Colorado Parks and Wildlife Research
A Brief Overview




Jeff Ver Steeg, Assistant Director
Research, Policy, and Planning Branch

Colorado Parks and Wildlife Research Goals

- Conduct scientifically sound experiments and research programs to provide solutions to fisheries and wildlife management issues.
- Experimental design and techniques are driven by actual management needs.
- Experiments are conducted with sufficient rigor to be accepted by peer-review and professional publication.

Colorado Parks and Wildlife Research Function

In-house Research function:

- Efficiently respond to immediate priorities as well as future information needs.
- Long-term, large-scale, coordinated programs.
- Staff scientists directly coordinate with managers and facilitate use of research results in management programs and policy decisions.
- Supports the science-based culture of the agency.

Aquatic Research Section

Scientific Solutions for Fisheries Management

Aquatic Research Section

Scientists in this section are involved in multiple research experiments and long-term projects identified as critical for fisheries management in Colorado. These needs are prioritized by senior aquatic staff, field biologists, and managers.

Each project is designed to simultaneously provide management solutions and advance scientific knowledge to the broader scientific community both at the State and National level.

In addition to research functions, the Aquatic Research Section contains other operational duties such as aquatics database management, habitat project implementation, assisting with hatchery and management functions, and extensive contract administration.

Aquatic Research Staff

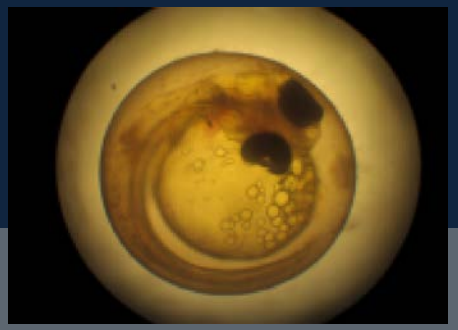
George Schisler, B.S., M.S., Ph.D. — Aquatic Research Section Leader
Kelly Carlson, B.S. —Administrative Assistant
Brad Neuschwanger, B.S. — Fish Research Hatchery Manager
Tracy Davis, B.S. — Fish Research Hatchery Technician
Andrew Perkins, B. S. — Fish Research Hatchery Technician
Peter Cadmus, B.S., M.S., Ph.D. —Research Scientist
Adam Hansen, B.S., Ph.D. —Research Scientist
Zachary Hooley-Underwood, B.S., M.S. — Research Scientist
Eric Fetherman, B.S., M.S., Ph.D. —Research Scientist
Ryan Fitzpatrick, B.S., M.S. —Research Scientist
Dan Kowalski, B.S., M.S. —Research Scientist
Matt Kondratieff, B.S., M.S.—Research Scientist
Eric Richer, B.S., M.S. —Research Scientist/Hydrologist
Kevin Rogers, B.S., M.S., Ph.D. —Research Scientist
Andrew Treble, B.S., M.S. —Research Scientist/Data Analyst

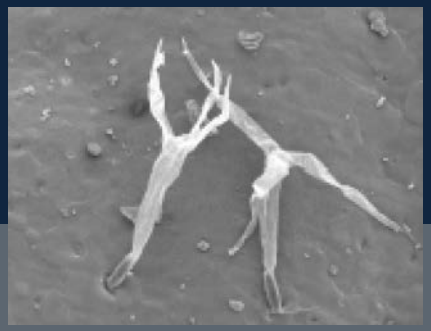
George J. Schisler: Aquatic Research Leader

Background and current research is focused on trout and salmon and fish disease

Responsible for oversight and supervision of Aquatic Research Section

Supervises three physical facilities including Parvin Lake Research Lab, Fort Collins Aquatic Toxicology Lab, and Bellvue Fish Research Hatchery





Kelly Carlson: Aquatic Research Program Assistant

- Contract Administration
  - CSU and other contractors
  - Cooperative Fish and Wildlife Research Unit
- Purchasing
  - Purchase Orders
  - Work Orders
- Reporting
  - Professional Publications

Eric Fetherman: Salmonid disease and wild trout studies

- Salmonid Diseases
  - Whirling disease (WD)
  - Bacterial coldwater disease
  - Bacterial kidney disease
- Wild fish population monitoring
  - Brood stocks
  - WD-resistant rainbow trout introductions
- Colorado River Fish Movement Study

Salmonid Disease Research

- Whirling Disease
  - Strain resistance evaluations
  - Prevalence in aquatic systems
  - Immune responses
  - Elimination in wild systems
  - Detection methods

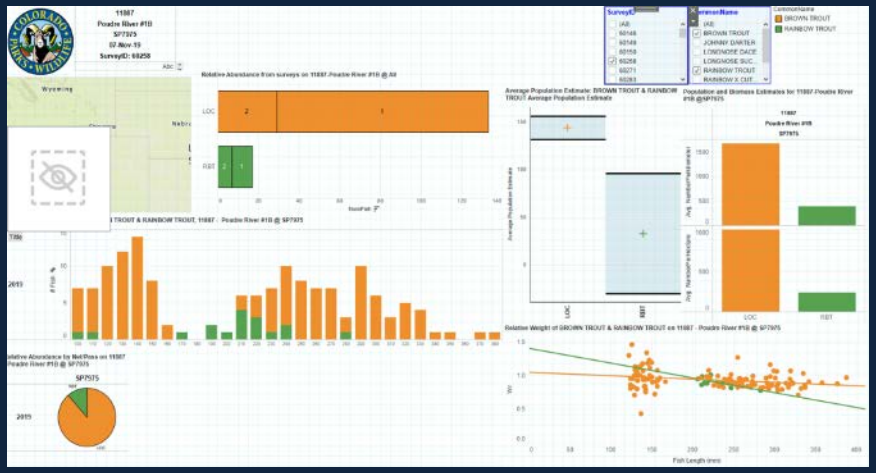
- Bacterial Coldwater Disease
  - Hatchery rearing strategies
  - Resistant strains
  - Dual resistance

- Bacterial Kidney Disease
  - Antibiotics for reducing hatchery transmission
  - Horizontal and vertical transmission
  - Detection strategies
  - Population-level effects

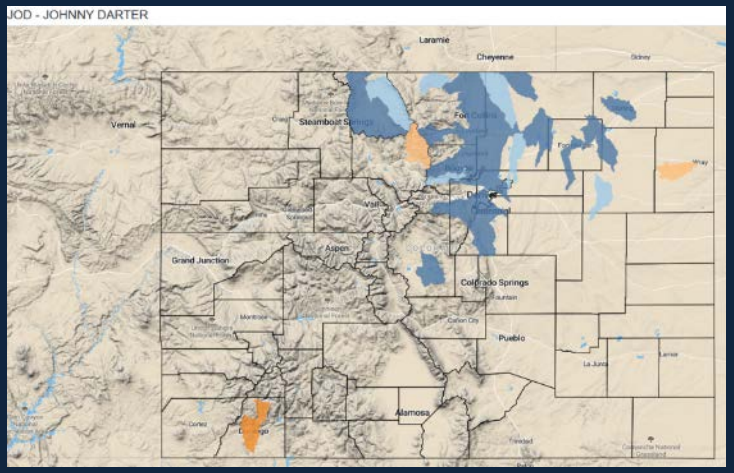
Andrew Treble: Data Analyst

- Statewide Fisheries Database
- Creel Survey Database
- Boreal Toad and Herptile Databases
- Colorado Stream Temperature Database
- Internal & External Aquatic Data Requests
- Scientific Collection Permit Reports
- Support Management, Research, Water Resources
- Compiling/Editing/Writing ‘Fishes of Colorado’

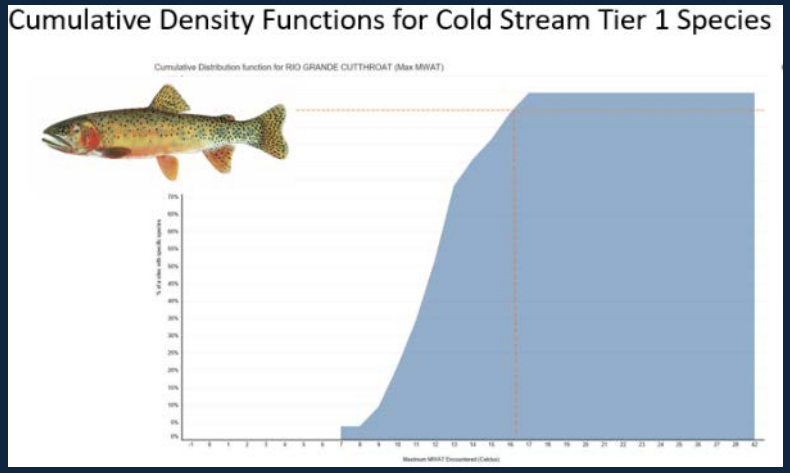
Fisheries Survey Analysis



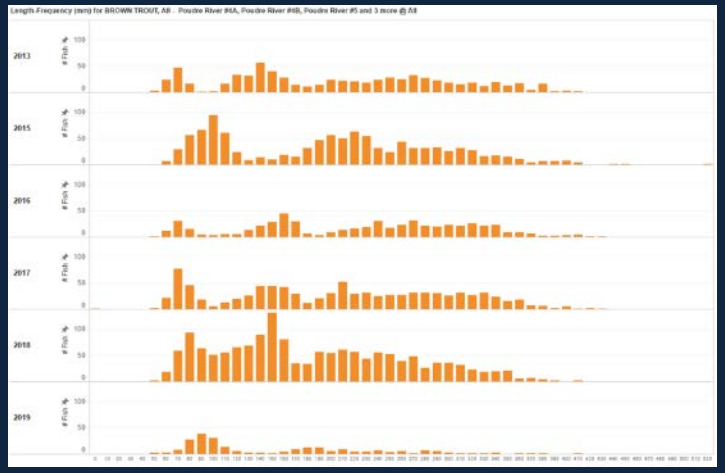
Species Distribution



Stream Temperature Analyses

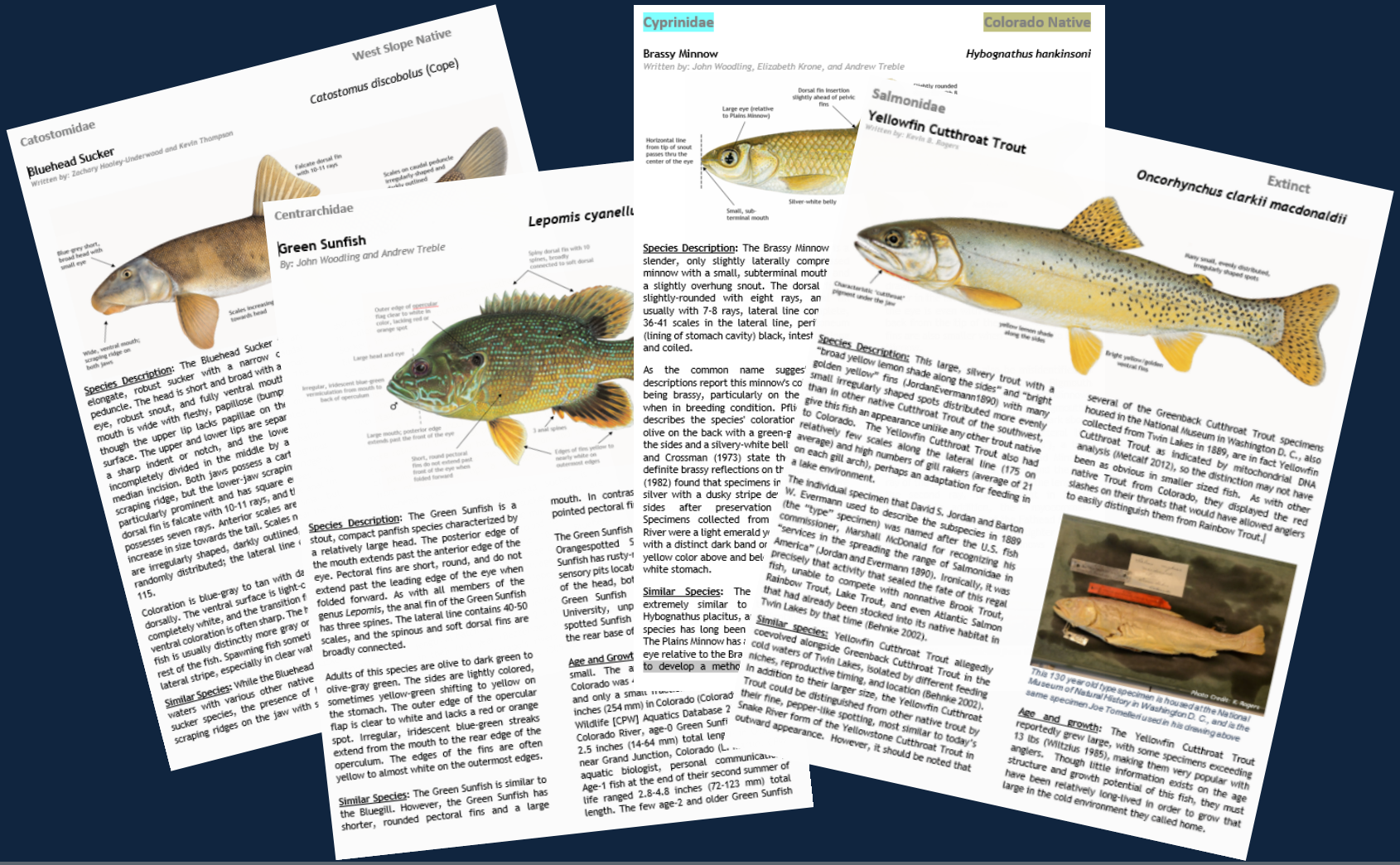


Population Demographics

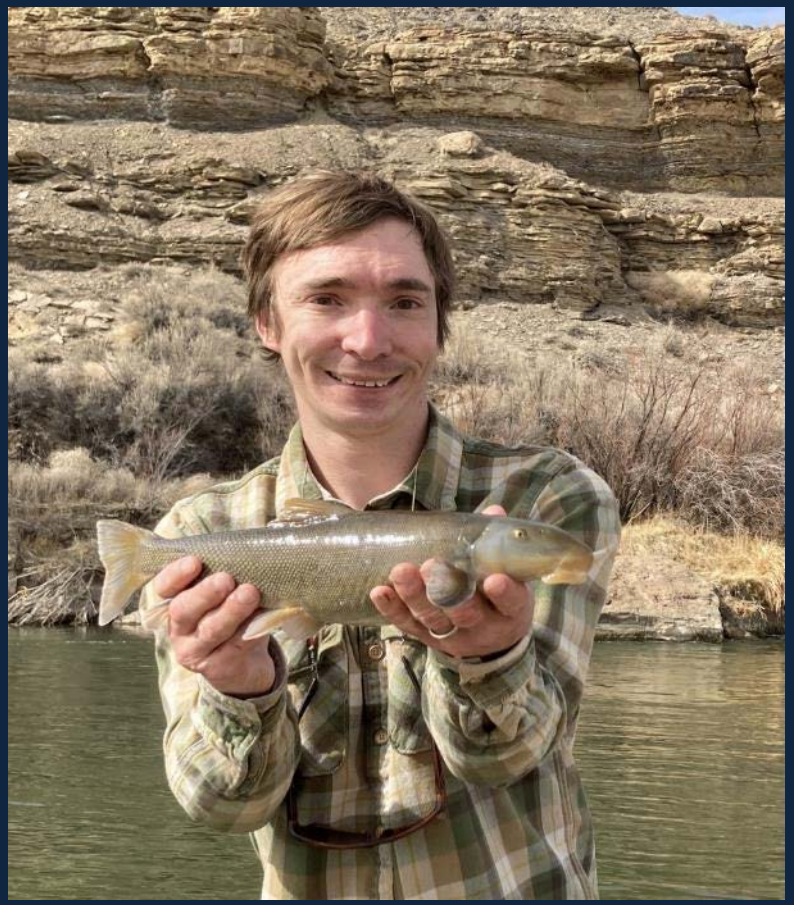


LIVE LIFE OUTSIDE

Fishes of Colorado



Zachary Hooley-Underwood: Western Slope and Rio Grande Native Fish



The “Three-Species” and Rio Grande Sucker and Chub

The “Three-Species” - Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub

- Ongoing projects:
- Identifying ways to limit native sucker hybridization with non-native suckers
- Identifying movement dynamics
- Defining the species’ current distributions in Colorado

Rio Grande Sucker and Rio Grande Chub

- Specific questions to be determined but will likely involve habitat requirements and movement

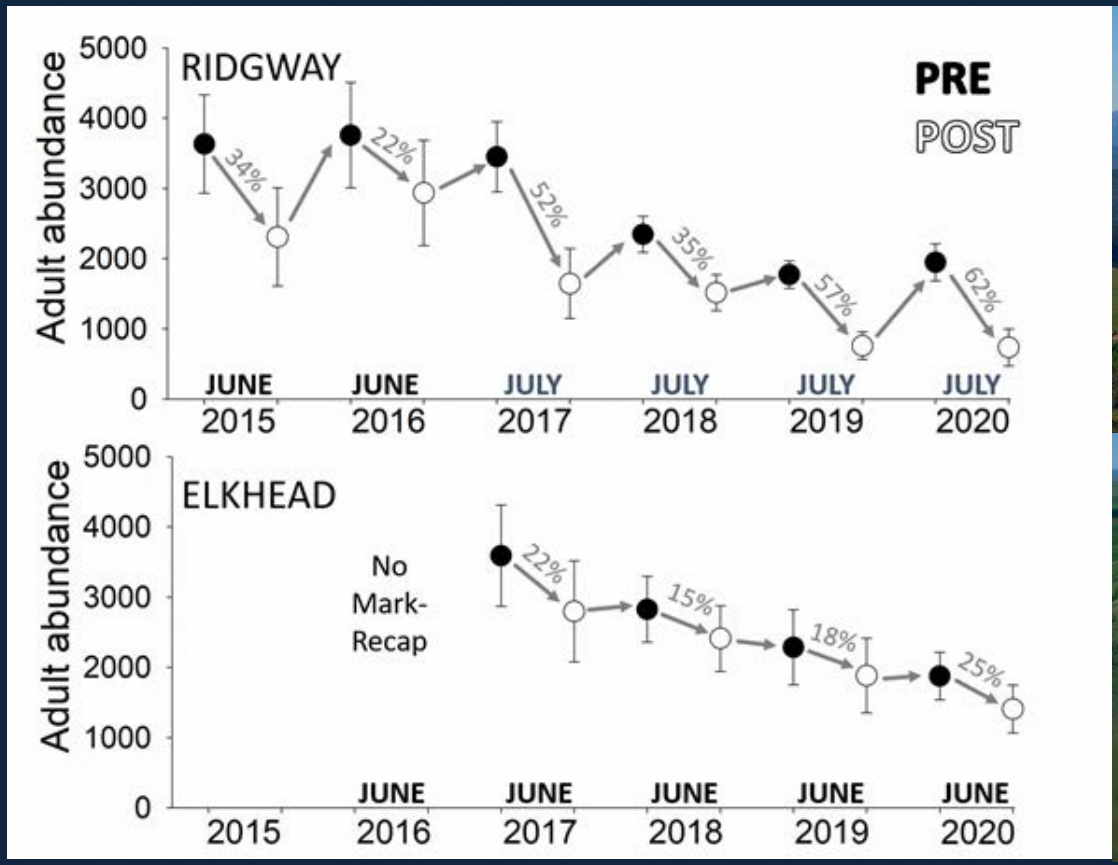
Using a Resistance Board Weir to exclude Non-native Suckers from participating in spawning

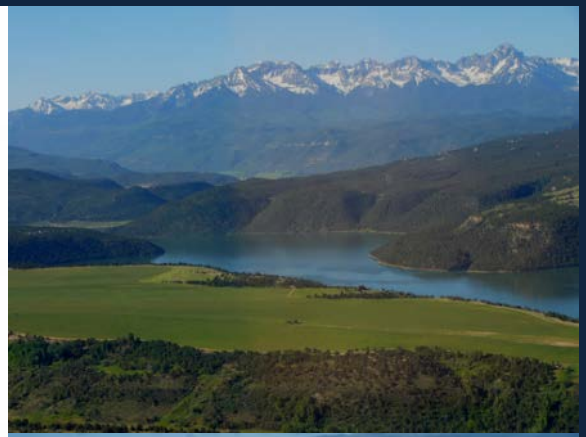
- Roubideau Creek - Tributary to the Gunnison River
- Can we eliminate or reduce hybridization in a major spawning tributary by removing non-native suckers?

Adam Hansen: Lakes and Reservoir Research

- Incentivized angling for suppression of predator fish in unwanted locations.
- Sterile walleye stocking procedures and management on western slope.
- Walleye broodstock management & harvest regulations.
- Food web interactions & strategies for maintaining predator-prey balance.
- Parasite-host dynamics between kokanee salmon and gill lice.
- Standardized sampling techniques (SPIN, FWIN, North American netting).
- SONAR, zooplankton & *Mysis* monitoring.

Research Highlight: Collaborative effort among aquatic section managers, lake and reservoir research, and anglers has facilitated the effective suppression of nonnative smallmouth bass in key locations for native fish protection



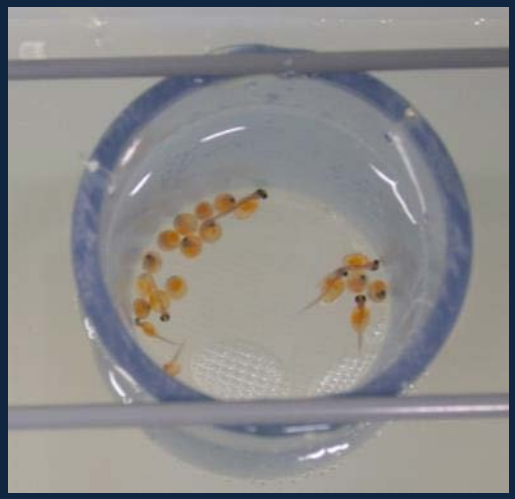


Pete Cadmus: Aquatic Toxicology

- Heavy metals exposure standards
- Endocrine disruptors
- Temperature tolerances
- Water quality standards
- Impacts of chemical spills


6 WEEKS
CONTROL
250
µg Zn/L
500
µg Zn/L
1000
µg Zn/L


6/1/05



Fish Research Hatchery, Bellvue, CO

Priority Aquatic Research and Fish Culture Issues

Research Hatchery Personnel

Left to Right: Brad Neuschwanger, Tracy Davis, Andrew Perkins

Whirling Disease Resistant Trout

Hofer Rainbow Trout

Harrison Rainbow Trout

Boreal Toads

Currently producing between 5,000 and 10,000 tadpoles annually

Stream Habitat Investigations and Assistance

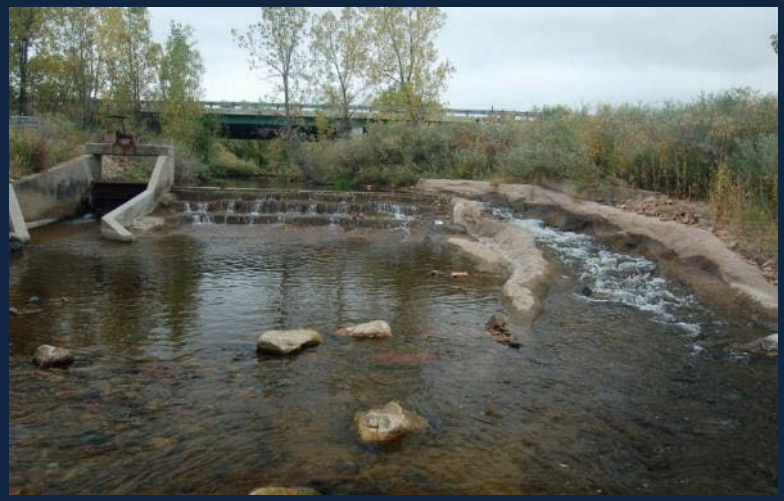
Eric Richer

Matt Kondratieff

Stream Habitat Investigations and Assistance

- Project design and evaluation:
  - Stream Restoration
  - Fish Passage
  - Conservation Barriers

- Technical Assistance:
  - Design review
  - State and federal agencies
  - NGOs (e.g., Trout Unlimited)



Evaluation of Toewood Treatments

Badger Basin SWA

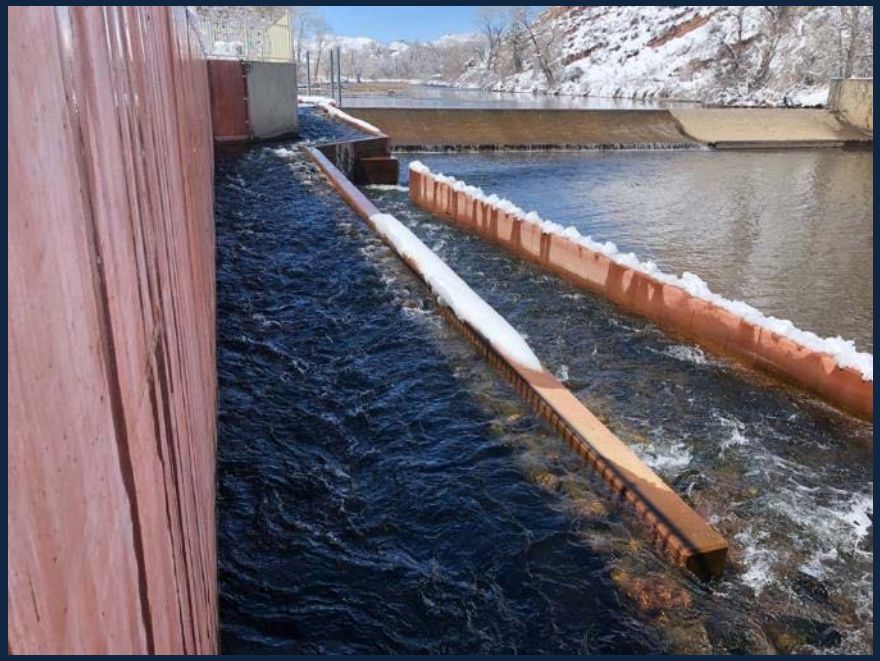
LIVE LIFE OUTSIDE

Fish Passage Projects: Cache la Poudre River

Fossil Creek Reservoir Diversion (FCRID)

- Design and construction oversight
- Evaluated passage for 9 fish species
- Reconnected 9.7 miles of habitat

Watson Hatchery Diversion



- Technical design assistance
- Evaluated passage for 4 fish species
- Reconnected 2.2 miles of habitat

Dan Kowalski: Stream and River Ecology

Current Stream Ecology Research Projects

- Ecology of the Upper Colorado River and effects of a reservoir bypass channel on invertebrates and sculpin.
- Habitat characteristics of the Giant Salmonfly *Pteronarcys californica*
- Diversity and phylogeny of sculpin in Colorado
- Bacterial kidney disease in wild and hatchery trout

Stream Ecology Research Projects

- Water diversions and mainstem reservoir have altered the aquatic invertebrate community and fish assemblage of the Upper Colorado River
- Aquatic insect diversity has declined and serval sensitive species that were previously common are rare or absent at sites below the reservoir
- Objective of this project is to define the habitat characteristics of the Giant Salmonfly and to evaluate the effects of a reservoir bypass channel on the invertebrate community and native sculpin

Ryan Fitzpatrick: Native Plains Fishes

Current Research Projects

- Evaluation of the Owens-Hall fish passage structure
- Incorporation of eDNA into plains fish sampling protocol
- Laboratory and field examination of the effects of temperature and winter duration periods on reproductive success of Johnny Darter, *Etheostoma nigrum* to guide temperature standards
- Flathead Chub, *Platygobio gracilis* ecology in Fountain Creek
- Optimize sampling protocols

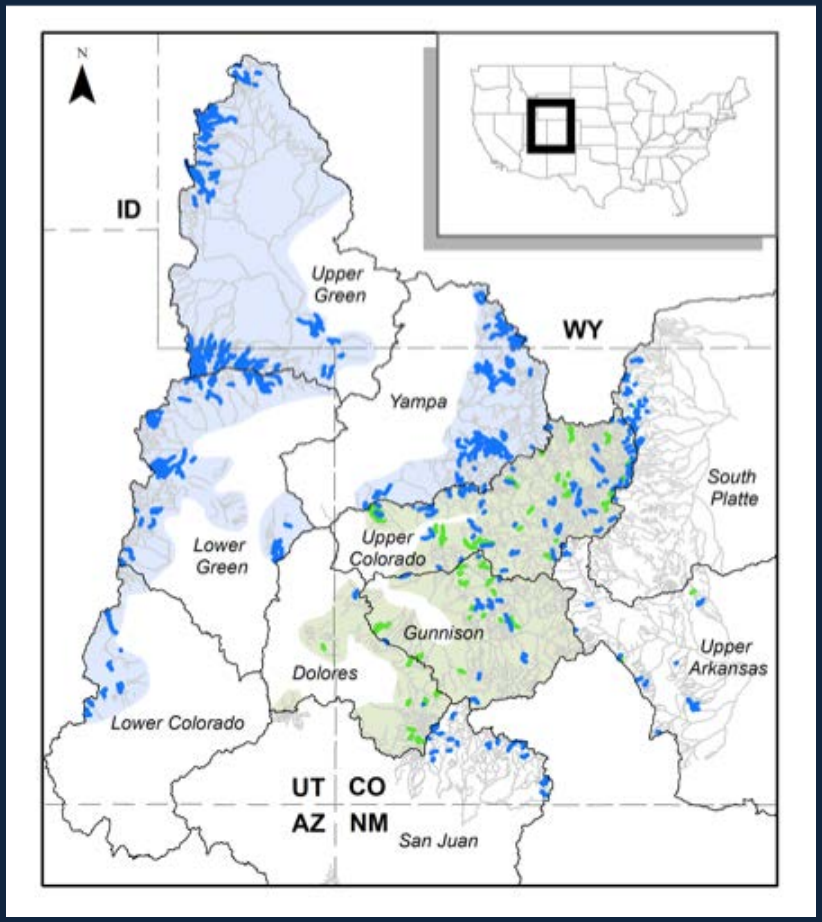
Kevin Rogers: Native Cutthroat Trout

LIVE LIFE OUTSIDE

Taxonomy

Evaluate purity and heritage of Colorado's native trout

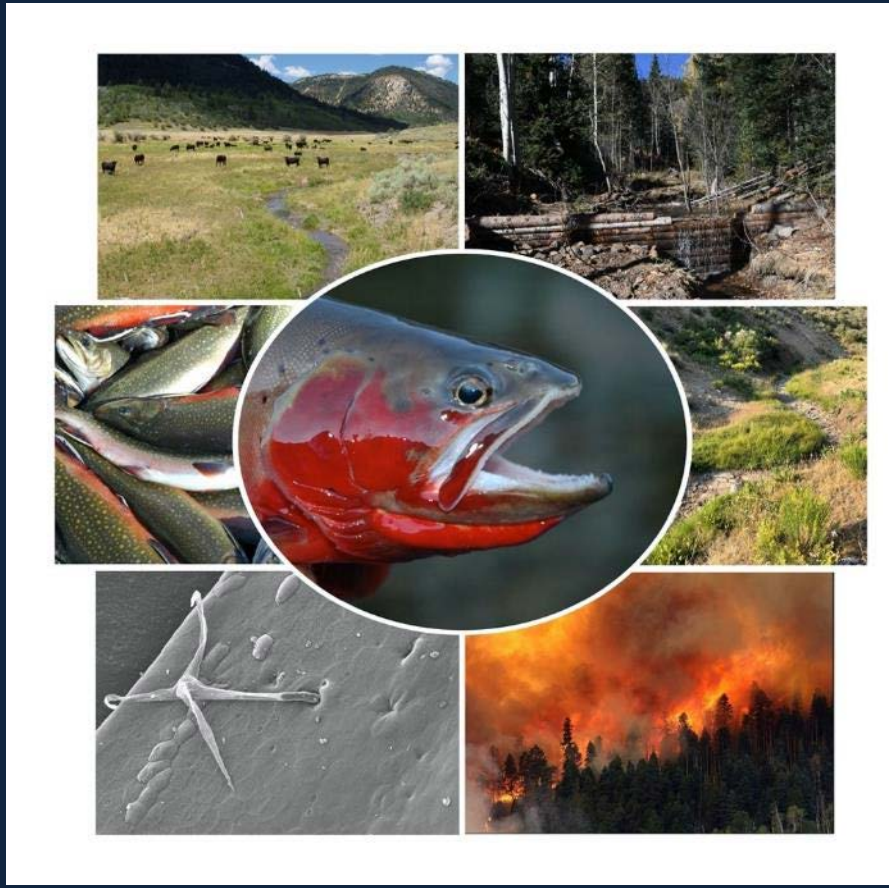
- Use molecular methods to characterize what diversity remains and where
  - Discovery of the native trout of the San Juan basin
  - Status assessments
- Ensuring purity of wild and hatchery stocks used for recovery
- Measuring genetic diversity to inform robust management of hatchery populations



Conservation

Using science to help ensure persistence in an uncertain future

- Evaluating thermal tolerance in consequential stocks
- Maintaining fitness in small populations following rescue efforts (e.g. spawn matrixing)
- Develop models to predict probabilities of persistence for all three currently recognized subspecies, and identify most vulnerable populations



Avian Research Section

Applied research to support management and conservation of birds and wildlife habitats

LIVE LIFE OUTSIDE

Avian Research Staff

- Jim Gammonley, B.S., M.S., Ph.D. – Avian Research Leader
- Sandra Billings, A.A., B.S. – Program Assistant
- Tony Apa, B.S., M.S., Ph.D. – Avian Researcher
- Adam Behney, B.S., M.S., Ph.D. – Avian Researcher
- Reesa Conrey, B.S., M.S., Ph.D. – Avian Researcher
- Danielle Johnston, B.S., Ph.D. – Habitat Researcher
- Brett Walker, B.S., M.S., Ph.D. – Avian Researcher
- (Vacant) – Spatial Ecologist
- Temporary employees, graduate students, interns, volunteers

Sandra Billings: Program Assistant

- Purchasing/Contracting
- Budget tracking
- Hiring temporary employees
- Vehicle/Equipment tracking
- Administrative procedures/policies

Tony Apa: Grouse Ecology and Conservation

- Gunnison sage-grouse
  - Captive breeding methods
  - Movements, habitat use
  - Success of translocations
- Greater sage-grouse
  - Adult, juvenile survival; nest success
  - Movements, dispersal, habitat use
  - Response to surface coal mining
- Sharp-tailed grouse
  - Adult, juvenile survival; nest success
  - Habitat use, response to habitat treatments

- Conservation strategies, recovery planning, local working groups, workshops/training

Adam Behney: Bird-Habitat Relationships, Game Bird Management

- Pheasant/songbird response to Conservation Reserve Program (CRP) vegetation management
- Waterbird food availability in wetlands
- Bird community response to playa wetland vegetation buffers
- Bobwhite quail survival, reproductive success in relation to grazing, habitat enhancements
- Breeding duck populations and response to wetland conditions and habitat management in North Park

- CPW representative on Pacific Flyway Study Committee – migratory game bird management plans, monitoring, harvest management

Reesa Conrey: Grassland Bird, Raptor Conservation

- Bird community response to prairie dog, plague management
- Mountain plover, burrowing owl monitoring
- Raptor distribution, habitat use
- Evaluation of large-scale raptor monitoring methods
- Breeding bald eagle response to land use changes along the Front Range

- Review, improve statewide raptor nest monitoring protocols
- Manage photo databases
- Science liaison with bird conservation partners

Danielle Johnston: Habitat Ecology and Management

- Native plant restoration around oil/gas development
- Cheatgrass control
- Evaluation of alternative late-succession shrub removal methods
- Native shrub establishment methods

- Recommendations for restoration practices, mitigation standards
- Seed mixes
- Development of new soil/seeding implement
- Technical assistance on habitat treatments

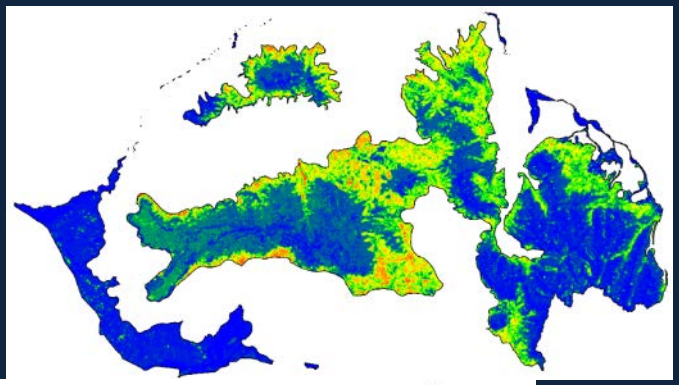
LIVE LIFE OUTSIDE

Brett Walker: Greater Sage-grouse, Sagebrush Bird Conservation

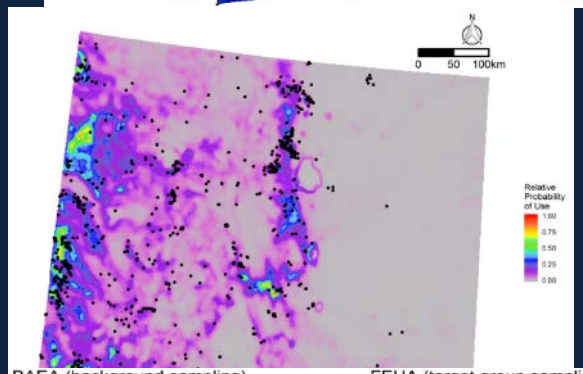
- Greater sage-grouse
  - Response to oil/gas development
  - Response to tree/shrub removal
  - Seasonal habitat selection
  - Movements and habitat connectivity
  - Evaluation, development of monitoring methods
- Brewer's sparrow distribution, taxonomy

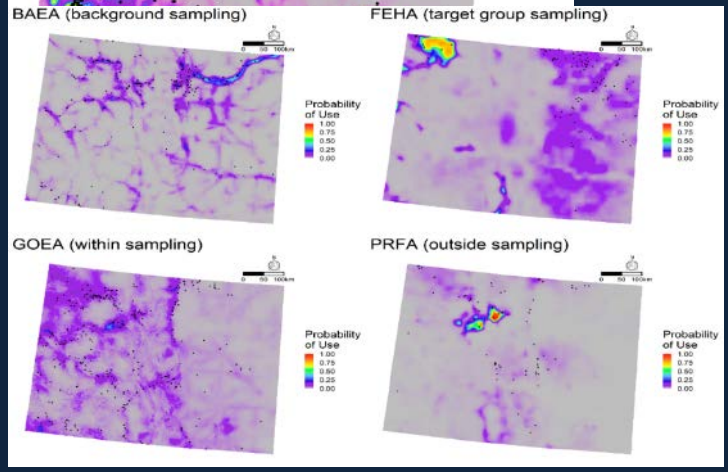
- Greater sage-grouse priority habitat maps
- Monitoring, marking protocols
- COGCC recommendations
- Science liaison with local work group, federal partners

(Vacant): Spatial Ecologist



- Analysis, interpretation of animal location data
  - Distribution, habitat selection models/maps
  - Home range, movement corridors
  - Quantifying habitat, land-use changes and animal response





- Workshops, software packages for analysis of habitat selection, animal movements
- Use of citizen science data
- Standards for study design

Jim Gammonley: Wetland Bird Conservation, Migratory Game Bird Management

- Waterbird breeding ecology and response to wetland habitat management in the San Luis Valley
- Sandhill crane habitat use, distribution changes
- Canada goose population status, management
- Duck hunting regulations and harvest management

- Central Flyway Technical Committees
- Migratory bird surveys
- Intermountain West Joint Venture Technical Committee
- Wetland Program technical assistance
- Annual mourning dove banding operations

Mammals Research Section

Applied research to enhance management and conservation of mammals in Colorado

Mammals Research Staff

Chuck Anderson, B.S., M.S., Ph.D. — Mammals Research Section Leader

Michelle Gallagher, B.A. — Mammals Research, Wildlife Health, & GIS Section Program Assistant

Alexandria Austermann, B.A., M.S. — CPW Research Librarian

Ken Logan, B.S., M. S., Ph.D. — Puma/Mountain Lion Research Scientist

Eric Bergman, B.A., M.S. Ph.D. — Ungulate Research Scientist

Mat Alldredge, B.S. M.S. M.B. Ph.D. — Carnivore/Ungulate Research Scientist

Jake Ivan, B.S., M.S., Ph.D. — Nongame Research Scientist

Nathaniel Rayl, B.A., M.S. Ph.D. — Ungulate Research Scientist

Michelle Gallagher: Mammals, Wildlife Health & GIS Section Program Assistant

- Section support:
  - Purchasing
  - Purchase Orders
  - Budget monitoring
  - Temp hiring
  - CPW Animal Care & Use Committee coordination

Alex Austermann: CPW Research Librarian

- CPW support:
  - Catalogs internal and external publications
  - Maintains subscriptions and CPW access to scientific/management related journals and technical reports
  - Provides assistance in searching databases, the internet & other electronic media for scientific, historic, and technical publications.
  - Assists with maintaining and updating research website content

Ken Logan: Research Scientist, puma/mountain lion focus

- Research Focus:
  - Completed 10 year research project investigating cougar management questions and developed management recommendations
  - Collaborating with Arizona State University to investigate cougar genetics questions

Eric Bergman: Research Scientist, ungulate focus

- Research Focus:
  - Investigated mule deer population response to habitat treatments
  - Addressed mt. goat/bighorn sheep spatial dynamics
  - Investigating cost effective approaches to inform moose management
  - Addressing elk response to recreational activity to develop best management practices for trail-based recreation

Mat Alldredge: Research Scientist, carnivore/ungulate focus

- Research Focus:
  - Investigated cougar/human interactions along Colorado's Front Range urban interface
  - Collaborated with University of Wisconsin to investigate cougar and black bear diets
  - Evaluated nuisance bear translocation policies, and is evaluating cougar conflict data to inform management
  - Addressing cougar/mule deer interactions and the influence of cougar management on cougar/human interactions

Jake Ivan: Research Scientist, lynx/small mammal focus

- Research Focus:
  - Lynx/hare/habitat associations to inform lynx conservation

  - Investigated lynx response to winter recreation
  - Addressed lynx and snowshoe hare response to the recent bark beetle outbreak in Colorado

  - Investigating snowshoe hare response to varied forest management practices

Nathaniel Rayl: Research Scientist, ungulate focus

- Research Focus:
  - Supervising large scale project addressing factors influencing declining elk calf recruitment in Colorado and elk response to recreation.

  - Collaborating on graduate research with University of Wyoming and Southern Illinois University

Chuck Anderson: Mammals Research Leader

- Research Focus:
  - Recently completed long-term research project addressing mule deer/energy development interactions

  - Completing analyses addressing predation influences on neonate mule deer survival

Mammals Research Collaborations

Research and management staff are applying research results to:

- Update big game DAU plans
- Multiple examples of developing methods to improve field techniques and animal handling efficiency
- Estimate mountain lion and pine marten densities
- Develop new oil and gas rules associated with SB 181
- Assist with recreational trail and Fishers Peak state park development
- Guide wolverine and lynx management in Colorado and the west

Wildlife Health Section

Applied research to enhance management of healthy wildlife populations
Veterinary, diagnostic, training, and support services for wildlife managers

Wildlife Health Staff

- Mary Wood MPH, DVM – Wildlife Health Section Leader
- Mark Fisher BS – Wildlife Capture Technician
- Karen Fox DVM, PhD, DACVP – Wildlife Pathologist

- Karen Griffin BS, BS – Molecular Diagnostic Technologist
- Michael Miller DVM, PhD – Veterinary Researcher/Epidemiologist
- Pauline Nol MS, DVM, PhD – Field Veterinarian

- Shari Singleton BS, CVT – Necropsy Technician
- Maicie Sykes BS, Research Facility Manager
- Daniel Tripp MS – Disease Researcher
- Numerous seasonal/temporary staff

Sylvatic Plague

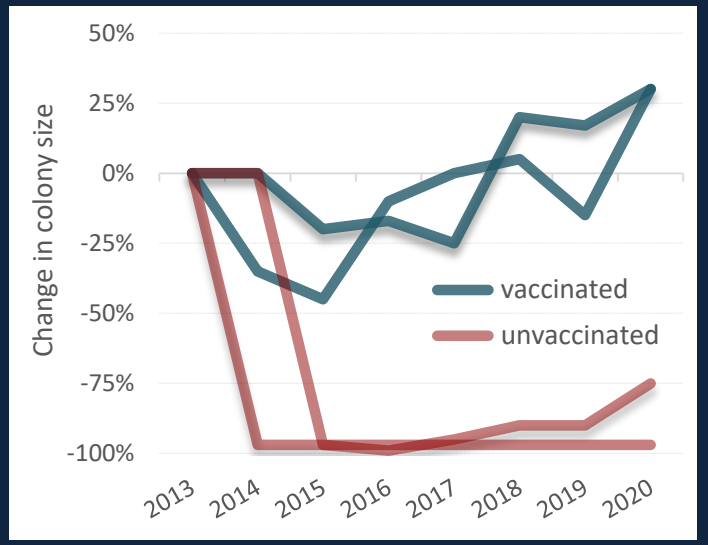
We are working to refine and operationalize oral vaccination as a conservation tool for plague suppression.

What have we learned?

1. Vaccination speeds recovery: Vaccinated prairie dog colonies withstand plague outbreaks better and rebound more quickly than colonies not vaccinated.

2. Dose matters: Recent studies revealed that the original vaccine dose yields insufficient "herd immunity" to suppress plague at black-footed ferret reintroduction sites.

3. Vaccine modification may improve response: A simple modification to the vaccine preparation may improve immune responses to give 8x efficacy at 1x cost.



Bighorn Sheep Respiratory Disease

We are working on development/evaluation of novel vaccines to prevent pneumonia and improved diagnostics.

What have we learned?

1. New diagnostics improve understanding: We are developing next generation sequencing capabilities to better understand the role of different pathogens in population performance.
2. Treatment in captivity: We developed a successful treatment protocol to clear respiratory disease pathogens in captive bighorn sheep.
3. Oral vaccines offer hope: We are evaluating oral vaccine formulations for respiratory disease pathogens.

Chronic Wasting Disease

Current work focuses on identifying management strategies to suppress the disease in free-ranging populations.

What have we learned?

1. Harvest can limit CWD: In-state and multi-jurisdiction analyses suggest that increasing male harvest can suppress CWD.

2. Later harvest helps: Shifting harvest timing closer to the breeding season may provide added control benefits.

3. Other species aren't susceptible: Mountain lions, cattle, and bighorn sheep were not susceptible to CWD under natural exposure conditions.

Wildlife Capture Drugs

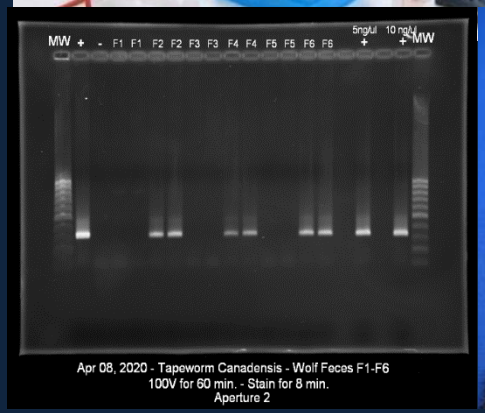
Our work focuses on developing and improving upon immobilizing drugs that are effective and safe—as well as legal to use.

What have we learned?

1. Dose and formulation matter: We improved dosing and selection of long-acting tranquilizers for bighorn sheep translocation.

2. Tissue residues are short: We established species-specific drug withdrawal times for field immobilization drugs.

Services: Assays on Demand



Customized in-house lab tests to help meet researchers' and managers' needs for information on new diseases of concern

1. Rabbit Hemorrhagic Disease: When federal diagnostics were unavailable, we developed in-house testing capacity and expanded testing to include feces.

2. Echinococcus: When a case was identified in 2017, we developed in-house testing capacity and recently expanded testing to include canid feces.

Services: Pathology and Diagnostics

Submissions from field personnel statewide for disease surveillance/forensics support

Research support – cause specific mortality

Research laboratory – disease diagnostics unavailable elsewhere

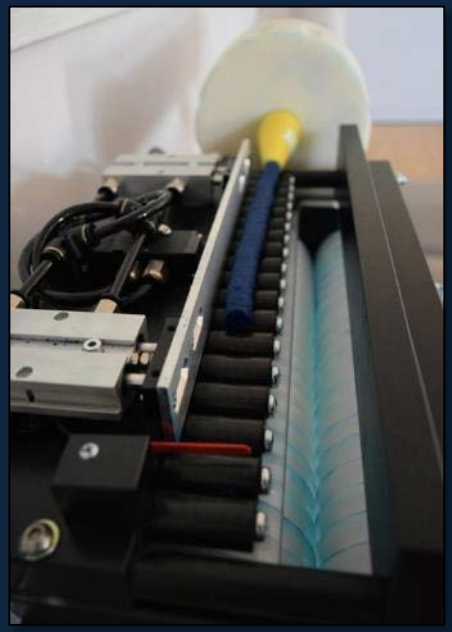
Chronic wasting disease surveillance and monitoring

Services: Field/Capture Support

Veterinary support at captures

Prescription drugs to facilitate capture

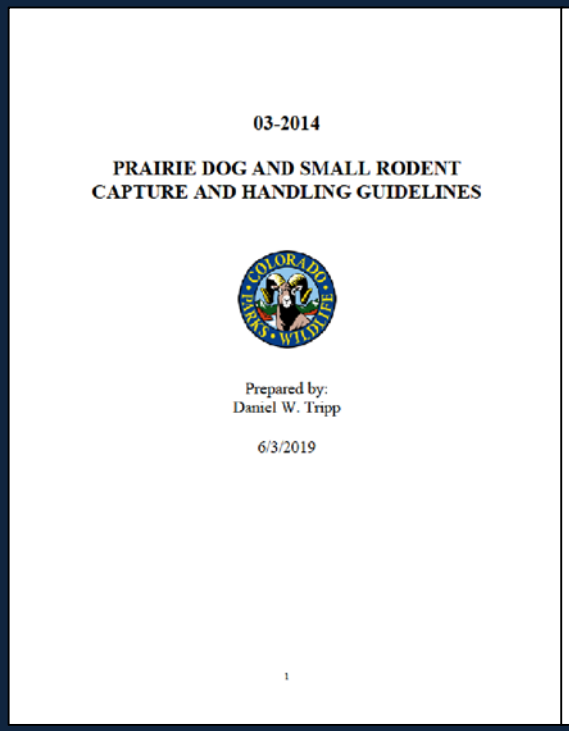
Services: Vaccine Bait Production



2 million vaccine doses produced since 2016

Services: Disease Management

Provide information, guidance, recommendations on wildlife health related issues



03-2014

PRAIRIE DOG AND SMALL RODENT CAPTURE AND HANDLING GUIDELINES

Prepared by:
Daniel W. Tripp

6/3/2019

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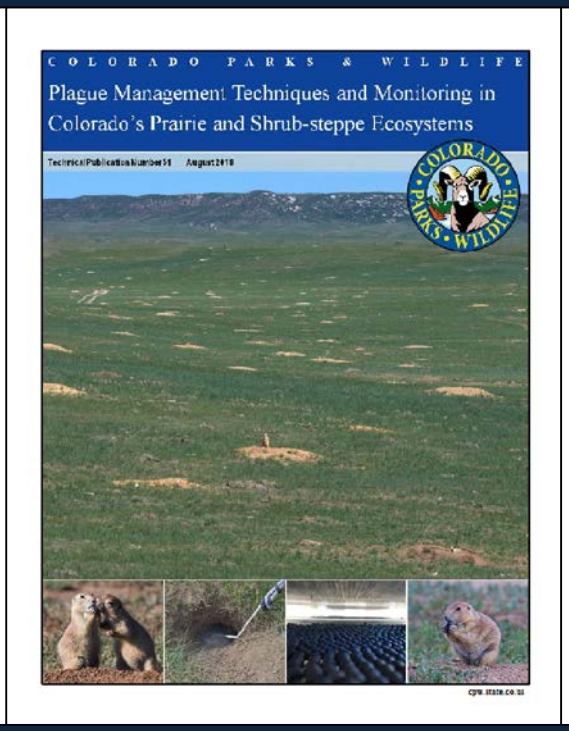
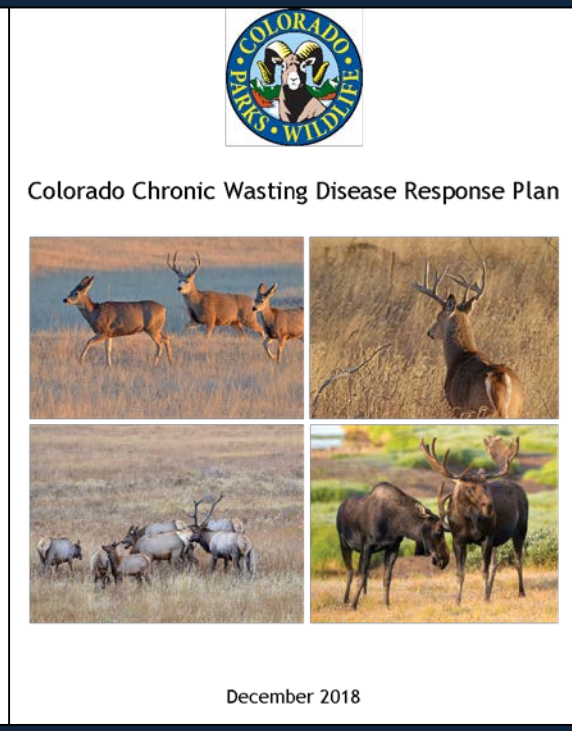


COLORADO PARKS & WILDLIFE

Plague Management Techniques and Monitoring in Colorado's Prairie and Shrub-steppe Ecosystems



Colorado Chronic Wasting Disease Response Plan

December 2018

LIVE LIFE OUTSIDE

Services: Training and Education

Capture/Immobilization training

CWD sampling training

Information/education on wildlife disease

Veterinary student externship

COLORADO PARKS & WILDLIFE

Canine Distemper

- Canine distemper is a viral disease of wild and domestic carnivores with a wide range of symptoms. Neurologic signs are indistinguishable from rabies.

Species Affected in Colorado

- Raccoons
- Coyotes
- Skunks
- Foxes
- Black-footed ferrets (endangered)

What to Look For

- Abnormal behavior
- Incoordination, seizures
- Weakness, slow-moving
- Crusting around eyes and nose
- Other general signs of illness

Raccoon with dichorrea showing crusting from eyes

Cause and Transmission

Canine distemper is a contagious disease of carnivores, caused by canine distemper virus (CDV). The signs of CDV are not always the same and depend on the species and how long the animal has been infected. Sick animals often have difficulty moving, and can act abnormally due to brain infections. Crusting around the eyes and/or nose is commonly observed, while other signs like coughing, diarrhea, vomiting, and thickened paw pads tend to be less obvious. Sick animals usually do not survive. Spread of the virus is mostly by direct contact with infected animals as the virus does not survive long outside the body. Numerous sick raccoons in a localized region of Colorado are a likely sign of a CDV outbreak. However, because CDV can cause symptoms that are indistinguishable from rabies, CDV cannot be definitely differentiated from rabies without testing of the brain (see CPW rabies fact sheet).

Public Health Considerations

Because distemper cannot be definitively distinguished from rabies without testing of the brain, sick animals that have contacted people or pets should be tested for rabies. Please report any contact with wild animals to your local department of public health. Canine distemper cannot be transmitted to humans, but may be transmitted to unvaccinated domestic dogs. Please refer to your veterinarian for proper vaccination protocols for your pets.

Additional Information/References:

Canine Distemper, in *Infectious Diseases of Wild Mammals* (Author: Elizabeth S. Williams)

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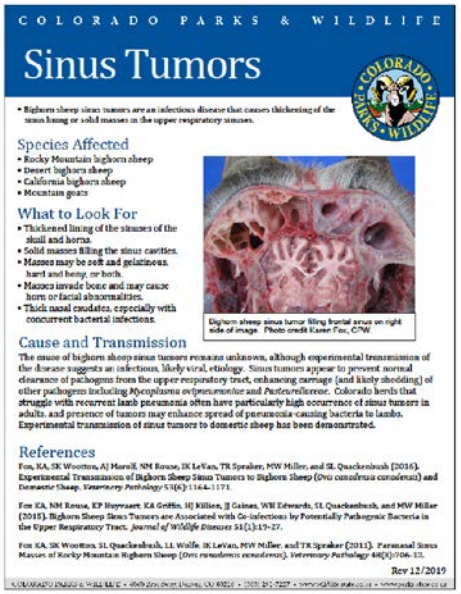

COLORADO PARKS & WILDLIFE

Sinus Tumors

- Bighorn sheep sinus tumors are an infectious disease that causes thickening of the sinus lining or solid masses in the upper respiratory sinuses.

Species Affected

- Rocky Mountain bighorn sheep
- Desert bighorn sheep
- California bighorn sheep
- Mountain goats

What to Look For

- Thickened lining of the sinuses of the skull and horns.
- Solid masses filling the sinus cavities.
- Masses may be soft and gelatinous, hard and bony, or both.
- Masses invade bone and may cause horn or facial abnormalities.
- Thick nasal exudates, especially with concurrent bacterial infections.

Bighorn sheep sinus tumor filling frontal sinus on right side of image. Photo credit Kaiser Fox, CPW

Cause and Transmission

The cause of bighorn sheep sinus tumors remains unknown, although experimental transmission of the disease suggests an infectious, likely viral, etiology. Sinus tumors appear to prevent normal clearance of pathogens from the upper respiratory tract, enhancing carriage (and likely shedding) of other pathogens including *Mycoplasma ovipneumoniae* and *Pasteurellaceae*. Colorado herds that struggle with recurrent lamb pneumonia often have particularly high occurrence of sinus tumors in adults, and presence of tumors may enhance spread of pneumonia-causing bacteria to lambs. Experimental transmission of sinus tumors to domestic sheep has been demonstrated.

References

Fox, KA, SK Wootton, AJ Marolf, NM Rouse, IK LeVan, TR Spraker, MW Miller, and SL Quackenbush (2016). Experimental Transmission of Bighorn Sheep Sinus Tumors to Bighorn Sheep (*Ovis canadensis canadensis*) and Domestic Sheep. *Veterinary Pathology* 53(6):1164-1171.

Fox KA, NM Rouse, KP Huyvaert, KA Griffin, HJ Killion, JJ Gaines, WH Edwards, SL Quackenbush, and MW Miller (2015). Bighorn Sheep Sinus Tumors are Associated with Co-infections by Potentially Pathogenic Bacteria in the Upper Respiratory Tract. *Journal of Wildlife Diseases* 51(1):19-27.

Fox, KA, SK Wootton, SL Quackenbush, LL Wolfe, IK LeVan, MW Miller, and TR Spraker (2011). Paranasal Sinus Masses of Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*). *Veterinary Pathology* 48(3):706-12.

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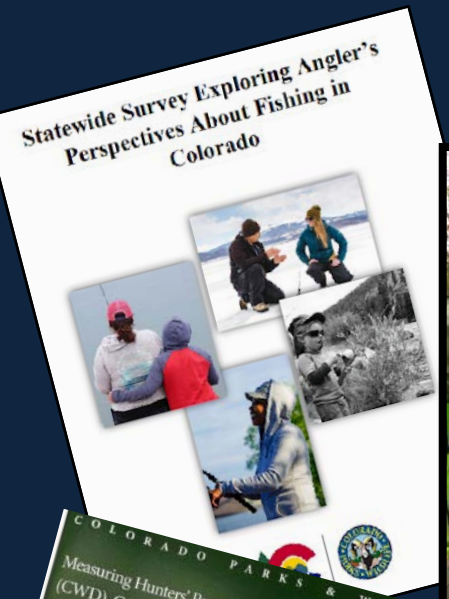
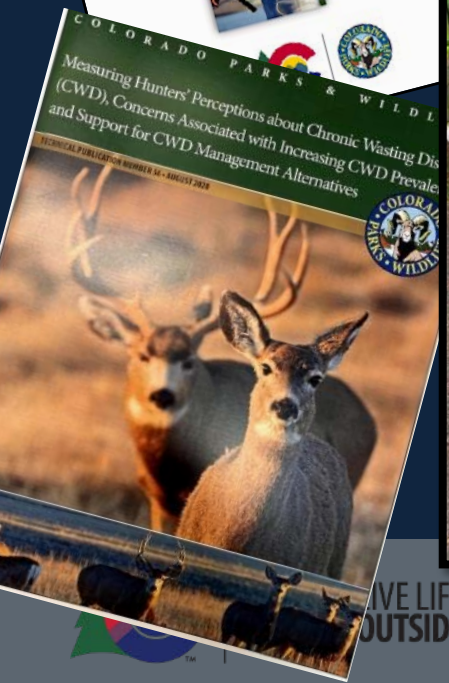
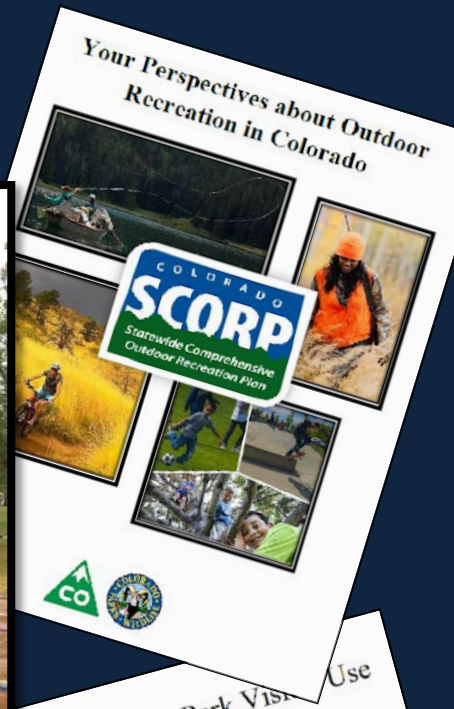
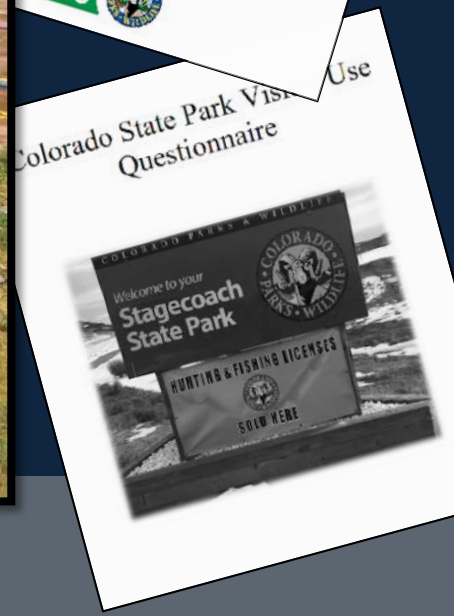
LIVE LIFE OUTSIDE

Human Dimensions Research Program







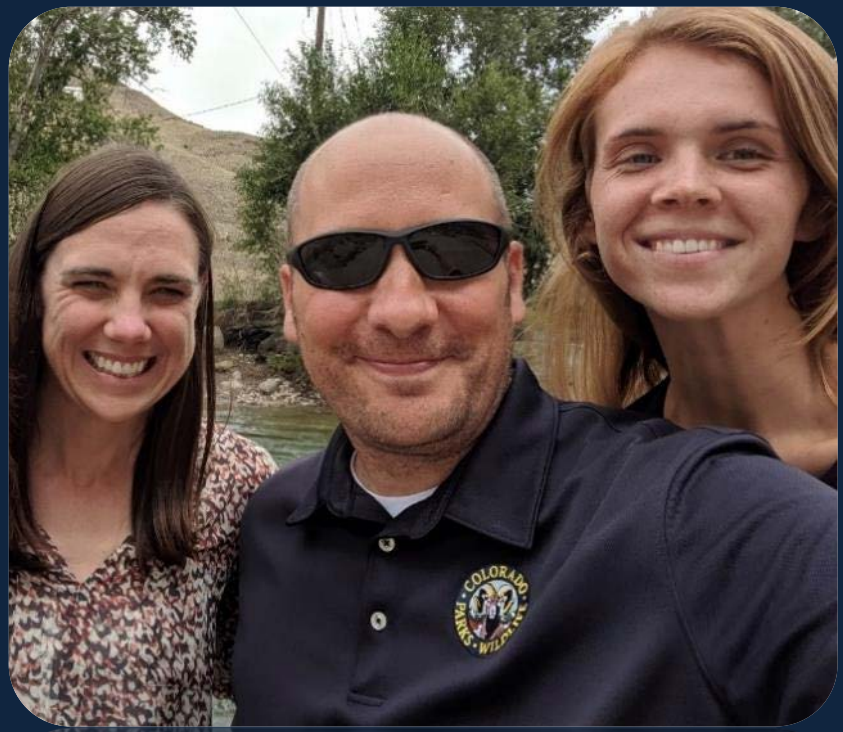


IVE LIFE OUTSIDE

Mike Quartuch, Ph.D. : Human Dimensions Specialist/Researcher

- Education:
  - BS, Natural Resource Management, CSU
  - MS, Forestry, U. of New Brunswick
  - PhD, Forest Resources, U. of Maine
  - Postdoc, Cornell University, Center for Conservation Social Science

- Research Focus:
  - Social, environmental, and community psychology *(beliefs, attitudes, motivations)*
  - Stakeholder engagement processes
  - Risk perceptions and behavioral constraints
  - Hunter and angler recruitment/retention, evaluation



LIVE LIFE OUTSIDE

HD Research Collaborations

1. CWD
2. Female anglers
3. Wildlife values and land use
4. R3 efforts
5. State park visitor study
6. SCORP
7. Big game attitude survey
8. Statewide angler satisfaction survey