

# 46<sup>th</sup> Joint Annual Meeting

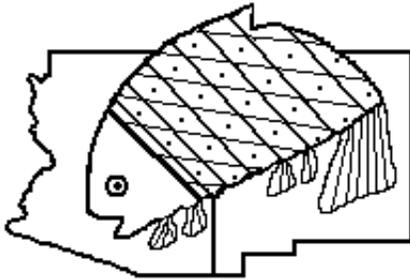
Arizona/New Mexico Chapters of the Wildlife Society  
and  
Arizona/New Mexico Chapter of the American Fisheries Society



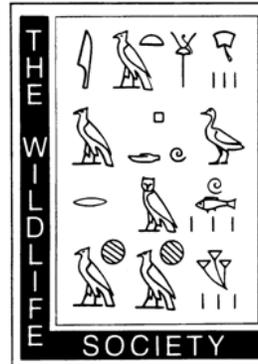
*New Mexico Chapter of*  
**The Wildlife Society**



*Excellence in Wildlife Stewardship Through Science and Education*



AZ/NM Chapter of the American Fisheries Society



AZ Chapter of the Wildlife Society

## Program Committee

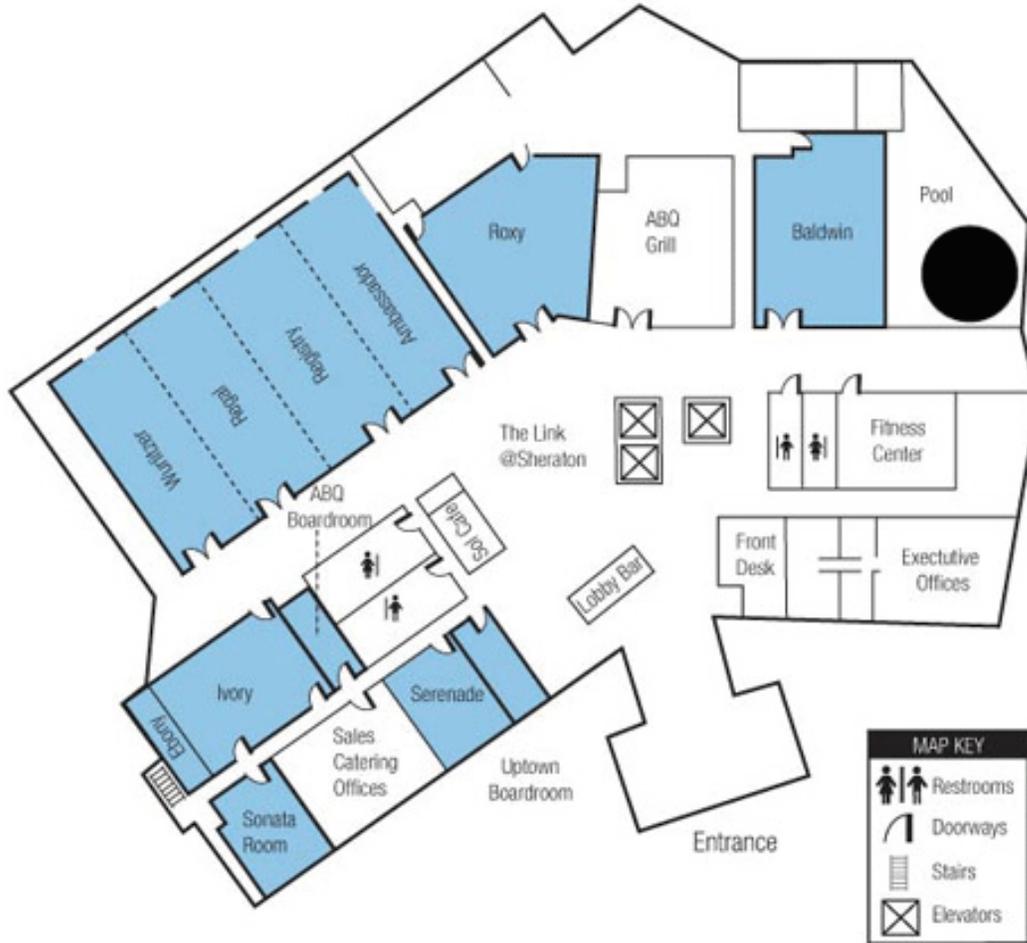
### NM TWS Chapter

Ken Boykin  
Brian Hanson and Rachel Jankowitz  
Renaë Held  
Renaë Held  
Renaë Held  
Kathy Granillo  
Elise Goldstein  
Ken Boykin and Rachel Jankowitz  
Leland Pierce and Esther Nelson  
Robert Osborn  
Jennifer Frey  
Teri Waldron  
Robert Osborn  
Mark Watson and Jim Stuart  
Ty Allen, Rachel Jankowitz & Shawn Knox  
Virginia Seamster and Valerie Williams

### Meeting Host

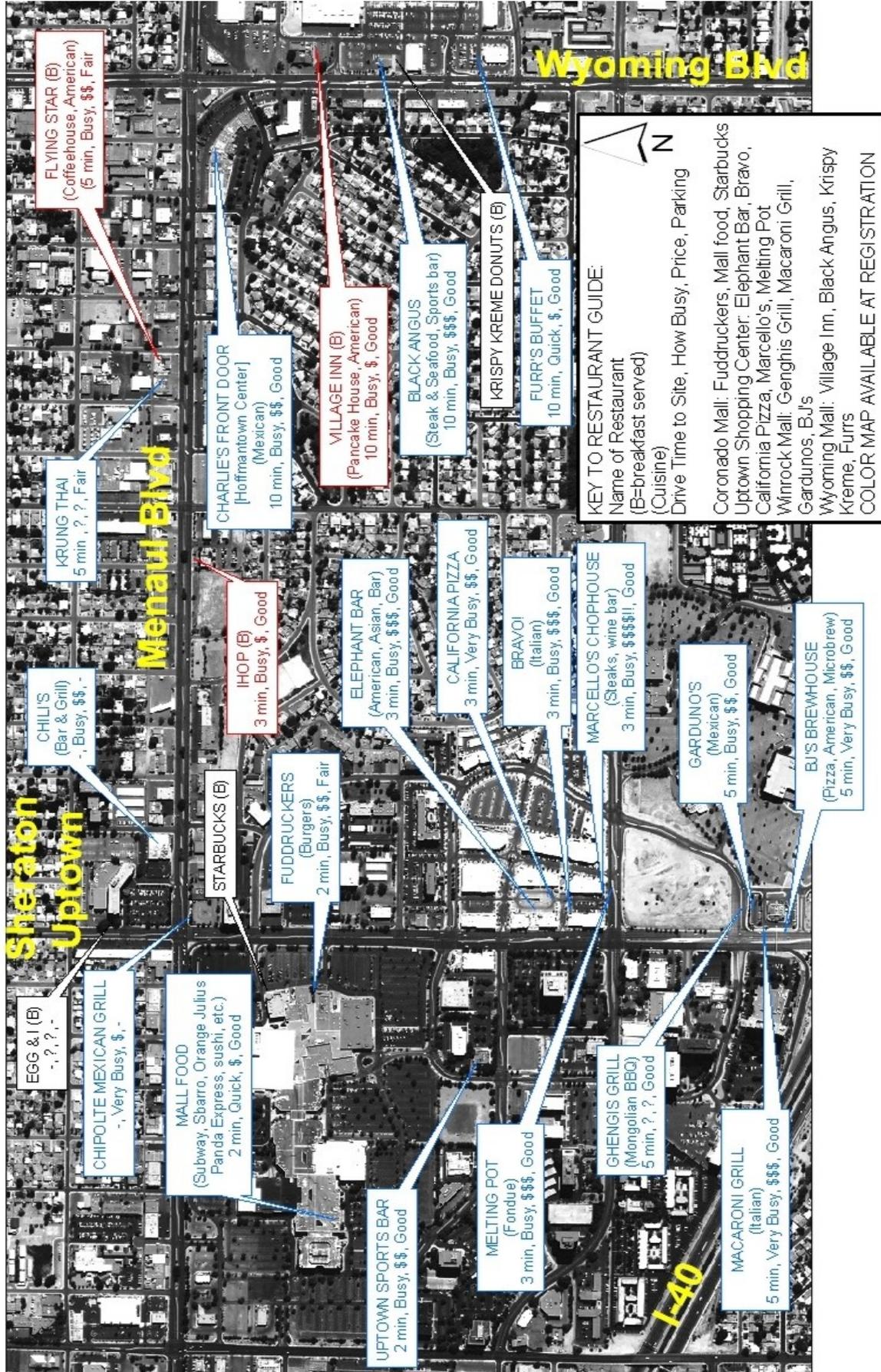
Annual Meeting Coordinator  
Facility Arrangements  
Program Layout and Printing  
Announcements  
Commercial Exhibits/Vendor  
Raffle/Auction  
Registration  
Plenary/General Session  
Audio-Visual Equipment  
Poster Session  
Student Paper/Poster Judging  
Student Volunteers  
Job Board and Message Board  
Photo Contest  
Technical Session  
Planning Committee

# HOTEL



**Please Recycle: If you don't want your programs and/or nametags, please drop them off at the back of the presentation rooms or the registration desk at the end of the meeting. Boxes will be provided.**

RESTAURANTS



## Meeting Schedule

<b>February 7</b>	<b>8:00 am – 5:00</b>	<b>Workshops</b>	See page 3
	<b>6:00 pm</b>	<b>Start of Poster Set-up</b>	Ivory
	<b>5:00 – 7:00</b>	<b>Chapter Business Meetings</b>	See page 3
	<b>7:00 – 10:00</b>	<b>Social</b>	Wurlitzer/Regal
	<b>7:00 – 10:00</b>	<b>Silent Auction</b>	Ivory
<b>February 8</b>	<b>8:00 am – 8:45</b>	<b>Wildlife Rehabilitation Workshop Test</b>	Ebony
	<b>8:00 – 8:45</b>	<b>Southwest Section Meeting</b>	Registry/Ambassador
	<b>8:00 – 5:30</b>	<b>Poster Viewing</b>	Ivory
	<b>8:00 am – 9:20pm</b>	<b>Silent Auction</b>	Ivory
	<b>9:00 – 12:00pm</b>	<b>Plenary Session</b>	See page 5
	<b>12:00</b>	<b>Deadline for Poster Set-up</b>	Ivory
	<b>12:00 – 1:30</b>	<b>Lunch on Your Own &amp; Student Mentor Lunch (Serenade)</b>	
	<b>1:30 – 5:30</b>	<b>Concurrent Sessions</b>	See page 6 and 7
	<b>6:00</b>	<b>Photo Contest Closes</b>	
	<b>5:30 – 7:00</b>	<b>Poster Session /Social, Cash Bar</b>	Ivory
	<b>7:00 – 8:00</b>	<b>Banquet, Food Served 7:00 (Wildlife Videos)</b>	Wurlitzer/Regal/Registry
	<b>7:00 – 8:00</b>	<b>Raffles Announcements &amp; Student Chapter Raffles</b>	Wurlitzer/Regal/Registry
	<b>8:00 – 9:20</b>	<b>Chapter Awards</b>	Wurlitzer/Regal/Registry
<b>February 9</b>	<b>6:00am</b>	<b>Executive Board Breakfast</b>	Uptown Board Room
	<b>8:00 – 12:00</b>	<b>Concurrent Sessions</b>	See page 7 and 8
	<b>10:20</b>	<b>Silent Auction Ends</b>	Ivory
	<b>10:20-12:30</b>	<b>Pick up and pay for Silent Auction Items</b>	Ivory

## Plenary Speaker Biographies

**JIM LANE** – Director New Mexico Game and Fish Department

Jim is responsible for overseeing more than 300 employees and an annual budget in excess of \$34 million. Since taking the position, his Department has initiated a Conservation Education Program throughout New Mexico and has begun implementation of a Families Afield Program to break down barriers to hunter recruitment.

Previously chief of the Wildlife Management Division, Lane was named Director in October 2011 by the State Game Commission. As wildlife chief, Lane helped increase numbers of big-game licenses, improved communication within the agency and with sportsmen and landowners, established a four-year rule process to improve big-game and small-game management decisions, and successfully delisted endangered desert bighorn sheep.

Before joining the Department in 2009, Lane worked with the Kentucky Department of Fish and Wildlife Resources as an environmental scientist, wildlife division director, wildlife program coordinator and other positions. He holds a master's degree in forestry from the University of Kentucky, and is a current member of several NGOs including the Wildlife Society, National Rifle Association, National Wild Turkey Federation, Rocky Mountain Elk Foundation and Ducks Unlimited.

Lane currently lives in Rio Rancho with his wife, Beth, of 19 years; and children Allison and Christian. His entire family shares his passion of the outdoors and all are avid hunters and fishermen.

**BOBBI BARRERA** - Deputy Director, Wildlife, Fish, and Rare Plants Pgrm. U.S. Forest Service, Region 3

Bobbi received her Bachelor of Science and Master degrees in Wildlife Ecology and Management from Michigan State University. She has worked for both state and federal agencies throughout her 25 year career, including the Department of Natural Resources for the states of Wisconsin and Michigan, and the U.S. Fish and Wildlife Service and the U.S. Forest Service in the Midwest, Pacific northwest, and the Southwestern United States. She has worked on a diversity of controversial issues and species and has extensive experience with endangered species conservation and management and the Endangered Species Act. She is currently the Deputy Director of the Wildlife, Fish and Rare Plants Program in the Forest Service Southwestern Regional Office.

**EMILY IRWIN** – Assistant Director - Fuels and Fire Ecology, US Forest Service, Southwestern Region, Albuquerque, New Mexico.

Emily began her career with the Forest Service in 1986 on the Coconino National Forest in lands and minerals as a co-op student. After several years, Emily accepted a fire management trainee position in the Forest Supervisor's Office. In 1994, she moved to the Gila NF, as a Fuels Specialist. In 1997, she accepted the District Fire Management Officer position on the Wilderness RD, Gila NF. In 2002, Emily moved to Albuquerque as the Lead Coordinator at the Fire Use Training Academy, and in 2009 she accepted her current position.

Emily has worked on Wildland Fire Management Teams since 2000, and is a Planning Section Chief on the Northern Rockies Wildland Fire Management Team. Emily's hobbies include fly fishing, tying flies, participating and watching sports. She also stays busy playing, camping, and fishing with her two grandchildren. She earned a B.S. degree in Forestry from Northern Arizona University in 1987.

## Plenary Speaker Biographies

**JAMES E. (JIM) BROOKS**, Supervisory Fish Biologist, U.S. Fish and Wildlife Service, New Mexico Fish and Wildlife Conservation Office

Native fish conservation in the American Southwest and northern Mexico has been the focus of my career efforts for the past thirty years. I am intimately knowledgeable of the planning, design, and implementation of complex programs for native fish and natural flow regime conservation. My knowledge base includes a healthy emphasis on river and fish ecology, the Endangered Species Act, federal water management and State water law. As a senior level biologist I am responsible for working with a diverse cadre of cooperators, including private landowners, academicians, agency biologists, Native American tribes, and lawyers, engineers, and biologists representing consumptive water interests, and Congress. I have led cooperative efforts to implement recovery actions for listed fish species in most New Mexico river basins. To attain a level of success I have worked my way through the labyrinth created by the need to implement collaborative programs aimed at protecting natural resources while integrating with the very resource use activities that initially endangered the riverine environments. I have authored or co-authored peer-reviewed publications, technical reports, reports to Congress and popular articles. My speaking experience includes a variety of experiences in technical and more bureaucratic environments, ranging from friendly to very hostile.

### Professional Experience

1994-Present Supervisory Fish Biologist, U.S. Fish and Wildlife Service, NM Fish and Wildlife Conservation Office, Albuquerque, New Mexico;  
1985-1994 Fish Biologist, U.S. Fish and Wildlife Service, Dexter National Fish Hatchery and Technology Center, Dexter, New Mexico;  
1977-1985 Research biologist- Native fish biologist-Wildlife Manager, AZ Game and Fish Department, throughout AZ.

### Education

1977 University of Arizona, Tucson; Bachelor of Science in Fishery Management  
1983 Arizona State University, Tempe; graduate studies in Department of Zoology, no degree;

**DAVID BROOKSHIRE** - Distinguished Professor, Department of Economics: Director, Science Impact Laboratory for Policy and Economics, University of New Mexico

David S. Brookshire is a Distinguished Professor and Director of the Science Impact Laboratory for Policy and Economics (SILPE) within the Department of Economics at the University of New Mexico (UNM). After completing his B.A. in Economics at California State University at San Diego in 1970, David earned his Ph.D. in Economics at the University of New Mexico in 1976. He was on the faculty at the University of Wyoming from 1976 to 1990. He returned to UNM in 1990 and served as Department chair from 1993-2000.

David specializes in environmental and resource economics. Among his many appointments, he has served as Policy Sciences Editor of *Water Resources Research* (published by the American Geophysical Union, served on the Executive Board of the Sustainability of semi-Arid Hydrologic and Riparian Areas (SAHRA) Science and Technology Center at the University of Arizona, served on three National Research Council panels and worked as an economist for the National Water Commission, the U.S. Department of Commerce, and the U.S. Geological Survey. David specializes in public policy issues in the natural resource, environmental and natural hazards areas. In particular, he has completed studies pertaining to seismic building codes, earthquake prediction impacts, environmental regulations, endangered species, air pollution, the effects of seismic zoning and the value of geologic information and water allocation. His current research interests include ecosystem valuation, natural hazards issues, endangered species protection, field and laboratory experiments for the estimation of disaggregated demand of consumer water users, the value of water in non-market settings, and integrated hydrological/biological/economic modeling of alternative institutional and behavioral characteristics of water banking/leasing markets.

## Meeting Schedule

THURSDAY	Ebony	Sonata	Serenade	Wurlitzer/Regal	Ivory	NMDGF
8:00-12:00	Photography Wrksp. 1st Session	Piscicide Wrksp.	Disease Wrksp.		Grant Writing	Wildlife Rehab. Wrksp.
12:00pm-1:00	<b>LUNCH ON YOUR OWN</b>					
1:00-5:00	Photography Wrksp. 2nd Session	Piscicide Wrksp.	Law Wrksp.		Grant Writing	Wildlife Rehab. Wrksp.
5:00-7:00		AFS Business Meeting	AZ TWS Business Meeting		NMTWS Business Meeting	Wildlife Rehab. Wrksp.
7:00-10:00				Social	Silent Auction	

Friday AM	Ebony	Registry and Ambassador
8:00-8:45	Wild. Rehab. Test	Southwest Section Meeting
9:00-9:10		Welcome - Plenary: Ecological Thresholds: Fire, Water and Climate - Ken Boykin
9:10-9:25		“NMDGF Overview” - Jim Lane - Director
9:25-9:40		“Improving Ecosystem Resiliency through Forest and Watershed Restoration” - Bobbi Berrera - Deputy Director, Wildlife, Fish, and Rare Plants Pgrm. U.S. Forest Service, Region 3
9:40-10:20		“Ecological Thresholds” - Emily Irwin - Program Manager, Fuels & Fire Ecology R3, Forest Service
10:20-10:40	<b>BREAK</b>	
10:40-11:20		“What Might John Wesley Powell Say Now?” - Jim Brooks, Supervisory Fish Biologist USFWS
11:20-12:00		“Valuing Ecosystem Services: An Integrated Modeling Approach” - David Brookshire, Distinguished Professor, Dept. of Economics: Director, Science Impact Laboratory for Policy and Economics UNM
12:00-1:30	<b>LUNCH ON YOUR OWN &amp; STUDENT MENTOR LUNCH (Serenade, Pre-Registered)</b>	

<b>Friday PM</b>	<b>Wurlitzer</b> Fisheries Student	<b>Regal</b> Fisheries	<b>Registry</b> Large Mammals	<b>Ambassador</b> Small Mammals
<b>Moderator</b>	<b>Yvette Paroz</b>	<b>Jason Kline</b>	<b>James Cain</b>	<b>Scott Carleton</b>
1:30-1:50	Spawning Ecology of the Critically Endangered Moapa Dace, <i>Moapa coriacea</i> , Revealed Through Underwater Videography- <b>Ruggirello*</b>	Status of headwater chub ( <i>Gila nigra</i> ) in the Spring Creek drainage- <b>Avenetti</b>	Microhabitat selection and mortality site characteristics of elk calves in areas of differing predator composition in New Mexico- <b>Pitman*</b>	Hairtube sampling for detection and identification of small mammals- <b>Jessen</b>
1:50-2:10	A comparison of habitat suitability criteria for Apache trout and the non-native virile crayfish- <b>Petre*</b>	Status and distribution of headwater chub ( <i>Gila nigra</i> ) in the Haigler Creek watershed- <b>Mosher</b>	Elk calf survival and mortality patterns in north-central New Mexico, 2009-2010- <b>Quintana*</b>	Status of Santa Catalina gray squirrels: potential influence of fire and introduced Zbert's squirrels- <b>Ketcham*</b>
2:10-2:30	Relationship between U.S.-Mexico border operations and suspended sediment in headwaters of the Rio Yaqui.- <b>Clark*</b>	Standard weight (Ws) equation for headwater chub ( <i>Gila nigra</i> )- <b>Vasey</b>	Influence of livestock grazing on forage biomass, activity budgets and foraging efficiency of desert bighorn sheep ( <i>Ovis canadensis mexicana</i> ) in southern New Mexico- <b>Garrison*</b>	Can red squirrel middens influence species diversity?- <b>Posthumus*</b>
2:30-2:50	Conservation implications of fragmentation of the threatened leopard darter, <i>Percina pantherina</i> - <b>Schwemm*</b>	Genetic analysis suggests high conservation value of peripheral populations of Chihuahua chub ( <i>Gila nigrescens</i> ).- <b>Osborne</b>	Using non-invasive genetic analysis to estimate the abundance and density of American black bears ( <i>Ursus americanus</i> ) in New Mexico- <b>Gould*</b>	
2:50-3:10	Potential methods to cool streams containing Apache trout in the White Mountains of Arizona with implication for climate change- <b>Price*</b>	Colorado River fish monitoring in Grand Canyon, Arizona: 2002-2011 humpback chub, <i>Gila cypha</i> , aggregations.- <b>Persons</b>	Pumaplex: a high-throughput assay for the genetic monitoring of pumas in the southwestern U.S.- <b>Fitak*</b>	Re-establishment of a potential keystone species: initial impacts on mammal and arthropod species assemblages- <b>Hale*</b>
3:10-3:30	<a href="http://fisheriesstandardsampling.org">http://fisheriesstandardsampling.org</a> : A simple web-based tool to analyze standard fish data with a click of a button- <b>Bonar</b>	A rare find in Grand Canyon—the razorback sucker.- <b>Bunch</b>	Carnivore distributional patterns in White Sands National Monument, NM- <b>Robinson*</b>	How do dispersers select a place to settle? Exploring the role of natal habitat experience in an altered forest landscape- <b>Merrick*</b>
3:30-3:50	<b>BREAK</b>			

\* Student Talks

<b>Friday PM</b>	<b>Wurlitzer Fisheries</b>	<b>Regal Fisheries</b>	<b>Registry Birds</b>	<b>Ambassador Herps and Conservation</b>
<b>Moderator</b>	<b>Julie Carter</b>	<b>Jason Kline</b>	<b>Martha Desmond</b>	<b>David Grandmaison</b>
3:50-4:10	Efforts to conserve New Mexico populations of loach minnow and spikedace affected by the Whitewater-Baldy Complex fire.- <b>Monie</b>	Conservation and Mitigation Program: an overview and progress update of Arizona's newest conservation program- <b>Lashway</b>	Movements and habitat/space use of golden eagles ( <i>Aquila chrysaetos</i> ) from southern New Mexico- <b>Munro*</b>	Mexican gartersnakes--survey considerations for improving detection of cryptic herpetofauna- <b>Emmons*</b>
4:10-4:30	The Effects of the Whitewater-Baldy Fire on Gila trout Recovery- <b>Wick</b>	Do stocked trout eat native fish?- <b>Ward</b>	Influence of nest density and landscape fragmentation on burrowing owl prey delivery to nests- <b>Campos*</b>	Developing processes to quantify ecological context in support of CEAP: a focus on wildlife- <b>East*</b>
4:30-4:50	The genetic status of Gila Trout after the Whitewater-Baldy Fire: implications for recovery- <b>Turner</b>	Flow related responses to the age-0 rainbow trout population in the Colorado River in lower Glen Canyon, AZ.- <b>Avery</b>	Influence of temperature, precipitation and vegetation on burrowing owl (BUOW) occupancy and abundance along the boundary of the BUOW range in the western U.S.- <b>Garcia*</b>	Barrier effects of roads on an endangered forest obligate: importance of canopy cover- <b>Chen*</b>
4:50-5:10	Short term response of fish fauna and habitat in trout streams after the Wallow Fire.- <b>Meyer</b>	Status of the Lees Ferry rainbow trout fishery, Colorado River, Arizona 1991-2011- <b>Anderson</b>	Of owls and alfalfa: why do burrowing owls associate with irrigated agriculture in the southwestern U.S.?- <b>Oleson*</b>	Applications of "epigenetic" tools in wildlife management and conservation- <b>Vaughn*</b>
5:10-5:30			Proposed assessment of forest treatment effects on Mexican spotted owl occupancy using tribal information- <b>Hoagland*</b>	Spatial concordance between recreationally harvested species and biodiversity- <b>Kopp*</b>
<b>Saturday AM</b>	<b>Wurlitzer Fisheries</b>	<b>Regal Small Mammals</b>	<b>Registry Conservation</b>	<b>Ambassador Las Conchas Fire</b>
<b>Moderator</b>	<b>Aaron Bunch</b>	<b>Kay Nicholson</b>	<b>Robert Fink</b>	<b>Bob Parmenter</b>
8:00-8:20	Genetic Monitoring Wild and Refuge Populations of Comanche Springs Pupfish ( <i>Cyprinodon elegans</i> ).- <b>Robinson</b>	Hot, dry, and bitten: a woodrat recipe for reducing availability of keystone desert resources- <b>Hayes</b>	Development of a decision support system to facilitate species conservation in New Mexico- <b>Seamster</b>	Introduction and overview of the Las Conchas Fire: Antecedent conditions, causes and patterns.- <b>Parmenter</b>
8:20-8:40	Salinity tolerance of Rio Grande silvery minnow eggs and larvae- <b>Khan</b>	Derivation of soil screening thresholds to protect chisel-toothed kangaroo rat from uranium mine waste in northern Arizona- <b>Hinck</b>	Candidate conservation agreements for the dunes sagebrush lizard and lesser prairie-chicken in southeast New Mexico- <b>Mathis</b>	Effects of the 2011 Las Conchas Fire on fish populations and habitat in meadow streams of the Valles Caldera National Preserve, New Mexico.- <b>Zeigler</b>

<b>Saturday AM</b>	<b>Wurlitzer Fisheries</b>	<b>Regal Small Mammals</b>	<b>Registry Conservation</b>	<b>Ambassador Las Conchas Fire</b>
<b>Moderator</b>	<b>Aaron Bunch</b>	<b>Kay Nicholson</b>	<b>Robert Fink</b>	<b>Bob Parmenter</b>
8:40-9:00	Tonto Creek Restoration Project; Lessons Learned- <b>Robb</b>	Impact of grazing and wildfires on small mammal community diversity in montane meadows of the Apache-Sitgreaves National Forests- <b>Horncastle</b>	Programmatic habitat conservation measures to reduce consultation stress for agencies and landowners- <b>Tuttle</b>	Terrestrial habitat and vegetation changes from the Las Conchas Fire in the Valles Caldera National Preserve, New Mexico.- <b>Oertel</b>
9:00-9:20	San Juan River Small-bodied Fish Community: Time and Space- <b>Gilbert</b>	Cost-effective techniques to restore and create wetlands habitats for bats, endangered amphibians, and other wildlife- <b>Taylor</b>	Conceptualizing and designing corridors for climate change- <b>Beier</b>	Responses of aquatic macroinvertebrates to the Las Conchas Fire in streams of the Valles Caldera National Preserve, New Mexico.- <b>Jacobi</b>
9:20-9:40	Utility of stream temperature and hydrology measurements in evaluating climate related vulnerabilities of Rio Grande cutthroat trout populations, with applicability to other native southwestern salmonids- <b>Zeigler</b>	A primer on the endangered Mt. Graham red squirrel: current status and threats- <b>Koprowski</b>	Rain harvesting for wildlife: pueblo's initiative to the severe drought to implement water resources.- <b>Smith</b>	The post-fire effects of the Las Conchas Fire on terrestrial arthropod populations in the Valles Caldera National Preserve, New Mexico.- <b>Hodson</b>
9:40-10:00		Evolutionary dynamics of dispersal in metapopulations of the american pika (Ochotona princeps)- <b>Nagy</b>	Wildlife use of solar facilities on and near airports- <b>Van Pelt</b>	Effects of the Las Conchas Fire on forest and grassland bird populations on the Valles Caldera National Preserve.- <b>Greenlee</b>
10:00-10:20	<b>BREAK</b>			

<b>Saturday AM</b>	<b>Wurlitzer Herps</b>	<b>Regal Large Mammals</b>	<b>Registry Birds</b>	<b>Ambassador Las Conchas Fire</b>
<b>Moderator</b>	<b>Bill Gould</b>	<b>Tom Hildebrandt</b>	<b>Valerie Williams</b>	<b>Bob Parmenter</b>
10:20-10:40	Trends in amphibian breeding occupancy along the continental divide (2000-2011)- <b>Gould</b>	On overview of the status and management of ocelots in Arizona- <b>Hanna</b>	Nesting habitat of Mexican spotted owls in the Sacramento Mountains, New Mexico - <b>Ganey</b>	Wildfire, forest restoration, and mammal monitoring in the Southwest Jemez Mountains, New Mexico.- <b>Cain</b>
10:40-11:00	Saltcedar biocontrol affects herpetofauna activity and habitats- <b>Bateman</b>	Seasonal impacts of forage quality and dietary composition on pronghorn ( <i>Antilocapra americana</i> ) in a semi-arid environment- <b>Caldwell</b>	Bald eagles wintering in northern Arizona select perches based on food availability, visibility, and cover- <b>Zylo</b>	Summary, synthesis and future directions for fish and wildlife habitat restoration in the Jemez Mountains.- <b>Parmenter</b>
11:00-11:20	Reptile occurrence and habitat associations on Holloman Air Force Base- <b>Harings</b>	Current status, known movements, and management challenges associated with two recently established rocky mountain bighorn sheep populations in northern New Mexico- <b>Walker</b>	Raptors of the upper Rio Grande, New Mexico- <b>Williams</b>	
11:20-11:40	Quick response experimental post-wildfire translocations in the narrow-headed gartersnake ( <i>Thamnophis rufipunctatus</i> )- <b>Romero</b>	Wildlife water catchment program on the tonto national forest over the last 30 years, which catchments worked- <b>Menasco</b>	Wildlife monitoring and reintroduction within tribal lands: reintroduction of Merriam's wild turkeys, monitoring of various species of wildlife and fishes and the possibility of large ungulate reintroduction- <b>Smith</b>	
11:40-12:00	Ornate box turtle watch: using citizen science to collect data and increase awareness of a nongame program- <b>Owens</b>		Tamarisk leaf beetle distribution and ecosystem impacts monitoring program— <b>Lanci</b>	

# DONORS

**The following entities have supported the 2013 Joint Annual Meeting by donating items for the raffle and auction or through donation of funds.**

The Arizona Chapter, TWS

Arizona Game and Fish Department

The Fat Finch, Albuquerque, NM – [www.fatfinch.com/](http://www.fatfinch.com/)

Mari Howe

Judy Liddell and Barbara Hussey – [birdinghotspotscentralnm.com](http://birdinghotspotscentralnm.com)

The New Mexico Chapter, TWS

New Mexico Department of Game and Fish

Dennis Prichard

REI – [www.rei.com](http://www.rei.com)

Sports Systems, Albuquerque, NM – [www.nmsportssystems.com/](http://www.nmsportssystems.com/)

Wildbirds Unlimited – [www.wbu.com/](http://www.wbu.com/)

Monetary Sponsor – Southwest Section of TWS

# VENDORS

Telonics – [www.telonics.com/](http://www.telonics.com/)

H. Steven Logsdon\Wildlife Artist – P.O. Box 4070, Silver City, NM 88062 (575) 388-8101

Pete David , Author – [www.petedavidbooks.com/](http://www.petedavidbooks.com/)

Fight White-Nose Syndrome – [www.fightnns.org](http://www.fightnns.org)

# **New Mexico and Arizona Chapters of TWS and AFS 2013 Joint Annual Meeting Photo Contest**

## **RULES**

Open to all current paid chapter members (except professional photographers). Participant must be an amateur photographer and must have taken the photo(s) entered into the contest.

Photo entries must not include photos that have been awarded in this contest previously. Prints only please: 5 x 7 inches up to 11 x 14 inches, color or B & W. Prints may be matted and/or mounted on backing board. NO glass, metal, or wood frames. Each entry must be labeled on back (not on front!) with photographer's name, address, phone number, professional society affiliation and category of photo. Each photographer is limited to two photo entries per category, for a maximum of ten entries.

### **Categories:**

- Wild mammals
- Wild birds
- Wild reptiles, amphibians, fish or invertebrates
- Habitat and landscapes
- Recreation or employees at work (human dimension)

## **ENTRY PROCEDURES**

All entries must be registered **by 10:00 A.M. on Friday, February 8**, and must be picked up by the end of the meeting. Submit photos in the approved format at the registration desk. Organizers will post them.

Contestants are urged to submit duplicate prints (not originals). Efforts will be made to safeguard your print; however, the organizers will not be liable for any damage to or loss of your photo.

## **AWARDS**

\$50 Best of Show cash award.

\$15 First Place winner in each category award.

\$10 Second Place winner in each category award.

\$5 Third Place winner in each category award.

Best of Show and other category winners will be determined by popular vote of Joint Annual Meeting attending members. Each attending member will receive a ballot in their registration packet to be filled out and deposited in a box at the photo contest display area starting at approximately noon on Friday, February 8. Balloting will end at approximately 6:00 P.M. on Friday, February 8.

Winners will be announced and receive their cash award at the social on Friday night.

## **Silent Auction and Raffle**

**Silent Auction:** Starts Thursday evening at the Social, and continues through Saturday at 10:20 am (Items will be on display in the Ivory Room).

Don't miss this opportunity to bid on a wide variety of items sure to appeal to the wildlife and/or fisheries biologist. Auction items include books, jewelry, clothing, and artwork.

**How does the Silent Auction work?** A bid sheet is placed on the table in front of each item to be auctioned. The bid sheet contains a brief description of the item, the minimum bid for that item, and the bidding increment. All bids must meet the minimum bid or be at least one bid-increment higher than the previous bid. The person having the highest (last) bid at the time of bid closing will purchase the item for that amount. Cash or check (made out to "NM Chapter of TWS") will be accepted for payment. Items can be picked up after the Saturday morning break - 10:20 am until 12:30 pm.

**The Raffle:** Raffle tickets will be on sale Thursday through Friday until approximately 7:00 pm, during the banquet. Raffle items will be on display next to the Silent Auction items. Drawing for all raffle items will be towards the end of the banquet.

One raffle item will be an Old Town Otter Plus Kayak (list price \$350), paddles and tiedowns. For the kayak, we are limiting the number of tickets to 52, at \$10 each.

Other raffle items include framed artwork, a beautiful quilted wall hanging, and a carved sandhill crane. For these other raffle items, tickets will be \$2 each, 3 for \$5, or 8 for \$10.

## **Student Chapter Raffles**

**The Raffle:** Raffle tickets will be on sale Thursday and Friday until approximately 7:00 pm, during the banquet. Raffle items will be on display outside the meeting rooms. Drawing for all raffle items will be towards the end of the banquet.

Raffle Items will be 16x20 color posters donated from local photographers. Each Student Chapter will be raffling off a different poster.

Tickets will be \$2 each, 3 for \$5, or 8 for \$10.

**Your support is appreciated . . . Thank you**

## PRESENTATION ABSTRACTS

### \* Student Talks

#### **STATUS OF THE LEES FERRY RAINBOW TROUT FISHERY, COLORADO RIVER, ARIZONA 1991-2011.**

ANDERSON, MIKE, Aaron Bunch, Bill Stewart, Arizona Game and Fish Department, Research Branch, 506 N. Grant St. Suite L, Flagstaff, AZ 86004.

Standardized long-term monitoring and research programs provide critical information in adaptive management situations. These long-term datasets provide a baseline with which to compare changes in population trends in response to fishery management objectives as well as hydroelectric operations. Rainbow trout (*Oncorhynchus mykiss*) were initially stocked in the Colorado River downstream from Glen Canyon Dam in 1964, and since that time fish management efforts, dam operations, and flow regimes have interacted to influence the trout community. Since 1991, Arizona Game and Fish Department (AGFD) has conducted electrofishing surveys in the Lees Ferry reach of the Colorado River (RM -15.5-0) downstream from Glen Canyon Dam. Rainbow trout catch-per-unit-effort (CPUE; fish/min.) for all sizes during 2012 was  $7.3 \pm 0.94$  fish/min., which is similar to the rainbow trout CPUEs in the early 2000's. Rainbow trout condition ( $K_n$ ) increased significantly compared to the previous 4 years of sampling. This increase was seen among multiple size classes of rainbow trout in 2012, the increase was likely due to an increase in  $K_n$  among fish 152-305 mm which were comprised largely of individuals from the 2011 year class. Continued monitoring of the Lees Ferry rainbow trout fishery will allow the evaluation of population trends following reduction in discharge and resultant decrease in habitat availability after equalization flows have ceased.

#### **STATUS OF HEADWATER CHUB (*GILA NIGRA*) IN THE SPRING CREEK DRAINAGE**

AVENETTI, LORRAINE, Arizona Game and Fish Department, Research Branch, 5000 W. Carefree Hwy, Phoenix, AZ, 85086.

There has been concern of the status of headwater chub (*Gila nigra*) in the Tonto Creek, Salt, and Verde River watersheds. Recently, mitigation has brought forth a need for current data on this species and their potential interactions with stocked rainbow trout. Over the last two years, the Research Branch has conducted a series of inventories on known headwater chub streams in the Tonto Creek and Verde River watersheds to evaluate the population status for headwater chub. Our objectives were to determine relative abundance, distribution, size structure, and relative condition of these populations. We used a multiple-gear sampling approach to identify the most efficient methods to capture headwater chub. Spring Creek, a tributary of Tonto Creek, and streams within its watershed were surveyed during July 2012. Sampling efforts consisted of backpack electrofishing (EF) and hoop nets in Spring Creek, backpack EF in Rock Creek (tributary to Spring Creek), visual surveys in Turkey and Dinner Creeks, and hoop nets in Buzzard Roost Creek (tributaries to Rock Creek). Multiple size classes of headwater chub were observed throughout these streams excluding Dinner Creek, which was dry. Nonnative fish were absent in Turkey and Buzzard Roost Creeks while commonly captured in the lower portions of Rock and Spring Creeks, where they remain a concern for the future persistence of headwater chub. These data suggest robust populations of headwater chub are found throughout the Spring Creek watershed.

#### **FLOW RELATED RESPONSES TO THE AGE-0 RAINBOW TROUT POPULATION IN THE COLORADO RIVER IN LOWER GLEN CANYON, AZ**

AVERY, LUKE, Grand Canyon Monitoring and Research Center, U.S. Geological Survey, 2255 Gemini Drive, Flagstaff, AZ 86001 and Josh Korman, Ecometric Research Inc., 3560 W. 22<sup>nd</sup> Ave., Vancouver, BC, V6S, IJ3

The Rainbow Trout Early Life Stage Study (RTELSS) was initiated in 2003 to monitor the effects of experimental increased daily fluctuation of flows from Glen Canyon Dam on the Lees Ferry age-0 rainbow trout (*Oncorhynchus mykiss*) population. The increased daily fluctuation of flows during the springs of 2003-2004 increased estimated redd mortality to 23% and 49% for years 2003 and 2004, respectively, up from 2-11% for years of normal fluctuation (2006-2012). However, a compensatory increase in early survival of larval rainbow trout nullified the effect at a population level. Though intended to be an isolated study, RTELSS has continued on as a monitoring effort that has provided

valuable information on the response of age-0 trout to additional experimental flow events. In 2008, a high flow event (HFE, ~42,000 cfs) occurred in March, which is in the peak of the spawning season in Glen Canyon. Though the flows decimated the redds and larvae of pre-HFE spawning, they also cleaned the spawning substrate, which lead to increased hatch success for post-HFE spawning. There was also a shift in dominate foodbase taxa from New Zealand mudsnail (*Potamopyrgus antipodarum*, non-digestible) to Simuliids and Chironimids (highly palatable). This resulted in increased early survival and growth. July 2008 showed a Lees Ferry age-0 rainbow trout population estimate of 883,000 fish (95% CI, 647,000-1,168,000), three times the July average for all other years. Flows during 2011 were higher and less variable than other recent years (2006-2010, 2012). Increased wetted habitat is the likely reason for the record high redd estimate of 3,062 for 2011 (9-year average=1,701). Increased habitat quantity and decreased flow variability likely resulted in increased hatch success and month to month survival. The November age-0 rainbow trout population estimate for 2011 was 214,000 fish (95% CI: 175,000-253,000), 3.6 times the November average for all other years.

## **SEASONAL IMPACTS OF FORAGE QUALITY AND DIETARY COMPOSITION ON PRONGHORN (*ANTILOCAPRA AMERICANA*) IN A SEMI-ARID ENVIRONMENT**

AVERY, MINDI, New Mexico State University, Department of Fish, Wildlife and Conservation Ecology, Box 30003, MSC 4901, Las Cruces, NM 88003. (575) 646-6053, [mma.avery@gmail.com](mailto:mma.avery@gmail.com) and CALDWELL, COLLEEN, U.S. Geological Survey, New Mexico Cooperative Fish and Wildlife Research Unit, Department of Fish, Wildlife and Conservation Ecology, Box 30003, MSC 4901, Las Cruces, NM 88003. (575) 646-8126. [ccaldwel@nmsu.edu](mailto:ccaldwel@nmsu.edu) (Presenter)

A population of pronghorn (*Antilocapra americana*) on White Sands Missile Range (WSMR), in south-central New Mexico, has declined since 1980 despite little to no hunting pressure and minimal competition for forage with livestock. While this decreasing trend has coincided with intermittent periods of severe drought, competition with the non-native South African gemsbok (*Oryx gazella*) is presumed as a contributor to the overall decline of the population. Precipitation patterns profoundly affect viability of ungulate populations throughout this semi-arid landscape and less is known regarding the effects precipitation has on forage selected by pronghorn. Thus the goal of this study was to relate seasonal changes in forage selection throughout pronghorn habitat on WSMR and relate these seasonal changes to diet composition and nutrition in both pronghorn and gemsbok. Forbs represented a major component of pronghorn diet during warm-dry (68%), warm-wet (55%), and cool-dry seasons (32%). A slight decrease (42%) in the percentage of forbs occurred in the warm-dry season during the 2011 drought. Although gemsbok and pronghorn share the same habitat (were often seen grazing together), an analysis of dietary overlap between the two species revealed low (17%) to moderate (37%) overlap and suggests the gemsbok may not be negatively influencing forage selection of pronghorn on WSMR. Dietary quality (fecal nitrogen, FN and fecal 2,6-diaminophelic acid, FDAPA) reflected seasonal differences in available forage as well as severe drought. Average FN increased in pronghorn from 1.4% in the cool-dry season to 2.1% in the warm-dry (2010) season. In contrast, FN decreased in pronghorn from 2.1% in the warm-dry (2010) to 1.4% in the drought of the warm-dry season of 2011. Gemsbok dietary quality did not differ between warm-dry (2010) and the drought of the warm-dry season of 2011, revealing resiliency in the gemsbok compared to the pronghorn during abnormally low precipitation periods.

## **SALT CEDAR BIOCONTROL AFFECTS HERPETOFAUNA ACTIVITY AND HABITATS**

BATEMAN, H.L., Arizona State University at the Polytechnic campus, Mesa, AZ, 85212; D.M. Merritt, U.S. Forest Service, Stream Systems Technology Center, Fort Collins, CO, 80526; P.L. Nagler, U.S. Geological Survey, Southwest Biological Science Center, Tucson, AZ, 85721; and E.P. Glenn, University of Arizona, Environmental Research Laboratory, Tucson, AZ, USA, 85706.

The biological control agent (tamarisk leaf beetle, *Diorhabda* spp.) has been used to defoliate non-native saltcedar (*Tamarix* spp.) in western riparian systems. The Virgin River in Arizona and Nevada is a system where beetle populations are expanding. Saltcedar biocontrol, like other control methods, has the potential to impact non-target species (in both positive and negative ways). Because amphibians and reptiles respond to vegetation changes in habitat and forage in areas where beetles are active, herpetofauna are model taxa to investigate the potential impacts of

biocontrol. Our objectives were to relate herpetofauna abundance to vegetation indices (measured vegetation cover, NDVI and EVI) and timing of biocontrol. We quantified herpetofauna abundance using mark recapture techniques and vegetation using remotely sensed images in 16 to 20 sites two years prior to (2009-2010) and two years after (2011-2012) beetle introduction (biocontrol). Our results indicated that many species of reptiles utilized both monotypic stands of saltcedar and habitats mixed with saltcedar and native riparian trees. However, mixed stands had a greater capture rate of herpetofauna compared to saltcedar stands. Herpetile captures were significantly related to higher cover of vegetation (NDVI). Following biocontrol defoliation of saltcedar, both mixed and saltcedar stands had significantly lower NDVI and EVI values and fewer herpetofauna captures. General linear models indicated that variables such as canopy cover and saltcedar stems are good predictors of herpetofauna activity (both variables inversely related). These results include short-term effects of saltcedar biocontrol and the trajectory of the herpetofauna community is uncertain given that the saltcedar, biocontrol insects, and native vegetation may reach a future equilibrium that cannot be predicted based on the early-stage interactions studied so far. Management of non-native plants should consider how control activities could impact habitat physiognomy and native wildlife communities in riparian areas affected by biocontrol.

## **CONCEPTUALIZING AND DESIGNING CORRIDORS FOR CLIMATE CHANGE**

BEIER, PAUL, School of Forestry, Northern Arizona University, Flagstaff AZ 86011

In the rush to embrace corridors as an adaptation strategy, some ecologists have framed the strategy as using complex models to design corridors extending hundreds of kilometers from low-elevation, low-latitude sites to distant high-elevation, poleward sites along paths that capture the shifting climate envelopes of individual species. This conceptualization of corridors differs from traditional corridors designed to support gene flow and recolonization. In contrast, I argue that both short-distance and long-distance shifts to future climate space can be achieved by a combination of short movements within large, topographically and climatically diverse natural landscape blocks and short coarse-filter corridors between those blocks. These coarse-filter corridors can be designed in 3 non-mutually-exclusive ways. First, rivers areas provide natural conduits for movement of plants and animals and are therefore priorities for conservation and restoration as climate corridors. Second, linkages that provide continuity and interspersion of land facets (units defined by topographic or soil variables) should support movement under any future climate regime. This approach is best suited to link large topographically diverse blocks separated by distances < 30 km. The third approach, climate gradient corridors, is appropriate in landscapes where natural landscape blocks have low within-block topographic diversity (such as where blocks are small), especially if the blocks are dissimilar. The coarse filter approaches described here are reasonable and well-grounded in fundamental concepts of ecology, but conservation and restoration decisions should also be based on empirical evidence of how well coarse filter corridors protect demographic and genetic flows for today's focal species.

## **<http://fisheriesstandardsampling.org>: A SIMPLE WEB-BASED TOOL TO ANALYZE STANDARD FISH DATA WITH A CLICK OF A BUTTON**

BONAR, SCOTT A., Unit Leader, U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, and Associate Professor, School of Natural Resources, University of Arizona. 104 Biological Sciences East, Tucson, AZ 85721, (520)-349-1894 [sbonar@ag.arizona.edu](mailto:sbonar@ag.arizona.edu); Matt Rahr, IT Project Manager, College of Agriculture and Life Sciences Networking Laboratory, University of Arizona, Tucson, Arizona 85721; Toby Torrey, Web Developer, College of Agriculture and Life Sciences Networking Laboratory, University of Arizona, Tucson, Arizona 85721; Norman Mercado Silva, Senior Research Specialist, University of Arizona and Professor, University of Guadalajara, University of Arizona, Tucson, Arizona 85721; and Averill Cate, Web Developer, School of Natural Resources, University of Arizona, 325 Biological Sciences East, Tucson, AZ 857214

Recently, the American Fisheries Society developed standard methods to sample freshwater fish populations, publishing them in the 2009 book "*Standard Methods for Sampling North American Freshwater Fishes*". This project involved 284 scientists from 107 different organizations across Canada, Mexico and the United States. Data collected using standard methods gives biologists the ability to compare data across regions or time. Here we show most recent developments in an on-line web-accessible tool to compare fish growth, condition, length-frequency, and catch per unit

effort data collected using AFS standard methods with a simple click of a button. Development of this tool was a collaborative effort among AFS, the US Geological Survey, the National Park Service, the U.S. Forest Service, the University of Arizona, the University of Guadalajara, and others. This web-based tool (1) provides on-line summaries of more than 4000 data sets of condition, length-frequency, CPUE and growth indices of common freshwater fishes, collected using standard gears from 42 states and provinces across North America; (2) allows easy entry of new data collected using standardized methods, so summaries can be rapidly updated; and (3) allows users to quickly compare condition, growth and abundance of fish collected in a particular waterbody with regional (continent, ecoregion and state) and rangewide averages and percentiles, thus increasing resource information for a variety of areas. The site is programmed in a PHP-based Drupal framework and was invited for demonstration at the AFS Annual Meeting in Minneapolis, and at workshops and symposia at the AFS Division Meetings in the South and Midwest. We will demonstrate latest updates to the program, based on input from testers and collaborators, and show how the program can help diagnose fish population problems in specific waterbodies.

### **A RARE FIND IN GRAND CANYON—THE RAZORBACK SUCKER**

BUNCH, A.J., Arizona Game and Fish Department, Flagstaff, AZ 86004; M. McKinstry, U.S. Bureau of Reclamation, Salt Lake City, UT, 84138; B. Albrecht, Bio-West, Logan, UT, 84321; M. Anderson, Arizona Game and Fish Department, Flagstaff, AZ 86004; W. Persons, U.S. Geological Survey, Flagstaff, AZ 86001; and E. Smith, National Park Service, Flagstaff, AZ 86001

The endangered razorback sucker *Xyrauchen texanus* is one of eight native fish species that historically inhabited the Grand Canyon section of the Colorado River. The last confirmed razorback sucker collection in Grand Canyon was 1990 at the Little Colorado River confluence. Recent studies have shown natural reproduction and recruitment near the Lake Mead inflow. The Lake Mead population represents the only naturally recruiting population of razorback sucker in the Colorado Basin, although there is evidence to suggest that a similar situation is occurring in Lake Powell near the San Juan River inflow. Standardized electrofishing has been conducted in the mainstem Colorado River between Glen Canyon Dam and Lake Mead since 2000. On October 7, 2012, we collected a wild, untagged, male razorback sucker in lower Grand Canyon near Spencer Canyon (RM 246) marking the first collection in more than 20 years. The fish was an adult measuring 543 mm total length. Additionally, in 2012 during monitoring efforts for razorback sucker near the Colorado River inflow area, three sonic-tagged fish were tracked upstream 15 miles below the capture of this fish and 30 miles upstream of the inflow area, confirming that razorback suckers are using the Colorado River in Grand Canyon. Both studies suggest that the species is using an area where they were once thought to be extirpated. The mechanisms influencing the return of this species to Grand Canyon are unknown; however, it is not surprising given the relatively close proximity to a naturally recruiting population within Lake Mead. Future monitoring efforts will evaluate habitat use, movement, and if spawning and recruitment is occurring in Grand Canyon.

### **WILDFIRE, FOREST RESTORATION, AND MAMMAL MONITORING IN THE SOUTHWEST JEMEZ MOUNTAINS, NEW MEXICO.**

CAIN III, JAMES W., U.S. Geological Survey, New Mexico Cooperative Fish and Wildlife Research Unit and Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University; Robert Parmenter, Mark A. Peyton, Valles Caldera National Preserve; and Sarah R. Kindschuh, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University

Catastrophic wildfires over the past two decades has increased the requests for forest restoration projects designed to restore historic forest structure, plant species composition, and fire regimes. Both wildfires and forest restoration treatments can result in profound changes to habitat conditions for many wildlife species. We are currently monitoring the responses of small mammals to the 2011 Las Conchas Fire and large mammals (mule deer, elk, black bear, and mountain lion) to both forest fire and forest restoration treatments in the southwest Jemez Mountains, New Mexico. Small mammal populations were sampled with live-traps in replicated burned and unburned forest stands in 2012, and results showed no significant differences in densities for deer mice, least chipmunks, golden-mantled ground squirrels or other ground-dwelling species associated with fire treatment; however, tree squirrels (Abert's and red squirrels) were completely absent from burned forests. Gunnison's prairie dog colonies appeared to be unaffected by the Las Conchas

grassland fires. The large mammal monitoring project was initiated in 2012. As of December, 32 elk, 10 black bears and 2 mule deer have been captured and fitted with radio collars, and an additional 30 mule deer and 7 mountain lions will be captured during winter 2012-2013. Study objectives, research design and preliminary results of the large mammal project will be discussed. These studies will result in data that will be useful for managers when planning overall forest restoration projects as well as provide information for the development of species-specific management treatments to improve habitat conditions.

### **\*INFLUENCE OF NEST DENSITY AND LANDSCAPE FRAGMENTATION ON BURROWING OWL PREY DELIVERY TO NESTS**

CAMPOS, MIRANDA (Undergraduate Student), Jenny Davis and Martha Desmond, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, NM 88003

The western burrowing owl (*Athene cunicularia hypugaea*) is a species of conservation concern native to the western United States. Burrowing owl populations are declining throughout their range, with the strongest declines in the north. This is likely, in part, due to habitat loss and fragmentation. Habitat fragmentation may result in increased nest densities and increased competition for resources. We are interested in how nest density and landscape fragmentation influences the type of prey items delivered to nests. We hypothesized that the percentage of vertebrate prey delivered to the owl nests would be negatively related to owl density and measures of landscape fragmentation. To test this hypothesis, cameras were distributed at nests (n=54) across five Forest Service National Grasslands from northeastern New Mexico and west Texas to northwestern South Dakota along a latitudinal gradient during summer 2010. Video data was collected at each nest and examined for delivered prey items (vertebrate, invertebrate, and unknown). Prey type was examined in relation to the size of the prairie dog colony, distance to colony edge, burrowing owl density, percent agriculture, precipitation and number of young fledged. A multiple regression analysis and an Information Theoretic Approach were used to test 15 *a priori* models. Our analysis identified two competing models ( $<_2$  AIC<sub>c</sub>). Our top model contained only precipitation, indicating that the type of prey items delivered to owl nests were most strongly influenced by annual rainfall. The competing model contained both precipitation and owl density, supporting our prediction that owl density has a negative influence on the amount of vertebrate prey delivered to nests. There was limited support for the percentage of agriculture negatively influencing prey quality. This research will contribute to a greater understanding of substantial burrowing owl population declines in the Northern Great Plains.

### **\*BARRIER EFFECTS OF ROADS ON AN ENDANGERED FOREST OBLIGATE: IMPORTANCE OF CANOPY COVER**

CHEN, H. (Graduate Student), and J.L. Koprowski, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721.

Anthropogenic habitat fragmentation and destruction caused by infrastructural development such as roads are recognized as one of the major threats to biodiversity. Roads and traffic can influence animal movements and may act as barriers by restricting movement of animals, especially for small, forest obligates such as tree squirrels. The barrier effect is driven by several distinct mechanisms, including edge, gap and traffic avoidance. A clear understanding of these factors is important to develop appropriate mitigation. The Mt. Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) is an endangered subspecies of red squirrel endemic to high elevation forests of the Pinaleño Mountains in southeastern Arizona. Previous observations and telemetry data suggest Mt. Graham red squirrels may avoid roads, but factors that influence road avoidance remain unclear. In this study, we combined radio telemetry and traffic monitoring with accurate, three-dimensional remote sensing imagery (LiDAR) to comprehensively examine edge, gap and traffic effects of roads and to determine the relative degree of contribution of each to road avoidance. In 2010, we radio collared 20 red squirrels. We overlaid red squirrel seasonal home ranges with linear features (reference lines at least 100 m from roads, low to high canopy cover lines, low and high traffic volume roads) and estimated probability of home ranges that cross linear features with logistic regression. Degree of canopy cover is the most significant factor affecting probability of overlap between squirrel home ranges and linear features. Probability of overlap is lower than

42 % when canopy cover is less than 50 % regardless of distance from linear features to roads. Probability of crossing low traffic roads (<50 cars/day) is not significantly different than high traffic roads (100-200 cars/day). Our results suggest that gap avoidance may play an important role in road avoidance of forest obligate species.

### **\*RELATIONSHIP BETWEEN U.S.-MEXICO BORDER OPERATIONS AND SUSPENDED SEDIMENT IN HEADWATERS OF THE RIO YAQUI**

CLARK, STEPHANI L., (Graduate Student) and Scott A. Bonar, University of Arizona, School of Natural Resources and the Environment, AZ Cooperative Fish and Wildlife Research Unit.

Impacts of U.S./Mexico border operations on many terrestrial species have been well documented, yet little is known about the impacts of border operations on aquatic ecosystems. Black Draw, a tributary to the headwaters of the Rio Yaqui, originates in San Bernardino National Wildlife Refuge (SBNWR) on the United States (U.S.)- Mexico border and is home to several species of threatened or endangered fishes. Construction of bridges and roads on or near SBNWR by U.S. Border Patrol, and other activities conducted by the U.S. Border Patrol have prompted concern about increased sedimentation of the Rio Yaqui. Increased sedimentation could elevate total suspended sediment (TSS) and turbidity in the Rio Yaqui thus causing changes in diet and survival of fishes inhabiting the system. To evaluate impact of border patrol activities on TSS and turbidity in Black Draw, we installed Nalgene stormwater samplers, which collect single 1L first flush grab samples of storm water. Samplers were installed at randomly chosen sites, above and below three areas of border operations and at additional random sites throughout Black Draw to identify major sources of sediment to the stream. Initial results show TSS concentrations ranged from 3.0mg/L to 67340.4mg/L and turbidity ranged from 0.6 nephelometric turbidity units (NTU) to greater than 10,000NTU. Turbidity and TSS concentrations are now being plotted and compared among locations in the drainage. Furthermore, these values are being used to identify a range of turbidity and TSS concentrations for which to test effects on Rio Yaqui fishes in laboratory experiments. Results will be used to inform management considerations involving turbidity, TSS and the imperiled fishes of the Rio Yaqui drainage.

### **DEVELOPING PROCESSES TO QUANTIFY ECOLOGICAL CONTEXT IN SUPPORT OF CEAP: A FOCUS ON WILDLIFE**

EAST, N.F.<sup>1</sup> (Graduate Student), R.K. Guy<sup>1</sup>, K.G. Boykin<sup>1</sup>, W.G. Kepner<sup>2</sup>, D.C. Goodrich<sup>3</sup>, D.F. Bradford<sup>2</sup>, D.A. Kopp<sup>1</sup>, A.K.K. Leimer<sup>1</sup>, E.A. Sampson<sup>1</sup>, <sup>1</sup>New Mexico State university, Las Cruces, NM, <sup>2</sup>U.S. Environmental Protection Agency, Las Vegas, NV, <sup>3</sup>USDA Agricultural Research Service, Tucson, AZ

The Conservation Effects Assessment Project (CEAP), a nationwide effort conducted by the National Resource Conservation Service, seeks to quantify the effects of conservation practices to inform the decision making process of future management practices. An important component in the decision making process is the incorporation of a quantifiable description of the context: the surroundings in which the management area exists and is a part of. This can be accomplished in part by modeling the potential vertebrate species richness of the context in relation to the management area. For this analysis, potential vertebrate species richness was quantified by the summation of groupings of species habitat models, called biodiversity metrics, which represent ecosystem components of interest to the study area. Species distribution data were obtained from the Southwest Regional Gap Analysis Project, which bases its models in part on the interplay between landscape categorization and species biology. Biodiversity metrics included in this analysis include divisions of taxa, species of greatest conservation need (SGCN), threatened and endangered species, and classes of harvestable species. The Bureau of Land Management's Las Cruces District Office (LCDO) in southern New Mexico served as a prototype area for this study in a first level effort of coarse scale characterization, where a 75-km buffer was used to characterize the context of the LCDO for each metric. The analysis identified metrics with a disproportionate concentration of mean species richness within either the study area or the context of the study area. The Amphibians, SGCN Birds, and Upland Game metrics showed a higher potential richness outside of the study area (context to study area ratio of mean species richness at  $\geq 1.10$ ); while the reptiles and SGCN reptiles metrics were shown to have a higher potential richness within the study area (context to study area ratio at  $\leq 0.90$ ).

## **\*MEXICAN GARTERSNAKES--SURVEY CONSIDERATIONS FOR IMPROVING DETECTION OF CRYPTIC HERPETOFAUNA**

EMMONS, IAIN D., and Erika M. Nowak, Colorado Plateau Research Station and Biological Sciences Department, Northern Arizona University, Flagstaff, AZ 86011.

Mexican gartersnakes (*Thamnophis eques*) are highly aquatic snakes found in Arizona, New Mexico, and Mexico that have experienced significant population declines in the United States. We surveyed five sites in the Verde River watershed in Arizona during 2012 as part of a collaborative effort to identify extant populations, document habitat use, and compare the relative effectiveness of different sampling techniques. Survey methods included Gee minnow traps installed along river banks and wetland edges, time-constrained visual encounter surveys, wood coverboards arranged along wetland edges, and radio telemetry to track individuals surgically implanted with radio transmitters. We documented 61 detections among the sites surveyed in 2012. Among these, minnow traps accounted for 56 of the detections, four were seen incidentally while checking traps, and one snake was found during radio telemetry. Preliminary radio telemetry data suggest a tendency towards cryptic behavior associated with densely vegetated cover that creates challenges for visually-based sampling methods. Our findings indicate that snake detections are aided by the use of strategically placed funnel traps, particularly in complex habitats. Comparison of our results with previous research underscores the need for intensive survey efforts utilizing multiple sampling techniques in sites with potentially low population densities.

## **\*PUMAPLEX: A HIGH-THROUGHPUT ASSAY FOR THE GENETIC MONITORING OF PUMAS IN THE SOUTHWESTERN U.S.**

FITAK, ROBERT R. (Graduate Student) and Melanie Culver, GIDP Genetics and School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721.

Pumas (*Puma concolor*) are a captivating wildlife species that draw much attention from managers for their use as a game species, for preying upon (at times endangered) wildlife, and for human-animal conflicts. In response to this attention, managers must make informed decisions when managing puma populations, often utilizing the most recent and robust scientific techniques. These techniques include the use of genetics, which is employed to discern such questions as population structure, diet, individual identification, population size, inbreeding, migration, parentage, etc. Often, a genetic marker called a microsatellite is used, however these data suffer from disadvantages such as difficulty in being compared across studies, the high cost of examination, and homoplasy. Therefore, new markers are necessary that can circumvent these concerns. To do so we developed PumaPlex, an assay to rapidly examine single nucleotide polymorphisms (SNPs) in a large number of pumas. PumaPlex can simultaneously analyze 27 SNPs in 383 samples using the Sequenom<sup>TM</sup> massarray technology. Initial calculations demonstrate that this assay has a resolution similar to ~10 microsatellite markers. In this presentation we will highlight the assay design and its experimental validation in ~500 pumas samples. Finally, we include a discussion of how this information can improve the monitoring and management of puma populations in the southwest.

## **NESTING HABITAT OF MEXICAN SPOTTED OWLS IN THE SACRAMENTO MOUNTAINS, NEW MEXICO**

GANEY, JOSEPH L., Darrell L. Apprill, Todd A. Rawlinson, Sean C. Kyle, Ryan S. Jonnes, and James P. Ward, Jr., US Forest Service, Rocky Mountain Research Station, Flagstaff, AZ, USA

Understanding the habitat relationships of rare species is critical to conserving populations and habitats of those species. Nesting habitat is suspected to be an important factor limiting distribution of the Mexican spotted owl (*Strix occidentalis lucida*), and may vary among geographic regions. To provide information on nesting habitat of Mexican spotted owls in the Sacramento Mountains, New Mexico, we compared characteristics of owl nest trees and nest sites to characteristics of randomly located trees and sites representing the general nest vicinity, core area, and foraging areas of spotted owls. Owls nested almost exclusively in mixed-conifer forest, and most nested in cavities in trees or snags (48.2%), or in dwarf mistletoe (*Arceuthobium* spp.) witches' brooms (36.1%). Nest trees were larger in diameter,

taller, and had greater levels of dwarf mistletoe infection than random trees. They also were more likely to be in white fir (*Abies concolor*) or Douglas-fir (*Pseudotsuga menziesii*) trees, and in trees with broken tops. At all spatial scales examined, owl nest sites had greater canopy cover, greater amounts of basal area contributed by large trees, and greater densities of large snags and logs than random sites. Nest sites generally were dominated by large white fir trees, suggesting that these sites fell toward the wetter/cooler end of the mixed-conifer continuum in the southwestern US. Most nest sites occurred on the lower two thirds of north- or east-facing slopes. Our results suggest that managers in this area should retain high levels of canopy cover and large trees in owl habitat, including large trees with cavities or large Type II or Type III dwarf mistletoe witches' brooms. They also suggest that managers conducting restoration or other treatments could reduce potential impacts to owl nesting habitat by locating treatment units on ridgetops or on the upper third of south- or west-facing slopes.

**\*INFLUENCE OF TEMPERATURE, PRECIPITATION AND VEGETATION ON BURROWING OWL (BUOW) OCCUPANCY AND ABUNDANCE ALONG THE BOUNDARY OF THE BUOW RANGE IN THE WESTERN U.S.**

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Many species appear to be shifting their distributions north in response to a warming climate. However, the western burrowing owl (BUOW) is one of several species whose breeding range has shifted southward rather than northward over the past 40 years. Understanding the cause of this shift is particularly important because BUOWs are a species of national conservation concern in the U.S. and federally endangered in Canada. We examined the relationship of both BUOW occupancy and abundance with temperature, precipitation, and vegetation along the boundary of the BUOW's breeding range in the western U.S. We used data from the Breeding Bird Survey, PRISM, and National Land Cover Data to identify climate and vegetation thresholds beyond which burrowing owls were absent, and then excluded BBS routes with attributes beyond these thresholds to create occupancy and abundance models. May precipitation, August-September maximum temperature, and the amount of low intensity development and grassland best predicted BUOW occupancy ( $P < 0.05$ ). Variables that best explained variation in BUOW abundance included: the maximum temperature of the previous November and current January, April-May precipitation, and the amount of developed open space, grassland, pasture, and shrub. Temperature explained the greatest variation in BUOW abundance. The relationship between BUOW abundance and precipitation was always negative: spring precipitation is forecasted to become drier in the southwest, and so precipitation may better explain the southward contraction of the BUOW range rather than temperature. A consistent positive relationship between BUOWs and small amounts of development across both models suggests that development influences both BUOW occupancy and abundance.

**\*INFLUENCE OF LIVESTOCK GRAZING ON FORAGE BIOMASS, ACTIVITY BUDGETS AND FORAGING EFFICIENCY OF DESERT BIGHORN SHEEP (*OVIS CANADENSIS MEXICANA*) IN SOUTHERN NEW MEXICO**

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The desert bighorn sheep (*Ovis canadensis mexicana*) is an iconic species treasured for both aesthetics and sport. Prior to European settlement, desert bighorn numbered in the thousands in New Mexico. By 1980, however, over-hunting, disease, and habitat degradation by livestock reduced *O.c. mexicana* to just 69 wild animals. In the following thirty years, desert bighorn populations have recovered to an approximate 550 animals state-wide. Though trends are promising, desert bighorn recovery remains an ongoing challenge. One profound land use which can impact bighorn populations is cattle grazing. By altering the habitat and foraging behavior of desert bighorn, cattle grazing may influence bighorn population growth. Thus, we have begun research investigating the impacts cattle grazing on desert bighorn sheep in New Mexico. We hypothesize that cattle grazing on desert bighorn habitat reduces the quantity of

forage for desert bighorn, thus reducing foraging efficiency. To test this hypothesis we are quantifying forage biomass and composition and foraging behavior of desert bighorn in grazed and ungrazed mountain ranges. Specifically, we are measuring the composition and biomass of key forage species at the site-wide and patch spatial scales by sampling vegetation transects across each habitat and at observed bighorn foraging stations. We are also collecting observational data on desert bighorn activity budgets and foraging bouts to quantify foraging efficiency. Observational data will include time spent feeding, number of steps taken, and time spent in non-feeding activities. We predict that the ungrazed habitat will have higher edible forage biomass, allowing desert bighorn to forage more efficiently than in the grazed habitat.

### **SAN JUAN RIVER SMALL-BODIED FISH COMMUNITY: TIME AND SPACE**

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To characterize the presence, status, and trends of Colorado pikeminnow, razorback sucker, and associated fishes, small-bodied fish monitoring has occurred annually since 1998 in the San Juan River. With the exception of 2001-2003, Colorado pikeminnow was captured (total n = 250) each year since monitoring began while no razorback sucker has been captured. Colorado pikeminnow are more abundant in the upper portion of the river and in secondary channels compared to the primary channel and backwaters. Using these data, we assessed Colorado pikeminnow habitat use, differences in fish community structure in primary versus secondary channels, and influence of young-of-year catfish densities on recruitment strength of juvenile catfishes. Our data indicated Colorado pikeminnow may prefer eddies in the primary channel, and embayments and run type habitats in secondary channels. The fish communities present in secondary channels and the primary channel are significantly different such that discriminant function analysis correctly predicts membership within a given channel type at 67%. Densities of channel catfish and speckled dace were the best predictors of primary channels while fathead minnow, Colorado pikeminnow, and black bullhead were good predictors of secondary channels. Time-lag analysis showed juvenile catfish capture was constrained by prior years' collection of young-of-year catfish. In addition to providing data relevant to the San Juan River Basin Recovery Implementation Program, annual small-bodied fish monitoring provides information important to the Range-Wide Conservation Agreement and Strategy for Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker. Densities of both species of suckers were at their lowest from 1998-2002. Collection of roundtail chub occurred in 2011 and 2012. These years were the first time since 1999 that roundtail chub was captured during this annual monitoring event.

### **\*USING NON-INVASIVE GENETIC ANALYSIS TO ESTIMATE THE ABUNDANCE AND DENSITY OF AMERICAN BLACK BEARS (*URSUS AMERICANUS*) IN NEW MEXICO**

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One of the main challenges for wildlife management agencies is to set harvest levels that ensure for the long-term persistence of populations. Due to financial and logistical constraints, management agencies often lack relevant estimates of vital rates for all populations or subpopulations for which they must set harvest quotas or must extrapolate vital rates and population parameters estimated from research studies to populations and areas outside the study area. Currently, estimates of black bear abundance and density are lacking in New Mexico. In a collaborative effort between New Mexico State University, the New Mexico Cooperative Fish and Wildlife Research Unit, and the New Mexico Department of Game and Fish, we will estimate the abundance and density of black bears within 5 of the new 13 bear management zones in New Mexico. We will use non-invasive hair traps and bear rubs along with genetic samples collected from management, research, and hunter-harvested bears in mark-recapture models to estimate the abundance and density of black bears in the Sacramento and Sangre de Cristo Mountains of New Mexico. Hair samples will be collected over the course of three summers. Genetic samples will be analyzed at the termination of each field season.

Population estimates will be provided to the New Mexico Department of Game and Fish, and will aid them in setting harvest limits for black bears in the Sacramento and Sangre de Cristo Mountain black bear management zones. This is the first non-invasive black bear DNA project conducted in the state of New Mexico.

### **TRENDS IN AMPHIBIAN BREEDING OCCUPANCY ALONG THE CONTINENTAL DIVIDE (2000-2011)**

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We have monitored amphibian populations for over a decade in several national parks along the Continental Divide to determine the status and trend of amphibians in some of the United States' most significant protected landscapes. Within Glacier, Yellowstone, Grand Teton, and Rocky Mountain National Parks, we conducted annual surveys for breeding occupancy from 2000-2011, adopting a consistent sampling approach among the Parks beginning in 2006. We used multi-season occupancy estimation to assess changes in the occurrence of tiger and long-toed salamanders, boreal toads, boreal chorus frogs and spotted frogs at two scales: small watershed (catchment) and individual site. In this talk, we will focus on the dynamics of individual wetland site occupancy. Numerous *a priori* models were considered within an information theoretic framework including covariates such as climatic and habitat-specific covariates. We will highlight the similarities and differences among the parks in observed trends and relationships with covariates.

### **EFFECTS OF THE LAS CONCHAS FIRE ON FOREST AND GRASSLAND BIRD POPULATIONS ON THE VALLES CALDERA NATIONAL PRESERVE.**

GREENLEE, ERIN, and Gail Garber, Hawks Aloft, Albuquerque, NM

We monitored the 2012 avian breeding season, the first breeding season after the 2011 Las Conchas Fire. We used variable distance point count surveys at 36 points spanning three paired (burned vs. not burned) habitat types (Ponderosa Pine, PP; Mixed Conifer, MC; and Meadow Grassland, MG). Overall, we documented a total of 72 species, including breeding pairs of American Three-toed Woodpeckers, a new species for the Valles Caldera National Preserve. In the forest plots (PP and MC), we detected significant differences in abundance among several species. Densities of Ruby-crowned Kinglet and White-breasted Nuthatch were significantly lower in burned forest plots than in unburned forest plots. In contrast, American Robin, American Three-toed Woodpecker and Mountain Bluebird were present at significantly higher densities in burned forest plots than unburned forest plots. We did not detect any significant differences in total numbers of birds or species richness within treatment type between the two forest types: PP and MC. Within our grassland MG sites, we found significant differences in avian abundance and species richness. We documented 43 species in unburned MG vs. 16 in burned MG, and 48 individuals per plot in unburned MG versus 18 per plot in burned MG. American Crow and Chipping Sparrow were significantly more abundant at unburned MG sites than burned MG sites. We hypothesize these differences are a result of architectural differences in habitat between the two treatments (burned and unburned), such as reduced litter and standing dead trees in the burned forest sites and reduced density and abundance of arthropods in burned grassland habitats.

### **\*RE-ESTABLISHMENT OF A POTENTIAL KEYSTONE SPECIES: INITIAL IMPACTS ON MAMMAL AND ARTHROPOD SPECIES ASSEMBLAGES**

HALE, S. L. (Graduate Student), School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721 and J. L. Koprowski, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721.

Many tests of the keystone species concept have only assessed areas occupied by these species or the effects of their removal. We have the opportunity to assess effects of adding a potential keystone species to an ecosystem where they have been extirpated for at least 50 years. The black-tailed prairie dog (BTPD; *Cynomys ludovicianus*) has been

commonly described as a keystone species, and over the past 4 years Arizona Game and Fish Department has re-established the BTPD at Las Cienegas National Conservation Area in southeastern Arizona. We trapped small mammals and arthropods between May and July 2012 to quantify species diversity on and around black-tailed prairie dog colonies in order to address the question, do translocated ecosystem engineers establish a role as a keystone species? We found that the age of colonies over a short-time span affects small mammal community composition, with kangaroo rats being the most common on/around the newest unoccupied colony, and least common on the oldest colony. Our early results suggest intriguing trends that we will continue monitoring as colonies expand and age.

## **ON OVERVIEW OF THE STATUS AND MANAGEMENT OF OCELOTS IN ARIZONA**

HANNA, JON, Arizona Game and Fish Department – retired [moremuledeer@gmail.com](mailto:moremuledeer@gmail.com)

Several recent ocelot sightings and even a road kill have renewed interest for ocelot management in Arizona. This presentation looks at the historical record of ocelots in Arizona and gives an overview of the most recent documentation and distribution along with a review of current management strategies.

## **REPTILE OCCURRENCE AND HABITAT ASSOCIATIONS ON HOLLOMAN AIR FORCE BASE**

HARINGS, NICOLE M. and Kenneth G. Boykin, Department of Fish, Wildlife, and Conservation Ecology, New Mexico State University, Las Cruces, NM 88003

Increasing evidence implies that habitat heterogeneity is necessary to support reptile species diversity and abundance. In the North American Desert southwest, there is little information regarding habitat preferences that influence reptile occupancy. In south central New Mexico, we sampled reptiles on Holloman Air Force Base (HAFB) in relatively undisturbed habitat within gypsum sand dunes and clay/loamy soil to determine species richness and relative abundance using Occupancy Modeling. We also related reptile species assemblages to habitat gradients (cover and soil type) using Canonical Correspondence Analysis (CCA). Species were intensively surveyed using pitfall traps, funnel traps, road cruising and active searching; however detections were lower than anticipated. We found six lizard, five snake, and one turtle species; lizards being more abundant, particularly the Common Side-blotched (*Uta stansburiana*) and Little-striped Whiptail (*Aspidoscelis inornata*) lizards. *Uta stansburiana* were found to be habitat generalists. *Aspidoscelis inornata* displayed a general affinity to habitat variables, with soil type influencing its distribution. Soil type also influenced the distribution of the Bleached Earless Lizard (*Holbrookia maculata*), Southwestern Fence Lizard (*Sceloporus cowlesi*), and Coachwhip Snake (*Masticophis flagellum*). Species showing a preference for grasses and forbs included Collared Lizards (*Crotaphytus collaris*), followed by Western Diamondback Rattlesnakes (*Crotalus atrox*), and Night Snakes (*Hypsiglena torquata*). Gopher Snakes (*Pituophis catenifer*) had a strong association with bare ground, while none of the species we observed had a strong relation to shrub habitat. There may be confounding influences on reptile species occurrence, most notably rainfall, given persistent drought conditions in the Desert southwest. Given our low reptile detections in effectively undisturbed habitat on HAFB, undisturbed areas may be necessary to maintain reptile diversity given the predicted increase in extreme drought conditions.

## **HOT, DRY, AND BITTEN: A WOODRAT RECIPE FOR REDUCING AVAILABILITY OF KEYSTONE DESERT RESOURCES**

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The saguaro (*Carnegiea gigantea*) is a keystone resource for Sonoran desert consumers of nectar, pollen, fruit, and cactus tissues. Saguaro tissue contains oxalic acid and is unavailable to most consumers. The white-throated woodrat (*Neotoma albigula*) is, however, able to consume foods with high oxalate content, and is strongly associated with desert succulents, primarily cacti of the genus *Opuntia*. *N. albigula* forages secondarily on saguaro tissues, reducing

photosynthetic surface area and eliciting an energetically-demanding wound response that reduces energy stores available to fuel reproduction. We observed and quantified *Neotoma* herbivory on saguaros in a low desert environment. Evidence of *Neotoma* grazing was found on 44% of all saguaros surveyed, and 13% of all saguaros had >20% of their surface area affected by *Neotoma* grazing. *Neotoma* herbivory on saguaros was predicted by the number of nearby succulents, presence of *Neotoma* middens, and saguaro age. When comparing similarly sized plants, saguaros with high levels (>20% of surface) of herbivory produced fewer flowers and fruits than plants with no *Neotoma* herbivory. These findings suggest that periodic use of saguaros by *N. albigula*, such as during extended droughts with conditions unfavorable for *Opuntia* growth and establishment, may reduce long-term reproductive capacities in low-density saguaro populations.

## **DERIVATION OF SOIL SCREENING THRESHOLDS TO PROTECT CHISEL-TOOTHED KANGAROO RAT FROM URANIUM MINE WASTE IN NORTHERN ARIZONA**

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The ecotoxicological risks of uranium mining in the Grand Canyon region are largely unknown, and chemical concentration data in biota inhabiting the region are lacking. Many species such as the herbivorous Arizona chisel-toothed kangaroo rat (*Dipodomys microps leucotis*) have specialized life history strategies and physiological adaptations that allow them to survive in the region's arid environment but may also increase their exposure to mine-related contaminants. Chemical data from soil and weathered waste material samples collected from five uranium mines (3 reclaimed, 1 left on standby and not reclaimed, and 1 never mined) were used in a screening-level risk analysis; risks from radiation exposure were not evaluated. Dietary toxicity reference values based on lowest observed adverse effect levels from the scientific literature were used to estimate soil screening thresholds presenting risk to kangaroo rats. Concentrations of arsenic, cadmium, copper, lead, nickel, thallium, uranium, and zinc were approximately an order of magnitude greater in soils at the non-reclaimed mine than those from reclaimed mines. Sensitivity analyses indicated that body weight critically affected outcomes of exposed-dose calculations; juvenile kangaroo rats were more sensitive to the inorganic chemical toxicities than adults. Species-specific soil screening thresholds derived for arsenic (137 mg/kg), cadmium (16 mg/kg), copper (1461 mg/kg), lead (1143 mg/kg), nickel (771 mg/kg), thallium (1.3 mg/kg), uranium (1513 mg/kg), and zinc (731 mg/kg), derived using toxicity reference values that incorporate expected chronic field exposure of kangaroo rats, were lower than consensus-based ecological soil screening levels (Eco-SSLs). The Eco-SSL data available for laboratory rodents may overestimate contaminant risk to burrowing species such as kangaroo rats. Inorganic contaminants in soils in and near the mine areas generally posed minimal risk to kangaroo rats. Most exceedances of soil thresholds were for arsenic and thallium and were associated with weathered mine wastes; few exceedances occurred for cadmium, copper, lead, nickel, uranium, and zinc. Management goals to protect kangaroo rats from arsenic may also protect them from the individual chemical toxicities of other inorganic constituents but would not account for additive, antagonistic, or synergistic effects of chemical mixtures. Studies to establish chemical toxicity thresholds using kangaroo rats and other burrowing mammals are warranted to better characterize risk to desert species.

## **PROPOSED ASSESSMENT OF FOREST TREATMENT EFFECTS ON MEXICAN SPOTTED OWL OCCUPANCY USING TRIBAL INFORMATION**

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Western forests have departed from historical conditions and are experiencing severe wildfires due to decades of fire suppression, timber harvesting and livestock grazing practices. Late-successional forests that provide habitat for Mexican spotted owls (*Strix occidentalis lucida*) are susceptible to such wildfires but evolved under low severity wildfire regimes. Although the Mexican spotted owl Recovery Plan recommends strategically placed forest treatments and restoration projects to increase forest resiliency and maintain Mexican spotted owl habitat, there is little empirical

information about how Mexican spotted owls will respond to such forest treatments. By using tribal wildlife and forest data, this project will be the first attempt to use empirical information to understand the effects of modest forest treatments on Mexican spotted owl occupancy. This project also shows the need to recognize traditional ecological knowledge as another means to guide forest and wildlife management practices.

### **THE POST-FIRE EFFECTS OF THE LAS CONCHAS FIRE ON TERRESTRIAL ARTHROPOD POPULATIONS IN THE VALLES CALDERA NATIONAL PRESERVE, NEW MEXICO.**

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Beginning in the summer of 2011, Valles Caldera National Preserve arthropod populations' were monitored in burned and unburned forests and grasslands immediately following the Las Conchas Fire to determine the impact of the fire on these taxa. Terrestrial arthropods were collected from a total of 36 arthropod pitfall trap sites (18 unburned, 18 burned) in forested sites (Ponderosa pine and mixed-conifer forests) and valle grasslands with 3 replicates per site from May to November of both 2011 and 2012. In 2012, ultra-violet blacklight and malaise traps were added to examine nocturnal and flying arthropods (16 sites; 8 unburned, 8 burned). Arthropod populations were initially affected by the fire, but have begun to recover quickly, especially within the grassland habitats. Pest and beneficial arthropods are vital to their environment, functioning as herbivores, pollinators, fungivores, predators, parasitoids, and decomposers. They also play an important role for many vertebrate wildlife species, serving as the prey-base in the ecosystem for insectivorous, omnivorous, and carnivorous individuals (i.e. fish, mice, shrew, lizards, passerine birds, coyotes, and bears). With knowledge of these pest and beneficial arthropod population dynamics, managers can expand their assessment of post-fire recovery rates in terms of ecosystem trophic structure, ecological processes and successional patterns.

### **IMPACT OF GRAZING AND WILDFIRES ON SMALL MAMMAL COMMUNITY DIVERSITY IN MONTANE MEADOWS OF THE APACHE-SITGREAVES NATIONAL FORESTS**

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Across northern Arizona and New Mexico wet meadows are thought to be of great value because of their importance to several species of wildlife and plants and their potential to improve water quality and reduce flood peaks. Understanding the importance of these rare montane meadows on small mammal communities is crucial so managers can make management decisions (e.g., grazing, post-fire). Few studies have investigated the independent and synergistic effects of grazing and wildfire on vegetation and small mammal communities, and none have focused on Southwestern montane wet meadows. In addition, managers need information on occurrence and habitat use of the New Mexican meadow jumping mouse (*Zapus hudsonius luteus*), currently considered for listing under the ESA. In 2012, we established trapping grids in wet and dry montane meadows in the Apache-Sitgreaves National Forests. We sampled 53 sites: 25 in wet meadows, 26 in dry meadows, and two in streams. Sites were distributed within and outside the Wallow Fire boundaries and in cattle-grazed and non-grazed meadows. Twenty-nine sites occurred in unburned meadows and 24 occurred in burned meadows ranging from low burn severity to moderate severity. During 6,639 trap nights, we captured 724 small mammals representing 11 species. Most common captures were Arizona montane vole (*Microtus montanus arizonensis*) and deer mouse (*Peromyscus maniculatus*). Initial analyses indicate that there was no difference in richness and species composition between burned and unburned meadows. Species richness was higher in dry meadows where three species occurred exclusively: Mogollon vole (*Microtus mogollonensis navajo*), western harvest mouse (*Reithrodontomys megalotis*), and thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). Sites grazed by cattle had a lower number of total captures and species richness than sites without grazing. Preliminary work indicates that grazing may have a greater effect than wildfires on the small mammal community by reducing population numbers.

## **RESPONSES OF AQUATIC MACROINVERTEBRATES TO THE LAS CONCHAS FIRE IN STREAMS OF THE VALLES CALDERA NATIONAL PRESERVE, NEW MEXICO.**

JACOBI, GERALD Z., Santa Fe, New Mexico.

Following the Las Conchas fire and subsequent flash floods in July, 2011, aquatic macroinvertebrates were quantitatively sampled in replicated permanent reaches of streams affected by the floods in 2011 and 2012. Data from these samples were compared to samples collected from these sites in previous years before the Las Conchas fire. In the Rito De Los Indios, the benthic macroinvertebrate community standing crop was reduced by 65% and the total number of taxa was reduced by 20% on August 1, three days after ash flow. In late September, the standing crop and total number of taxa were still reduced. In May 2012, the channel had filled in with sediment and a reduced number of organisms were collected, dominated by opportunistic black flies. On August 1, 2011, in San Antonio Creek (downstream of the Rito), the standing crop was reduced by 80% and EPT taxa (mayflies, stoneflies, and caddisflies) were reduced by 50%. EPT taxa numbers were low in September but were increasing in May 2012. Future ash and sediment flows at these locations have the potential to further suppress standing crops and total taxa of these important fish food organisms.

### **\*HAIRTUBE SAMPLING FOR DETECTION AND IDENTIFICATION OF SMALL MAMMALS**

JESSEN, T.G. (Graduate student), and J.L. Koprowski, School of Natural Resources and the Environment, The University of Arizona, Tucson, AZ 85721

Inconspicuousness and cryptic behavior of small mammals frequently contribute to the relative difficulty in studying this important group. Hairtube sampling is a novel technique offering great potential for study of small mammals and other species. Hair tube sampling is noninvasive, relatively inexpensive, and less labor intensive than traditional live trapping methods. In addition, hair tubes can be left to sample over longer periods of time and a variety of species of different body sizes can potentially be detected in any individual hair collection tube. These qualities have led to increased interest and use of hair tube sampling within the scientific community. However, strength of hairtube sampling is not fully understood. From June – November (2010), we placed hairtubes (n=265) over two study sites on Mt. Graham located within the Pinaleno Mountains of southeastern Arizona, USA. Tubes were checked once every two weeks for total of 4 checks comprising 15,120 tube nights of effort. Detection of hair increased over time and was collected in > 85% of tubes after 28 days in the field. Following 56 days in the field, detection of hair was >90% at both study sites. We have identified 8 individual species from hair collected by hairtubes. We offer data on ability of hairtube sampling to detect multiple species and demonstrate methods used in species identification. Hairtubes appear to have value for collecting hair and present an easy, cost efficient, and potentially effective sampling technique with broad applications for small mammal research. Hair tube sampling could be an extremely useful tool in wildlife management and conservation but validation of the technique is required before relying on data for management decisions or conservation actions. Our research promises to show efficacy of hairtubes to detect species and the technique's utility within wildlife research.

### **SALINITY TOLERANCE OF RIO GRANDE SILVERY MINNOW EGGS AND LARVAE**

KHAN, I.A., and C.L. Sykes, Southwestern Native Aquatic Resources & Recovery Center, Dexter NM 88230

Increasing water temperature and salinity, and reduced freshwater inflows are some of the consequences of climate change with the potential to impact all the river systems in the desert Southwest region. The Rio Grande silvery minnow (*Hybognathus amarus*) in its current range of distribution may encounter significant salinity challenges. The relatively fragile eggs and larvae may be particularly susceptible to these salinity challenges. In the present study, salinity tolerance of the fertilized eggs of Rio Grande silvery minnow was examined in terms of hatching success and survival of their offspring. Hatching of eggs was delayed or prevented following exposure to salinity equivalents of 2.4 to 12.0 ppt. Ten to 30 percent of the larvae in the 2.4, 4.8 and 7.2 ppt groups were unable to break free from their egg shells, whereas the egg shells dissolved prematurely resulting in 95-100% mortality of the embryos in higher salinity groups (12.0 and 14.4 ppt). Three-day old silvery minnow larvae were also exposed to the same salinity regimes for 96 h. The 48 and 96 h LC50 values for the larvae were 8.98 and 8.17 ppt, respectively in this experiment. These data are important to

understand the salinity challenges the species can tolerate and together with other water quality parameters will inform habitat selection or restoration for the recovery of this endangered species. Future experiments to be conducted at the Southwestern NARRC include the acclimation of silvery minnow broodstocks to selected salinity regimes and subsequent salinity challenges to the eggs and larvae to determine whether parental exposure prepares the offspring to better survive higher salinity challenges.

### **\*STATUS OF SANTA CATALINA GRAY SQUIRRELS: POTENTIAL INFLUENCE OF FIRE AND INTRODUCED ABERT'S SQUIRRELS**

KETCHAM, S. L. (Graduate Student), and J. L. Koprowski, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721.

Anthropogenic and natural influences such as wildfire, insect infestations, invasive species, and climate change have rapidly changed ecosystems; therefore, understanding impacts of an invasive squirrel on a native squirrel after wildfire should determine species thresholds and behavioral mechanisms to deal with such changes. During the 1940s, Abert's squirrels (*Sciurus aberti*) from northern Arizona were introduced to southern Arizona mountain ranges by Arizona Game and Fish Department to increase hunting opportunities. By 1960, Abert's squirrels had crossed Sonoran upland and lowland desert to establish in additional ranges. Currently, Abert's squirrels are thriving in these areas outside of their native range. The impacts of introduced species on native species is more poorly known. We will examine how native and declining Santa Catalina gray squirrels (*Sciurus arizonensis catalinae*) and introduced Abert's squirrels use areas within a mosaic of burn severities in the Santa Catalina Mountains of southeastern Arizona. Fires burn in a mosaic pattern of unburned, low, moderate, and high burn severity patches. Recently, 2 large fires burned on the Santa Catalina mountains; the Bullock fire of 2002 and the Aspen fire of 2003. These 2 fires burned a total of ~46,000 ha on a mountain range that is ~62,937 ha in size. To determine how fire may impact squirrel populations, we used distance sampling, hair tubes, and trail cameras to compare squirrel abundance and distribution within a mosaic of burn severities (unburned, low, moderate, high severity burns). Trail cameras and hair samples collected from hair tubes demonstrate that Abert's squirrels occupy every burn severity except for high burn severity patches and that Santa Catalina gray squirrels are restricted to riparian, unburned to low burn areas. Distance sampling has revealed that Abert's squirrels nest primarily in Ponderosa pine (*Pinus ponderosa*) trees with low burn severities, while Santa Catalina gray squirrels nest in non-coniferous trees that are unburned or low burn severity. Our research is needed because some forestry management practices may have unintended adverse effects on native species and may favor introduced species. Examining impacts of introduced Abert's squirrels and fire on Santa Catalina gray squirrels will provide an understanding about the status of this declining squirrel and may offer insight on how to conserve this potentially threatened, native squirrel.

### **\*SPATIAL CONCORDANCE BETWEEN RECREATIONALLY HARVESTED SPECIES AND BIODIVERSITY**

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Ecosystem services are aspects of nature which enhance or contribute, either directly or indirectly, to human well-being. This concept may provide an opportunity to amalgamate human interests with biodiversity protection by focusing on the benefits ecosystems provide. The concept of biodiversity encompasses the variety of life from genes to organisms to ecosystems and the interactions between them. Though aspects of biodiversity do participate in ecosystem service provision, the relationship is often imperfect inasmuch as increasing biodiversity levels do not always yield greater ecosystem service provision. Recreationally harvested species (i.e. species typically hunted and managed by state agencies), represent an aspect of biodiversity and are considered an ecosystem service. Here, we

investigate the spatial relationship between harvestable species richness, a relatively small subset of terrestrial vertebrate taxa, and other aspects of biodiversity, namely total species richness, ecological system richness, globally at risk species richness and federally threatened and endangered species richness to identify areas of coincidence at the watershed scale throughout New Mexico.

## **A PRIMER ON THE ENDANGERED MT. GRAHAM RED SQUIRREL: CURRENT STATUS AND THREATS**

KOPROWSKI, JOHN L., Professor, Wildlife Conservation & Management, School of Natural Resources & the Environment, University of Arizona, Tucson, AZ 85721.

The Mt. Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) was federally listed as endangered in 1987 and this montane endemic remains among the most critically endangered species in North America. Population numbers have fluctuated over 20 years of surveys but current numbers remain similar to abundance when the species was first listed. Mt. Graham red squirrels traverse large home ranges that suggest issues related to habitat quality including response to fire, insect damage, roads, and introduced Abert's squirrels. Mortality is high with few animals living to reproduce more than once in their short lifetime. Raptors are the primary source of mortality. Litter size is reduced compared to non-endangered populations of red squirrels. The demographic challenges faced by Mt. Graham red squirrels are likely exacerbated by a paucity of genetic variation. Ultimately, climate change induced habitat changes that facilitate open forest conditions may prove the greatest threat.

## **TAMARISK LEAF BEETLE DISTRIBUTION AND ECOSYSTEM IMPACTS MONITORING PROGRAM**

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A number of chemical, mechanical, and cultural controls are routinely utilized, often in concert with one another, to manage tamarisk (*Tamarix* spp.), an invasive woody shrub abundant along riparian areas in the western United States. Over a decade ago, the tamarisk leaf beetle (*Diorhabda* spp.), a biological control agent that damages tamarisk through repeated leaf defoliation, was introduced as another management tool. The efficacy of this control agent is apparent across portions of many western states and parts of northern Mexico, where large areas of beetle affected tamarisk can be observed. While many welcome a cost-effective approach to tamarisk management, the ecosystem implications of widespread defoliation of a dominant woody species are a topic of discussion, and occasionally, concern. For example, defoliation is presently, or at risk of, affecting the reproductive success of the southwestern willow flycatcher (*Empidonax traillii extimus*), an endangered bird that often nests in tamarisk in the absence of native plants. Defoliation of tamarisk surrounding flycatcher nests results in decreased nest cover and leads to increased predation risk and altered microclimate. Other issues include: standing-dead biomass mitigation, bank destabilization, restoration challenges, and the societal repercussions implicit with a rapidly changing landscape. Ultimately, biological control may assist in the long-term recovery and resiliency of riparian communities; however, potential short-term ramifications are not inconsequential and bear further exploration/study. In order to better understand the distribution and potential impacts of the beetle, Tamarisk Coalition, working with partners across the American West, developed a multi-tiered research and monitoring strategy that can be employed by researchers, land managers, agency employees and other interested parties. Tamarisk Coalition will be helping partners implement the new strategy beginning in the spring and summer of 2013.

## **CONSERVATION AND MITIGATION PROGRAM: AN OVERVIEW AND PROGRESS UPDATE OF ARIZONA'S NEWEST CONSERVATION PROGRAM**

LASHWAY, Sharon, Arizona Game and Fish Department, Tucson, AZ 85745

The Conservation and Mitigation Program (CAMP) was created in 2011 to reduce and offset impacts of the Arizona Game and Fish Department's (AGFD) Sportfish Stocking Program as identified through the ESA and NEPA process as the result of Section 7. The CAMP is responsible for fulfilling conservation and mitigation measures for threatened and endangered (T&E), Candidate, and sensitive species that may be affected by the AGFD sportfish stocking program. There are 45 mandatory measures that CAMP will be responsible for fulfilling within the next ten years. The Tucson Region of the Arizona Game and Fish Department is currently working towards meeting these measures through various projects specifically working with the Chiricahua Leopard frog (*Rana chiricahuensi*) and the Northern Mexican gartersnake (*Thamnophis eques megalops*).

## **CANDIDATE CONSERVATION AGREEMENTS FOR THE DUNES SAGEBRUSH LIZARD AND LESSER PRAIRIE-CHICKEN IN SOUTHEAST NEW MEXICO**

MATHIS, M, E.K. Pifer, and D. Lynn, Center of Excellence for Hazardous Materials Management, 505 North Main Street, Carlsbad, NM 88220.

CEHMM, BLM, and FWS developed Candidate Conservation Agreements (CCAs) as a mechanism to conserve Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*) (LPC) and Dunes Sagebrush Lizard (*Sceloporus arenicolus*) (DSL) habitats. Under these agreements, a property owner voluntarily commits to implement specific conservation measures for the species. Federal lessees, operators, or permittees sign a Certificate of Participation (CP) and receive a high degree of certainty that additional restrictions would not be placed on their otherwise legal activities if either species is listed as threatened or endangered. The companion Candidate Conservation Agreement with Assurances (CCAA) provides incentives for voluntary conservation of species-at-risk on private and state lands. If either species is listed, private landowners receive assurances through the CCAA that additional restrictions would not be placed on their otherwise legal activities.

## **WILDLIFE WATER CATCHMENT PROGRAM ON THE TONTO NATIONAL FOREST OVER THE LAST 30 YEARS, WHICH CATCHMENTS WORKED**

MENASCO, KEITH A. Retired Forest Service. Flagstaff, AZ 86001

Over the years hundreds of various kinds of rain catchments (guzzlers) have been constructed throughout the Payson and Pleasant Valley Ranger Districts on the Tonto National Forest. I conducted a survey consisting of a site visit for each guzzler obtaining GPS coordinates and pictures documenting current conditions. I found that even though there is a high wildlife use of these waters there is a lack of resources for any kind of maintenance program following initial construction. Many were not accurately located. One of the most reliable guzzlers has proven to be one consisting of a sheet metal watershed laid down on the ground with a Z curb covered with rocks and soil that supplied water to a walk-in metal tank positioned at ground level. Many of the guzzlers constructed in the 80's and 90's consisted of a metal umbrella tank that supplied a small drinker with a float valve. These tanks have proven to be very dependable and these systems can provide many years of service however the drinkers are too small and are unreliable. Most guzzlers that had as one of its primary components a float and valve as part of a trough or drinker were not functional. Trial and error for various trough/drinker systems have been tried over the years with one of the most promising one using a rubber maid trough. Where a fiberglass/asphalt watershed was used to collect rain water most were in complete disrepair. Dependable waters will become more important in the future due to Climate Change. The maintenance issue may be addressed with greater partnership with grazing permittees and partnerships with conservation organizations.

## **\*HOW DO DISPERSERS SELECT A PLACE TO SETTLE? EXPLORING THE ROLE OF NATAL HABITAT EXPERIENCE IN AN ALTERED FOREST LANDSCAPE**

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Natal dispersal consists of three phases: emigration, exploration, and immigration, with habitat selection playing an important role in each. However, underlying mechanisms determining how naïve dispersers select areas in which to explore and settle remain poorly understood. Natal habitat preference induction (NHPI) is a potential mechanism explaining how dispersers select a settlement location, whereby natal habitat cues provide dispersers with a search image of quality habitat. If habitat imprinting occurs, forest structure and composition in natal areas should be similar to settlement locations. We combine field and remotely sensed (LiDAR) measurements to quantify forest composition and structure in order to investigate whether natal habitat cues play a role in settlement decisions of juvenile Mt. Graham red squirrels (*Tamiasciurus hudsonicus grahamensis*; MGRS) dispersing through a mosaic of forest quality and fragmentation. We radio collared 60 juvenile MGRS in 2010 - 2012, measured dispersal distance, and compared forest structure and composition among natal areas, settlement locations, and random locations for individuals that successfully settled. Natal habitat cues appear to play a role in conditioning dispersal movements and settlement decisions. Forest structure within 100m of natal and settlement territory centers is similar. Intra-individual pairwise comparisons of natal vs. settlement structural characteristics (collapsed via PCA) indicate that immigrating individuals select habitat characteristics similar to those in their own natal areas (mean individual natal PC score - settlement PC score =  $0.43 \pm 2.7$ ,  $p = 0.48$ ). In damaged, fragmented forest, NHPI could impose contrasting fitness consequences. NHPI could continue to serve as an adaptive strategy for identifying quality habitat in a matrix of poor quality or non-habitat. Conversely, NHPI could represent an ecological trap if key natal habitat cues become decoupled from historically reliable fitness benefits found in quality forest. We quantify food availability, reproduction, and survivorship to assess potential fitness consequences of NHPI.

## **SHORT TERM RESPONSE OF FISH FAUNA AND HABITAT IN TROUT STREAMS AFTER THE WALLOW FIRE.**

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The Wallow Fire occurred in summer 2011 and impacted 80% of Forest Service streams in Northeast Arizona. We hypothesized that this disturbance would decrease numbers of exotic fishes and increase numbers of native fishes. Initial surveys were done post monsoon to quantify the scope of the impacts to fishes and their habitat. In general, impacts to habitat were less than expected with local impacts to stream bank stability and streamside vegetation. Sediment impacts were more widespread than other habitat impacts. The sediment did not fill pools; however there was increased substrate embeddness in all streams downstream of the fire. Impact to fishes was characterized by stream order, there was varying amount of mortality in first order streams (depending on fire intensity and rainfall events), moderate mortality in second order streams, and extensive mortality in third order streams. We also looked at impacts to habitat and fishes one year after the fire in the East Fork of the Black River (where we had pre fire information in 2009). Vegetation and stream bank stability have shown signs of recovery from fall of 2011 to fall of 2012 (from 29 to 34% shading and 72 to 93% stability respectively). However, substrate embeddness has not improved (17% prefire to 33% in fall of 2011 and 34% in fall of 2012). Population numbers of brown trout (*Salmo trutta*) and speckled dace (*Rhinichthys osculus*) have stayed depressed (17 and 30% of pre fire numbers respectively) despite opportunities for recruitment. Desert (*Catostomus clarki*) and Sonoran (*Catostomus insignis*) suckers numbers were low pre fire (21 and 3 fish per 100 meters respectively) and have not changed since the fire. However, the timing of our surveys missed the chance to measure post fire recruitment of suckers. We expect to see substantial increases in sucker numbers next year but we expect dace and trout numbers to remain low until substrate embeddness improves. We have scheduled surveys of habitat and fish numbers for next year to measure any changes in substrate embeddness or shift in fish numbers.

## **EFFORTS TO CONSERVE NEW MEXICO POPULATIONS OF LOACH MINNOW AND SPIKEDACE AFFECTED BY THE WHITEWATER-BALDY COMPLEX FIRE.**

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Loach minnow *Tiaroga cobitis* and spikedace *Meda fulgida* were uplisted from threatened to endangered in 2012, less than two months before ignition of the Whitewater-Baldy Complex fire. This fire, the largest in New Mexico state history (297,845 acres), affected a significant area of the drainages occupied by these two species. In June and July of 2012, New Mexico Department of Game and Fish (NMDGF) and U.S. Fish and Wildlife Service (USFWS) salvaged loach minnow and spikedace from the West Fork Gila River and loach minnow from the San Francisco River. These populations are currently being held separately at Southwestern Native Aquatic Resources and Recovery Center in Dexter, New Mexico. In October of 2012, NMDGF, USFWS, and U.S. Forest Service sampled multiple locations in the Upper Gila and San Francisco drainages as part of an annual monitoring program. While loach minnow and spikedace appear to be surviving in the Upper Gila, no fish were detected in the San Francisco River at a site just below Glenwood, an area which was previously occupied by loach minnow. Additional sampling throughout the San Francisco basin yielded similar results. Since habitat fragmentation is common throughout this area, the natural recolonization of loach minnow and spikedace into the San Francisco basin is unlikely. Additionally, ash flows are likely to continue for years, making a captive population of San Francisco loach minnow a necessity. In the future Captive populations of loach minnow and spikedace will be used for repatriation efforts in the future. It seems likely that those efforts will include the San Francisco River.

## **STATUS AND DISTRIBUTION OF HEADWATER CHUB (*GILA NIGRA*) IN THE HAIGLER CREEK WATERSHED**

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The Conservation and Mitigation program developed by the Arizona Game and Fish Department determined a need for current data regarding the status of headwater chub (*Gila nigra*). Over the past two years, we used a multiple-gear sampling approach to determine the relative abundance, distribution, size structure, and relative condition of headwater chub populations throughout the state. Haigler Creek and its tributaries, Marsh Creek and Gordon Creek, were surveyed during May – October 2012 using backpack electrofishing, hoops nets, minnow traps, gill nets, and visual observations. No headwater chub were captured or observed in upper Haigler Creek (Colcord Canyon to Alderwood Campground); however multiple size classes of headwater chub were observed in lower Haigler Creek (below Alderwood Campground) near its confluence with Gordon Creek. No headwater chub were captured or observed in Gordon Creek, despite suitable habitat and low numbers of nonnative fish species (one rainbow trout). The headwater chub population in Marsh Creek appeared robust and consisted of multiple size classes, even in the presence of nonnative green sunfish. Conservation opportunities exist for headwater chub within the Haigler Creek drainage and should be focused in lower Haigler Creek, Gordon Creek, and Marsh Creek.

## **\*MOVEMENTS AND HABITAT/SPACE USE OF GOLDEN EAGLES (*AQUILA CHRYSAETOS*) FROM SOUTHERN NEW MEXICO**

MUNRO, KATHRIN J. (Graduate student), James W. Cain III, U.S. Geological Survey, New Mexico Cooperative Fish and Wildlife Research Unit, Las Cruces, NM, 88003, and Gary W. Roemer, Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, NM 88003.

In spite of their attractiveness as a clean, renewable energy source, wind energy developments are not ecologically benign. Potential impacts of wind energy facilities on avian species include collision mortality, habitat degradation or loss, and displacement of migration patterns caused by disturbance from wind energy facilities. One species that has specifically elicited concern regarding wind turbine-related mortalities is the golden eagle (*Aquila chrysaetos*). In order to understand the impacts of wind energy developments on golden eagle populations it is necessary to first understand their behavior on multiple levels. Habitat selection and space use data are needed to gain a comprehensive

picture of golden eagle requirements and how land-use disturbances can affect survivorship. We collected 3-dimensional location data from satellite transmitters for five golden eagles in southern New Mexico. One of these eagles was a resident and had an active territory during spring/summer 2012. The remaining four birds dispersed in spring 2012 and settled in various parts of western US and Canada. They returned to southern New Mexico in late fall 2012. As of November 9, 2012 we had an average of 3,785 locations per eagle. These data will help to make informed decisions regarding future wind developments and will provide valuable information for use in post-development monitoring.

### **EVOLUTIONARY DYNAMICS OF DISPERSAL IN METAPOPOPULATIONS OF THE AMERICAN PIKA (*OCHOTONA PRINCEPS*)**

NAGY, JOHN D. and Andrew T. Smith

American pikas are obligate talus-dwelling lagomorphs that tend to live at high elevations throughout their range. Their charisma has increased in recent years due to a perceived threat from global climate change. However, recent studies suggest that pikas are remarkably resilient and able to thrive in an unexpected variety of habitats and climatic regimes. These observations highlight the need for a detailed understanding of pika life history evolution, perhaps the most critical aspect of which is their ability to disperse. Here we show, using a mathematical model based on and parameterized by the pika population at Bodie State Historic Park, California, that natural selection favors juvenile pika dispersal only in metapopulations with small patch sizes (10 territories per patch or less) when demographic stochasticity is the only cause of patch extinction. Metapopulations with larger patches or continuously distributed populations require external, density-independent mortality mechanisms to drive dispersal. Intriguingly, in small-patch metapopulations, selection favors greater dispersal as death rate from any external, density-independent mechanism increases. As a result, dispersal rate evolves in such a way that metapopulation dynamics (increasing patch colonization rate) can compensate for the increased mortality, thereby stabilizing the entire metapopulation. Therefore, this model suggests that pika populations that have adapted to fragmented landscapes with small patches may be robust to environmental change.

### **TERRESTRIAL HABITAT AND VEGETATION CHANGES FROM THE LAS CONCHAS FIRE IN THE VALLES CALDERA NATIONAL PRESERVE, NEW MEXICO.**

OERTEL, REBECCA, Forest and Range Plant Ecologist, Valles Caldera National Preserve; Orrin Myers, University of New Mexico; and Robert R. Parmenter, Valles Caldera National Preserve.

The vegetation response to the Las Conchas Fire varied considerably across the Preserve, depending on the location with respect to headfires or backing fires, and severity of the burn based on topography and localized fuel loads. Inventory and monitoring assessments were conducted on replicated burned and unburned forest stands of Ponderosa pine and mixed-conifer for tree densities and basal areas, as well as for herbaceous vegetation (grasses and forbs), logs, litter and bare ground. In addition, grassland vegetation on plots established in 2002 and monitored annually before the fire were continued to be measured after the fire in 2011 and 2012. Results indicated that forest herbaceous vegetation was rapidly recovering by fall, 2012, and would likely exceed control stands in 2013-2014 as the burned stands began conversion to montane meadows. Grassland vegetation responded quickly to monsoon moisture in 2011, and achieved nearly 100% plant cover by the end of the growing season (not significantly different from unburned grasslands). However, in both forests and grasslands, particular plant species were significantly impacted in terms of reduced or increased cover. Forage nutritional values increased following fire, attracting both native herbivores and livestock. Future vegetation monitoring will assess habitat recovery and change and provide information for wildlife management.

## **\*OF OWLS AND ALFALFA: WHY DO BURROWING OWLS ASSOCIATE WITH IRRIGATED AGRICULTURE IN THE SOUTHWESTERN U.S.?**

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Conversion of native plant communities to large-scale agricultural production regularly results in drastic declines in abundance of native wildlife. However, populations of western burrowing owls (*Athene cunicularia hypugaea*) have increased in many areas where native plant communities have been converted to agriculture, whereas populations elsewhere have declined. This pattern suggests that conversion of native vegetation to agriculture is good for burrowing owls, but fecundity of burrow owls is often low in agricultural areas. So, why is burrowing owl abundance positively associated with agriculture in the southwestern U.S.? The answer to this question will help managers design effective management plans for burrowing owls in the region and provide guidance to farm bureaus and irrigation districts on how they can aid burrowing owl recovery. Hence, we tested three hypotheses to explain why burrowing owls occur at higher densities in agricultural areas compared to areas dominated by native vegetation: 1) food is more abundant in agricultural areas (the prey availability hypothesis), 2) nest burrows are more abundant in agricultural areas (the burrow availability hypothesis), and 3) predation risk is lower in agricultural areas (the predation risk hypothesis). Abundance of avian prey was higher but abundance of small mammals was lower in agricultural areas compared to adjacent native vegetation. We failed to detect a difference in the number of nest burrows between agricultural areas and areas dominated by native vegetation. Predation rates at artificial nest burrows were lower in agricultural areas than in areas dominated by native vegetation. Our results support the predation risk hypothesis more so than the prey availability or burrow availability hypotheses.

## **GENETIC ANALYSIS SUGGESTS HIGH CONSERVATION VALUE OF PERIPHERAL POPULATIONS OF CHIHUAHUA CHUB (*GILA NIGRESCENS*).**

OSBORNE, MEGAN, Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, U.S.A.; Alana Sharp, Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, U.S.A.; Jerry Monzingo, U.S.D.A Forest Service, 3005 East Camino del Bosque, Silver City, New Mexico 88061; David L. Propst, Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, U.S.A.; and Thomas F. Turner, Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, U.S.A.

Genetic drift is expected to be the predominant evolutionary force in small, fragmented peripheral populations, which can lead to divergent allele frequencies and lowered diversity compared to the core population. Peripheral populations are not considered a high priority for conservation for this reason. However, peripheral populations may possess unique genetic variability not found elsewhere in the species' range, and may be especially important if core populations are at extirpation risk. Here, we characterized levels and patterns of genetic diversity at microsatellites and mtDNA for the peripheral populations of Chihuahua chub in New Mexico, and compared these results to populations in Mexico including a new locality in the Rio Yaqui basin. All populations of Chihuahua chub in New Mexico were genetically depauperate as expected due to their small and peripheral status, harbored distinct variation compared to those in Mexico, as expected. Allele and haplotype frequencies were divergent between New Mexican and Mexican populations, and mitochondrial haplotypes were not shared between them. All New Mexican populations were significantly divergent from one another suggesting little genetic exchange. New Mexican populations also exhibited relatively small genetic effective size. Chihuahua chub in New Mexico thus represent a unique component of the species' evolutionary legacy and hence suggests high conservation value of this peripheral population. Conservation value of this population is bolstered by the fact that Chihuahua chub has more legal protection than counterparts in Mexico.

## **ORNATE BOX TURTLE WATCH: USING CITIZEN SCIENCE TO COLLECT DATA AND INCREASE AWARENESS OF A NONGAME PROGRAM**

OWENS, AUDREY K. and Cristina A. Jones, Turtles Project, Nongame Branch, Arizona Game and Fish Department, 5000 W Carefree Hwy, Phoenix, AZ 85086.

The ornate box turtle appears to be declining in Arizona, but rigorous surveys for the species have proven inefficient due to its secretive nature. To acquire information on the species, the Turtles Project developed the Ornate Box Turtle Watch program (Watch), a citizen science project in which we ask the public to report their encounters with box turtles. Since the Watch started in September 2009, we have acquired 175 box turtle observations. The Watch allows the Department to passively gather data, which we anticipate will build a long-term database on the distribution, abundance, and habitat use of this cryptic species. The Watch also serves a public relations function; with increased scrutiny due to budget cuts, governmental agencies (particularly nongame programs) are searching for proactive ways to maintain relevancy and a positive image in the public's eye. Citizen science projects such as this one provide an opportunity for the public to participate in tangible conservation efforts which are perceived as "making a difference," and therefore valuable and worthy of support by the public.

## **INTRODUCTION AND OVERVIEW OF THE LAS CONCHAS FIRE: ANTECEDENT CONDITIONS, CAUSES AND PATTERNS.**

PARMENTER, ROBERT R., Chief Scientist, Valles Caldera National Preserve, NM.

The Las Conchas Fire burned 156,000 acres of forest and grassland in the Jemez Mountains during June-August 2011, including a third of the Valles Caldera National Preserve. The antecedent climate conditions during the 20<sup>th</sup> Century were characterized by a linear rise in temperatures, particularly during the summer, and by cycling periods of drought that tracked the Pacific Decadal Oscillation. By 2011, the combination of warmer than average temperatures and the depth of the drought created critical weather conditions that allowed a landscape-level uncharacteristic wildfire to burn across the Jemez Mountains. Coupled with high forest fuel loads, due in large part to second-growth forests created by logging operations in the 1960s and 1970s, many forest stands experienced high-severity stand-replacement fires. Subsequent monsoon thunderstorms created a series of flash floods, having severe impacts on streams and watersheds. A network of pre-existing monitoring sites, augmented by immediate post-fire inventory and monitoring efforts, provided extensive data on the fire effects to fish and wildlife populations and their habitats. This technical session reviews the results to date, and explores the needs and plans for post-fire habitat restoration, as well as pre-emptive actions to restore remaining unburned habitats to reduce the risk of uncharacteristic wildfire in the future.

## **SUMMARY, SYNTHESIS AND FUTURE DIRECTIONS FOR FISH AND WILDLIFE HABITAT RESTORATION IN THE JEMEZ MOUNTAINS.**

PARMENTER, ROBERT R., Chief Scientist, Valles Caldera National Preserve, NM.

The Las Conchas Fire impacts on fish and wildlife populations and habitat proved highly variable based on specific geographic locations and the natural history characteristics of individual species. The habitat mosaic created by the fire will increase habitat diversity and patchiness, creating expanses of montane meadow while reducing formerly continuous stands of mixed-conifer and Ponderosa pine forests. Wildlife responses to this landscape change will continue to be monitored for years to come. Landscape-scale restoration of forests and riparian areas, currently being implemented through the Southwest Jemez Mountains Collaborative Forest Landscape Restoration Project (CFLRP) will improve fish and wildlife habitats, allow for pre-settlement, low-intensity natural fire cycles to return, and reduce the risk of uncharacteristic wildfire in the Preserve and the Jemez Mountains region. However, the long-term role of climate warming in this area will clearly add to both the urgency and complexity of forest restoration activities.

## **COLORADO RIVER FISH MONITORING IN GRAND CANYON, ARIZONA: 2002-2011 HUMPSBACK CHUB, *GILA CYPHA*, AGGREGATIONS.**

PERSONS, WILLIAM R., U.S.G.S. Grand Canyon Monitoring and Research Center and David R. VanHaverbeke, U.S. Fish and Wildlife Service

Humpback chub, *Gila cypha*, is an endangered cyprinid species endemic to the Colorado River basin of western United States. The species was described in 1946 by R. Miller from a specimen taken near the mouth of Bright Angel Creek, Grand Canyon National Park, Arizona; and was listed as endangered in 1967. Long term fish monitoring in the Colorado River downstream of Glen Canyon Dam is a component of the Glen Canyon Dam Adaptive Management Program. Monitoring for humpback chub in the mainstem Colorado River in Grand Canyon has been conducted sporadically since the 1970's, and has improved since the introduction of small motorized watercraft and the use of hoopnets and trammel nets. Nine humpback chub aggregations were originally identified based on fish collected during 1990 -1993, and closed population model abundance estimates were generated for six of those aggregations. An aggregation was defined as "a consistent and disjunct group of fish with no significant exchange of individuals with other aggregations, as indicated by recapture of PIT-tagged juveniles and adults and movement of radio-tagged adults". An open population model has been developed to estimate the population size of the aggregation centered at the Little Colorado River and the adult humpback chub population is estimated between 9,000 and 12,000 fish. We estimated abundance of humpback chub at aggregations by applying a uniform set of capture probability estimates to annual catches within the aggregations to estimate humpback chub abundance. The adult humpback chub population at eight mainstem aggregations, exclusive of Little Colorado River aggregation, is estimated between 1,000 and 1,800 fish. There appears to have been an increase in 2010 and 2011 in the 30-mile, Shinumo, Havasu, and Pumpkin Springs aggregations compared to previous years. Shinumo and Havasu aggregations appear to have benefited from an ongoing program of translocations of young humpback chub to those tributaries.

### **\*A COMPARISON OF HABITAT SUITABILITY CRITERIA FOR APACHE TROUT AND THE NON-NATIVE VIRILE CRAYFISH**

PETRE, S.J. (Graduate Student), and S. Bonar, Arizona Cooperative Fish and Wildlife Research Unit University of Arizona and U.S. Geological Survey, Tucson, AZ.

Over the past century, fishes endemic to the southwestern United States have declined in abundance and range, resulting in the listing of the majority of these species (70%) under the U.S. Endangered Species Act (ESA). Apache trout (*Oncorhynchus giliae apache*) a salmonid endemic to the White Mountains of east-central Arizona, is listed as threatened under the ESA. Major reasons for the decline and listed status of Apache trout include overfishing, drought, habitat degradation and negative species interactions. A recently introduced invasive species thought to affect Apache trout recovery is virile crayfish (*Orconectes virilis*). To date, no removal method has been found to be effective or efficient for suppressing crayfish populations. However, altering certain habitat parameters to disfavor crayfish, while maintaining Apache trout habitat parameters, may be effective. Therefore, we developed habitat suitability criteria for Apache trout and virile crayfish to assess overlap in criteria and identify if habitat could be manipulated to favor Apache trout but suppress virile crayfish. We sampled the West Fork Black River by snorkel survey to identify where Apache trout were located (occupied vs. unoccupied) and measured environmental parameters (water velocity, depth, substrate, instream cover, overhead cover and temperature) at occupied and unoccupied locations. We used a 1m<sup>2</sup> quadrat sampler to sample crayfish at random locations. We performed a habitat suitability analysis to develop habitat suitability criteria for both species. Apache trout and virile crayfish occupy similar depths; however, virile crayfish occupy areas with significantly lower mean water column velocity than Apache trout (p=0.03). Overall, virile crayfish are found in slower, warmer water compared to Apache trout and areas where they can hide under cobbles or instream cover. We hope to use this assessment of habitat suitability criteria as a tool to better understand virile crayfish and Apache trout interactions and manage Apache trout recovery streams.

## **\*MICROHABITAT SELECTION AND MORTALITY SITE CHARACTERISTICS OF ELK CALVES IN AREAS OF DIFFERING PREDATOR COMPOSITION IN NEW MEXICO**

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In “hider” species, such as elk (*Cervus canadensis*), neonates rely on characteristics of hiding sites for protection from predation and adverse climatic conditions. The goal of this study is to characterize microhabitats selected for calf bedding sites and at mortality sites to determine if these characteristics are related to calf survival. The study was conducted in areas of differing predator composition throughout New Mexico, including the Blue Range Wolf Recovery Area, Carson National Forest, and Vermejo Park Ranch. The Blue Range Wolf Recovery Area, for the Mexican gray wolf (*Canis lupus baileyi*), is located in west-central New Mexico. Since reintroduction, studies have shown adult elk and calves to be the main component of Mexican wolf diets. However, impacts of wolves on maternal cow and calf habitat selection, and thus neonatal survival have not been assessed. The Valle Vidal Unit of Carson National Forest and Vermejo Park Ranch are located in northern New Mexico, where influences of wolf predation are not present. We addressed our objectives by tracking radio-tagged calves and collecting data on the physical features and vegetation structure at bed sites as well as at randomly determined available sites and mortality sites. Results to be discussed include assessing the importance of topographic and vegetation structure in site selection, determining influences guiding this selection, and determining the relative success of these selections in promoting calf survival. By determining microhabitat differences between surviving and non-surviving calves, optimal habitat characteristics and locations can be determined. Knowledge of these relationships may allow development of management plans that maintain optimal calf rearing habitat, reduce depredation impacts, and support sustainable elk populations.

### **\*CAN RED SQUIRREL MIDDENS INFLUENCE SPECIES DIVERSITY?**

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Animals modify habitats, and can alter landscapes and make resources available to other species; the consequences can be critical to species diversity. Red squirrels, *Tamiasciurus hudsonicus*, widespread throughout coniferous forests in large parts of North America, disperse seeds, serve as prey, create structure via cone scale piles (middens) that result from feeding, and are hypothesized to function as a keystone species. Whereas middens are associated with higher vertebrate species richness, little is known of the midden characteristics that attract these species. Long term data on midden occupancy by the federally endangered Mount Graham red squirrel (*T.h. grahamensis*) offers a unique opportunity to study the impact of middens on mammalian and avian diversity. We conducted small mammal trapping and avian point counts, used camera traps for medium and large mammals, and measured midden characteristics (i.e. vegetation features, food resources, midden structure, and midden microclimate) to address the following objectives: (1) determine whether species diversity differs between occupied middens, unoccupied middens and random locations, (2) determine whether characteristics of middens affect species diversity, (3) assess the importance of midden microclimate in explaining mammalian and avian diversity. Occupied middens have higher total species richness of mammals and birds than random sites. Canopy cover and cone scale pile area are positively related to midden occupancy. Small mammal species richness was positively correlated to number of seeds at each site. Increased knowledge of the interaction strength of the red squirrel with its environment may be used to enhance ongoing recovery efforts for an endangered subspecies, inform decisions in forest management and restoration throughout North America, and offer insight on the conservation value of larderhoarding mammals worldwide.

### **\*POTENTIAL METHODS TO COOL STREAMS CONTAINING APACHE TROUT IN THE WHITE MOUNTAINS OF ARIZONA WITH IMPLICATION FOR CLIMATE CHANGE**

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The distribution of Apache trout *Oncorhynchus apache*, a threatened species endemic to eastern Arizona, and that of other southwestern coldwater species may be compressed due to increased stream temperatures associated with removal of riparian vegetation, reduced stream flow, and higher air temperatures associated with drought and changes in climatic conditions. Knowledge of environmental conditions that best buffer streams against increases and fluctuations in water temperatures may help preserve current habitat for Apache trout. I modeled effects of select environmental variables on water temperatures, and estimated how management activities may affect stream temperatures. Using the Stream Segment Temperature model, I determined how changes in stream discharge, channel wetted width, and shade can prevent stream temperatures from exceeding thermal tolerance of Apache trout. Increasing stream discharge was more effective at lowering stream temperature for streams with a higher density of riparian vegetation. Narrowing the stream channel was more effective at lowering temperature of wider streams. However, the most successful method to reduce stream temperatures was reducing the amount of incoming solar radiation through artificial and natural shading. Conifers provided significantly more shade than deciduous trees ( $P = 0.0096$ ) but require more water and are slow growing. Many complex parameters affect stream temperature, but fishery managers may be able to alter specific parameters, especially stream discharge and width and riparian vegetation, to keep streams from reaching critical levels for Apache trout and other coldwater fish species.

## **\*ELK CALF SURVIVAL AND MORTALITY PATTERNS IN NORTH-CENTRAL NEW MEXICO, 2009-2010**

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Crews captured 78 elk calves in North-central New Mexico (Valle Vidal) during the birthing season in 2009 and 2010. Calves were captured by hand and equipped with an ear-tag transmitter. Calves averaged 2.8 days of age at capture and ranged from 0 to 6 days of age. We observed 50 mortalities in the first year of life, and the pooled 2009 and 2010 Kaplan-Meier annual survival rate was 34%. Predation accounted for 96% of these mortalities. Black bears were identified as responsible in almost half of all mortalities (46%, or 23 elk calves). Other predators included; coyote (14 calves), mountain lion (5 calves), and golden eagle (1 calf). Predation was the cause of death for 5 additional calves, but in these cases we were unable to identify the specific predator. The remaining two causes of mortality were disease and an accidental drowning, accounting for one mortality each. When applicable, field necropsies were performed to help identify possible causes of death. We specifically looked for subcutaneous hemorrhaging and presence of disease or sickness. We considered all evidence when determining the cause of death, this included; subcutaneous trauma, bite and scratch marks, predator tracks and scat, predator markings, consumption patterns, scavenging, as well as whether the calf had a visible infection or disease. This evidence allowed us to identify the cause of death and the specific predator species responsible. Elk calves appeared to be most vulnerable to mortality in their first 2 weeks post-parturition with only 55% surviving until their third week. Future work will address whether increased black bear harvest may result in increased elk calf survival.

## **GENETIC MONITORING WILD AND REFUGE POPULATIONS OF COMANCHE SPRINGS PUFFISH (*CYPRINODON ELEGANS*).**

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The Comanche Springs pupfish (*Cyprinodon elegans*) is an endangered fish endemic to a complex of desert springs near Toyahvale, TX. As this wild population is faced with a number of threats, refuge populations are being maintained at Southwestern Native Aquatic Resources and Recovery Center (NARRC) and Uvalde National Fish Hatchery (NFH). Genetic diversity was characterized in 199 *C. elegans* individuals from the wild (Phantom Lake Spring) and refuge (Uvalde NFH and Southwestern NARRC) populations using 5 microsatellite loci. All three populations (Uvalde, Southwestern NARRC, Phantom Lake Spring) of *C. elegans* examined had moderate levels of heterozygosity ( $HO = 0.681$  to  $0.772$ ). The wild Phantom Lake Spring population had lower mean allelic richness ( $AR = 5.36$ ) when compared to the Southwestern NARRC ( $AR = 8.002$ ) and Uvalde ( $AR = 7.766$ ) refuge populations. Unique alleles were observed in low frequencies in the Southwestern NARRC and Uvalde populations but not the wild Phantom Lake Spring population. A population structure analysis revealed that there are two genetic clusters: one that corresponds to the wild and the other to the refuge populations. This is most likely due to the refuge populations remaining large and retaining genetic diversity, while the relatively small wild population has lost genetic diversity. The results of this study provide valuable information to guide management of this species.

## **\*CARNIVORE DISTRIBUTIONAL PATTERNS IN WHITE SANDS NATIONAL MONUMENT, NM**

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We studied patterns and drivers of mammalian carnivore occupancy in White Sands National Monument from 2011-2012 as part of an ongoing investigation of carnivore distribution and community ecology in the monument. Remote cameras were deployed to 2 sets of 46 randomly generated sites within 6 major habitat types, using a stratified random design. Variation in prey abundance was identified *a priori* as a potential driver of carnivore occupancy; rodent abundance, rabbit density, and invertebrate biomass were investigated using mark-recapture trapping, distance sampling,

and pitfall trapping, respectively. Cameras detected 5 carnivore species: coyote [(*Canis latrans*), 395 detection days], kit fox [(*Vulpes macrotis*), 297 detection days], American badger [(*Taxidea taxus*), 35 detection days], bobcat [(*Lynx rufus*), 15 detection days], and striped skunk [(*Mephitis mephitis*), 8 detection days]. Prey abundance was highest in shrubland habitat types and lowest in the gypsum dunefield and its surrounding grasslands and playa flats. Preliminary analysis suggests that prey abundance is a key determinant of coyote and badger occupancy; both species were most frequently captured by cameras in habitat types with high prey abundance. In contrast, kit foxes were photographed most frequently in habitat types where prey abundance was relatively low. Kit fox occupancy may be driven by avoidance of competitively superior coyotes, whereby foxes disproportionately occupy resource-poor areas where coyotes are unlikely to occur. Image data was not sufficient for preliminary analyses to discern occupancy patterns for bobcat or striped skunk. Occupancy analysis remains ongoing; final modeling will also include a covariate to assess the influence of land-surface temperature on carnivore occupancy.

### **\*SPAWNING ECOLOGY OF THE CRITICALLY ENDANGERED MOAPA DACE, *MOAPA CORIACEA*, REVEALED THROUGH UNDERWATER VIDEOGRAPHY**

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Moapa dace, *Moapa coriacea*, are a critically endangered cyprinid endemic to the Warm Springs area of Clark County, Nevada. Because of its limited range, low abundance, and impacts from introduced species, Moapa dace were federally listed as an endangered species within thirty years of being described. The spawning ecology, a portion of Moapa dace life history that is crucial to comprehend for its recovery, is not fully understood. We installed twelve underwater cameras, one every ten meters, in the uppermost reach of Plummer Stream. Cameras were equipped with infrared light to record both day and night activity. Camera sites were randomly selected to represent a variety of habitat-types (i.e. pools, glides, runs, and riffles). We quantified available habitat by dividing the field of view in front of each camera into a grid to measure size and embeddedness of substrate, depth, stream velocity, and categorize cover. We recorded approximately 21,000 hours of video from March through May 2012. We randomly selected sixteen 10-minute video clips in every 24-hour period, from each camera, to analyze for spawning activity. Based on activity reviewed to date, Moapa dace appear to be broadcast spawners. Spawning events were recorded in three sites; one in a run, four in a glide, and five in a pool. Three spawning events occurred between 7:50am to 9:00am and seven between 2:10pm and 6:40pm. Further knowledge of the spawning ecology of Moapa dace will be important for identifying factors that induce spawning in captivity and will provide crucial data for managers to utilize in habitat improvement projects.

### **QUICK RESPONSE EXPERIMENTAL POST-WILDFIRE TRANSLOCATIONS IN THE NARROW-HEADED GARTERSNAKE (*THAMNOPHIS RUFIPUNCTATUS*)**

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When catastrophic events effect habitats, management actions including salvage, translocation or repatriation of threatened species, may be necessary. In May of 2012, the largest wild-fire in New Mexico occurred in the Gila National Forest. In the wake of the fire, wildlife professionals raised concerns regarding post-fire effects on extant populations of Narrow-headed gartersnake, *Thamnophis rufipunctatus*, currently listed as threatened by New Mexico

Department of Game and Fish (NMGF 2006) due to population declines in New Mexico and Arizona. Post-fire threats to the snake include ash flows from monsoonal rains in burned areas, causing loss of foraging habitat and die-offs of native fish. Narrow-headed gartersnakes primarily prey on fish. Previous translocation research on other snakes suggests low survivorship; translocation has never been attempted with Narrow-headed gartersnakes. Translocations post-fire provided an opportunity to potentially minimize some of the predicted severe adverse effects from the wildfire for translocated individuals, as well as an opportunity to assess movement and survivorship in the translocated individuals. The decision was made to salvage gartersnakes from two creeks which had robust populations in which post fire impacts were predicted to be severe. Narrow-headed gartersnakes were salvaged in June 2012 from Whitewater Creek and the Middle Fork of the Gila River and temporarily housed at the Albuquerque Biopark. On July 31-August 1, 2012 eighteen snakes (8 radioed and 10 under 440 SVL) from Whitewater Creek were relocated into Saliz Creek. Snakes without transmitters were not observed after release, but search effort was limited. Snakes with transmitters were tracked weekly throughout August and September, using telemetry, in an attempt to understand movements and behavior of translocated Narrow-headed gartersnakes. Telemetry results were compared to those of previous studies, on non-translocated Narrow-headed gartersnakes, to determine differences in behavior and movements attributed to translocation efforts for this species.

#### **\*CONSERVATION IMPLICATIONS OF FRAGMENTATION OF THE THREATENED LEOPARD DARTER, *PERCINA PANTHERINA***

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Low abundance and limited distribution has characterized *Percina pantherina*, a percid endemic to the Little River system, Oklahoma and Arkansas. Fragmentation by reservoir construction and silvicultural perturbations has been apparent since federal listing in 1978. We compare levels of heterozygosity and population subdivision and estimate genetic effective size. Variation at eight microsatellite loci revealed low levels of allele richness ( $AR = 3.74$  to  $6.60$ ) and heterozygosity ( $He = 0.461$ - $0.636$ ) within populations. Tributary streams separated by reservoirs differed significantly in allele frequencies, with 10.2% of the genetic diversity attributable to differences among tributaries. Maximum Likelihood (MIGRATE) and Bayesian (MSVAR) coalescence approaches indicate current effective population sizes are similar with those from alternative approaches, and about three orders of magnitude smaller than the ancestral population sizes and one order smaller than the long-term effective sizes. Point estimates of time since the start of the decline (69 to 398 yrs) and support limits are consistent with the hypothesis that low diversity is a result of fragmentation in the last century.

#### **DEVELOPMENT OF A DECISION SUPPORT SYSTEM TO FACILITATE SPECIES CONSERVATION IN NEW MEXICO**

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Compilation and organization of documents generated by and for wildlife agencies is important for species conservation and management. Every year, the New Mexico Department of Game and Fish generates and receives hundreds of documents pertinent to species management. These include field surveys and contractor reports, annual reports, permit reports, responses to projects with a federal nexus, and species management plans. The Department's ability to access and utilize the information in these documents to further species management and conservation, and carry out other aspects of their mission, depends on the documents being readily available to Department personnel. The purpose of this pilot project is to develop a decision support system composed of a document database and an associated web mapping application. The database has been designed in Microsoft SQL Server and is intended to serve as a central repository for metadata on documents pertaining to the management of two focal species. The web mapping application is being designed in ArcGIS Viewer for Flex and populated by map services published using ArcGIS 10.1. The application will facilitate text and spatial searches of the database. The two focal species for this pilot project are the dunes sagebrush lizard (*Sceloporus arenicolus*) and the lesser prairie chicken (*Tympanuchus pallidicinctus*) which have conservation and management implications. Both species have been identified in the

Comprehensive Wildlife Conservation Strategy for New Mexico as Species of Greatest Conservation Need, and are negatively impacted by a variety of anthropogenic activities, including energy development and the modification of shinnery oak habitat. Over 200 documents pertaining to these two species have been compiled in electronic format and will be used to populate the database. The system developed for this project will readily incorporate other document types, species, and geographic areas.

**RAIN HARVESTING FOR WILDLIFE: PUEBLO'S INITIATIVE TO THE SEVERE DROUGHT TO IMPLEMENT WATER RESOURCES. WILDLIFE MONITORING AND REINTRODUCTION WITHIN TRIBAL LANDS: REINTRODUCTION OF MERRIAM'S WILD TURKEYS AND MONITORING OF THE POSSIBILITY OF LARGE UNGULATES.**

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Climate change has become a major issue for the southwest. Severe drought is starting to take its toll on private lands, forest service lands, national refugees, farm and agricultural lands and tribal lands. With urbanization encroachment, habitat fragmentation, climate change and loss of free range, the Pueblo of Sandia has taken the initiative to implement additional water sources for wildlife. Through a United States Fish and Wildlife Partners for Wildlife Grant, the Pueblo of Sandia was able to conduct a workshop and install three (3) water guzzlers in the Sandia Mountain foothills. This presentation will discuss how the Pueblo of Sandia conducted the rain harvesting workshop for wildlife and how these additional water guzzlers are being used on the Pueblo of Sandia to address shrinking water resources.

**WILDLIFE MONITORING AND REINTRODUCTION WITHIN TRIBAL LANDS: REINTRODUCTION OF MERRIAM'S WILD TURKEYS, MONITORING OF VARIOUS SPECIES OF WILDLIFE AND FISHES AND THE POSSIBILITY OF LARGE UNGULATE REINTRODUCTION.**

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Throughout the Southwest lack of habitat, climate change, urbanized encroachment, winter and summer range disruption, have been brought to the Pueblo's attention and to protect their natural resources within their lands some wildlife has been reintroduced along the Rio Grande corridor. Through active restoration projects, habitat improvements, invasive species removal, and the planting of native shrubs, grasses, and trees, the Pueblo of Sandia reintroduced wild turkeys and is planning on reintroducing large ungulates within the Foothills of the Sandia Mountains. This presentation will discuss how the Pueblo of Sandia reintroduced wild turkeys to the Pueblo lands, currently monitoring other wildlife species, including fish monitoring, and future plans of a possible large ungulate reintroduction Pueblo lands.

**COST-EFFECTIVE TECHNIQUES TO RESTORE AND CREATE WETLANDS HABITATS FOR BATS, ENDANGERED AMPHIBIANS, AND OTHER WILDLIFE**

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Water availability is one of the primary factors limiting wildlife populations in the southwest, and wetlands are one of the most threatened, yet ecologically vital habitats. The great majority of Arizona and New Mexico's 31 native amphibian species depend on wetlands and associated habitats. Almost all of Arizona's 27 species of bats need pooled water for drinking and highly prefer wetland habitats for foraging. Wetlands and their associated habitats are also critical migratory habitat for shorebirds and passerines and are important to many other game and non-game species. Unfortunately, 70-95% of Arizona and New Mexico's wetlands have been lost over the last 150 years, due primarily to irrigation agriculture, historic overgrazing, and human development. Changing climate has now emerged as a primary

threat; from 2003-2007 the 11 western states experienced 70% more warming than the average global increase for the 20<sup>th</sup> century, with the greatest increase recorded for the southwest. Fortunately, cost-effective and practical techniques have been developed that use readily available heavy equipment and groundwater to restore and create wetland pools and riparian habitat at springs, seeps, and wet meadows. Where groundwater is unavailable, the reconfiguration and compaction of clay soils, or modern liner systems can be used to capture and create surface water wetlands. From 2011-2013, BCI's Water for Wildlife Program worked with the Forest Service, BLM, FWS Partners, AZGFD, and several other partners to design, restore and create more than 50 wetland water sources for bats, endangered frogs and native fish, and many other wildlife species.

## **THE GENETIC STATUS OF GILA TROUT AFTER THE WHITEWATER-BALDY FIRE: IMPLICATIONS FOR RECOVERY**

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As climate becomes warmer and drier in the southwestern US, the frequency and severity of wildfires is predicted to increase. Large fires can have negative effects on abundance and geographic range sizes of imperiled fishes that, in turn, negatively affect genetic diversity. For example, the Whitewater-Baldy Fire in 2012 negatively impacted all populations of Gila trout to some degree, with local effects ranging from reduced abundance to extirpation. We report levels of genetic diversity in the species before and after the fire to assess impacts of fire to long-term evolutionary potential and recovery. Our analysis focused on variation in highly variable nuclear genes (microsatellites) and a gene in the Major Histocompatibility Complex (MHC II) that is part of the immune systems. One relict lineage extirpated by the fire, Iron Creek, contained previously unrecognized diversity that is now lost to the species as a whole. Other lineages are predicted to experience genetic bottlenecks due to reduced abundance. Geographically extensive restocking of relict lineages is a top priority for recovery, but implementation of this strategy will depend on how long it takes to restore ecological integrity to trout streams. In the meantime, restoration of metapopulation dynamics to contiguous watersheds and securing hatchery brood stock for relict lineages will help ameliorate effects of fire-induced genetic bottlenecks. Catastrophic fires in the west are likely to be the “new normal”, so managers should plan extensively for fire effects to persistence and recovery of aquatic biota.

## **PROGRAMMATIC HABITAT CONSERVATION MEASURES TO REDUCE CONSULTATION STRESS FOR AGENCIES AND LANDOWNERS**

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The Natural Resources Conservation Service (NRCS) in Arizona is working with numerous agencies and landowners in a proactive approach to conserve species habitat while minimizing impacts to agricultural operations. Reducing perceived or actual impediments to regular agricultural activities and conservation practices should encourage more participation from landowners in programs designed to conserve or enhance habitat. Involving landowners in the process is essential to focusing efforts on removing barriers to improving habitat for listed species and eliminating myths surrounding the Endangered Species Act. NRCS examined all conservation practices prescribed in conservation plans and developed measures to reduce or eliminate negative effects. These measures are discussed through an introduction to five templates developed in Arizona that ease consultation requirements with the US Fish and Wildlife Service. Discussion includes a draft document describing measures for grazing within Sonoran desert tortoise habitat, measures for conservation practices on Arizona rangeland for all listed species and range-wide consultations for the southwestern willow flycatcher and black-footed ferret. A summary template is presented as a proposed model for this approach.

## **WILDLIFE USE OF SOLAR FACILITIES ON AND NEAR AIRPORTS**

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Accelerated development of solar energy production has generated numerous conservation concerns in the U.S. and elsewhere, including reductions in wildlife habitat. Ideal locations for new development of solar facilities contain large expanses of undeveloped land, harbor relatively little wildlife, and are mostly unsuitable for conservation initiatives. Airports offer one of the few land holdings where reductions in wildlife abundance and habitat quality are necessary and socially acceptable, due to the risk of wildlife collisions with aircraft. Further, a recent study estimated that airports in the contiguous U.S. contain over 3,300 km<sup>2</sup> of undeveloped grasslands, much of which potentially could be converted to alternative energy production. Several airports in the U.S. already have installed large solar arrays on airport properties. However, before wide-scale conversion of airport grasslands to solar arrays, wildlife use of solar arrays should be examined to determine whether such land uses serve as attractants to wildlife hazardous to aircraft. We studied bird and small mammal use of six pairs of solar arrays and adjacent airport grasslands in Arizona, Colorado, and Ohio over one year. Across sites, we observed 61 species of birds in airfields, compared to 53 species in solar arrays. However, we observed 1.8 times more birds in airfields than in solar arrays. For those species considered especially hazardous to aircraft (e.g. waterfowl and raptors;  $\geq 10\%$  of all reported strikes cause damage to the aircraft), we observed 6.1 times more birds in airfield habitats. Further, we trapped 2.2 times more small mammals (which potentially could attract raptors) in airfield habitats than in solar arrays. Our results indicate that where feasible, converting airport grasslands to solar arrays may provide more environmentally sound alternative energy, increase revenue for airports, and reduce the local abundance of wildlife hazardous to aircraft.

## **STANDARD WEIGHT (WS) EQUATION FOR HEADWATER CHUB (*GILA NIGRA*)**

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Relative weight ( $W_r$ ) is commonly used in fisheries management to evaluate the body condition of fish using a standard weight ( $W_s$ ) equation. Relative weight has principally been used to evaluate sport fishes; however potential relationships between fish growth and environmental quality suggest  $W_r$  could be important in evaluating nongame species as well. Regression-line percentile (RLP) is frequently used to develop  $W_s$  equations but consideration must be given regarding potential length-related bias associated with extrapolating beyond the range of the data. Alternatively, an empirical percentile (EmP) method enables consistent and valid interpretation of relative weight using a three quadratic regression line approach. This free method, developed by Ken Gerow (2010), is available through the American Fisheries Society Fisheries Management Section. Length and weight data collected during the Research Branch's inventory project along with data obtained through AZGFD Region VI and Scott Bonar with the University of Arizona were analyzed using this EmP method to develop a  $W_s$  equation for headwater chub. The development of this equation provides managers with an additional tool to assist headwater chub management throughout its range.

## **\*APPLICATIONS OF "EPIGENETIC" TOOLS IN WILDLIFE MANAGEMENT AND CONSERVATION**

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Measurements of genetic diversity have helped to guide the management of wild populations for decades. High levels of genetic diversity indicate the potential for a robust response to future environmental change. Rarely, however, do these indices inform managers of the response of a population to past and ongoing environmental change. Such knowledge would facilitate better estimates of how a population has responded to specific stressors and these estimates could

improve management plans for sensitive species. One such record of an organism's response to its environment is kept in the form of small edits made to its genome but above the genes (epigenetic) instead of the underlying DNA sequence. These epigenetic changes differentiate individuals and can be passed from one generation to the next. Emerging techniques now allow researchers to assess a species' response to a myriad of stressors including pollution and climate change. In addition to assisting in the prediction of a response in a sensitive species, the epigenetic response of indicator species can be harnessed to assess environmental quality. I will discuss the exciting new ways in which epigenetic monitoring will improve wildlife and fisheries management. Epigenetic monitoring capabilities are in an early stage of research but managers and ecologists should be aware of the technology's potential, nonetheless, so as to best communicate their research needs to geneticists.

## **CURRENT STATUS, KNOWN MOVEMENTS, AND MANAGEMENT CHALLENGES ASSOCIATED WITH TWO RECENTLY ESTABLISHED ROCKY MOUNTAIN BIGHORN SHEEP POPULATIONS IN NORTHERN NEW MEXICO**

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New Mexico Department of Game and Fish trapped and transplanted 86 Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) in 2007 and 2008. Twenty five bighorn were trapped in 2007 from the Pecos Wilderness and transplanted into the Rio Grande Gorge west of Taos, NM to supplement an initial introduction of 23 bighorn by the Taos Pueblo in 2006. Thirty four bighorn trapped in 2007 from the Pecos Wilderness and 27 in 2008 from the Wheeler Peak Wilderness were transplanted into the Dry Cimarron River valley north of Clayton, NM. Current population estimates are 130-145 adults for the Rio Grande Gorge and 80-90 adults for the Dry Cimarron populations. The average annual population growth rate ( $\lambda$ ) has been 1.12 for the Dry Cimarron population and 1.21 for the Rio Grande Gorge population across years that did not include additional translocations. Known movements from the core release area have been approximately 60 km for Rio Grande Gorge bighorn and approximately 100 km for Dry Cimarron bighorn. Management challenges for both populations include harvest management in a multi-state mixed land status environment, disease epizootics, and risk of contact with domestic sheep and goats.

## **DO STOCKED TROUT EAT NATIVE FISH?**

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Most hatchery reared trout have never eaten anything other than commercially prepared feed pellets, and yet it is commonly assumed that hatchery trout will adversely impact native fish through predation after stocking. We evaluated this assumption by exposing hatchery reared rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) (250 – 350 mm TL) to native roundtail chub (*Gila robusta*) (50 mm TL) and bonytail (*Gila elegans*) (70 mm TL) in laboratory predation trials. Hatchery trout were tested in overnight trials immediately after transport from the fish hatchery and then re-tested again after two weeks of being fed exclusively fathead minnows. Although hatchery trout readily consume fathead minnows, when fed at the surface in a fashion similar to pellets, they were largely unable to catch and eat chub that had been acclimated to test tanks. Our results indicate that both rainbow and brown trout reared in hatcheries pose little predation threat to native chub species for at least two weeks post stocking. Lack of experience catching and eating live fish and poor swimming ability appear to make hatchery trout relatively inefficient predators on native fish.

## **THE EFFECTS OF THE WHITEWATER-BALDY FIRE ON GILA TROUT RECOVERY**

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The Whitewater-Baldy Complex fire started in May of 2012 and burned over 290,000 acres encompassing much of the current range of the federally threatened Gila trout, *Oncorhynchus gilae*. Seven (7) Gila trout “recovery” populations were severely impacted, including two of the four relict lineages. The current status of these populations and the extent of the post-fire impacts are still largely unknown. Based upon aerial reconnaissance, interpretation of infrared aerial photography, and on-site inspection, it is likely that within the Gila River Recovery Unit (GRRU), Gila trout populations in Whiskey (a relict population), Cub, White, and Langstroth creeks as well as the upper West Fork Gila River were eliminated. Within the San Francisco River Recovery Unit (SRRU), the Big Dry Creek population was likely eliminated and the Spruce Creek (a relict population) population was severely reduced or eliminated as well. In an effort to protect these irreplaceable relict lineages, Gila trout were evacuated from Whiskey, Langstroth (Whiskey replicate), and Spruce creeks during the fire and brought into captivity. Given the location and intensity of the burns, it is likely that spring runoff and any significant rainfall events will continue to impact these watersheds and affect habitat suitability for some time. Although the fire was a serious setback for Gila trout recovery, it also presents several excellent opportunities to substantially increase the number of populations and expand the current range of Gila trout. For the first time all four lineages of Gila trout are now in captivity, and broodstocks are being developed for each lineage. For the next several years, suitable streams identified in the Gila Trout Recovery Plan (2003) that were also affected by the fire will be explored. They may now be void of nonnative fish and ready for the repatriation of Gila trout.

## **RAPTORS OF THE UPPER RIO GRANDE, NEW MEXICO**

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The Upper Rio Grande Gorge is an important area for nesting raptors and a migration corridor for many other raptor species. This area includes an abundance of cliff faces that provides ideal nesting substrate for many raptors, including Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Peregrine Falcon (*F. peregrinus*), Red-tailed Hawk (*Buteo jamaicensis*), and Great Horned Owl (*Bubo virginianus*). The BLM Taos Field Office and Hawks Aloft, Inc., began collaboration on monitoring distribution and productivity of breeding raptors in 2000. Surveys continued from 2003 to 2007, 2010 and 2011, documenting a total of 92 nests. In 2011, there were 17 active nest sites, representing five raptor species. Reproductive success was determined at 16 sites and, of those, all were successful. A minimum of 28 chicks were fledged, resulting in an average productivity of 1.75 chicks per site. Productivity was highest for Ferruginous Hawk (3.00, n=1), Prairie Falcon (2.40, n=5) and Peregrine Falcon (2.00, n=2), and lowest for Red-tailed Hawk (1.25, n=4) and Golden Eagle (1.00, n=4). Here we document 2011 results and summarize findings from past survey years.

## **EFFECTS OF THE 2011 LAS CONCHAS FIRE ON FISH POPULATIONS AND HABITAT IN MEADOW STREAMS OF THE VALLES CALDERA NATIONAL PRESERVE, NEW MEXICO.**

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The Las Conchas wildfire began on 26 June 2011 and burned 12,148 ha, or one-third, of the Valles Caldera National Preserve until it was fully contained on 1 August 2011. Precipitation after the wildfire resulted in exceptionally high flows and large ash input throughout the Rio San Antonio and Rito de los Indios watersheds. An annual spring and fall monitoring program was initiated in 2011 to assess post-fire effects on fish populations and habitat. Compared to pre-burn (2007) surveys, brown trout populations decreased 100% in the Rio San Antonio and 91% in the Rito de los Indios.

One year post-fire, salmonid populations remain low, compared to 5 years of pre-fire data, in areas of the watersheds affected by the wildfire and floods. Habitat surveys revealed fine sediment (< 2 mm) continues to dominate in both streams with an increase in width to depth ratios (wider shallower) throughout the open-meadow streams. The severity of the wildfire within the headwaters of both watersheds will continue to result in variable flows and elevated sediment transfer into the future, negatively affecting habitat and recovery of the fish populations. This study highlights the difficulty in determining post-fire effects on stream systems with little pre-fire data and how wildfires and post-wildfire floods differentially affect meadow streams in comparison to forested streams.

## **UTILITY OF STREAM TEMPERATURE AND HYDROLOGY MEASUREMENTS IN EVALUATING CLIMATE RELATED VULNERABILITIES OF RIO GRANDE CUTTHROAT TROUT POPULATIONS, WITH APPLICABILITY TO OTHER NATIVE SOUTHWESTERN SALMONIDS**

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Rio Grande cutthroat trout occupy approximately 12% of their historical habitat and have recently been added as a candidate species for protection under the Endangered Species Act. Several risks threaten the subspecies' persistence, including non-native salmonids, habitat fragmentation, population isolation, and climate change. To increase our understanding of individual stream vulnerability to changing climate drivers, a stream temperature and summer baseflow monitoring program was initiated in 2010 in New Mexico and southern Colorado. Over 100 sites within currently occupied Rio Grande cutthroat trout habitat are currently being monitored, and to date, we have collected over 60,000 days of stream temperature data and over 200 manual baseflow measurements. The majority of Rio Grande cutthroat trout populations currently occur within areas of suitable thermal habitat, but experience extremely low summer baseflows (< 1.0 cfs). Information from the monitoring program is being used to develop decision tools to inform future management of these streams, factoring in the potential climate change effects of increasing stream temperature and altered hydrological regimes. We describe the utility of characterizing the specific environmental conditions of individual populations and how these tools can be easily incorporated into monitoring programs of other native southwestern salmonids to better inform managers of the effects of climate change.

## **BALD EAGLES WINTERING IN NORTHERN ARIZONA SELECT PERCHES BASED ON FOOD AVAILABILITY, VISIBILITY, AND COVER**

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During winter when food is scarce, bald eagles (*Haliaeetus leucocephalus*) use day perches to access limited food sources. Arizona Game and Fish Department (AZGFD) and Army National Guard Camp Navajo attached Platform Transmitter Terminals to 13 bald eagles during the winters of 2005, 2007, and 2009, and tracked them for up to 6 years. We hypothesized that proximity to prey (indicated by distance to roads, road-killed animals, lakes, and rivers), visibility (open areas with lower percent crown cover and more variation in vegetation height, cliffs, and other elevated geologic features), and protected microclimate (aspect) influenced eagles in their choice of perch sites. Of 1,692 eagle perches obtained, most (55%) were in Petran montane conifer forest (PMCF) and Great Basin Conifer Woodland (GBCW; 29%). Within the PMCF forest type, we compared perch selection with randomly-selected locations using binary logistic regression. We used Akaike's Information Criterion to assess habitat models and determine variables that predicted use. Bald eagles selected day perches that were closer to road kill sites, lakes, roads, and water features than random. They selected north-facing sites with greater diversity in vegetation structure and hilltops more than random. Our study focused on the detail of sites selected in PMCF because it was selected most often, but GBCW was

also selected frequently. PMCF and GBCW occur along the Mogollon Rim. Where these vegetation types were selected, it may have been because prey concentrate there and they provide elevated perch sites. These vegetation types provide taller perch trees surrounded by lower vegetation thus providing easy flight access and a panoramic view of the area. Thinning of small and medium sized trees as well as use of prescribed fire could maintain and increase these types of habitat.

## POSTER ABSTRACTS

### **\*PHYLOGENETIC ANALYSES OF BOBWHITE QUAIL IN SOUTHERN ARIZONA AND MEXICO**

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The masked bobwhite (*Colinus virginianus ridgewayi*) is a species of quail native to southern Arizona and Sonora. Quail populations rapidly declined in the mid 1800's due to widespread habitat destruction. Despite extensive efforts, reintroduction attempts of the masked bobwhite failed, and the masked bobwhite was federally listed as endangered in 1967. In 1985, the Buenos Aires ranch in Sasabe, Arizona was acquired by the USFWS, and has since served as a refuge for the masked bobwhite. A captive breeding program was set up and maintained, with birds being periodically released on the refuge. Previous studies have analyzed the intraspecific genetic relationships among northern bobwhites; however little is known regarding the relationships between masked bobwhite and its North American counterparts. In our study, we will investigate the phylogenetic relationships between the masked bobwhite, Texas bobwhite (*C. v. texanus*), and five Mexican sub-species. We are using a sequence capture method to isolate and sequence ~5,000 conserved regions in approximately 50 bobwhite samples. These data will be used to construct phylogenetic trees to identify the closest extant relative of the masked bobwhite. Along with wildlife managers, this data will also allow us to make informed management decisions regarding the reintroduction of masked bobwhite. Furthermore, we can also use this data for the discovery of single nucleotide polymorphisms (SNPs). This DNA sequence variation will result large amounts of data which are very useful for population genetic analyses.

### **\*FOOD RESOURCE UTILIZATION BY RIO GRANDE SILVERY MINNOW (*HYBOGNATHUS AMARUS*) AT LOS LUNAS SILVERY MINNOW REFUGIUM**

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The Rio Grande Silvery Minnow (*Hybognathus amarus*) has an omnivorous diet composed of benthic algae and invertebrates. Seasonal shifts in the availability of food resources can be reflected in the diet of age-0 fish. In order to determine seasonal changes and preferential feeding of the minnow, we conducted gut content analyses and surveys of algal and invertebrate assemblages at the Los Lunas Silvery Minnow Refugium, a conservation hatchery. Surveys indicate that densities of food resources (algal and invertebrate) were variable but generally stable overall. Many of the diatom taxa were only recorded in the environment and not in gut contents: this may be related to sampling and damage to the glass cell walls needed for taxonomic identification. Gut content analyses indicate that ostracods and dipterans were important food resources. Fish guts examined from younger fish in the two earlier months (July and August) were full of algae and invertebrates; diet items were dominated by a few key taxa, indicating some preferential feeding. In later months (September and October), a high proportion of guts were empty of invertebrates and nearly the same number lacked algal contents as well. This study is an important step in understanding food resource use by *H. amarus*.

## **\*USING EXPERIMENTAL REMOVALS AND STABLE ISOTOPE ANALYSIS OF DIET TO DETERMINE MECHANISMS OF COMPETITION BETWEEN AN ENDANGERED TREE SQUIRREL AND A NON-NATIVE COMPETITOR**

DERBRIDGE, J. J. (Graduate Student), Wildlife Conservation and Management, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721, USA. And J.L. Koprowski, Professor of Wildlife Conservation and Management, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721, USA. Introduced species comprise a major threat to biodiversity, but effects of their competitive interactions with native mammals are poorly understood, and experimental data are particularly lacking. I am conducting experimental removals of introduced Abert's squirrels (*Sciurus aberti*) to quantify effects of dietary overlap on the endangered Mount Graham red squirrel (MGRS; *Tamiasciurus hudsonicus grahamensis*), of which there is a single, small population ( $n < 220$ ) at the southernmost extent of red squirrel range. Abert's squirrels were introduced to the Pinaleno Mountains, SE Arizona, during the 1940s for hunting. They now occupy the MGRS' entire range, and models suggest resource competition is raising the likelihood of extinction for the endangered native. Dietary overlap is known to occur, and if the magnitude of this overlap reflects the degree to which red squirrel diet is sub-optimal, such knowledge could lead to further inferences about fitness costs. Both species primarily consume fungi and conifer seeds, and because these items have distinct carbon and nitrogen stable isotope signatures, analysis of these values in squirrel tissues will reveal the proportional contribution of these and other diet sources. By conducting experimental removals of Abert's squirrels and maintaining a control area, 2011-2014, I will be able to detect dietary shifts that occur by comparing stable isotope values in MGRS tissues grown before and after removals. Both species increase fungi consumption following seasonal rains that arrive in late summer on Mount Graham; therefore, a post-removal increase in proportion of fungi in MGRS diet during this period would likely represent a shift toward optimality. Quantifying impacts of introduced Abert's squirrels will improve long term predictions for MGRS recovery, and much-needed experimental data on this form of anthropogenic disturbance will provide insight to future research on the fate of small, isolated populations threatened by introduced competitors.

## **THE NRCS LESSER PRAIRIE CHICKEN INITIATIVE IN NEW MEXICO**

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The Natural Resources Conservation Service (NRCS) collaborated with Partners in a five state area where Lesser Prairie Chickens reside to develop the Lesser Prairie Chicken Initiative (LPCI) under the Environmental Quality Incentives Program (EQIP). LPCI is a proactive incentives program, for landowners, to voluntarily improve Lesser Prairie Chicken habitat and help avoid the bird being listed under the Endangered Species Act (ESA). The program provides both financial and technical assistance to landowners within currently occupied habitat, accompanied by a 10 mile buffer. In New Mexico three Strategic Watershed Action Team (SWAT) biologists were hired by NRCS partners to assist with implementation and monitoring of these practices. In 2012, eight LPCI contracts were initiated in three counties under the Environmental Quality Incentives Program with over 83,000 acres contracted. SWAT biologists mapped these lands, conducted pretreatment assessments, assisted in planning treatments, monitored the application of treatments and are involved in contacting landowners to secure future contracts.

## **\*JUVENILE BURROWING OWL SURVIVAL AND MOVEMENT PATTERNS ACROSS AN URBAN AND AGRICULTURAL GRADIENT**

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In southern New Mexico Burrowing Owls (*Athene cunicularia*) inhabit urban and agricultural habitats in addition to native habitats. In this study we are interested in movement patterns, foraging locations and survival of juvenile Western burrowing owls along an urban and agricultural gradient. We hypothesized that 1) rates of juvenile mortality

and timing of mortality will be influenced by the amount of development within 2.5km of the nest, 2) juvenile movement will be related to the percent development within 2.5 km of the nest with juveniles dispersing earlier in areas with greater development 3) causes of mortality will differ across a gradient of urbanization and 3) foraging distance will be influenced by the amount of development within 2.5km of the nest. To accomplish this juvenile burrowing owls are being radio tagged at 35-42 days of age and located daily to determine day roost locations, nocturnal foraging areas and daily survival. Twenty-three juveniles were radio-tagged in 2012 (13 males and 10 females) and an additional 30 will be tagged in 2013. For diurnal roost locations, owls were located between the hours of 1000-1600 and for foraging locations between 2000-0800. We are using NAIP imagery to classify habitat type within a 2.5km radius of the nest. Habitat will be classified as urban (commercial, housing), agriculture (crop type), greenspace (parks, desert scrub), roads, and other. We define dispersal as movements at least 300m from the nest. Age at dispersal will be modeled in relation to the surrounding landscape matrix using multiple regression analysis and an Akaike Information Theoretic Approach. Ten *a priori* models will be tested. These models are still being developed and will include combinations of the following variables year, sex, body condition, % urban, % agriculture, # habitat patches, and greenspace. We will compare foraging habitat with landscape percentages within the foraging radius using a Chi square analysis. This research will aid in the management of burrowing owls in urban landscapes.

### **EFFECTIVENESS OF NIGHTTIME AND DAYTIME ELECTROFISHING: IMPLICATIONS FOR MECHANICAL REMOVAL OF NON-NATIVE BROWN TROUT**

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The effectiveness of night and daytime electrofishing in small mountain streams was compared as part of an assessment focused on improving the mechanical removal of non-native brown trout (*Salmo trutta*). To assess if nighttime electrofishing was more effective at capturing brown trout than daytime electrofishing, 12 50-m sections across three streams were sampled using a three-pass depletion, during day and night with a backpack electrofisher. An analysis of co-variance was used to determine if brown trout capture probability was greater at night than during the day and Chi-square analysis was used to test if catch per unit effort (CPUE) of nighttime electrofishing was higher than daytime efforts. Brown trout were 19% more likely to be captured at night than during the day ( $P < 0.01$ ). Nighttime electrofishing had higher CPUEs than daytime for first pass efforts ( $P < 0.01$ ) and when all three passes were considered ( $P < 0.01$ ). The use of nighttime electrofishing to mechanically remove brown trout may help improve catch rates of target species, increasing the chance of a successful removal project.

### **\*RE-ESTABLISHMENT OF A POTENTIAL KEYSTONE SPECIES: BLACK-TAILED PRAIRIE DOGS AND GRASSLANDS**

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Grasslands are an important biome that many species depend on, but this biome has been greatly reduced due to conversion to agriculture. Grasslands harbor a diversity of species with complex interactions, and some species have a disproportionate impact on their communities relative to their abundance. The black-tailed prairie dog (BTPD: *Cynomys ludovicianus*) has been described as a keystone species in grasslands, and was extirpated by humans from its historical range in Arizona by 1960. BTPDs are seen as pests by many people, but provide burrows for other species (e.g. burrowing owls [*Athene cunicularia*] and rattlesnakes [*Crotalus* sp.]), excavate nutrient rich soil that provides rich vegetation for grazers, and serve as food for carnivores and birds of prey. Many keystone species studies assess effects of removal, but I have the unique opportunity to assess how prairie dogs affect an ecosystem when they are added to it. Between 2008 and 2011 Arizona Game and Fish Department translocated approximately 380 BTPDs from New Mexico and Sonora to 3 sites at Las Cienegas National Conservation Area in southeastern Arizona to attempt to improve grassland health and increase species diversity within the BTPD's historical range. In September 2012, a fourth site was populated with BTPDs from an existing colony at Las Cienegas. We observed very poor BTPD survival and reproduction at the colonies during the 2011 season, but survival and reproduction increased markedly during the 2012 season, possibly due to supplemental feeding. We will continue to monitor survival and reproduction over the next 2 seasons.

## **AN OVERVIEW OF FERAL HORSE AND BURRO MANAGEMENT AND THE BIOLOGICAL AND ECONOMIC OPTIONS OF MANAGEMENT THROUGH HUNTING**

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In an attempt to control the growing populations of feral, free-roaming horses and feral burros, Federal Public Law 92-195 was passed in 1971, incorporating a variety of management strategies including capture and removal, sales and adoption, euthanasia, and contraception. Despite this law, populations continue to grow. The Wildlife Society's official position regarding feral horses and burros in North America recognizes both as an invasive species. One policy statement supports euthanasia as a humane method for removal of old, ailing, or unadoptable feral horses and burros. As hunting of large ungulates, such as elk and bison, has become an important management strategy for controlling population levels; applying this same strategy to feral horses and burros would be a pragmatic solution for this ongoing concern.

## **THE NEW MEXICO MEADOW JUMPING MOUSE IN THE SACRAMENTO MOUNTAINS: LESSONS LEARNED**

HAYS, Q.R., Williams, J.D., Mercer, P. A., Jonnes, R.S. and R.L. Gay

The New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) occurs in isolated areas in New Mexico, Colorado and Arizona, and is a candidate for listing under the Endangered Species Act. In recent years, this species has apparently been locally extirpated from 70-80 percent of its historic range, including previously documented areas of occupancy in New Mexico. Much of the remaining suitable riparian habitat in the state occurs within the Sacramento Mountains of south-central New Mexico, and is managed by the Lincoln National Forest. Beginning in 2009, we surveyed historic jumping mouse locations and newly identified suitable habitat in an attempt to determine occurrence, persistence, or possible local extirpation. During the first two trapping seasons, seasonal effort averaged approximately 1500 trap-nights. Subsequent seasons saw a large increase in effort, and culminated with nearly 3500 trap-nights in 2012. Over the course of four field seasons four jumping mice were captured, including three in 2012. This species is notoriously difficult to detect, with previous studies showing similar success rates per unit effort. The inability to detect jumping mice in areas where they occur should be a concern to biologists working with this species, and managers should be careful not to assume local extirpation without exhaustive (multi-year) survey efforts. Additionally, success realized during the 2012 season points to bait specifics and precise trap-setting methodology as being critical to successful capture efforts. During the four-year survey period extended drought and grazing negatively impacted previously occupied areas, but efforts to protect riparian habitat through enclosures, including work already implemented on Forest lands, should prove beneficial.

## **\*THE ROLE OF BIRD DISPERSAL IN JUNIPER ENCROACHMENT OF NORTHEASTERN NEW MEXICO RANGELANDS**

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Juniper seed dispersal by birds into rangeland ecosystems is dependent upon; the dispersers present, the microsite requirements for successful germination and recruitment of the plant, and the structural complexity of adjacent, 'encroaching' habitats. Seed dispersal and spatial arrangement of One-seed juniper (*Juniperus monosperma*) seedlings, saplings, and maturing trees was investigated along a continuum of juniper density from grassland to scattered savanna to closed canopy escarpment woodland. Bird surveys were also conducted in the study area to determine bird population structure and abundance of potential dispersing species. Results showed that significant amounts of seedlings were found under structurally complex perches. The majority (59%) of seedlings were found underneath seed-producing, female junipers, however 8% and 29% of seedlings were found in open interspaces and underneath male junipers, respectively. As junipers moved into larger size-age classes, abundance increased in open interspaces and underneath male junipers rather than female junipers, highlighting the importance of dispersal away from parent trees for successful establishment and recruitment. Mountain Bluebirds (*Sialia currucoides*), a frugivorous thrush that relies heavily on juniper berries throughout the winter was the most commonly encountered species in the study area. Although other species known to consume and disperse juniper were present, the abundance and behavior of Mountain Bluebirds suggest they are the primary disperser in the region.

### **\*TESTING ABILITY OF HAIRTUBES TO DETECT SPECIES**

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Accurate and reliable sampling techniques are paramount in studying wildlife. Small mammals offer particular challenges to sampling due to small size, inconspicuousness, and often cryptic behavior. Hairtube sampling presents great potential for small mammal research. Hairtubes are noninvasive, can be placed over large areas, can sample for extended periods, and any one tube has potential to detect more than one species. Like other North American red squirrels the Mt. Graham red squirrel (MGRS: *Tamiasciurus hudsonicus grahamensis*) is a territorial, larderhoarding species. These central feeding areas create large, conspicuous scale piles used for caching cones and are indicative of occupancy. Thus the MGRS offers an ideal model to test ability of hairtubes to detect species when occupancy is well-known. We placed hairtubes at occupied MGRS middens (n=30). Tubes were placed over 30 m radial transects extending N, E, S, and W of the occupied midden. On each transect, one tube was placed at midden center; following tubes placed 10m, 20m, and 30m, from center. Tubes were baited with peanuts and peanut butter. Gorilla Tape (Gorilla Glue Company; Cincinnati, Ohio, USA) was used as adhesive for collecting mammal hair. Tubes were checked once a week for three weeks totaling 336 hairtube sampling days. Tape was replaced at all tubes during each collecting period. Hairtubes detected MGRS hair at each distance from the occupied midden. Across all occupied middens, initial analysis suggests average proportion of hairtubes detecting MGRS presence is 0.73 at midden center; whereas, overall average proportion of hairtubes detecting MGRS hair is 0.57 at the farthest point (30m) from midden center. Our results show hairtubes do have potential for reliably detecting species when present. Continued research endeavors to determine if hairtube sampling can be a dependable technique for sampling small mammal species and be relied upon as a valuable research tool.

### **\*EVALUATING THE USE OF GPS CLUSTER ANALYSIS TO LOCATE BLACK BEAR PREDATION AND SCAVENGING SITES**

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GPS cluster analysis has been used successfully to identify predation rates and prey composition of many large carnivores but has not been tested for American black bears (*Ursus americanus*). Cluster parameters indicative of predation events vary among carnivores due to differences in behavior and prey species. We are monitoring black bears in the southwest Jemez Mountains for predation or scavenging of ungulate prey using GPS cluster analysis. This project will test a range of cluster definitions to determine which are most appropriate for remotely locating sites where black bears feed on ungulates. We captured bears in 2012 to deploy 7 GPS telemetry collars that transmit location data via satellite at regular intervals. We are monitoring the GPS data to identify clusters of activity which we investigate in the field to determine whether the site is used for feeding on ungulate prey. Between July and October 2012 we visited 27 clusters and identified ungulate prey at 7 (26%). This project will continue through 2014. This new technique could provide future researchers with a more efficient method of monitoring the impacts black bears have on ungulate populations.

### **\*BAT ECHOLOCATION SURVEY IN THE MIDDLE RIO GRANDE BOSQUE**

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From August and September 2011 and for six months between May and November 2012 we recorded bat echolocation calls using Analook software and a microphone setup on the edge of the Rio Grande's riverside forest (bosque) within Albuquerque, NM. The recording location was adjacent to a pond and a flowing irrigation ditch. We analyzed all bat

echolocation recordings made each Saturday from 00:01 to 07:00 and 19:00 to 24:00. On those Saturdays we recorded  $\geq 700$  bat calls. After collecting the calls, we sorted the calls by frequency pattern to identify the bat genera and species present in that part of the bosque. We sought to see if our results – collected in a time of drought and after the outbreak of white nose syndrome – were similar to the results of an earlier study conducted from 2004 to 2006 by Gannon et al. at a similar site 1.6 kilometers distant. Our results show a preponderance of silver-haired bat (*Lasionycteris noctivagans*), California Bat (*Myotis californicus*), Pallid Bat (*Antrozous pallidus*), and Allen's big-eared bat (*Idionycteris phyllotis*) calls. Our preliminary results indicate that our data track with Gannon's related to *M. californicus*, *A. pallidus*, *L. noctivagans*, and *I. phyllotis* and differ in relation to Mexican free-tailed bat, (*Tadarida brasiliensis*), and the species in the Genus *Pipistrellus*, of which we have seen significantly fewer than observed by Gannon et al.

## **MECHANICAL BROOK TROUT (*SALVELINUS FONTINALIS*) REMOVAL FROM A WILDFIRE AFFECTED STREAM IN THE WHITE MOUNTAINS OF ARIZONA**

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Following Arizona's largest recorded wildfire, the Wallow Fire, we were presented with an opportunity to remove a population of introduced Brook Trout (*Salvelinus fontinalis*) in a fire affected stream in the White Mountains of Arizona. Post-fire surveys found a Brook Trout population in the headwaters of Rudd Creek restricted to 1077 linear meters of fire-affected habitat. 5 removal efforts were conducted from September of 2011 to September of 2012, resulting in removals of over 221 individuals and a reduction in distribution of 1024m. Only 5 age-0 fish were removed following the post-fire spawning season, indicating post-fire habitat conditions that are less-suitable for trout spawning. Results are encouraging that continued intensive mechanical removal efforts can succeed in eliminating a population of introduced trout.

## **CONCEPTUAL EARLY LIFE HISTORY MODEL OF THE ENDANGERED RIO GRANDE SILVERY MINNOW TO UNDERSTAND HABITAT REQUIREMENTS**

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The Rio Grande silvery minnow, *Hybognathus amarus*, once prevalent throughout the Rio Grande River, is now an endangered species restricted to the middle 170 miles of the Rio Grande River in New Mexico between Cochiti Dam and Elephant Butte Reservoir. The silvery minnow is a small cyprinidae that produces semi-buoyant eggs. Various life history stages of the silvery minnow require shallow water habitat for survival of the larval life stages. Water management has altered the river's once braided system into a narrow channel disrupting the river's natural flow and sediment transport destroying suitable silvery minnow habitat. Manipulation of the hydrograph has reduced lateral habitat connectivity between the main channel and the floodplain. Changes in floodplain availability can have important implications for fish reproduction and recruitment. The altered river flow and channel morphology have disconnected the river from the floodplains making it difficult for the silvery minnow to find suitable habitat. Nursery habitat requirements for incubating fish eggs and rearing larvae are often poorly defined for many species. Silvery minnows appear to spawn in the channel depending on flow volume during spring runoff. The nursery habitat concept links silvery minnow early life history to changes in river channel morphology and hydrology. Data acquired from egg drift, egg retention, and floodplain spawning studies between 2002-2011 can be used to formulate several conceptual early life history models of silvery minnow. Bayesian statistical analysis can be used to evaluate the conceptual models to better understand habitat requirements. These models will inform future recovery plans to increase the population of the silvery minnow.

## **DEVELOPMENT OF AN INFORMATION MANAGEMENT DATABASE FOR BIOLOGICAL RECORDS AT THE SOUTHWESTERN NATIVE AQUATIC RESOURCES AND RECOVERY CENTER**

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Fisheries research laboratories are typically encumbered by an information management challenge: to accurately document and keep track of a wide array of different data types. The Research Unit at the Southwestern Native Aquatic Resources and Recovery Center (Southwestern NARRC) in Dexter, NM needs to not only manage individual biological sample collection information such as lengths, weights, and PIT-tags, but also other data such as project information, species, habitat, genetic markers, resulting data, and current location of archived samples. While it may be possible to track these different data sets independently, a database framework that coherently relates them and enforces data input rules would allow for both higher efficiency and fewer data entry errors. Furthermore, such a data management system would allow for a more streamlined approach in data archiving, retrieval, and computations. There are few database tools specifically designed to aid in management of fisheries data that are generated, stored, and analyzed. Southwestern NARRC is in the process of developing a relational database to provide such a tool. This database will be implemented in Microsoft Access and will be customizable. Once complete, the new database will help with Southwestern NARRC's data management and allow for better organization resulting in higher productivity and fewer data entry errors.

### **\*LANDSCAPE GENETICS OF MOUNTAIN LIONS IN THE SONORAN DESERT**

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We are investigating the current population genetic status of mountain lions (*Puma concolor*) in the Sonoran Desert with the following questions: 1) What is the potential source of the recent mountain lion colonization in Kofa National Wildlife Refuge (Kofa NWR), Arizona? 2) What are the habitat corridors for mountain lion movement in southwestern Arizona? And 3) Are interstate highways, the Colorado River, and the Central Arizona Project canal restricting gene flow among mountain lions? To answer these questions, we have genotyped ~280 mountain lion DNA samples from Arizona with 15 well-known *Felis catus* (FCA) microsatellite DNA markers. We also used the PumaPlex (a panel of ~30 SNP markers) to genotype a subset (~190) of these mountain lion DNA samples from Arizona. Although preliminary results indicate no resolvable genetic structure in the mountain lion population analyzed from Arizona, during year 2013, we will be genotyping ~300 additional mountain lion DNA samples with a panel of 22 FCA microsatellite markers and the PumaPlex. Using this dataset, we will calculate relatedness between pairs of individual mountain lions and attempt to estimate the source of mountain lions occurring on Kofa NWR. We are also creating a GIS based habitat suitability map for mountain lions in southwestern Arizona, which will provide us with the potential corridors for mountain lion movement. We will then test the hypotheses of whether population structure (if there is any) among the sampled mountain lions is purely based on isolation-by-distance, or if it is due to natural or man-made barriers. Data generated from this study will be useful for wildlife managers to take regional or statewide management decisions for mountain lions, planning of habitat corridors for big game species, and facilitating collaborative research through genetic databases.

### **EFFICACY OF IMMERSION BATCH MARKING WALLEYE (*SANDER VITREUS*) USING THE BIO MARKER OXYTETRACYCLINE (OTC).**

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Oxytetracycline (OTC) is used as a biomarker in finfish because of its epifluorescence characteristics. OTC is often used to mark fish to determine hatchery contributions to wild fish stocks. The purpose of this study is to determine the efficacy of immersion batch marking walleye (*Sander vitreus*) with OTC. Each batch of fish was marked with a 600-700 mg/L concentration of OTC for a six hour exposure time in tubs/coolers containing approximately 200,000 fry (mean

length = 10mm). Approximately 50,000 of the fish were retained for 35 days at the Rock Lake Hatchery in Santa Rosa, NM to be raised to an advanced size (mean length = 32 mm). A small portion of the fish (n=100) that were retained were then harvested for this study. The results for this study are pending.

## **THE IMPORTANCE OF MICROCLIMATE TO FOOD STORAGE OF A LARDERHOARDING MAMMAL**

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Animals exhibit a variety of strategies to meet caloric requirements in environments with fluctuating resources. Some species store food at times of surplus, one form of which is larderhoarding; a large cache that often is actively defended from other animals. The North American red squirrel (*Tamiasciurus hudsonicus*) larderhoards conifer cones and mushrooms at the center of its well-defended territory, generally in dense forest with high canopy cover. Cone storage structures (middens) prevent cones from opening and subsequent loss of seeds. Cone opening is temperature and moisture dependent, and is thus directly linked to climate. We placed HOBO data loggers (Onset Computer Corporation) at 25 red squirrel middens and 10 non-midden locations selected randomly from our study area in the Pinaleno Mountains of Southeastern Arizona in 2011 and 2012. At a subset of 10 middens we placed loggers both on the surface of the cone storage structure and buried 15 cm within the structure. Temperatures were more variable at random locations than at middens, with greater daily average maximum temperatures and lower daily average minimum temperatures in summer months. Humidity was higher at middens than random locations, and random locations had a larger range in humidity than middens in summer months. Temperature was lower and humidity was higher within cone storage structures than on the surface with a smaller range in temperature and humidity within cone storage structures. Red squirrels likely rely on stable, cool temperature and high humidity to maintain cones for winter dietary needs. Predicted climate warming and resulting warmer, drier forests may have significant impacts on red squirrels and other species with strong linkages to specific microclimates.

## **\*SYNERGISTIC EFFECTS OF CLIMATE CHANGE, WILDFIRE, AND SEVERE WATER QUALITY ON THE AQUATIC ECOSYSTEMS AND ICHTHYOFAUNA OF THE MIDDLE RIO GRANDE**

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Since the 1900's, wildfire frequency and severity in the southwestern U.S. has increased despite human suppression efforts. Watershed impacts, including accelerated flooding and erosion, are common after high intensity crown fires. Accelerated riverine sedimentation, following wildfires, can negatively impact water quality and aquatic ecological health. Impacts may include increased sediment oxygen demand resulting in dissolved oxygen sags and fish kills. In 2011, the Las Conchas Fire burned ~157,000 acres in central New Mexico. Subsequent monsoonal precipitation events occurring within the burnt watershed resulted in altered downstream water quality and documented fish kills. Continuous water quality monitoring stations (2006-present) will be used to compare pre and post-fire water quality parameters (pH, temperature, dissolved oxygen, turbidity, and specific conductance) at four stations in the Middle Rio Grande (MRG). Water quality data will be combined with local meteorological data and monthly fish community data collected at 20 MRG sites by American Southwest Ichthyological Researchers (2002-current) to assess the impacts of a high intensity crown fire on stream metabolism and fish communities in the Middle Rio Grande. Results will provide insight into the effects of a significant disturbance to southwestern aquatic ecosystems, which are likely to increase in frequency over the next several decades.

## **\*HERPETOLOGICAL DIVERSITY AND ABUNDANCE WITHIN VEGETATION TREATMENT AREAS**

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The purpose of the study was to determine species diversity and abundance in areas that were chemically treated and areas that were not treated for Mesquite (*Prosopis glandulosa*) and Creosote (*Larrea tridentate*) encroachment. The study was funded in partnership with Bureau of Land Management (BLM) and the National Fish and Wildlife Foundation. The locations were chosen for their vegetative component types and available herpetological resources. The project started in May 2008, continuing through July 2012. Mesquite and Creosote were the two vegetation types both located within the study area. It on average takes one to two years for vegetation to react to chemical treatment. The

Creosote areas were treated with Tebuthiuron, while the Mesquite areas were treated with a mix of Remedy and Reclaim, with two survey areas observed for each. The surveys were conducted using pitfall traps and arrays. Pitfall arrays consisted of one central bucket that was attached to three drift fences, which were attached to three radial buckets. It is notable that Arrays C and D (observed between 2010 and 2012) observed a higher number of species diversity. In 2008 and 2009 the high total of 10 species were observed. In 2010 there was a low of 5 species being observed. Arrays A and B observed the greatest number of individuals between 2008 and 2010. In 2011, 7 species were observed, while in 2012 the highest number of species caught was 2. This survey will assist on determining the effects of vegetation treatments to the local herpetological community.

## **\*AN INVESTIGATION OF BEHAVIORAL PATTERNS OF THE AMERICAN PIKA AT A NEW LOW-ELEVATION STUDY SITE**

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Over the past half-century, the American pika (*Ochotona princeps*) has been studied at only a few sites throughout its range. It is thought that pikas living at the lowest possible elevations (<8200 ft.) in their southern range are testing the limits of their abilities to adapt to changes in climate. Current research has shown that pikas may be modifying their daily behavior, or evolving new dispersal strategies, to overcome physiological challenges associated with pressures from global climate change. Here we describe a new study site at Mono Craters, California (elevation of 8000 ft.) where we spent six days collecting data regarding behavior (ex. calling, surveillance). We examined the differences in levels of behavioral activity amongst different slopes at Mono Crater and how the behavioral patterns compare to other study sites. A significant difference in the short call/total call ratio was found between the Mono Crater site and two other comparison study sites located in Colorado. These observations help us to learn how, and if at all, pikas living in fringe areas of their conventional habitat range can adapt to increasing global temperatures. These methods and results can be applied to other small vertebrates that may be facing similar threats.