Utah Chapter

of the

American Fisheries Society

2008 Annual Meeting

February 25-27

Moab, Utah

Aquatic Resource Management/ Stewardship Change Over Time

MOAB 2008 SCHEDULE

TIME	MONDAY (FEBRUARY 25, 2008) Colorado Room
9:00 AM	
10:00 AM	
11:00 AM	
12:00 PM 1:00 PM 2:00 PM 3:00 PM 4:00 PM 5:00 PM	*CONTINUING EDUCATION* **Fisheries Statistics** Taught by Robert Al-Chokhachy (course begins at 12:00 pm and ends at 5:00 pm) (hosted break at 2:30-2:45)
6:00 PM 10:00PM	**OPENING SOCIAL** ***Hosted by USU Student Chapter*** ***Pizza and Beverages provided at*** ***Eddie McStiff's 59 S. Main, Moab***

MOAB 2008 SCHEDULE CONT.

TIME	TUESDAY (February 26, 2008) Colorado Room
8:00 AM	**Registration, Coffee, etc. Colorado Room Lobby**
8:30 AM	***Welcome and Logistics***
8:45 AM	***Plenary Session Begins*** ***"Aquatic Resource Management/Stewardship Change Over Time"*** ***Moderator: Eric Wagner***
8:45 AM	**Dale Hepworth** (Utah Division of Wildlife Resources, retired)
9:10 AM	**James Bowns** (Southern Utah University, Ex-Wildlife Board Chair)
9:35 AM	**Reed Harris** (Utah Department of Natural Resources, JSRIP)
10:00 AM	**HOSTED BREAK** **Poster Display (Lobby)**
10:20 AM	**Grant White** (Sportsman's Paradise, Ex-Fish Health and Policy Board Member)
10:45 AM	**Harv Forsgren** (U.S. Forest Service, Regional Forester)
11:10 AM	***Plenary panel Q & A***
11:40 AM	**LUNCH (on your own Taco Bar at Red Cliff Lodge)**
	Aquaculture / Sport Fish and Fisheries Management ***Moderator: Terry Howick***
12:40 PM	**Zane Olsen,** June Sucker Performance at the Springville Fish Hatchery
1:00 PM	**Dave Behunin,** Trout Egg Sterilization
1:20 PM	**Eric Wagner,** Hatchery and Field Performance of a Whirling-Disease Resistant Rainbow Trout Compared to a Utah Strain: 2007 Data
1:40 PM	**Randall W. Oplinger,** Angler Catch Rates of Whirling Disease Resistant Rainbow Trout and Creel Data from Two Utah Reservoirs
2:00 PM	**Alan Ward,** Management of a Cutthroat Predator *Oncorhynchus clarki utah* to Control Utah Chub *Gila atraria* in a High Use Sport Fishery
2:20 PM	**Jeremiah Wood, (Student)** Spawning Ecology and Early Life-Stage Survival Influence the Distribution of Brown Trout in a Native Cutthroat Trout Stream
2:40 PM	**HOSTED BREAK** **Poster Display (Lobby)** ***Sport Fish and Fisheries Management / Native Species*** ***Moderator: Don Wiley***
3:00 PM	**Paul Burnett,** Using Geodatabases in Fisheries Management: The Current Status of Bonneville Cutthroat Trout
3:20 PM	**Wayne Gustaveson,** Drought Induced Population Boom of Striped Bass at Lake Powell
3:40 PM	**W. Colyer,** Tracking Fluvial Cutthroat Trout Movements in the Bear River with Stable Isotope Markers
4:00 PM	**Charles B. Chamberlain,** Field Comparisons of Diploid and Triploid Rainbow Trout
4:20 PM	**Scott A. Tolentino,** Spawning Habitat Preferences and Feeding Ecology of Two Endemic Bear Lake Whitefishes *(Prosopium spilonotus and P. absyyicola)*
4:40 PM	**Aaron Webber,** Status of the Bluehead Sucker *(Catostomus discobolus)* in the Weber River, UT
5:00 PM	**Josh Rasmussen,** Comparison of Survival Probability of Stocked June sucker from Different Sources
5:20 PM	**POSTER SESSION** **Colorado Room Lobby**
6:00 PM	**Social Cash Bar** **Rio Grand Room**
6:30 PM	**Banquet/Raffle Rio Grande Room**

MOAB 2008 SCHEDULE CONT.

TIME	WEDNESDAY (February 27, 2008) Colorado Room
8:00 AM	**BUSINESS BREAKFAST BUFFET (Colorado Room)** **(Hosted by Chapter)**
9:30 AM	***Native Species / Ecological and Habitat Issues*** ***Moderator: Chris Keleher***
9:30 AM	**Nina J. Laitinen, (Student)** Genetic Relationships of Mountain Suckers and Bluehead Suckers Based on Mitochondrial DNA
9:50 AM	**Matt Bartley,** Conservation Aquaculture of Leatherside Chub
10:10 AM	**Laura L. C. Hines,** Status of Least Chub *(Iotichthys phlegethontis)* in Utah
10:30 AM	**Cassie Mellon,** The Use of Grow-Out-Ponds and Hatcheries in the Recovery of June Sucker, *(Chasmistes liorus)*
10:50 AM	**Eric J. Billman, (Student)** Comparison of Two Cage Designs for the Grow-Out of Juvenile June Sucker in Utah Lake
11:10 AM	**Aaron Fordham, (Student)** Age and Growth of Utah *Cottus bairdi* Populations
11:30 AM	**Tracy Bowerman, (Student)** Use of Predictive Models to Assess the Importance of Riverscape Connectivity on the Distribution of an Imperiled Fish Species
11:50 PM	**HOSTED BREAK** **Poster Display (Lobby)**
12:10 PM	***Ecological and Habitat Issues*** ***Moderator: Josh Rasmussen***
12:10 PM	**Larry B. Dalton,** Utah Division of Wildlife Resources' New ANS Program
12:30 PM	**Ben Nadolski, (Student)** Factors Influencing Brook Trout Distribution in the Mill Creek Drainage, Utah
12:50 PM	**Eric C. Dinger,** Potential Impacts of a Widely Used Herbicide to Utah Stream Invertebrates
1:10 PM	**Keith J. Tanner, (Student)** Estimating Dispersal of Spring Invertebrates Through Genetic Diversity in Threatened Habitats of the Great Basin
1:30 PM	**Christine Swan,** An Update on Coldwater Disease in Utah
1:50 PM	**Anna Forest,** An Overview of Endocrine Disrupting Compounds: Prevalence and Impacts to Fish
2:10 PM	**Kirk Dahle, (Student)** Predicting the Growth Potential of a Shallow, Warm-Water Sport Fishery: A Spatially Explicit Bioenergetics Approach
2:30 PM	**Presentation of Awards** **Adjourned LUNCH (Boxed Lunch)**
4:00 PM	**Excomm rap-up mtg.**
5:00 PM	
6:00 PM	

2008 List of Raffle Donors

We would like to thank the following organizations and individuals for their support of the Utah Chapter of the American Fisheries Society. They have helped make our chapter successful through the donations of goods and services for our annual meeting:

- Bio-West and Paul Holden
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- Chris Keleher

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TECHNICAL SESSION I
Aquaculture

JUNE SUCKER PERFORMANCE AT THE SPRINGVILLE FISH HATCHERY

Zane Olsen and Richard Hartman, Utah Division of Wildlife, Springville Hatchery, 1115 North Main Street, Springville, UT 84663; (801) 489-4421; zaneolsen@utah.gov, richardhartman@utah.gov

Our objective was to compare growth, survivability, and health condition profile (HCP) for June Suckers raised in different conditions at the Springville Hatchery. Our goal was to produce fish averaging 200mm in length by fall 2007. In June 2006 3,475 fish were stocked into two dirt ponds located on the west side of the Springville Hatchery. Our study called for feeding the fish in the north pond Bozeman June Sucker diet while leaving the fish in the south pond to search for natural feeds existing in the pond. This plan was abandoned when the fish in the north pond began to ignore the prepared feeds in favor of natural foods. Each month we sampled the fish to determine growth rates. This was accomplished with minnow traps and tap nets. We closely monitored water quality parameters. Twenty fish were sacrificed for HCP profiles.

In late September 2007 we began harvesting the June Suckers to stock them into Utah Lake. 1,011 fish were recovered (58%) from the south pond. These fish averaged 209mm in length. Unfortunately, only 10 fish were recovered from the north pond (0.6%). This pond had been heavily attacked by avian predators, which were difficult to deter. These fish averaged 319mm in length.

We met our growth goals for these fish. A comparison of growth factors shows significant differences in pond vs. raceway culture methods. Growth of the fish was determined by natural cycles found in the pond, rather than culture techniques we normally apply to raceway culture. We will continue this project next year. Before the fish are stocked, the north pond will have a liner installed and we will try other methods to discourage avian predation. We will also raise 10,000 fish in concrete raceways.

TROUT EGG STERILIZATION

Dave Behunin, Utah Division of Wildlife, J. Perry Egan Hatchery, 2550 South 200 West, P.O. Box 85, Bicknell, UT 84715; (435) 425-3547; davebehunin@ut.gov

Equipment needed: Fiberglass trough, perforated aluminum baskets, heat pumps, pipe manifold, to fit trough, timers, buckets, nets, etc. Manpower: one extra man to transport eggs from spawn trailer to treatment area and equipment back to spawn trailer. Full spawn crew. One extra man to rinse eggs before treatment and to help empty baskets at end of treatment. One extra man to run actual Heat shock treatment. Time and temperature requirements: 20 minutes after fertilization, put into 26.5 Centigrade water for 20 minutes, then into incubation jars. Do not let temperature fluctuate more than ½ degree. Time and pressure requirements: 35 minutes after fertilization, 9800 ppsi for 5 minutes, then back into incubation jar. We use for BKOW only, as it works better than Heat Shock. Techniques we've developed: Increased temperature by 1 degree over original recipe, being very careful not to let temperature vary more than ½ degree. Rinse eggs really well prior to going into water bath. As egg go into water bath move or stir eggs carefully to eliminate any cool spots. Finally disinfect all equipment in water bath with chlorine after each use. Over the last two years we have achieved 100% sterilization using this method. Average eye-up all strains: For 2005-2006 spawn year Triploid 70% Diploid 86%. Average eye-up Brook: For 2006-2007 spawn year Triploid 59.6% Diploid 77.9%. For 2007-2008 spawn year Triploid 39.0% Diploid 71.3%. Average eye-up all strains: For 2006-2007 spawn year Triploid 71.7% Diploid 89.2%. Average percent survival hatch to stocking: Triploid 60.5% Diploid 88%.

HATCHERY AND FIELD PERFORMANCE OF A WHIRLING-DISEASE RESISTANT RAINBOW TROUT COMPARED TO A UTAH STRAIN: 2007 DATA

Eric Wagner, R. Arndt, M.D. Routledge, R. Mellinthin, M. Bartley, and C. Allen, Fisheries Experiment Station, 1465 West 200 North, Logan, UT 84321; (435) 752-1066; ericwagner@utah.gov

The hatchery and field performance of a whirling disease resistant strain of rainbow trout (*Oncorhynchus mykiss*; GH) was compared to a traditional Utah strain: Ten Sleep (TS). The resistant strain consisted of progeny from German strain x Harrison Lake strain backcrossed with a German strain. The disease resistance of the two strains has been documented, but performance data is needed. This report summarizes a second year of hatchery evaluation (including a separate experiment with a small subset of fish to see if GH would still out-grow the TS at low rations), plus the field performance of the two strains in two infected Utah reservoirs.
Hatchery performance—The percent hatch averaged 91.3% for TS and 92.7% for GH, and did not significantly differ. SGR ranged from 2.5 to 2.8 among all replicates and was significantly higher for GH (2.78) than for TS (2.55). Feed conversions were also significantly better for the hybrid (0.77) than TS (0.93). In a parallel test in which the two strains were fed either a low or high ration, GH had higher specific growth rates than TS at either ration level. GH were much more aggressive feeders than the TS strain.
Field performance— The fish were spray-marked with fluorescent grit (red = GH, green = TS) prior to stocking. A week after marking, the retention of the mark averaged 97.9% (red) and 88.5% (green). Fish were stocked into Porcupine (~10,000 of each) and Hyrum (13,008 GH, 14,309 TS) reservoirs on May 8 and 9, 2007, respectively. A portion of the fish of each strain was kept at the hatchery to stock at a larger size (45-63 g) and later date (July). Already spray-marked, these were given a pelvic fin clip to differentiate them from fish stocked in May. After adjusting marked numbers for mark retention, there were significantly more GH recovered than TS in both Hyrum and Porcupine reservoirs for both the May 2007 cohort and for all fish combined. For the July 2007 cohort, significantly more GH than TS were recovered in Hyrum Reservoir, but in Porcupine there was no significant difference in survival between strains in this cohort or for the 9 fish recaptured from the 2006 cohort. In Porcupine, the prevalence of M. cerebralis in GH was significantly lower than in TS, but not in Hyrum Reservoir (0% for both). Mean spores per fish also were significantly higher in TS than GH in Porcupine Reservoir. Creel data indicated that few marked fish were caught. The few that were caught indicated that there was no selective harvest of one strain over another. The data indicates that the new strain of rainbow trout can outperform the TS strain both in the hatchery and in the field and is recommended for further use in Utah fisheries management and whirling disease control programs.

TECHNICAL SESSION II
Sport Fish and Fisheries Management

ANGLER CATCH RATES OF WHIRLING DISEASE RESISTANT RAINBOW TROUT AND CREEL DATA FROM TWO UTAH RESERVOIRS

Randall W. Oplinger and Eric Wagner, Utah Division of Wildlife Resources, Fisheries Experiment Station, 1465 West 2nd North, Logan, UT 84321; (435) 752-1066; randyoplinger@utah.gov, ericwagner@utah.gov

Whirling disease affects many salmonid species including rainbow trout *Oncorhynchus mykiss.* In the past decade, it was discovered that the Hofer strain of rainbow trout is whirling disease resistant and thus may be a desirable strain for use in stocking programs. However, while it survives and grows well in the hatchery, the Hofer strain is highly domesticated and performs poorly in the wild. Recently, it was discovered that Harrison Lake strain rainbow trout also convey whirling disease resistance, however, this resistance is not found in all fish. Harrison Lake strain rainbow trout are from a lake source and perform better in the wild than the Hofer strain. At the Utah Division of Wildlife Resources Fisheries Experiment Station, Hofer strain rainbow trout were crossed with Harrison Lake strain rainbow trout with the goal of producing a hybrid that has the most desirable traits of both strains. Previous studies have shown that the Hofer x Harrison Lake hybrid is highly resistant to whirling disease. In the present study, we performed a creel survey to compare angler catch rates of Hofer x Harrison Lake rainbow trout with the State of Utah's standard hatchery strain (TenSleep). Equal numbers of fish from each strain were stocked into two Cache County, Utah reservoirs; Porcupine and Hyrum. None of the stocked fish from either strain were reported in the creel at Porcupine. Only three fish from each strain were reported in the creel at Hyrum. In general, the creel data shows that Hyrum receives more angling pressure than Porcupine and more fish are harvested from Hyrum than Porcupine. We found that >80% of anglers that visit each reservoir travel less than 30 miles to fish. Angler catch rates were typically higher at Hyrum than Porcupine. The most commonly harvested fish from Porcupine are rainbow trout and kokanee salmon. Rainbow trout are the most commonly harvested species at Hyrum. Overall, we estimate that about 1,500 fish are harvested annually from Porcupine and about 4,100 are harvested from Hyrum.

MANAGEMENT OF A CUTTHROAT PREDATOR *ONCORHYNCHUS CLARKI UTAH* TO CONTROL UTAH CHUB *GILA ATRARIA* IN A HIGH USE SPORT FISHERY

Alan Ward, Justin Robinson and Roger B. Wilson[2], Utah Division of Wildlife, Strawberry Project Office, 777 SR 319, Box 5, Heber, UT 84032; (435) 649-9368; alanward@utah.gov, justinrobinson@utah.gov; [2]Utah Division of Wildlife Resources, 1594 West North Temple, Suite 2110, Salt Lake City, UT 84114-6301; (801) 538-4814; rogerwilson@utah.gov

Strawberry Reservoir is a highly utilized cold-water sport fishery, sustaining as many as 1.5 million angler hours annually. Persistent problems with the introduced Utah chub *Gila atraria* have necessitated two reservoir-wide rotenone treatments, of which, the most recent treatment in 1990 was the largest complete treatment ever attempted to date. In an effort to avoid future rotenone treatments, the current management plan at Strawberry Reservoir includes the use of Bear Lake cutthroat trout *Oncorhynchus clarki utah* as a biological controller of Utah chub populations. Ongoing studies over the last 17 years have been focused on assessing the effectiveness of cutthroat predators in Strawberry on chub populations. Various fishing regulation changes have been utilized to create a functioning cutthroat predator population to control chubs in Strawberry. Rapidly expanding chub populations indicated that earlier (1990-2002), more liberal, cutthroat bag limits were not effective at creating the necessary predatory cutthroat population. Diet information suggested that large (>508 mm TL) cutthroat were more effective predators on the chubs, and a slot-limit protecting cutthroat from 15" to 22" (381 mm to 559 mm) was enacted in 2003 to produce these larger predators. The current slot limit has created a large population of cutthroat that are bigger on average than have previously been documented in the reservoir. Since 2003, overall chub populations have decreased by 61%, and age one chubs have decreased by 97%. Diet studies and resulting bioenergetics analyses indicated that cutthroat are responsible for considerable predation pressure on these chubs. The Bear Lake cutthroat have proven to be effective predators on Utah chubs in Strawberry Reservoir, and their predation is likely the major factor in the recent declines in chub numbers. However, adequate protection from over-harvest needed to be provided so that a large population of large cutthroat predators could be produced.

Spawning Ecology and Early Life-Stage Survival Influence the Distribution of Brown Trout in a Native Cutthroat Trout Stream

Jeremiah Wood (student) and Phaedra Budy; USGS Utah Cooperative Fish and Wildlife Research Unit, Department of Watershed Sciences, Utah State University, Logan, UT 84322-5210; (435) 764-0372; jrwood@cc.usu.edu, phaedra.budy@usu.edu

Cutthroat trout populations have suffered significant losses throughout the American West, and the presence of exotic fish species is widely documented as an important factor leading to these declines through predation on, and competition with, native species. Our objectives were to: 1) document the spatial distribution of brown trout spawning along an elevational gradient, and 2) evaluate the potential for differential egg hatching success. We evaluated these objectives in the Logan River, Utah, where cutthroat trout and brown trout exhibit distinct allopatric distributions common to Intermountain West streams. We conducted an intensive survey of brown trout spawning activity over a 50 km stretch of the Logan River via weekly redd counts in suitable areas throughout two spawning seasons, and we assessed brown trout hatching success by placing replicated eyed hatchery eggs and fertilized wild eggs in enclosed incubation boxes in river gravel at eight different sites along the elevational gradient of the river. We documented brown trout spawning in areas at elevations higher than we capture brown trout during our summer electrofishing surveys. Redd densities decreased with increasing elevation, similar to trends observed in adult population estimates. Egg survival also decreased consistently with increasing elevation, indicating that survival at this life stage may play a role in limiting the upper elevational extent of brown trout in the Logan River. We hypothesize extreme winter conditions in higher elevations cause lower egg-to-fry survival for fall spawning fish, therefore preventing brown trout from expanding into these areas. Our results have important implications in terms of predicting and understanding the potential for brown trout expansion into remaining cutthroat trout habitat under both current and changing environmental conditions.

USING GEODATABASES IN FISHERIES MANAGEMENT: THE CURRENT STATUS OF BONNEVILLE CUTTHROAT TROUT

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Many of the services that people utilize over the course of a day are database-driven. In fisheries management, geodatabases have refined and revolutionized how spatial data are stored and displayed, greatly improving the speed and consistency at which data can be extracted and analyzed. This allows for more accurate decisions to be made based on complex datasets. Unfortunately, large volumes of fisheries data are stored in paper files and various digital forms that are not conducive to efficient analyses. Here I present information extracted from the Bonneville cutthroat trout (*Oncorhynchus clarkii utah*) (BCT) geodatabase to demonstrate how information can be extracted and displayed with relative ease.

The BCT database was designed and built in 2004 with the objectives of standardizing the rangewide assessment of BCT. The USGS National Hydrography Dataset (NHD) was used as the base layer. The NHD adheres to a national standard and is the most comprehensive stream and lake data layer available. Data was entered during a series of workshops and has been updated yearly since. Biologists identified and mapped historic and current distributions, fish migration barriers, and conservation populations. All map layers were assigned attributes such as genetic status, habitat quality, coexistence of nonnative species, life history and barrier types. The information displayed here includes comparisons of historic and current distributions, genetic status by Geographic Management Unit, and maps showing the overlap of BCT with nonnative species.

By using a standard spatial layer, disparate data sources, such as fish and habitat surveys, stocking records, state water id's, and species databases can all be linked. This allows for a powerful network of data, providing an opportunity to develop dynamic status assessments and conservation plans of other sensitive species as well as understanding the distributions of nonnative and Tier III species.

DROUGHT INDUCED POPULATION BOOM OF STRIPED BASS AT LAKE POWELL

Wayne Gustaveson and Georg Blommer, Lake Powell Project, Utah Division of Wildlife, PO Box 1446, Page, AZ; (928) 645 2392; Wayne@wayneswords.com

Striped bass introductions into Colorado River reservoirs produced unique results. Over the past 30 years, there has been a direct relationship between shad abundance and striped bass condition (Kfl) at Lake Powell. Low shad numbers result in poor striped bass growth and eventual decline in striped bass numbers. As predatory pressure declines shad numbers rebound which in turn results in a striped bass population boom.

The boom and bust cycle was recently derailed by drought. Low water allowed sediment to be redistributed releasing stored nutrients. Bioavailable nutrients increased plankton numbers and shad forage. Striped bass and other game fish responded immediately with increased size, condition and reproduction. Unlike the past annual cycle striped bass and shad boomed for 3 consecutive years creating the best sport fishery ever seen at Lake Powell.

Lake fluctuation could be used as a management tool to manipulate fish populations in certain circumstances.

TRACKING FLUVIAL CUTTHROAT TROUT MOVEMENTS IN THE BEAR RIVER WITH STABLE ISOTOPE MARKERS

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We tested the application of nitrogen stable isotopes to discern fluvial from resident Bonneville cutthroat trout (BCT; *Oncorhynchus clarkii utah*) captured in a headwater stream. Fluvial BCT migrate from headwater streams with good water quality to main stem habitats with impaired water quality and become piscivorous. Resident BCT remain in headwater streams and are primarily insectivorous. We tested two predictions: (1) fluvial BCT have a higher $\delta^{15}N$ than resident BCT and resident brown trout (BNT; *Salmo trutta*), (2) fluvial BCT $\delta^{15}N$ reflects main stem habitat diet and N enrichment characteristic of impaired water quality. We found that fluvial BCT $\delta^{15}N$ was greater than resident trout $\delta^{15}N$. Our data also showed that fluvial BCT had high diet overlap with resident trout in headwater sites and that $\delta^{15}N$ of lower trophic levels was greater in main stem sites than in headwater sites. We conclude that the high $\delta^{15}N$ values of fluvial BCT relative to resident trout were acquired in main stem sites. We suggest that $\delta^{15}N$ is a simple and accurate marker of fluvial BCT.

FIELD COMPARISONS OF DIPLOID AND TRIPLOID RAINBOW TROUT

Charles B. Chamberlain, Michael J. Ottenbacher, and Michael J. Hadley, Utah Division of Wildlife Resources, P.O. Box 606, Cedar City, UT 84720; (435) 865-6107; chuckchamberlain@utah.gov

Approximately 1.5 million triploid rainbow trout are stocked into Utah waters annually. These fish are used to reduce the threat of hybridization with native trout species, improve performance and return of stocked trout by eliminating the negative effects associated with sexual maturation and spawning, and provide means to improve sport-fishing in native trout habitats. However, results from studies designed to document the performance of triploid fish are not consistent. To further evaluate the relative performance of triploid and diploid rainbow trout, three southern Utah reservoirs were stocked with equal numbers of fish from each study group for two consecutive years. During 2006 and 2007, experimental gill nets were used to sample study fish spring and fall, at all three reservoirs. Data collected from these fish were used to evaluate growth, survival, condition and gonad development. In addition, creel data were collected to document return to the creel of study fish. No differences were detected in return to the creel between diploid and triploid rainbow trout. However, differences in growth, survival, and condition were detected. In nearly all cases, differences favored diploid trout. Diploid trout exhibited larger sizes, better survival, and higher body condition. These differences were most pronounced when water quality was poor. Triploid fish performed poorly in low oxygen environments and should not be used in waters with winter or summer kill potential. Additional sampling will continue to evaluate study fish as they continue to mature.

TECHNICAL SESSION III
Native Species

SPAWNING HABITAT PREFERENCES AND FEEDING ECOLOGY OF TWO ENDEMIC BEAR LAKE WHITEFISHES (*PROSOPIUM SPILONOTUS* AND *P. ABYSSICOLA*)

Scott A. Tolentino and Brandon Albrecht[2], Utah Division of Wildlife Resources, 1030 N. Bear Lake Blvd., Garden City, UT 84028; (435) 946-8501; scotttolentino@utah.gov; [2]BioWest, Inc., 1063 West 1400 North, Logan UT, 84321

Spawning habitat preferences for two endemic whitefish species, Bonneville whitefish (*Prosopium spilonotus*) and Bear Lake whitefish (*P. abyssicola*), in Bear Lake were investigated during the winter of 2003-2004. Gill-net catches of Bonneville whitefish and Bear Lake whitefish over four different habitat types during their respective spawning seasons were used to estimate the relative utilization of each habitat type. Netting results indicated that both species select rock habitat as preferred spawning substrate. The gill-net catches over each substrate type were corroborated using underwater video to observe spawning fish. Spawning activity was only documented over rocky habitat even though all habitat types were investigated. The feeding ecology of both species was examined from 2002-2004. Bonneville whitefish were caught in highest numbers at depths < 35 m. At a size of < 250 mm total length, they were found to consume a variety of food types, with chironomids being the dominant item consumed (present in 59-100% of all stomachs that contained food). In contrast, Bear Lake whitefish were caught in the highest numbers at depths > 35 m and almost exclusively consumed ostracods (present in 71-85% of the stomachs that contained food). Although the greatest biomass of ostracods occurred at depth of ≤ 25 m, Bear Lake whitefish were not caught in large numbers at these shallower depths (no Bear Lake whitefish were caught at depths of < 15m) nor were they likely feeding in the most productive depths of Bear Lake. Even though they fed heavily on ostracods at depths where ostracods were not as prevalent, this food source is likely not a limiting factor in their diet.

STATUS OF THE BLUEHEAD SUCKER (*CATOSTOMUS DISCOBOLUS*) IN THE WEBER RIVER, UT

Aaron Webber, Utah Division of Wildlife Resources, 515 East 5300 South, Ogden, UT, 84405; (801) 476-2772; peterwebber@utah.gov

Historically, bluehead sucker occupied numerous drainages in the Bonneville Basin. Since 1988, extensive survey efforts have documented an absence of bluehead sucker from historical habitat with the exception of the Weber River. Between 2000 and 2005, only 22 individuals were documented in the Weber River and all but three were found within a 1.6 km reach of river near Coalville, Utah. Recent genetic research on the Weber River bluehead sucker indicate that this population has a unique mitochondrial DNA lineage and may be considered a unique species. Based on this information, we considered that this small population had the potential of becoming extinct. Our research during the summer of 2007 was thus intended to obtain baseline information, obtain an adult population estimate, determine movement, and obtain additional tissue samples for genetic analyses. In an attempt to obtain a population estimate we completed a two-pass, mark recapture effort in the entire 11.5 km reach between Rockport and Echo reservoirs. This effort resulted in the capture of 125 individuals, which equated to a population estimate of approximately 215 bluehead suckers. Of the 125 bluehead suckers captured, some had been PIT-tagged during previous years and these had grown only a few millimeters. In addition, only five juveniles (200 mm or less in length) were captured, indicating a senescent population. In August 2007, we installed two stationary flat plate antennas within the 1.6 km occupied reach and as of January 2008, we have documented 56 individual fish and have had over 600 hits. Considering the genetic background and potential lack of recruitment and/or reproduction, we feel this population is imperiled and warrants additional research and management focus.

COMPARISON OF SURVIVAL PROBABILITY OF STOCKED JUNE SUCKER FROM DIFFERENT SOURCES

Josh E. Rasmussen (student) and Mark Belk, Brigham Young University, Department of Biology, 401 WIDB, Provo, UT 84602; (801) 422-8615; josh_rasmussen@byu.edu

We used logistic regression modeling to analyze the survival probability of June sucker stocked into Utah Lake. We included the source of the fish (Fisheries Experiment Station, Red Butte Reservoir, and Camp Creek Reservoir), total length at the time at stocking and weight at the time of stocking as factors. A subset of the data was used to account for the limited overlap of lengths at the time of stocking among the sources. Given this subset, source and length significantly predicted the probability of survival of the stocked fish. Weight was insignificantly related to survival probability. We also used nonparametric Kaplan-Meier analysis to assess the time to capture in the spawning run of stocked individuals, including source, size and sex as factors.

GENETIC RELATIONSHIPS OF MOUNTAIN SUCKERS AND BLUEHEAD SUCKERS BASED ON MITOCHONDRIAL DNA

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Mountain suckers (*Catostomus platyrhynchus*) are widespread in the western U. S. and co-occur with bluehead suckers (*C. discobolus*) in three separate basins: the Bonneville, Colorado, and the Upper Snake River. Bluehead suckers are thought to have invaded the Upper Snake River and Bonneville basins from the Green River of the Colorado River Basin, and mountain suckers may have invaded in the opposite direction from the Upper Snake River. A third species, the desert sucker occurs in the Lower Colorado River. We are examining mountain sucker and bluehead sucker mitochondrial DNA from the Colorado River, Bonneville, and Upper Snake River basins as well as mountain sucker from the Lahontan and desert sucker from the lower Colorado. Based on cytochrome b, bluehead suckers from the Upper Green River Basin had 0.8% sequence divergence. Approximately 2.6% to 2.8% sequence divergence separates the mountain sucker in the Bonneville Basin from bluehead suckers. However, bluehead suckers in the Weber River of the Bonneville Basin differed from those in the Green River by about 2.2% sequence divergence. In addition, specimens that morphologically appeared to be mountain suckers in the Snake River drainage basin (Raft River of northern Utah) and from the upper Green River (Blacks Fork, UT) contained mitochondrial DNA that was more similar to bluehead suckers of the Weber River than to mountain suckers of the northern Bonneville Basin. Mountain suckers from the Blacks Fork were similar to Green River bluehead suckers. Also, bluehead suckers were more closely related to the desert sucker than mountain suckers were to the desert sucker.

CONSERVATION AQUACULTURE OF LEATHERSIDE CHUB

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Northern leatherside chub (*Lepidomeda copei*) adults originating from Yellow and Deadman creeks, Summit County, UT, were placed in replicate tanks at densities of either 5 or 10 fish per tank. An additional tank held 14 adults. Within each tank, the fish were given two spawning substrate options: either medium cobble or glass marbles on plastic mesh. The latter option was evaluated to potentially reduce the labor required to harvest eggs. The total number of eggs and fry produced was not significantly higher at densities of 10 spawners per tank (2,888) than at densities of five per tank (1,420). In contrast, the average number of eggs laid per spawning event was significantly higher in densities of 10 (144) versus 5 fish (83). Significantly more eggs were recovered from the rock substrate (8,870) than the marbles (894).

A second study monitored a known-age cohort of northern leatherside chub to determine the age at first spawning. No eggs were recovered from the tank when the fish were Age 1, but at Age 2, 572 eggs were harvested, indicating that reproduction begins at 2 years of age. Eggs incubated at 24.5°C had hatching rates of 19.4% ± SD 29.4, which did not significantly differ from the percent hatched at 18.8°C (21.6% ± 28.2). Disinfection experiments evaluated the efficacy of formalin or iodine for reducing egg mortality. Survival was significantly higher for eggs given a single formalin treatment of 1500 ppm for 15 min upon harvest (41.9 % ± SD 16.1%), than for eggs treated with 1500 ppm formalin for 15 min on three consecutive days (one exposure each day; 0.0% ± 0.0% hatch). There was no significant difference in survival to hatching among eggs treated with 100 mg/L active iodine on either Day 1, 2 or 3 after harvest. Fry fed a probiotic diet (*Artemia* fed *Lactobacillus* sp.) did not significantly differ in growth or survival from fish fed *Artemia* alone or a Tetramin® ration. In another test, fry fed *Artemia* continuously over 7-8 h via an automated drip system had higher specific growth rates than fry fed the same ration manually four times per day.

STATUS OF LEAST CHUB (*IOTICHTHYS PHLEGETHONTIS*) IN UTAH

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The least chub is a small monotypic minnow endemic to the Bonneville Basin of Utah, located in the Great Basin of western North America. Faced with many threats including habitat loss through water diversion, development, and livestock grazing; and competition and predation by non-native fish introductions, the Least Chub Conservation Agreement and Strategy was initiated in 1998 in response to population declines evident through monitoring efforts. Several conservation actions were developed in the conservation agreement and strategy and implemented with the goal of protecting and enhancing populations of least chub in Utah. Many efforts have taken place and are underway to address the conservation actions. These efforts include: habitat enhancement, habitat protection, restoring hydrologic conditions, nonnative species control, range expansion (surveys/inventory, baseline studies, genetic integrity, refuges/reintroductions), monitoring, mitigation, regulation, and information and education. Great achievements have been made since the initiation of the conservation agreement and strategy to conserve, enhance, and protect the least chub populations. Yet, this past summer 2007, the least chub was petitioned for listing under the Endangered Species Act for the second time. Since the first listing petition in 1995 (warranted but precluded), many surveys and studies have provided valuable information and insight into least chub range, life history, and population status. Habitat enhancement projects and reintroductions have expanded the least chub range to more historical locations than before 1995. However new proposed water development projects threaten least chub populations in the Utah West Desert.

THE USE OF GROW-OUT PONDS AND HATCHERIES IN THE RECOVERY OF JUNE SUCKER, *(CHASMISTES LIORUS)*

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June sucker (*Chasmistes liorus*) are endemic to Utah Lake in central Utah and are federally listed as endangered. June sucker are raised at the Fisheries Experiment Station (FES) and 78,000 have been stocked into Utah Lake since 1994. 8,375 June sucker were stocked into Utah Lake from a refuge population at Red Butte Reservoir in 2005. Higher numbers of June sucker from Red Butte returned to the Provo River to spawn than from FES, which led to investigating the use of grow-out facilities in June sucker recovery. June sucker from one progeny lot at FES were raised in the warm-water recirculation facility and others from the same lot in the cold-water flow-through facility. June sucker from this same lot were also placed in outdoor dirt grow-out ponds at Rosebud Ranch and Springville Fish Hatchery. Growth, survival, and health condition factors were monitored monthly and prior to stocking. All fish were marked with passive integrated transponder (PIT) tags or coded wire tags (CWT) pre-stocking so when they are recaptured, rearing location is known. Pre-stocking and monthly data show that fish at FES had greater growth, survival and health condition factors than those in the grow-out facilities. While growth and survival were greater at FES, other potential benefits of grow-out facilities such as predator awareness and feeding behaviors that better prepare fish for survival in Utah Lake are more difficult to measure. The use of both hatcheries and grow-out facilities in conjunction may result in higher survival in Utah Lake and aide in the recovery of June sucker.

Comparison of Two Cage Designs for the Grow-Out of Juvenile June Sucker in Utah Lake

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The June sucker, *Chasmistes liorus*, is an endangered species endemic to Utah Lake, a shallow lake in the Bonneville basin. Recovery efforts have focused on producing hatchery-reared fish to bolster the decimated population in the lake. Due to concerns about the fitness of hatchery-reared fish, managers have begun searching for alternative sites to acclimate hatchery produced suckers prior to being stocked into Utah Lake. Recent studies have indicated that larval suckers could be reared in net pens or cages in Provo Bay of Utah Lake during the summer months, before stocking them into the lake, thus providing wild-reared suckers. We tested two designs of large cages (4 x 2.5 x 1 m), one fixed and one floating, to examine survival and growth of hatchery produced larval June suckers at two densities (50 and 150 fish/m^3). Survival and growth was determined after 66 d (10 July – 14 September). Survival ranged from 35 – 60%, and was not significantly different between cage types or densities. Growth rates were higher in the floating cages compared to fixed cages, and higher in the low density compared to the high density. Growth rates ranged from 0.44 – 0.67 mm/d. These results demonstrate that cages could be used to raise wild-reared suckers at low cost in addition to hatchery production.

AGE AND GROWTH OF UTAH *COTTUS BAIRDII* POPULATIONS

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Mottled Sculpin *Cottus bairdii* is common throughout colder waters in North America. No extensive descriptions of age and growth patterns have been completed for this species in the western United States. Because of the cool water requirements of *C. bairdii*, we hypothesized that elevation could be a major determinant of annual growth rate. Twenty-five populations of *Cottus bairdii* from Utah were examined to determine the relationship between elevation and growth rate. The elevation of the collection sites ranged from1377m (4518ft) to 2685m (8809ft). Sample Sizes ranged from 23 to 121 individuals, with the average sample being 50 specimens. The standard length of each fish was recorded and otoliths were removed, mounted, and ground. The prepared otoliths were then photographed under magnification and the images examined to determine the age of the fish. Distance from the focus to the edge of the otoliths was measured to quantify otolith size – fish length relationships. Distance from the focus to each annulus was also measured for size-at-annulus back calculations. The age structure of each population also allowed an estimate of the proportion of fish that grow to maturity. The data indicated that elevation has a significant growth effect. The onset of reproduction began for *c. bairdii* at three years of age. The maximum age of fish in the populations in our data sets was 9 years of age, with a mean maximum age of just over 6 years.

TECHNICAL SESSION IV
Ecological and Habitat Issues

USE OF PREDICTIVE MODELS TO ASSESS THE IMPORTANCE OF RIVERSCAPE CONNECTIVITY ON THE DISTRIBUTION OF AN IMPERILED FISH SPECIES

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Development of sound conservation strategies for imperiled species requires the identification of occupied habitat and potential threats to these habitat units. Bull trout *(Salvelinus confluentus)* populations have experienced local declines in distribution and abundance throughout their range; however, in many river systems, species presence/absence and distribution remains unknown. Building on previous approaches, we used a combination of existing redd distribution and abundance data to determine bull trout habitat occupancy in the John Day River Basin, Oregon, to validate a landscape model of distribution and connectivity between occupied habitat units. Connectivity can influence the occurrence and persistence of local bull trout populations through dispersal from surrounding populations. We delineated potential habitat patches (local populations) as stream catchments of adequate size (>400 hectares) and thermal suitability (>1700 meters elevation as a surrogate for < 16° C maximum summer temperature) to support juvenile bull trout populations. We then used GIS-based analysis to estimate distance between potential patches and evaluated the relative influence of a set of hypothetical connectivity indices on patch occupancy. Connectivity factors of patch size and distance to other patches appear to be important factors explaining the current distribution of bull trout populations; however, consideration of additional biological factors (e.g., barriers to movement and the presence of other species) may increase the accuracy of models for predicting bull trout occurrence and distribution under different scenarios of habitat restoration or climate change. Models of species occurrence provide requisite predictions of suitable habitat and connectivity, and may streamline sampling efforts as well as increase our understanding of the implications of habitat fragmentation.

UTAH DIVISION OF WILDLIFE RESOURCES' NEW ANS PROGRAM

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Aquatic nuisance species seem to be popping up weekly, changing our management options for aquatic resources, possibly forever. The recent find of quagga mussel (Dreissena bugensis) in Lake Mead and other lower Colorado River Basin waters during January 2007 caused a great stir amongst aquatic resource managers across the west. This find spurred Utah Division of Wildlife Resources to establish a new aquatic nuisance species (ANS) program in July 2007. The program will be founded upon the backs of 41 new employees (2 coordinators, 5 biologists, 5 conservation officers, and 29 wildlife technicians) and is funded with $1.64 million of general fund. The immediate focus of the ANS program will be to keep Dreissenid mussels (quagga mussel, zebra mussel & Conrad's false mussel) out of Utah or contain them to areas that become infested. The ANS program has already began to expand its vision to attack other ANS species (e.g. New Zealand mud snail). This programmatic growth is unprecedented within UDWR, and is necessary to combat the uncontrolled negative impacts from ANS. The program's message to ANS is: "WATCHOUT, WE ARE COMING."

FACTORS INFLUENCING BROOK TROUT DISTRIBUTION IN THE MILL CREEK DRAINAGE, UTAH

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Brook trout (*Salvelinus fontinalis*) are implicated as a primary factor leading to the decline in distribution and abundance of native cutthroat trout (*Oncorhynchus clarkii*). To determine the factor(s) that influence the distribution and abundance of brook trout in Mill Creek and its tributaries, we collected a suite of biotic and abiotic data from ten index sites throughout the drainage. Additionally, at each index site, we conducted three-pass depletion electroshocking surveys to determine fish species composition and abundance. To determine drainage-wide population connectivity and invasion potential, fish movement was assessed using two-way weir traps. At the meta-population scale, based on GIS analysis, stream gradient appears to limit brook trout expansion into some portions of the drainage. At the local population scale, regression analyses indicate that water chemistry and minimum water temperature may influence abundance of brook trout. Using a mark/recapture model in Program MARK, we determined that large-scale fish movement was minimal, further suggesting that local conditions limit further expansion of this population. These findings will help prioritize cutthroat trout management actions in the Mill Creek drainage, and will be useful in determining why brook trout are successful invaders in some systems, yet, remain in low and patchy abundance in others.

POTENTIAL IMPACTS OF A WIDELY USED HERBICIDE TO UTAH STREAM INVERTEBRATES

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Observations of spraying of the herbicide Veteran 720 into the Logan River by the Utah Department of Transportation (UDOT) during July 2007 led us to investigate potential impacts. The dominant active ingredient in Veteran 720 is 2,4-D, a readily available, haphazardly sprayed common herbicide used to control broadleaf plants. Direct effects of 2,4-D were evaluated by aquatic invertebrate bioassays. Invertebrates were placed in microcosms with 4 herbicide concentrations: 0% – control, 0.65% – low, 1.3% – medium, and 4% – high. Salmonflies (Plecoptera: Pteronarcyidae *Pteronarcys californica* and *Pteronarcella badia)* exposed to high concentrations were dead within 2 hours and those exposed to low and medium concentrations died within 8 hours. *Hesperoperla pacifica* (Plecoptera: Perlidae), also known as golden stoneflies, exposed to high concentrations died in 1.5 hours and those exposed to low and medium concentrations died within 4 hours. Controls treatments for both taxa had 100% survivorship. To test the indirect effects of spraying roadside vegetation we put dead fallen leaves from trees that had been sprayed by UDOT in July and salmonflies into flow-through screened canisters that were placed in the Blacksmith Fork River in September 2007. After 20 weeks, salmonflies exposed to treated leaf litter experienced 24% higher mortalities compared to control cages. Throughout the experiment, mortalities in cages with herbicide treated leaf litter were higher than controls. These results show that both direct and indirect application of a commonly used herbicide along stream corridors can cause high mortalities in aquatic invertebrates, even at low concentrations. Additionally, we report on and suggest that broad-scale spraying of 2,4-D throughout the Logan River Basin by the U.S. Forest Service in the 1950s and 1960s may be responsible for the disappearance of salmonflies that occurred in the Logan River 40 years ago.

Estimating Dispersal of Spring Invertebrates Through Genetic Diversity in Threatened Habitats of the Great Basin

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The Southern Nevada Water Authority has begun to develop water rights to carbonate aquifers in many isolated basins of eastern Nevada. Springs in pluvial lake beds are at risk of drying if the surface water table is depressed by the pumping. It is unknown how unique the invertebrate communities in these springs are within or between basins. Furthermore, it is unknown which taxa are capable of recolonizing if dried springs are restored through mitigation efforts. Analyses on <i>Hyallela azteca</i>, a poor dispersing amphipod, in the Great Basin have revealed a tremendous degree of cryptic diversity and endemism despite morphologically being recognized as a single species (Witt et al. 2006, Mol. Ecol.15:3073-3082). We hypothesize that aquatic invertebrates with low dispersal ability will tend to be more unique, in terms of genetic diversity, within basins than between basins compared to invertebrates with high dispersal ability. Multiple springs from each of six basins were qualitatively sampled. Two of these basins will be directly impacted by the pumping project. Cytochrome c oxidase subunit I, a mitochondrial gene, and the large ribosomal subunit 28S, a nuclear gene, were amplified from isolated <i>H. azteca</i> DNA and sequenced. A parsimony phylogeny with well supported bootstrap values showed great divergence between spring populations. Genetic divergence averaged 4% within populations and 15% between. Snake Valley populations were especially different from the other basins and separated out early in the phylogeny. These preliminary results are part of a population genetics study of strong and weak dispersers in these systems.

AN UPDATE ON COLDWATER DISEASE IN UTAH

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Flavobacterium psychrophilum, the causative agent of bacterial coldwater disease, is common in freshwater salmonids and has been shown to cause high mortality in commercial and public aquaculture operations around the world. First isolated in Washington State from coho salmon *Oncorhynhus kisutch* in 1948, the bacteria continues to spread. Epizootics initially occurred most frequently at 4-10°C with mortalities decreasing as temperatures rise above 15°C. Increasingly, disease outbreaks are occurring at warmer temperatures. Fish of all ages are susceptible to infection, but clinical disease has been shown to occur most often in young fish.

First reported in Utah in 1996, the bacteria has since been implicated in disease outbreaks and significant losses at several state hatcheries. It is now considered the most serious bacterial pathogen affecting hatchery fish in Utah. The disease was initially reported in rainbow trout but has now been diagnosed in several cutthroat trout strains. The bacterium is showing an alarming trend towards antibiotic resistance which has researchers looking for alternative approaches to dealing with infections.

One such approach has shown that outer membrane fraction (OMF) proteins from the bacteria may provide protection from disease. In this study, serum responses of juvenile rainbow trout were characterized using an enzyme linked immunosorbent assay (ELISA) after intraperitoneal injection with an OMF vaccine. At the end of both 6 and 12 weeks, trout immunized with the OMF combined with adjuvant showed significant antibody responses. All control groups had no significant antibody response. Trout in the study were then challenged by injection with live *F. psychrophilum* bacteria to assess the protective ability of this vaccine. The OMF vaccine combined with adjuvant provided protection with a relative percent survival rate of 77.8%. This suggests that use of OMF proteins combined with adjuvant provides enhanced protection from disease. Additional vaccine trials are underway to further assess the protective capacity of OMF vaccines.

An Overview of Endocrine Disrupting Compounds: Prevalence and Impacts to Fish

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Endocrine disrupting compounds (EDCs) have been a hot topic in the media and have even been featured in an episode of CSI "The Case of the Cross-Dressing Carp". EDCs are defined by Endocrine Disruptor Screening and Testing and Advisory Committee of the EPA as "An exogenous chemical substance or mixture that alters the functions(s) of the endocrine system and thereby causes adverse effects to an organism, its progeny, or (sub) population." Disruption of the endocrine system can occur in various ways. EDC's can stimulate or inhibit the endocrine system, causing overproduction or underproduction of hormones. They can also minic or block hormones by binding to hormone receptors and cause inappropriate physiological responses. Vitellogenin is an egg yolk protein that is normally synthesized by the liver in female egg-laying vertebrates and sequestered in developing oocytes as yolk. Although vitellogenin production is restricted to females, exposure to estrogen or estrogen mimicking compounds can also trigger gene expression in males and result in vitellogenin secretion. The detection of vitellogenin and the presence of oocytes in male fish have been reported worldwide. Recent findings and the need for a program to properly dispose of unused pharmaceuticals are discussed.

Predicting the Growth Potential of a Shallow, Warm-Water Sport Fishery: A Spatially Explicit Bioenergetics Approach

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Spatial description of aquatic habitats is necessary to accurately predict growth and consumption responses of game fish in large, heterogeneous reservoirs. Cutler Reservoir located in northern Utah, demonstrates a wide range of physical conditions and potential water quality problems that include high summertime water temperature, low dissolved oxygen, and high nutrient loading. To quantify the interaction that these water quality parameters have on fish growth potential and subsequent habitat quality we measured a suite of biotic and abiotic variables across six sites during 2006. We combined measurements of water temperature, fish distribution, diet, and growth into a bioenergetic-based model; and then used a GIS framework to spatially delineate the growth potential of the predominant species throughout the reservoir.

Based on our model results, the growth potential of our target species varied spatially and seasonally in response to changes in the thermal habitat of the study area. Black crappie and walleye growth potential peaked during spring with a second, lower peak during fall. Both walleye and crappie experienced reductions, 103% and 99% respectively, in their average daily growth potential from May 21st to July 30th, as thermal conditions became limiting for these species. Conversely, channel catfish average daily growth potential increased by 78% during this same period, achieving the highest rates during the summer as temperatures reached the optimal range for this species across most of the reservoir. Our model suggests that game fish within Cutler Reservoir accomplish the majority of their annual growth during narrow periods of habitat suitability within the summer growing season. Ultimately, this model will provide a tool for identifying the factors potentially limiting fish populations in Cutler Reservoir as well as explaining the role of water quality in structuring the fish community of the water body.

POSTER SESSION

DETECTION OF CHEMICAL ALARM CUES IN AN ENDANGERED LAKE SUCKER

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The June Sucker (*Chasmistes liorus*) is a lake sucker, endemic to Utah Lake, UT federally listed as an endangered species since 1986. Historically the primary native piscivorous fish in Utah Lake was the Bonneville cutthroat trout. Since 1895, several nonnative predatory fish including Largemouth Bass (*Micropterus salmoides*), Walleye (*Stizosteodon vitreum*), White Bass (*Morone* chrysops), and Channel Catfish (*Ictalurus punctatus*) have been introduced and are now thriving. For the past five years, a large scale stocking program has been instituted by the June Sucker Recovery Program, as directed by the USFWS 1999 recovery plan. The goal of this stocking program is to enhance June Sucker numbers to levels where natural reproduction can sustain a viable population. The June Sucker is in the family Catostomidae that is included in the super-order Ostariophysi that possess the ability to produce and detect chemical alarm cues. While many species have been tested for their detection and learning abilities there has been little work on fish in the family Catostomidae. My data show that predator-naive June Sucker do not have an innate recognition of predator odor, but that they are able to detect conspecific alarm cues. I measured the behavioral response of hatchery raised, one-year old June Sucker exposed to three stimuli. Tank area usage, number of fish moving, distance moved, and dashing behaviors were recorded for 5 minutes prior to exposure to a stimulus and for 5 minutes after at 15 second intervals. The goal of this study is to determine if June Sucker can associate conspecific alarm cues with predator presence. If so, a training program could be implemented at the hatchery and lead to improved survival of stocked fish, eventually increasing the natural recruitment, aiding in recovery of the June Sucker.

HABITAT REQUIREMENTS, VITAL RATES, AND MOVEMENT PATTERNS OF THREE ENDEMIC FISH IN THE SAN RAFAEL RIVER, UTAH

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The native Colorado River Basin icthyofauna represents one of the most imperiled fish assemblages in the world. Habitat alteration, water development, fragmentation, and interactions with non-native species have led to severe declines in both distribution and abundance of many endemic fishes. The bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*) and roundtail chub (*Gila robusta*) are species native to the Colorado River Basin which have experienced severe declines in abundance and distribution and thus, placement on the Utah Sensitive Species List. However, all three species are found in the San Rafael River in southern Utah, providing an area of high conservation priority. Our goal is to estimate vital rates, migration patterns, and habitat requirements for each species and life stage, the critical components for completing robust population viability analyses and to evaluate management options. In 2007, we sampled fish from 22 systematically selected (random seed) 300-m stream reaches. All fish were weighed, measured, and released. Target species were PIT tagged. Habitat parameters were recorded in each sampled reach. Although non-native fish comprised the majority of our catch, 20 native fish were PIT tagged, including flannelmouth sucker and roundtail chub of multiple age classes, along with a pair of adult bluehead sucker. Age-0 flannelmouth sucker distribution showed a strong correlation with backwater habitat. Although successful reproduction was documented, recruitment was likely negligible as water development and drought led to the near-complete dewatering of the San Rafael River in the summer of 2007. Future research will include the installation of a solar-powered antennae and additional early-spring sampling. The data collected as part of this study will be used to develop a population viability model, including source and sink dynamics that will allow resource managers to plan future research, assess vulnerability, and rank management options for these sensitive species.

SPAWNING ECOLOGY AND EARLY LIFE HISTORY OF BONNEVILLE CUTTHROAT TROUT (BCT) IN NORTHERN UTAH

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The Logan River, in northern Utah, is home to one of the largest remaining metapopulations of imperiled Bonneville cutthroat trout (BCT) throughout the Bonneville Basin. Given the importance of the reproductive stage to overall persistence, there is a need to better understand the spawning ecology and early life history stages of these fish. Spawn Creek is a 2nd-order tributary to the Logan River and is anecdotally known as an important spawning area for BCT. In 2007 spawning surveys were conducted in Spawn Creek to document the timing, spatial distribution, and minimum number of redds and adult BCT. A total of 113 unique redds were identified with peak spawning occurring on the descending limb of the hydrograph, between May 5 and May 25. We also completed a pilot study of spawning surveys throughout the Logan River. These surveys revealed that the spatial distribution of BCT spawning is far more widespread than originally thought: spawning encompassed more than 25 rkm for a total of approximately 870 redds. In addition, we observed noticeable differences in the density of BCT redds among sites; for example, in Little Bear Creek and Temple Fork, we counted a high density of redds at 98 and 130 redds per km, respectively. In contrast, in Cottonwood Creek and Franklin Basin we counted only 24 and 54 redds per km, respectively. We will use these data to select index sites for intensive future studies of spawning ecology, spawning habitat and egg-to-fry survival; the sites will be chosen to capture the range of spawning habitat used, within a paired study design of high and low density areas generally paired by similar geology and physical stream characteristics. Future conservation efforts for BCT must address potential limiting factors, as related to spawning, to the persistence of BCT throughout the Logan River.

TAXONOMIC DIVERSITY OF SPRING INVERTEBRATES IN THREATENED HABITATS OF THE GREAT BASIN

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Las Vegas, Nevada, through the Southern Nevada Water Authority (SNWA) is developing a pipeline to mine deep aquifers in Eastern Nevada. This has the potential to drop the water table and result in drying of springs and wetlands. We collected spring invertebrates from six closed basins of Eastern Nevada and Utah, some of which would be affected by the ground water exploitation. The number of taxa ranged from a high of 35 genera from a spring near Rosenlund Ranch in Spring Valley to a low of ten genera from Indian Spring located in Steptoe Valley. Of the 105 total genera identified, 49% were unique to a single valley and 43% were found in a single spring. We found *Hyalella Azteca*, *Gammarus lacustris*, and *Callibaetis* spp. to be among the most common species. This correlates with other research in the neighboring Bonneville Basin. We assessed the extent of taxonomic distinctness using exploratory techniques – cluster analysis, and funnel graphs. The data showed a broad range of taxonomic diversity within individual springs but not between valleys

Life History of Introduced Burbot in Flaming Gorge Reservoir

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During the last decade Burbot, *Lota lota*, was introduced into the Flaming Gorge Reservoir. Typically found in more northern waters the burbot are thriving in this reservoir that is not part of their historical range. This coming year we will examine age structure, population density, trophic position and prey selection of burbot in the reservoir. Preliminary samples collect in October 2007 indicated that most individuals in the populations were less than 4 years old. Growth rates were high and fall diets consisted mostly of crayfish. Our goal is to examine the impact of burbot on the popular sport fishery and ecology of Flaming Gorge Reservoir to aid in future management decisions.

EVALUATION OF FISH MUCUS COMPONENTS AS AGENTS FOR DISCHARGE OF TRIACTINOMYXON POLAR CAPSULES

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Whirling disease, caused by the salmonid parasite *Myxobolus cerebralis*, has been the subject of study since its discovery in 1893. Despite all of the scientific inquiry, the life cycle of *M. cerebralis* was unknown until 1984. Waterborne triactinomyxons (tams) are released from an oligochaete worm *Tubifex tubifex,* float in the water column, attach to a salmonid and then invade its secondary host through a hole in the epidermis. Invasion into the fish host is facilitated by 3 polar capsules, with eversible polar filaments that attach to the fish. Several studies have investigated the mechanism in which tams recognize their host and the stimuli that cause polar filament discharge. These studies demonstrated that a chemical stimulus from salmonid mucus must precede a mechanical stimulus to elicit polar capsule discharge. This study investigates the ability of isolated fish mucus components to induce *M. cerebralis* triactinomyxon polar capsule discharge. Small glass tabs were covered with agar and allowed to set. The agar was overlaid with; fish mucus; bovine salivary mucus; or 0.01 M and 0.1 M solutions of glucosamine, aspartic acid, galactose, serine, fucose, threonine, D+galactosamine, or N-Acetyl neuraminic acid, and allowed to dry.

Tabs were held with forceps and oscillated in 1 ml of fluorescein-labeled tams for 1 minute. Tabs were rinsed with well water and evaluated under a fluorescent microscope at 20x for tams with discharged polar capsules and sporoplasm. The agar coated glass tabs provided a medium in which *M. cerebralis* tams could discharge polar capsules and inject sporoplasm. The only solution that elicited a significantly stronger response than the positive control was 0.1 M N-acetyl neuraminic acid.

SEASONAL DISTRIBUTION, AGGREGATION, AND HABITAT SELECTION OF COMMON CARP IN A SHALLOW, EUTROPHIC IOWA

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The common carp *Cyprinus carpio* is widely distributed and frequently considered a nuisance species outside its native range. Common carp are abundant in Clear Lake, Iowa, where they are both a symptom of degradation and an impediment to improving the water quality and fishery. We used radio telemetry to quantify seasonal distribution, aggregation, and habitat selection of adult and subadult common carp in Clear Lake in an effort to guide future control strategies. Over a 22-month period we recorded a total of 1,951 locations from 54 adults and 60 subadults implanted with radio-transmitters. Adults demonstrated a clear tendency to aggregate in an offshore area during the late fall and winter and in shallow vegetated areas prior to and during spring spawning. Late fall and winter aggregations were estimated to include a larger percentage of the adult population than in spring. Subadults aggregated in shallow vegetated areas during the spring and early summer. Our study when considered with previous research suggests repeatable patterns of distribution, aggregation, and habitat selection that should facilitate common carp reduction programs in Clear Lake and similar systems.