

COLORADO DIVISION OF PARKS AND WILDLIFE REPORT
WESTERN ASSOCIATION OF FISH AND WILDLIFE AGENCIES
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AQUATIC SPECIES CONSERVATION

Cutthroat trout

Recent genetic and meristic studies determined that each major river drainage in Colorado historically supported a genetically distinct cutthroat trout lineage, resulting in six discrete forms rather than the four previously recognized subspecies. Ancestral distribution of the four extant lineages had previously been obscured by extensive movement of trout through stocking activities. Notably, the true greenback cutthroat trout (Colorado's state fish) was discovered to have been native only to the South Platte basin, and to persist in just a single stream outside of its native range. A captive brood stock was developed, and in 2014 - 2016 fish of this lineage were repatriated into Zimmerman Lake in the headwaters of the Cache la Poudre River. Overwinter survival has been very good, and in 2016 the first greenback spawn operation at Zimmerman Lake was conducted, yielding over 58,000 eggs. Four streams and two lakes in the South Platte Basin were reclaimed in 2015-16 in anticipation of restocking with South Platte native cutthroats. Greenbacks were stocked into three of these streams in 2016, resulting in 9 miles of new occupied habitat. Additional reclamations, barrier projects and stocking are anticipated in 2017, which when completed would create a total of approximately 12 stream miles and 39 lake surface acres of occupied native greenback habitat within the South Platte Basin. The USFWS, the Greenback Cutthroat Trout Recovery Team (chaired by CPW), and the Colorado River Cutthroat Trout Conservation Team, continue to explore the taxonomic implications on recovery goals and status of the four lineages that remain on the landscape today.

Three-species (Bluehead Sucker, Flannelmouth Sucker, Roundtail Chub)

CPW continues extensive three-species work in several areas including genetic delineation of lineages, brood stock development and captive breeding of all three species, research on thermal requirements, and survey work to better characterize distribution and abundance. In 2016 CPW stocked approximately 6,000 bluehead suckers into the Mancos and Dolores Rivers in southwest Colorado, and approximately 5,000 into Milk Creek (a White River tributary) and the Yampa River in northwest Colorado. The latter is an experimental treatment to evaluate the potential for stocking to offset impacts of hybridization with white sucker, a sympatric species not native to the drainage. These efforts are expected to continue for several more years.

Arkansas darter

CPW and other Arkansas Basin states participated in a range-wide status assessment throughout much of 2015 - 2016. Based on the information developed in this process, the Fish and Wildlife Service determined the species to be "not warranted" for federal listing and removed it from the candidate list, in October 2016. CPW will continue actively working on conservation of this species. For example, CPW stocked over 17,500 Arkansas darters into five waters in 2016, including establishment of one new potential population.

Eastern plains fishes

CPW stocked over 142,000 plains minnow, suckermouth minnow, and southern redbelly dace in 2016. We also maintained a broodstock of Common shiners at the Native Aquatic species

Restoration Facility (NASRF), in anticipation of stocking in 2017. A dedicated plains fish researcher continues to study aspects of plains fish ecology relevant to conservation, and several other field staff devote significant resources to plains fish recovery and management.

Boreal toad

The Boreal Toad Recovery Team (chaired by CPW) continues work on a review and update of the 2001 Recovery Plan and Goals. CPW continues to conduct extensive annual monitoring, survey and culture work on boreal toad. Additionally CPW provides material and logistical support to a suite of boreal toad researchers studying disease resistance, captive husbandry techniques, and population demographics. In 2016 CPW funded a groundbreaking initial field test of a probiotic treatment that may confer resistance to *Batrachochytrium dendrobatidis* (Bd), a virulent amphibian pathogen and the primary cause of boreal toad population declines.

Colorado River endangered fishes

CPW is a founding partner in the Upper Colorado Endangered Fish Recovery Program, and participates extensively in recovery activities for the Colorado pikeminnow, razorback sucker, bonytail, and humpback chub. Ongoing efforts include production and stocking of bonytail, riverine habitat improvement projects, population estimation and non-native fish control activities, both under the auspices of the Recovery Program and on our own initiative and resources. In 2016 a \$1.3 million net was installed at Elkhead reservoir to prevent non-native fish escapement into designated critical habitat. \$500,000 of this funding was provided by Colorado through Species Conservation Trust Fund awards jointly secured by CPW and the Colorado Water Conservation Board (CWCB).

Rio Grande sucker and Rio Grande chub

CPW and other state, federal and tribal agencies have established a range-wide Conservation Team for these two species, and held an initial meeting in 2016. Work is underway to produce a database conservation strategy and agreement, and other cooperative tools for conservation and recovery of these species.

AQUATIC RESEARCH

Dissolved Oxygen Tolerances

Dr. Eric Fetherman and Chris Praamsma of our Research Hatchery, along with Jon Wardell and veterinary student Marta Hura have recently published a paper on dissolved oxygen tolerances of rainbow trout in the North American Journal of Aquaculture. This paper details two experiments, one where four strains of rainbow trout were exposed to a short-term decrease in dissolved oxygen concentrations while simultaneously being exposed to formalin, and the second where the same four strains were exposed to a prolonged decrease in dissolved oxygen. Larger fish were found to be more sensitive to low dissolved oxygen conditions in this experiment. Pure domestic-strain fish (Hofer) were found to be more tolerant of low oxygen concentrations with respect to mortality than pure wild strain (Harrison Lake) fish. Exposure to formalin was not found to diminish tolerance of rainbow trout to low oxygen in the absence of other stressors.

Native Cutthroat Trout

Dr. Kevin Rogers, along with numerous other experts in the field, has published an article in

Fisheries magazine, which describes the status of native Pacific Trout across their range. This includes a discussion of the current taxonomic relationships of the species, subspecies, and lineages of these fish, as well as a description of the current threats to their persistence into the future.

Cryopreservation

Our Aquatic Research Section is collaborating with the USDA-ARS national animal germplasm program housed at Colorado State University. The facility stores seeds and gametes from plants and animals of interest to the agriculture community for preservation and to provide genetic security for select populations. We have been working with them over the last several years, primarily to cryogenically store trout sperm that is later thawed and used to fertilize eggs from other strains of trout to create crosses of fish that would typically not overlap in spawn timing. A paper was recently published in the journal *Cryobiology*, co-authored by Dr. Phil Purdy from USDA, Eleonora Barbosa from the University of Brasilia, Chris Praamsma from our Fish Research Hatchery and Dr. George Schisler, our aquatic research leader, that describes changes in cell membranes of cutthroat trout sperm as it undergoes the freezing and thawing process. Egg eye-up rates among eggs in the experiment fertilized with sperm activated in water were only 10% (not unusual for frozen milt), but increased to 45% when using Lahnsteiner activation solution.

Whirling Disease Resistant Worms

You may remember a paper we published last year by R. Barry Nehring, (with co-authors Schisler, Chiaramonte, Horton, and Poole) demonstrating that the viability of *M. cerebralis* myxospores declines exponentially with time, and that the spores do not remain viable for longer than about one year under normal conditions. A new paper by the same authors has recently been published in the journal *Diseases of Aquatic Organisms* that describes a concurrent study to evaluate the influence of the presence *T. tubifex* worms on the viability of myxospores over time. We found that presence of *T. tubifex* worms leads to a more rapid decline in viable spores due to their consumption by the worms. Remarkably, this more rapid decline in myxospores occurred in treatment groups containing the susceptible and the non-susceptible lineages of worms. This experiment provides evidence that non-susceptible worm lineages are capable of reducing parasite load in natural systems.

Aquatic Toxicology

Our aquatic research scientist-toxicologist Pete Cadmus has just published two manuscripts. The first, published in the *Journal of Freshwater Ecology*, entitled "Low-cost floating emergence net and bottle trap: comparison of two designs" describes an insect emergence trap originally designed for CPW and CSU's biomonitoring efforts on the Arkansas River. It is markedly faster and more efficient than previous net designs. It has already been adopted by over 60 labs around the world. The second paper was published in *Environmental Science and Technology* and entitled "The Use of Field and Mesocosm Experiments to Quantify Effects of Physical and Chemical Stressors in Mining-Contaminated Streams". This paper separates physical (habitat) effects of pollution versus direct (toxic) effects of pollution.

AQUATIC NUISANCE SPECIES PROGRAM

A recent Colorado Supreme Court decision related to severance taxes has significantly reduced funding available for the ANS program. Colorado Parks and Wildlife (CPW) is no longer collecting income from the ANS Act, and does not expect to receive any more severance tax. CPW is actively assessing various potential long term funding options for the program, including an ANS annual sticker for boaters, directing a portion of a potential fishing license increase to the ANS program, increased support for the program from other sources, and a reduction in the scope of the program. CPW is encouraging all partners, including several federal and local governments, to contribute to the ANS Program. The Colorado Marine Dealers Association has recently made a donation to support inspection and decontamination stations. A decision on how the program will proceed in 2017 and future years has not yet been determined.

Per the Western Regional Panel's Building Consensus guidelines, CPW will de-list Pueblo Reservoir for Quagga Mussels in January 2017. There has not been a verified detection at Pueblo since 2011. This is the only water body currently positive, and therefore **Colorado will be a NEGATIVE state for zebra and quagga mussels by January 1, 2017!** CPW credits their aggressive mandatory inspection and decontamination program, along with education efforts, which have stopped the continued inoculation of our waters with mussels. Colorado continued its aggressive prevention and containment watercraft inspection and decontamination (WID), training/certification, public education and sampling programs to prevent the spread of zebra or quagga mussels, and other ANS. There have been 116 interceptions of quagga or zebra mussel infested watercraft in Colorado since 2008.

CPW completed modifications on their mobile app and website for watercraft inspection and decontamination (WID) stations and launched the new Regional WID Data Collection System this summer. A Quagga Zebra Action Plan (QZAP) grant from USFWS helped to fund modifications to the system which created administrative features to allow states, provinces, parks and special districts to personalize the application to fit their procedures. QZAP is also supporting one year of operating, maintenance and help desk costs so the system can remain free to users for the 2017 boating season. The workflow is based on Uniform Minimum Protocols and Standards (UMPS) and the Watercraft Inspection Training (WIT) Procedures. It is truly a collaborative product from Western Invasive Species Coordinating Effort (WISCE) discussions and collaboration among the Building Consensus participants. The States of Nevada, New Mexico and Utah, and Lake Tahoe, are currently using the system with Colorado. We hope that all states with WID programs will be using the shared system within three years. CPW is proposing new ANS regulations to de-list *Daphnia lumholtzi* from both wildlife prohibited aquatic species list and the prohibited ANS list. The non-native waterflea has recently been found in most reservoirs East of the Continental Divide and at Navajo Reservoir. It does not appear to be having an impact on the fisheries; and is not capable of having an impact on economics or recreation. De-listing will alleviate the need for mandatory exit inspections at positive waters to contain the waterflea, as well as eliminate the need for decontamination when coming from a positive to negative water.

Updated ANS regulations are proposed to include the drain removal, plant removal and clean, drain, dry language per the WAFWA resolution. We expect these to go into effect in 2017.

The Invasive Species Program launched a new website this year (<http://cpw.state.co.us/aboutus/Pages/Invasive-Species-Program.aspx>).

FISH PRODUCTION

In 2016, CPW spawned over 150 million eggs of various wild trout, salmon and cool water species at many lakes, streams and reservoirs, including an all-time record of 19.7 million kokanee salmon. In addition, CPW Brood Hatcheries produced over 20 million warmwater and trout eggs in 2016. Prolific spawn operations at both hatchery and wild sources resulted in providing excess eggs and/or fish to many other states as well as USFWS hatcheries. Over 50,000 visitors toured CPW hatcheries in 2016 and over 2500 hrs of volunteer time was utilized. In 2016, CPW Hatcheries stocked over 98 million trout, cool water and warm water fish into more than 1200 different bodies of water.

WILDLIFE HEALTH

Plague Control

CPW staff, in cooperation with USDA-APHIS-WS and others, developed scaled-up methods for vaccine bait production using "off-the-shelf" technology, then guided production of over 300,000 vaccine baits to support field vaccination campaigns in Colorado and other western states. Planning for a more sustainable vaccine bait production model is underway, but the work done in 2016 provides a solid foundation for progress. A manuscript comparing the effectiveness of oral vaccination to burrow dusting in preventing prairie dog colony collapse is in review.

Chronic Wasting Disease

Internal discussions are underway to identify preferred strategies for improving chronic wasting disease (CWD) monitoring and surveillance in Colorado. New CWD foci have been detected in recent months. Estimated prevalence has increased in most known-affected population units, reaching levels sufficient to impact population performance in some deer herds. Reliance on voluntary sample submission (offered since 2002 mainly as a customer service for carcass quality assurance) has limited sample sizes in most units, and also may be biasing prevalence estimates in at least some locations. Adaptive approaches for monitoring and controlling CWD deserve further attention.

Hemorrhagic Diseases

Additional cases of deer adenovirus were detected in aborted mule deer fawns from a field study area in northwestern Colorado. It remains unclear whether this virus was introduced recently or whether improved diagnostic approaches have simply improved detection capability. Management implications remain uncertain. Sporadic cases of bluetongue and epizootic hemorrhagic disease virus infections also occurred in autumn 2016.

MAMMALS RESEARCH

The Mammals Research Section of Colorado Parks and Wildlife addresses applied research questions to benefit the management and conservation of various mammal species in Colorado. These research efforts represent long term projects (4 - 10 years) in various stages

of completion. Currently ongoing mammal research projects are addressing (1) Snowshoe hare and red squirrel response to the recent spruce beetle outbreak to develop lynx management implications for the Colorado; (2) ungulate management questions to evaluate demographic and behavioral responses of mule deer to energy development activities and address potential mitigation approaches, an evaluation of moose demographic parameters in relation to various habitat conditions to inform future moose management in Colorado, and begin to address the reasons for declining calf:cow ratios from the southern tier of Colorado elk range; and (3) predatory mammal management questions addressing improved understanding and management approaches to address black bear and mountain lion-human interactions, evaluation of model assumptions applied to mountain lion management, and assessment of non-invasive sampling methods to estimate abundance, diet composition, and age class distribution of carnivore populations.

Related to the above and recently completed projects, the Mammals Research Section has produced numerous scientific publications since 2015, which can be accessed or are referenced at <http://cpw.state.co.us/learn/Pages/ResearchMammalsPubs.aspx>.

On December 14, 2016, the Parks and Wildlife Commission approved two research projects designed to evaluate the impact of predation by mountain lions and bears on two mule deer populations. The proposals generated considerable public input and media coverage. Additional information about the research proposals can be found at: <http://cpw.state.co.us/aboutus/Pages/CommissionMeeting2016-12.aspx>