle schedule is as follows:

- Tuesday, March 12 at 5:30 PM - Pickup at hotel; Dropoff at Utah Valley Convention Center (UVCC)
- Tuesday March 12 at 6:00 PM - Pickup at hotel; Dropoff at UVCC
- Tuesday March 12 at 9:30 PM - Pickup at UVCC; Dropoff at hotel
- Tuesday March 12 at 10:00 PM - Pickup at UVCC; Dropoff at hotel
- Wednesday March 13 at 7:15 AM - Pickup at hotel; Dropoff at UVCC
- Wednesday March 13 at 7:45 AM - Pickup at hotel; Dropoff at UVCC
- Wednesday March 13 at 9:30 PM - Pickup at UVCC; Dropoff at hotel
- Wednesday March 13 at 10:00 PM - Pickup at UVCC; Dropoff at hotel

Opening Social Information

THE OPENING SOCIAL HAS BEEN MOVED TO THE UTAH VALLEY CONVENTION CENTER and it will run from 6:30 pm until 10:00 pm in Cascade Room C.

Motel Information

Hyatt Place Provo

Address: 180 W 100 N, Provo, UT 84601

Phone: 801-609-2060

Website: https://www.hyatt.com/en-US/hotel/utah/hyatt-place-provo/pvuzp?src=corp_lclb_gmb_seo_nam_pvuzp

Springhill Suites by Marriott Provo

Address: 1580 Freedom Blvd 200 W, Provo, UT 84604

Phone: 801-373-0073

Website: www.marriott.com/hotels/travel/slcps-springhill-suites-provo/

Schedule at a Glance

Tuesday, March 12th		
Time	Event	Location
10:00 am – 5:00 pm	Continuing Education – R - 101	UVCC – Cascade A
1:00 pm – 5:00 pm	Continuing Education – How to Message Box	UVCC – Cascade B
12:00 pm – 6:30 pm	Registration	UVCC – Level 3 lobby
6:30 pm – 10:00 pm	Opening Social	UVCC – Cascade C
Wednesday, March 13th		
6:00 am – 7:30 am	Continental Breakfast	motel
7:00 am – 5:30 pm	Registration	UVCC – Level 3 lobby
7:00 am – 5:00 pm	Presentation Download	UVCC – Level 3 lobby
8:00 am – 8:10 am	Opening Remarks – Paul Thompson	UVCC – Cascade CDE
8:10 am – 8:15 am	National AFS Message – Dan Dauwalter	UVCC – Cascade CDE
8:15 am – 11:50 pm	Plenary Session – Lake Sucker Summit	UVCC – Cascade CDE
12:00 pm – 1:30 pm	Lunch – provided by AFS	UVCC – Level 3 lobby
12:30 pm – 1:30 pm	Utah AFS Business Luncheon	UVCC – Cascade CDE
1:30 pm – 4:30 pm	Status, Research, and Future of Utah Blue Ribbon Fisheries	UVCC – Cascade A
1:30 pm – 4:50 pm	Lake Sucker Summit	UVCC – Cascade CDE
4:30 pm – 5:45 pm	Poster Session	UVCC – Soldier Creek
6:00 pm – 10:00 pm	Banquet/Awards/Raffle	UVCC – Cascade CDE
Thursday, March 14th		
6:00 am – 7:30 am	Continental Breakfast	motel
7:30 am – 10:00 am	Presentation Download	UVCC – Level 3 lobby
8:30 am – 12:30 am	Contributed Papers	UVCC – Cascade A
8:30 am – 10:10 am	Status, Research, and Future of Utah Blue Ribbon Fisheries	UVCC – Cascade B
10:30 am – 12:30 pm	Wildfire: Preparation, Management, and Rehabilitation	UVCC – Cascade B
12:30 pm	Lunch – provided by AFS/Adjourn	UVCC – Level 3 lobby
1:00 pm – 3:00 pm	Hatchet Throwing	Heber Valley Hatchets -Provo

AGENDA

Wednesday, March 13th

Plenary Session

Room: Cascade CDE

Moderator: Paul Thompson

8:00 – 8:10	**Paul Thompson** – Opening Remarks and Presidential Message	
8:10 – 8:15	**Dan Dauwalter** – National AFS Message	
8:15 – 9:00	**Doug Ouellette** – Pyramid Lake – Land of the Giants	
9:00 – 9:30	**Josh Rasmussen** – Status and Future of Klamath Basin Lake Suckers	
9:30 – 10:00	**Michael Mills** – June Sucker Recovery in Utah Lake: A Very Real Fish Story	
10:00 – 10:20	BREAK – Level 3 lobby – includes breakfast snacks	
10:20 – 10:50	**Gary Scoppetone** – Cui-ui: An Unlikely Survivor of Pluvial Lake Lahontan	
10:50 – 11:20	**David Hewitt** – Do Cyanobacteria Blooms and Associated Water Quality Conditions Cause Mortality of Juvenile or Adult Suckers in Upper Klamath Lake, Oregon?	
11:20 – 11:50	**Scott Daly/Ben Holcomb** – Utah's Efforts to Stem the Tide of Cyanobacteria Dominating Utah Lake	
12:00 – 1:30	LUNCH – Level 3 lobby	
12:30 – 1:30	Utah AFS Business Luncheon	
TIME	**Session 1A: Blue Ribbon Fisheries** **Room:** Cascade A **Moderator: Randy Oplinger**	**Session 1B: Lake Sucker Summit** **Room:** Cascade CDE **Moderator: George Weekley**
1:30 – 1:50	**Herbert Ley** – The Blue Ribbon Fisheries Program in Utah and the Blue Ribbon Fisheries Advisory Council	**Erik Horgen** – Fish Passage and Spawning Activities of Cui-ui (*Chasmistes cujus*) in the Truckee River
1:50 – 2:10	**Nic Braithwaite** – Utah's Blue Ribbon Fisheries Program in Southern Utah	
2:10 – 2:30	**Chris Penne** – Fishing for Answers: Using Citizen Science to Study the Population Dynamics of Tiger Muskellunge in Pineview Reservoir	**Gary Howes** – June Sucker: the Evolution of Captive Fish Culture and its Resulting Successes
2:30 – 2:50	**Natalie Boren** – Restoration of Pelican Lake, Utah: a Multi-phase Approach to Success	**Dale Fonken/Melissa Stamp** – Addressing the Recruitment Bottleneck of June Sucker in Utah Lake and Documenting Natural Reproduction
2:50 – 3:10	BREAK – Level 3 lobby	

Wednesday, March 13th

TIME	Session 2A: Blue Ribbon Fisheries **Room:** Cascade A **Moderator: George Weekley**	Session 2B: Lake Sucker Summit **Room:** Cascade CDE **Moderator: Paul Thompson/Sarah Seegert**
3:10 – 3:30	**Alan Ward** – Developing a Monitoring Plan for Flat Waters: Strawberry Reservoir Case Study	**Jereme Gaeta** – 123 Blue Whales Worth of Carp and Counting: Carp Removal on an Unprecedented Scale, Indicators of Ecosystem Health, and the Conservation of an Endangered Sucker in Utah Lake
3:30 – 3:50	**Wes Pearce** – Factors influencing Cutthroat Trout Population Dynamics in Strawberry Reservoir, Utah	**David Hewitt** – Dynamics of Endangered Sucker Populations in Clear Lake Reservoir, California
3:50 – 4:10	**Scott Tolentino** – Status of Utah's Largest Cold-Water Blue Ribbon Fishery: Management Techniques that have Worked and Where, When, and How to Fish Bear Lake	**Kevin Landom** – Predator Trophic Response to Invasive Carp Removal in a Large Shallow Lake
4:10 – 4:30	**Clint Brunson** – Lost Creek Reservoir Renovation Efforts	Panel Discussion – all speakers
4:30 – 5:45	POSTER PRESENTATION – UVCC – Soldier Creek	
	Blake Hansen – Stonefly Assemblages vs Trout in Low-Order Creeks Along the Northern Wasatch Front	
	Kate Holcomb – An Update on Utah Mollusk Conservation Efforts	
	Ryan West – Feeding Ecology and Diet Overlap of Coexisting Lake Trout and Arctic Grayling in Two Open and Connected Arctic Lakes	
	Justin Kilmer – Estimating the Abundance of Slimy Sculpin in an Arctic Lake Using Catch Data and Mark-Recapture Methods	
	Manny May – Diet Analyses Demonstrating Adaptability in June Sucker Foraging Behavior	
	Adam Johnson – Testing Macroinvertebrate Sampling Method Bias as Biomonitoring	
	Daison Weedop – A Spatial Comparison of Diets of Predatory Fishes Above and Below the Paiute Farms Waterfall in the San Juan River, Utah	
	Sean Cochran – Experimentally Altered Flow Regimes Effect on Bonneville Cutthroat and Brown Trout Growth	
	Austin White – The Effect of Fish Stocking Pattern Changes on the Presence of Double-crested Cormorants at Suburban Ponds in Northern Utah	
6:00 – 10:00	Banquet/Awards/Raffle – Cascade CDE	

Thursday, March 14th

TIME	Session 3A: Blue Ribbon Fisheries **Room:** Cascade B **Moderator: Randy Oplinger**	Session 3B: Contributed Papers **Room:** Cascade A **Moderator: Trina Hedrick**
8:30 – 8:50	**Jackie Watson** – Using Anglers to Develop Management Plans: Case Study of Jordanelle Reservoir	**R. Paul Evans** – Comparative Analysis of Gene-Expression Patterns in June Sucker and Utah Sucker
8:50 – 9:10	**Jack Dudding** – Using Bioenergetics and Population Dynamics Modeling to Inform Fisheries Management at Joe's Valley Reservoir, Utah	**Bryan Engelbert** – Utah's North Slope Uinta Colorado River Cutthroat Trout Brood: Lessons and Progress After 17 Years
9:10 – 9:30	**Peter Searle** – Food Web Structure Informs Potential Causes of Bimodal Size Structure in a Top Predator	**Nick Barrett** – A Slimy Situation: Effects of Temperature & Food Availability on the Performance of Slimy Sculpin (*Cottus cognatus*)
9:30 – 9:50	Blue Ribbon Discussion	**Timothy Walsworth** – Diminishing Effectiveness of Invasive Species Removal Over Time May Require Alternative Approaches to Finish the Job
9:50 – 10:10		**Jordan Nielson** – Farming for Fish Flows
10:10 – 10:30	BREAK – Level 3 lobby – includes breakfast snacks	
TIME	**Session 4A: Wildfire** **Room:** Cascade B **Moderator: James Whelan**	**Session 4B: Contributed Papers** **Room:** Cascade A **Moderator: Trina Hedrick**
10:30 – 10:50	**Brett Roger** – Fires, Fish, and National Forests	**Timothy Walsworth** – Harnessing Process-Based Restoration to Improve In-Stream and Riparian Habitat in the Price River, Utah
10:50 – 11:10	**Cassie Mellon** – Prescribed Fire as a Tool for Sensitive Species Conservation	**Ryan Dillingham** – Monitoring Ecosystem Response to Whole-Lake Biomanipulation in a Shallow, Eutrophic, Utah Lake
11:10 – 11:30	**Mark Holden** – 2018 Dollar Ridge Fire	**Eric Wagner** – Effects of Dreissenid Mussels on Fish Populations + AIS Updates
11:30 – 11:50	**Brian Van Winkle** – Cleaning Up the Mess: Fire Rehabilitation Following the 2017 Brian Head Fire	**Mark Fuller** – The U.S. Fish and Wildlife Service's National Fish Passage Program in Utah

Thursday, March 14th

TIME	Session 4A: Wildfire **Room:** Cascade B **Moderator: James Whelan**	Session 4B: Contributed Papers **Room:** Cascade A **Moderator: Trina Hedrick**
11:50 – 12:10	**James Whelan** – Mapping Post-Fire Stream Disturbance and Recovery on Fish Creek, Utah Using Remote Sensing Data collected by an Unmanned Aerial System (UAS)	**Zach Ahrens** – Unintended Fragmentation: Fish Community Impacts and Conservation Implications of the Piute Farms Waterfall, San Juan River, Utah
12:10 – 12:30	Fire Discussion	**Ben Stout** – Gone But Not Forgotten: Bias and Error, the Legacy of Ghost PIT tags in Aquatic Systems
12:30	Lunch/Adjourn – Level 3 lobby	
1:00 – 3:00	Hatchet Throwing – Heber Valley Hatchets	

Utah Chapter of the American Fisheries Society

Business Meeting Agenda

March 13, 2018; 12:30-1:20 p.m.

Utah Valley Conference Center Ballroom

AGENDA

1. Determination of a Quorum
2. President's Welcome/opening remarks: Paul Thompson
   - Electrofishing Training
   - 2019 Student Scholarships
   - AFS 150th Anniversary
   - WDAFS 2021
   - Recovering Americas Wildlife Act
3. WDAFS Update: Dan Dauwalter
4. Treasurer's Report: Paul Burnett
5. President Elect Message: George Weekley
6. 2020 Meeting Plan: George Weekley
   - Potential Locations - Moab, St. George, Vernal
7. Annual Meeting Timing – move up to accommodate statewide spawning activities?
8. Election Results: Chance Broderius
9. Question and Discussion from Membership

2018 Utah Chapter of the American Fisheries Society
Contributed Paper Abstracts (alphabetical order)

Unintended Fragmentation: Fish Community Impacts and Conservation Implications of the Piute Farms Waterfall, San Juan River, Utah

Zach Ahrens: Utah Division of Wildlife Resources, Moab, UT 84532; zachahrens@utah.gov
Phaedra Budy; phaedra.budy@usu.edu
Gary Theide; gary.theide@usu.edu
Daison Weedop; daisonweedop@gmail.com

Abstract: Stream fragmentation and non-native species introductions are among a suite of anthropogenic disturbances shaping the structure and function of freshwater ecosystems and are broadly implicated in declining stream fish biodiversity. Numerous water developments and non-native fish introductions imperil the Colorado River basin's endemic native fish assemblage. On the San Juan River, Utah, an anomalous anthropogenic waterfall poses a likely barrier to upstream movement both for ESA-listed migratory fish species and potentially invasive predatory sportfish from a downstream impoundment (Lake Powell). In this study, we aim to weigh the relative costs and benefits of altered connectivity resulting from this novel feature in the context of native fish conservation. To meet this goal, we collected fish along a longitudinal river continuum spanning both sides of the waterfall and tested whether metrics of community composition, structure and species interactions differ between reaches above and below the feature. Overall, endangered fish comprised 7.4% of captures below the waterfall and 5.5% above. As expected, preliminary analysis of species composition show reservoir predators – though most abundant immediately below the waterfall – are largely absent above. Moreover, the same distributional pattern was shared by most taxa captured below the falls, indicating a non-selective barrier to upstream movement. We captured 23 unique Colorado Pikeminnow *Ptychocheilus lucius* (CPM) and 62 unique Razorback Sucker *Xyrauchen texanus* (RBS) during 21 hours of electrofishing below the waterfall. Though length-weight relationships of endangered species did not differ across the barrier; median lengths of CPM and RBS captured below the waterfall were greater than those above by 58% and 12%, respectively. These substantial numbers of large native fish isolated below the falls represent a potential increase in fecundity for upstream populations. Diet and trophic structure data (sample processing underway) will further elucidate structural differences between fish communities on either side of the waterfall and inform management. While restoring connectivity is a theme in management of stream fishes and can mitigate some negative effects of fragmentation, intentional barriers or connectivity filters may be appropriate management strategies to attenuate fish passage. In this case, water storage projections show decreasing likelihood of waterfall inundation by Lake Powell. Given the likely permanence of this feature, and the potential for both native migration and nonnative invasion presented here, this barrier presents an opportunity to promote native fish recovery by determining and implementing desired connectivity. We also provide a hypothetical framework and PVA model for barrier management that facilitates evaluation of barrier removal tradeoffs.

Presentation Format: Oral

Presentation Type: Student

A Slimy Situation: Effects of temperature & food availability on the performance of Slimy Sculpin (*Cottus cognatus*)

Nick Barrett: Utah State University, Logan, UT 84321; nbarret1992@gmail.com
Phaedra Budy; phaedra.budy@usu.edu

Abstract: Due to the temperature-dependence of nearly all physiological processes, climatic warming will likely lead to substantial modifications to individual ectotherm performance with consequences culminating at the population, community, and ecosystem levels. In addition, demand for resources will increase with warming due to increases in metabolic demand; as such, the physiological effects associated with climatic warming may be modulated by resource availability. Currently, the Arctic region is experiencing the highest rates of warming on the globe, and organisms that inhabit these high-latitude ecosystems may be particularly sensitive to changes in climate. The goal of this study was to investigate the independent and interactive effects of warming and food availability on Slimy Sculpin (*Cottus cognatus*), an abundant mid-level consumer within many arctic lakes, and one that also functions as a predator, competitor, and prey source. To accomplish this goal, we used both a factorial experiment manipulating temperature (three levels; low, medium and high) and food availability (two levels; low and high) as well as bioenergetic simulations. Results of our experiment indicated significant increases in consumption, excretion, and respiration rates with increases in temperature. In addition, when food was not limiting (i.e., high food treatment), growth increased significantly in the medium temperature treatment. However, when food was limiting (i.e., low food treatment), growth decreased with increasing temperatures. Results from the bioenergetic simulations indicate similar trends in that warming led to larger relative reductions in growth when food became more limiting. However, if sculpin behaviorally thermoregulate by selecting optimal temperatures, our bioenergetic simulations predict increased growth relative to ambient and warmed conditions. With changes in slimy sculpin growth and overall performance, we expect there to be important consequences for top predators such as Lake Trout (*Salvelinus namaycush*) and Arctic Char (*Salvelinus alpinus*), which rely on sculpin as a prey source. Furthermore, responses such as decreased growth may be particularly detrimental for individuals in low-grade environments or populations that must overwinter, as is true in the Arctic. Our results indicate the importance of considering the interaction between temperature and resource availability as well as individual behavior when considering the effects of climatic warming on individuals, populations, communities, and entire ecosystems.

Presentation Format: Oral

Presentation Type: Student

Restoration of Pelican Lake, Utah: A multi-phase approach to success

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Abstract: Pelican Lake, located 15 miles southwest of Vernal, Utah was once a world-class Bluegill fishery offering opportunity to catch two-pound Bluegill and quality Largemouth Bass. For several decades, the fishery was able to produce quality fish which were highly desired by anglers of all abilities. It is hypothesized that a 2008 and 2009 influx of adult Common Carp from upstream reservoirs began a slow and painful degradation of the fishery. In addition to Carp reducing important macrophytes in the

system and slowly taking over biomass in the lake, a major sediment problem was adding to the carp-induced turbidity within the lake. In 2015, a group of passionate anglers, federal agency personnel, Utah Division of Wildlife biologists and managers set out to find viable solutions and funding to tackle the many issues occurring at Pelican Lake. Solutions to these issues thus far have entailed coordination with the irrigation company that owns the Pelican Lake canal and water, development of a fishery management plan, reset of the fishery with a lake-wide rotenone treatment, identification of the main sources of sediment entering the lake and finding solutions and funding to eliminate these sources. This presentation will provide updates on progress made thus far on this multi-phase, multi-faceted approach to restoration of a watershed and distressed fishery.

Presentation Format: Oral

Presentation Type: Professional

Utah's Blue Ribbon Fisheries Program in Southern Utah

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Abstract: Utah's Blue Ribbon Fisheries Program (BRFP) provides a valuable opportunity for sport fish managers and angler representatives to interact and collaborate. Numerous sport fisheries and anglers have benefited from the BRFP's outreach and funding efforts, which promote, restore, enhance, and even create new Blue Ribbon Fisheries. Three specific examples of how this partnership has functioned well in southern Utah include the Boulder Mountain Area, Clear Creek, and Fish Lake. (1) The Boulder Mountain Area offers a variety of angling opportunities in a beautiful and unique setting, but winter hypoxia fish kills severely limit fisheries in several lakes with otherwise great potential. The BRFP has helped purchase solar-powered aerators and dissolved oxygen data loggers to address the problem of hypoxia-related fish kills. (2) Clear Creek was a Blue Ribbon Fishery that was lost after a catastrophic fire in 2010 and extreme flooding in 2011. The BRFP helped fund habitat restoration work that has allowed the fishery to regain Blue Ribbon status much more quickly than anticipated. (3) Fish Lake has long supported a quality sport fishery and been a popular destination for anglers, despite limitations to shore angling from ubiquitous near-shore vegetation and boat angling from aging infrastructure. The BRFP and other partners are in in the process of funding a large fishing pier and updating boat ramps and marinas at Fish Lake to enhance angler access at a meaningful scale.

Presentation Format: Oral

Presentation Type: Professional

Lost Creek Reservoir Renovation Efforts

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Abstract: Lost Creek Reservoir is a potential Blue Ribbon waterbody in the Northern Region. The fishery has a great trout fishery. When Blue Ribbon Fishery Advisory Council ranked this water, it fell just short of the points required. The missed points were not from a lacking fishery but from a very rough road, older amenities, a small narrow boat ramp, and poor access around the reservoir. In the spring of 2017, Utah Division of Wildlife Resources (UDWR), Utah Division of Parks and Recreation (UDPR), Morgan County and Bureau of Reclamation (BOR) started working on a new Memorandum of Understanding

(MOU). Throughout the process, this team discussed the future of Lost Creek Reservoir as a fishery and a destination for recreation. A short-term plan was created as we discussed options such as an improved wider boat ramp, new road, new restrooms, and potential camping options. This talk will discuss the options we have already finished and those still yet to come.

Presentation Format: Oral

Presentation Type: Professional

Experimentally Altered Flow Regimes Effect on Bonneville Cutthroat and Brown Trout Growth

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Sean Cochran: Utah State University, Logan, UT 84321; sean.cochran1@gmail.com

Abstract: Globally, humans divert and control flow regimes of lotic systems for municipal and agricultural uses. When flow regimes are altered, cold-water fisheries can be considerably affected, often with negative consequences to inhabitant fish species. The objective of this study is to assess how experimentally altered flow regimes affect Bonneville cutthroat and brown trout growth. Our study occurred in Diamond Fork and Sixth Water Creeks in north central Utah, an ecosystem with mandated instream flows that are substantially larger than natural base flows to provide water to Utah Valley. We worked with multiple agencies to experimentally reduce instream flows in 2016 and collected otoliths for age and growth analysis from 265 trout in 2016, 2017, and 2018. We hypothesized growth rates would be optimized when the flow regime is closer to a more natural state; however, our findings did not match our hypothesis. Our results should inform managers and stakeholders of the relationship between water management for off-stream uses and the growth and productivity of trout populations. With this information, managers can find the most favorable balance between stakeholder needs and ecosystem health.

Presentation Format: Poster

Presentation Type: Professional

Monitoring Ecosystem Response to Whole-lake Biomanipulation in a Shallow, Eutrophic, Utah Lake

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Abstract: Aquatic macrophytes function as important habitat for aquatic taxa by providing structural complexity, food production, refuge, and breeding grounds. However, common carp (*Cyprinus carpio*) consume and uproot littoral vegetation. The consequences of introduced common carp are particularly problematic in Utah Lake, UT, where early life stages of an endangered fish, the June sucker (*Chasmistes liorus*), need access to refuge and resources provided by littoral vegetation to complete their life cycle. A large-scale, whole-lake carp removal was initiated to promote recovery of vegetated habitat and improve ecosystem condition. The overarching goal of this study was to test ecosystem response to carp removal using aquatic macroinvertebrates as indicators of ecosystem condition. Here, we test whether

macroinvertebrate community structure differs across vegetation communities and is influenced by varying carp densities in Utah Lake. Macroinvertebrate community structure varied strongly with carp density, littoral vegetation availability, and across vegetation type. However, drought driven lake level declines influence these relationships. Our findings provide insight into the recovery of the endemic endangered fish species, while simultaneously improving our understanding of ecosystem response to biomanipulation.

Presentation Format: Oral

Presentation Type: Student

Using Bioenergetics and Population Dynamics Modelling to Inform Fisheries Management at Joe's Valley Reservoir, Utah

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Abstract: Introduction of aquatic species is increasingly problematic for fisheries management. Biological control using predators can be an effective tool for managing introduced populations; however fisheries biologists must strike a balance between management goals and ecological sustainability of the fishery. This can be achieved through the coupling of bioenergetics with prey population dynamics modeling and intensive field sampling. Since 1999, over-abundance of the introduced non-game fish Utah chub (*Gila atraria*) in Joe's Valley Reservoir has prompted concern over interspecific competition with salmonid game species (e.g. *Oncorhynchus mykiss*). Sterile hybrid top predators, splake (*Salvelinus namaycush* X *Salvelinus fontinalis*) and tiger muskellunge (*Esox masquinongy* X *Esox lucius*) were stocked in the lake to apply top-down pressure for control of the Utah chub population. Our goal was to evaluate the effectiveness of biological control on Utah chub through consumption by tiger muskellunge, splake and Bear Lake cutthroat trout (*Oncorhynchus clarki utah*) while also maintaining chub as a forage species to promote Joe's Valley Reservoir's status as a Blue Ribbon fishery. An age-structured bioenergetics model was constructed for each predator species to estimate annual consumption of Utah chub. Using estimated vital rates, an age-structured matrix population model was constructed for Utah chub to evaluate population viability. We found that the Utah chub population in Joe's Valley Reservoir was the primary forage for tiger muskellunge and splake, consuming 81.7% of the biomass of Utah chub annually. We found the asymptotic population growth rate (λ) for Utah chub to be 0.923, indicating an annual decline of 7.7% in the population. Extinction probability analysis found the mean time to population extinction was 45.75 years. These results will inform future stocking rates of splake and tiger muskellunge to stabilize the Utah chub population and ensure the long-term viability as a Blue Ribbon fishery at Joe's Valley Reservoir.

Presentation Format: Oral

Presentation Type: Professional

Utah's North Slope Uinta Colorado River Cutthroat Trout Brood: Lessons and progress after 17 years

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

Abstract: Northeast Utah's sole native salmonid is the Colorado River Cutthroat Trout (CRCT) *Oncorhynchus clarkii pleuriticus*. Several factors in the modern era have negatively impacted this alluring

fish that include nonnative species introductions, habitat loss, disease, and drought. State and federal stakeholders proactively formed the Conservation Agreement and Strategy for Colorado River Cutthroat Trout to combat this decline. A portion of this Strategy formed the Geographical Management Units (GMU's) as a basis to conserve the localized, unique genetic traits in individual CRCT populations. One of the underlying strategies for species recovery is to create wild broodstocks in each of these GMU's to secure fish sources, create sportfishing opportunities, and create an ability to supplement or repopulate conservation populations. We examine our current status and delve into lessons learned with efforts to create a wild CRCT broodstock on the North Slope of the Uinta Mountains in Northeast Utah. In the 17 years of developing this brood, we have faced issues of faulty genetics testing, impure genetics, disease, small fish size, low fecundity, small fish population size, remote harvesting locations, low re-capture efficiency, low egg survival, and time and money hurdles. We are currently working through various means to minimize or combat these issues and preserve our native fish heritage.

Presentation Format: Oral

Presentation Type: Professional

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

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Abstract: none provided

Presentation Format: Oral

Presentation Type: Professional

The U.S. Fish and Wildlife Service's National Fish Passage Program in Utah

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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 by reconnecting habitat that has been obstructed by barriers. The NFPP depends on partnerships that include individuals, organizations, local governments and agencies. Program participants and fish passage improvements in Utah will be focused on. In appreciation to our partners and their great work, many NFPP projects completed in Utah that have resulted in hundreds of river miles of fish habitat will be highlighted. Application criteria, process and FY2019 proposed projects will be discussed. Proposals may be initiated by contacting the U.S. Fish and Wildlife Service, Utah Fish and Wildlife Conservation Office in Vernal, Utah 435-789-0351.

Presentation Format: Oral

Presentation Type: Professional

123 Blue Whales Worth of Carp and Counting: Carp removal on an unprecedented scale, indicators of ecosystem health, and the conservation of an endangered sucker in Utah Lake

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Abstract: Utah Lake, UT is home, the only home, to June sucker (*Chasmistes liorus*), a rare non-benthic sucker species. However, June sucker were reduced to <500 individuals in this ~38,000ha lake and are now listed as federally endangered, largely due to the intentional 1880s introduction and subsequent establishment of invasive common carp (*Cyprinus carpio*; hereafter, 'carp'). Historical accounts describe Utah Lake as a clear water system home to a unique strain of cutthroat trout and macrophyte beds so thick, they inhibited canoeing in many areas, but this is far from the system we have today. Carp biomass in the 2000s accounted for ~80% of fish biomass in the system, and with common carp came increased turbidity and uprooted vegetation, eliminating optimal rearing habitat, refuge, and a rich source of macroinvertebrate prey. The system is further complicated with increased nutrient inputs associated with agriculture and water treatment facilities in the watershed and multiyear drought exacerbated by water withdrawal for human uses. Given the odds stacked against the June sucker, drastic measures were necessary. In this talk, I will discuss carp removal on an unprecedented scale that was initiated in 2009 and has continued to the present. To date, commercial fishermen have removed a staggering 123 blue whales worth of carp biomass from Utah Lake, reducing carp biomass by ~85%. This removal effort is associated with the detection of complex macrophyte beds beginning in 2016 that have not been observed in living memory. These complex macrophyte beds are not only associated with significantly increased macroinvertebrate biomass and richness, but also serve as critical rearing habitat for June sucker. However, nothing is simple in Utah Lake as multi-year drought conditions leave newly established macrophyte beds stranded along the shoreline and a recent northern pike (*Esox lucius*) invasion threatens the success of a comprehensive stocking program to re-establish June sucker. Despite these threats, the dedication and tremendous efforts by the June Sucker Recovery Implementation Program and agency collaborators have led to plans to down list this endangered species. Indeed, the odds are stacked against the June sucker, but a dedicated group has been willing to take that bet, and indicators of ecosystem health suggest we are winning the conservation battle.

Presentation Format: Oral

Presentation Type: Professional

Stonefly Assemblages vs Trout in Low-Order Creeks Along the Northern Wasatch Front

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Abstract: A previous study in Northern Utah suggested there is competition between large predatory Perlid stoneflies and trout. We examined stonefly abundance in two small Wasatch Front creeks, expecting fewer perlids to co-occur with trout. Each creek system had a trout (lower Strongs Creek and

Steed Creek) and troutless (upper Strongs Creek and Davis Creek) reach. We sampled 24 pools with trout and 27 troutless pools. We electrofished each pool to confirm the presence or absence of trout and mini-Surber sampled for two common families of stoneflies: Chloroperlidae (Sweltsa) and Perlidae (Hesperolperla, Eccoptura, Neoperla). Mean number of Perlidae per pool was lower in reaches with trout than without (Strongs Creek: 0.46 ± 0.22 SE with trout, 1.80 ± 0.51 SE troutless; Davis-Steed Creek: 0.00 ± 0.00 SE with trout versus 2.75 ± 1.12 SE troutless). This fit our prediction. The opposite trend was seen with the Chloroperlidae mean numbers (Strongs Creek: 0.85 ± 0.42 with trout versus 0.30 ± 0.15 SE troutless; Davis-Steed Creek: 6.08 ± 2.04 SE with trout versus 2.94 ± 0.77 SE troutless), but their abundance difference was not statistically significant. Competition or predation by trout may limit perlid abundance, whereas chloroperlids might not compete with or be preferred food for trout because they are much smaller than perlids.

Presentation Format: Poster

Presentation Type: Student

Do Cyanobacteria Blooms and Associated Water Quality Conditions Cause Mortality of Juvenile or Adult Suckers in Upper Klamath Lake, Oregon?

David Hewitt: U.S. Geological Survey, Klamath Falls, OR 97603; dhewitt@usgs.gov

Abstract: Massive seasonal blooms of cyanobacteria, primarily *Aphanizomenon flos-aquae*, exert strong control on summer water quality conditions in Upper Klamath Lake, Oregon. The growth and decay of the blooms can lead to extreme hypoxia, high pH, high concentrations of ammonia, and potentially hypercapnia (high concentrations of carbon dioxide). Such water quality conditions, and hypoxia in particular, were implicated in die-offs of adult suckers in the mid-1990s and again in 2017. In addition, water quality is often hypothesized to be the primary driver of the near-complete mortality of juvenile suckers within their first year of life. We reviewed the considerable literature on sucker tolerances of water quality conditions and examined 14 years of detailed water quality measurements in Upper Klamath Lake. We also monitored the effects of water quality on the survival of juvenile suckers in mesocosms. Regarding adult sucker die-offs, we found that hypoxia and other water quality conditions were not compelling as direct causes of mortality events. However, water quality is variable in time and space and sampling only captures some of that variation, so it is hard to draw definitive conclusions. Relative to thresholds that have been published for juvenile suckers, dissolved oxygen and pH in Upper Klamath Lake did not often reach levels expected to cause acute mortality. However, pH regularly reached levels documented to cause sub-lethal effects. Hypercapnia rose to potentially lethal levels only in the fall and winter. Un-ionized ammonia rarely exceeded even the lowest effect level for suckers. Microcystin, a toxin associated with a secondary bloom of *Microcystis aeruginosa*, is unlikely to cause acute sucker mortality due to the ingestion route of exposure and the concentrations found in Upper Klamath Lake, but could have sub-lethal effects. Nothing is currently known about the direct or indirect effects of other bioactive compounds (secondary metabolites) that are produced by cyanobacteria and known to occur in Upper Klamath Lake. Mortality of juvenile suckers in mesocosms varied spatially, but it was not clear that mortality was directly related to water quality conditions. Cyanobacteria blooms and associated water quality conditions in Upper Klamath Lake may cause chronic stress that increases sucker mortality due to other factors, but does not appear to be acutely lethal.

Presentation Format: Oral

Presentation Type: Professional

Dynamics of endangered sucker populations in Clear Lake Reservoir, California

David Hewitt: U.S. Geological Survey, Klamath Falls, OR 97603; dhewitt@usgs.gov

Abstract: Lost River suckers and shortnose suckers are long-lived endemic fishes of the Upper Klamath Basin, and both species are listed as federally endangered. Populations in Upper Klamath Lake, Oregon have received the most research and conservation attention, but populations in Clear Lake Reservoir, California are also imperiled. Results from a research and monitoring program for the Clear Lake populations that began in 2004 are beginning to reveal the factors that are hindering recovery of these populations. Spawning migrations into the only spawning tributary were monitored by remotely detecting PIT-tagged fish as they ascended the creek in the spring. Relating the timing and magnitude of the detections to reservoir water level and instream flows showed that both reservoir water level and instream flows exerted strong control on the migrations. Spawning was impeded by low water levels because creek access was limited, and the lowest instream flows were insufficient for spawning regardless of water level. Capture-recapture modeling based on PIT tag encounters showed that annual survival of both species in Clear Lake was lower overall and more variable than for spawning adults in Upper Klamath Lake. Monitoring for sucker PIT tags on breeding colonies of piscivorous waterbirds at Clear Lake revealed that large numbers of suckers were being consumed in years with successful waterbird nesting. Estimated waterbird predation rates on suckers were higher in years with large and successful nesting colonies of pelicans and cormorants, and annual survival estimates from capture-recapture models were correspondingly lower in those years. The population of Lost River Suckers in Clear Lake may be the most imperiled population of either species in the Upper Klamath Basin. Recovery of Clear Lake sucker populations depends on striking the right balance between the needs of downstream irrigators and the needs of the suckers for spawning and survival.

Presentation Format: Oral

Presentation Type: Professional

An Update on Utah Mollusk Conservation Efforts

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Abstract: Utah is home to about 139 species of mollusks, but 45 of these species are listed as species of greatest conservation need in the Utah Wildlife Action Plan. Utah's goal for mollusk conservation is to ensure the long-term persistence of mollusks and their habitats and prevent the need for listing under the Endangered Species Act (ESA). There have been limited efforts to understand the status and distribution of mollusks in Utah in the past, but efforts to address this goal have increased in recent decades. Much of the recent conservation effort has involved field and eDNA surveys. Working groups have also formed in an attempt to share knowledge and coordinate mollusk conservation efforts throughout Utah and surrounding states. Some important outcomes of recent mollusk conservation efforts in Utah include: (1) improved understanding of snail taxonomy, (2) determination that Bifid Duct Pyrg (*Pyrgulopis peculiaris*) was not warranted for listing under the ESA, (3) development of eDNA assays for Utah freshwater mussels, and (4) an improved understanding of Anodonta population genetics in the Bonneville Basin in Utah. There are still several species needing taxonomic revision, and surveys are still needed to solidify species distributions. There is also a need to identify and reduce threats to mollusks and determine whether propagation is an appropriate conservation action for some of the most imperiled species.

Presentation Format: Poster

Presentation Type: Professional

Utah's Efforts to Stem the Tide of Cyanobacteria Dominating Utah Lake

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Abstract: Utah Lake is no stranger to experiencing cyanobacterial blooms. However, recent events suggest that blooms are occurring earlier and at greater magnitudes; becoming more intense, spatially and temporally; and, as of last year, becoming more toxic. This presentation will cover the recent history of these events, the ramifications to recreation and aquatic life, and what UDWQ, health professionals, and other partners are doing to manage these events. Specifically, UDWQ will address the activities mitigating exposure risk and review potential solutions for controlling blooms. In addition, as a partner of the Utah Lake Water Quality Study (ULWQS), UDWQ will explain the strategy to restore and protect the multiple uses (aquatic life, recreation, and agriculture) of the lake with the goal of preventing (or at least minimizing) cyanobacterial blooms from occurring systemically across Utah Lake.

Presentation Format: Oral

Presentation Type: Professional

2018 Dollar Ridge Fire

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Abstract: The Dollar Ridge Fire began on July 2, 2018 on private property but quickly spread to adjacent public and private lands, eventually burning an area of almost 70,000 acres. This fire was centered over the Strawberry River watershed from Soldier Creek Dam downstream (eastward) over 20 miles to the confluence with Red Creek. This area has been a focal point of Central Utah Project fish and wildlife mitigation for almost 40 years. Working cooperatively, the Utah Division of Wildlife Resources, the U.S. Bureau of Reclamation, and the Mitigation Commission have acquired and manage over 23,000 acres for fish and wildlife habitat, angler access, and related recreation uses. This includes over 21 miles of the Strawberry River and its riparian corridor from Soldier Creek Dam to 1 mile above Red Creek.

The fire itself affected the river corridor, destroying riparian habitat and displacing wildlife populations. However, catastrophic impacts occurred during two separate monsoonal rain events that caused severe flooding and debris flows. The first flood occurred on July 22 while the fire was still burning and affected the Strawberry River from Sulphur Springs downstream (12 miles from Red Creek confluence). A second flood occurred on August 22 and affected the stream from the angler parking lot below Soldier Creek Dam downstream (20 miles to Red Creek confluence). During both floods large amounts of mud and debris from the surrounding burned upland areas washed into the stream channel filling bridges with sediment and creating numerous mud flats in the floodplain. Additionally, the floods created “reservoirs” at the mouths of several draws where large amounts of sediment and rock were deposited. These events led to loss of 10 miles of road and bridges, loss of public access, and numerous downstream impacts on water quality and private property. Flooding also affected water quality

downstream in Starvation Reservoir and in the Strawberry River below Starvation. Turbid water from the flooding traveled through Starvation Reservoir placing municipal water supplies drawn from Starvation Reservoir at risk and discolored the Strawberry River downstream of the reservoir for weeks.

Over 13,000 acres, primarily uplands, were re-seeded last fall through the Watershed Restoration Initiative. Representatives of affected agencies and communities are working together to develop a rehabilitation plan to guide not only what to do, but when to do it, to help this valuable blue-ribbon fishery and riverine corridor recover.

Presentation Format: Oral

Presentation Type: Professional

Fish Passage and Spawning Activities of Cui-ui (*Chasmistes cujus*) in the Truckee River

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Abstract: The Truckee River originates at the outflow of Lake Tahoe and works its way North East across a portion of the Great Basin where it terminates at Pyramid Lake. This watershed is home to several important native and endemic fishes, one of which is Cui-ui (*Chasmistes cujus*). Cui-ui are a long lived native sucker that spend a majority of their life in Pyramid Lake but require access to the Truckee River in the spring to spawn. Changes to this river system from its natural state have directly influenced the ability of fishes from Pyramid Lake to utilize the river for spawning. Ultimately, these changes led to the listing status of Endangered for Cui-ui in 1967. Over the years efforts have been made to improve fish passage and in stream river flow which has led to increased river access and spawning success.

Presentation Format: Oral

Presentation Type: Professional

June Sucker: The evolution of captive fish culture and it's resulting successes

Gary Howes: Utah Division of Wildlife Resources, Logan, UT 84321; garyhowes@utah.gov

Abstract: The need to produce captive raised June sucker (*Chasmistes liorus*) became a priority with it's listing under the Endangered Species Act in 1986. June sucker aquaculture at the Fisheries Experiment Station (FES) under the direction of the Utah Division of Wildlife Resources began in August of 1991. The goal was to establish a brood stock from which progeny could and would be produced to supplement the natural population as well as create refuge populations. The success of producing and stocking individuals of this endangered species has been a result of selective breeding, growth studies, dietary changes, stocking size studies, an easily manipulated recirculation facility, monitoring, and other observations that have resulted in an adaptive approach to aquaculture practices. To date, nearly one million June sucker have been raised and stocked out of FES. Recovery projects such as non-native fish management, habitat improvement, water protection, and continued research and monitoring have further improved the long-term outlook of this fish in Utah Lake.

Presentation Format: Oral

Presentation Type: Professional

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

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Abstract: Biomanipulation, such as fish removal, can be an important tool for restoring community structure and ecosystem function in degraded ecosystems. Biomonitoring (monitoring ecological condition based on the biotic community) is imperative for understanding any potential relationship between biomanipulation and the biotic community. Monitoring an entire community often requires multiple sampling methods since certain methods target specific taxa better than others. We are monitoring the macroinvertebrate community to test for a potential ecosystem response to carp removal in Utah Lake, Utah. Here, we test two sampling methods (sweep nets and light traps) for potential differences in macroinvertebrate community capture efficiency. We hypothesize sweep nets will be more likely to capture slow moving and sedentary taxa, whereas, light traps will capture the more mobile taxa. Results from this study will guide our sampling efforts while simultaneously contributing valuable insight into biomonitoring during ecosystem biomanipulation studies.

Presentation Format: Poster

Presentation Type: Student

Estimating the Abundance of Slimy Sculpin in an Arctic Lake Using Catch Data and Mark-Recapture Methods

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Abstract: Highest rates of rising temperatures in the Arctic as a cause of climate change have been observed and may have undesirable but yet unknown effects upon lotic ecosystems. In Northern Alaska, food web structure and dynamics in arctic lakes is relatively simple but predicted to change in the event of temperature increases. Slimy Sculpin (*Cottus cognatus*) are a mid-level consumer that may be impacted, thus also impacting higher trophic species (i.e. Arctic Char, *Salvelinus alpinus*) in the food web. In order to establish a baseline of metrics that will be used for future monitoring and the assessment of rising temperatures in arctic lakes, we have analyzed data from a mark-recapture study at Lake Fog 1. This analysis will help determine the abundance of Slimy Sculpin and make inferences about habitat selection and behavior. We set minnow traps over a two week period by subsectioned areas of the lake (quadrants 1, 2, 3, and 4) and depth (shoreline (0), 1, 3, and 5 Meters). We statistically compared sculpin catch, length, and condition between quadrants and depths. Using the Modified Lincoln-Petersen method, the abundance of Slimy Sculpin is estimated to be 7,270 fish (CI=2,531-13,831). Based on a Kolmogorov-Smirnov test, we observed significant differences in the catch of Slimy Sculpin for the shoreline (n=31) and 1-meter (n=23) shallow depths compared to the 3-meter (n=40) deeper depth. Habitat selection (i.e. boulders, macrophytes, and open sediment) of Slimy Sculpin is likely connected with depth and area of the lake (i.e., quadrant). The cost and benefit of Slimy Sculpin behavior may be

associated with the effects of predation risk, temperature, and forage availability amongst different habitats. Our results also suggest these relatively small closed lakes support surprisingly large populations of Slimy Sculpin. As sculpin represent an important prey and predator resource, altering their density could cause significant changes to the food web and trophic dynamics in this relatively delicate Arctic ecosystem. The collection of baseline and long-term data is critical to understanding large-scale environmental change.

Presentation Format: Poster

Presentation Type: Student

Predator Trophic Response to Invasive Carp Removal in a Large Shallow Lake

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Abstract: Invasive species removal efforts often aim to initiate beneficial ecosystem responses that proliferate throughout the food web, where quantitative changes to the food web may indicate ecosystem improvement. In Utah Lake, UT, mechanical removal of invasive Common Carp (*Cyprinus carpio*) has been implemented from 2009 to present day in order to initiate a suite of beneficial ecosystem responses, including increased macrophyte abundance and diversity, increased invertebrate biomass, and native species conservation benefits. Monitoring efforts recently revealed a reduction in carp biomass lead to an increase in macrophyte diversity and macroinvertebrate biomass. We tested whether the trophic ecology of Utah Lake fishes changed due to reduced carp biomass, and whether changes to the post-removal invertebrate prey composition invoked selective feeding behaviors. We compared the stomach contents of six prominent fish species before and after the onset of carp removal, and also examined the diet electivity of these same species in the post-removal period. Several fishes demonstrated increased invertebrate biomass in the diet after carp removal, particularly macroinvertebrate biomass. Zooplankton were the most abundant invertebrate prey in the environment during post-removal conditions, yet most zooplankton taxa were typically either avoided or preyed upon according to their availability. However, several fishes showed a high degree of feeding selectivity for the relatively larger bodied zooplankton taxa, Daphnia. Preferential feeding upon chironomid macroinvertebrate taxa proved most prominent across all predators, while other macroinvertebrate taxa were typically preyed upon according to their availability. Nevertheless, high variability in prey selectivity was noted among predator species, as well as among individuals within each predator species, likely owing to the generalist feeding behavior of the prominent fishes in Utah Lake. Our results highlight the importance of understanding primary consumer effects when exploring responses of prey communities to invasive species removal. Top down effects may inhibit our ability to fully detect food web responses to invasive species removal, particularly when prey taxa are consumed disproportionately to their availability in the environment. Our study also provides documentation of the proliferation through a food web of the beneficial ecosystem response to invasive species removal.

Presentation Format: Oral

Presentation Type: Professional

Diet Analyses Demonstrating Adaptability in June Sucker Foraging Behavior

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Abstract: The effective management and conservation of an endangered species requires an understanding of foraging behavior and ecology. Commonly identified as filter feeders, endangered June Suckers endemic to Utah Lake, UT, are believed dependent on zooplankton as their primary source of food, yet empirical evidence of this foraging behavior is limited. The goal of this study was to test for potential differences in diet amongst Utah Lake and refuge populations of June suckers. We analyzed whole stomachs collected from Utah Lake and from a refuge population accidentally introduced into a small wetland at Red Butte Gardens, UT, as well as gastric lavage samples obtained from an intentional refuge population in Red Butte reservoir, UT. Zooplankton were the dominant prey item in Utah Lake and Red Butte reservoir, but Utah Lake had the highest diversity of zooplankton prey. By contrast, macroinvertebrates were a more prominent prey than zooplankton in Red Butte Gardens. However, macroinvertebrates were found in the diets from all three locations. Our results suggest June Sucker foraging behavior extends beyond zooplankton prey, and that they can adapt to a reliance of macroinvertebrate prey when dictated by the environments. This study enlightened previous beliefs of June Sucker foraging ecology and will help inform effective management strategies toward conservation in Utah Lake.

Presentation Format: Poster

Presentation Type: Student

Addressing the Recruitment Bottleneck of June Sucker in Utah Lake and Documenting Natural Reproduction

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Abstract: June Sucker (*Chasmistes Liorus*) are one of three extant species of Lake Suckers. Endemic to Utah Lake, the species was listed as endangered in 1986. Loss of rearing habitat as well as introduction of non-native fish species have been identified as primary causes for the decline of June Sucker. A recent habitat improvement project on Hobble Creek, a Utah Lake tributary that was channelized and inaccessible to June Sucker prior to the project, has improved rearing habitat. The project converted a 21-acre field to a naturally-functioning delta that connects the creek to Provo Bay and Utah Lake. Quantifying success of this restoration has been a priority for the June Sucker Recovery Implementation Program (JSRIP). Intensive sampling effort has taken place in Hobble Creek; however, very few juvenile June Sucker have been observed. Despite the lack of observations, there is reason to believe the Hobble Creek restoration project has resulted in increased juvenile survival and recruitment. Since restoration was completed in 2008, more than half of adult PIT tag detections in Hobble Creek have been from fish of unknown origin. For comparison, between 15-25% of June Sucker detected in unrestored tributaries are of unknown origin. All hatchery June Sucker stocked into Utah Lake are implanted with a Coded Wire Tag (CWT). Therefore, fish of unknown origin may have recruited naturally, or be hatchery fish that have shed their CWT. Identifying natal origin is possible through microchemistry analysis of hard structures, and the JSRIP began collecting fin rays from June Sucker of unknown origin in 2016. Investigation of

natal origin through fin rays will determine the extent of natural recruitment, a major milestone in June Sucker recovery.

Presentation Format: Oral

Presentation Type: Professional

Prescribed Fire as a Tool for Sensitive Species Conservation

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Abstract: Least chub, *Iotichthys phlegethontis*, is endemic to the Bonneville Basin of Utah with only six isolated extant populations. One of these populations occurs at Gandy Marsh which is a complex of approximately 50 springheads located in the Snake Valley of Utah. Gandy Marsh provides habitat for least chub as well as Utah chub, *Gila atraria*, speckled dace, *Rhinichthys osculus*, Columbia spotted frog, *Rana lueteventris*, and northern leopard frog, *Rana pipiens*. Portions of this spring complex have been protected as a Bureau of Land Management Area of Critical Environmental Concern since 1992. Two livestock grazing exclosures (12 and 50 acres), which encompass 25 springheads, were built in the early 1990's to protect the unique ecosystem and habitat of Gandy Marsh. The discharge of these springheads varies seasonally. Open water is primarily restricted to springheads in the summer. In the spring and fall water flows through springbrooks to seasonally flooded basins.

Occupancy surveys for least chub at the springheads have been conducted every 1 to 3 years in August since the early 1990's. Declines in least chub occupancy at springheads within the exclosures were documented beginning in 2010, while occupancy at springheads outside the exclosures remained unchanged. This decline was attributed to a buildup of decadent vegetation within the exclosures which clogged the channels, limited open water, and prevented least chub from leaving or returning to the springheads during high water periods. We believed that least chub needed to leave the springheads to reach the seasonally flooded basins to spawn and then return to the springheads to overwinter and oversummer. With the buildup of vegetation, the channels were too clogged for least chub to complete this portion of their life cycle which led to a loss of least chub inside springheads in the exclosures.

A prescribed burn was conducted inside both exclosures in October 2017 with the goal of removing vegetation and increasing open water habitat to allow least chub to return to the springheads in the exclosures. In monitoring from 2010 to 2016, least chub were only found in one exclosure in one year. During monitoring in August 2018, least chub were documented in five springheads inside the exclosures. This increase in occupancy indicates that prescribed fire can be an effective tool to remove vegetation, maintain open water, and allow least chub to naturally recolonize springheads. We will continue to monitor least chub occupancy and vegetation response to determine frequency of future burns or other management efforts needed to help maintain this population.

Presentation Format: Oral

Presentation Type: Professional

June Sucker Recovery in Utah Lake: a Very Real Fish Story

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Spanning 24 miles in length and 13 miles in width, Utah Lake has been a valuable resource for all who have populated its shores. At the time of European settlement, 13 species were thriving in the lake and its tributaries. These species were a source of food for the state's early residents and the water from the lake served as a valuable water source for settlers' crops. As settlements around the lake grew, the lake became a favorite recreation destination and its tributaries were altered to make water supplies more reliable. Today the lake remains a fishing and recreation destination, and a key component of the region's water supply, but the lake also carries the stigma of poor water quality. Two of the original species, the June sucker (*Chasmistes liorus*) and the Utah sucker (*Catostomus ardens*), have managed to hang on throughout the various management actions associated with the lake. The June sucker was listed as an endangered species in 1986. The threats to the species' survival at the time included the alteration of habitat, particularly the dewatering and channelization of tributaries to Utah Lake, which prevented access to spawning habitat and threatened the survival of spawning fish. These impacts, combined with other threats to the species, resulted in the population being estimated at fewer than 1,000 individuals in the mid 1990's. Recovery actions for the species have been implemented under the June Sucker Recovery Implementation Program (JSRIP), which was formed in 2002. The JSRIP works towards the dual goals of recovering the June sucker so that it no longer requires protection under the Endangered Species Act and allowing the continued use and development of water within the Utah Lake basin. Today, thousands of adult June sucker migrate up the tributaries of Utah Lake as part of annual spawning runs and produce millions of larval fish. While the JSRIP has celebrated the population increase, considerable threats to the species' continued survival remain. Increasing demands for water present challenges in providing adequate in-stream flows to support spawning fish while still meeting the needs of municipal and agricultural interests. Additionally the introduction of non-native fish has destroyed habitat and increased predatory threats on the species. Overcoming these and other threats requires large scale habitat projects within an increasingly urban area. As a new recovery plan for the species is drafted by the Fish and Wildlife Service, the JSRIP must maintain an adaptable approach to address the existing threats and prepare for future challenges in order to achieve its goals.

Presentation Format: Oral

Presentation Type: Professional

Farming for Fish Flows

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Abstract: When we talk about flows in the Colorado River it gets messy in a hurry. Who really owns the water and when can they use it? Is it a "wet" water right or a "paper" water right? Farmers and ranchers are always worried about making sure that nobody can take their water right and move it somewhere else leaving them without the lifeblood of their farms and ranches. Some of that is driven by lack of education on how water rights work but some of it is genuine fear that endangered species or large downstream cities are going to swoop in and take their water and their livelihood. One thing is certain, there really isn't enough water for all the farms, ranches, industrial use, cities, and fish. So how do we creatively remedy the situation so all water users can maintain their ability to use the water?

Mountain Island Ranch (MIR) straddles the border of Utah and Colorado near the location where the Colorado River crosses the state line. They have long been interested in conservation and have several

conservation easements on their land. However, they are a heavy water user on the Colorado River with the Luster Farm, a hay producing portion of their property on the banks of the Colorado River. In 2015, MIR approached Trout Unlimited (TU) looking for creative ways to maintain their water right on decaying irrigation infrastructure while still maintaining their conservation ethic. TU worked with Intel Corporation and Bonneville Environmental Foundation to upgrade irrigation infrastructure, switch from alfalfa hay to native perennial grasses, create wetland habitat, and leave approximately 1,000 acre-feet of water in the Colorado River during the first year of the project and approximately 400 acre feet every year into the future. The water savings and timing create additional late season flows for native fish in the Colorado River.

Presentation Format: Oral

Presentation Type: Professional

Pyramid Lake - Land of the Giants

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Abstract: This presentation will chronicle the events of a native species of Cutthroat Trout that once thrived in Pyramid Lake, Nevada, including the circumstances that eventually led to the demise of this native fish species. The presentation will cover the introduction of non-native Cutthroat Trout to Pyramid Lake and several years later, the discovery of the lost "original" terminal lake strain that once populated Pyramid Lake. The presentation also will cover the reintroduction of these fish back to their native waters of Pyramid Lake and their adaptability to their long lost home.

Presentation Format: Oral

Presentation Type: Professional

Factors Influencing Cutthroat Trout Population Dynamics in Strawberry Reservoir, Utah

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Abstract: Numbers of age-3 and older Bear Lake Cutthroat Trout have shown a 53% decrease in Strawberry Reservoir in traditional gill-net surveys from the high in 2007 of 463,861 fish to a low in 2014 of 219,394 fish. It has been hypothesized that stocked Bear Lake Cutthroat Trout are being heavily preyed upon limiting their survival. This research looks at what influences are affecting survival of Age 1 Cutthroat. By identifying the critical factors and bottlenecks influencing stocked Bear Lake Cutthroat Trout survival in Strawberry Reservoir, we will be better able to make adjustments to the stocking program to help improve and sustain Bear Lake Cutthroat Trout populations, This 2 year study was completed fall of 2018, and data presented is a collection of two year intensive monitoring.

Presentation Format: Oral

Presentation Type: Professional

Fishing for Answers: Using citizen science to study the population dynamics of Tiger Muskellunge in Pineview Reservoir

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Abstract: A partnership by state biologists and a dedicated group of anglers is yielding new information on one of Utah's largest and most elusive fish; the Tiger Muskie. Hard to find and hard to catch, getting information on this rare fish had historically been a challenge until biologists gained the help of the anglers who target them. Over the past two years, anglers have captured and collected information on nearly 200 Tiger Muskie, affording biologists a deeper look at the population characteristics of this species than they have ever had before. In a great example of citizen science, this information will help biologists better manage the Tiger Muskie population for the very anglers that have been helping them. The following presentation summarizes the results of the first two years of a study that will last a minimum of three-years.

Presentation Format: Oral

Presentation Type: Professional

Status and Future of Klamath Basin Lake Suckers

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Abstract: The Lost River sucker (LRS), *Deltistes luxatus*, and the shortnose sucker (SNS), *Chasmistes brevirostris*, are western lakesucker species endemic to the upper Klamath Basin of southern Oregon and northern California. The species were federally listed as endangered in 1988. Two (LRS) to three (SNS) main populations and a handful of relict populations of the species occur throughout the basin. Populations in Gerber Reservoir and Clear Lake Reservoir appear to experience intermittent recruitment to the adult population, but population sizes remain very low and hybridization is extensive, particularly for SNS. In Upper Klamath Lake, populations continue to decline due to consistent annual cohort failure. Since 2001, SNS populations have declined by approximately 80% and LRS have declined by approximately 60%. This despite substantial restoration efforts, including dam removal, screening of canals, fish ladders, and river delta restoration, among numerous other smaller projects. Propagation of the species has only recently started. The first 2,500 individuals were released in 2018, but operations are progressing to be able to release up to 10,000 in 2019. Indications suggest that survival of the first cohort was minimal.

Presentation Format: Oral

Presentation Type: Professional

Fires, Fish, and National Forests

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Abstract: The western United States has seen an increase in the intensity and spatial scale of wildfires over the last couple decades. The effects of these fires on native fish communities has been described as minimal to cataclysmic depending upon the location, design, and objective of the study. Furthermore,

when large fires have occurred on federal lands, management practices that have occurred on these lands are often, at least partially, blamed for spatial extent of the fire. In this presentation I will review our current understanding of how fires affect aquatic ecosystems and the public. Through this discussion I will attempt to show how we might mitigate the effects of altered fire regimes and integrate management activities with species conservation and improved public acceptance. Through this presentation I hope it becomes clear that improved management of fire regimes at landscape scales will require an improvement in how managers communicate with the public and a recognition that how, when and where these activities occur, matter to humans and aquatic species.

Presentation Format: Oral

Presentation Type: Professional

Cui-ui An Unlikely Survivor of Pluvial Lake Lahontan

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Abstract: In the Late Pleistocene epoch, Cui-ui inhabited Lake Lahontan which fluctuated dramatically in surface area and elevation, a precarious existence for an obligate lake dweller but stream spawner. Protracted years of drought and lake elevation decline can lead to serial years of failed reproduction due to stream inaccessibility or heavy predation, factors ultimately shaping Cui-ui Life history and influencing population dynamics. In the Holocene epoch, Cui-ui habitat was reduced to Lake Lahontan's largest relic, Pyramid Lake, which has persisted through decadal long drought due to its substantial depth, and probably subjecting Cui-ui to serial years of failed reproduction. In the past hundred years, agricultural water diversion from the Truckee River, Pyramid Lake's only perennial tributary, has exacted periods of exaggerated lake level decline leading to the Cui-ui being federal listed as endangered; the rapid lake declines also presented the opportunity to study life history and population dynamics through serial years of failed reproduction. Researchers have studied changes in year class structure and strength, age and size at maturity, fecundity, reproductive longevity, and adult survival. Large female Cui-ui carry 150,000 to 200,000 eggs. Fecundity is enhanced following a year of failed reproduction with large female egg masses increasing 25% following a no-spawn year. Strongest year classes follow a failed or series of failed year classes, suggesting rapid rebound potential. Cui-ui maturity is size-related rather than age-related, suggesting a minimum fecundity of 50,000 eggs prior to attempting a spawning migration. Cui-ui into their 40's have viable gametes and this reproductive longevity has allowed the species to persist almost two decades with little to no successful reproduction. High Cui-ui density associated with rapid rebound has led to differential growth rates, and because age at maturity is size-related, age at maturity has ranged from 6-19. The Cui-ui's broad range of age at maturity for any given year class serves as a hedge against a year or years of spawner disaster. Adult survival was 60 and 62% in wet years, while in drought years with poor spawner migratory response survival was 91 and 89% for females and males respectively. In the two driest years there was 100% survival. American White Pelicans were the primary source of adult mortality accounting for 90% of the tags deployed in the prespawning aggregate. Thus, attributes contributing to Cui-ui persistence through periods of disrupted reproduction are high fecundity which is enhanced following failed reproduction, rapid rebound, large size at age of maturity, varied age of maturity, great longevity with viable gametes, and high adult survival following failed reproduction. Although Cui-ui life history and population dynamics have contributed to its persistence, its resilience promises to be further challenged in the future by reduced water availability from increases in human population growth within the Truckee River Watershed and associated greater water demand and reduced precipitation due to global climate changes.

Presentation Format: Oral

Presentation Type: Professional

Food Web Structure Informs Potential Causes of Bimodal Size Structure in a Top Predator

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Abstract: Assemblages of fishes in lakes and reservoirs in the western USA are dominated by non-native fishes that lack a shared evolutionary history. Top predators in these crowded systems are often characterized by unstable population dynamics and poor somatic growth rates. Fish Lake of south-central Utah contains a non-native assemblage. It includes lake trout (*Salvelinus namaycush*, Walbaum), splake (*Salvelinus namaycush*, Walbaum x *Salvelinus fontinalis*, Mitchill), yellow perch (*Perca flavescens*, Mitchill) and Utah chub (*Gila atraria*, Girard). Lake trout exhibit a bimodal size structure. A few lake trout grow rapidly to the large size typical of the species; whereas, most never grow beyond 600 mm total length. We hypothesized that competitive interactions in this assemblage caused the bimodal size structure in lake trout. We characterized the trophic niches in the lake with stable isotopes of C and N. We used a Bayesian mixing model to describe the trophic niche and infer diet of the fish community and Bayesian ellipse analysis to identify potential areas of high competition within the food web. Large lake trout feed mostly on small lake trout and splake, despite the abundant population of yellow perch. Small lake trout and splake feed mostly on zooplankton and have substantial overlap of their trophic niche implying competition for food. Yellow perch and Utah chub (formerly an important food item for lake trout) exhibit extreme overlap of their trophic niche, also implying strong competitive interactions. This suggests that yellow perch have generally excluded Utah chub from the lake. Our data suggest that lack of recruitment to large body size in lake trout may result from 1) the reduced availability of Utah chub as a forage fish and 2) increased competition from splake when lake trout are small. Management actions that may help ameliorate the poor somatic growth of lake trout include reducing perch populations, increasing vulnerability of perch to lake trout predation, and/or removal of splake as a competitor of small lake trout.

Presentation Format: Oral

Presentation Type: Student

Gone but not Forgotten: Bias and error, the legacy of ghost PIT tags in aquatic systems

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Abstract: Endangered species conservation and recovery are some of the biggest concerns in aquatic ecology today, and the Endangered Species Act provides us the funding to act. Almost two billion dollars is spent annually on endangered species management; however, in many systems we are unable to

determine the effect of our effort due to lack of accuracy and precision of our estimates of vital rates. Many new methods and sampling techniques have been developed over the years to improve our ability to gather and use data to its full potential. PIT tags and mobile PIT tag antenna systems are one of these new techniques, and although promising, passive mobile systems present new challenges to estimation techniques. Tags, not fish, are detected, thus increasing the chance that ghost tags (shed tags or dead fish with tags) are included as live fishes, which can lead to biases in survival and abundance estimates. Thus classification of tags as live or dead is essential, but sometimes may not be possible. Our goal was to examine the bias in survival rate estimation when classification is not possible and test a false positive model's ability to deal with non-classified detections. We used simulation data to examine the differences between a CJS mark recapture model (using only live recaptures), a biased CJS mark recapture model (including mobile antenna data, but did not try to classify tags), and a false positive model (accounting for the possibility of detecting ghost tags). The biased CJS model always overestimated survival, with an average estimate at 0.95 over all simulations despite a range of actual survival from 0.1-0.8. The standard CJS model and the false positive model's estimates were always close to truth. Despite a very low coefficient of variation, the relative bias of the biased CJS model was extremely high. The standard CJS model and the false positive model had low relative bias, but higher coefficients of variation. Overall, the false positive model generated estimates that were close to truth and could be used to incorporate mobile antenna data when tag status is unknown. The ability to incorporate mobile antenna data without needing to know tag status could help in systems where capture data is sparse, such as is common with endangered species, and where detection data is not robust enough to determine status. With this method, we can use all sources of data to improve vital rate estimation, which could help identify influential management actions, and potentially improve our ability to conserve and recover endangered and threatened fish.

Presentation Format: Oral

Presentation Type: Student

Status of Utah's Largest Cold-Water Blue Ribbon Fishery: Management techniques that have worked and where, when and how to fish Bear Lake

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Abstract: Bear Lake is Utah's second largest Blue Ribbon Fishery and is the state's largest cold-water Blue Ribbon Fishery. Bear Lake has more endemic and native fish species than any other water in the state. Four endemic species and other indigenous species have co-existed in Bear Lake for over a hundred thousand years. Although non-native fish have been stocked into Bear Lake since the late 1890's, they have also co-existed with the endemic and indigenous species since that time. This is quite unique when compared to other lakes/reservoirs in the western United States, since Bear Lake is an example where non-native species have not appreciably negatively affected the naturally reproducing native species' populations. Therefore, fisheries management at Bear Lake is a challenge that must consider not only native and non-native species populations but also sport and non-sport species. The apex indigenous sport and trophy fish in Bear Lake is the Bear Lake Bonneville Cutthroat Trout (*Oncorhynchus clarki utah*). Their population is maintained through both natural recruitment and supplemental stocking. The other extremely popular sport and trophy fish is the non-native Lake Trout (*Salvelinus naymaycush*) in which the population is maintained solely through stocking since there is little, if any, natural recruitment of this non-native fish due to limited rocky spawning habitat, intense egg predation, and unique water chemistry in Bear Lake. To alleviate concerns about stocking non-

native Lake Trout in Bear Lake, changes in their management have occurred which included a reduction of the number stocked and stocking only sterile Lake Trout. This presentation will discuss where, when and how to successfully angle for several "Blue Ribbon" species in Bear Lake including the endemic Bonneville Whitefish (*Prosopium spilonotus*), Bonneville Cisco (*P. gemmifer*), and Bear Lake Whitefish (*P. abyssicola*); the indigenous species Bonneville Cutthroat Trout and Utah Sucker (*Catostomus ardens*) as well as the non-native Lake Trout.

Presentation Format: Oral

Presentation Type: Professional

The Effect of Fish Stocking Pattern Changes on the Presence of Double-crested Cormorants at Suburban Ponds in Northern Utah

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Abstract: The Double-crested Cormorant (*Phalacrocorax auritus*) is a piscivorous bird populating a wide variety of aquatic habitats including urban fishing ponds. The behavior of Cormorants has become increasingly important to wildlife managers in North America due to their predatory activity on stocked fish. Previous studies have looked at how Cormorant numbers respond to the stocking of Rainbow Trout (*Oncorhynchus mykiss*) and Channel Catfish (*Ictalurus punctatus*) in small suburban ponds within northern Utah. These studies suggested that Cormorant numbers increased following the stocking of Rainbow Trout. This prompted recommendations that were implemented with cooperation from the Utah Division of Wildlife Resources (DWR) in 2018. These recommendations included: stocking fewer Rainbow Trout more frequently, stocking Rainbow Trout that are larger in size, and stocking Channel Catfish in place of Rainbow Trout. Every morning during May and June of 2018, we censused the number of Cormorants for 30 minutes at nine ponds, where we also measured other environmental factors. At selected ponds, fewer Rainbow Trout and more Channel Catfish were stocked compared to previous years. At one pond, Meadow Creek, the Rainbow Trout that were stocked were larger in size (~14 in). Another pond, Jensen Nature Park Pond, had Rainbow Trout stocked more frequently than in past years. These both showed a decrease in the average number of Cormorants seen per day at their respective ponds. This also showed an increase in the number of days where the ponds had no Cormorants visit. These results were consistent with our hypothesis that decreasing the number of Rainbow Trout stocked, increasing the size of the Rainbow Trout stocked, and stocking Channel Catfish will reduce Cormorant presence at these suburban ponds.

Presentation Format: Poster

Presentation Type: Student

Cleaning up the Mess: Fire rehabilitation following the 2017 Brian Head Fire

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Abstract: In 2017, the Brian Head Fire burned more than 70,000 acres of National Forest, State and private lands on the Markagunt Plateau in southern Utah. More than 60% of those acres burned at moderate to high severity. A large portion of the moderate and high severity acres were in the headwaters of perennial waterways. Homes, outbuildings, irrigation water, municipal water, road and

trail infrastructure, big game summer range, livestock operations, nearly 150 miles of fish bearing streams, two conservation populations of Bonneville cutthroat trout and three popular flatwater fisheries were at risk from post-fire impacts. Early engagement of State partners in the Burned Area Emergency Response (BAER) process and leveraging BAER funds with Utah Watershed Restoration Initiative (UWRI) funds allowed for a coordinated mulch and seeding effort for emergency watershed protection that allowed the Forest to mulch and seed an additional 500 acres of NFS lands and tie mulching and seeding efforts into State and private land treatments. Additionally, UDWR flew seed to benefit wildlife and for long-term watershed rehabilitation on nearly 17,000 acres of State, private and Forest Service Lands. Similarly, Forest Service large scale emergency rehabilitation funds (LaSER) were leveraged with UWRI funds to continue restoration efforts with road and trail maintenance and reroutes, facilities repair, range allotment fence reconstruction and vegetation management and fuels reduction projects in and surrounding the fire scar. While large and severe wildfires like the Brian Head fire are within the historic range of variability, human infrastructure and ecosystem services are likely to be unacceptably impacted until such time as watershed scale restoration efforts can make gains on late successional forest homogeneity and its associated risks . While proactive treatment is the best way to advance recovery, taking advantage of partnerships, political landscapes, and all the funding and implementation tools available can assist with speeding post-fire recovery.

Presentation Format: Oral

Presentation Type: Professional

Effects of Dreissenid Mussels on Fish Populations + AIS Updates

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Abstract: Dreissenids consume phytoplankton and zooplankton, especially the smaller species. Due to the sheer abundance of mussels and the collective large volume of water filtered, dramatic drops in phytoplankton and zooplankton can occur. This consumption transfers nutrients and energy to the benthos via mussel excretion and to mussel biomass. This increases heterotrophic bacteria, oligochates, chironomids, and invertebrates that are scrapers or predators, but decreases filter feeding organisms. Reductions in plankton can increase light penetration, which can enhance aquatic macrophyte growth where water levels are stable and increase nuisance algae biomass. Greater light penetration can increase predation due to longer sight distances, but also increase vegetative cover, depending on the nutrient levels of the water body. Consumption of plankton by mussels can compete directly with larval fish, reducing their growth and survival. Since most fish rely on plankton in their larval stages, the greatest impact on fish is on the young-of-year. Effects on larger juveniles and adult fish vary with fish species, with planktivores being impacted to the greatest degree. Fish species that can adapt to feeding on the benthic organisms or other prey are less impacted.

Presentation Format: Oral

Presentation Type: Professional

Diminishing Effectiveness of Invasive Species Removal Over Time May Require Alternative Approaches to Finish the Job

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Abstract: Control of long-established aquatic invasive species to aid conservation of native species presents substantial logistic and economic challenges. Invasive common carp (*Cyprinus carpio*) recently accounted for over 90% of the fish biomass in Utah Lake (Utah, USA), driving many undesired changes to ecosystem structure. Carp control efforts began in 2009 and have subsequently removed over 12 million kg of carp from the system. However, the impact of recent removal efforts on carp population structure and dynamics is not well understood. We develop an integrated age-structured population model to estimate the age-structure, biomass, and recruitment dynamics of carp in Utah Lake. Subsequently, we examine simulations of carp population response to alternative potential future management strategies as an example of how managers can determine how to best advance ecosystem objectives. Carp population biomass has decreased to approximately 15% (95% CI = 10.6 – 19.2%) of pre-removal biomass. However, carp removal gear is highly selective for older, larger individuals, thus having little documented impact on young age-classes. Evidence of recent strong juvenile cohorts of carp suggest a compensatory response to removal efforts may increase total biomass as these age classes mature. To this end, we simulated three future removal gear scenarios: 1) the status quo of targeting only adults, 2) a hypothetical new gear which targets only juveniles, and 3) a hybrid effort that targets both juveniles and adults. Simulations of carp population response to potential alternative harvest approaches demonstrate that eradication of carp is not likely to occur with any of our hypothetical removal gear scenarios, even with double the current effort. Only scenarios using the hypothetical gear selecting for juvenile carp are predicted to further reduce carp biomass in the next 30 years, and then only if effort is increased at least five-fold over current levels. Furthermore, the carp population is unlikely to be maintained at current low levels due to compensatory recruitment without a drastic increase in harvest effort. Even when historical management strategies have been successful at approaching management objectives, their efficacy may diminish as ecosystem conditions shift over time. Taking an adaptive management approach with periodic re-assessment of ecosystem response to management and willingness to explore potential alternative approaches is critical to the long-term success of any management program as our knowledge about ecosystems changes.

Presentation Format: Oral

Presentation Type: Professional

Harnessing Process-Based Restoration to Improve In-Stream and Riparian Habitat in the Price River, Utah

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Abstract: Habitat restoration is an increasingly common approach to mitigating landscape-scale changes to conserve lotic biodiversity. However, many projects rely on engineering solutions to the local symptoms of larger scale drivers of degradation, ignoring the underlying natural processes which create and maintain the habitats they seek to restore. Further, pre-and especially post-restoration monitoring efforts are frequently insufficient to determine whether and across what time-frames restoration actions were successful. The effectiveness of treating the symptoms of degradation is particularly dubious in desert river systems, which are extremely dynamic naturally and have experienced dramatic alterations to their hydrological regime. Here, we discuss the background and objectives of a process-based restoration project in the Price River, UT, which has experienced extensive habitat and hydrologic degradation in the past century, yet still supports remnant populations of several native fish species of conservation concern. The persistence of vulnerable species in the Price River suggests that even relatively minor improvements in habitat conditions may provide outsized benefits relative to efforts in systems in which the species are no longer present. Our project aims to (1) maintain and restore stream longitudinal connectivity, (2) provide sufficient habitat to ensure persistence of native fish and vegetation, (3) recover and sustain natural habitat forming processes, (4) provide sufficient flow to prevent dewatering and recover natural channel movement, and (5) conduct sufficient monitoring of restoration impacts to quantitatively assess restoration effectiveness. We present preliminary, pre-restoration monitoring data for the first phase of the project, including fish abundance and distribution, riparian vegetation composition, and in-stream habitat. Further, we discuss the experimental and adaptive spatial design of proposed restoration activities. Treatments will include different combinations of invasive riparian vegetation removal, beaver dam analog/post-assisted log-structures at different densities, and re-introduction of beavers to maintain habitat, which will allow comparisons of the effectiveness of alternative treatment options and intensities in desert rivers. Ultimately, we aim to scale up these restoration efforts to provide not only real, lasting benefits to the native in-stream and riparian biota, but also to provide useful information for restoration practitioners working in other systems, information which will only be available with appropriate monitoring and treatment comparisons.

Presentation Format: Oral

Presentation Type: Professional

Developing a Monitoring Plan for Flat Waters: Strawberry Reservoir case study

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Abstract: During the period 2017 and 2018, Strawberry Project staff undertook a research project to address specific concerns regarding fish populations in Strawberry Reservoir. As part of this research, we employed the use of a wide variety of fish population monitoring techniques including: traditional experimental gillnets, the AFS standard gillnets, a new style of variable mesh curtain nets, hydroacoustics, and trawling. Each of these methods has inherent strengths and weaknesses (which may vary by species) that need to be understood before a long-term, management friendly, monitoring program can be developed for any large flat water. We will present the findings of these varied monitoring tools on Strawberry Reservoir, and how the data from this research has led to a new understanding of the fishery, and how future monitoring techniques will be modified to better manage this important fishery.

Presentation Format: Oral

Presentation Type: Professional

Using Anglers to Develop Management Plans: Case study of Jordanelle Reservoir

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Abstract: Utilization of angler input to assist with the management of specific waters has varied throughout the history of the Utah Division of Wildlife Resources (UDWR). Recently, UDWR has adopted a process to involve working groups to assist with management direction at specific flat-waters. Generally, these working groups are comprised of government agencies, nongovernmental organizations, local business owners, private landowners and anglers who provide input to help draft fisheries management goals and objectives through consensus. This process recognizes the value of stakeholders and their contribution to sport fishing in Utah. Additionally, this collaboration facilitates two-way communication between the agency and partners which increases agency transparency and credibility. Review of one working group and management plan, Jordanelle Reservoir, illustrates the pros and cons of having citizen based working groups and the difficulty of managing social values within biological constraints. Each working group process provides fisheries managers insight into potential pitfalls to these working groups and ways to improve working group effectiveness.

Presentation Format: Oral

Presentation Type: Professional

A Spatial Comparison of Diets of Predatory Fishes Above and Below the Paiute Farms Waterfall in the San Juan River, Utah

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Abstract: Fishes that need to access upriver habitat to complete their later life-stages can be stopped from migrating by natural barriers and those created by humans. The Paiute Farms Waterfall, a recently formed river feature, near Lake Powell in the San Juan River, Utah is a barrier to both native and nonnative fishes that inhabit the San Juan River. Our goals were to compare diets of channel catfish (*Ictalurus punctatus*) captured above and below the waterfall, and to compare diets of striped bass (*Morone saxatilis*) and walleye (*Sander vitreus*) below the waterfall, longitudinally downstream from the waterfall. We collected fishes by electrofishing above and below the waterfall, we dissected and processed stomachs of fish, and finally we determined the biomass of prey by categories in each diet sample. We found nonnative fishes in diets of channel catfish captured above the waterfall, at the base of the waterfall, and one mile down river from the waterfall; however, channel catfish captured >1 mile down river did not have fish in their diets. Both striped bass and walleye captured >1 mile down river from the waterfall exhibited empty stomachs. Striped bass stomachs collected at the base of the waterfall contained only nonnative shiners and catfish (*Ictalurus* spp.), and walleye captured at the base of the waterfall demonstrated insignificant proportions of dipterans in their diets and mostly nonnative shiners and channel catfish. Our results display that the waterfall is protecting native fish upriver from highly piscivorous fish below the waterfall. The fact that walleye diets collected at the waterfall base contained 100% fish and striped bass diets collected at the base of the waterfall contained 99.4% fish

demonstrates that the waterfall is protecting fishes upriver from potential predation from striped bass and walleye. Our research sheds light on the challenging management tradeoffs of novel ecosystems; the barrier should be removed for native fish passage but at the same time is protecting the upper river from non-native predators.

Presentation Format: Poster

Presentation Type: Student

Feeding Ecology and Diet Overlap of Coexisting Lake Trout and Arctic Grayling in Two Open and Connected Arctic Lakes

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Abstract: Competition may be intensified in unproductive systems where resource availability is low. To alleviate this competition and enable coexistence, species may partition resources by reducing niche overlap. Arctic grayling (*Thymallus articus*) and lake trout (*Salvelinus namaycush*) coexist together in many arctic lakes where resources are likely limited. Our goal was to determine prey selectivity and to quantify niche overlap between arctic grayling and lake trout. We separated lake trout into size classes (small < 450 mm and large ≥ 450 mm) to reflect a likely ontogenetic diet shift. We collected arctic grayling and lake trout from two arctic lakes (Lake I1 and Lake I2) via angling, gill netting, and minnow trapping, between July – August 2018. We obtained diets via gastric lavage and stomach extraction. We then compared prey in diet proportions with in-lake macroinvertebrate density proportions. We used Ivlev's Foraging Ratio and Chesson's Alpha to determine prey selectivity. Arctic grayling selected Trichoptera (I1 = 0.96; I2 = 0.74). Small lake trout selected primarily Trichoptera (I1 = 0.84; I2 = 0.83) and to a lesser extent Mollusca, whereas large lake trout primarily selected Mollusca (I1 = 1.00; I2 = 1.00). Using Schoener's diet overlap index, we detected no significant niche overlap between large lake trout and arctic grayling; however, the highest interspecific overlap occurred between arctic grayling and small lake trout in Lake I1 (Chesson's = 0.49). We observed significant niche overlap overall was between large lake trout and small lake trout in Lake I2 (Chesson's = 0.92). The results from this study improve our understanding of factors (i.e., resource partitioning) enabling the coexistence of arctic grayling and lake trout in oligotrophic arctic lakes. With changes in resource availability as a result of a changing climate, competition between these species may very likely intensify.

Presentation Format: Poster

Presentation Type: Student

Mapping Post-Fire Stream Disturbance and Recovery on Fish Creek, Utah Using Remote Sensing Data Collected by an Unmanned Aerial System (UAS)

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Abstract: Three streams recovering from past disturbance on the Fishlake National Forest were selected for aerial image acquisition (remote sensing) using an Unmanned Aerial System (UAS). Goals were to assess UAS suitability for monitoring aquatic and riparian resources, develop techniques for identification of stream channel morphology changes, identify erosion source and depositional areas, identify type, location and extent of riparian and aquatic habitats, and assess aerial stream temperature monitoring. Channel morphology surveys are traditionally conducted in the field, but these surveys are constrained to a localized area, are costly and time consuming, and are difficult to accurately repeat. Advantages of UAS imagery are a relatively low cost, high flexibility, and high spatial and temporal resolution.

Fish Creek, one of the streams monitored, was impacted by the 2010 Twitchell Canyon fire. This fire was started by lightning but allowed to burn within a control perimeter for resource objectives and fire fighter safety. Forty seven percent of the Fish Creek watershed was burned at moderate to high soil fire severity. Aquatic fire effects included near extirpation of the non-native trout population and major channel adjustments. Post-fire floods occurred from 2011-2015. Lower Fish Creek riparian areas were rested for 5-years post-fire, but grazing has since resumed. Habitat restoration work using trackhoes in 2014 and 2015 restored large wood to the stream to create aquatic habitat complexity and trap bedload.

Aggie Air was contracted by UDWR to acquire the imagery. A large hexcoper DJI Matrice 600 drone was flown with Aggie Air's proprietary payload system with a normal color (RGB), near infrared (NIR), and thermal sensors. The flight was flown at 341 m collecting RGB/NIR imagery on 1.35km2 with a 150 m swath width and 6 cm pixel resolution. The imagery was ortho-rectified and geo-referenced and a point cloud (structure from motion) generated by Aggie Air. A second small quadcopter DJI Phantom 4 UAS flight with an ultra-high pixel resolution of 0.8 cm RGB imagery was conducted for two localized stream reaches within the study area.

We present selected results of the data analysis relevant to the Twitchell fire impact. We analyzed stream channel spatial migration changes pre- and post-fire, and investigated stream channel morphology changes for the years after the Twitchell fire based on remote sensing data. A surface water stream temperature map based on thermal infrared imagery was developed. We examined current stream bank stability both in the field using Rosgen's Bank Erosion Hazard Index (BEHI) and using remote sensing imagery and a digital surface model for comparison. Sample sub-cm imagery from the localized flights is presented to show how the larger area and smaller localized flights different spatial extent and resolution complement each other.

Presentation Format: Oral

Presentation Type: Professional