KANSAS COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT

25 YEARS (1991-2016) OF COOPERATIVE RESEARCH

COMPILED BY:
JOYCE BRITE
JULY 2016

Kansas Department of Wildlife, Parks and Tourism

Wildlife Management Institute, Washington, D.C.

USGS science for a changing world

Kansas State University

U.S. Fish & Wildlife Service

Preface

The Kansas Cooperative Fish and Wildlife Research Unit is jointly sponsored and financed by the U.S. Geological Survey-Biological Resources Division, Kansas Department of Wildlife, Parks, and Tourism, Kansas State University, U.S. Fish and Wildlife Service, and the Wildlife Management Institute.

In 1960, Congress gave statutory recognition to the Cooperative Research Unit program by enactment of Public Law 86-686. The act reads:

> "To facilitate cooperation between the Federal Government, colleges and universities, the States, and private organizations for cooperative unit programs of research and education relating to fish and wildlife, and for other purposes. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, for the purpose of developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources, the Secretary of the Interior is authorized to continue to enter into cooperative agreements with colleges and universities, with game and fish departments of the several States, and with nonprofit organizations relating to cooperative research units: Provided, That Federal participation in the conduct of such cooperative unit programs shall be limited to the assignment of the Department of the Interior technical personnel by the Secretary to serve at the respective units, to supply for the use of the particular unit's operations such equipment as may be available to the Secretary for such purposes, and the payment of incidental expenses of Federal personnel and employees of cooperating agencies assigned to the units. There is authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act."

The Kansas Unit opened in October 1991 at Kansas State University in Manhattan. Dr. Timothy R. Modde was appointed as the first Unit Leader. Ms. Joyce Brite was hired as support staff. In May 1992, Dr. Modde left the Unit to take a position with the Colorado River Fisheries Project, U.S. Fish and Wildlife Service, in Vernal, Utah. Dr. Michael R. Vaughan of the Virginia Cooperative Fish and Wildlife Research Unit was assigned to the Kansas Unit as Acting Unit Leader for a six-week period.

Dr. Philip S. Gipson was selected as the Unit Leader in May 1993. In 1994, Dr. Christopher S. Guy was hired as Assistant Leader-Fisheries and Dr. Jack F. Cully, Jr. was hired as Assistant Leader-Wildlife.

Dr. Guy left in August 2002 to become Assistant Leader-Fisheries at the Montana Cooperative Fishery Research Unit in Bozeman. In November 2003, Dr. Craig P. Paukert joined the Kansas Unit as Assistant Leader-Fisheries.

In May 2008, Dr. Philip S. Gipson retired from the Kansas Unit. He accepted a position as department head at Texas Tech University in Lubbock. Dr. Craig P. Paukert was appointed as Acting Unit Leader.

In May 2010, Dr. Paukert assumed the Unit Leader position at the Missouri Cooperative Fish and Wildlife Research Unit. Dr. Jack Cully was appointed Acting Unit Leader. Dr. Martha Mather joined the Kansas Unit in October 2010 as Assistant Leader-Fisheries. Dr. David Haukos was hired as Unit Leader in February 2011. In September 2012, Dr. Jack Cully retired from the Kansas Unit.

Dr. Phil Gipson

Dr. Chris Guy

Dr. Jack Cully

Joyce Brite

Dr. Craig Paukert

Dr. David Haukos

Dr. Martha Mather

The Kansas Cooperative Fish and Wildlife Research Unit (Unit) was established in 1991 through a cooperative agreement among Kansas Wildlife and Parks, Kansas State University, U.S. Fish and Wildlife Service, and Wildlife Management Institute. The 2012 Agreement (Cooperative Agreement No. 1434-12HQRU1578) included Kansas Wildlife, Parks and Tourism, Kansas State University, U.S. Geological Survey, U.S. Fish and Wildlife Service, and Wildlife Management Institute further strengthened the partnerships and continued the collaboration through 2022.

The purpose of this report is to compile and provide an extensive history of the research productivity by Unit scientists and collaborators. This is the first time that all funded research project, graduate student listing, publications, and professional presentations have been compiled for the Unit. This compilation represents known research projects and products; however, it is possible that records may have been missed during the compilation. Therefore, these records will be frequently updated as new information becomes available.

Summary Statistics

Funded Research Projects - 189
- USGS Research Work Orders (Page 7) – 66
- Kansas Wildlife, Parks, and Tourism (Page 10) – 69
- Other Funding Sources (Page 12) – 54

Conducted Research Projects – 131 (can have >1 funding source/project)
- Fisheries and Aquatic (Page 16) – 58
- Wildlife (Page 81) – 73

Specific Research Products
- Peer-Reviewed Publications (Page 177) - 349
- Books and Book Chapters (Page 198) – 35
- Technical Publications (Page 201) – 60
- Theses and Dissertations (Page 206) – 74
- REU Students (Page 212) – 16
- Presentations (Page 213) – 654

List of Graduate Students (Page 258) – 89

FUNDED RESEARCH PROJECTS 1991-2016

Table 1. Federal Research Work Orders (RWO) for the Kansas Cooperative Fish and Wildlife Research Unit 1991-2016.

No.	Date signed	Date ended	Title	Principal Investigator	Funded by	Student support
1	7/21/92	8/31/95	Abundance and Nesting Success of Neotropical Migrants Breeding in the Tallgrass Prairie	John L. Zimmerman	USFWS	
2	8/16/93	12/31/97	Evaluation of Wildlife Management Practices on the Fort Riley Military Installation	Robert J. Robel	DOD	
3			Monitoring Wildlife Populations of Elk on Fort Riley	Philip S. Gipson	DOD	
4	4/25/94	9/30/95	Status of Feral Pigs and Their Control on Fort Riley	Philip S. Gipson	DOD	Ray Matlack
5	5/29/94	9/30/96	Impacts and Marketability of the Wildlife Habitat Evaluation Program	Leonard E. Bloomquist-Sociology	USFWS	Bobi Naylor
6	6/8/94	5/31/97	Status of Three Sensitive Bird Species on Fort Riley	Jack F. Cully, Jr.	DOD	Heidi Michaels, Greg Hoch
7	9/13/94	3/29/96	The Capacity of Fort Riley Tallgrass Prairie to Support Military Training Activity-Preliminary Analysis	Alan K. Knapp	DOD	Phil Fay, Post-Doc
8	5/10/95	3/31/99	Gap Analysis in Kansas	Jack F. Cully, Jr.	Natl Biol. Survey	Glennis Kaufman, Post-Doc
9	7/6/95	6/30/97	Fort Riley Process-level Carrying Capacity Research	Philip S. Gipson	DOD	Carin Richardson, Kirk Cherry-Research Associates
10	8/1/95	12/31/01	Ecology of Predators on Fort Riley Army Base, Kansas	Philip S. Gipson	DOD	Jan Kamler
11	8/23/95	12/30/95	Habitat use and population dynamics of benthic fishes along the Missouri River	Christopher S. Guy	Army COE	Patrick Braaten
12	9/7/95	9/30/00	Effects of Size, Fragmentation, and Management of Prairie Remnants on Biodiversity & Sustainability	Jack F. Cully, Jr.	Natl Biol. Service	Anne Cully
13	8/3/95	5/30/98	Effects of prairie dogs on short-grass prairie range condition and cattle grazing behavior	Jack F. Cully, Jr.	USFWS	Justin Kretzer
14	8/17/95	9/30/97	Quivira Geographic Information System (GIS)	H.L. Seyler-Geography	Natl Biol. Service	Matthew June
15	4/23/96	12/31/97	Habitat use and population dynamics of benthic fishes along the Missouri River, 1996	Christopher S. Guy	Army COE	Patrick Braaten
16	7/23/96	6/30/02	Gap Analysis in Kansas	Jack F. Cully, Jr., Glennis Kaufman	Natl Biol. Service	Glennis Kaufman, Todd Hoernemann, Post-Docs
17	7/18/96	12/31/96	Archaeological survey for the Fort Riley Natural/Cultural Resources LCTA Integration	Donna Roper-Sociology &Anthropology	DOD	
18	4/2/97	5/30/02	Evaluation of Land Condition Trend Analysis as a Component of the Integrated Training Area Management Program at Fort Riley, Kansas	Philip S. Gipson, Don Althoff	DOD	Don Althoff-Post-Doc, James Rivers, Troy Livingston, Gerald Zuercher
19	2/25/97	6/30/98	Population structure and habitat use of benthic fishes along the	Christopher S. Guy	Army	Patrick Braaten

			Missouri River		COE	
20	7/28/97	12/31/01	Environmental Impacts of Reducing Pesticide Uses on Fort Riley	Wayne Geyer, Thomas Warner-Horticulture	DOD	
21	7/21/97	9/30/00	Reclamation of Native Tallgrass Prairie at the Kansas Army Ammunition Plant	Philip S. Gipson	DOD	Tracy Johnson
22	8/12/97	10/31/99	Modeling soil erosion and surface runoff from military training land at Fort Riley, Kansas	Prasanta Kalita-Bio & Ag Engg	DOD	
23	8/12/97	9/30/00	Effectiveness of Land Condition Trend Analysis transects for monitoring wildlife abundance in areas used for military training	Philip S. Gipson	DOD	Jonathan Conard
24	7/15/97	6/30/98	Habitat use and population dynamics of benthic fishes along the Missouri River, Field Season 1997	Christopher S. Guy	Army COE	Patrick Braaten
25	8/29/97	9/30/00	GIS Coverages of Flint Hills National Wildlife Refuge	H.L. Seyler-Geography	USFWS	
26	3/6/98	9/30/99	Population structure and habitat use of benthic fishes along the Missouri River in Montana, 1998	Christopher S. Guy	Army COE	Patrick Braaten, Sally Schrank
27	6/1/18	4/30/99	Age and growth analysis of selected Missouri River benthic fishes	Christopher S. Guy	Army COE	Patrick Braaten, Sally Schrank
28	4/5/99	7/31/01	Age and growth analysis of selected Missouri River benthic fishes	Christopher S. Guy	Army COE	Patrick Braaten
29	5/28/99	3/31/00	Assessment of Physiochemical, Biological and Landscape Features Influencing Topeka Shiner (Notropis topeka) Distribution in Kansas Streams	Christopher S. Guy	USGS/BRD	
30	9/8/99	9/30/04	Metapopulation Ecology of the Black-tailed prairie dog: A Keystone Species of Badlands National Park	Jack F. Cully, Jr.	USFWS	Lorri Newby, Tammi Johnson
31	4/11/00	11/30/01	Landscape Ecology of Plague in Black-tailed prairie dogs	Jack F. Cully, Jr.	USGS/BRD	Lorri Newby, Tammi Johnson
32	6/1/00	5/31/04	Responses of birds and other wildlife to recreation along the Niobrara River, Fort Niobrara National Wildlife Refuge	Philip S. Gipson	USFWS	Chris Anderson
33	9/1/00	12/31/04	Responses of neotropical migrant birds to natural and forestry related changes in riparian forests of North-Central Kansas	Philip S. Gipson, Dusty Becker	DOD	
34	5/3/01	4/30/06	Vegetation Response in mixed fescue and native grass pastures to winter grazing by cattle	Philip S. Gipson, Brett Sandercock	DOD	Tracy Johnson
35	9/20/01	5/31/05	Development of Aquatic Gap Analysis for Kansas	Keith Gido, Walter Dodds, Chris Guy	USGS Gap Office	
36	5/10/01	11/30/02	Community and landscape dynamics of sylvatic plague in Black-tailed prairie dogs	Jack F. Cully, Jr.	USGS/BRD	
37	9/21/01	12/20/06	Land Condition Trend Analysis on Fort Riley, 2001-2006	Philip S. Gipson, Don Althoff	DOD	Kevin Blecha, Res. Asst., Jodi Whittier-Res.Asst. Prof.
38	7/1/02	9/30/03	Great Plains Gap Analysis	Jack F. Cully, Jr.	USGS/BRD	

39	1/1/03	6/30/05	Evaluation of the Impact of Military Training on Soil Quality Indicators	Steve Thien, Philip S. Gipson	DOD	Peg (Althoff) McBee
40	8/15/04	8/14/06	A Comprehensive Sampling Design for Environmental Monitoring as Related to the Land Condition Trend Analysis Program at Fort Riley, Kansas	Jeffrey Pontius	DOD	
41	7/13/04	12/31/07	Changes in Vegetation, Small Mammal Communities, and Soil Compaction Associated with Military Training at the Smoky Hills Air National Guard Range, Kansas	Philip S. Gipson, Don Althoff	DOD	Kevin Blecha, Res. Asst.
42	6/22/04	6/30/05	Tracking Real-time Wildlife Responses to Military Mission-related Activities	Philip S. Gipson	USACERL	Jonathan Conard
43	5/1/04	6/30/05	Factors that Influence Current and Historical Distributions of Fishes in the Lower Colorado River	Keith Gido	USGS Gap Office	
44	6/1/04	6/30/07	Identification of Data Gaps in Published and Unpublished Literature on Fishes of the Lower Colorado River	Craig Paukert	USGS Gap Office	Kristen Pitts Bouska
45	9/13/04	8/31/08	Soil Sustainability in High-Use Military Training Areas	Steve Thien, Philip S. Gipson	DOD	Peg (Althoff) McBee
46	3/14/05	12/31/08	Assessing Wildlife Responses to Vehicle Impacts	Philip S. Gipson, Craig Paukert	DOD	
47	8/15/05	6/30/07	Evaluation of Standardized Techniques for the Measurement of Fish Community Structure and Abundance of Wadeable Streams in the Great Plains	Craig Paukert	CRU	Jesse Fischer
48	1/24/06	9/30/08	Evaluation if Sampling Protocols Used to Determine the Status and Trends of Rare and Endangered Missouri River Species	Craig Paukert	USGS/SSP	Andrea Severson
49	9/1/06	9/30/11	Range and Training Lands Assessment on Fort Riley	Philip S. Gipson	DOD	Derek Moon
50	5/1/06	9/30/10	Development of conservation priorities to protect biodiversity of fishes in the Lower Colorado River	Craig Paukert	USGS Gap Office	Jodi Whittier, Res.Asst.Prof.
51	5/25/07	5/31/08	Landscape genetics of deer and the potential spread of CWD across Kansas: A pilot study to examine deer density and hunting pressure as factors	Jack F. Cully, Jr., Samantha Wisely	USGS Wildlife Dis. Center	
52	4/29/08	12/31/11	Status and management of black-tailed prairie dogs on small cultural parks of the western Great Plains	Jack F. Cully, Jr.	USGS NRPP	Amanda Goldberg, Rachel Pigg
53	6/4/08	4/30/09	Biogeography and molecular epidemiology of the PRNP gene in Kansas	Samantha Wisely, Jack F. Cully, Jr.	USGS	Rachel Pigg
54	8/13/08	9/30/10	Factors influencing threatened and endangered fishes in the Great Plains	Craig Paukert	USFWS	Joe Gerken
55	8/13/08	9/30/09	Genetic susceptibility and animal movement patterns of sympatric populations of mule deer and white-tailed deer in western Kansas	Samantha Wisely	USGS	
56	6/8/09	3/31/10	Development and validation of models to assess the threat to freshwater fishes from environmental change and invasive species	Craig Paukert	USGS	moved to Missouri

57	8/12/09	4/12/10	Conservation planning for fishes in the Upper Colorado River Basin	Craig Paukert	USGS	moved to Missouri
58	5/1/11	12/31/14	Development of conservation and climate adaptation strategies for wetlands in the Great Plains LCC region	David Haukos	USGS	Gene Albanese, Post-Doc
59	9/1/11	5/31/14	Estimating inundation frequency of playa wetlands using 1970s Landsat MSS Data: Did irrigation practices artificially increase frequency and longevity of landscape wetness	David Haukos	USFWS	Brandon Weihs
60	1/1/14	5/31/16	Risk assessment of exposure to lead for mottled ducks on national wildlife refuges of the gulf coast	David Haukos	USFWS	Brian Kearns
61	12/4/13	12/30/15	Occurrence and prediction of avian disease outbreaks in Kansas	David Haukos	USFWS	Thomas Becker
62	8/1/12	12/31/16	Lesser Prairie-chicken response to USDA conservation practices in Kansas and Colorado	David Haukos	USDA FSA	Beth Ross, Post-Doc, David Spencer
63	12/17/12	9/30/14	Optimal allocation of training lands (OPAL) field assessment using remote sensed imagery	Stacy Hutchinson	USAERDC, CERL	
64	7/17/13	6/30/16	Demographic analysis and life cycle modeling of Arctic-breeding shorebirds	Brett Sandercock	USFWS	Emily Weiser, Post-Doc
65	2/10/14	8/31/16	A multi scale examination of the distribution and habitat use patterns of the Regal Fritillary (*Speyeria idalia*) within the Fort Riley Military Reservation	David Haukos	DOD	Kelsey McCullough
66	6/30/16	12/31/16	Multi Scale Examination of the Distribution and Habitat Use Patterns of the Regal Fritillary (*Speyeria idalia*) within the Fort Riley Military Reservation-II	David Haukos	DOD	Kelsey McCullough

Table 2. Projects funded by Kansas Parks, Wildlife, and Tourism at the Kansas Cooperative Fish and Wildlife Research Unit, 1991-2016.

Date signed	Date ended	Title	Principal Investigator	Funded by	Student supported
	10/31/1995	Coded Wire Tag Loss from paddlefish	Christopher S. Guy	KDWPT	
	2/28/1996	Relative position of coded wire tags in paddlefish rostrums	Christopher S. Guy	KDWPT	Scott Waters, undergraduate
	1/31/1996	Comparison of catch per unit effort and size structure of white crappie collected with trap nets and gill nets	Christopher S. Guy	SDSU, KDWPT	
	8/31/1996	A revised standard weight (W_s) equation for spotted bass	Christopher S. Guy	SDSU, KDWPT	Jennifer Wiens
1/7/1994	12/31/1996	CRP use by ring-necked pheasant in the high plains	Philip S. Gipson	KDWPT	William Smith, Eric Arnold, Matthew McCoy
3/31/1994	8/31/1996	Survival rates and cause-specific mortality of swift fox in cropland and rangeland sites in western Kansas	Philip S. Gipson	KDWPT	Ray Matlack
9/16/1994	9/30/1996	Best management practices for riparian area projects on plant and aquatic communities	Christopher S. Guy	KDWPT	Jennifer Wiens
1/9/1995	3/30/1997	An evaluation of spotted bass in Kansas streams	Christopher S. Guy	KDWPT	Jeff Tillma
	6/30/1997	Spatial and temporal variability of fish population characteristics in a warmwater Kansas Stream	Christopher S. Guy	KDWPT	Jeff Tripe
	11/30/1999	Age and growth of white bass in Kansas reservoirs	Christopher S. Guy	KDWPT	
	8/31/2000	Temporal variation in growth, condition, and egg diameter of white bass in Fall River reservoir	Christopher S. Guy	KDWPT	
1/9/1995	9/30/1997	Seasonal variation of fish population characteristics in warmwater streams	Christopher S. Guy	KDWPT	
5/3/1995	6/30/1997	Licensed angler use and preference survey and evaluation of attitudes towards angling by secondary education students	Christopher S. Guy	KDWPT	Matt Burlingame
10/1/1995	5/31/1998	Fencing riparian buffer zones in pastures of southeastern Kansas: Imapcts to wildlife and economic costs and benefits	Philip S. Gipson	KDWPT	David Hoover
	12/31/2000	Movement patterns and habitat use of spotted bass in southeast KS streams; Vulnerability of spotted bass to angling in Kansas streams (spotted bass telemetry)	Christopher S. Guy	KDWPT	Travis Horton
3/1/1996	2/27/1999	Biological Assessment of Fort Riley Streams and Riparian Resources	Christopher S. Guy	KDWPT	Michael C. Quist
7/1/1996	6/30/1997	Gap Analysis in Kansas, 1996-1997	Jack F. Cully, Jr., Glennis Kaufman	KDWPT	
	8/31/2000	Growth, food habits and lipid composition of Age-0 largemouth bass in El Dorado reservoir	Christopher S. Guy	KDWPT	Jeff Tripe
1/1/1999	12/31/2003	Stocking Succes and Factors Influencing Survival and Growth of Stocked Walleyes	Christopher S. Guy	KDWPT	Michael C. Quist
	12/31/2002	Evaluation of walleye, crappie, and gizzard shad population characteristics in Kansas reservoirs	Christopher S. Guy	KDWPT	Michael C. Quist

2/1/1999	6/30/2001	Bird and Mammal Responses to Conversion from Fescue Pastures to Native Tallgrass Prairie	Jack F. Cully, Jr.	KDWPT	Amber Rucker
4/17/000	11/1/2001	Landscape Ecology of Plague in Black-tailed Prairie Dogs	Jack F. Cully, Jr.	KDWPT	
7/1/2000	8/31/2001	Kansas Upland Game Bird Hunter Satisfaction with Management Programs for Wild Turkeys and Bobwhite Quail	Philip S. Gipson	KDWPT	
7/1/2000	6/30/2001	Gap Analysis in Kansas, FY 2001	Jack F. Cully, Jr., Glennis Kaufman	KDWPT	
11/1/2000	12/30/2005	Effects of water willow on age-0 centrarchids in Kansas reservoirs	Keith Gido	KDWPT	Timothy Strakosh
1/1/2001	12/31/2001	Influence of Instream Habitat Restoration on Spotted Bass in a Kansas Stream	Christopher S. Guy	KDWPT	Stan Proboszcz
1/2/2001	12/31/2003	Seasonal Movement and Habitat Use of Spotted Bass in Southeast Kansas Streams	Christopher S. Guy	KDWPT	Stan Proboszcz
1/1/2001	12/31/2002	Changes in land use patterns and their effects on Rio Grande turkeys in southwest Kansas	Philip S. Gipson	KDWPT	Brian Spears
5/1/2001	6/30/2003	Cowbird abundance effects on spatial patterns of brood parasitism in grassland bird communities	Jack F. Cully, Jr.	KDWPT	William Jensen
7/1/2003	6/30/2006	Responses to Northern Bobwhite to Landscape Scale Habitat Improvements	Philip S. Gipson	KDWPT	Brian Flock
	12/31/2008	Effects of anthropogenic disturbance of fish community and food web structure in a Great Plains river	Craig Paukert	KDWPT	Jeff Eitzmann
	5/31/2009	Behavioral ecology of grasshopper mice and deer mice	Jack F. Cully, Jr.	KDWPT, NSF	Ron VanNimwegen
	12/31/2009	Occupancy and Interspecies relationships of river otters in eastern Kansas	Craig Paukert	KDWPT	Mackenzie Shardlow Jeffress
1/1/2008	12/31/2012	Recruitment of fishes in the Kansas River	Craig Paukert	KDWPT	
1/1/2008	5/31/2010	Effects of zebra mussels on invertebrate and fish abundance, and growth of age-0 largemouth bass five years after invasion	Craig Paukert	KDWPT	Andrea Severson
1/1/2010	12/31/2011	Sand dredging effects on fishes and fish habitat in the Kansas River	Craig Paukert	KDWPT	Jason Fischer
8/10/2012	4/30/2017	Lesser Prairie-chicken habitat use, survival, and recruitment	David Haukos	KDWPT	Joseph Lautenbach, Reid Plumb, John Kraft, Dan Sullins, Samantha Robinson
1/1/2012	12/31/2014	Assessing distribution and movement of blue catfish in Kansas reservoirs	Martha Mather	KDWPT	Kayla Gerber, Zach Peterson
2/1/2012	1/31/2015	Neosho Madtom. Developing & testing a spatially explicit, science-based, decision support tool for making riverscape-scale management decisions…	Martha Mather	KDWPT	Jane Fencl, Sean Hitchman
1/1/2014	12/31/2016	Early spawn and natural spawn age-0 largemouth bass: Food habits and habitat use evaluation	Martha Mather	KDWPT	Robert Mapes
7/15/2016	6/30/2019	Ring-necked Pheasant Use of Cover Crops in Western Kansas	David Haukos	KDWPT	Alixandra Godar, Adela Annis

Table 3. Projects funded by other sources at the Kansas Cooperative Fish and Wildlife Research Unit, 1991-2016.

Date signed	Date ended	Title	Principal Investigator	Funded by	Student support
	10/31/1995	An uneven-age silvicultural model for Mexican spotted owl habitat	Jack F. Cully, Jr.	KSCFWRU	
	12/31/1996	Stranding of *Pentagenia vittigera* following flow reductions in the lower Missouri River	Christopher S. Guy	USCOE	Patrick Braaten
	12/31/1996	Catch rates and size structure of two ictalurids sampled with different sizes of hoop nets	Christopher S. Guy	USCOE, USFWS	Jeff Tillma
	2/28/1997	Precision of aging river carpsuckers using scales and dorsal fin rays	Christopher S. Guy	Army COE	Patrick Braaten, Matt Doeringsfeld, Res.Asst.
	2/28/1997	Population dynamics of channel catfish and shovelnose sturgeon populations in the Upper Kansas River	Christopher S. Guy	DOD	Mike Quist
	5/31/1998	Overwinter habitat use by shovelnose sturgeon in the Kansas River	Christopher S. Guy	KSU Biology Seed Grant	Jeff Tillma, Matt Burlingame, Mike Quist
4/1/1995	3/31/1997	Wild Turkey Damage to Corn Seedlings in the Flint Hills of Kansas	Spencer Tomb, Jack Cully	Natl Wild Turkey Fed.	
1/1/1996	7/31/1996	Interactions of Mammalian and Avian Predators and Their Responses to Military Training	Philip S. Gipson	Army COE	Jan Kamler
	5/31/1997	Effects of fire and bison grazing on abundance of the Lonestar tick (*Amblyomma americanum*) at the Konza Prairie Research Natural Area	Jack F. Cully, Jr.	NSF, KSCFWRU, McNair Scholars Program	Justin Kretzer
	8/31/1997	Adult fishes associated with tributary confluences in the lower Missouri River	Christopher S. Guy	Army COE	Patrick Braaten, Matt Doeringsfeld, Res.Asst.
	5/31/1999	Influence of Black-tailed prairie dogs and cattle grazing on bird and plant diversity in the shortgrass biome of southwest Kansas and Southeast Colorado	Jack F. Cully, Jr.	US Forest Service, USFWS	Stephen L. Winter
1/3/1996	12/31/1997	Environmental Assessment of the Integrated Natural Resources Management Plan at Fort Riley	Philip S. Gipson	HydroGeoLogic, Inc.	none
8/15/1996	12/31/1997	Environmental Assessment for the Mounted Color Guard Exercise and Demonstration Area, Fort Riley	Philip S. Gipson	HydroGeoLogic, Inc.	none
9/24/1996	12/31/1996	Inventory of Missouri River Fishes at Ft. Leavenworth	Christopher S. Guy	USFWS	
	3/31/2003	The genetic structure of greater prairie-chicken (*Tympanuchus cupido pinnatus*) populations in Kansas	Jack F. Cully, Jr.	DOD, KDWPT	Mayee Wong

	12/31/1998	Structure and function of fish communities in streams on the Fort Riley Military Reservation, Kansas	Christopher S. Guy	DOD	Mike Quist
	6/30/1998	Genetic diversity of reptile ticks on the Galapagos Islands	Jack F. Cully, Jr.	KSCFWRU	Mayee Wong
	8/31/1998	Standard weight (W_s) equation for flathead catfish	Christopher S. Guy		Mike Quist
	12/31/1998	Famous damaging wolves and credibility of early wildlife literature	Philip S. Gipson	KSCFWRU	
	10/31/1999	Seasonal avian use patterns of farmed wetlands and nest predation dynamics in riparian grasslands dominated by reed canary grass (*Phalaris arundinacea*)	Philip S. Gipson, Ted Cable	EPA	James Rivers
	12/31/1999	Growth, mortality and sources of larval freshwater drum in the lower channelized Missouri River	Christopher S. Guy	USCOE, KDWPT, MO DoC	Patrick Braaten
	12/31/1999	Determination of coyote, bobcat, and raccoon movements based on activity transmitter pulse rates	Philip S. Gipson	DOD, KSCFWRU	Patricia Snyder
1998	1999	Population Dynamics and Competitive Interactions of Bighead Carp	Christopher S. Guy	KSU Faculty Award	
	6/30/2000	Topeka Shiner	Christopher S. Guy	USFWS, USGS-BRD	Sally Schrank
	11/30/2000	Spatial and temporal variation in abundance of bighead carp larvae in the channelized Missouri River	Christopher S. Guy	USCOE, KDWPT, MO DoC	Sally Schrank
	11/30/2000	Population characteristics of bighead carp in the Missouri River and interspecific dynamics with paddlefish	Christopher S. Guy	KSU	Sally Schrank
6/1/1999	6/1/2000	Domestic Livestock/Black-tailed Prairie Dogs Interactions	Jack F. Cully, Jr.	US Forest Service	
6/8/1999	12/30/2000	Study of the population genetic structure of Greater Prairie Chickens in the Flint Hills	Jack F. Cully, Jr.	MO Dept of Conservation	Mayee Wong
	9/30/2001	Tooth wear as a method of determining age of mammalian predator	Philip S. Gipson	KSCFWRU	
	12/31/2001	An examination of the bush dog, *Speothos venaticus,* as part of the mammalian predator community in the Interior Atlantic Forest of Paraguay	Philip S. Gipson	KSCFWRU, KSU Biol., DOD, Sunset Zoo, American Zoo & Aquarium Assn, KSU small research grant	Gerald Zuercher
1/1/2002	12/31/2004	Food Habits of Hybrid Striped Bass in Harlan County Reservoir	Christopher S. Guy	Nebraska Game & Parks	
	10/31/2002	Community and landscape dynamics of sylvatic plague in black-tailed prairie dogs at the Kiowa and Rita Blanca Natl Grasslands	Jack F. Cully, Jr.	US Forest Service	
1/1/2002	12/31/2002	Avian Study on the Fort Niobrara National Wildlife Refuge	Philip S. Gipson	Niobrara Council	Tim Parker

6/1/2002	12/31/2007	Landscape Effects on Disease Dynamics in Prairie Dogs	Jack F. Cully, Jr.	Univ. of Colorado subcontract	Bala Thiagarajan
	4/30/2007	Habitat alteration and disease dynamics in Black-tailed prairie dogs	Jack F. Cully, Jr.	EPA, USGS, KDWPT, US Forest Service	Tammi Johnson
	5/31/2007	Structural organization of Great Plains Stream Fish Assemblages: Implications for Sampling and Conservation	Craig Paukert	Turner Enterprises	Jesse Fischer
	8/31/2007	High Water Habitat: Fish populations in two Kansas river backwaters	Craig Paukert	NSF, KSU	Andrea Severson
	9/30/2008	Evaluation of sampling methods and habitat use of Missouri River fishes	Craig Paukert	USGS, SSP Program	Joshua Schloesser
	12/31/2008	Assessment of elk habitat use, population dynamics, and genetic variability at Fort Riley Military Reservation, Kansas	Philip S. Gipson	Rocky Mountain Elk Found., DOD USACERL	Jonathan Conard
	12/31/2008	Vegetation and small mammal community response to military track vehicle disturbance at Smoky Hills Air National Guard Bombing Range, Kansas	Philip S. Gipson et al.	USACERL	Ryan Limb (Okla. State)
	3/31/2009	Impacts of road crossings on prairie stream fishes	Craig Paukert	KDOT	Wesley Bouska
	12/31/2009	Deer density, movement patterns, and group dynamics on Quivira National Wildlife Refuge: Assessing potential risk for disease transmission	Philip S. Gipson	USFWS, KDWPT, USACERL	
6/1/2007	9/30/2012	Chronic Water Disease - Whitetail Deer - Kansas	Philip S. Gipson	USFWS	Jonathan Conard, Kevin Blech-Res.Asst.
8/22/2011	9/30/2012	Patterns and processes of dispersal of Black-tailed prairie dogs in a heavily managed landscape of the Great Plauins LCC	Samantha Wisely, Jack F. Cully, Jr.	USFWS	Rachel Pigg
9/22/2011	6/30/2012	Smoky Valley Ranch Prairie Dog Management	Jack Cully, Samantha Wisely, Charles Lee	The Nature Conservancy	
10/6/2011	6/302016	Monitoring of Black-footed ferret populations at reintroduction sites in Kansas	David Haukos	USFWS	
9/1/2013	8/31/2016	Coupled climate, cultivation, and culture in the Great Plains: Understanding water supply and water quality in a fragile landscape	David Haukos, Martha Mather	NSF	Willow Malone, Richard Lehrter
6/1/2014	5/31/2017	Climatic and anthropogenic forcing of wetland landscape connectivity in the Great Plains	David Haukos	NSF	Gene Albanese, Post-Doc
8/1/2012	7/31/2016	Plum Island Ecosystems LTER	Martha Mather	Marine Biol. Lab.	Ryland Taylor

8/15/2012	12/31/2014	Parasitemia, Health, and Reproduction in a migratory waterfowl	David Haukos	USFWS	Andrew Stetter
11/8/2012	4/30/2013	Development of annotated bibliography for Lesser Prairie Chickens	David Haukos	WAFWA	Jennifer Zavaleta
9/1/2012	5/31/2017	Impacts of energy production, habitat selection and population size on resource selection, survival, and recruitment of Lesser Prairie-chickens in OK, KS & CO	David Haukos	NRCS	Joseph Lautenbach, Reid Plumb, John Kraft, Dan Sullins, Samantha Robinson
2013	2014	Agreement with Cibola National Forest and Grasslands	Jack F. Cully, Jr.	US Forest Service	
10/1/2016	5/31/2019	Use of Grazing Management and Prescribed Fire for Conservation of Lesser Prairie-Chickens	David Haukos	NRCS	

FISHERIES AND AQUATIC RESEARCH

KSCWRU Projects – Fisheries and Aquatic Resources

2016

Developing and Testing a Spatially-Explicit, Science-Based, Decision-Support Tool for Making Riverscape-Scale Management Decisions: How Dams Affect Fish Communities in the Neosho River, Kansas

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigators: Jane Fencl, M.S. Student
Sean Hitchman, Ph.D. Student
Dr. Joe Smith, Post-Doctoral Associate
Dr. Katie Costigan, Post-Doctoral Associate
Dr. Martha Mather, Assistant Unit Leader-Fisheries
Jason Luginbill, Kansas Department of Wildlife, Parks and Tourism

Expected Completion: February 2018

The valued native fish communities that inhabit Kansas streams and rivers are threatened by human impacts, such as dams. Dam impacts on biodiversity can be mediated by natural habitat heterogeneity and implemented through dam-related habitat alterations. In order to help managers make science-based decisions on the impact of dams on native fish communities, the Neosho River research team (Jane Fencl, M.S. student; Sean Hitchman, Ph.D.; Dr. Joseph Smith, post-doctoral fellow; and Dr. Martha Mather, Principal Investigator) are sampling fish communities and instream habitat at dammed and undammed sites within the upper Neosho River, KS. Ultimately, this research can be used to develop and test a spatially-explicit, science-based decision support tool for managing fish and dams in Great Plains stream and river networks.

In consultation with our project liaisons at Kansas Department of Wildlife, Fisheries, and Parks (KDWPT), our research efforts have focused on the collection of fish and habitat data at sites with dams as well as at paired undammed reference sites. As a team, we have identified the best gear to use to sample fish upstream and downstream of dammed and undammed sites. Our gear test showed that the mini-Missouri trawl, the gear we chose to use for all stream sampling, caught as many species as other common stream sampling gears and more individuals than other gears. Once we determined that the mini-Missouri trawl performed as well as other gears, we conducted a trawl length experiment to determine the optimal trawl length (30 m). These results have been incorporated into our standardized sampling protocols.

In 2012, we sampled three dams and one undammed site. Fish and habitat were sampled at 20 transects above and below all dams (or the site centerline of the undammed location) resulting in 90 fish samples at transects around dams. To assess microhabitat (width, depth, velocity, substrate), we sampled 42 habitat transects at four sites (168 microhabitat samples). In addition, we categorized mesohabitat (pool, riffle, run, glide) across 16.1 km of stream for a total of 65,

100-m long mesohabitat samples. Within these mesohabitats, we sampled fish with an additional 44 trawls.

In 2013, we expanded the number of sample sites from 4 to 11 and extended the distances we sampled at each site to include 22 transects that extended 3 km above and below each dam or undammed site centerline. We sampled habitat and native fish communities using standardized methods at 22 transects (13 transects downstream and 9 transects upstream of each dam or centerline at undammed sites) at 11 sites. At these 11 sites, in 2013, collectively we sampled fish and habitat at 52 upstream transects, 70 downstream transects, 70 transects at undammed sites, 73 additional transects to address temporal variation, for a total of 265 fish and habitat transect samples. At these same 11 sites, in 2013, we also collected samples to identify the relationship between fish communities and specific habitat types. Specifically, at 11 locations, we sampled five replicates of four mesohabitat types (pool, riffle, run, and glide) during 64 days of field sampling. This sampling resulted in 220 habitat-specific fish samples (42 total species), 220 stream width measurements, 1,100 depth, flow velocity, substrate measurements, and mesohabitat data for patch mosaics across 51 km of stream. At the six dam sites, we quantified the geomorphic dam footprint to identify the spatial extent of the dam effect. This helped us interpret dam impacts on fish communities.

Jane Fencl Thesis: ***How Big of an Effect Do Small Dams Have?: Using Ecology and Geomorphology to Quantify Impacts of Low-Head Dams on Fish Biodiversity***. In contrast to well documented adverse impacts of large dams, little is known about how smaller low-head dams affect fish biodiversity. Over 2,000,000 low-head dams fragment United States streams and rivers and can alter biodiversity. The spatial impacts of these common low-head dams on geomorphology and ecology are largely untested. A select review of how intact low-head dams affect fish species identified four methodological inconsistencies that impede our ability to generalize about the ecological impacts of low-head dams on fish biodiversity. This project tested the effect of low-head dams on fish biodiversity (1) upstream vs. downstream at dams and (2) downstream of dammed vs. undammed sites. Fish assemblages for both approaches were evaluated using three community summary metrics and seven habitat guilds (based on empirically based species occurrence in pools, riffles, and runs). Downstream of dams vs. undammed sites, this project tested if (a) spatial extent of dam disturbance, (b) reference site choice, and (c) site variability altered fish biodiversity at dams. Based on information from geomorphic literature, this research quantified the spatial extent of low-head dam impacts using width, depth, and substrate. Sites up- and downstream of dams had different fish assemblages regardless of the measure of fish biodiversity. Richness, abundance and Shannon's index were significantly lower upstream compared to downstream of dams. In addition, only three of seven habitat guilds were present upstream of dams. Methodological decisions about spatial extent and reference choice affected observed fish assemblage responses between dammed and undammed sites. For example, species richness was significantly different when comparing transects within the spatial extent of dam impact but not when transects outside the dam footprint were included. Site variability did not significantly influence fish response. Furthermore, these small but ubiquitous disturbances may have large ecological impacts because of their potential cumulative effects. Therefore, low-head dams need to be examined using a contextual riverscape approach. How low-head dam studies are designed has important ecological insights for scientific generalization and methodological consequences for interpretations about low-head dam effects.

This research provides a template on which to build this approach that will benefit both ecology and conservation.

Sean M. Hitchman, Martha E. Mather, Joseph M. Smith, Jane S. Fencl. *A Mosaic-Based Approach to Biodiversity in Freshwater Ecosystems*. A mosaic-based approach can identify keystone habitats, increase scientific understanding of organismal-habitat relationships, and facilitate conservation of native biodiversity in disturbed freshwater ecosystems. Rivers and streams provide valuable goods and services to society. Freshwater biodiversity is a key attribute of streams and rivers. Organisms that comprise biodiversity are influenced by habitat. A suite of anthropogenic impacts, exacerbated by climate change, threaten aquatic habitats and freshwater biodiversity. Because many ecological processes require spatially-connected data, a mosaic approach offers a scientific foundation for understanding and managing a range of disturbance-related conservation problems. Here, we ask if patterns of aquatic biodiversity differ for habitat mosaics (i.e., connected series of individual juxtaposed habitats) compared to isolated, individual habitats. Traditional approaches to conserving native biodiversity will be inadequate if mosaics create different patterns of biodiversity than isolated mesohabitats. Our sampling of fish and habitat along 10 3-km sites within the Upper Neosho subdrainage, KS, from June-August 2013, yielded four important insights. First, mesohabitats (pool, riffle, run, and glide) formed discrete habitat categories based on three physical characteristics. Together juxtaposed mesohabitats formed diverse mosaics. Second, multivariate, community analysis on three fish biodiversity data sets confirmed guild-based organism-habitat associations identified from type and strength of species-mesohabitat associations. Third, patterns of biodiversity were different in mosaics than for isolated mesohabitats. Fourth, riffles acted as keystone habitats in that mosaics with more riffle mesohabitat (<5% of sampled area) had higher native species diversity. Links among human impacts, water use, land use change, climate change predictions, precipitation, discharge, aquatic habitat, and biodiversity make a suite of diverse and often complex spatial and temporal impacts inevitable in disturbed aquatic ecosystems. Thus, developing a new approach for quantifying connected biodiversity-habitat relationships is essential for biodiversity baselines to which future human impacts and climate disturbances can be compared. A mosaic approach can provide this framework for examining ecological processes in both reference and disturbed ecosystems.

Products:

Peer-reviewed and Scientific Publications:

Fencl, J. S., M. E. Mather, K. H. Costigan, and M. D. Daniels. 2015. How Big of an Effect Do Small Dams Have? Using Geomorphological Footprints to Quantify Spatial Impact of Low-Head Dams and Identify Patterns of Across-Dam Variation. PloS One, 10(11), e0141210.

Thesis or Dissertation:

Fencl, J.S. 2015. How big of an effect do small dams have?: using ecology and geomorphology to quantify impacts of low-head dams on fish biodiversity. M.S. Thesis, Division of Biology, Kansas State University (Advisor: Mather)

Presentations:

Hitchman, S.M., M.E. Mather, J.M. Smith and J.S. Fencl. 2016. Viewing streams as a habitat mosaic; implications for riverscape ecology and stream conservation. American Fisheries Society. Kansas City, MO.

Smith, J.M., M.E. Mather and Hitchman, S.M. 2016. Operationalizing riverscapes. American Fisheries Society. Kansas City, MO.

Fencl J.S., Mather M.E., Smith J.M., and S.M. Hitchman. 2015. Quantifying river fragmentation: impacts of low-head dams on geomorphology and fish biodiversity in the Neosho River, Kansas. 75th Midwest Fish and Wildlife Conference; Indianapolis, Indiana.

Hitchman, S.M., M.E. Mather, J.M. Smith and J.S. Fencl. 2015. Are riffles keystone habitats in a low-gradient prairie stream?; implications for riverscape ecology and stream conservation. American Fisheries Society. Portland, Oregon.

Fencl, J.S., M.E. Mather, S.M. Hitchman and J.M. Smith. 2014. Quantifying impacts of river fragmentation: How low-head dams alter geomorphology, fish biodiversity, and habitat in the Neosho River, Kansas, American Fisheries Society Meeting, Quebec, Canada.

Hitchman, S.M., M.E. Mather, J.M. Smith and J.S. Fencl. 2014. Does heterogeneity in habitat type, size, and arrangement influence patterns of fish biodiversity in the Neosho River, Kansas? American Fisheries Society. Quebec City, Quebec, Canada.

Fencl, Jane, Martha Mather, Sean Hitchman and Joseph Smith. 2014. Quantifying impacts of river fragmentation: how low-head dams affect distributions of fish biodiversity and habitat in the Neosho River, Kansas. Graduate Student Research Forum, Division of Biology, Kansas State University.

Hitchman, Sean, Martha Mather, Jane Fencl and Joseph Smith. 2014. Heterogeneity influences patters of fish biodiversity at multiple scales. Graduate Student Research Forum, Division of Biology, Kansas State University.

Fencl, J. S., K. H. Costigan, M. E. Mather and S. M. Hitchman. 2014. How long is the dam footprint?: Applying methodology that quantifies the geomorphic extent of low-head dams in the Neosho River basin, KS. Kansas Natural Resources Conference, Wichita, KS.

Hitchman, S.M., M.E. Mather, J.M. Smith, and J.S. Fencl. 2014. Do FRAGSTATS sink or swim?; Calculating metrics of heterogeneity for aquatic macrohabitat within the Neosho River, KS. Kansas Natural Resources Conference, Wichita, KS.

Smith, J. M., M. E. Mather, J. Fencl, and S, M. Hitchman. 2013. Stopping biodiversity loss: An evaluation of metrics that quantify the composition of fish communities in aquatic ecosystems. Midwest American Fisheries Society Meeting, Wichita, KS.

A field manipulation that evaluates size through time, habitat-specific diet, isotope values, and distribution of early spawn and natural spawn age-0 largemouth bass

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigators: Robert Mapes, M.S. Student
Dr. Martha Mather, Assistant Unit Leader-Fisheries
Jason Goeckler, Kansas Department of Wildlife, Parks and Tourism
Doug Nygren, Kansas Department of Wildlife, Parks and Tourism

Expected Completion: December 2016

Largemouth bass (*Micropterus salmoides*) is an important predator and a popular sportfish. However, adult survival is often poor because of size-structured interactions in the first year of life. For example, a link has been observed between poor first year survival and small size during the first summer. Many fish grow faster when they consume fish prey instead of invertebrate prey. If young largemouth bass can switch to fish prey during their first summer, they may grow faster, overwinter at a larger size, and possibly survive better as adults. However, young largemouth bass are gape-limited predators (i.e., the size of prey eaten is limited by mouth size). Consequently, naturally spawned age-0 largemouth bass often are not large enough to consume young-of-year fish prey.

To test the role of size-structured interactions among age-0 largemouth bass, fish prey, invertebrate prey, fish competitors, and fish predators, we compared habitat-specific size through time, diet, stable isotope values, and distribution among three groups of age-0 largemouth bass

[(1) naturally spawned or wild bass, (2) stocked phase 1 early-spawned bass, (3) stocked phase 2 early-spawned bass,] in Hillsdale Reservoir. The results of this whole-system manipulation will provide useful guidance for fisheries management and advance basic ecological knowledge about controls on first-year survival of this important predator.

During the initial sampling in 2014, we created effective, standardized, science-based sampling protocols that allowed us to sample the same sites with the same gear in the same way each other week (except when water levels or weather prevented standardized sampling). Sites within Hillsdale Reservoir were chosen to (a) provide a logistically-feasible but broad spatial coverage of the lake, (b) represent a range of habitat types (e.g., vegetation, beach, rock, wood, offshore - > 3 m deep), and (c) utilize sites with the highest catches from previous KDWPT largemouth bass sampling (Andy Jansen, personal communication). Although multiple habitats were present at some sites, all habitats were not present at any site. Backpack electrofishing and minnow traps did not catch many fish, but beach seine was very effective in catching largemouth bass such that seine was our primary collection gear.

We retained largemouth bass < 150 mm TL for laboratory analysis in 2014 and < 120 mm TL in 2015 because all fish < 150 mm in midsummer and fall were age-0. Numbers of small largemouth bass in each square meter of habitat were summarized as catch per unit effort (CPUE). Following sampling, fins from largemouth bass were sent to KDWPT for genetic sampling to identify stocking treatment (wild, phase 1, and phase 2). In the laboratory, 1-2 muscle fillet samples were dried for 24 h at 60oC, then ground into a fine powder for stable isotope analysis of carbon and nitrogen.

Stomach contents from young largemouth bass were analyzed using a standard diet protocol in which alimentary canals were removed and the contents were immediately fixed in 95% ethanol. Diet items were grouped into five functional groups: (1) benthic invertebrates, (2) zooplankton, (3) terrestrial invertebrates, (4) fish prey, and (5) unidentified prey. Diets were analyzed by three metrics: number of prey eaten, weight of prey eaten, and frequency of occurrence (i.e., number of individual largemouth bass within a sample that contained at least one individual of a prey type). For fish prey, we identified species by counting vertebrate of prey fish backbones. Potential prey and potential fish competitors [pelagic invertebrate prey (zooplankton), benthic invertebrate prey, potential fish prey (< 50% sampled largemouth bass length), and potential fish competitors (> 50% sampled largemouth bass)] were sampled monthly.

In 2014 at Hillsdale Reservoir, we captured 823 largemouth bass < 150 mm TL in 11 biweekly samples at 9 sample sites. In addition, we collected 190 CPUE samples, 657 largemouth bass isotope samples, 99 zooplankton prey samples, 99 benthic prey samples, and 190 prey fish samples.

In 2015 at Hillsdale Reservoir, we captured 251 largemouth bass < 120 mm TL during 9 biweekly samples at 12 sample sites. In addition, we collected 130 CPUE samples, 216 largemouth bass isotope samples, 81 zooplankton prey samples, 81 benthic prey samples, and 130 prey fish samples.

Based on preliminary data analysis, in both years the highest mean catch per unit effort (largemouth bass per m2) (CPUE) for all three treatment groups (wild, phase 1, phase 2) occurred in vegetated (2014), beach (2014), and rock habitats (2015). No small largemouth bass were ever caught in wood or offshore habitats (2014, 2015).

Wild largemouth bass were smaller than hatchery fish (phase 1, phase 2) throughout the field season for both years.

For all young largemouth bass (wild, phase 1, phase 2), benthic invertebrates were an important diet item by number, terrestrial invertebrates were consistently eaten, and, by weight, fish prey was the most important diet item. Fish prey increased in importance later in the summer and in fall. Diets for all young largemouth bass (wild, phase 1 hatchery, phase 2 hatchery) were complex and varied across years and habitats for all measures (numbers, weight, frequency of occurrence) and all taxonomic categories (benthic invertebrates, terrestrial invertebrates, zooplankton, fish). Data analysis continues. When the analysis and summary are complete, our extensive and comprehensive data set will provide substantial insights about young largemouth bass that can aid effective sportfish and predator management in Kansas and elsewhere.

Products:

Presentations:

Mapes, R. L., M.E. Mather. Location, location, location: Incorporating spatial context into fisheries research. American Fisheries Society Meeting, Kansas City, MO, August 2016.

Mapes. R. M., and M. E. Mather. 2015. Using the land mosaic concept to test how habitat heterogeneity alters the distribution of young-of-year largemouth bass in a Great Plains reservoir. North Central Division, American Fisheries Society, Indianapolis, IN.

Mapes, R., M. E. Mather, J. M. Smith, S. M. Hitchman, A. Earl, J. Romine. 2015. Is all heterogeneity created equal? how types of habitat heterogeneity differentially alter distribution, abundance, and diets of age-0 largemouth bass. American Fisheries Society, Portland, OR.

Mapes, R.L. and Mather, M.E. Habitat and resource use of age-0 largemouth bass in a Great Plains reservoir. Lake Erie Center Brown Bag Seminar. University of Toledo – Lake Erie Center, July 2015.

Coupled Climate, Cultivation and Culture in the Great Plains: Understanding Water Supply and Water Quality in a Fragile Landscape

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigators: Richard Lehrter, M.S. Student
Dr. Melinda Daniels, Department of Geography
Dr. David Haukos, Unit Leader
Dr. Martha Mather, Assistant Unit Leader-Fisheries
Dr. Marcellus Caldas, Department of Geography
Dr. J. Heier Stamm
Dr. Jason Bergtold
Dr. Aleksey Sheshukov
Dr. Matthew Sanderson

Expected Completion: December 2017

Models are needed that account explicitly for human-landscape interactions. In the four components of this proposal, an interdisciplinary team develops a coupled human-landscape model that incorporates atmospheric, terrestrial, aquatic, and social processes to predict the potential impact of climate variability, climate change, land use, and human activity on water resources. In this specific project, we evaluate the effects of the above on native Kansas fish biodiversity.

Throughout the U.S., freshwater ecosystems provide valuable societal goods and services that are being adversely affected by humans. Climate, likely is exacerbating these adverse impacts. Great Plains rivers are model systems for looking at a coevolved animal community that inhabit naturally-connected dendritic ecosystems which are adversely affected by climate change and human land and water use.

Our collaborative research is unique in that it integrates multiple disciplines with the goal of understanding how water systems in the Great Plains (geomorphology, hydrology, ecology) are affected by human land and water use, as well as, how humans value the components of an aquatic ecosystem. All stakeholders (farmers, ranchers, urban residents, conservationists, anglers) will benefit from our interdisciplinary insights about how aquatic ecosystems are structured and function.

Aquatic biodiversity (e.g., fish biodiversity) has intrinsic ecological value. For example, communities with native biodiversity are often more resilient and better able to respond to disturbances. Biodiversity is also valued by a diverse human stakeholders including groups interested in conservation, recreation, and hunting-fishing. Thus, biodiversity is a natural link for coupling human and natural systems. Our integrated research should provide wide benefits to both science and society.

Fish comprise a large biomass in aquatic systems and have several attributes that make them an ideal focus for interdisciplinary research on natural and anthropogenic process drivers of biodiversity. First, fish distribution is strongly linked to geomorphology, hydrology, and land use. Second, fish represent an important component of ecological diversity. As such, they are a good taxa to examine how biodiversity is affected by human and climatic influences. Third, many human groups value fish. Thus, these charismatic megafauna, are an obvious link between natural and human systems.

This project's contribution to this collaboration will be to relate distribution of fish communities to environmental impacts. By coordinating fish biodiversity sampling in the Smoky Hill River with geomorphology, hydrology, and land use, our research team will better understand how humans impact aquatic systems. This information can then be combined with human surveys of use and value to advance science and increase the efficiency of conservation efforts.

Presentations:

Lehrter, R., M. E. Mather, M. Daniels. Fish biodiversity as a component of ecosystem function and indicator of environmental degradation in a Great Plains river. Governor's Water Conference, Poster, 2015

Plum Island Ecosystems LTER

Funding: National Science Foundation

Investigator: Ryland Taylor, M.S. Student

Advisor: Dr. Martha Mather, Assistant Unit Leader-Fisheries and
12 other Principal Investigators from multiple universities

Expected Completion: December 2017

The Plum Island Ecosystems (PIE) LTER has been working towards a predictive understanding of the long-term response of coupled land -water ecosystems since its inception in 1998. The Plum Island Estuary-LTER includes the coupled Parker, Rowley, and Ipswich River watersheds. The present grant build upon past progress that the research team has made in understanding the importance of spatial patterns and connections across the land-margin ecosystem. Higher trophic levels, such as fish, rely on seascape configurations that create 'hot spots' of energy transfer up the food web.

Understanding the role of predators requires that we understand the regional scale dynamics of highly migratory striped bass. Our involvement in this project focuses on how movements of top fish predators affect ecosystem structure and function. Specifically, using acoustic tags in conjunction with acoustic receivers, we have discovered that 65% of PIE striped bass (ages 4-6) stay in PIE to feed for > 60 days each year, winter in Delaware Bay or the Hudson River, then return to PIE the following year.

Products:
Presentations:

Mather, M.E., J. M. Smith. C. G. Kennedy, and R. T. Taylor. 2016. Mobile organisms in the 'scape': patterns, consequences, and challenges. American Fisheries Society. Kansas City, MO.

Taylor, R., M. E. Mather, C. G. Kennedy, J. M. Smith, K. M. Gerber. 2015. Confluence network dynamics can create a spatial mosaic of predator interactions. Poster, Ecological Society of America, Baltimore, MD.

Mather, M. E. Spatial patterns of striped bass. 2012. All Scientists Meeting, Plum Island Long Term Ecological Research, Woods Hole, MA. Invited

2015

Recruitment of Fishes in the Kansas River

Funding: Kansas State University
Kansas Department of Wildlife, Parks and Tourism

Investigator: Joseph E. Gerken, Ph.D. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader-Fisheries

Completion: 2015

River discharge influences fish and invertebrate communities and understanding how hydrologic variables contribute to fish and invertebrate composition can provide information for restoration and management. This study examines the relationship between several flow regime metrics that may influence fish and invertebrate community structure in large river systems such as the Kansas River. First, I examined how hydrology influences macroinvertebrate (drifting and benthic) density and fish communities before, during, and after flooding in both main and secondary channels. I found that drifting invertebrate density increased during flooding potentially providing increased prey opportunities for fishes. I also found that fluvial dependent and generalist fish species use inundated habitats more than fluvial specialists. My results suggest that the flux of water into inundated habitats supports a unique subset of invertebrate and fish communities of the main channel. Next, I examined the importance of lateral connectivity on fish and invertebrate composition by examining differences in seasonally and permanently inundated secondary channels in relation to main channel reaches. I found that drifting and benthic invertebrate assemblages and fish assemblages differed between seasonally inundated and permanently connected secondary channels. These results suggest that maintenance of diverse secondary channel connections is useful in preserving native biota in the Kansas River. Finally, I tested if hydrologic variables influenced recruitment of four native Kansas River fishes. I found that recruitment for two of the four fish species (flathead catfish, *Pylodictis olivaris*, and shovelnose sturgeon, *Scaphirhynchus platorynchus*) increased in high flow years. These results indicate that a natural and variable flow regime may be important for maintaining fish community structure in the Kansas River. The results of this study have implications for management strategies that include the use of high flows to provide a pulse of insect prey to the main channel for fishes, restoration of natural high and low flow variability as important to fish recruitment, and diversity in secondary channel connectivity (seasonal and permanently connected) that promotes unique fish and invertebrate communities.

Products:

Peer-reviewed and Scientific Publications:

Gerken, J., and C. Paukert. 2013. Fish community and habitat factors associated with the distribution of Topeka shiner (*Notropis topeka*) in Kansas streams. Journal of Freshwater Ecology 28: 503-516 DOI: 10.1080/02705060.2013.792754

White, K., J. Gerken, C. Paukert, and A. Makinster. 2010. Fish community structure in natural and engineered habitats in the Kansas River. River Research and Applications 26:797-805.

Technical and Semi-Technical:

Paukert, C.P., J.L. Eitzmann, and J.E. Gerken. 2009. Distribution and Abundance of Fishes in the Kansas River. Final Report, Kansas Department of Wildlife and Parks, Project Number T-15-R-1, Pratt, Kansas.

Thesis or Dissertation:

Gerken, J.E. 2015. Fish and invertebrate community response to flow magnitude in the Kansas River. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Gerken, J., and C. Paukert. 2011. Age-specific demography of silver carp: implications for management and control. American Fisheries Society Annual Meeting, Seattle, WA.

Gerken, J., and C. Paukert. 2011. Can silver carp be controlled? Population level response to various management regimes. Midwest Fish and Wildlife Conference, Des Moines, IA.

Gerken, J., and C. Paukert. 2011. The importance of high flows and floodplain inundation for fish and invertebrates of the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Mammoliti, K., J. Gerken, and C. Paukert. 2010. Population characteristics of channel catfish in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J. E., and C. P. Paukert. 2010. Fish recruitment in the Kansas River: the role of flow, habitat, and urbanization. Kansas Natural Resources Conference, Wichita, KS.

White, K., J. Gerken, C. Paukert, and A. Makinster. 2010. Fish community structure in natural and engineered habitats in the Kansas River. Kansas Natural Resources Conference, Wichita, KS. Poster

Paukert, C. and J. Gerken. 2010. The Importance of secondary channels to mainchannel fishes in the Kansas River. Big River Confab, Jefferson City, MO.

Gerken, J., and C. Paukert. 2010. Floods and fishes: examining the role of high flows on fish and invertebrates in a large Great Plains River. Midwest Fish and Wildlife Conference, St. Paul, MN.

Gerken, J., and C. Paukert. 2010. Testing the flood pulse concept: The importance of floodplain inundation on fish and invertebrates of a Great Plains river. American Fisheries Society Annual Meeting, Pittsburgh, PA.

Gerken, J. E., and C. P. Paukert. 2009. Effects of urbanization on recruitment of Riverine fishes. 70th Midwest Fish and Wildlife Conference, Springfield, IL.

Gerken, J. E., and C. P. Paukert. 2009. Topeka shiners status and trends in Kansas. 70th Midwest Fish and Wildlife Conference, Springfield, IL.

Gerken, J., and C. Paukert. 2009. Spatial variation in the recruitment patterns of three riverine fishes in the Kansas River. American Fisheries Society Annual Meeting, Nashville, TN.

Gerken, J., and C. Paukert. 2009. Spatial variation in the recruitment patterns of three riverine fishes in the Kansas River. KSU Biology Student Research Forum, Manhattan, KS.

Gerken, J., W. Bouska, and C. Paukert. 2009. Effects of instream habitat and fish communities on the endangered Topeka shiner in Kansas streams. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J.E., and C.P. Paukert. 2009. Impacts of a low-head dam on fish communities in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J.E., and C.P. Paukert. 2009. Factors impacting Topeka shiner distribution in Kansas. American Fisheries Society Midwest Student Colloquium, Annual Meeting, Ames, IA.

Gerken, J.E., and C.P. Paukert. 2009. Impacts of a low-head dam on a Great Plains River Fish Community. American Fisheries Society Midwest Student Colloquium, Annual Meeting, Ames, IA.

Gerken, J. E., and C. P. Paukert. 2008. Fish recruitment in the Kansas River: the role of flow, habitat, and urbanization. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J., and C. P. Paukert. 2008. Effects of a low-head dam on the fish community of a large Great Plains river. Southwestern Association of Naturalists, Memphis, TN.

Gerken, J., and C. Paukert. 2008. Effects of a low-head dam on the fish community of a large Great Plains River. American Fisheries Society Annual Meeting, Ottawa, Canada.

Gerken, J., and C. Paukert. 2008. Fish community changes associated with a low-head dam in a large Great Plains river. Midwest Fish and Wildlife Conference, Columbus, OH.

Gerken, J., W. Bouska, and C. Paukert. 2008. Factors influencing the endangered Topeka shiner in Kansas streams. Midwest Fish and Wildlife Conference, Columbus, OH.

Assessing Distribution and Movement of Blue Catfish in Kansas Reservoirs

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Kayla Gerber, M.S. Student
Zach Peterson, M.S. Student

Advisor: Dr. Martha Mather, Assistant Unit Leader-Fisheries

Completion: 2015

The objectives of this project were to (a) develop methods that can be used to monitor and understand sport fish movement, (b) document distribution and egress patterns of multiple sizes of Blue Catfish in Milford Reservoir, KS, and (c) collect related data that will help explain reasons for distribution and egress of this important, popular, and highly mobile sport fish.

Many Kansas anglers target catfish through specialized clubs (e.g., KC Catfish, Catfish Chasers, US Cats, and U.S. Catfish Association). For example, in 2001, 216,000 Kansas anglers spent $40.1 million fishing for catfish. Blue Catfish, in particular, provide trophy catches (i.e., KS state record, 102.8 lbs). Thus, the results from this research can provide basic scientific, management, and outreach information.

In 2012, Team Blue Catfish developed and tested tagging protocols at the KDWPT hatchery at Milford Reservoir. On June 26-28, 2012, Team Blue Catfish surgically implanted 48 Blue Catfish captured at three different locations in Milford Reservoir with VEMCO V9 acoustic tags. In 2012, mean size of Blue Catfish was 487 mm total length (TL) (range = 383-1020 mm TL; SE = 14.5; 88% of tagged fish were 400-600 mm TL, the most common sized fish in Milford Reservoir). Twenty VEMCO receivers, placed throughout Milford Reservoir, recorded the date, time, and location of fish distribution when tagged fish moved within 300 m of the stationary receivers. Two of these receivers detected if any tagged fish egressed Milford Reservoir either through the upstream Republican River or downstream over the dam. On June 3-6, 2013, an additional 75 Blue Catfish were tagged with V9 and V13 acoustic tags. In 2013, we tagged smaller and larger Blue Catfish as they became available, resulting in an average size of 517 mm TL (range = 343-1090 mm TL; SE = 17.8; 71% of the tagged fish were 400-600 mm TL). Data were retrieved regularly.

In both years, all Blue Catfish survived the tagging and were detected over a million times each year. No tagged catfish left Milford Reservoir through the upper or lower connections to the Republican River. In the field, 85.4-100.0% of the tagged catfish were detected at least once a month from June-November in both years. All tagged Blue Catfish moved throughout the reservoir and were detected at an average of 6-10 receivers.

No differences in tagged Blue Catfish distribution were observed across dawn, day, dusk, night. Distribution changed across seasons with a subset of tagged fish moving to the deeper lower part of Milford Reservoir in the fall. Individual fish did not behave the same. Specifically, based on the results of a cluster analysis that used the amount of time tagged fish spent at each receiver, groups of fish differed in their space use and movement patterns. These multiple clusters illustrate different types of behavior within a single population. Although all tagged fish moved on a regular basis, the majority of fish spent most of their time in the middle portion of the reservoir.

Kayla Gerber Thesis. Tracking Blue Catfish: Quantifying System Wide Distribution of a Mobile Fish Predator Throughout a Large Heterogeneous Reservoir. A flexible distribution is an adaptive response that allows animals to take advantage of spatial variation in the fluctuation of resources. Distribution of mobile organisms is complex so multi-metric patterns derived from dynamic distribution trajectories must be deconstructed into simpler components for both individuals and populations. Tagging and tracking fish is a very useful approach for addressing these fisheries research questions, but methodological challenges impede its effectiveness as a research tool. This research project developed and evaluated a high-retention, high-survival tagging methodology for catfish. Then, Team Blue Catfish integrated multiple distribution metrics to identify if sites within an ecosystem function differently for mobile predators. Finally, Kayla and colleagues determined if distinct groups of individuals existed,

based on distributional patterns. The research team also tested sources of variation in system-wide detections (i.e., season, diel period, size, and release location) and provided additional details on methods and interpretation of the results. To address these objectives, the study tracked 123 acoustically tagged (VEMCO V9-V13) Blue Catfish *(Ictalurus furcatus* mean: 505.3 mm TL; SE: 12.3 mm; range: 300-1090 mm) from June through November, 2012-2013, in Milford Reservoir, KS. Across the five months, 85.4-100.0% of the tagged Blue Catfish were detected at least once a month by an array of 20 stationary receivers (VR2W), a detection rate much higher than rates reported in the literature for catfish (38%). Blue Catfish were consistently aggregated in the northern portion of the middle region of Milford Reservoir. Using three metrics (population proportion, residence time, and movements), this study found four types of functional sites that included locations with (i) large, active aggregations, (ii) exploratory/transitory functions, (iii) small, sedentary aggregations, and (iv) low use. This study also found that tagged Blue Catfish clustered into three groups of individuals based on distribution. These included (1) seasonal movers, (2) consistent aggregations across seasons, and (3) fish exhibiting site fidelity to Madison Creek. Sites with different functions and groups of individual fish were related but not the same. The approach to looking at multiple responses, functions of sites, and individual groupings provided new insights into fish ecology that can advance fisheries management of mobile predators.

Zachary Peterson Thesis. Quantifying Patterns and Select Correlates of the Spatially and Temporally Explicit Distribution of a Fish Predator (Blue Catfish, *Ictalurus Furcatus*) Throughout a Large Reservoir Ecosystem. Understanding how and why fish distribution is related to specific habitat characteristics underlies many ecological patterns and is crucial for effective research and management. Blue Catfish, *Ictalurus furcatus*, are an important concern for many fisheries agencies. However, lack of information about their distribution and habitat use remains a hindrance to proper management. Here, over all time periods and across months, Team Blue Catfish quantified fish distribution and environmental correlates of distribution in Milford Reservoir, the largest reservoir in Kansas. This research tested relationships among acoustically tagged Blue Catfish and three groups of variables postulated to influence Blue Catfish distribution in the literature (i. localized microhabitat variables, ii. larger-scale mesohabitat variables, iii. biotic variables). Blue Catfish were consistently aggregated in two locations of the reservoir across five months during summer and fall, 2013. Using multiple linear regression and an information theoretic model selection approach, consistent correlates of distribution included localized, microhabitat variables (i.e., dissolved oxygen, slope) larger-scale, mesohabitat variables (i.e., distance to channel, river kilometer from the dam) and a biotic variable (i.e., Secchi depth). This research identified which five of the 12 variables identified in the literature were most influential in determining Blue Catfish distribution. As a guide for future hypothesis generation and research, this study proposes that Blue Catfish distribution was driven by three ecologically-relevant tiers of influence. First, Blue Catfish avoided extremely low dissolved oxygen concentrations that could cause physiological stress. Second, Blue Catfish aggregated near the channel, an area of bathymetric heterogeneity that may offer a foraging advantage. Third, Blue Catfish aggregated near low Secchi depths, shown here to be associated with increased productivity. Building on these results, future research into the distribution and habitat use of Blue Catfish should incorporate aggregated distributions of fish into research designs, focus on how both small and large scale relationships interact to produce patterns of

distribution, and explore further the mechanisms, consequences, and interactions among the three tiers of influence identified here.

Products:

Technical and Semi-Technical:

Mather, M., K. Gerber, Z. Peterson. 2015. Assessing distribution and movement of blue catfish In Kansas reservoirs. Final Report to Kansas Wildlife, Parks, and Tourism.

Thesis or Dissertation:

Gerber, K.M. 2015. Tracking blue catfish: quantifying system-wide distribution of a mobile fish predator throughout a large heterogeneous reservoir. M.S. Thesis, Division of Biology, Kansas State University (Advisor: Mather)

Peterson, Z.J. 2015. Quantifying patterns and select correlates of the spatially and temporally explicit distribution of a fish predator (Blue Catfish, *Ictalurus furcatus*) throughout a large reservoir ecosystem. M.S. Thesis, Division of Biology, Kansas State University (Advisor: Mather)

Presentations:

Gerber, K. M., M. E. Mather, J. M. Smith, and Z. Peterson. 2016. Identifying overall, seasonal, and diel patterns for reservoir-wide distribution of Blue Catfish: filling critical gaps for fish ecology and fisheries management. American Fisheries Society. Kansas City, MO.

Peterson, Z., M. E. Mather, J. M. Smith, and K. M. Gerber. 2016. Correlates of the whole-system distribution of a reservoir predator (Blue Catfish, *Ictalurus Furcatus*). American Fisheries Society. Kansas City, MO.

Smith, J. M., M. E. Mather, and K. M. Gerber. 2016. Seasonal and diel patterns of depth and temperature distribution of Blue Catfish in Milford Reservoir, Ks. American Fisheries Society. Kansas City, MO.

Gerber, K.M. and M.E. Mather. 2015. A high retention methodology for surgically implanting telemetry tags in catfish. 2015 Kansas Natural Resource Conference, Wichita, KS.

Gerber, K.M., M.E. Mather, J.M. Smith, and Z. Peterson. 2015. Distribution patterns of individual fish predators (Blue Catfish) in a Midwestern reservoir. 75th Midwest Fish and Wildlife Conference, Indianapolis, IN.

Gerber, K.M., M.E. Mather, J.M. Smith, and Z. Peterson. 2014. Patterns of variability in the distribution and movement of individual fish predators in a heterogeneous aquatic ecosystem. Presentation. 144th Annual AFS Conference, Quebec City, Quebec, Canada.

Peterson, Z.J., M.E. Mather, K.M. Gerber, and J.M. Smith. 2014. Evaluating the adequacy of fish-habitat data for the blue catfish. Upcoming Presentation. 144th Annual AFS Conference, Quebec City, Quebec, Canada.

Gerber, Kayla, Martha Mather, Joseph Smith and Zach Peterson. 2014. Distribution and movement of predators in a heterogeneous aquatic ecosystem. Graduate Student Research Forum, Division of Biology, Kansas State University.

Gerber, K. M., M. E. Mather, Z. Peterson, J. M. Smith, J. Reinke, J. Goeckler. 2012. Where are those $$#@@ fish?; Distribution and movement of a top predator (blue catfish) in a large, highly-variable Midwestern reservoir. Midwest American Fisheries Society Meeting, Wichita, KS.

Peterson, Z., K. Gerber., M. E. Mather, and J. Smith. 2012. Quantifying spatially-explicit patterns in a large reservoir: an approach for determining associations between a top fish predator and physical habitat. Midwest American Fisheries Society Meeting, Wichita, KS. Poster

2013

Habitat Heterogeneity Concentrates Predators in the Seascape: Linking Intermediate-Scale Estuarine Habitat to Striped Bass Distribution

Funding:

Investigator: Cristina Kennedy, M.S. Student

Advisor: Dr. Martha Mather, Assistant Unit Leader-Fisheries

Completion: 2013

Predators are key components of aquatic ecosystems and innovative approaches to understanding their spatial distribution are imperative for research, effective management, and conservation. Discontinuities, created by abrupt changes between two unlike entities, are irregularly-distributed, intermediate-scale features that can have a disproportionate effect on organismal distribution within the seascape. Here I use the discontinuity concept to relate the distribution of a predator, striped bass (Morone saxatilis), to physical features within Plum Island Estuary (PIE), MA. I mapped the distribution of 50 acoustically-tagged striped bass during four monthly surveys at 40 sites to evaluate if heterogeneity in physical features concentrated predators. All striped bass survived tagging, were coastal migrants, displayed seasonal residency within PIE, and moved freely throughout the estuary. However, these highly mobile predators were not evenly distributed. Specifically, striped bass were clustered in the middle region of PIE in response to sandbar area, intermediate bottom unevenness, channel networks, and, to a lesser extent, confluences and drop-offs. The highest predator counts occurred at sites with the greatest additive habitat complexity. I measured 23 geomorphic metrics at 40 sites within the seascape to characterize the spatial patterns of confluences, drop-offs, bathymetry and land features. Then, I mapped integrated measurements of multimetric physical features to reveal distinct spatial trends in physical complexity of the estuary. By expanding the discontinuity concept and combining irregularly-distributed, intermediate-scale physical features with smaller-scale, traditional fish habitat methodologies, I revealed consistent and ecologically-meaningful patterns within a north temperate estuarine seascape.

Products:

Thesis or Dissertation:

Kennedy, C. 2013. Habitat Heterogeneity Concentrates Predators in the Seascape: Linking Intermediate-Scale Estuarine Habitat to Striped Bass Distribution. Master's Thesis. University of Massachusetts-Amherst. (Advisor: Mather)

Presentations:

Kennedy, C. G., M. E. Mather, J. T. Finn, L. A. Deegan, and S. M. Pautzke. 2010. Determining acoustic receiver range in a shallow northeastern estuary with complex bathymetry: the role of habitat, depth and tide. Southern New England Chapter, American Fisheries Society, Groton, CT.

Kennedy, C. G., M. E. Mather, J. T. Finn, L. A. Deegan. 2011. The geomorphic complexity of a New England estuary and its role in shaping seasonal habitat use and site fidelity of striped bass on a foraging migration. Annual meeting of the American Fisheries Society, Seattle, WA.

Kennedy, C. G., M. E. Mather, J. T. Finn, L. A. Deegan. 2011. The complexity of habitat complexity: how physical features of a New England estuary shape seasonal habitat use of migratory striped bass. CERF meeting, FL.

2012

Sand Dredging Effects on Fishes and Fish Habitat in the Kansas River

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Jason Fischer, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2012

In-stream dredging is a common practice in rivers worldwide that can affect fish and fish habitat. We investigated the magnitude of these alterations and their influence on the fish community of the Kansas River, a large sand bed river. Fishes were collected monthly from June 2010 to June 2011 in Edwardsville and Lawrence, KS from 12, 1-km reaches (three actively dredged, two historically dredged that have not been dredged in at least one month, and seven control reaches) with bottom trawls, seines, and electrofishing. Water depths and velocities were measured with an acoustic doppler current profiler and interpolated in ArcGIS at all 12 reaches. Actively dredged reaches had proportionally more deep water habitat (> 3 m) and lower velocity (< 0.15 m/s) near the river bed than control reaches ($P < 0.01$ and $P = 0.04$, respectively). However, the mean proportion of shallow water habitat (< 0.5 m), high velocities near the river bed (> 0.30 m/s), low velocity habitat (< 0.25 m/s), and high velocity habitat (> 0.75 m/s) were similar among all reach types (Ps > 0.05). A canonical correspondence analysis was used to characterize relationships among habitat variables, reach types (actively dredged, historically dredged, and control), and catch per unit effort (CPUE) of fishes in the Kansas River. Mean velocity and depth explained a significant amount of variation in species CPUE; however, reach type was not a significant factor for any of the gear types for any season. Our results show that dredging in Great Plains Rivers can increase depths, but alterations to fish community structure was not evident, likely because many of these fishes are adapted to a range of habitat conditions and are highly mobile.

Products:

Peer-reviewed and Scientific Publications:

Fischer, J., C. Paukert, and M. Daniels. 2012. Fish community response to habitat alteration: impacts of sand dredging in the Kansas River. Transactions of the American Fisheries Society 141:1532-1544.

Paukert, C. P., J. Schloesser, J. Eitzmann, J. Fischer, K. Pitts, and D. Thornbrugh. 2008. Effect of instream sand dredging on fish communities in the Kansas River USA: current and historical perspectives. Journal of Freshwater Ecology 23:623-633.

Thesis or Dissertation:

Fischer, J.L. 2012. Fish community response to habitat alteration: impacts of sand dredging in the Kansas River. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Fischer, J., C. Paukert, and M. Daniels. 2012. Influence of in-stream and watershed alterations on sandbars and islands in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Daniels, M. K., J. Fischer, K. Costigan, J. Gerken, and C. Paukert. 2011. Making sense of an intensively modified sediment regime: measuring the relative impact of in-channel dredging amidst reservoir trapping and network-scale incision in the Kansas River basin. International Symposium on the Interactions between Sediment and Water. Dartington, England.

Fischer, J. J. Gerken, C. Paukert, and M. Daniels. 2011. Habitat and fish community response to sand dredging in a large Great Plains river. American Fisheries Society Annual Meeting, Seattle, WA.

Fischer, J., C. Paukert, J. Gerken, and M. Daniels. 2011. Influence of sand dredging on fish communities in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Fischer, J., J. Gerken, C. Paukert, and M. Daniels. 2011. Habitat and fish community response to sand dredging in a large Great Plains river. Midwest Fish and Wildlife Conference, Des Moines, IA.

Fischer, J., C. Paukert, J. Gerken, and M. Daniels. 2010. Fish community response to habitat alteration: impacts of sand dredging in the Kansas River. Midwest Fish and Wildlife Conference, St. Paul, MN.

Beaver dams maintain native fish biodiversity via altered habitat heterogeneity in a coastal stream network: Evaluating gear, quantifying fish assemblages, and testing ecological hypotheses

Funding: Plum Island Ecosystems-Long Term Ecological Research Station
Massachusetts Cooperative Fish and Wildlife Research Unit

Investigator: Joseph E. Smith, Ph.D. Student

Advisor: Dr. Martha Mather, Assistant Unit Leader-Fisheries

Completion: 2012

Understanding the relationship between heterogeneity, biodiversity and ecosystem function is an active focus of ecological research that has direct applications to the formulation of sustainable, science-based, watershed conservation plans. Here, I applied ecological theory on heterogeneity to the expansion of North American beaver to test hypotheses about physical habitat and fish biodiversity at a riverscape scale. To test these hypotheses (Chapter 4), I first addressed two methodological issues (Chapter 2, 3). By evaluating three types of gear at three levels of effort in a randomized block design over 4 replicate days, I show that 10 minnow traps, 2 hoop nets and 20 m of electrofishing captured most fish species within a 30-m sampling area (Chapter 2). Multiple statistical measures provided similar information, therefore I used general indices (richness, diversity), ecological guilds (flow based), and select multivariate analyses (DCA) to summarize fish communities (Chapter 3). I used these methodological insights to test ecological hypotheses by collecting habitat and fish data at all beaver dams (n = 15) and select control sites (n = 9) in Fish Brook, a coastal watershed in northeastern Massachusetts. From these data, I gained six basic and applied insights. First, beaver dams were distributed throughout the stream network. Second, at a local scale, beaver dams created more habitat heterogeneity than control sites. Specifically, beaver dams created four types of habitat alterations based on upstream-downstream differences in stream width, depth, velocity, and substrate. Third, richness and diversity of fish species around beaver dams were linked to habitat heterogeneity. Fourth, the mechanisms by which beaver dams altered fish biodiversity were mediated through habitat changes at the beaver dam patch boundary. Upstream of the dam macrohabitat guilds occupied the lentic areas, while below dams, fluvial fish guilds used shallow, faster water. Fifth, fluvial species responded the most dramatically to these habitat changes. Finally, in a system depauperate of lotic habitat, fluvial habitats created below beaver dams provided an important refuge for native stream fish. These source areas can increase resiliency and maintaining them may be useful for sustainable watershed conservation plans in these types of systems.

Products:

Peer-reviewed and Scientific Publications:

Smith, J. M., S. P. Wells, M. E. Mather, and R. M. Muth. 2014. Fish biodiversity sampling in stream ecosystems: a process for evaluating the appropriate types and amount of gear. Aquatic Conservation: Marine and Freshwater Ecosystems. Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/aqc.2420

Smith, J. M and M. E. Mather. 2013. Beaver dams maintain native fish biodiversity by increasing habitat heterogeneity throughout a low-gradient stream network. Freshwater Biology 58: 1523-1538.

Thesis or Dissertation:

Smith, J.M. 2012. Beaver dams maintain native fish biodiversity via altered habitat heterogeneity in a coastal stream network: Evaluating gear, quantifying fish assemblages, and testing ecological hypotheses. Ph.D. Dissertation, University of Massachusetts-Amherst. (Advisor: Mather)

Presentations:

Smith, J.M., M.E. Mather, S.M. Hitchman and J.S. Fencl. 2013. An evaluation of metrics that quantify the composition of fish communities in aquatic systems. Midwest Fish and Wildlife Conference. Wichita, KS.

Smith, J. M., M. E. Mather, R. M. Muth and J. T. Finn. 2010. Beaver-dam alterations of fish assemblages in coastal watersheds: Implications of fragmentation on ecosystem function. National meeting, Ecological Society of America, Pittsburgh, PA.

2011

Developing Standardized Metrics to Quantify the Temporal Distribution of Migrating Anadromous Herring: Comparing Adult Returns Across Coastal Rivers

Funding: Massachusetts Division of Marine Fisheries
Town of Plymouth, MA
National Oceanic and Atmospheric Administration

Investigator: Matt Burak, M.S. Student

Advisor: Dr. Martha Mather, Assistant Unit Leader-Fisheries

Completion: 2011

Understanding, quantifying, and comparing the temporal distribution of anadromous fish spawning migrations is an important yet vexing problem for fisheries research, management, and conservation. Central to this problem is the lack of a representative and comprehensive standardized suite of quantitative metrics to characterize the complex, multidimensional temporal distribution of migrating anadromous fish. Without this, it is not possible to develop effective sampling regimes, extrapolate counts to accurate population estimates, understand the basic ecology and behavior of anadromous fish, or make the comparisons through time and across river systems that are fundamental to sustainable conservation. In this thesis, I define, calculate, and compare 17 metrics that characterize the temporal distribution of migrating adult river herring [two closely related clupeids, the alewife (Alosa pseudoharengus) and blueback herring (Alosa aestivalis)] as they return to spawn. These metrics are based on fish counts from three southeastern Massachusetts river systems that were obtained through a low-cost video monitoring system.

Products:

Thesis or Dissertation:

Burak, M.K. 2011. Developing Standardized Metrics to Quantify the Temporal Distribution of Migrating Anadromous Herring: Comparing Adult Returns Across Coastal Rivers. Master's Thesis. University of Massachusetts-Amherst. (Advisor: Mather)

Presentations:

Burak, M. K., M. E. Mather, J. T. Finn, J. B. Kim, and R. M. Muth. 2010. Identification of the timing and magnitude of anadromous alewife spawning migrations in three coastal Massachusetts rivers. Northeastern Division American Fisheries Society, Newton, MA.

Mather, M. E., M. K. Burak, J. T. Finn, R. M. Muth, J. B. Kim, K. H. Ferry. 2010. Counting anadromous fish at remote fishways in small coastal streams: a review of past uses of video monitoring with an evaluation of a new system. Northeastern Division American Fisheries Society, Newton, MA.

2010

Effects of zebra mussel (*Dreissena polymorpha*) invasion on the aquatic community of a Great Plains reservoir

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Andrea Severson, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2010

The zebra mussel is an invasive bivalve that was first confirmed in Kansas in 2003, and has decreased zooplankton abundance and altered the aquatic community in other areas where it has invaded. However, little is known about its effects on the aquatic communities of warm-water Great Plains reservoirs. We analyzed zooplankton, benthic macroinvertebrate, and juvenile and small-bodied fish abundance in the littoral zone of an Eastern Kansas reservoir with an established zebra mussel population (El Dorado Reservoir) and a control reservoir without zebra mussels (Melvern Reservoir) for two years pre-zebra mussel invasion (2001-2002) and two years post-invasion (2008-2009). We found no difference in littoral zooplankton abundance between reservoirs across time, but abundance of some macroinvertebrate taxa increased, and abundance of juvenile *Lepomis* spp. and red shiners decreased in the littoral zone of El Dorado Reservoir in August of the post-zebra mussel invasion period in comparison to the control reservoir. We also analyzed abundance and condition of six adult reservoir fishes in El Dorado Reservoir and three control reservoirs in Eastern Kansas for ten years pre-zebra mussel invasion (1993-2002) and five years post-invasion (2004-2008). Adult white crappie abundance remained constant in El Dorado Reservoir but decreased in the control reservoirs during the post-zebra mussel invasion period, and condition of adult bluegill, white bass, and white crappie decreased in El Dorado Reservoir in the post-zebra mussel invasion period compared to the control reservoirs. Our findings suggest that zebra mussel invasion in El Dorado Reservoir may have affected some benthic macroinvertebrates, juvenile and small-bodied fishes, and adult fishes. We did not find evidence that zebra mussels have had substantial effects on the zooplankton community of El Dorado Reservoir. However, July-August zebra mussel veliger densities in El Dorado Reservoir averaged less than 12 veligers/L in four of the six post-zebra mussel invasion years. Additional research and long-term monitoring of zooplankton, macroinvertebrates, and fishes will be necessary to determine the full effects of zebra mussels on the aquatic communities of warm-water reservoirs throughout North America.

Products:

Thesis or Dissertation:

Severson, A.M. 2010. Effects of zebra mussel (*Dreissena polymorpha*) invasion on the aquatic community of a Great Plains reservoir. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Paukert, C. and A. Severson. 2010. Zooplankton community characteristics in El Dorado Reservoir: response to zebra mussel invasion. Kansas Natural Resources Conference, Wichita, KS.

Severson, A. and C. Paukert. 2010. Zooplankton community response to zebra mussel invasion in a Kansas reservoir. Midwest Fisheries Student Colloquium, Manhattan, KS.

Paukert, C. P., and A. M. Severson. 2009. Using long-term data to determine the effects of zebra mussels on reservoir sport fishes. 70th Midwest Fish and Wildlife Conference, Springfield, IL.

Severson, A. and C. Paukert. 2009. Zebra Mussel Invasion and Zooplankton in a Great Plains Reservoir: Cause for Concern? American Water Resources Association Annual Water Resources Conference, Seattle, WA.

Severson, A., and C. Paukert. 2009. Does zebra mussel presence affect abundance and condition of reservoir fishes in a Kansas reservoir? American Fisheries Society Annual Meeting, Nashville, TN. Finalist, best student poster.

Severson, A., and C. Paukert. 2009. Effects of zebra mussel invasion on fish abundance and condition in a Kansas reservoir. KSU Biology Student Research Forum, Manhattan, KS.

Severson, A., and C.P. Paukert. 2009. Impacts of zebra mussels on fishes in El Dorado Reservoir. Kansas Natural Resources Conference, Wichita, KS.

Paukert, C. and A. Severson. 2008. Zooplankton community characteristics in El Dorado Reservoir: response to zebra mussel invasion. Kansas Natural Resources Conference, Wichita, KS.

Severson, A., J. Schloesser, J., K. Pitts, J. Eitzmann, and C. Paukert. 2008. Abundance and size structure of fishes in main and secondary channels of the Kansas River. First Annual Midwest Student Fisheries Colloquium, Lincoln, NE.

Long-Term Monitoring of Kansas River Fishes

Funding: Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Andy Makinster, M.S., 2006
Jeff Eitzmann, M.S. 2008
Joe Gerken, Ph.D. 2015
Jason Fischer, M.S. 2012
Dr. Craig Paukert

Project Supervisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2010

Developing long-term monitoring of fish and wildlife populations is essential to determine future effects of disturbance, climate change, or other effects that may impact biodiversity. We began a long term monitoring program of fishes in the Kansas River beginning March 2005. Since March 2005, we have electrofished 36 stations 5 times per year within 6 reaches of the Kansas River. These six reaches consist of sample sites near Kansas City, Lawrence below Bowersock Dam, Lawrence above Bowersock Dam, Topeka, Wamego, and Manhattan, Kansas. All species of fish are weighed and measured at each site, and individually numbered t-bar tags are attached to selected species (blue suckers, shovelnose sturgeon, flathead catfish, channel catfish, and other large bodied fishes). To date over 3,398 fish have been collected in this program. Data from this program have been used by the US Fish and Wildlife Service, Kansas Department of Wildlife and Parks, and in several research projects at Kansas State University.

Products:

Peer-reviewed and Scientific Publications:

White, K., J. Gerken, C. Paukert, and A. Makinster. 2010. Fish community structure in natural and engineered habitats in the Kansas River. River Research and Applications 26:797-805.

Presentations:

Paukert, C. 2010. Fish and fish habitat in the Kansas River: what have we learned? Kansas Natural Resources Conference, Wichita, KS.

White, K., J. Gerken, C. Paukert, and A. Makinster. 2010. Fish community structure in natural and engineered habitats in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J. E., and C. P. Paukert. 2009. Impacts of a low-head dam on fish communities in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J. E., and C. P. Paukert. 2009. Impacts of a low-head dam on a Great Plains River Fish Community. American Fisheries Society Midwest Student Colloquium, Annual Meeting, Ames, IA.
Gerken, J., and C. Paukert. 2008. Fish community changes associated with a low-head dam in a large Great Plains river. Midwest Fish and Wildlife Conference, Columbus, OH.
Gerken, J., and C. Paukert. 2008. Effects of a low-head dam on the fish community of a large Great Plains River. American Fisheries Society Annual Meeting, Ottawa, Canada.
Gerken, J., and C. P. Paukert. 2008. Effects of a low-head dam on the fish community of a large Great Plains river. Southwestern Association of Naturalists, Memphis, TN.

2009

Zooplankton Dynamics in Marion Reservoir: Implications for Monitoring the Effects of Zebra Mussel Invasion

Funding: Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Dr. Craig Paukert, Assistant Unit Leader-Fisheries
Michael Proffer, Undergraduate Student

Project Supervisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2009

Zebra mussels were documented in Marion Reservoir in July 2008, which was attributed to irresponsible boaters. Monitoring the changes in zooplankton before and after invasion can help determine the effects of the zebra mussel on the aquatic community. Standardized collections of zooplankton in Marion Reservoir were conducted by the U.S. Army Corps of Engineers for several years prior to zebra mussel invasion in 2008. The data obtained from these pre-zebra mussel zooplankton collections may play an important role in studying the effects of zebra mussels within a reservoir system, and can act as a baseline for future monitoring data. A total of 36 samples (3 sites, x 3 years x 4 months) were analyzed from sites 15, 2, and 5 for this report. Mean total zooplankton abundance was not consistent among years or months (year by month interaction $p=0.0002$), therefore the analysis was separated by year. Mean total zooplankton abundance did not differ by month for 2004 or 2005). However, total zooplankton was highest in May and July of 2005. Cyclopoid density did not differ among years or months, while Calanoid density was slightly higher in July ($p=0.015$). Daphnia density did not differ among years or months. The mean coefficient of variation for total zooplankton abundance ranged from 93 in May to 109 in June, but was similar among months ($p=0.936$). Power analysis revealed that to detect a 50% change in total zooplankton abundance at a power level of 0.8, you would need 35 to 63 zooplankton tows, depending on month. June sampling required the greatest number of samples (63) whereas the other months were fairly similar. However, May sampling required slightly less samples (35) than July and August (42-44 samples).

Products:

Technical and Semi-Technical:

Proffer, M., and C. P. Paukert. 2009. Zooplankton dynamics in Marion Reservoir. Report Submitted to US Army Corps of Engineers, Tulsa District, and Kansas Department of Wildlife and Parks, Emporia.

2008

Road crossing designs and their impact on fish assemblages and geomorphology of Great Plains streams

Funding: Kansas Department of Transportation

Investigator: Wesley Bouska, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2008

Improperly designed stream crossings may prohibit movement of stream fishes by creating physical or behavioral barriers and may alter the form and function of stream ecosystems. A mark-recapture and geomorphological study was conducted to evaluate fish passage and stream morphology at three types of vehicle crossings (compared to control sites) located on streams in the Flint Hills of Northeast Kansas. We investigated five concrete box culverts, five low-water crossings (concrete slabs vented by one or multiple culverts), and two single corrugated culverts. A total of 6,433 fish were marked April to May 2007 and 709 were recaptured June to August 2007. Fish passage occurred at all crossing types, but upstream movement of recaptured fish was higher at controls (41.1%) than at crossing reaches (19.1%) for low-water crossings. Control sites had more species in common upstream and downstream than did crossings. There was reduced overall abundance of fish upstream at low-water crossings, commonly percids and centrarchids. A comparison of channel and road crossing dimensions showed that box culverts and corrugated culverts would be more effective than low-water crossings at transporting water, sediments, and debris during bankfull flows, and fish passage at base flows. Upstream passage of Topeka shiner (*Notropis topeka*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinella lutrensis*), and Southern redbelly dace (*Phoxinus erythrogaster*) was tested through three simulated crossing designs (box culverts, round corrugated culverts, and natural rock) across 11 different water velocities (0.1 m/s to 1.1 m/s) in an experimental stream. Upstream movement did not differ among designs, except natural rock crossings had lower movement than box or corrugated culverts for red shiners. A greater proportion of Topeka shiners moved upstream at higher velocities. These results suggest that crossing type affects fish passage and the morphology of the stream, although water velocity in different crossing designs alone may not be a determining factor in fish passage. Low-water crossings had the greatest impact on fish community and movement, but barriers to fish movement are likely caused by other variables (e.g. perching). Use of properly designed crossing structures has great promise in conserving critical stream habitat and preserving native fish communities.

Products:

Peer-reviewed and Scientific Publications:

Bouska, W. W., and C. P. Paukert. 2010. Road crossing designs and their impact on fish assemblages of Great Plains streams. Transactions of the American Fisheries Society 139:214-222.

Bouska, W. W., and C. P. Paukert. 2010. Effects of visible implant elastomer mark color on the predation of red shiners by largemouth bass. Fisheries Management and Ecology 17:294-296.

Bouska, W. W., T. Keane, and C. P. Paukert. 2010. The effects of road crossing design on geomorphology and classification of prairie streams. Journal of Freshwater Ecology 25:499-506.

Pullen, R. R., W. W, Bouska, S. Campbell, and C. P. Paukert. 2009. Intestinal helminths of *Cyprinella lutrensis* in Deep Creek, Kansas; prevalence and spatial distribution estimates *for Bothriocephalus acheilognathi* (the Asian fish tapeworm) and *Rhabdochona Canadensis*. Journal of Parasitology 95(5):1224-1226.

Technical and Semi-Technical:

Bouska, W. W., C. P. Paukert, and T. Keane. 2009. Inventory and assessment of road-stream crossings for aquatic organism passage, with recommendations for culvert design. Final report, Kansas Department of Transportation, KTRANS Program, Project Number KSU 07-6, Topeka.

Thesis or Dissertation:

Bouska, W.W. 2008. Road crossing designs and their impact on fish assemblages and geomorphology of Great Plains streams. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Bouska, W. W., and C. P. Paukert. 2010. Road crossing designs, their effect on prairie stream fishes, and an update on the Topeka shiner. Dakota Chapter of the American Fisheries Society annual meeting, Spearfish, SD.

Mammoliti, K., W. Bouska, and C. Paukert. 2010. Seasonal stockpiling of prairie stream fishes below road crossings in the flinthills of Kansas. Kansas Natural Resources Conference, Wichita, KS.

Bouska, W., and C. Paukert. 2009. Passage of prairie fishes through different crossing designs and water velocities in an experimental stream. Kansas Natural Resources Conference, Wichita, KS.

Paukert, C., W. Bouska, and T. Keane. 2009. Road crossing design and their impacts of fish assemblages and geomorphology of Great Plains streams. Kansas Transportation Engineering Conference, Manhattan, KS.

Bouska, W. W. and C. P. Paukert. 2008. Effects of road crossing design on movement and species composition of Great Plains stream fishes. Kansas Natural Resources Conference, Wichita, KS. 23 February 2008.

Bouska, W. W. and C. Paukert. 2008. Effects of road crossing design on movement and species composition of Great Plains stream fishes. First Annual Midwest Student Fisheries Colloquium, Lincoln, NE.

Bouska, W., and C. Paukert. 2008. Fish on the move: effects of culvert design on the passage of Great Plains stream fish. Midwest Fish and Wildlife Conference, Columbus, OH.

Bouska, W., and C. Paukert. 2008. Road crossing designs and their impact on movement and diversity of Great Plains stream fishes. American Fisheries Society Annual Meeting, Ottawa, Canada.

Bouska, W., and C. Paukert. 2008. The effects of crossing design and water velocity on the movement of Great Plains lotic fishes. Midwest Fish and Wildlife Conference, Columbus, OH.

Mammoliti, K., W. Bouska, and C. Paukert. 2008. Seasonal stockpiling of prairie stream fishes below road crossings in the Flinthills of Kansas. Kansas Natural Resources Conference, Wichita, KS.

Bouska, W., and C. P. Paukert. 2007. Impacts of Road Crossings on Prairie Stream Fishes. Midwest Fish and Wildlife Conference, Madison, WI 11 December 2007.

Assessing threats to native fishes of the Lower Colorado River Basin

Funding: US Geological Survey Gap Analysis Program

Investigator: Kristen Pitts Bouska, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2008

We investigated the influence of anthropogenic threats and hydrologic alteration on fish assemblages within the Lower Colorado River Basin (LCRB). Life history traits of fish assemblages for individual stream segments were summarized by presence/absence data of current (1980-2006) records. To assess anthropogenic threats, we developed a series of ecological risk indices at various scales (e.g., catchment, watershed, aquatic ecological system and upstream of aquatic ecological system) and related each index to fish life-history traits to determine the method and scale that best relates to biotic metrics. Hydrologic alteration was quantified using the Indicators of Hydrologic Alteration (IHA) software to calculate hydrologic alteration values using the range of variability approach (RVA). Ecological risk indices within all

scales were strongly correlated (r^2>0.54, p<0.0001) to one another. Relationships between fish life history traits and ecological risk indices occurred only at the catchment and watershed scales. Strongest relationships were at the watershed scale where increased levels of anthropogenic risk were related to reduced occurrences of native, fluvial dependent species (r^2=0.12, p<0.0001) and increased occurrences of nonnative generalist species (r^2=0.22, p<0.0001). The percent agriculture was positively related to indices of alteration of low flows (r=0.401, p=0.006) while forested land cover was negatively related to alteration of low flow events (r=-0.384, p=0.008). Relationships between indices of hydrologic alteration and fish traits indicate the occurrence of piscivorous, nonnative fishes increased with alteration of low flow events whereas occurrence of fluvial dependent fishes that preferred rubble substrate decreased with alteration of low flow events (r=0.64, p=0.001). Our analysis suggests that ecological risk indices and hydrologic alteration in the LCRB are related to composition of biotic communities. Incorporating cost-effective risk indices into conservation planning will likely increase the effectiveness of conservation efforts while understanding biotic responses to modified flow regimes are a necessity in sustainable development of water resources as human populations grow and water resources decrease in the LCRB.

Products:

Peer-reviewed and Scientific Publications:

Paukert, C.P., Pitts, K.L., Whittier, J.B. and Olden, J.D., 2011. Development and assessment of a landscape-scale ecological threat index for the Lower Colorado River Basin. Ecological Indicators, 11(2), pp.304-310.

Technical and Semi-Technical:

Whittier, J. B., C. P. Paukert, and K. Gido. 2006. Development of an Aquatic GAP for the Lower Colorado River Basin. Maxwell et al., editors. Gap Analysis Bulletin No. 14 USGS/BRD/Gap Analysis Program. Moscow, Idaho.

Thesis or Dissertation:

Pitts, K.L. 2008. Assessing threats to native fishes of the Lower Colorado River Basin. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Pool, T., J. Olden, J. Whittier, and C. Paukert. 2009. Riverscape patterns and environmental drivers of functional diversity and composition of fish communities in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

Whittier, J., C. Paukert, and J. Olden. 2009. Modeling local and watershed drivers of native and non-native fishes in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

Pitts, K.L., C. Paukert, and J. Whittier. 2008. Alteration of flow regime and its influence on fish assemblages within the Lower Colorado River Basin. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ. 8 February 2008.

Pitts, K.L., C. Paukert, and J. Whittier. 2008. Evaluation of an ecological risk index in quantifying threats to fishes. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ. 8 February 2008.

Pitts, K.L., C. Paukert, and J. Whittier. 2008. Utility of an ecological risk index to assess threats to native fishes: insights from the Verde River Basin, Arizona. Kansas Natural Resources Conference, Wichita, KS. 23 February 2008.

Whittier, J.B., C.P. Paukert, K.L. Pitts, and J. Olden. 2008. Building a classification hierarchy for the Lower Colorado River Basin to provide an ecological basis for selecting conservation areas. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ. 8 February 2008.

Pitts, K. L., C. P. Paukert, and J. B. Whittier. 2008. Assessing anthropogenic threats to fishes in the Lower Colorado River Basin. American Fisheries Society Annual Meeting, Ottawa, Canada.

Pitts, K. L., C. Paukert, and J. Whittier. 2008. Evaluation of an ecological risk index in quantifying threats to fishes. Western Division of the American Fisheries Society Annual Meeting, Portland, OR.

Pitts, K. L., C. Paukert, and J. Whittier. 2008. Utility of an ecological risk index to assess threats to native fishes: insights from the Verde River Basin, Arizona. First Annual Midwest Student Fisheries Colloquium, Lincoln, NE.
Pitts, K. L., C. P. Paukert, and J. B. Whittier. 2007. Development and Assessment of an Ecological Risk Index for Fishes in the Verde River Basin, Arizona. Midwest Fish and Wildlife Conference, Madison, WI 11 December 2007.
Pitts, K. L., C. P. Paukert, and J. W. Whittier. 2007. Hydrologic variability in the Lower Colorado River Basin: implications for fish conservation. American Fisheries Society Annual Meeting, San Francisco, CA. 6 September 2007.
Whittier, J. B., C. P. Paukert, K. L. Pitts, and J. D. Olden. 2007. The Lower Colorado River aquatic GAP project-an update. Arizona-New Mexico American Fisheries Society Annual Meeting, Albuquerque, NM 7 February 2007.
Whittier, J. W., C. P. Paukert, K. L. Pitts, and J. D. Olden. 2007. Lower Colorado River aquatic GAP: meeting the needs of stakeholders. National GAP Meeting, Asheville, NC. 13 September 2007.
Whittier, J. B., C. P. Paukert, and K. B. Gido. 2006. Development of an aquatic GAP for the Lower Colorado River Basin. Arizona/New Mexico American Fisheries Society Annual Meeting, Flagstaff, AZ.
Whittier, J. B., C. P. Paukert, and K. B. Gido. 2005. Development of an aquatic GAP for the Lower Colorado River Basin. National GAP Meeting, Reno, NV.

Effects of Anthropogenic Disturbance of Fish Community and Food Web Structure in a Great Plains River

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Jeff Eitzmann, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2008

We investigated spatial variation in fish assemblage and food web structure in the Kansas River, USA in relation to habitat changes. Fishes were collected at ten sites throughout the Kansas River for assessing assemblage structure in summer 2007 using fish community metrics and at 3 sites in 2006 for food web structure using stable isotope analysis. Satellite imagery indicated riparian habitat on the Kansas River was dominated by agriculture in the upper reaches (>35%) and tended to increase in urban land use in the lower reaches (>58%). Instream habitat complexity also decreased with increased urban area (<25%) becoming more channelized. Jaccard's similarity and percent similarity indices suggested that large-bodied fishes show changes in species presence and composition longitudinally within the river. Also, reaches directly above Bowersock Dam in Lawrence, Kansas and below the Johnson County Weir, near Kansas City, Kansas had low percent similarity compared to other reaches, suggesting the dam and the weir affect community composition. Canonical correspondence analysis indicated that species that prefer high velocity flows and sandy substrate (blue sucker and shovelnose sturgeon) are associated with the upper river reaches. Also, there was a higher abundance of omnivorous and planktivorous fish species in the lower more channelized river. The lower reaches contain more tolerant, macrohabitat generalist species and the upper river contained more intolerant, fluvial specialist species. Fish, macroinvertebrates, and detritus were collected at three river reaches classified as the heterogeneous instream habitat (>40% grass islands and sand bars) intermediate (22% grass islands and sand bars), and homogeneous (6% grass islands and sand bars) instream habitat reaches in June 2006. Riparian land use (proportion as agricultural and

urban) was related to instream habitat with homogeneous areas having more urban riparian area compared to the heterogeneous and intermediate reaches. The heterogeneous habitat reach had higher variability in $\delta^{13}C$ for fish classified as piscivores/invertivores (P=0.029) and macroinvertebrates (P=0.004) suggesting the complex habitat in the heterogeneous habitat reach provided more variable food sources. The $\delta^{15}N$ values also indicated that ten of the twelve fish species tended to consume prey at higher trophic levels in the heterogeneous habitat reach suggesting a more complex food web. Land use practices are leading to homogenization of instream habitat and this homogenization of habitats may be related to food web diversity and trophic position of fishes. Conserving intolerant, native species in the Kansas River may require maintaining suitable habitat for these species and restoration of impacted areas of the river.

Products:

Peer-reviewed and Scientific Publications:

Eitzmann, J. L., and C. P. Paukert. 2010. Longitudinal differences in habitat complexity and fish assemblage structure of a Great Plains River. American Midland Naturalist 163:14-32.

Eitzmann, J. L., and C. P. Paukert. 2010. Urbanization in a Great Plains river: effects on fishes and food webs. River Research and Applications 26:948-959.

Eitzmann, J. L., A. S. Makinster, and C. P. Paukert. 2007. Distribution and growth of blue sucker in a Great Plains, USA river. Fisheries Management and Ecology 14:255-262.

Thesis or Dissertation:

Eitzmann, J.L. 2008. Spatial habitat variation in a Great Plains river: effects on the fish assemblage and food web structure. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Paukert, C. P., and J. Eitzmann. 2008. Food web dynamics of a Great Plains river: effects of habitat alteration. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ.

Eitzmann, J. L., and C. P. Paukert. 2008. Effects of anthropogenic changes on food web dynamics in a Great Plains river. Kansas Natural Resources Conference, Wichita, KS.

Eitzmann, J., and C. Paukert. 2007. Electrofishing and hoopnetting gear comparisons for fish communities in the Kansas River, Kansas. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Eitzmann, J. L., and C. P. Paukert. 2007. Evaluation of multiple gears to assess a Great Plains river fish community. American Fisheries Society Annual Meeting, San Francisco, CA.

Eitzmann, J. L., and C. P. Paukert. 2006. Comparison of electrofishing and trammel netting of shovelnose sturgeon in the Kansas River. 67th Midwest Fish and Wildlife Conference, Omaha, NE.

Large river fish community sampling strategies and fish associations to engineered and natural river channel structures

Funding: US Geological Survey, SSP Program

Investigator: Joshua T. Schloesser, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2008

I evaluated sampling strategies and the effects of dike structure modifications in the lower Missouri River to better develop sampling and mitigation strategies to protect and enhance native river fishes. Sampling occurred in the lower 1,212 km of the Missouri River during October-June (coldwater season) and June-October (warmwater season) with stationary gill nets (GN), drifted trammel nets (TN), towed otter trawls (OT), and mini fyke nets (MF) from 2003-2006. We

compared probabilities of detection (p), variability (coefficient of variation; CV) in catch per unit effort, and lengths for 25 species. Over 80% of adult large-bodied fishes were collected in GN during coldwater, >90% of chub spp. (*Macrhybopsis*) were collected in OT, and >90% of nine small-bodied and juvenile fishes were collected in MF. Trammel nets never had the highest p during coldwater, but had the highest or equally high p for 85% of adult large-bodied fishes during warmwater. Mean CV was lowest with GN for adult large-bodied fishes; chub spp. had the lowest CV in OT. Mean lengths were typically greater in GN and TN. Large river monitoring programs might best achieve the highest p, lowest variability, and widest size range of fishes by employing GN and OT during coldwater and TN, OT, and MF during warmwater sampling periods. We also compared fish community composition and the probability an un-notched and notched dike structure and channel sand bar (referred to as channel structures) was occupied by various fish species. Few differences in species richness and diversity were evident among channel structures. Notching a dike structure had no effect on proportional abundance for any habitat guild. Catch per unit effort (CPUE) was greater at notched dikes for only three (lake sturgeon *Acipenser fulvescens*, paddlefish *Polyodon spathula*, and shovelnose sturgeon *Scaphirhynchus platorynchus*) of 12 great river species. Occupancy at notched dikes increased for blue catfish *Ictalurus furcatus* and decreased for blue sucker *Cycleptus elongatus*, but did not differ for 17 (81%) other species. No distinct increase in occupancy at natural channel sand bars compared to engineered dike structures was evident. Mean CPUE was higher in dike structures than channel sand bars for four great river species (goldeye *Hiodon alosoides*, lake sturgeon, paddlefish, and shortnose gar *Lepisosteus platostomus*), but did not differ for ten. Our results suggest dike structures may provide necessary habitats for many fluvial species when compared to channel sand bars, but notching did not increase abundance or occupancy of most native Missouri River fishes.

Products:

Peer-reviewed and Scientific Publications:

Schloesser, J.T., Paukert, C.P., Doyle, W.J., Hill, T.D., Steffensen, K.D. and Travnichek, V.H., 2012. Fish assemblages at engineered and natural channel structures in the lower Missouri River: implications for modified dike structures. River Research and Applications, 28(10), pp.1695-1707.

Schloesser, J.T., Paukert, C.P., Doyle, W.J., Hill, T.D., Steffensen, K.D. and Travnichek, V.H., 2012. Heterogeneous detection probabilities for imperiled Missouri River fishes: implications for large-river monitoring programs. Endangered Species Research, 16(3), pp.211-224.

Thesis or Dissertation:

Schloesser, J.T. 2008. Large river fish community sampling strategies and fish associations to engineered and natural river channel structures. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Schloesser, J. T., and C. P. Paukert. 2008. The use of occupancy modeling to aid the Missouri River pallid sturgeon monitoring program. Missouri River Natural Resources Conference, Nebraska City, NE.

Schloesser, J. T., C. Paukert, W. Doyle, T. Hill, G. Mestl, and V. Travnichek. 2008. Comparison of sampling gear detection probabilities and variability for Missouri River fishes. Kansas Natural Resources Conference, Wichita, KS.

Schloesser, J., C. Paukert, W. Doyle, T. Hill, G. Mestl, and V. Travnichek. 2008. Detection and occupancy probabilities for monitoring Missouri River fishes. American Fisheries Society Annual Meeting, Ottawa, Canada.

Schloesser, J. T., C. P. Paukert, W. Doyle, T. Hill, G. Mestl, and V. Travnichek. 2007. Probability of detection and catch rate variability by gear type for Missouri River fishes. Midwest Fish and Wildlife Conference, Madison, WI.

Schloesser, J. T., D. E. Haines, and C. P. Paukert. 2007. Walleye harvest restrictions to reduce gizzard shad impingement. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Schloesser, J., J. Finley, C. Paukert, W. Doyle, and T. Hill. 2007. Comparison between push trawl and mini fyke nets to sample shallow water fish communities. American Fisheries Society Annual Meeting, San Francisco, CA.
Schloesser, J., J. Finley, C. Paukert, W. Doyle, and T. Hill. 2007. Comparison between push trawl and mini fyke nets to sample shallow water fish communities. Missouri River Natural Resource Conference, Nebraska City, NE.

2007

Structural organization of Great Plains stream fish assemblages: Implications for sampling and conservation

Funding: Kansas Department of Wildlife, Parks and Tourism
Nebraska Game and Parks Commission

Investigator: Jesse R. Fischer, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2007

Stream fish assemblages were investigated in Nebraska and Kansas to determine the effects of habitat and sampling methodologies on the community structure and abundance of prairie stream fishes of the Great Plains. The number of reaches (<1 km) required to estimate segment (20-30 km) species richness decreased with increased reach length (10, 20, 40, or 60 mean stream width [MSW]) whereas total sampling effort decreased with more and shorter reaches. Only after all 10 reaches was total species richness obtained with 40 to 60 MSW. A greater number of reaches was needed to detect 90% of species richness and 25% changes in relative abundance when community similarity and habitat heterogeneity was lower. Our results suggest homogenous stream segments require more reaches to characterize fish community structure and monitor trends in fish abundance and a greater number of shorter reaches may be better than fewer longer (e.g. 40 or larger MSW) reaches. Effects of local environmental influences on the structure of fish assemblages were evaluated from 159 sites in two regions of the Great Plains with limited anthropogenic disturbance. These least disturbed regions offered an opportunity to evaluate the structure and natural variation of streams and fish assemblages within the Great Plains. Similar environmental factors structured streams and fish assemblages, despite differences in environmental conditions and species composition between regions. Variance in fish assemblages was best explained by stream size and habitat features linked with stream size.

Products:

Peer-reviewed and Scientific Publications:

Fischer, J.R., and C. P. Paukert. 2009. Spatial scale of stream fish assemblage and abundance estimates: effects of sampling effort, community structure, and habitat heterogeneity. Canadian Journal of Fisheries and Aquatic Sciences 66:277-290.
Fischer, J. R., and C. P. Paukert. 2008. Historical and current environmental influences of an endemic Great Plains fish. American Midland Naturalist 159:364-377.
Fischer, J. R., and C. P. Paukert. 2008. Habitat relationships with fish assemblages in least disturbed Great Plains regions. Ecology of Freshwater Fish 17:597-609.
Brinkley, P., J. R. Fischer, and C. P. Paukert. 2008. Effects of fixative on total length of small bodies stream fishes. Journal of Freshwater Ecology 23:471-473.

Thesis or Dissertation:

Fischer, J.R. 2007. Structural organization of Great Plains stream fish assemblages: Implications for sampling and conservation. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Fischer, J. R., and C. P. Paukert. 2008. Habitat relationships with fish assemblages in minimally disturbed Great Plains regions. Dakota and Iowa Chapter of the American Fisheries Society Joint Annual Meeting, Sioux Falls, SD.

Fischer, J., and C. Paukert. 2008. Habitat relationships with fish assemblages in minimally disturbed Great Plains regions. American Fisheries Society Annual Meeting, Ottawa, Canada.

Fischer, J. R., and C. P. Paukert. 2007. Spatial scale of stream fish assemblages and abundance estimates: effects of sampling effort, community structure, and habitat heterogeneity. American Fisheries Society Annual Meeting, San Francisco, California.

Fischer, J., and C. Paukert. 2007. Historical and current environmental influences on an endemic Great Plains fish. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Fischer, J., and C. Paukert. 2007. Sampling effort required to estimate species richness in wadeable Great Plains streams with a towed electrofishing. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Brinkley, P., J. Fischer, and C. P. Paukert. 2006. Effect of fixative on total length of small-bodied stream fish. 31st Kansas Chapter of the American Fisheries Society Annual Meeting, Hays, KS.

Fischer, J. R., and C. P. Paukert. 2006. Environmental influences structuring Great Plains stream fish assemblages. 67th Midwest Fish and Wildlife Conference, Omaha, NE.

Fischer, J. R., and C. P. Paukert. 2006. Historical and environmental influence on an endemic Great Plains fish. 67th Midwest Fish and Wildlife Conference. Omaha, NE.

Fischer, J., and C. P. Paukert. 2006. Factors influencing lotic fish-habitat relationships in the Great Plains. American Fisheries Society Annual Meeting, Lake Placid, NY.

Fischer, J., and C. P. Paukert. Habitat use of stream fishes in South Central Kansas. Kansas State University Biology Graduate Student Research Forum, Manhattan, KS.

Fischer, J., and C. P. Paukert. 2006. Environmental influences of stream fish in the Nebraska Sandhills. Nebraska Chapter of the AFS Annual Meeting, Gretna, NE.

Fischer, J., and C. P. Paukert. 2006. Fish habitat relationships in South Central Kansas. 31st Kansas Chapter of the American Fisheries Society Annual Meeting, Hays, KS.

Title: **High Water Habitat: Fish Populations in Two Kansas River Backwaters**

Funding: National Science Foundation
Kansas State University

Investigator: Andrea Severson, REU Student

Advisors: Dr. Craig P. Paukert

Completion: 2007

The Flood Pulse Concept states that flooding in large rivers may benefit fishes by providing spawning and nursery habitats as well as increased productivity. The Kansas River flooded in May 2007 and provided an opportunity to test the Flood Pulse Concept. We hypothesized that the flooding would result in greater fish abundances in the backwaters than in the main channel, and that fish would experience faster growth in the nutrient-rich backwater areas. Fishes in two Kansas River backwater and adjacent main channel areas were sampled using electrofishing and seining. No differences were found in fish abundances in the main channel or backwater areas, which did not support the hypothesis that the backwater areas would have greater fish abundances. However, two small-bodied fish species in one of the backwaters averaged greater

lengths than the same species sampled in the adjacent main channel. These data appear to support the hypothesis that fish would experience faster growth in backwater areas. However, it is possible that these larger fish were the result of increased sampling efficiency or an increased proportion of larger, spawning fish in the backwater versus the main channel. Also, it was assumed that these fish were all of the same age class, although no aging or determination of hatch date was attempted, and thus it is possible that the larger fish were older than their main channel counterparts. Nevertheless, backwater areas do appear to be productive, and further sampling in the future may reveal the true effects of the 2007 flooding.

Products:

Presentations:

Severson, A., J. Schloesser, K. Pitts, J. Eitzmann, and C. Paukert. 2008. Abundance and growth of fishes in main and secondary channels of the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Severson, A. 2007. High-water habitat: fish populations in two Kansas River backwaters. Research Experience For Undergraduates Student Research Symposium, Manhattan, KS.

2006

Effects of water willow establishment on littoral assemblages in Kansas reservoirs: Focus on Age-0 largemouth bass

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Timothy Strakosh, Ph.D. Student

Advisor: Keith Gido, Professor, Division of Biology

Completion: 2006

A large scale habitat manipulation was conducted to assess the effects of establishing an emergent macrophyte, American water willow *Justicia americana,* on littoral reservoir communities. Coves in three large (>1,800 ha) Kansas impoundments were chosen and half planted with water willow. Sampling was conducted during the summer from 2001 to 2004. I found that water willow coves had more complex habitat as well as higher abundance and diversity of fishes, macroinvertebrates, and zooplankton than control coves. However, strong temporal variation in water levels influenced the amount of inundated water willow available in these systems. The effects of water willow on density, growth, condition, and diet of age-0 largemouth bass *Micropterus salmoides* were assessed. Significantly higher densities of age-0 largemouth bass were found in water willow coves, but growth, condition, and diet did not differ between water willow and control coves. Therefore, water willow was able to support higher abundances of age-0 largemouth bass than control coves without affecting growth, condition, or diet. Characteristics of age-0 largemouth bass from the water willow coves were compared to those from two small impoundments (<80 ha) with abundant macrophyte and healthy largemouth bass populations. Small impoundments had higher densities of age-0 largemouth bass than water willow coves in the three large impoundments, but individuals on average also had lower growth, condition, and fewer fish in their diet. Thus, largemouth bass populations in small impoundments may be more regulated by density dependent factors than populations in large impoundments. Overall, water willow is beneficial to littoral areas, supporting an increase in both abundance and

diversity of assemblages. Finally, I used a field experiment to test the inundation and desiccation tolerance of water willow for different depths and durations. Water willow was susceptible to inundation, but resistant to desiccation. My findings provide information that can be used to select candidate reservoirs for water willow establishment based on expected water-level fluctuations.

Products:

Peer-reviewed and Scientific Publications:

Strakosh, T. R., K. B. Gido, and C. S. Guy. 2009. Effects of American water willow establishment on density, growth, diet, and condition of age-0 largemouth bass in Kansas reservoirs. Transactions of the American Fisheries Society 138:269-279.

Strakosh, T. R., J. L. Eitzmann, K. B. Gido, and C. S. Guy. 2005. The response of water willow, *Justicia americana*, to different inundation and desiccation regimes. North American Journal of Fisheries Management 25:1476-1485.

Thesis or Dissertation:

Strakosh, T.R. 2006. Effects of water willow establishment on littoral assemblages in Kansas reservoirs: Focus on Age-0 largemouth bass. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Gido)

Flathead catfish population dynamics in the Kansas River

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Andrew Makinster, M.S. Student

Advisor: Dr. Craig Paukert, Assistant Unit Leader

Completion: 2006

We investigated the spatial variation of flathead catfish Pylodictis olivaris relative abundance, condition, size structure, growth, and total annual mortality in the 274-km Kansas River. A randomized, electrofishing regime was used to collect fish throughout the river between May-August, 2005-2006. Relative abundance of age 1 fish (< 200 mm), subadult (> 200-400 mm), and adult fish (> 400 mm) ranged from 0.34 to 14.67 fish per hour, with lowest abundance of all sizes of fish occurring in the lowermost river segment. Increased abundance of age 1 flathead catfish appeared to be related to availability of riprap habitats, but no relation was found among larger fish. Body condition (relative weight) decreased with increased fish size and was consistent across river segments. Proportional stock density (PSD) remained consistent across all river segments ranging from 21 to 75. Mean length at age 3 ranged from 293 to 419 mm total length among river segments with the slowest growth occurring in the lowermost segment and fastest growth in upper segments of the river. Total annual mortality estimated from catch curves followed a similar trend and varied from 11-28% throughout the river with exploitation likely < 10% based on tag returns. Discriminant function analysis suggested flathead catfish abundance and growth differed among four reaches of the Kansas River. Simulation modeling of 305 mm, 610 mm, and 762 mm minimum length limits revealed PSD and relative stock density of preferred-sized fish (RSD-P) declined substantially (> 25 PSD units and > 15 RSD-P units) as exploitation increased regardless of river reach, suggesting different regulations among reaches was not needed. No substantial differences were observed in flathead catfish size structure with the 610 and 762 mm length limits among reaches; however, anglers would have to sacrifice

about 50% of the number flathead catfish harvested under current mortality conditions with a 610 mm length limit. Estimated mortality caps revealed that each reach could sustain about 60% and 55% total annual mortality to maintain current PSD and RSD-P levels, respectively. Spatial differences in population dynamics need to be considered when evaluating riverine fish populations. Maintaining a quality fishery for flathead catfish in the Kansas River may require more restrictive harvest regulations if exploitation increases.

Products:

Peer-reviewed and Scientific Publications:

Paukert, C. P., and *A. S. Makinster. 2009. Longitudinal patterns in flathead catfish relative abundance and length at age within a large river: effects of an urban gradient. River Research and Applications 25:861-873.

Makinster, A.S., and C. P. Paukert. 2008. Effects and utility of minimum length limits and mortality caps for flathead catfish in discrete reaches of a large prairie river. North American Journal of Fisheries Management 28:97-108.

Thesis or Dissertation:

Makinster, A.S. 2006. Flathead Catfish Population Dynamics in the Kansas River. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Paukert, C. P., and A. S. Makinster. 2007. Flathead catfish population dynamics in the Kansas River: implications for management. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

2003

Evaluation of habitat enhancement structure use by spotted bass in natural and experimental streams

Funding: Kansas Department of Wildlife and Parks

Investigator: Stanley L. Proboszcz, M. S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: 2003

A common method used to enhance salmonid populations is to improve lotic habitat by installing habitat enhancement structures. However, the effects of enhancement structures have not been evaluated for spotted bass *Micropterus punctulatus*. The objectives of this study were to evaluate use of half-log, rootwad structure, and LUNKERS (little underwater neighborhood keeper encompassing rheotactic salmonids), by adult and juvenile spotted bass in natural and experimental streams. Enhancement structures were installed in Otter Creek, Kansas. Adult spotted bass use of natural and enhancement structure was documented weekly during summer and fall of 2001 and 2002 using radiotelemetry. Mean home range size ws 3,158 m2 (SE = 705 m2). Selection ratios were high for enhancement structures (half-log = 21.8; LUNKERS = 4.2; rootwad structure = 1.1) and did not differ significantly from natural structure. Habitat use by juvenile spotted bass and the influence of a predator (flathead catfish Pylodictis olivaris) were evaluated in an experimental stream. Juvenile spotted bass used enhancement structures similarly to the field study. For example, half-log had the highest selection ratio (2.1) and no structure (an empty position) had the lowest (0.1). Mean velocity available was not significantly

different among half-log, rootwad structure, and LUNKERS; however, half-log and rootwad structure differed from no structure. Mean light intensity available was lowest for half-log and differed significantly from no structure and rootwad. Flathead catfish position had not significant effect on spotted bass habitat selection. These results indicate that juvenile spotted bass habitat use is a function of low velocity and low light intensity. In addition, half-log is the most appropriate structure to use for spotted bass lotic restoration projects and would likely benefit both juvenile and adult fish in Kansas streams.

Products:

Peer-reviewed and Scientific Publications:

Proboszcz, S.L. and Guy, C.S., 2006. Evaluation of Habitat Enhancement Structure Use by Spotted Bass. Prairie Naturalist, 38(4), pp. 223-238.

Thesis or Dissertation:

Proboszcz, S.L. 2003. Evaluation of habitat enhancement structure use by spotted bass in natural and experimental streams. M.S. Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

2002

Abiotic Factors and Species Interactions that Influence Recruitment of Walleyes in Kansas Reservoirs

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Michael C. Quist, Ph.D. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborators: James Stephen, Aquatic Research Biologist

Completion: 2002

Walleyes *Stizostedion vitreum* are an important secondary consumer and sport fish throughout the Great Plains; however, little is known about the factors influencing their recruitment in Kansas reservoirs. Therefore, the objective of the first study was to examine factors influencing variability in walleye recruitment over 20 years in seven Kansas reservoirs. Recruitment of walleyes was highly variable within and among reservoirs. A reduction in recruitment through time was not apparent for most reservoirs, but peaks in recruitment were generally highest in the 1980s. Strong walleye year classes were produced during years with warm spring temperatures, low water levels, and high storage ratios. Juvenile white crappie *Pomoxis annularis* abundance was negatively associated with walleye recruitment in all reservoirs. Mesocosm experiments suggested that predation may affect walleye recruitment when white crappie densities are high.

Many of the factors identified as important for walleye recruitment across Kansas reservoirs likely influence the early life history of walleyes. Therefore, the objective of the second study was to investigate the influence of temperature and prey availability on growth and survival of larval walleyes in Glen Elder Reservoir during 1999-2001. Despite similarities in zooplankton abundance among years, recruitment of walleyes in 1999 was the lowest in nearly 20 years, while moderate year classes were produced in 2000 and 2001. During 1999, low spring temperatures resulted in poor growth of walleyes. Larval gizzard shad *Dorosoma cepedianum*

were extremely abundant in 1999 and likely competed with larval walleyes for zooplankton resources. In addition, slow growth of walleyes in 1999 probably prevented walleyes from feeding on larval gizzard shad. Walleyes grew faster in 2000 and 2001 and were able to consume larval gizzard shad resulting in moderate recruitment.

Reservoirs are unique habitats for fishes. Not only are abiotic conditions different from natural lakes and rivers, but fish communities are comprised of species with little or no history of co-occurrence. The results of this study suggest that recruitment of walleyes is highly variable within and among reservoirs and further illustrates the importance of interactions between abiotic and biotic conditions.

Products:

Peer-reviewed and Scientific Publications:

Quist, M. C., J. L. Stephen, C. S. Guy, and R. D. Schultz. 2004. Age structure and mortality of walleyes in Kansas reservoirs: applications for establishing realistic management objectives. North American Journal of Fisheries Management 24:990-1002.

Quist, M.C., Guy, C.S., Bernot, R.J. and Stephen, J.L., 2004. Factors related to growth and survival of larval walleyes: implications for recruitment in a southern Great Plains reservoir. Fisheries Research, 67(2), pp.215-225.

Quist, M.C., K. R. Pember, C. S. Guy, and J. L. Stephen. 2004. Variation in larval fish communities: implications for management and sampling designs in reservoir systems. Fisheries Management and Ecology 11:107-116.

Quist, M. C., C. S. Guy, and R. J. Bernot. 2004. Anti-predator behavior of larval walleyes and saugeyes. Transactions of the Kansas Academy of Science 107: 69-76.

Quist, M. C., C. S. Guy, R. D. Schultz, and J. L. Stephen. 2003. Latitudinal comparisons of walleye growth in North America and factors influencing growth of walleyes in Kansas reservoirs. North American Journal of Fisheries Management 23:677-692.

Quist, M. C., C. S. Guy, and J. L. Stephen. 2003. Recruitment dynamics of walleyes (*Stizostedion vitreum*) in Kansas reservoirs: generalities with natural systems and effects of a centrarchid predator. Canadian Journal of Fisheries and Aquatic Sciences 60:830-839.

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Seasonal variation in condition, growth, and food habits of walleyes in a Great Plains reservoir and simulated effects of an altered thermal regime. Journal of Fish Biology 61:1329-1344.

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Efficiency of removing food items from walleyes using acrylic tubes. Journal of Freshwater Ecology 17:179-184.

Quist, M. C., R. J. Bernot, C. S. Guy, and J. L. Stephen. 2001. Seasonal variation in population characteristics of gizzard shad. Journal of Freshwater Ecology. 16(4): 641-646.

Quist, M. C., C. S. Guy, and J. L. Stephen. 2001. The effect of light shock on short-term survival of walleye fry. Transactions of the Kansas Academy of Science 104:158-163.

Technical and Semi-Technical:

Guy, C. S., W. K. Dodds, M. C. Quist, and R. J. Bernot. 2003. Stocking success and factors influencing survival and growth of stocked walleyes. Kansas Department of Wildlife and Parks, Project F-45-R-2, Emporia.

Thesis or Dissertation:

Quist, M.C. 2002. Abiotic Factors and Species Interactions that Influence Recruitment of Walleyes in Kansas Reservoirs. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Guy)

Presentations:

Quist, M. C. 2002. Abiotic and biotic factors influencing recruitment of walleyes in southern Great Plains reservoirs. Department of Zoology and Physiology, University of Wyoming, Laramie, Wyoming. PLATFORM (INVITED)

Quist, M. C., C. S. Guy, and J. L. Stephen. 2002. Abiotic factors and species interactions that influence recruitment of walleyes in reservoirs. 132nd Annual Meeting of the American Fisheries Society, Baltimore, Maryland. PLATFORM

Quist, M. C., R. J. Bernot, C. S. Guy, and J. L. Stephen. 2002. Seasonal variation in condition, growth, and food habits of walleye in Glen Elder Reservoir and potential effects of climate change on growth. 132nd Annual Meeting of the American Fisheries Society, Baltimore, Maryland. POSTER

Quist, M. C., K. R. Pember‡, C. S. Guy, and J. L. Stephen. 2002. Spatial and temporal variation in ichthyoplankton from Glen Elder Reservoir. 27th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. PLATFORM

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Seasonal variation in condition, growth, and food habits of walleyes in a Great Plains reservoir and simulated effects of an altered thermal regime. 27th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. POSTER

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Walleyes in Kansas reservoirs: a focus on Glen Elder Reservoir. Annual Meeting of the Kansas Department of Wildlife and Parks–Fisheries Division, Wichita, Kansas. PLATFORM (INVITED)

Bernot, R. J., M. C. Quist, W. K. Dodds, and C. S. Guy. 2002. Spatial and temporal variation in water chemistry, phytoplankton, and zooplankton characteristics in Glen Elder Reservoir. Annual Meeting of the Kansas Department of Wildlife and Parks–Fisheries Division, Wichita, Kansas. PLATFORM (INVITED)

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2001. Seasonal variation in condition, growth, and food habits of walleyes in a Great Plains reservoir and simulated effects of an altered thermal regime. 63rd Annual Midwest Fish and Wildlife Conference, Des Moines, Iowa. POSTER

Quist, M. C. 2001. Relationships between walleyes and white crappies in Kansas reservoirs. The Wildlife Society, Kansas State University, Manhattan, Kansas. PLATFORM (INVITED)

Quist, M. C., and C. S. Guy. 2000. Growth and recruitment of walleyes *Stizostedion vitreum* and interactions with white crappies *Pomoxis annularis* and gizzard shad *Dorosoma cepedianum* in reservoir systems. 26th Annual Forum for Student Research, Kansas State University, Division of Biology, Manhattan, Kansa. PLATFORM

Bernot, R. J., M. C. Quist, W. K. Dodds, and C. S. Guy. 2000. Temporal and spatial variability in zooplankton communities in Glen Elder Reservoir. 26th Annual Forum for Student Research, Kansas State University, Division of Biology, Manhattan, Kansas. PLATFORM

Quist, M. C., C. S. Guy, J. L. Stephen, and R. D. Schultz. 2000. Growth, mortality, and recruitment of walleyes and interactions with white crappies and gizzard shad in Kansas reservoirs. 25th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Manhattan, Kansas. PLATFORM

Quist, M.C., C.S. Guy, J.L. Stephen, and R.D. Schultz. 1999. Abundance of age-0 walleyes and interactions with gizzard shad, white crappie, black crappie, and adult walleyes in Kansas reservoirs. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Quist, M. C., and C. S. Guy. 1999. The influence of military training activities on physicochemical habitat and fish community structure and function in Flint Hills streams. 24th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Emporia, Kansas. PLATFORM

2000

The main Missouri River project

Growth of Fishes in the Missouri River and Lower Yellowstone River, and Factors Influencing Recruitment of Freshwater Drum in the Lower Channelized Missouri River

Funding: U. S. Army Corps of Engineers
Kansas Department of Wildlife and Parks
Missouri Department of Conservation

Investigators: Patrick J. Braaten, Ph. D. Student
Matthew R. Doeringsfeld, Research Assistant

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborators: Missouri River Benthic Fishes Consortium

Completion: September 2000

The first goal of this study was to discern patterns of growth and other life history characteristics of five fish species (emerald shiner *Notropis atherinoides*, Sicklefin chub *Macrhybopsis meeki*, freshwater drum *Aplodinotus grunniens*, river carpsucker *Carpiodes carpio*, sauger *Stizostedion canadense*) samples from 18 Missouri River segments varying from 38º 47' North to 48º 03' North. Populations in southern latitudes were shorter-lived, and had higher life-span growth rates than northern latitude populations. Growth increments (mm) of all species during the first and second growing seasons varied among latitudes, but growth rates (mm/degree-day, mm/day) increased from south to north for all species except sauger for which growth rates declined from south to north. Species exhibited differential growth responses to water velocity. Within river segments, growth increments were related to median discharge during the growing season in 30% of the species by river segment analyses; however, growth responses to discharge varied among species and river segments. Results suggest growth and life-history patterns of fishes in the Missouri River are strongly influenced by the thermal regime which varies directly with latitude. At reduced spatial scales (i.e., within segments), interannual variations in river discharge mediate differential fish growth.

The second goal of this study was to examine factors influencing recruitment of freshwater drum in the channelized Missouri River. Larval and age-0 freshwater drum were sampled during 1997 and 1998 at four study sites located 514, 581, 699, and 788 km downstream from Lewis and Clark Lake - an upstream spawning area and source of larval freshwater drum. Larval density declined form upstream to downstream in 1998, providing evidence that upstream areas were the primary spawning locations and sources of freshwater drum. This pattern was not observed in 1997; however, Lewis and Clark Lake was the primary source of larval freshwater drum available for colonization at all sites during both years. Catch per effort of age-0 freshwater drum during fall was positively related to larval density during both years. There was little evidence for size-selective overwinter mortality. Results emphasize the importance of upstream to downstream linkages in the recruitment dynamics of fishes in demographically open aquatic systems.

Previous Missouri River research on this project:

Population Structure and Habitat Use of Benthic Fishes Along the Missouri and Lower Yellowstone Rivers

The objectives of this multi-year, basin-wide research project are: 1) describe and evaluate recruitment, growth, size structure, body condition, and relative abundance of selected benthic fishes in the Missouri and lower Yellowstone Rivers, 2) measure physical habitat features (e.g, water velocity, turbidity) in macro- and mesohabitats where fishes are collected, and 3) describe the use of dominant macro- and mesohabitats by benthic fishes. The Kansas Cooperative Fish and Wildlife Research Unit is responsible for sampling fish and collecting habitat use information in the lower channelized Missouri River from Rulo, NE to Glasgow, MO. Sampling

was conducted from August through September 1998. Some of target benthic fishes collected included channel catfish *Ictalurus punctatus* (539), freshwater drum *Aplodinotus grunniens* (223), shovelnose sturgeon *Scaphirhynchus platorynchus* (204), flathead catfish *Pylodictis olivaris* (145), river carpsucker *Carpiodes carpio* (114), blue sucker *Cycleptus elongatus* (11), sauger *Stizostedion canadense* (9), and smallmouth buffalo *Ictiobus bubalus* (7). Other benthic fishes collected included emerald shiners *Notropis atherinoides*, sicklefin chubs *Macrhybopsis meeki*, flathead chubs *Platygobio gracilis*, sturgeon chubs *Macrhybopsis gelida*, and *Hybognathus* spp. In addition, a federally endangered pallid sturgeon *Scaphirhynchus albus* was collected near Leavenworth, KS.

Growth, Mortality, and Sources of Larval Freshwater Drum in the Lower Channelized Missouri River

Previous ichthyoplankton studies in the lower Missouri River have suggested that two areas in the unchannelized reaches of the Missouri River in South Dakota are the primary spawning sites and sources of freshwater drum *Aplodinotus grunniens* for the lower channelized Missouri River. This study was conducted to test this hypothesis, and to examine growth and mortality dynamics of larval freshwater drum in the lower channelized Missouri River. Larval freshwater drum were collected from May through July in 1997 and 1998 at four sites located 499, 579, 709, and 790 river kilometers downstream from the potential source areas. Density of freshwater drum larvae differed significantly ($P < 0.05$) among sites, sampling periods, and years. In addition, density declined from upstream to downstream. Instantaneous growth and mortality rates of larvae were similar among sites. Based on daily ages from otoliths and travel time flow estimates, we estimated that 30-95% of the larval freshwater drum collected in the channelized Missouri River originated in Lewis and Clark Lake and the unchannelized reaches of the Missouri River in South Dakota. These results provide evidence that the unchannelized Missouri River is an important source of freshwater drum for the lower channelized Missouri River, and emphasize the importance of upstream to downstream linkages in the recruitment dynamics of fish.

Precision of aging river carpsuckers using scales and dorsal fin rays

Several studies have examined the age and growth characteristics of river carpsucker *Carpiodes carpio*. Scales have been used for determining age in this species; however, researchers have noted that false annuli, inconsistencies in the location of annulus formation on scales, and the lack of "cutting over" of true annuli make age determinations difficult. Thus, an alternative body structure may reduce the variability of age determinations for this species. In this study, we compared the precision of age determinations between readers and mean back-calculated lengths at age of river carpsuckers using scales and dorsal fin ray sections from 172 individuals collected in the Missouri River. Age agreement between readers was 71% for both scales and dorsal fin ray sections. Similarly, age agreement between scales and fin rays within readers was 68% and 72%. Precision of age determinations between readers declined after age-5. The intercept value (*a* - value) calculated from the body length - structure length relationship was greater for fin rays (29.5) than scales (13.9). As a consequence, back-calculated lengths derived from scales were less than back-calculated lengths derived from rays. We suggest using scales to age and back-

calculate lengths for river carpsuckers; however, fin rays can be used to corroborate ages derived from scales.

Juvenile and adult fishes associated with tributary confluences in the lower Missouri River

We sampled juvenile and adult fish from seven tributary confluences in the channelized Missouri River throughout the annual hydrologic cycle to determine if fish use of these habitats was influenced by temporal changes in physicochemical variables in tributaries and the Missouri River. Seven sampling periods were pooled into four significantly ($P < 0.05$) distinct Missouri River water temperature groups representing periods of cold (December and January, mean = 1.5° C), cool (March, mean = 4.4° C), warm (May and October, mean = 17.0° C), and hot (June and July, mean = 26.2° C) water temperatures. Similarly, Missouri River discharge groups were significantly ($\underline{P} < 0.05$) delineated as periods of low (January, discharge = 82% of mean annual discharge), medium (October, December, March, mean = 142%), medium-high (July, mean = 164%), and high discharges (June and May, mean = 189%). Ten of 26 species composed > 90% of the fish collected. River carpsucker *Carpiodes carpio*, goldeye *Hiodon alosoides*, and sauger *Stizostedion canadense* were the most abundant species sampled. Fish density in tributary confluences was significantly higher ($P < 0.05$) during the Missouri River cool and hot temperature periods than the cold period. Fish density was positively related to tributary surface water temperature during the cool period ($r^2 = 0.62$, $P = 0.04$), and positively related to tributary maximum depth ($r^2 = 0.48$, $P = 0.04$) and Missouri River turbidity ($r^2 = 0.58$, $P = 0.02$) during the hot period. Fish density in the tributary confluences did not differ significantly ($P = 0.31$) among the four Missouri River discharge groups, but density was negatively related to tributary turbidity ($r^2 = 0.68$, $P = 0.04$) during the medium-high discharge period. Our results demonstrate that tributary confluences are used by juvenile and adult fishes native to the Missouri River, and provide important low-velocity habitat during most times of the year. The associations of fish with tributary confluences are influenced by temporal changes in physicochemical factors that vary throughout the annual hydrologic cycle in the Missouri River and tributaries.

Adult fishes associated with tributary confluences in the lower Missouri River

Tributary confluences provide some of the remaining low-velocity habitat available to fishes in the channelized lower Missouri River. Although studies have shown that tributary confluences are important habitats for larval and juvenile fishes, few studies have examined the temporal use of these habitats by adult fishes. The objectives of this study are: 1) examine the temporal changes in species composition of adult fishes in tributary confluences of the lower Missouri River in Kansas and Missouri, and 2) examine relationships between adult fish composition and physicochemical characteristics (e.g., turbidity, water temperature, depth) of tributary confluences and the Missouri River.

Inventory of Missouri River Fishes at Fort Leavenworth

This project was initiated to provide the U.S. Fish and Wildlife Service baseline information on the fishes in the Missouri River at Fort Leavenworth. Four stations were sampled quarterly (i.e., spring, summer, fall, and winter). Two stations were on outside bends (river km 642 and 652) and two on inside bends (river km 645 and 648). We sampled 21 species from 10 June 1996 to 13 December 1996. Emerald shiners (*Notropis atherinoides*), flathead catfish (*Pylodictus*

olivaris), and common carp (*Cyprinus carpio*) composed over 50% of the sample. We did not collect any threatened or endangered species. However, we did collect brassy minnows (*Hybognathus hankinsoni*) which are listed as species in need of conservation (SINC) by the Kansas Department of Wildlife and Parks.

Stranding of Pentagenia vittigera following flow reductions in the lower Missouri River

In December 1995, we observed numerous aquatic invertebrates exposed on a mud flat downstream from a wing dike in the lower Missouri River following decreases in navigation flows. During a 9-day period, water levels in the lower Missouri River declined 1.65 m. Stranded aquatic invertebrates were predominately *Pentagenia vittigera*. On three mud zones extending from the shoreline towards the water edge, mean numbers (number/m^2) of stranded *P. vittigera* were 0.80 (shoreline border zone), 86.0 (intermediate zone), and 51.0 (water edge zone). The estimated number of stranded *P. vittigera* on the mud flat was 6,400 individuals. Based on an analysis of December discharge and water levels from 1980-1994, it appears that the rate of water level declines and subsequent stranding of *P. vittigera* in 1995 were rare events. Our results indicate that rapid decreases in discharge associated with the transition period between the navigation and non-navigation seasons can negatively impact *P. vittigera*.

Products:

Peer-reviewed and Scientific Publications:

Braaten, P. J., and C. S. Guy. 2004. First-year growth, condition, and size-selective winter mortality of freshwater drum in the lower Missouri River. Transactions of the American Fisheries Society 133:385-398.

Pierce, C.L., Guy, C.S., Braaten, P.J., and Pegg, M.A., 2003, Fish growth, mortality, recruitment, condition, and size structure. Volume 4. Population structure and habitat use of benthic fishes along the Missouri and lower Yellowstone rivers. USGS Columbia Environmental Research Center Publication.

Braaten, P. J., and C. S. Guy. 2002. Life history attributes of fishes along the latitudinal gradient of the Missouri River. Transactions of the American Fisheries Society 131:931-945.

Braaten, P.J. and Guy, C.S., 1999. Relations between physicochemical factors and abundance of fishes in tributary confluences of the lower channelized Missouri River. Transactions of the American Fisheries Society, 128(6), pp.1213-1221.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1999. Comparison of age and growth estimates for river carpsuckers using scales and dorsal fin ray sections. North American Journal of Fisheries Management 19:786-792.

Braaten, P.J., and C.S. Guy. 1997. Stranding of *Pentagenia vittigera* following flow reductions in the lower Missouri River. Journal of Freshwater Ecology 12:493-494.

Technical and Semi-Technical:

Pegg, M.A., L. Coyle, C.L. Pierece, P.J. Braaten, M. Doeringsfeld, and C.S. Guy. 1998. Age and growth of Missouri River benthic fishes. Pages 175-199 in Young, B.A., T.L. Welker, M.L. Wildhaber, C.R. Berry, and D. Scarnecchia, editors. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone rivers. 1997 Annual Report of Missouri River Benthic Fish Study, PD-95-5832, U.S. Army Corps of Engineers.

Braaten, P.J., and C.S. Guy. 1997. Section: Channelized II, Kansas. Pages 239-244 in D.J. Dieterman, M.P. Ruggles, M.L. Wildhaber, and D.L. Galat, editors. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. 1996 Annual Report of Missouri River Benthic Fish Study, PD-95-5832. U.S. Army Corps of Engineers.

Braaten, P. J., and C. S. Guy, editors. 1995. Population structure and habitat use of benthic fishes along the Missouri River. Corps of Engineers, Annual Report PD-95-5832.

Thesis or Dissertation:

Braaten, P.J. 2000. Growth of Fishes in the Missouri River and Lower Yellowstone River, and Factors Influencing Recruitment of Freshwater Drum in the Lower Channelized Missouri River. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Guy)

Presentations:

Braaten, P.J., M.A. Pegg, C.S. Guy, and C.L. Pierce. 2000. Population dynamics of benthic fishes in the Missouri and lower Yellowstone Rivers. 130th Annual Meeting of the American Fisheries Society. St. Louis, MO.

Braaten, P.J., and C.S. Guy. 1999. Growth, mortality and sources of larval freshwater drum in the lower channelized Missouri River. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society.

Braaten, P.J., and C.S. Guy. 1999. Growth, mortality and sources of larval freshwater drum in the lower channelized Missouri River. 129th Annual Meeting of the American Fisheries Society.

Braaten, P.J. 1999. Overwinter survival and growth of age-0 freshwater drum in the channelized Missouri River. 61th Midwest Fish and Wildlife Conference. Chicago, IL (Poster).

Braaten, P.J., and C.S. Guy. 1998. Physiochemical determinants of fish abundance in tributary confluences of the lower channelized Missouri River. 2nd Annual Conference on Natural Resources of the Missouri River Basin, Nebraska City, NE.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1998. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Guy, C.S. 1998. Missouri River Benthic Fishes Project, Kansas Department of Wildlife and Parks Fisheries and Wildlife Division Meeting, Invited.

Guy, C.S., P.J. Braaten, M.A. Pegg, and C.L. Pierce. 1998. Growth and condition of benthic fishes in the Missouri River. 2nd Annual Conference on Natural Resources of the Missouri River Basin, Nebraska City, NE.

Braaten, P.J., and C.S. Guy. 1998. Growth, mortality and sources of freshwater drum larvae in the lower Missouri River. 60th Midwest Fish and Wildlife Conference.

Braaten, P.J. and C.S. Guy. 1997. Adult fishes associated with tributary confluences in the Lower Missouri River. 127th Annual Meeting of the American Fisheries Society.

Braaten, P.J., C.S. Guy, and the Missouri River Benthic Fishes Consortium. 1997. Habitat use and population dynamics of benthic fishes along the Missouri River. Annual Meeting of the Kansas Chapter of the American Fisheries Society, poster.

Braaten, P.J., M.N. Doeringsfeld, and C.S. Guy. 1997. Precision of aging river Carpsuckers using scales and dorsal fin rays. 1st Annual Conference on Natural Resources of the Missouri River Basin, Columbia, Missouri.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1997. Temporal dynamics of fish abundance in tributary confluences of the lower Missouri River. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Braaten, P.J., and C.S. Guy. 1997. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1997. Temporal dynamics of fish abundance in tributary confluences of the lower Missouri River. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Braaten, P. J., and C.S. Guy. 1996. Stranding of *Pentagenia vittigera* Following Flow Reductions in the Lower Missouri River. 58th Midwest Fish and Wildlife Conference, poster.

Temporal Variation in Growth, Condition, and Egg Diameter of White Bass in Fall River Reservoir

Funding: Kansas Department of Wildlife and Parks
Kansas Cooperative Fish and Wildlife Research Unit

Investigators: Randall D. Schultz, Aquatic Research Biologist
Christopher S. Guy, Assistant Unit Leader
Carson A. Cox, Fisheries Biologist

Completion: August 2000

White bass (*Morone chrysops*) were sampled monthly from March 1996 to August 1997 in Fall River Reservoir, Kansas to document temporal variation in gonad development, growth, and condition. Female and male white bass became sexually mature at age 2. Mean egg diameter

varied temporally with largest egg diameters occurring from March through May. Age structure was skewed toward younger ages with 91% of the females and 94% of the males sampled less than age 5. Growth in length and weight was variables between sexes. Female white bass grew faster in length and weight than males. Mean length and weight varied temporally by sex and year class, and specific growth in length and weight was highest during the summer and fall. During late winter and spring white bass lost up to 7% of the previous year's growth in weight. Variation in gonadosomatic index (GSI) for females paralleled variation in egg diameter, with higher GSI values in spring. The decline in weight during the later winter and spring with the increase in GSI indicated that somatic growth decreased during the spring. Relative weight was variables among seasons and was correlated with length only during the summer. Variation in growth and condition were best explained by the presence of age-0 gizzard shad. These data characterize the highly dynamic nature of gonad development, growth, and condition of white bass in a Kansas reservoir.

Products:

Peer-reviewed and Scientific Publications:

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Ecology of larval white bass in a large Kansas reservoir. North American Journal of Fisheries Management 22:637-642.

Cox, C. A., R. A. Schultz, and C. S. Guy. 2001. Diets of white bass in Fall River Reservoir, Kansas. Journal of Freshwater Ecology. 16:429-433.

Presentations:

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2001. Dynamics of larval white bass in a large Kansas reservoir. 26th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Pittsburg, Kansas. POSTER

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2000. Dynamics of larval white bass in a large Kansas reservoir. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium, St. Louis, Missouri. POSTER

Guy, C.S., R.D. Schultz, and C.A. Cox. 2000. Variation in gonad development, growth, and condition of white bass in Fall River Reservoir, Kansas. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium. St. Louis, MO.

Quist, M.C., and C.S. Guy. 2000. Spatial and temporal distribution of larval white bass in a Kansas reservoir. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium. St. Louis, MO.

Schultz, R.D., C.S. Guy, and D.A. Robinson, Jr. 2000. Recruitment of white bass in Kansas reservoirs: relations to reservoir hydrology and gizzard shad. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium. St. Louis, MO.

Growth, Food Habits, and Lipid Composition of Age-0 Largemouth Bass in El Dorado Reservoir

Funding: Kansas Department of Wildlife and Parks

Investigator: Jeff A. Tripe, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborator: Ronald E. Marteney, Fisheries Biologist

Completion: August 2000

Studies focusing on survival of largemouth bass *Micropterus salmoides* during the first year of life are critical to understanding recruitment variability. This study was conducted to provide baseline information on age-0 largemouth bass population characteristics and examine the factors influencing recruitment of largemouth bass in El Dorado Reservoir, Kansas.

Littoral shoreline areas were sampled biweekly from June 1 through August 30 in 1997 and 1998. During both years, the most common form of physical habitat among littoral areas was submerged terrestrial vegetation. Biomass of submerged terrestrial vegetation was approximately six times higher in 1997 than in 1998. Age-0 largemouth bass hatched as early as April 15 in 1997 and 1998. Density of age-0 largemouth bass was approximately three times greater in 1997 (631 per ha) than in 1998 (240 per ha). Growth and mortality rates of age-0 largemouth bass were similar between years. In both years, age-0 largemouth bass consumed macroinvertebrates during all sampling periods and overall length groups, while piscivory by age-0 largemouth bass was low. Triacylglyceride content (TAG) relative to the dry weight of each age-0 largemouth bass (TAGDW) decreased with increases in size and age

The experimental portion of the study compared survival, growth, and lipid content of age-0 largemouth bass in vegetated and non- vegetated mesocosms. Physicochemical variables and total zooplankton abundance were not different between vegetated and non- vegetated mesocosms. In general, macroinvertebrate production was higher in vegetated mesocosms than non-vegetated mesocosms. Catch per unit effort (CPUE; number per minute of electrofishing) of *Leopomis* spp. was four times greater in vegetated than non- vegetated areas. Survival of age-0 largemouth bass was similar between treatments. Growth rates and TAGDW of age-0 largemouth bass varied between treatments, and were lowest in vegetated mesocosms.

These results indicate the importance of high-quality littoral habitat for age-0 largemouth bass and *Leopomis* spp. production and recruitment. However, poor growth rates of age-0 largemouth bass may also be linked to decreased feeding efficiency in dense aquatic vegetation. In water bodies with low densities of aquatic vegetation, such as El Dorado Reservoir, increasing the quality and quantity littoral habitat will increase recruitment success of age-0 largemouth bass.

Products:

Peer-reviewed and Scientific Publications:

Tripe, J.A., and C.S. Guy. 1999. Spatial and temporal variation in habitat and fish community characteristics in a Kansas Flint Hills stream. Ecology of Freshwater Fish. 18:216-226.

Thesis or Dissertation:

Tripe, J. A. 2000. Density, Growth, Mortality, Food Habits, and Lipid Content of Age-0 Largemouth Bass in El Dorado Reservoir, Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Presentations:

Tripe, J.A., C.S. Guy, and R.E. Marteney. 1999. Density, growth, and food habits of age-0 largemouth bass in a Kansas reservoir. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society.

Tripe, J.A., C.S. Guy, and R. Marteney. 1998. Structure and dynamics of age-0 fish in the littoral zone of El Dorado reservoir. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Tripe, J.A. and C.S. Guy. 1998. Density, growth, and food habits of age-0 largemouth bass in a Kansas reservoir. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH.

Tripe, J.A., and C.S. Guy. 1997. Spatial and temporal variability of fish population characteristics in a warmwater stream. 59th Midwest Fish and Wildlife Conference.

Tripe, J.A., C.S. Guy, and C.S. Mammoliti. 1997. Spatial and temporal variability of fish population characteristics in a warmwater stream. Annual meeting of the Kansas Chapter of the American Fisheries Society.

Tripe, J.A., and C.S. Guy. 1997. Growth, food habits, and lipid composition of Age-0 Largemouth Bass in El Dorado Reservoir. Wichita Bass Club Meeting.

Movement Patterns and Habitat Use of Spotted Bass in Southeast Kansas Streams

Funding: Kansas Department of Wildlife and Parks

Investigator: Travis B. Horton, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborator: Thomas D. Mosher

Completion: December 2000

Understanding habitat use and movement patterns of fishes increases the success of habitat-restoration projects. Stream- habitat restoration and enhancement of stream-dwelling spotted bass *Micropterus punctulatus* populations is a long-term goal for the Kansas Department of Wildlife and Parks. Thus, the objectives of this study were to determine habitat use and movement patterns of spotted bass using radiotelemetry in Otter Creek, Kansas. Spotted bass were tracked biweekly from May 1998 through April 2000. Mean movement varied from 7.2 (m/h) to 18.1 (m/h) and differed significantly ($P = 0.002$, $F = 6.13$, $df = 37$) among seasons. Movement during spring and fall was significantly different ($P \leq 0.1$) compared to summer and winter movement. During all seasons, mean movement differed significantly ($P \leq 0.1$) among diel periods, and movement was typically lowest at night. A significant ($P = 0.0009$, $R^2 = 0.40$, $df = 29$) quadratic relationship existed between mean movment during daylight hours and water temperature, with peak movement at 16°C. The mean home range size used by spotted bass was 3,954 m^2 (SE = 537.7). Macrohabitat (i.e., pool, run, and riffle) use by spotted bass was non-random ($P = 0.0006$, Wilk's lambda (Λ) = 0.51, $df = 2$), and pool ranked significantly different ($P \leq 0.1$) than the ranks of run and riffle. Cover-habitat (i.e., open water, overhanging vegetation, log complex, rootwad, and undercut bank) use by spotted bass was non-random ($P = 0.0001$, $\Lambda = 0.06$, $df = 4$), and woody debris (i.e., log complex and rootwad) and undercut bank ranked highest. Cover-habitat compositional analysis by season showed similar patterns. Woody debris use did not differ significantly ($P \geq 0.1$) among diel periods for summer and fall, but did differ significantly ($P \leq 0.1$) during winter and spring. Spotted bass use of clay and bedrock substrate was similar to availability, and spotted bass used large substrates less than available. Spotted bass used fine substrates more than available; however, use of fine substrates was positively linearly correlated ($P = 0.004$, $r = 0.57$, $df = 23$) with use of log complexes. Fine substrates were more common within 2 m of log complexes than other substrates. The use of depth by spotted bass in pools was similar to availability. Use of velocity by spotted bass in pools varied from 0 to 0.46 m/s (mean = 0.03 m/s, SE = 0.0014), was similar to availability, and represented the low-velocity environment of pools in Otter Creek. These results indicate that spotted bass have distinct movement patterns, small home ranges, and extensively use woody debris and undercut-

bank habitats in pools. Thus, I suggest that subsequent habitat- restoration efforts focus on these habitats.

Products:

Peer-reviewed and Scientific Publications:

Horton, T. B., C. S. Guy, and J. Pontius. 2004. Influence of tracking interval on estimations of movement and habitat use. North American Journal of Fisheries Management 24: 690-696.

Horton, T.B. and Guy, C.S., 2002. Habitat use and movement of spotted bass in Otter Creek, Kansas. In American Fisheries Society Symposium (Vol. 31, pp. 161-171).

Thesis or Dissertation:

Horton, T.B. 2000. Habitat Use and Movement of Spotted Bass in Otter Creek, Kansas. Master's Thesis. Division of Biology, Kansas State University (Advisor: Guy)

Presentations:

Horton, T.B., and C.S. Guy. 2000. Habitat use and movement patterns of spotted bass in a Kansas stream. 130th Annual Meeting of the American Fisheries Society. St. Louis, MO.

Horton, T.B. 1999. Habitat use of spotted bass in a southeast Kansas stream. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Horton, T.B., and C.S. Guy. 1999. Vulnerability of spotted bass to angling in Kansas streams. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society (Poster).

Spatial and Temporal Variation in Abundance of Bighead Carp Larvae in the Channelized Missouri River

Funding: U. S. Army Corps of Engineers
Kansas Department of Wildlife and Parks
Missouri Department of Conservation

Investigator: Sally J. Schrank, M. S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: November 2000

Bighead Carp *Hypopthalmichthys nobilis*, an exotic planktivore, were introduced into Arkansas in 1973, and have subsequently dispersed upstream into the Mississippi River and its tributaries. Early life history characteristics of bighead carp in North American rivers have not been documented. The objectives of this study were to examine temporal and spatial variation in density of larvae, and estimate spawning date of bighead carp in the lower Missouri River. We sampled larval fish weekly at four sites between White Cloud, KS and Lexington, MO, from May through July 1997 and 1998. Density of larval bighead carp varied spatially and temporally. Larval bighead carp were only collected on June 25, 1997 and July 2 and 9, 1998 (3 of 19 sampling periods), and bighead carp were collected at all four sites (Lexington, MO; Kansas city, KS; St. Joseph, MO; White Cloud, KS) in 1997, but only at Kansas City, MO, and Lexington, MO, in 1998. Density was highest (24.4 larvae/m^3) at the most downstream site (Lexington, MO) and lowest (0.1 larvae/m^3) at the most upstream site (White Cloud, KS) in 1997. Bighead carp spawning occurred in three distinct period (June 16-19, 1997; June 23-26, 1998; July 3, 1998). Spawning in both years occurred in conjunction with a rise in discharge (an increase of 2,764 m^3/s in 1997 and 3,511 m^3/s in 1998) after water temperatures stabilized above

22ºC. These data demonstrate the link between water temperature and discharge as spawning cues and successful hatching criteria for bighead carp in the lower Missouri River.

Products:

None listed

Population Characteristics of Bighead Carp in the Missouri River and Interspecific Dynamics with Paddlefish

Funding: Kansas State University

Investigator: Sally J. Schrank, M. S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: November 2000

Basic biological data on bighead carp *Hypophthalmichthys nobilis* in the Missouri River are needed to predict potential ecological problems and provide a foundation for manipulative studies. The objectives of this study were to document spatial and temporal variability of larval bighead carp in the Missouri River, to assess age, growth and gonadal characteristics of bighead carp in the Missouri River, and to experimentally test for competitive interactions between bighead carp and paddlefish *Polyodon spathula*. Larval bighead carp were collected on June 25, 1997 and July 2 and 9, 1998 (3 of 19 sampling periods during May-July 1997 and 1998). Density was highest (24.4 larvae/m3) at the most downstream site (Lexington, MO) and lowest (0.1 larvae/m3) at the most upstream site (White Cloud, KS) in 1997. Spawning of bighead carp occurred in three distinct periods (June 16-19, 1997; June 23-26, 1998; July 3, 1998), in conjunction with a rise in discharge (> 2,700 m3/s) after water temperatures stabilized above 22°C. Adult bighead carp in our sample varied from age-3 to age-7 and length varied from 475 mm to 1,050 mm. There was variation in length at age and overall, bighead carp exhibited fast growth. For example, mean back-calculated length at age-3 was 556 mm. The sample was dominated by bighead carp from the 1994 year class. There was no difference in gonad development (gonadal somatic index, egg diameter) between winter and spring samples. Egg diameter frequencies exhibited a bimodal distribution, indicating protracted spawning. Mean fecundity was 226,213 eggs per female, with a maximum fecundity of 769,964. In a mesocosm experiment, age-0 paddlefish exhibited a decrease in relative growth in enclosures with bighead carp, while bighead carp exhibited a decrease in relative growth in enclosures without paddlefish. Bighead carp negatively affected growth of paddlefish through competition for food, and an increase in intraspecific competition negatively affected growth of bighead carp. These results suggest that bighead carp have become well established in the Missouri River, and may negatively influence paddlefish. It is likely that increased dispersal and population density of this exotic species will negatively affect native planktivores in the Missouri River.

Products:

Peer-reviewed and Scientific Publications:

Schrank, S. J., C. S. Guy, and J. F. Fairchild. 2003. Competitive interactions between age-0 bighead carp and paddlefish. Transactions of the American Fisheries Society 132:1222-1228.

Schrank, S. J., and C. S. Guy. 2002. Age, growth, and gonadal characteristics of adult bighead carp *Hypophthalmichthys nobilis* in the lower Missouri River. Environmental Biology of Fishes. 64:443-450.

Schrank, S. J., P. J. Braaten, and C. S. Guy. 2001. Spatiotemporal variation in density of larval bighead carp in the lower Missouri River. Transactions of the American Fisheries Society 130:809-814.

Thesis or Dissertation:

Schrank, S.J. 2000. Population Characteristics of Bighead Carp Hypophthalmichthys nobilis Larvae and Adults in the Missouri River and Interspecific Dynamics with Paddlefish Polyodon spathula. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Presentations:

Schrank, S.J., and C.S. Guy. 2000. Bighead carp in the Missouri River. Asian carp management and control workshop, Invited.

Schrank, S.J., and C.S. Guy. 2000. Bighead carp life history characteristics in the lower Missouri River. 130th Annual Meeting of the American Fisheries Society. St. Louis, MO.

Schrank, S.J., and C.S. Guy. 1999. Population and reproductive characteristics of bighead carp in the lower Missouri River. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Schrank, S.J. and C.S. Guy. 1999. Spatial and temporal variation in abundance of bighead carp in the channelized Missouri River. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society. (Poster).

Topeka Shiner

Funding: U.S. Fish and Wildlife Service
U.S. Geological Survey-Biological Resources Division

Investigators: Sally J. Schrank, M.S. Student
Dr. Christopher S. Guy, Assistant Unit Leader

Completion: June 2000

The Topeka shiner *Notropis topeka* has declined in abundance throughout its historical range in the central U.S. As a result, this minnow was listed as federally endangered in 1999. The objective of our study was to quantitatively assess instream physical, chemical, and biological parameters and landscape-level factors influencing the distribution (i.e., extant or extirpated) of Topeka shiners. We sampled 26 streams in the Flint Hills region of Kansas: 12 sites where Topeka shiners are extant, and 14 sites where they are extirpated. Multivariate analysis of variance was used to test if variables were different between extant and extirpated sites. Mean catch per effort of largemouth bass in stream pools was higher at extirpated sites, and species diversity by trophic guild and richness in stream pools were higher at extirpated sites. Stepwise logistic regression was used to develop a model to predict whether Topeka shiners were extant or extirpated. Number of small impoundments per watershed area, catch per effort of largemouth bass *Micropterus salmoides* in pools, and length of pool were the only significant variables in the logistic model. Our model correctly classified 83% of extant sites and 85% of extirpated sites. In a landscape-level analysis of 111 streams, only number of small impoundments per watershed area was significant in the logistic model. These results provide predictive tools to assess instream and landscape-level characteristics for habitat management and possible reintroduction of Topeka shiners in Kansas Flint Hills streams.

Products:

Peer-reviewed and Scientific Publications:

Schrank, S. J., C. S. Guy, M. R. Whiles, and B. L. Brock. 2001. Influence of instream and landscape-level factors on the distribution of Topeka shiners *Notropis topeka* in Kansas streams. Copeia 2001 (2)413-421.

Technical and Semi-Technical:

Guy, C.S., and M.R. Whiles. 2000. Assessment of physicochemical and landscape features influencing Topeka shiner (*Notropis topeka*) distribution in Kansas streams. Final Report, U.S. Geological Survey.

Presentations:

Guy, C.S., S.J. Schrank, M.R. Whiles, and B.R. Brock. 2000. Influence of instream, and landscape-level factors on the distribution of Topeka shiners in Kansas Streams. 62nd Midwest Fish and Wildlife Conference.

Guy, C.S., S.J. Schrank, M. Whiles, and B. Brock. 2000. Assessment of physicochemical, biological, and landscape level factors influencing presence or absence of Topeka shiner populations in Kansas streams, Topeka shiner recovery plan meeting, Invited.

Long-term Fisheries Data Collection on Kings Creek

Funding: National Science Foundation - LTER

Investigators: Jeff A. Tripe, Research Assistant
Dr. Christopher S. Guy, Assistant Unit Leader

A long-term sampling program was initiated in May of 1995 on Kings Creek located within the Konza Prairie Research Natural Area. The objective of this project is to document fish population form and function characteristics (e.g., species diversity, relative abundance, and mean length) and stream morphometry (particularly stream depth, width, velocity and substrate type) on a large spatial scale. Hopefully, the long-term data set will allow us to better understand the relationships between stream morphometry and fish population dynamics in Flint Hills streams.

Products:

Peer-reviewed and Scientific Publications:

Franssen, N.R., Gido, K.B., Guy, C.S., Tripe, J.A., Shrank, S.J., Strakosh, T.R., Bertrand, K.N., Franssen, C.M., Pitts, K.L. and Paukert, C.P., 2006. Effects of floods on fish assemblages in an intermittent prairie stream. Freshwater Biology, 51(11), pp.2072-2086.

Fritz, K.M., Tripe, J.A. and Guy, C.S., 2002. Recovery of three fish species to flood and seasonal drying in a tallgrass prairie stream. Transactions of the Kansas Academy of Science, 105(3), pp.209-218.

Presentations:

Tripe, J.A., and C.S. Guy. 1997. Long-term sampling in Kings Creek. 9th Annual Konza Prairie Workshop.

Tripe, J.A., and C. S. Guy. 1996. Long-term sampling in Kings Creek. 8th Annual Konza Prairie Workshop.

1999

Structure and Function of Fish Communities in Streams on the Fort Riley Military Reservation, Kansas

Funding: Department of Defense, Fort Riley

Investigator: Michael C. Quist, M. S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborators: Chris S. Mammoliti, Aquatic Ecologist
B. Craig Phillips, Range Conservationist

Completion: December 1998

Instream habitat is important in determining fish community characteristics; however, few studies have been conducted to determine the influence of physicochemical habitat on fish community structure and function in tallgrass-prairie streams. In addition, little is known about the influence of military activities on soil and vegetation characteristics and the effects on instream habitat and fish community characteristics. Thus, the purpose of this study was to provide information on the relationships among physicochemical habitat variables and fish community structure and function on Fort Riley Military Reservation and to determine the influence of large-scale disturbance on instream habitat and fish assemblages. Sampling sites were selected from headwater, middle (mid), and lower reaches and sampled during June and July 1997, 1998. Physical habitat and fish communities were sampled within each macrohabitat (i.e., pools and riffles). Percent disturbance within a watershed was positively correlated with percent silt in pool macrohabitats from headwater and mid reaches. Percent canopy cover was inversely correlated with aquatic vegetation in all reaches and positively correlated with area of woody habitat (e.g., bank root, rootwad) in headwater and mid reaches. In riffle macrohabitats, percent disturbance was inversely correlated with mean depth, width, and velocity for headwater reaches. Percent disturbance and silt were highest in headwater reaches; therefore, few species were collected from headwater sites. However, a slight improvement in habitat heterogeneity (e.g., gravel) was associated with higher species richness. The increase in species richness was due to the addition of trophic generalists and tolerant species. Species richness and diversity were positively correlated with percent disturbance in mid-reach watershed and was reflective of increase abundance of omnivores and tolerant species. Most relationships in lower reaches (pools and riffles) were associated with hydrologic or stream morphologic variables (e.g., width, depth, velocity). In riffle macrohabitats, percent disturbance was inversely correlated with catch per unit effort (C/f) of benthic-insectivores in headwater reaches and positively correlated with C/f of tolerant species in mid reaches. Riparian area variables (e.g., canopy cover, bank root) in pool macrohabitats were positively correlated with trophic guild diversity, C/f of benthic-insectivores, generalized-insectivores, omnivores, and intolerant species among reaches. Similar relationships were found in riffle macrohabitats where riparian area variables were positively correlated with C/f of benthic-insectivores and omnivores and inversely correlated with C/f of tolerant species. The results of this study suggest the importance of large-scale disturbance and woody-riparian vegetation to instream habitat and fish community characteristics.

Products:

Peer-reviewed and Scientific Publications:

Quist, M. C., P. A. Fay, C. S. Guy, A. K. Knapp, and B. N. Rubenstein. 2003. Effects of military training on terrestrial and aquatic communities on a grassland military installation. Ecological Applications 13:432-442.

Quist, M. C., and C. S. Guy. 2001. Growth and mortality of prairie stream fishes and relations with instream habitat. Ecology of Freshwater Fish. 10:88-96.

Technical and Semi-Technical:

Quist, M. C., and C. S. Guy. 1999. Structure and function of fish communities on Fort Riley Military Reservation. Completion Report, Directorate of the Environment and Safety, Fort Riley Military Reservation, Fort Riley, Kansas.

Quist, M. C., and C. S. Guy. 1998. Stream resources on Fort Riley Military Reservation. Educational brochure, Directorate of the Environment and Safety, Fort Riley Military Reservation, Fort Riley, Kansas.

Thesis or Dissertation:

Quist, M.C. 1999. Structure and function of fish communities in streams on Fort Riley Military Reservation. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Presentations:

Quist, M. C., and C. S. Guy. 2001. Growth and mortality of prairie stream fishes: relations with fish communities and instream habitat. 26th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Pittsburg, Kansas. POSTER

Quist, M. C., and C. S. Guy. 2000. Growth and mortality of prairie stream fishes: relations with fish communities and instream habitat. 62nd Annual Midwest Fish and Wildlife Conference, Minneapolis, Minnesota. POSTER

Quist, M.C., P.A. Fay, C.S. Guy, A.K. Knapp, B.N. Rubenstein, and C. Phillips. 2000. The influence of disturbance from military training on terrestrial aquatic linkages in a tall grass prairie ecosystem. 65th North American Wildlife and Natural Resource Conference, National Military Fish and Wildlife Association, Rosemont, Illinois.

Quist, M.C., and C.S. Guy. 1999. The effects of large-scale disturbance from military activity on instream habitat and fish community characteristics in streams on Fort Riley Military Reservation. 129th Annual Meeting of the American Fisheries Society, Charlotte, NC.

Quist, M.C., and C.S. Guy. 1999. The influence of military training activities on physicochemical habitat and fish community structure and function in Flint Hills streams. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society, Emporia, KS.

Quist, M.C., and C.S. Guy. 1998. Structure and function of fish communities and relations with training activities on Fort Riley Military Reservation. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH.

Quist, M. C., and C. S. Guy. 1997. Stream sampling and fish communities on Fort Riley Military Reservation. Fort Riley Natural Resources Department, Fort Riley Military Reservation, Kansas. PLATFORM (INVITED)

1998

Vulnerability of Spotted Bass to Angling in Kansas Streams

Funding: Kansas Department of Wildlife and Parks

Investigators: Travis B. Horton, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborators: Thomas D. Mosher

Completion: December 1998

In 1996 and 1998, standardized angling was conducted on four streams to determine the vulnerability of stock-length (≥180 mm) spotted bass to angling. Block nets were used to prevent movement of fish into or out of the reach. Two anglers fished the entire reach from the bank. After angling was completed, spotted bass were sampled using pulsed-DC backpack electrofishing equipment. A three-pass depletion method was used to estimate density. Population estimates varied from 8 to 19 stock-length spotted bass per stream reach and density varied from 21 to 63 spotted bass/ha. Mean angler catch per effort (CPE) was 0.39 fish/h and potential harvest was 5.1 fish/ha. Percent of the spotted bass population that was captured by angling varied from 0% to 26%.

Products:

Peer-reviewed and Scientific Publications:

Horton, T.B., J.S. Tillma, and C.S. Guy. 2000. Vulnerability of spotted bass to angling in Kansas streams. Journal of Freshwater Ecology 15:7-11.

Presentations:

Horton, T.B., J.S. Tillma, and C.S. Guy. 1998. Vulnerability of spotted bass to angling in Kansas streams. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH (Poster).

Population Characteristics of Channel Catfish from the Kansas River

Funding: Department of Defense, Fort Riley
Kansas State University, Division of Biology Seed Grant

Investigator: Michael C. Quist, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: April 1998

Channel catfish *Ictalurus punctatus* were sampled from the Kansas River during October 1996 and August 1997 from Fort Riley Military Reservation and during August 1997 near Lawrence, Kansas. Fish varied in length from 100 to 506 mm at Fort Riley and from 120 to 637 mm at Lawrence. Catch per unit effort (number per net-night) was greater at Lawrence than at Fort Riley. Proportional stock density values were 23 and 48 for the Fort Riley and Lawrence samples, respectively. Individuals from both populations were in poor condition and typically had relative weight values less than 90. Age structure was similar between locations; however, approximately 44% of the channel catfish from Fort Riley were from the 1993 year class. Mean back-calculated lengths at age were significantly higher at Lawrence than Fort Riley for fish of ages 1 through 4 ($P \leq 0.05$). Incremental growth analysis on channel catfish from Fort Riley indicated that growth was fastest during 1993. Channel catfish collected near Lawrence did not exhibit the same trends in recruitment and growth. These data illustrate spatial variation in population characteristics of channel catfish in a prairie river and suggest the importance of over-bank discharge on recruitment and growth.

Products:

Peer-reviewed and Scientific Publications:

Quist, M.C., and C.S. Guy. 1998. Population characteristics of channel catfish from the Kansas River, Kansas. Journal of Freshwater Ecology. 13(3):351-359.

Standard Weight (Ws) Equation for Flathead Catfish

Investigator: Michael C. Quist, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: April 1998

Weight-length data were solicited from biologists within the geographic distribution of flathead catfish (*Pylodictus olivaris*). A standard weight equation (W_s) will be developed using the regression-line-percentile (RLP) technique and correlations between size structure and relative weight (W_r) will be assessed. The W_s equation will provide a tool for managers to describe condition of flathead catfish.

Products:

Peer-reviewed and Scientific Publications:

Bister, T. J., D.W. Willis, M. L. Brown, R. M. Neumann, S. M. Jordan, C. S. Guy, M. C. Quist. 2000. Proposed standard weight (*Ws*) equations and standard length categories for 18 warmwater nongame and riverine fish Species. North American Journal of Fisheries Management 20:570-574.

Presentations:

Bister, T.J., D. W. Willis, M.L. Brown, R.M. Neumann, S.M. Jordan, C.S. Guy, and M.C. Quist. 1999. Proposed standard weight (Ws) equations for 19 game and non-game fishes. 129th Annual Meeting of the American Fisheries Society (Poster)

Bister, T.J., D.W. Willis, M.L. Brown, R.M. Neumann, S.M. Jordan, C.S. Guy, and M.C. Quist. 1999. Development of standard weight (Ws) equations for 18 game and non-game fishes. 35th annual Meeting of the Dakota Chapter, American Fisheries Society (Poster).

Spatial Variation in Population Characteristics of Shovelnose Sturgeon in the Kansas River

Funding: Department of Defense, Fort Riley
Kansas State University, Division of Biology Seed Grant

Investigator: Michael C. Quist, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: May 1998

Shovelnose sturgeon *Scaphirhynchus platorynchus* were collected from the Kansas River during August 1997 from Fort Riley Military Reservation and Lawrence Kansas. Catch per unit effort (number per meter) of shovelnose sturgeon was not significantly different between locations (P = 0.16). Catch per unit effort was highest in channel crossover macrohabitats at both locations. We estimated that 52 drifts in channel crossovers, 72 drifts in inside bends, and 300 drifts in outside bends were required for the coefficient of variation to equal 20% at Fort Riley; however, channel crossovers required the most drifts (N = 45) followed by outside bends (N = 35) and inside bends (N = 20) at Lawrence. Size structure [i.e., proportional stock density, relative stock density of preferred-length fish (≥ 510 mm)] was significantly higher at Fort Riley ($P \leq 0.01$), Mean population relative weight (*Wr*) was significantly higher at Lawrence (P = 0.006), but *Wr* of preferred-length fish was similar between locations (P = 0.54). Shovelnose sturgeon sampled from Lawrence had significantly higher mean back-calculated lengths at age ($P \leq 0.05$; all ages) and mean annual growth increments ($P \leq 0.05$; except ages 11 and 12). Spatial variation in population characteristics of shovelnose sturgeon indicate that management decisions may differ longitudinally within a river.

Products:

Peer-reviewed and Scientific Publications:

Quist, M.C., and C.S. Guy. Variation in population characteristics of shovelnose sturgeon in the Kansas River. The Prairie Naturalist 31:65-74.

Quist, M.C., J.S. Tillma, M.N. Burlingame, and C.S. Guy. 1999. Overwinter habitat use of shovelnose sturgeon in the Kansas River. Transactions of the American Fisheries Society. 128:522-527.

Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (Ws) equation and length categories for shovelnose sturgeon. North American Journal of Fisheries Management 18:992-997.

Presentations:

Guy, C. S., and M. C. Quist. 2001. Potential influence of harvest of shovelnose sturgeon populations in the Missouri River system: A case for pro-active management. Missouri Department of Conservation shovelnose sturgeon commercial harvest closure workshop. Invited.

Quist, M. C., C. S. Guy, M. A. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri and Yellowstone Rivers. 5th Annual Missouri River Natural Resource Conference.

Quist, M. C., C. S. Guy, M. S. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system: a case for pro-active management. 131st Annual Meeting of the American Fisheries Society.

Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (Ws) equation for shovelnose sturgeon. 2nd Annual Conference on Natural Resources of the Missouri River Basin, Nebraska City, NE.

Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (Ws) equation for shovelnose sturgeon. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Age and Growth of White Bass in Kansas Reservoirs

Funding: Kansas Department of Wildlife and Parks
Kansas Cooperative Fish and Wildlife Research Unit

Investigators: Randall D. Schultz, Aquatic Research Biologist
Dr. Christopher S. Guy, Assistant Unit Leader

Completion: November 1999

White bass (*Morone chrysops*) scales and otoliths were collected from 18 reservoirs throughout Kansas. Age and growth characteristics and the factors that influence growth will be determine. In addition, age and growth characteristics will be analyzed between hard structures (i.e., scales and otoliths) to determine if one structure provides more precise estimates.

Products:

None listed

Movement Patterns and Habitat Use of Spotted Bass in Southeast Kansas Streams

Funding: Kansas Department of Wildlife and Parks

Investigator: Travis B. Horton, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: December 2000

The spotted bass *Micropterus punctulatus* is a popular sportfish in the United States. Subsequently, most research on spotted bass has been conducted in lentic ecosystems. There is a paucity of information regarding spotted bass life history characteristics and habitat use in Kansas streams. Thus, the objectives of this study are to document movement patterns and habitat use of spotted bass. Seasonal and diel movement data will be collected from May 1998 to April 2000. In addition, habitat data (i.e., depth, substrate, current velocity, temperature, and macrohabitat type) will be determined for each spotted bass location. Movement patterns and habitat use will be compared among seasons and diel periods. During 1998, 1,100 locations were recorded on 16 spotted bass. Preliminary results indicate that spotted bass use woody debris in higher proportion than available (Ivlev's selectivity index; 0.74). In addition, spotted bass used gravel, sand, silt, and clay in higher proportion than available (Ivlev's selectivity index; 0.47, 0.71, 0.07 and 0.11 respectively). Spotted bass did not exhibit large-scale movement patterns. For example, most spotted bass stayed within a 70 m to 550 m stream reach. Spotted bass were more active during the day than night

Products:
None listed

Mortality of Hatchery-Reared Walleye Fry Using Various Hauling Methods and Varying Hauling Times

Funding: Kansas Department of Wildlife and Parks

Investigator: Michael C. Quist, Ph.D. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborators: James Stephen, Aquatic Research Biologist

Completion: April 1999

The Kansas Department of Wildlife and Parks (KDWP) annually stocks 35 million fry in reservoirs across the state, but little is known about the survival of walleye fry during transportation. The goal of this study is to determine the influence of different hauling techniques (e.g., hatchery bags versus hatchery jugs) and hauling times on survival of hatchery-reared walleye fry. The results of this study will provide techniques that enable maximum survival of walleye fry to Kansas reservoirs.

Products:
None listed

1997

Abiotic and Biotic Factors Influencing Spotted Bass in Southeast Kansas Streams

Funding: Kansas Department of Wildlife and Parks

Investigator: Jeff Tillma, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborator: Chris S. Mammoliti, Aquatic Ecologist

Completion: May 1997

Spotted bass *Micropterus punctulatus* are a popular sportfish in streams and reservoirs throughout the southeastern U.S. Despite their popularity there is a paucity of research regarding population characteristics, habitat requirements, and vulnerability to angling, especially in streams. The purpose of this study was to investigate age and growth, influence of abiotic and biotic habitat variables on population characteristics, and angling vulnerability of spotted bass in southeast Kansas streams.

Study sites were selected throughout the native range of spotted bass in Kansas. Spotted bass were sampled by electrofishing, and 36 habitat variables were measured at 19 study sites. Linear regression analysis (single and multiple) was used to determine relationships between habitat variables and density, biomass, catch per effort (CPE) relative weight (Wr), and growth.

Mean back-calculated length at age 2 varied from 139 mm to 263 mm. Mean ultimate length (L) was 495 mm for spotted bass in streams compared to 450 mm for spotted bass in Kansas reservoirs. Variability in density was best explained by area of rootwads ($P= 0.002$, $r= 0.70$), and percent pebble substrate ($P= 0.004$, $r= 0.64$). Biomass of spotted bass was positively correlated with area of logs ($P= 0.001$, $r= 0.75$). Catch per effort for quality-length ($\geq$280 mm) spotted bass was positively correlated with area of bank roots ($P= 0.01$, $r= 0.64$) and area of rootwads ($P=0.0001$, $r= 0.84$). Relative weight (Wr) was negatively correlated with biomass ($P= 0.001$, $r= -0.71$) and mean back-calculated length at age 3 was positively correlated with overall mean Wr($P= 0.008$, $r= 0.89$). These data indicate that habitat, especially woody debris, influences spotted bass populations in Kansas streams.

Standardized angling was conducted on three streams to study the vulnerability of stock-length ($\geq$180 mm) spotted bass to angling. Mean angler CPE was 0.26 fish/h and potential harvest was 2.7 fish/ha. Percent of the spotted bass population that was vulnerable to harvest varied from 0% to 15.4%. Thus, it is likely that 43% of spotted bass $\geq$ 180 mm could be harvested in 19.0 h (five angler trips). These data illustrate the vulnerability of spotted bass to angling.

Products:

Peer-reviewed and Scientific Publications:

Delp, J.G., J.S. Tillma, M.C. Quist, and C.S. Guy. 2000. Age and growth of four centrarchid species in southeastern Kansas streams. Journal of Freshwater Ecology 15:475-478.

Tillma, J.S., C.S. Guy, and C.S. Mammoliti. 1998. Relations among habitat and population characteristics of spotted bass in Kansas streams. North American Journal of Fisheries Management. 18:886-893.
Tillma, J.S., and C.S. Guy. 1998. Growth of spotted bass in Kansas streams and impoundments. The Prairie Naturalist. 30:144-149.

Technical and Semi-Technical:

Tillma, J.S., and C.S. Guy. 1997. Evaluation of spotted bass populations in Kansas streams. Kansas Department of Wildlife and Parks, Final Report, Project F-27-R.

Thesis or Dissertation:

Tillma, J.S. 1997. Characteristics of spotted bass in southeast Kansas streams. Master's Thesis. Division of Biology, Kansas State University. 64 pp. (Advisor: Guy)

Presentations:

Tillma, J.S., C.S. Guy, and C.S. Mammoliti. 1997. Abiotic and biotic factors influencing Spotted Bass in southeast Kansas streams. Annual Meeting of the Kansas Chapter of the American Fisheries Society.
Tillma, J.S., and C.S. Guy. 1996. Abiotic and Biotic Factors Influencing Spotted Bass *Micropterus punctulatus* in Southeast Kansas Streams. 58th Midwest Fish and Wildlife Conference.

Spatial and Temporal Variability of Fish Population Characteristics in a Warmwater Kansas Stream

Funding: Kansas Department of Wildlife and Parks

Investigator: Jeff A. Tripe, Research Assistant

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborator: Chris S. Mammoliti, Aquatic Ecologist

Completion: June 1997

Spatial and temporal variation in catch per unit effort (CPUE), mean length, body condition (Kn and Wr), and species diversity (H'; Shannon-Weaver) were evaluated at four reaches (mouth, lower midreach, upper midreach, headwaters) on the West branch of Mill Creek, Kansas, from June 1995 to October 1996. Fish were sampled bimonthly at each reach by electrofishing. A total of 49,695 fish representing 50 species were collected. Bluntnose minnow (*Pimephales notatus*), central stoneroller (*Campostoma anomalum*) and red shiner (*Cyprinella lutrensis*) composed 62% of fish sampled. Species diversity differed significantly ($P = 0.0002$) among reaches, with the mouth and upper midreach stations having the highest diversity. In general, relative abundance, mean length, and body condition exhibited spatial and temporal variation. Catch per unit effort for feeding guilds and habitat guilds differed significantly ($P \leq 0.05$) among locations except for the surface-water column insectivore guild ($P = 0.59$), benthic insectivore guild ($P = 0.22$) and riffle guild ($P = 0.48$). These data indicate that it is important to standardize warmwater stream sampling both spatially and temporally, especially when developing long-term data sets.

Products:

Peer-reviewed and Scientific Publications:

Tripe, J.A., and C.S. Guy. 1999. Spatial and temporal variation in habitat and fish community characteristics in a Kansas Flint Hills stream. Ecology of Freshwater Fish. 18:216-226.

Technical and Semi-Technical:

Tripe, J.A., and C.S. Guy. 1998. Seasonal variation of fish population characteristics in a warmwater stream. Kansas Department of Wildlife and Parks, Final Report, Project F-24-R.

Presentations:

Tripe, J.A., and C.S. Guy. 1996. Spatial and Temporal Variability of Fish Population Characteristics in a Warmwater Stream. 58th Midwest Fish and Wildlife Conference.

Licensed Angler Use and Preference Survey and Attitudes Toward Angling by Secondary Education Students

Funding: Kansas Department of Wildlife and Parks

Investigator: Matthew N. Burlingame, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborator: Thomas D. Mosher, Aquatic Research Coordinator

Completion: December 1997

The 1995 licensed angler survey was initiated to study the opinions of Kansas resident, lifetime and non-resident anglers. It was designed to describe the demographic patterns of these angler groups and determine if there were differences in opinions and preferences toward angling among user groups. In addition, the study determined the opinions of secondary education students with regards to angling and the outdoors. A total of 14,302 surveys were mailed to Kansas resident, lifetime, and non-resident anglers and response rates after three mailings were 56%, 75%, and 59%, respectively. Telephone follow-up interviews were conducted on 253 non-respondent resident anglers to account for non-response bias. Comparisons between non-respondent and respondent resident anglers revealed few differences; therefore the angler survey results were not adjusted for non-respondents. All licensed anglers were predominately male, 30-49 years old, with some college education, and a gross income between $30,001 and $50,000 in 1995. Resident and lifetime anglers ranked largemouth bass as their most favored species of fish to catch. Non-residents indicated they preferred to catch crappie more than any other species. Resident and non-resident licensed anglers selected federal reservoirs as their most preferred body of water to fish; whereas lifetime anglers selected private lakes and ponds. All three licensed-angler types indicated that habitat improvement, fish management, and fisheries research were important KDWP management activities. Anglers also expressed support for threatened and endangered species by indicating that management of these species was important. Anglers believed that their license dollars are wisely spent in Kansas. Student anglers indicated that they preferred to fish for largemouth bass. Students also preferred to fish in large lakes. Nearly half the students' rates catching a big fish as "Critical" compared to the majority of residents selecting "Somewhat important" and "Not important." Students did indicate that catching any kind of fish was significantly more "Critical" to them than to resident licensed anglers. Anglers indicated that KDWP management activities such as fisheries research, habitat improvement, and fish management were important. They also were satisfied with how their license money was being spent by KDWP. The results indicate that Kansas

licensed anglers appear to be relatively pleased with fishing in Kansas and support KDWP management programs.

Previous research on this project:

Exemption of Bass Tournament Anglers from Kansas Fishing Regulations: An Opinion Survey

A telephone survey was initiated regarding largemouth bass (*Micropterus salmoides*) tournaments in Kansas reservoirs. A total of 300 Kansas licensed anglers were contacted and asked to be interviewed, these anglers were also respondents to the 1995 Kansas Licensed Angler Use and Preference Survey. Overall response rate not including, wrong numbers, numbers no longer in service, and anglers not available, was 86%. Anglers were grouped into three strata: largemouth bass anglers not in a sport or conservation organization (non-club), largemouth bass anglers in a sport or conservation organization (club), and general resident anglers (general). Response rates for non-club, club, and general were 86.8%, 76.6%, and 89.3%, respectively. Significantly ($P \leq 0.05$) more club anglers participated in fishing tournaments in Kansas than non-club or general anglers. The majority of all angler groups strongly agreed or agreed that fishing tournaments should be held on Kansas reservoirs. All angler groups strongly disagreed or disagreed with the statement "Fishing tournaments for largemouth bass that require live release should *not* have to follow the 18 inch length limit." Similarly, all angler groups strongly disagreed or disagreed that fishing tournaments should be allowed exemption from current creel limits. These data provide important information for managing largemouth bass fishing tournaments on Kansas reservoirs.

Products:

Peer-reviewed and Scientific Publications:

Burlingame, M. N., and C. S. Guy. 2000. Diversity among anglers in Kansas: A focus on channel catfish anglers. Catfish 2000 Proceedings.

Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1999. Exemption of bass tournaments from regulations: an opinion survey. North American Journal of Fisheries Management 19:188-191.

Technical and Semi-Technical:

Burlingame, M.N., and C.S. Guy. 1997. 1995 Kansas licensed angler use and preference survey and attitudes toward angling by secondary education students. Kansas Department of Wildlife and Parks, Final Report, Project F-37-R.

Guy, C. S., C. F. Blodgett, and K. P. Price. 1996. Feasibility of using geographical information system to assess licensed angler data. Completion Report, Kansas Department of Wildlife and Parks, Pratt.

Thesis or Dissertation:

Burlingame, M.N. 1997. 1995 Kansas licensed angler use and preference survey and attitudes towards angling by secondary education students. Master's Thesis. Division of Biology, Kansas State University. 196 pp. (Advisor: Guy)

Presentations:

Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1998. Exemption of bass tournament anglers from Kansas fishing regulations: An opinion survey. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Burlingame, M.N., C.S. Guy, and T.D. Mosher. 1997. 1995 Kansas licensed angler use and preference survey and attitudes toward angling by secondary education students. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Burlingame, M.N., C.S. Guy, and T.D. Mosher. 1997. 1995 Kansas Resident Licensed Angler Use and Preference Survey: An analysis by management region. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Burlingame, M.N., C.S. Guy, and T.D. Mosher. 1997. 1995 Kansas Licensed Angler Use and Preference Survey and attitudes toward angling by secondary education students. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.
Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1997. Exemption of bass tournament anglers from Kansas fishing regulations: An opinion survey. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.
Burlingame, M.N., and C.S. Guy. 1996. Kansas Resident Licensed Angler Use and Preference Survey: A Typological Analysis. 58th Midwest Fish and Wildlife Conference.

Overwinter habitat use by shovelnose sturgeon in the Kansas River

Funding: Kansas State University, Division of Biology Seed Grant

Investigators: Michael C. Quist, Jeff S. Tillma, and Matthew N. Burlingame

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: November 1997

Overwinter habitat use of shovelnose sturgeon (*Scaphirhynchus platorynchus*) in the Kansas River was determined by radiotelemetry during November 1996 to March 1997. Eighty percent of the shovelnose sturgeon locations were in water depths of 1.0-2.0 m, where current velocities were 0.01-1.11 m/s at the surface and 0.02-0.79 m/s at the bottom. Depths and surface current velocities at shovelnose sturgeon locations were positively related to discharge (r=0.47, P=0.001; r=0.60, P=0.0001, respectively); whereas, bottom current velocities were not significantly correlated (r=0.08, P=0.31) with discharge. Ninety-two percent of the shovelnose sturgeon locations were over sand substrate. Inside bend macrohabitats were used in proportion to their abundance (P>0.05), while channel crossovers were used in greater proportion than available ($P\leq$0.05) and outside bend habitats were avoided ($P\leq$0.05). During high discharge (i.e., greater than 150 cubic meters per second), fish moved near-shore or downstream of instream cover. Most shovelnose sturgeon moved less than 2 km during the study period, but some fish moved more than 8 km. These data indicate that shovelnose sturgeon use channel crossover macrohabitats and areas with bottom velocities between 0.02-0.79 m/s --independent of discharge. In addition, it appears that shovelnose sturgeon do not congregate in deep areas during low water temperatures (i.e., < 9°C).

Products:

Peer-reviewed and Scientific Publications:

Quist, M.C., J.S. Tillma, M.N. Burlingame, and C.S. Guy. 1999. Overwinter habitat use of shovelnose sturgeon in the Kansas River. Transactions of the American Fisheries Society 128: 522-527.
Quist, M. C., and C. S. Guy. 1999. Spatial and temporal variation in population characteristics of shovelnose sturgeon in the Kansas River. Prairie Naturalist 31:65-74.

Presentations:

Quist, M.C., C.S. Guy, M.N. Burlingame, and J.S. Tillma. 1998. Population characteristics and overwinter habitat use of shovelnose sturgeon. 128th Annual Meeting of the American Fisheries Society.
Quist, M.C. and C.S. Guy. 1997. Structure and function of Channel Catfish and Shovelnose Sturgeon in the Upper Kansas River. Annual Meeting of the Kansas Chapter of the American Fisheries Society.
Quist, M.C., J.S. Tillma, M.N. Burlingame, and C.S. Guy. 1997. Overwinter habitat use by shovelnose sturgeon in the Kansas River. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Standard Weight (Ws) Equation and Length Categories for Shovelnose Sturgeon

Investigators: Michael C. Quist, M.S. Student
Patrick J. Braaten, Ph.D. Student
Dr. Christopher S. Guy, Assistant Unit Leader

Completion: January 1998

Weight-length data were compiled from 32 populations of shovelnose sturgeon (*Scaphirhynchus platorynchus*; N = 11,820) from 9 states within the geographic distribution of the species. We used the regression-line-percentile technique, which provides a 75-percentile standard, to develop the standard weight (W_s) equation. The proposed equation in metric units is $\log_{10}W_s$ = -6.287 + 3.330 $\log_{10}$FL: W_s is weight in grams and FL is fork length in millimeters. The English equivalent is $\log_{10}W_s$ = -4.266 + 3.330 $\log_{10}$FL: W_s is weight in pounds and FL is fork length in inches. These equations are proposed for use with shovelnose sturgeon between 120 mm (5 in) and 1,050 mm (41 in). Relative weight (W_r) values calculated using the W_s equation did not consistently increase or decrease with increasing fish length, indicating absence of length bias. We propose the following length categories for calculation of proportional stock density (PSD) and relative stock densities (RSDs): stock, 250 mm (10 in); quality, 380 (15 in); preferred 510 mm (20 in); memorable, 640 (25 in); and trophy, 810 mm (32 in). We found significant relations between size structure indices and mean population W_r. Additionally, significant differences were found among incremental W_r values. We believe the W_s equation and length category designations will be useful tools for managing shovelnose sturgeon populations.

Products:
Peer-reviewed and Scientific Publications:
Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (Ws) equation and length categories for shovelnose sturgeon. North American Journal of Fisheries Management. 18:992-997.

1996

Population dynamics of Channel Catfish and Shovelnose Sturgeon Populations in the Upper Kansas River

Funding: Department of Defense, Fort Riley
Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Michael C. Quist, M. S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: February 1997

Channel catfish (*Ictalurus punctatus*) and shovelnose sturgeon (*Scaphirhynchus platorhynchus*) are common species in large Midwestern rivers. Although both species have been extensively studied, little is known about their population structure in Kansas rivers. The objectives of the study are to describe the size and age structure, growth, and condition of channel catfish and

shovelnose sturgeon populations in the upper Kansas River located on Fort Riley Military Reservation, Kansas. During the fall of 1996, 79 channel catfish and 135 shovelnose sturgeon were collected with seines, drifted trammel nets, and baited hoop nets. Pectoral spines and anterior fin rays were collected from channel catfish and shovelnose sturgeon for ageing, respectively. Channel catfish varied in length from 45 mm to 506 mm total length (mean=250 mm) and ages varied from age-0 to age-6. Over 73% of the channel catfish were age-3 or younger. Shovelnose sturgeon varied in length from 435 mm to 693 mm fork length (mean=554 mm). Shovelnose sturgeon varied in age from age-3 to age-19 with over 55% of the sampled fish age-6 to age-10. Channel catfish had a mean relative weight (W_r) of 87 indicating that the channel catfish population in the upper Kansas River was in poor condition during our sampling period. The growth of channel catfish was similar to other Midwestern streams, but most closely followed growth patterns of lower Missouri River populations. Similarly, shovelnose sturgeon growth was most similar to Missouri River populations. In 1997, we will repeat the study on the Kansas River further downstream.

Products:

Peer-reviewed and Scientific Publications:

Quist, M. C., and C. S. Guy. 1998. Population characteristics of channel catfish from the Kansas River, Kansas. Journal of Freshwater Ecology 13:351-359.

Presentations:

Quist, M. C., J. S. Tillma, M. N. Burlingame, and C. S. Guy. 1998. Population characteristics and overwinter habitat use of shovelnose sturgeon in the Kansas River. 128th Annual Meeting of the American Fisheries Society, Hartford, Connecticut. PLATFORM

Quist, M. C., J. S. Tillma, M. N. Burlingame, and C. S. Guy. 1997. Overwinter habitat use of shovelnose sturgeon in the upper Kansas River. 59th Annual Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin. PLATFORM

Quist, M. C., and C. S. Guy. 1997. Structure and function of channel catfish and shovelnose sturgeon populations in the Kansas River. 22nd Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. PLATFORM

Catch Rates and Size Structure of Two Ictalurids Sampled with Different Sizes of Hoop Nets

Funding: U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
Kansas Cooperative Fish and Wildlife Research Unit

Investigators: Jeff S. Tillma, M.S. Student
James M. Milligan, Fisheries Biologist

Collaborator: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: Completed

Hoop nets with initial openings of 0.6 m and 0.8 m were set in a Missouri River tributary stream to determine if catch per unit effort (CPUE) and size structure [length (mm)] of channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictus olivaris*) differed between the two sizes of nets, set baited or unbaited. Catch per unit effort for channel catfish varied from 0 to 12 and was higher in 0.6-m hoop nets independent of bait; however, CPUE was only significantly higher in

unbaited 0.6-m hoop nets ($P = 0.03$). Length of channel catfish captured in unbaited 0.6-m hoop nets was significantly ($P = 0.03$) lower than in unbaited 0.8-m hoop nets. Similar trends were observed for flathead catfish; however, sample sizes were low and subsequently statistical power ($1-\beta$) was ≤ 0.13. Nevertheless, these data indicate that standardizing initial hoop size is important, especially if comparative information is sought.

Products:

Peer-reviewed and Scientific Publications:

Tillma, J.S., and C. S. Guy. 1997. Catch rates and size structure of two ictalurids sampled in varying sizes of hoop nets. Journal of Freshwater Ecology 12:315-319.

Presentations:

Tillma, J. S., C. S. Guy, and J. Milligan. 1996. Catch Rates of Channel Catfish and Flathead Catfish in Two Sizes of Hoop Nets, Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Tillma, J. S., C. S. Guy, and J. Milligan. 1995. Catch Rates of Channel Catfish and Flathead Catfish in Two Sizes of Hoop Nets, 57th Midwest Fish and Wildlife Conference, poster.

Effects of Tree Revetments on the Abiotic and Biotic Components in Two Kansas Streams

Funding: Environmental Protection Agency
Kansas Department of Wildlife and Parks

Investigator: Jennifer R. Wiens, M.S. Student

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Completion: December 1996

Tree revetments have been used throughout the Midwest since the 1930s to provide streambank stabilization and prevent soil erosion. However, there have been few studies to address what effect they have on stream morphometry and aquatic biota. Tree revetments were installed on Kings Creek (Riley County), and West Creek (Greenwood County), Kansas during the spring of 1995. Prior to tree revetment installation, downstream control, upstream control, and tree revetment locations were sampled. Changes in channel morphometry were quantified by net change in area ($\Delta A\%$), absolute percent change in area ($|\Delta A\%|$), and the Gini coefficient (G). Siltation was assessed by mean percent change in dry weight (g). Changes in aquatic insects were quantified by density. Fish populations were assessed using relative abundance, mean length, and biomass. Time by location interactions were used to identify differences among locations. Significant ($P \leq 0.05$) interactions only occurred for $|\Delta A\%|$ and G at Kings Creek. Net streambed degradation was the least at the tree revetment locations on Kings Creek and West Creek. In addition, there were no significant ($P > 0.05$) interactions for amount of silt. Twenty-three families of aquatic insects were collected in Kings Creek and twenty-one in West Creek. There were no significant ($P > 0.05$) interactions for density of the three most common families of aquatic insects. Twenty species of fish were collected in Kings Creek and thirty-two in West Creek. In general, there were no significant interactions for relative abundance for the four most abundant fish species in Kings Creek and West Creek. In addition, mean length and biomass did not differ significantly among locations ($P > 0.05$). In general, abiotic and biotic variables at tree revetment locations on Kings Creek and West Creek varied in concert with those at control

locations -- as indicated by numerous non-significant time by location interactions. These data indicate that tree revetments can likely reduce excessive streambank erosion.

Products:

Technical and Semi-Technical:

Wiens, J.R., and C.S. Guy. Streambank revetment. Kansas State University, Technical Bulletin, MF-2294, Manhattan.

Thesis or Dissertation:

Wiens, J.R. 1996. Effects of tree revetments on the abiotic and biotic components in two Kansas streams. M.S. Thesis, Kansas State University, Manhattan. 90 pp. (Advisor: Guy)

Presentations:

Warren, J. R., and C. S. Guy. 1996. Effects of tree revetments on the abiotic and biotic components in three Kansas streams. 8th Annual Konza Prairie Workshop.

Wiens, J.R., and C.S. Guy. 1996. Effects of Tree Revetments on Fish Populations and Channel Morphometry in Two Kansas Streams. 58th Midwest Fish and Wildlife Conference.

Wiens, J.R. and C.S. Guy. 1997. Tree Revetments in Kansas: how well do they work? Annual Meeting of the Kansas Chapter of the American Fisheries Society.

A Revised Standard Weight (Ws) Equation for Spotted Bass

Funding: Kansas Cooperative Fish and Wildlife Research Unit
South Dakota State University

Investigators: Jennifer R. Wiens, M.S. Student
Dr. Christopher S. Guy, Assistant Unit Leader
Dr. Michael L. Brown, Assistant Professor

Completion: August 1996

Weight-length data were compiled from 139 populations of spotted bass (*Micropterus punctulatus*) (N = 26,289) from 16 states within the geographic range of the species. The regression-line-percentile (RLP) technique was applied to these data to develop a new 75th-percentile standard weight (W_s) equation. The revised W_s equation is $\log_{10} W_s = -5.392 + 3.215 \log_{10}$TL (total length), where W_s is the standard weight in grams and TL is in millimeters and is valid for fish 100-640 mm. The English equivalent is $\log_{10} W_s = -3.533 + 3.215 \log_{10}$TL where W_s is the standard weight in pounds and TL is in inches and is valid for fish 4-25 in. We found the current W_s equation to be length-biased ($\chi^2 = 19.58$, df = 1, $P < 0.0001$), but no such bias was apparent in the new equation.

Products:

Peer-reviewed and Scientific Publications:

Wiens, J. R., C. S. Guy, and M. L. Brown. 1996. A revised standard weight (Ws) equation for spotted bass. North American Journal of Fisheries Management 16:958-959.

Presentations:

Warren, J. R., C. S. Guy, and M. L. Brown. 1995. Development of a Standard Weight-Equation for Spotted Bass using the RLP-Technique. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Wiens, J.R., C. S. Guy, and M. L. Brown. 1995. Proposed Revision of the Standard Weight (Ws) Equation for Spotted Bass, 57th Midwest Fish and Wildlife Conference, poster.

Comparison of Catch per Unit Effort and Size Structure of White Crappie Collected with Trap Nets and Gill Nets

Funding: Kansas Cooperative Fish and Wildlife Research Unit
South Dakota State University
Kansas Department of Wildlife and Parks

Investigators: Dr. Christopher S. Guy, Assistant Unit Leader
Dr. David W. Willis, Professor
Randall D. Schultz, Aquatic Research Biologist

Completion: January 1996

White crappies (*Pomoxis annularis*) were collected from 13 Kansas reservoirs using trap nets and horizontal gill nets. Ten of the reservoirs were sampled concurrently for two or more years. Our objective was to determine if catch per unit effort [CPUE; number of stock-length ($\geq$ 130 mm) white crappies captured per trap net night or per gill net complement night] and size structure (indexed by stock density indices) differed between trap nets and gill nets. We found no significant relation between trap net and gill net $\log_{10}$ CPUE. Conversely, size structure of white crappies was relatively similar between gears. Proportional stock density (PSD) and relative stock density of preferred-length fish (RSD-P) values were positively correlated between gears. Relative stock density values, by length category, were also significantly correlated between gears. These data indicate that the two gears likely would give similar information about changes in white crappie population size structure, but disparate information about the species' relative abundance.

Products:
Peer-reviewed and Scientific Publications:

Guy, C. S., D. W. Willis, and R. D. Schultz. 1996. Comparison of catch per unit effort and size structure of white crappies collected with trap nets and gill nets. North American Journal of Fisheries Management 16:947-951.

Relative Position of Coded Wire Tags in Paddlefish Rostrums

Funding: Kansas Cooperative Fish and Wildlife Research Unit
Kansas Department of Wildlife and Parks

Investigator: D. Scott Waters, Undergraduate

Advisor: Dr. Christopher S. Guy, Assistant Unit Leader

Collaborator: Christopher P. Clouse, Assistant Hatchery Manager

Completion: February 1996

Coded wire tags (CWT) have become a popular method of tagging fish because of their easy use, high retention rates, and binary coding system. These tags are commonly used on salmonids

such as chinook salmon (*Oncorhynchus tsawytscha*), coho salmon (*O. kisutch*), and rainbow trout (*O. mykiss*). Coded wire tags have also been used to tag paddlefish (*Polyodon spathula*). For example, the Mississippi Interstate Cooperative Resource Association (MICRA) has recommended that all stocked paddlefish be tagged in the tip of the rostrum slightly left of the sagittal plane. Coded wire tag loss has been studied by numerous researchers. However, there is a paucity of information regarding CWT movement within fish tissues. Movement of CWTs is important when trying to recognize the presence of a tag, and when benign recovery is one of the tagging objectives. Therefore, the objective of this study was to determine if CWTs placed 2 mm in the distal end of the rostrum remained at that location through time. Paddlefish (*Polyodon spathula*) were tagged with 2 mm long CWTs inserted 2 mm in the distal end of the rostrum to determine if relative position of CWTs changed as the rostrum grew. Thirty fish were randomly selected weekly for body length [(mm) BL; anterior eye to tail fork], rostrum length (anterior eye to distal end of the rostrum), and relative position of the tag [(mm) determined from X-rays] measurements. Mean body length of tagged paddlefish ranged from 79 mm on 30 June, 1995 to 183 mm on 11 August, 1995. Mean position of the tag varied from 9.7% of total rostrum length on 30 June, 1995 to 18.6% on 10 August, 1995. We believe that the change in relative position of CWTs is a function of rostrum growth rate, and the change would likely be highest in age-0 paddlefish and decline as age increases.

Products:

Peer-reviewed and Scientific Publications:

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1996. Coded wire tag loss from paddlefish: A function of study location. North American Journal of Fisheries Management 16:931-934.

Waters, D.S., C. S. Guy, and C. P. Clouse. 1997. Coded wire tag movement in paddlefish rostrums. Transactions of the American Fisheries Society. Transactions of the American Fisheries Society 126:338-342.

Presentations:

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1995. Effects of Study Location on Tag Loss from Paddlefish, 57th Midwest Fish and Wildlife Conference.

Guy, C. S., R. D. Schultz, and C. P. Clouse. Effects of Study Location on Tag Loss from Paddlefish. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Coded Wire Tag Loss from Paddlefish

Funding: Kansas Cooperative Fish and Wildlife Research Unit
Kansas Department of Wildlife and Parks

Investigators: Dr. Christopher S. Guy, Assistant Unit Leader
Randall D. Schultz, Aquatic Research Biologist
Christopher P. Clouse, Assistant Hatchery Manager

Completion: October 1995

Paddlefish (*Polyodon spathula*) were tagged with 1.25 mm long coded wire tags (CWTs) to determine rate of tag loss and identify a suitable tagging location. Tag loss was 77% for paddlefish held 51 d in rectangular fiberglass tanks (tank study), and 3% for fish held 96 d in ponds (pond study). We believe the difference in tag loss between the two studies was related to fish behavior. In intensive culture operations, a paddlefish tends to injure the tip of their rostrum by striking it on the walls of the tank; thus, it is likely that high tag loss is a result of rostra being

continually scraped. Mortality rate of tagged fish was 4% and not influenced by tagging procedures. In the pond study, paddlefish with tags implanted 5 mm in the distal end of the rostrum, slightly off the center axis, had significantly lower tag loss (0%) than those implanted 2 mm in the center of the ventral side (3%) or 2 mm into the distal end, slightly off the center axis. However, we recommend implanting CWTs 2 mm deep into the tip of the rostrum, slightly off the center axis, to allow biologists and anglers to remove a small portion of the rostrum containing the tag and return the fish to the water relatively unharmed.

Products:

Peer-reviewed and Scientific Publications:

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1996. Coded wire tag loss from paddlefish: A function of study location. North American Journal of Fisheries Management 16:931-934.

Waters, D.S., C. S. Guy, and C. P. Clouse. 1997. Coded wire tag movement in paddlefish rostrums. Transactions of the American Fisheries Society. Transactions of the American Fisheries Society 126:338-342.

Presentations:

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1995. Effects of Study Location on Tag Loss from Paddlefish, 57th Midwest Fish and Wildlife Conference.

Guy, C. S., R. D. Schultz, and C. P. Clouse. Effects of Study Location on Tag Loss from Paddlefish. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

WILDLIFE RESEARCH

2016

Title: **Lesser Prairie-Chicken Adult Female Seasonal Habitat Selection, Use of Grazed Range, and Predation Risk in Kansas and Eastern Colorado**

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: John Kraft, M.S. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: August 2016

Lesser prairie-chickens (*Tympanuchus pallidicinctus*; hereafter LPCH) and their status throughout their five-state range are popular topics of conversation. The listing of LPCH as "Threatened" under the Endangered Species Act has stimulated conservation efforts and plans for management. The majority of the individuals that persist occur in within the Kansas and Colorado borders. However, most research investigating LPCH has been concentrated on southern populations (Texas, Oklahoma, and New Mexico). This project aims to assist in the management of LPCH within the northern reaches of LPCH range by answering questions in regard to habitat selection, livestock grazing and its effects on LPCH, and predator community influences on LPCH habitat use and success. Collaborating researchers are determining demographic characteristics for the species within Kansas and Colorado. From this information (movements, survival, recruitment), habitat types that are selected by adult LPCH females for various ecological functions (nesting, brooding, non-breeding seasons) will be determined and quantified in terms of size, vegetation, and management. These inferences will then aid in the determination of target habitats that are essential pieces for landscape management of LPCH. Common livestock grazing strategies and practices within the Kansas and Colorado LPCH range are also important to large scale management. Adult females have been trapped, marked, and being monitored via telemetry on selected ranching operations at each field site. Habitat use and success (recruitment and survival) of adult female LPCH will be investigated among the various grazing techniques represented at each field site. This will assist managers (private and public) in the future by helping shape grazing operations towards LPCH management goals. Predator populations are currently being monitored via road surveys (avian) and motion-sensored camera traps (mammalian). Relative values of abundance for LPCH predator species will be determined spatially (across habitats) and temporally (thought breeding season). These values will then be used to make inferences about LPCH adult survival and habitat selection across various time periods and habitats. Results of this project will contribute to effective population management and hopefully the delisting of LPCH from the Endangered Species Act.

Products:

Presentations:

Kraft, J.D., D. Haukos, C. Hagen, and J. Pitman. 2016. Are larger pastures and sparser herds the way to manage grassland birds? A case-study of the lesser prairie-chicken. Annual Meeting of The Wildlife Society, Raleigh, NC. (Invited)

Kraft, J.D., D. Sullins, and D.A. Haukos. 2016. Evaluation of lesser prairie-chicken brood habitat selection across categorical habitats. Kansas Natural Resource Conference, Wichita, KS.

Kraft, J.D., D. Sullins, and D.A. Haukos. 2016. Dynamic interactions of Conservation Reserve Program, native grasslands, and lesser prairie-chicken habitat selection. Kansas Natural Resource Conference, Wichita, KS.

Kraft, J.D., D. Haukos, and C. Hagen. 2016. Implications of pasture area, grazing strategy, and region on lesser prairie-chicken habitat selection and vegetation. Annual Meeting of the Society of Range Management, Corpus Christi, TX.

Kraft, J.D., and D.A. Haukos. 2015. Landscape level habitat selection of female lesser prairie-chickens in western Kansas and eastern Colorado. International Grouse Symposium, Reykjavík, Iceland.

Kraft, J.D., D. Haukos, J. Pitman, and C. Hagen. 2015. Identifying drivers of lesser prairie-chicken habitat selection within western Kansas grazed lands. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Kraft, J.D., J. Lautenbach, D. Haukos, J. Pitman, and C. Hagen. 2015. Female lesser prairie-chicken response to grazing in western Kansas grasslands. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Kraft, J.D., J. Lautenbach, D. Haukos, J. Pitman, and C. Hagen. 2015. Female lesser prairie-chicken response to grazing in western Kansas grasslands. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Kraft, J.D., S.G. Robinson, R.T. Plumb, and D.A. Haukos. 2015. Landscape characteristics of home ranges of lesser prairie-chickens. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Kraft, J.D., J. Lautenbach, D.A. Haukos, J.C. Pitman, and C.A. Hagen. 2015. Female lesser prairie-chicken response to grazing practices in western Kansas grasslands. Annual Meeting of the Society of Range Management, Sacramento, CA.

Kraft, J.D., J. Lautenbach, D.A. Haukos, and J.C. Pitman. 2015. Seasonal habitat selection by female lesser prairie-chickens in varying landscapes. Kansas Natural Resource Conference, Wichita.

Title: **Influence of Patch-Burn Grazing, Microclimate, and Vegetation Characteristics on Habitat Selection of Female Lesser Prairie-Chickens**

Funding: Kansas Department of Wildlife, Parks and Tourism
U.S. Fish and Wildlife Service
Great Plains LCC
USDA Forest Service

Investigator: Jonathan Lautenbach, M.S. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: December 2016

The lesser prairie-chicken (*Tympanuchus pallidicinctus* has experienced a 90% reduction in population over the past century. The primary reason for this decline is conversion of native grasslands to other states (e.g., row-crop agriculture, energy development, and woodlands). Remaining grasslands are threatened by these same issues. Lesser prairie-chickens occupy different ecoregions throughout their range. Vegetation communities vary between these ecoregions. Across these ecoregions, habitat management goals are the same. With this project, we plan to assess lesser prairie-chicken habitat selection across multiple scale, including between ecoregions. This will inform managers how best to manage habitats within each ecoregion. Additionally, this project will also be assessing habitat selection based on microclimate, answering the questions: do birds select for areas that moderate microclimate conditions during extreme weather events? Knowing areas that lesser prairie-chickens use as thermal refugia during extreme events will help managers understand how they survive extreme weather events and allow them to better manage for these areas. Finally, this project will assess the impacts of patch-burn grazing on vegetation characteristics and lesser prairie-chicken space use. Patch-burn

grazing is seldom used as a management technique throughout the lesser prairie-chickens range. Knowledge of how this influences lesser prairie-chickens will help inform managers if this is another management action that they can use to promote lesser prairie-chickens.

Products:

Presentations:

Lautenbach, J., D. Haukos, and C. Hagen. 2016. Satisfying the quilt work of habitat needs of the lesser prairie-chicken: the role of patch-burn grazing. Annual meeting of The Wildlife Society, Raleigh, NC.

Lautenbach, J., J. Lautenbach, and D. Haukos. 2016. Using patch-burn grazing to maintain prairie for lesser prairie-chickens. Kansas Natural Resource Conference, Wichita, KS.

Lautenbach, J., and D. Haukos. 2015. Effect of pyric herbivory on vegetation composition with management implications for lesser prairie-chickens. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Title: **Landscape Demography and Spatial Use of Lesser Prairie-Chickens in Kansas and Colorado**

Funding: Kansas Department of Wildlife, Parks and Tourism
USDA NRCS
USDA FSA
Kansas State University

Investigator: Dan Sullins, Ph.D. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: May 2017

Loss of habitat and concurrent long and short-term population declines have led to the recent listing of the lesser prairie-chicken (*Tympanuchus pallidicinctus*, LPC) as a threatened species under the Endangered Species Act (1973). Recovering LPC to stated population goals will require a solid understanding of LPC boom and bust population cycles across time and metapopulations. Past research has shown that fragmented populations likely rely on the immigration of individuals from other areas. Therefore, we plan to examine variables for which the population rate of change may be sensitive, or elastic, and to use influential parameters to model differences in predicted population rate of change and population persistence amongst multiple spatial scenarios.

Products:

Presentations:

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2016. Impacts of Conservation Reserve Program grasslands on lesser prairie-chicken populations in the northern extent of their range. Kansas Natural Resource Conference, Wichita, KS.

Sullins, D.S., and D.A. Haukos. 2016. Available foods and diets of lesser prairie-chickens in native and CRP grasslands of Kansas and Colorado. Kansas Natural Resource Conference, Wichita, KS.

Sullins, D.S., and D.A. Haukos. 2016. Lesser prairie-chicken foraging in native and CRP grasslands of Kansas and Colorado. Annual Meeting of The Wildlife Society, Raleigh, NC.

Sullins, D.S., D.A. Haukos, J. Kraft, J. Lautenbach, J. Lautenbach, R. Plumb, S. Robinson, and B. Ross. 2016. Conservation planning for lesser prairie-chickens among reproductive and survivorship landscapes of varying anthropogenic influence. North American Congress for Conservation Biology, Madison, WI. (Invited)

Sullins, D.S., and D.A. Haukos. 2016. Lesser prairie-chicken foraging in native and CRP grasslands of Kansas and Colorado. Annual Meeting of the Society of Range Management, Corpus Christi, TX.

Sullins, D.S., and D.A. Haukos. 2015. Lesser prairie-chicken diets during brooding and winter. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2015. Regional demographic variability for lesser prairie-chickens in Kansas and Colorado. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2015. Regional demographic variability for lesser prairie-chickens in Kansas and Colorado. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2015. Population demographic sensitivity for the threatened lesser prairie-chicken. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Sullins, D.S., and D.A. Haukos. 2015. Optimal nesting substrate drives lesser prairie-chicken habitat use in Kansas and Colorado. Kansas Natural Resource Conference, Wichita.

Title: **A multi-scale examination of the distribution and habitat use patterns of the Regal fritillary (*Speyeria idalia*) within the Fort Riley Military Reservation**

Funding: Department of Defense

Investigator: Kelsey McCullough, M.S. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: December 2016

The Regal fritillary was once an abundant butterfly species of the prairie biome with a range that extended from the Canadian border to Oklahoma and east to the Atlantic coast. Populations have declined approximately 99% in the prairie region and it is nearly extirpated from the eastern portion of its former range. However, populations within northeastern Kansas remain relatively abundant and are considered stable. The Regal fritillary is univoltine with adults flying in Kansas from June to mid-September. Larvae hatch in fall, enter larval diapause and then emerge in spring to begin feeding. The larval host plants of Regal fritillary are all violets (Viola spp.), with Kansas populations feeding on Prairie violet (*V. pedatifoda*). Prairie violet is a small (<8 cm), perennial plant characteristic of native tallgrass communities within Kansas. Causes of Regal fritillary decline remain largely undetermined but like many oligophagous butterflies associated with native plant communities, the decline of this species appears to be the result of habitat loss and the subsequent breakdown of metapopulation dynamics. The large tracts of native tallgrass prairie at the Fort Riley Military Reserve (FRMR) and Konza Prairie Biological Station (KPBS) offer a unique research opportunity to examine the habitat-use patterns and metapopulation dynamics of a stable population of this imperiled species. The objectives of the research are to (1) provide spatially explicit estimates of the current distribution and relative abundance patterns of the Regal fritillary and its host plant, prairie violet at the FRMR and KPBS; (2) Provide baseline population estimates of the Regal fritillary within the FRMR; (3) provide models that identify habitat features and management practices that influence the density of adult Regal fritillary within the FRMR; (4) provide models that identify habitat features and management practices that influence the occurrence of late instar larvae among discrete clusters of prairie violet within the FRMR and KPBS ; and (5) produce information products on the

effectiveness of current and potential management strategies for the conservation of Regal fritillary populations within the FRMR. Using GIS and distribution modeling, we produced a predictive distribution map of Prairie violet within our study area and inferred on the importance of the environmental variables that contributed to the model. These results will be evaluated and improved with field validations of prediction areas. Further, these model predictions will be used to locate Regal fritillary larvae among host plant clusters to examine microhabitat conditions suitable for larval development. Additionally, we will use repeated-modified Pollard walks to survey adult Regal fritillaries and estimate adult abundance and detectability.

Products:

Presentations:

McCullough, K.E., G. Albanese, and D.A. Haukos. 2016. Re-thinking regal fritillary conservation and management: habitat characteristics and the impact of disturbance regime on an imperiled grassland butterfly. Annual meeting of The Wildlife Society, Raleigh, NC.

Skidmore, C., K.E., McCullough, G. Albanese, and D.A. Haukos. 2016. A distribution modeling approach to monarch butterfly density, host plant occurrence, and preferred habitat in the Flint Hills. Annual meeting of The Wildlife Society, Raleigh, NC.

McCullough, K., G. Albanese, and D.A. Haukos. 2016. Habitat characteristics and the impact of disturbance regime on an imperiled grassland butterfly: re-thinking regal fritillary (*Speyeria idalia*) conservation and management. Kansas Natural Resource Conference, Wichita, KS.

McCullough, K., G. Albanese, and D.A. Haukos. 2015. Gradient habitat modeling of regal fritillary (*Speyeria idalia*) and larval host plant using distribution modeling approach with notes on life history attributes. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Title: **Measuring the Response of Grassland Avian and Lepidopteran Communities to the Management of an Invasive Forb with Prescribed Fire and Targeted Livestock Grazing**

Funding: National Fish and Wildlife Federation

Investigator: Sarah Ogden, M.S. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: December 2016

The tall-grass prairie is the most endangered of the three North American temperate grassland ecotypes (tall-grass prairie, short-grass prairie, and mixed-grass prairie; Vickery et al. 2000), a group which, due to habitat loss and under-protection, is one of the most at-risk of all biomes in the world (Samson and Knopf 1994, Hoekstra et al. 2005). Up to 99% of original tall-grass prairie has been developed and that which remains is highly degraded and fragmented (Vickery et al. 2000). With such extensive habitat loss and degradation, it comes as no surprise that many of the taxa that rely on the tall-grass prairie are in decline. Specifically, grassland birds are experiencing the greatest declines of any guild of North American birds (Knopf 1994). In addition, pollinators are experiencing global population declines (Potts et al. 2010), with prairie skippers (Lepidoptera:Hesperidae) considered to be more endangered than the tall-grass prairie itself (Schlict and Orwig 1998). Unfortunately, a reduction in biodiversity will further compound the precarious status of the prairie due to a consequential reduction in resilience to disturbances (Chapin III et al. 2000).

One such disturbance that alters the delicate ecological balance of the tall-grass prairie is the introduction of non-native plant species. The perennial woody forb, Lespedeza cuneata (hereafter sericea lespedeza), native to Asia, was initially was planted in the United States for erosion control and wildlife cover. The plant's high competitive ability has allowed it to expand its range and is now having detrimental effects in grassland habitats. In Kansas alone, over 250,000 hectares of pasture has been invaded by sericea lespedeza and most of that land is in the Flint Hills region (Kalburtji and Mosjidis 1992; Dudley and Fick 2003; Eddy et al. 2003). In 2000, Kansas became the first state to declare sericea lespedeza a noxious weed. The invasion in the Flint Hills is particularly problematic because it is adversely affecting wildlife species that use tall-grass habitat as a refuge and domestic livestock species that graze on the pastures (Olson 1999, Eddy et al. 2003).

The hardy forb is likely having adverse effects on the avian and pollinator communities of the tall-grass prairie by reducing forage and cover important for grassland passerines and reducing vegetative density on which the pollinators depend (Eddy and Moore 1998, Eddy et al. 2003); major problems considering the population declines of these taxa. The spread of sericea lespedeza throughout the Flint Hills is additionally problematic for the ranching community. The plant reduces the availability of native and preferred cattle forage, is unpalatable to cattle, and, if eaten by cattle, is indigestible (Eddy et al. 2003). These factors cumulatively translate to reduced cattle weight-gain, reduced ranchers' income, and an overall decrease in the economic value of land invaded by sericea lespedeza. Finding an effective management technique to control sericea lespedeza invasions and restore areas invaded by the species are top concerns for landowners and wildlife managers alike; however, sericea lespedeza's high fecundity, summer seed production, and high tannin content make finding a solution difficult (Eddy et al. 2003).

The traditional vegetation management techniques of spring prescribed fire, grazing, herbicide use, and mechanical removal are not effective for sericea lespedeza control (Eddy et al. 2003, Cummings et al. 2007). Sericea lespedeza is highly fecund, capable of producing up to 8000 seeds per plant, which is five times the number of seeds per plant that native tall-grass prairie forb species can produce (Woods et al. 2009). The plant disperses and colonizes at such a rate that mechanical removal is inefficient and impractical. Herbicides are effective at preventing seed production at early stages of invasion, however, due to the rocky substrate of the Flint Hills, tractor-spraying is impractical, spot spraying is inefficient, and aerial spraying is expensive and kills other beneficial broad-leafed forbs (Eddy et al. 2003).

Sericea lespedeza flowers and produces seed in August and September; therefore, to prevent seed production and dispersal, control mechanisms must be implemented late in the growing season. In the Flint Hills, it is common practice to subject pastures to prescribed fire early in the growing season, as spring fire promotes the growth of cattle forage and retards growth of woody vegetation (Knapp and Seastedt 1986, Briggs et al. 2002). Attempts to validate the supposed benefits of spring burning, however, have shown no difference in average grass production and woody species cover between burning in winter, autumn, or spring (Towne and Kemp 2003, Towne and Craine 2014). Further, the critical precipitation period for grass production was shorter in spring burned grasslands than in autumn or winter burned grasslands, indicating that grasslands burned in spring could be more sensitive to summer drought (Towne and Craine 2014). Cummings et al. (2007) report that spring fires are ineffective at reducing sericea lespedeza seed production and dispersal and the plant remains unpalatable to cattle after such burns. Prescribed fire in summer, on the other hand, is reported to be effective at decreasing

richness, evenness, and frequency of non-native woody plant species in the tall-grass prairie (Adams et al. 1982) and increases the palatability of sericea lespedeza (Cummings et al. 2007). Cattle grazing is another popular means of grassland management, though unfortunately, sericea lespedeza's unpalatability to cattle precludes it as a viable option (Olson 1999). Grazing by more tannin-tolerant ruminants, such as goats and sheep, however, could be an effective management technique for sericea lespedeza (Pacheco et al. 2012). Goats have been effective grazers of sericea lespedeza and can develop a preference for the woody forb (Hart 2001) and sheep have effectively reduced seed production by sericea lespedeza when placed in a pasture after the graminoid component was depleted by cattle (Lemmon et al. in press). Additionally, sheep grazing has been effective at managing spotted knapweed, which, like sericea lespedeza, is unpalatable to cattle (Henderson et al. 2014), thus sheep grazing may be similarly effective at managing sericea lespedeza.

The lack of effective management for sericea lespedeza is a major problem for grassland birds and pollinators. Ninety-nine percent of avian habitats in North American tall-grass prairie have been lost to agricultural development and sericea lespedeza is altering the vegetative community of extant grasslands (Eddy and Moore 1998). Vegetative structure is particularly important for nesting grassland birds. Sericea lespedeza decreases the vegetative density of grasslands, which reduces nesting cover for grassland birds, making them more vulnerable to predation. Reduced vegetative density is also problematic for pollinators, which make use of plants for nectar and oviposition substrate. Further, macroinvertebrates are a major food source for many wildlife species, including grassland birds, so a detriment to macroinvertebrates translates to a detriment to higher trophic levels.

In addition to grassland habitat being invaded by non-native species, it is also highly fragmented, resulting in smaller continuous tracts of prairie and greater edge density. Grassland birds are deterred from nesting near edges, especially wooded edges (Bakker 2003, Ellison et al. 2013, Thompson et al. 2014). Further, it has been reported that those grassland birds that do nest near trees may face a higher risk of nest parasitism and depredation (Ellison et al. 2013, Bakker 2003). The effect of wooded edges on biodiversity and the distance at which wooded edges no longer have a negative effect on grassland passerines remain unclear and are of great importance in managing the remaining tall-grass prairie habitat.

The spread of sericea lespedeza and increased edge density both pose immediate threats to the biodiversity, and thus the resilience, of the tall-grass prairie. It must be a priority to understand how various agricultural management practices affect the ecosystem to mitigate adverse effects and, when possible, choose management tools that promote the persistence of the biotic community.

Products:

Presentations:

Ogden, S. 2016. Grassland bird and butterfly responses to summer fire: Species- and community-level analyses tell different, yet encouraging stories. Annual Graduate Research Forum, Division of Biology.

Ogden, S. 2016. Patterns of Butterfly Community Composition in Response to Sericea lespedeza Control Using Fire and Grazing. Kansas Natural Resources Conference, Wichita, KS.

Ogden, S. 2016. Grassland Bird Community Response to Sericea lespedeza Control Using Fire and Grazing. Society for Range Management Annual Conference, Corpus Christi, TX.

Ogden, S., D. Haukos, K.C. Olson, J. Alexander, and J. Lemmon. 2016. Grassland bird community response to sericea lespedeza control using fire and grazing. Annual Meeting of the Midwest Fish and Wildlife Conference, Grand Rapids, MI.

Ogden, S., D.A. Haukos, K.C. Olson, and J. Alexander. 2016. Birds, butterflies, and burning: wildlife response to summer fire used for invasive plant control in tall-grass prairie. Annual Meeting of The Wildlife Society, Raleigh, NC.

Ogden, S., D. Haukos, K. Olson, and J. Lemmon. 2015. Response of grassland passerine communities to tall-grass prairie restoration using summer fire and sheep grazing. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Ogden, S., D. Haukos, K.C. Olson, and J. Lemmon. 2015. Response of grassland passerine communities to tall-grass prairie restoration with summer fire and sheep grazing. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Ogden, S., D. Haukos, K.C. Olson, J. Alexander, and J. Lemmon. 2015. Grassland nesting bird community response to Sericea Lespedeza using fire and grazing. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Title: **Occurrence and Prediction of Avian Disease Outbreaks in Kansas**

Funding: Kansas Department of Wildlife, Parks and Tourism
U.S. Fish and Wildlife Service

Investigator: Thomas Becker, M.S. Student

Advisor: Dr. David A. Haukos

Expected Completion Date: December 2016

There are a wide variety of diseases that affect birds. These diseases can be bacterial, viral, fungal, parasitic, and toxic (i.e., environmental contaminant). Of the diseases that affect migratory, wild birds, those of primary concern are avian cholera, avian botulism, duck plague, aspergillosis, West Nile, Newcastle disease, and avian influenza. Avian cholera and avian botulism are bacterial diseases, Pasteurella multocida and Clostridium botulinum, respectively, that typically affect waterfowl and shorebird species. Occurence, causes, and impacts of disease in wild bird populations are rarely studied beyond documentation of large outbreaks in terms of date, duration, species affected, and estimated number of individuals affected. These records are stored throughout many different venues. For many avian diseases, certain environmental conditions are hypothesized to be necessary prior to the occurrence of epizootic events. By location in the middle of the Central Flyway, Kansas provides critical habitat for breeding, migrating, and wintering migratory birds. In addition, several areas (e.g., Cheyenne Bottoms, Quivira, Jamestown, and McPherson wetland habitats) support large populations of migratory waterfowl and other waterbirds that would result in a major mortality event should a disease outbreak occur. Further, survey evidence f indicate that migratory birds are staging for longer periods in Kansas compared to historical duration, increasing the likelihood of increased impacts of disease outbreaks in the state. All records of disease outbreaks will be compiled through a comprehensive search of all potential locations that may house any such reports. Once all possible records are compiled, a data base will be generated that includes all potential information related to disease outbreaks (e.g., date, location, duration, species involved, number of dead birds counted). Upon completion of the historical data base, a web-based reporting process will be developed for use by anyone in the state of Kansas. We will use one of the suite of available models and software (e.g., MaxEnt, Environmental-Niche Factor Analysis, Genetic

Algorithm for Rule-Set Prediction) used to develop predictive models based on known occurrence of a disease outbreak and the environmental conditions associated with the outbreak.

Products:

Presentations:

Becker, T., A. Ahlers, and D. Haukos. 2016. A retrospective surveillance study of avian disease outbreaks in Kansas. Kansas Natural Resource Conference, Wichita, KS.

Becker, T., P. McBee, and D. Haukos. 2015. Occurrence and predictions of avian disease outbreaks in Kansas. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Becker, T., P. McBee, and D. Haukos. 2015. Occurrence and prediction of avian disease outbreaks in Kansas. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Title: **Use of Moist-Soil Management for Waterfowl on the Texas Coast**

Funding: U.S. Fish and Wildlife Service
U.S. Geological Survey
Stephen F. Austin State University

Investigator: Mike Whitson, M.S. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: December 2016

The overriding goal for this research is to quantify variation in vegetation species response, biomass production, invertebrate availability and waterfowl use as related to early, mid and late flooding dates in moist soil managed fallow rice fields on the upper Texas coast. This research will provide federal, state, private land managers and conservation agencies with viable wetland management techniques to enhance habit conditions, wetland mitigation, and assist in reducing migratory waterfowl and residential mottled duck populations to exposure of areas with high lead contamination. Specific objectives include estimate existing seed bank composition and variation in biomass production, seed production, above ground plant community composition in areas under varying temporal implementation regimes and treatment conditions. We will also determine, compare and characterize bird use and behavior among treatments to estimate moist soil management practices that drive waterfowl habitat selection and use.

Products:

Presentations:

Whitson, M.D., W.C. Conway, D.A. Haukos, and D. Collins. 2016. Seed bank potential of moist-soil managed fallow rice fields on the upper Texas coast. 7th North American Duck Symposium, Annapolis, MD.

Whitson, M.D., T.V. Riecke, W.C. Conway, D.A. Haukos, J.A. Moon, and P. Walther. 2016. Waterfowl identification skills by duck hunters on the upper Texas coast. 7th North American Duck Symposium, Annapolis, MD.

Whitson, M., W. Conway, C. Comer, and J. Moon. 2013. Vegetation and waterfowl response to temporal inundation variation in moist-soil managed fallow rice fields on the upper Texas Coast. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas. Poster.

Title: **Climate Variation and Human-Landscape Interactions Affect Functional Capacity of the Central Great Plains Wetlands**

Funding: National Science Foundation

Investigator: Willow Malone, M.S. Student

Advisors: Dr. David A. Haukos

Expected Completion Date: December 2016

Freshwater resources in the Central Great Plains are becoming increasingly unstable through land use and water practices. As the global climate continues to change, it will affect these ecosystems as the precipitation events increase in intensity and duration of dry periods in-between precipitation events increase. As the hydroperiods change, it can affect the biotic community, decrease biodiversity and the support for carbon stores. Biodiversity is currently declining due to natural and anthropogenic factors such as habitat fragmentation, agricultural sedimentation and nutrient pollution. These wetlands are important ecosystems and stopover sites for waterfowl and shorebirds during migration. To achieve a more conservative landscape management, research is needed to explain the human-landscape interactions and develop models of the hydrosystem and human system responses to climate change.

The stimulation model, WETLANDSCAPE will facilitate an understanding of the effects of climate change on wetlands. The model will simulate wetland surface water, groundwater, vegetation, and apply it to wetlands with changing hydroperiods. The Soil and Water Assessment Tool model will simulate the future hydrological responses to climate changes such as wetland hydroperiods, volume, and sediment yield. This project will increase understanding of how interactions among climate change, changing precipitation levels and temperature will potentially affect the functional capacity of wetlands.

The wetlands studied will be in the Smoky Hill watershed, which can be related to the Central Great Plains area. The wetlands will be mapped and categorized with remote sensing and GIS capability. Wetlands sampling will estimate the storage volume of each wetland category. Staff gauges on water level monitoring techniques will determine the hydroperiod. Water quality changes and measurements (temperature, depth, DO, BOD, nutrients, turbidity) will be monitored. The water quality, temperature, and precipitation will evaluate the effects of climate change. Weekly avian counts will identify the wetland's species richness, chronology, behavior, and habitat selection as it relates to the wetland's hydroperiod. Results from this project are a component of a bigger proposal that will develop an integrative mechanistic human-landscape interaction model to achieve sustainable landscape management.

Products:

Presentations:

Malone, W.E.A., and D.A. Haukos. 2016. The influence of watershed condition on avian use of dry playa wetlands. Kansas Natural Resource Conference, Wichita, KS.

Malone, W.E.A., D.A. Haukos, and M.D. Daniels. 2015. Our essential freshwater source: estimating the occurrence and function of playa wetlands in western Kansas. Governor's Water Conference, Manhattan, Kansas.

Malone, W., and D.A. Haukos. 2015. The influence of watershed condition on avian use and diversity of playa wetlands in western Kansas. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Malone, W., and D.A. Haukos. 2015. The influence of watershed condition on avian use and diversity of playa wetlands in western Kansas. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas. (poster)

Malone, W.E.A., and D.A. Haukos. 2015. The influence of watershed condition on avian use of dry playa wetlands. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK. (poster)

2015

Title: **Risk Assessment of Exposure to Lead for Mottled Ducks on National Wildlife Refuge of the Texas Gulf Coast**

Funding: U.S. Fish and Wildlife Service
U.S. Geological Survey

Investigator: Brian Kearns, Ph.D. Student

Project Supervisors: Dr. David A. Haukos, Unit Leader
Dr. Warren Conway, Texas Tech University

Completion: May 2015

Mottled ducks (*Anas fulvigula*) are dabbling waterfowl species native to coastal wetlands of the Gulf of Mexico of the United States and Mexico. Although closely related to common waterfowl species such as the mallard (*A. platyrhynchos*) and American black duck (*A. rubripes*), the mottled duck exhibits unique behavior, mainly in its life history as a non-migratory species. As such, because of population declines caused by predation, habitat destruction, and environmental contaminants, this species requires specialized conservation concerns and species-specific management to protect population numbers. The goal of this study was to assess ongoing effect of observed lead (Pb) contamination and exposure issues in mottled ducks and their habitats, which I achieved by conducting assessments that will provide managers habitat and organism level metrics to detect and mitigate lead in mottled ducks and their environments.

My field study was conducted at the Texas Chenier Plain National Wildlife Refuge Complex (TCPC), which was the area of greatest mottled duck density on the Texas Coast. I first created a body condition index to provide managers a tool to monitor population health, and a proxy for lead exposure and avian health without destructively sampling individuals. I then used presence-only maximum entropy (MaxENT) and multivariate statistical modeling procedures in conjunction with mottled duck movement data to elucidate sets of habitat conditions that were conducive to predicting the occurrence of mottled ducks and environmental lead "hot spots". MaxENT analyses suggested that lead in the top portion of the soil column is similarly related to all environmental variables considered, may be increasingly available after large-scale environmental disturbances. Lack of variation in coarse-scale habitat use between breeding and non-breeding seasons may further point to a food-based exposure pathway for lead as mottled ducks switch from an invertebrate to plant diet, either as a result of changing age classes or normal adult phenology, during the period of increased lead exposure. Using stable isotope ratio analysis, I then tested environmental samples of soil and vegetation as well as mottled duck

blood to determine isotopic signatures that were consistent with particular sources of lead deposition (e.g., lead shot pellets, leaded fossil fuel combustion, industrial effluents). Comparisons suggested a great deal of similarity to lead shot reference values in vegetation and blood samples, especially in blood samples with higher concentrations of lead present. Last, I conducted a formal Ecological Risk Assessment (ERA) procedure to quantify the risk to mottled ducks from lead exposure in their current habitat and direct managers towards effective mitigation and habitat management strategies to reduce exposure in the future. One scenario suggested that mottled ducks were at greatest risk from eating an invertebrate-based diet, but lead content values at the TCPC suggest that a plant-based diet may provide a higher lead exposure risk for mottled ducks, depending on true levels of bioavailability in environmental media.

Overall, I determined that mottled ducks experience greatest lead exposure risk from lead shot pellets on the TCPC or in nearby habitat, while potentially also experiencing low levels of exposure from several other sources. Additionally, management efforts that focus on plants that do not provide food resources for mottled ducks as a potential environmental sink for lead contamination, such as phytoremediation, may prove effective in reducing the overall lead load from historical activities that likely deposited much of the lead in this ecosystem.

Products:

Peer-reviewed Publications:

Kearns, B., P. Walther, W. Conway, and D. Haukos. 2015. Factors affecting fat content in mottled ducks on upper Texas Gulf Coast. Journal of the Southeastern Association of Fish and Game Agencies 2:274-280.

Thesis or Dissertation:

Kearns, B.V. 2015. Patterns and pathways of lead contamination in mottled ducks (*Anas fulvigula*) and their habitat. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Haukos)

Presentations:

Kearns, B., P. Walther, and D. Haukos. 2014. Developing a body condition index for mottled ducks on the upper Texas Gulf Coast. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Kearns, B., S. McDowell, J. Moon, W. Conway, and D. Haukos. 2014. The legacy of lead: developing new methods for assessing lead contamination and wildlife exposure risks in Gulf Coast wetland habitats. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Kearns, B., S. McDowell, J. Moon, E. Rigby, and D. Haukos. 2014. Identifying landscape-level indicators of environmental contaminants that affect wildlife: a species distribution approach. Midwest Fish and Wildlife Conference, Kansas City, MO.

Kearns, B., P. Walther. W. Conway, and D. Haukos. 2014. A body condition index for non-breeding mottled ducks on the upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Kearns, B., D. Haukos, J. Moon, and E. Rigby. 2013. Species distribution in environmental decision-making: characterizing the efficacy of different models for use in habitat and wildlife management. Annual Meeting of the Society for Conservation GIS. Monterey, California.

Kearns, B., S. McDowell, J. Moon, and D. Haukos. 2013. Spatial analysis and ecological risk assessment for lead exposure in Gulf Coast waterfowl: does environmental lead represent an ecological trap? Annual Meeting of the Ecological Society of America. Minneapolis, Minnesota.

Title: **Reproductive Success of and Response to Shrub Removal by Lesser Prairie-Chickens in Western Kansas and Eastern Colorado**

Funding: Kansas Department of Wildlife, Parks and Tourism
Colorado Department of Wildlife and Parks
U.S. Fish and Wildlife Service

NRCS USDA
FSA USDA
U.S. Geological Survey
Great Plains LCC

Investigator: Joseph Lautenbach, M.S. Student

Project Supervisors: Dr. David A. Haukos, Unit Leader
Dr. Christian Hagen, Oregon State University
Jim Pitman, Kansas Department of Wildlife, Parks and Tourism

Completion: May 2015

The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is a species of prairie grouse native to the southwest Great Plains. Population declines and threats to populations of lesser prairie-chickens led U.S. Fish and Wildlife Service to list the species as "threatened" under the protection of the Endangered Species Act in May 2014. Lesser prairie-chickens are found within three distinct ecoregions of Kansas and Colorado and portions of the species' range are affected by tree encroachment into grasslands. The effect of trees on lesser prairie-chickens is poorly understood. I evaluated habitat selection and reproductive success and across the northern portion of the species' range. I captured female lesser prairie-chickens within the three different ecoregions in Kansas and Colorado to track nest and brood survival and measure nest and brood habitat. My findings show that there are regional and annual variations in nest and brood survival. Mean nest survival during 2013 and 2014 was estimated to be 0.388 (95% CI = 0.343 – 0.433) for a 35-day exposure period. Brood survival during 2013 and 2014 was estimated to be 0.316 (95% CI = 0.184 – 0.457) for 56 days. Chick survival was the lowest during the first week of life and is probably a limiting factor for population growth. Chick and brood survival decreased as Julian hatch date increased. Across the northern portion of the species' range, females consistently select visual obstruction between 2-3 dm. Vegetation at the nest changes between regions and years to reflect environmental and regional conditions. Broods consistently selected habitats with greater percent cover of forbs than was expected at random across all study sites. Broods also selected against areas of bare ground. The threshold of lesser prairie-chicken use was 2 trees/ha throughout the year. No nests were located within areas with greater densities. Lesser prairie-chickens had a greater probability of use at greater distances from trees and at lower tree densities. To provide adequate nesting habitat managers should provide 2-3 dm of visual obstruction. Providing forb cover with visual obstruction between 2.5-5 dm near nesting habitat should provide adequate habitat for broods. Removing trees in core habitats and expand removal efforts outward should expand potential habitat for lesser prairie-chickens.

Products:

Thesis or Dissertation:

Lautenbach, J.M. 2015. Lesser prairie-chicken reproductive success, habitat selection, and response to trees. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

Presentations:

Lautenbach, J., J. Lautenbach, and D. Haukos. 2016. Killing trees and maintaining prairie for lesser prairie-chickens through patch-burn grazing. Annual Meeting of the Society of Range Management, Corpus Christi, TX

Lautenbach, J., R. Plumb, D. Haukos, J. Pitman, and C. Hagen. 2015. Effects of tree encroachment on lesser prairie-chickens. Annual Meeting of The Wildlife Society, Winnipeg, Manitoba.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Impacts of tree encroachment on lesser prairie-chickens. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Survival and habitat selection of lesser prairie-chicken chicks and broods. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Differences in successful and unsuccessful nests of lesser prairie-chickens in Kansas and Colorado. Kansas Natural Resource Conference, Wichita, Kansas.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Nest site location by lesser prairie-chickens in Kansas and Colorado. Midwest Fish and Wildlife Conference, Kansas City, MO.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2013. Regional variation in nest success of lesser prairie-chickens in Kansas and Colorado. Biennial meeting of the Prairie Grouse Technical Council, Crookston, MN.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2013. Factors affecting brood and chick survival of lesser prairie-chickens in Kansas and Colorado. Biennial meeting of the Prairie Grouse Technical Council, Crookston, MN.

Title: **Landscape Conservation Design, Movements, and Survival of Lesser Prairie-Chickens in Kansas and Colorado**

Funding: Kansas Department of Wildlife, Parks and Tourism
Colorado Department of Wildlife and Parks
U.S. Fish and Wildlife Service
NRCS USDA
FSA USDA
U.S. Geological Survey
Great Plains LCC

Investigator: Samantha Robinson, M.S. Student

Project Supervisors: Dr. David A. Haukos
Jim Pitman

Completion: 2015

The lesser prairie-chicken (*Tympanuchus pallidicinctus*) has experienced range-wide population declines and range contraction since European settlement. Due to ongoing declines, lesser prairie-chickens were listed as threatened under the Endangered Species Act in 2014; however, uncertainty regarding the legal status of the species has developed following a judicial decision to vacate the listing in September 2015. Regardless, new research is required for conservation planning, especially for understudied portions and temporal periods of the occupied range. I evaluated nonbreeding lesser prairie-chicken survival using known-fate models, and tested for the influence of environmental, landscape and predator effects on weekly survival. I estimated nonbreeding home-range size using fixed kernel density estimators and Brownian Bridge movement models for VHF and Satellite tagged lesser prairie-chickens, and measured habitat use during the 6-month nonbreeding period (16 September – 14 March). I also determined the influence of lek location on space use intensity within home ranges using resource utilization

functions. Female survival was high (0.75, SE = 0.05) and consistent across nonbreeding seasons, but not explainable by selected variables. Mean home range size for birds with GPS transmitters (955 ha, SE = 128.5) was 215% larger than for individuals with VHF transmitters (303 ha, SE = 24.1) and 136% greater during the 2014-2015 nonbreeding season than the 2013-2014 season. Males and females were tied to leks throughout the nonbreeding season, and this relationship was not variable across the months of the nonbreeding season. Proportions of habitat used differed among study sites, but temporal trends were not evident. Lesser prairie-chickens exhibited consistency among ecoregions for home-range, space use, and survival; however, with differing habitat use among regions, management should be on the regional scale.

Agriculture and energy development have caused fragmentation of the landscape where lesser prairie-chickens evolved. I used known fate survival models to test if landscape composition or configuration within sites caused survival to differ by site, as well as within home ranges to determine if functional relationships exist between weekly survival and landscape configuration or composition. I used Andersen-Gill models to test whether distance to anthropogenic features affected hazard rates. Differences in survival rates between sites, with survival rates 50% greater in Clark County, Kansas compared to Northwestern, Kansas, corresponded to differences in the amount of grassland habitat on the landscape, but study-site configuration was not measurably different. Increasing the number of patch types within home ranges increased survival, indicating positive effects of heterogeneity. In addition, as distance to fences decreased, lesser prairie-chickens experienced greater risk. Overall, further breakup of grassland landscapes that lesser prairie-chickens occupy should be avoided, to avoid habitat loss and fragmentation thresholds that could further affect survival rates. Additionally, fences should be removed or avoided around active leks.

Products:

Peer-reviewed Publications:

Robinson, S.G., D.A. Haukos, D.S. Sullins, and R.T. Plumb. 2016. Use of free water by nesting lesser prairie-chickens. Southwestern Naturalist. In Press

Robinson, S.G., D.A. Haukos, R.T. Plumb, C.A. Hagen, J.C. Pitman, J.M. Lautenbach, D.S. Sullins, J.D. Kraft, and J.D. Lautenbach. 2016. Lack of lesser prairie-chicken mortality due to fence collisions in Kansas and Colorado. Journal of Wildlife Management. In Press

Thesis or Dissertation:

Robinson, S. 2015. Landscape ecology, survival and space use of lesser prairie-chickens. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

Presentations:

Robinson, S., R. Plumb, D. Haukos, C. Hagen, J. Pitman, and B. Sandercock. 2016. Come rain or no water, I will survive: nonbreeding lesser prairie-chicken survival and space use. North American Ornithological Congress, Washington, D.C.

Robinson, S., R.T. Plumb, J.M. Lautenbach, D.S. Sullins, J.D. Kraft, D.A. Haukos, C.A. Hagen, and J.C. Pitman. 2015. Functional relationships among lesser prairie-chicken survival, habitat type, and landscape fragmentation. International Grouse Symposium, Reykjavik, Iceland.

Robinson, S.G., and D.A. Haukos. 2015. The influence of habitat composition and configuration on lesser prairie-chicken survival rates in Kansas. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Robinson, S., R.T. Plumb, J.M. Lautenbach, D.S. Sullins, J.D. Kraft, and D.A. Haukos. 2015. Attributing landscape characteristics to lesser prairie-chicken survival in Kansas and Colorado. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Robinson, S., R. Plumb, D. Haukos, S. Carleton, A. Meyers, and J. Reitz. 2015. There is no space like home: space use of nonbreeding lesser prairie-chickens. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Robinson, S.G., R.T. Plumb, J.M. Lautenbach, D.A. Haukos, S. Carleton, A. Meyers, and J. Reitz. 2015. Space use by nonbreeding lesser prairie-chickens. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Robinson, S.G., D.A. Haukos, and J.C. Pitman. 2015. Nonbreeding season movement and space use of lesser prairie-chickens in Kansas. Kansas Natural Resource Conference, Wichita.

Robinson, S., R. Plumb, J. Lautenbach, D. Haukos, and J. Pitman. 2014. Nonbreeding season movement and habitat use of lesser prairie-chickens in Kansas. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Title: **Breeding Season Survival, Space Use, Movement, and Habitat Use of Female Lesser Prairie-Chickens (*Tympanuchus pallidicinctus*) in Kansas and Colorado**

Funding: Kansas Department of Wildlife, Parks and Tourism
Colorado Department of Wildlife and Parks
U.S. Fish and Wildlife Service
NRCS USDA
FSA USDA
U.S. Geological Survey
Great Plains LCC

Investigator: Reid Plumb, M.S. Student

Project Supervisors: Dr. David A. Haukos, Unit Leader
Jim Pitman, Kansas Department of Wildlife, Parks and Tourism

Completion: 2015

The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is an endemic North American prairie grouse once widely distributed in the southwestern Great Plains. Recent population declines and continued threats to lesser prairie-chicken populations prompted the U.S. Fish and Wildlife Service to list the species as "threatened" under the protection of the Endangered Species Act of 1973 in May 2014. The northern extent of the species range in Kansas and Colorado supports 2/3 of the remaining range-wide population of lesser prairie-chickens, but has thus far been relatively understudied. Concern for species viability has created a need to fill current knowledge gaps in lesser prairie-chicken ecology, provide more recent demographic information, and develop appropriate conservation actions. I evaluated female survival, movement, space use, and effects of anthropogenic features during the breeding seasons of 2013 and 2014. I captured and radio-tagged 201 females with satellite GPS (N = 114) and VHF (N = 82) transmitters within the three ecoregions of Kansas and Colorado. Mean daily movement varied by region, year, and breeding season period but the amount of space used was consistent between ecoregions and years. On average, females moved 1352 m ± 12 [SE] per day. Females moved the greatest distances during the lekking period of the breeding season with females moving 2074 m ± 36 per day. Females were most sedentary during the brooding period moving only 780 m ± 14 per day. Mean breeding season home range size was estimated to be 340 ha ± 27. The lekking period had the greatest amount of movement as a result of females visiting leks to find mates, copulate, and search for nest locations. Female's movements were reduced during the brooding period because of physical limitations of the brood mobility. Variation in movement between ecoregions was

most likely a product of fragmentation as females moved 10-30% more in northwest Kansas compared to the study sites, which was characterized by northwest Kansas having the greatest degree of fragmentation. Survival varied by ecoregion with females in northwest Kansas having the lowest probability of surviving the 6-month breeding season compared to other ecoregions. Estimated 6-month breeding season survival during 2013 and 2014 was 0.455 (95% CI = 0.38 – 0.53). Survival was lowest during the nesting period, which claimed 59.5% of all observed mortalities. Survival increased from 2013 to 2014 in northwest Kansas as grassland habitats recovered from extreme drought conditions in 2013. Drought was less severe in south-central Kansas and survival rates remained fairly consistent across years. Avian and mammalian predators caused 45.7% and 34.3% of breeding season mortalities, respectively. Other mortalities were either cause by snakes or were unknown (5.7%, 14.3%). Overhead cover may have been limited from drought conditions causing nesting females to be more visible to avian predators during incubation. When pooled across years and ecoregions, rump-mounted GPS transmitters did not adversely affect female survival when compared to commonly used necklace style VHF transmitter (VHF: 0.48 95% CI = 0.39 – 0.58; GPS: 0.50 95% CI = 0.38 – 0.64). Distance to distribution power lines and lek were significant predictors of female space use within their home range with females behaviorally avoiding distribution power lines and using space closer to leks. Space use decreased with increasing oil well density. Females avoided areas that had well densities of 23 wells/250 ha. Observed female locations were further from anthropogenic features but closer to leks on average than at random. Avoidance behavior of anthropogenic features may result in functional habitat loss and reduce the amount of suitable habitat available; compounding previously fragmented landscapes. Anthropogenic features may limit movement by acting as barriers on the landscape and potentially disrupt population connectivity. Furthermore, habitats selected for nesting and brooding may result in potential ecological traps because of reduce breeding success when impacted by increased occurrence and densities of anthropogenic features. Reduced breeding success can have significant negative impacts on population persistence. Average home range size across all ecoregions indicated that female lesser prairie-chickens need at least 340 ha of habitat to fulfill her life-history requirements during the breeding season. Brooding habitats need to be in close proximity (≤ 750 m) to nesting cover to reduce distance traversed by newly hatched broods. Reducing grazing pressure will ensure that sufficient vertical habitat structure is available during the nesting period and increase female survival; especially in times of drought. Mangers should restrict construction of anthropogenic features near or within suitable lesser prairie-chicken habitat with emphasis on distribution power lines. Well densities should not exceed 1 well/60 acres (11 wells/section) for a >10% probability of use. However, because the affect that density of wells has on demographic rates of lesser prairie-chickens has yet to be determined, a conservative approach where well densities in or adjacent to grassland patches should be minimized as much as possible is best.

Products:

Thesis or Dissertation:

Plumb, R.T. 2015. Lesser prairie-chicken movement, space use, survival, and response to anthropogenic structures in Kansas and Colorado. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

Presentations:

Plumb, R.T., J.M. Lautenbach, S.G. Robinson, J.D. Kraft, D. Sullins, J. Lautenbach, D.A. Haukos, J.L. Winder, J.C. Pitman, C.A. Hagen, and D. Dahlgren. 2016. Lesser prairie-chicken space use response to anthropogenic structures among landscapes. North American Congress for Conservation Biology, Madison, WI. (Invited)

Plumb, R.R., J.M. Lautenbach, S.G. Robinson, J.D. Kraft, D. Sullins, D.A. Haukos, J.C. Pitman, C.A. Hagen, and D. Dahlgren. 2015. Lesser prairie-chicken space use response to anthropogenic structures. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Plumb, R.R., J.M. Lautenbach, S.G. Robinson, J.D. Kraft, D. Sullins, D.A. Haukos, J.C. Pitman, C.A. Hagen, and D. Dahlgren. 2015. Lesser prairie-chicken space use response to anthropogenic structures among landscapes. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, and D. Dahlgren. 2014. Breeding season habitat patch use by female lesser prairie-chickens in Kansas and Colorado. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, and D. Dahlgren. 2014. Effects of habitat patch use on breeding season survivorship of lesser prairie-chickens in Kansas and Colorado. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Breeding season space use dynamics of female lesser prairie-chickens in Kansas and Colorado. Symposium on Animal Movement and the Environment, Raleigh, North Carolina.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Past, Present, and Future: using historical and information to guide conservation decisions for an iconic prairie grouse of the southwestern Great Plains. Regional Pheasants Forever and Quail Unlimited Conference, Wichita, Kansas.

Plumb, R.T., J. Lautenbach, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Breeding season home-range characteristics of female lesser prairie-chickens in Kansas and Colorado. Kansas Natural Resource Conference, Wichita, Kansas.

Plumb, R., Lautenbach, J., R. Plumb, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Nest site location by lesser prairie-chickens in Kansas and Colorado. Midwest Fish and Wildlife Conference, Kansas City, MO.

Plumb, R., Lautenbach, J., R. Plumb, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Effects of habitat patch selection on breeding season survivorship of lesser prairie-chickens in Kansas and Colorado. Midwest Fish and Wildlife Conference, Kansas City, MO.

Plumb, R., J. Lautenbach, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2013. Adult female survival of lesser prairie-chickens in Kansas and Colorado. Biennial Prairie Grouse Technical Council Meeting, Crookston, MN

Plumb, R., J. Lautenbach, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2013. Breeding season movements of adult female lesser prairie-chickens in Kansas and Colorado. Biennial Prairie Grouse Technical Council Meeting, Crookston, MN.

Title: **Lesser Prairie-Chicken Response to USDA Conservation Practices in Kansas and Colorado**

Funding: NRCS USDA
FSA USDA

Investigator: Dr. Beth Ross, Postdoctoral Research Associate

Project Supervisor: Dr. David A. Haukos, Unit Leader

Completion: 2015

Significant numbers of lesser prairie-chickens of Kansas and Colorado are associated with former croplands that have been enrolled in a U.S. Department of Agriculture conservation programs/practices, principally the Conservation Reserve Program (CRP) and Environmental

Quality Incentive Program (EQIP). At a broad-scale CRP has reduced habitat fragmentation and assisted in connecting extant and expanding populations. Additionally, conservation practices with CRP fields that may be affecting these populations include vegetation species composition, development of supplemental water areas, mid-term management practices, and emergency haying/grazing declarations. Use of CRP may also be related to juxtaposition of CRP, cropland, and other land uses. In addition, the overall population response by lesser prairie-chickens to conservation programs needs to be assessed in regard to demography of the population to model future population trends. Concurrent with CRP and land use practices, more information is needed on the response of lesser prairie-chickens to changes in climate. The Great Plains region is predicted to experience increasing drought conditions, which could negatively affect lesser prairie-chickens in the future. A better understanding of the interaction between land use and climate change on lesser prairie-chicken population demographics is important for future management practices. Our results thus far indicate that extreme values of Palmer Drought Severity Index (both low and high, or dry and wet conditions) during the spring breeding season were the best predictors of changes in lesser prairie-chicken abundance, though neither had a significant effect on male lesser prairie-chicken abundance on leks. Abundance on leks was highest during the mid-1980s, followed by low population abundance in the 1990s. The population has remained relatively stable since the late 1990s. Future research will incorporate land use variables to determine how vital rates (nest success, survival relative to other habitat types) differ by landscape type. Interactions between land use type and with climate change will be quantified, as well as interactions with climate and a variety of landscape metrics (e.g., edge, patch size, patch configuration). Population demography will be linked to a variety of USDA conservation practices. The influence of CRP on LEPC populations will be determined by scaling results up to landscape levels.

Products:

Peer-reviewed Publications:

Ross, B.E., D. Haukos, C. Hagen, and J. Pitman. 2016. The relative contribution of climate to changes in lesser prairie-chicken abundance. Ecosphere. In Press

Ross, B.E., D.A. Haukos, C.A. Hagen, and J.C. Pitman. 2016. Landscape composition creates a threshold influencing lesser prairie-chicken population resilience to extreme drought. Global Ecology and Conservation 6:179-188.

Presentations:

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2016. Combining multiple data sources to determine drought and land-use impacts on lesser prairie-chickens. North American Ornithological Congress, Washington, D.C.

Ross, B.E., D. Haukos, and P. Walther. 2016. Drivers of mottled duck pairs on the upper Texas Gulf Coast. 7th North American Duck Symposium, Annapolis, MD.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2015. Extreme drought events and changes in land cover interact to reduce resilience of the lesser prairie-chicken. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2015. Combining multiple data sources to determine drought and land-use impacts on lesser prairie-chickens. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2015. The relative influence of climate variability and landscape change on lesser prairie-chicken populations. Annual Meeting of The Wildlife Society, Winnipeg, Manitoba.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2014. Changes in lesser prairie-chicken abundance in Kansas. Kansas Natural Resource Conference, Wichita, Kansas.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2014. The relative influence of drought and habitat on lesser prairie-chickens. Society for Conservation Biology, Missoula, Montana.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2014. Combining multiple data sources to determine climate and land-use impacts on lesser prairie-chickens. Annual Meeting of The Wildlife Society, Pittsburgh, Pennsylvania.

Title: **Development of Conservation and Climate Adaptation Strategies for Wetlands in the Great Plains LCC Region**

Funding: U.S. Geological Survey

Investigator: Dr. Gene Albanese, Post-Doctoral Research Associate

Project Supervisors: Dr. David A. Haukos, Unit Leader
Dr. Susan Skagen, U.S. Geological Survey, Fort Collins, CO

Completion: September 2015

We developed a framework to examine dynamic processes in a dense, broad-scale wetland habitat network. In particular, we provide a formal mechanism for the representation, measurement and modeling of potential movements between spatially discrete populations of playa wetland-dependent species within the Southern Great Plains. We used this framework to model and quantify changes to the structural and functional connectivity of Texas playa wetlands and identify playa wetlands critical to the maintenance of system wide connectivity (and hence, top priority for conservation) based on historic records, recent surveys, and forecasted future scenarios.

Initially, we conducted a network analysis on playa wetlands throughout the GPLCC (n = 48,981). We used a network hierarchical decomposition analysis to identify distinct, emergent sub networks based on the underlying physical structure of the playa wetlands within the region. Percolation behavior in response to variation in playa wetland configuration (h) was used to decompose the network into a hierarchy. Beginning at h = 20 km, links of decreasing distance were sequentially removed at increments of 1 km (i.e., h = 19 km, 18 km, 17 km...) to a distance of h = 500 m. At each distance, a quantified description of network-level percolation was obtained. The Texas playa wetland network (TPWN) was identified as a distinct and dominate sub network within this system. The TPWN emerged rapidly (i.e., h = 2 km) and remained a distinct sub network when h = 15 km. The TPWN included 24,338 playa wetlands within portions of New Mexico, Oklahoma, and Texas, US (Fig. 1a).

To quantify the range in variation and to provide a standard for which network connectivity metrics calculated from further parameterize network models could be compared we constructed a random reference network of the TPWN. The potential range of variation in connectivity within the TPWN in both space and time were calculated using sequentially lower values of wetland availability (p) and h across 88,000 random playa wetland removal simulations. Our results indicate that the TPWN is characterized by dense clustering across the network at fine spatial scales (h > 2 km but < 5 km) and a single dominant sub network at broader spatial scales (> 5 km) even when p was relatively low (i.e., p = 0.2). Furthermore, we quantified the

percolation metric ΔD across the range of scalar parameter (h x p) values to define the spatiotemporal domain of the phase transition and the percolation threshold of the TPWN (Fig. 1b). At the percolation threshold (i.e., h = 4 km, p = Δ0.2 -0.4) within the critical phase transition, the TPWN rapidly shifts from a network dominated by many small, dense, loosely connected sub networks to a single large sub network connected by increasingly direct and redundant paths. Through time, fine-scale redundancy in the formation of localized playa wetland clusters and broad-scale redundancy in path formation among playa wetlands across the TPWN insulate the network from total collapse by minimizing the probability of complete loss in function at any point in time. The phase transition in the TPWN acts as a bridge linking fine and broad-scale population dynamics and it is at the percolation threshold that the TPWN is most sensitive to changes in playa wetland availability and configuration.

Network damage processes are used to characterize the robustness of complex networks to failure from damage. Using a network damage process, we assessed the relative importance of individual playa wetlands to maintaining network-level connectivity by comparing the response of network-level percolation metrics from a heterogeneous weighted TPWN to the reference distribution after targeted removals of high ranking playa wetlands. To construct the heterogeneous TPWN model, we assigned weights to each wetland that reflected differences in the potential magnitude of movement from wetlands. Weights were used in a bivariate, distance-decay kernel and were a product of probability of inundation estimates calculated using field and weather station data and habitat quality estimates derived using sediment deposition rates from a Universal Soil Loss equation (Fig. 1a & 1c). To target playa wetlands for removal in the network damage process, we calculated two different centrality metrics for each wetland that conceptually capture alternate aspects of connectivity at different scales (Fig 1d & 1e). At finer scales, playa wetlands with greater degree centrality may be important because their position in a localized cluster implies that these wetlands are highly accessible and thus sub populations within these wetlands are more likely to persist through time (i.e., Metapopulation Theory). At broader scales, playa wetlands with greater betweenness centrality may be important because their position in a network implies that populations have to move through these playa wetlands more often to cross the network. Within the large patchy populations that breed throughout the TPWN, these playa wetlands may act as "stepping stones" on long routes through the network maintaining movements within wetland clusters and facilitating occasional movements among sub networks. Based on the percolation behavior of the reference TPWN, we rank-ordered the wetlands of the TPWN by normalized weighted degree and betweenness centrality metrics calculated with h = 4 km in a distance decay kernel function and targeted the top 40% for removal in a network damage process. When removed, the dense, fine-scale clustering indicative of the TPWN when playa availability was relatively low (i.e., p = 0.2) shifted upward to p = 0.4 (Fig.1f). Additionally, the global TPWN failed to coalesce and redundant, broad-scale paths across the network did not form. These results suggest that the targeted wetlands are critical to maintaining functional connectivity across spatiotemporal scales among populations of playa wetland-dependent species within the TPWN.

Products:

Peer-reviewed Publications:

Albanese, G., and D.A. Haukos. 2016. A network model framework for prioritizing wetland conservation in the Great Plains. Landscape Ecology In Press.

Presentations:

Albanese, G., and D. Haukos. 2015. A framework for understanding connections within dense broad-scale habitat networks: prioritizing wetlands for conservation within a dynamic landscape. Annual meeting of the Society of Wetland Scientists, Providence, RI.

2014

Title: **Status and distribution of black-tailed prairie dogs on small cultural National Parks in the western Great Plains**

Funding: U.S. Geological Survey

Investigator: Rachel Pigg, Ph.D. Student

Advisor: Dr. Jack F. Cully, Jr.

Completion: 2014

Dispersal remains one of the most important, yet least understood, life history traits. As the vehicle of gene flow among populations, dispersal can both relieve inbreeding depression and prevent local adaptation. Regionally, dispersal can stabilize or destabilize metapopulations, given its critical roles in disease transmission among populations as well as recolonization following local extinction events. Furthermore, in light of climate change and increasing habitat loss and fragmentation, the ability to navigate through unfamiliar, unsuitable habitat between populations is essential to the long-term survival of a species across its range. In my dissertation, I present a multi-scale investigation of factors affecting gene flow and disease transmission among populations of a keystone species and an agricultural pest of the North American prairie: the black-tailed prairie dog (*Cynomys ludovicianus*). Black-tailed prairie dogs are social, ground-dwelling squirrels that live in spatially isolated populations called colonies. First, we conducted a landscape genetic analysis of black-tailed prairie dogs throughout a large portion of their current range. Our estimates of gene flow indicate that the genetic neighborhood size of both male and female prairie dogs reaches 40-60 km within short-grass prairie, whereas colonies within mixed-grass prairie are more isolated. At a broad scale, we observed isolation-by-distance among colonies and great influence of grassland productivity on genetic connectivity; however, neither distance nor landscape characteristics greatly explained observed genetic differentiation among colonies separated by < 50 km. Last, we investigated whether landscape features could predict disease transmission patterns of sylvatic plague among colonies in short-grass prairie and found evidence that pastures act as corridors for plague transmission. Our results indicate that black-tailed prairie dogs are more resilient to habitat loss and fragmentation than other obligate grassland species and likely capable of transmitting sylvatic plague over long distances. Taken together, these studies illustrate how a multi-scale approach can reveal complexities of dispersal dynamics that would otherwise remain undetected.

Products:

Technical and Semi-Technical:

Cully, J. F., Jr. 2010. Black-tailed Prairie Dog Colony Mapping at the Kiowa and Rita Blanca National Grasslands. Project Report to the U.S.D.A., Forest Service, Cibola National Forest, Agreement Number Agreement Number 09-CS-11030300-012, Albuquerque, NM.

Pigg, R. M., and J. F. Cully, Jr. 2009. Status and Management of Black-tailed Prairie Dogs on Small Cultural Parks of the Western Great Plains. Annual Report to U.S.G.S. N.R.P.P. Program and National Park Service.

Thesis or Dissertation:

Pigg, R.M. 2014. A multi-scale investigation of movement patterns among black-tailed prairie dog colonies. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Pigg, RM, SM Wisely, C Lee, JF Cully, Jr. 2013. Broad-scale patterns of connectivity among black-tailed prairie dog colonies in a heavily managed landscape. American Society of Mammalogists Conference, Philadelphia, PA.

Pigg, R., T. Johnson, and J. F. Cully. The influence of landscape features on the disease ecology of sylvatic plague. Fifth Biennial Meeting of the International Biogeographical Society, 7-11 January 2011. Crete.

Pigg, R., T. Johnson, and J. F. Cully. The influence of landscape features on the disease ecology of sylvatic plague. 72nd Midwest Fish and Wildlife Conference, Des Moines, Iowa, 4-7 December 4-7, 2011.

Cully, J., R. Pigg, and A. Goldberg. 2010. Sustainability of black-tailed prairie dogs at small culture parks of the western Great Plains. 22nd North American Prairie Conference, Cedar Falls, Iowa.

Title: **Nest-site selection, duckling survival, and blood parasite prevalence of lesser scaup nesting at Red Rock Lakes National Wildlife Refuge**

Funding: U.S. Fish and Wildlife Service
U.S. Geological Survey
Kansas State University

Investigator: Andrew Stetter, M.S. Student

Advisor: Dr. David Haukos

Completion: 2014

Abstract–Duckling Survival

Lesser scaup (scaup) populations have been experiencing continent-wide decline since the 1980s. It is important to have complete understanding of the critical factors influencing population change (e.g., duckling survival, nesting success, and health) to advance our understanding of population dynamics and improving species conservation. Duckling survival is a primary driver of scaup demography. I conducted a capture-mark-recapture study using Cormack-Jolly-Seber models in Program MARK to compute apparent daily survival and recapture probabilities for 3256 individually marked ducklings with 620 recaptures during 2010 to 2013. The most parsimonious survival model based on a priori hypotheses found that Julian hatch date squared was the most significant predictor of survival and consistent through all four years. Mass at hatch also was significant as a quadratic effect. Duckling survival to 30 days ranged from 29.0 to 80.0. During this study, stabilizing selection played a significant role in duckling survival, which indicates that there was trade-offs for selection of an optimal timing of hatch on survival and a cost associated with hatching too early or too late and being too heavy or to light.

Abstract–Nest-Site Selection

There is a hierarchical process of behavioral and environmental processes that influence habitat selection, which inherently influences the survival and fitness of that individual and contributes to population growth. I investigated nest fate, spatial attributes, and all relationships between high and low-water levels with habitat attributes (distance to upland, distance to open water, nearest neighbor distance) of located nests using general linear models in SAS, t-tests in R, and Hot Spot Analysis in ArcGIS of 481 nests over eight years. In low-water years, successful nests

($\bar{X}$ = 1153 m) were located 22.0% farther from upland than unsuccessful nests ($\bar{X}$ = 944 m), but support for a similar relationship was lacking in high-water years. Successful nests were located 21.0% and 23.0% (i.e., 49 and 50 m) closer to conspecific nests than unsuccessful nests in low and high-water levels, respectively. In both high and low-water level years, clusters of nests initiated later in the season coincided with Hot Spots for nest fate (i.e., high-quality habitat patches, clusters of successful nests), whereas areas that tended to be selected first, evidenced by clusters of nests initiated earlier, tended to overlap with clusters of Cold Spots for nest fate. The core Hot Spot for nest fate was in the same spot in both water level conditions and located in flooded emergent vegetation in the heart of Lower Red Rock Lake furthest from any upland habitat. Three out of six Cold Spots for nest fate both in high and low-water years were located in emergent vegetation on the perimeter of Lower Red Rock Lake adjacent to uplands. Density-dependence seems to be a factor affecting late-nesting scaup females that are apparently cuing in on the reproductive performance of conspecifics when determining where to nest. Therefore, management actions focused on survival and reproductive success of scaup should consider managing water levels and habitat for later nesting scaup to increase adult survival and ultimately recruitment of ducklings.

Abstract – Blood Parasite Prevalence

Blood parasites, per se, do not lead to direct mortality, but instead reduce the health of individual birds, which may ultimately lead to decreased reproductive success. Evidence has shown that presence of blood parasites can reduce fitness, body condition, and reproductive success of waterfowl. For many avian species, the cost of reproduction is manifested as a negative relationship between female breeding effort and breeding season survival, with trade-offs occurring when these adaptive choices become detrimental to future reproductive performance. Blood was drawn for parasite load determination from 112 individual adult scaup captured from 2011to 2012 via spotlighting and drive-trapping. Parasite prevalence was determined through blood assays that were created using a two-slide wedge technique. Relationships among seasonal heterophile:lymphocyte ratio (a proxy for health), body mass at time of capture (throughout pre-, during, and post-breeding periods), breeding status (females only), and Julian date of capture (date of capture) of capture with parasite prevalence were analyzed using linear (lm) regression models in R 2.15.2. The blood parasite infection rate was 5.0%, with prevalence differing by gender with 33.3% of males positive for blood parasites compared to 1.0% of females. The presence of blood parasites did not affect health, fitness, or breeding status of scaup. A quadratic relationship was found with body mass and date of capture, indicating that body mass increased from pre-breeding period to the breeding period and decreased significantly at the end of the summer during molt. A negative relationship between the heterophile:lymphocyte ratio of female scaup and date of capture (i.e., the health of scaup females was greatest during the pre-breeding period after which it consistently decreased until the molting period). A strong negative correlation between heterophile:lymphocyte ratio and body mass was found in both genders, which indicated that scaup in poor body condition were also in poor health at the end of the breeding season.

Products:

Thesis or Dissertation:

Stetter, A.P. 2014. Nest-site selection, duckling survival, and blood parasite prevalence of lesser scaup nesting at Red Rock Lakes National Wildlife Refuge. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

Presentations:

Stetter, A., J. Warren, and D. Haukos. 2014. Duckling survival at the edge of scaup range in Montana. Midwest Fish and Wildlife Conference, Kansas City, MO.

Stetter, A. P., J. M. Warren, and D. A. Haukos. 2014. Nest-Site Selection by Scaup at Red Rock Lakes National Wildlife Refuge. Midwest Fish and Wildlife Conference, Kansas City, MO.

Stetter, A., D. Haukos, and J. Warren. 2013. Parasitemia, health, and reproduction in lesser scaup at Red Rock Lakes National Wildlife Refuge. 6th North American Duck Symposium, Memphis, Tennessee.

Stetter, A., J. Warren, and D. Haukos. 2013. Duckling survival at the edge of scaup range in Montana. Annual Meeting of The Wildlife Society, Milwaukee, Wisconsin.

Title: **A Historical Record of Land Cover Change of the Lesser Prairie-Chicken Range in Kansas**

Funding: USDA
NRCS
FSA

Investigator: David Spencer, M.S. Student

Advisor: Dr. Melinda Daniels, Department of Geography

Completion: December 2014

The Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*) is a prairie grouse of conservation concern in the Southern Great Plains. In response to declining population numbers and ongoing threats to its habitat, the Lesser Prairie-Chicken was listed as threatened under the Endangered Species Act in May 2014. In western Kansas, the Lesser Prairie-Chicken occupies the Sand Sagebrush Prairie, Mixed-grass Prairie, and Short-grass/CRP Mosaic Ecoregions. Since the beginning of the 20th century, the overall range and population has declined by 92% and 97% respectively. Much of this decline is attributed to the loss and fragmentation of native grasslands throughout the Lesser Prairie-Chicken range. Whereas much of the loss and degradation of native grassland have been attributed to anthropogenic activities such as conversion of grassland to cropland and energy exploration, federal legislation since the 1980s to convert cropland on highly erodible soils to perennial grasses through the U.S. Department of Agriculture (USDA) Conservation Reserve Program (CRP) may curtail or reverse these trends. My objective was to document changes in the areal extent and connectivity of grasslands in the identified Lesser Prairie-Chicken range in Kansas from the 1950s to 2013 using remotely sensed data. I hypothesized that the total amount of grassland decreased between the 1950's and 2013 because of an increase in agricultural practices, but predicted an increase of grassland between 1985 and 2013 in response to the CRP. To document changes in grassland, land cover maps were generated through spectral classification of LANDSAT images and visual analysis of aerial photographs from the Army Map Service and USDA Farm Service Agency. Landscape composition and configuration were assessed using FRAGSTATS to compute a variety of landscape metrics measuring changes in the amount of grassland present as well as changes in the size and configuration of grassland patches. Since 1985, the amount of grassland in the Lesser Prairie-Chicken range in Kansas has increased by 210,9963.3 ha, a rise of 11.9%, while the mean patch size and area-weighted mean patch size of grassland increased 18.2% and 23.0% respectively, indicating grassland has become more connected during this time in response to the

CRP. Prior to the implementation of CRP, the amount of grassland had been decreasing since 1950, as 66,722.0 ha of grassland was converted to croplands. The loss of grassland had a considerable effect on the patch size of grasslands, as mean patch size and area-weighted mean patch size decreased by 8.8% and 11.1% respectively. The primary driver of grassland loss between 1950 and 1985 was the emergence of center pivot irrigation, which had its greatest impact in western and southwestern parts of the range in Kansas. In particular, while the amount of grassland in Range 5, a region of the Lesser Prairie-Chicken range found in southwest Kansas, has increased overall since the 1950s by 4.7%, the area-weighted mean patch size has decreased by 53.0% in response to center pivot irrigation fragmenting the landscape. While the CRP has been successful in increasing and connecting grassland throughout the Lesser Prairie-Chicken range to offset the loss of grassland since the 1950s, continuation of the CRP faces an uncertain future in the face of rising commodity prices, energy development, and reduction in program scope leaving open the possibility that these areas that have created habitat for Lesser Prairie-Chickens could be lost. As time progresses, a reduction in the scope of the CRP would reduce the amount of habitat available to Lesser Prairie-Chickens, threatening the persistence of their population.

Products:

Thesis or Dissertation:

Spencer, D.A. 2014. A historical record of land cover change of the lesser prairie-chicken range in Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Daniels)

Presentations:

Spencer, D., M. Daniels, and D. Haukos. 2014. A historical record of land cover change of the lesser prairie-chicken range in Kansas. Midwest Fish and Wildlife Conference, Kansas City, MO.

Title: **Mottled duck (*Anas fulvigula*) Ecology in the Texas Chenier Plain Region**

Funding: U.S. Fish and Wildlife Service

Investigator: Jena Moon, Ph.D. Student, Stephen F. Austin State University

Advisors: Dr. David A. Haukos

Completion: May 2014

Many studies and plans have outlined the importance of the Chenier Plain Region of the Western Gulf Coast (WGC) to resident mottled ducks (*Anas fulvigula*), including the Mottled Duck Conservation Plan and the Chenier Plain Initiative for the Gulf Coast Joint Venture. The Chenier Plain Region historically, and currently, has the greatest density of mottled ducks in the WGC Population. Loss and degradation of mottled duck coastal habitats is the leading cause for mottled duck decline in the Chenier Plain Region (Stutzenbaker 1988). Urbanization, erosion, subsidence, conversion to agriculture, saltwater intrusion, invasive plant and animal establishment, loss of natural disturbance, sea level rise, and heavy metal accumulation all have played a role in the decline of quantity and quality habitats available to mottled ducks (Stutzenbaker 1988, Wilson 2007). However, the over-riding limiting factor affecting the species recovery lies within altered hydrology of the Chenier Plain Region. The mottled duck (*Anas fulgivula*) has been established as an indicator species to coastal marsh health and function (Stutzenbaker 1988, USFWS 2011). Currently, biologists have a relatively poor understanding of

mottled duck habitat use, regional movements, response to habitat management, and movements. This information is needed to assist in strategic habitat conservation planning and to inform conservation for the species.

We captured mottled ducks via night lighting from airboats during summer 2009, 2010, and 2011. Upon capture, we sorted mottled ducks based on sex, age, and mass. To each adult female >740 g, we fitted a Model 100 solar/satellite backpack PTT with a custom fitted Teflon ribbon harness. We attached satellite radio transmitters to 15, 30,
and 45 adult female mottled ducks in 2009, 2010, and 2011, respectively. PTTs were deployed with a duty cycle of 10 hours active and 72 inactive. We used the Argos system to collect data on date, time, latitude, longitude, and location class of each tagged female. Mortalities were assessed through a series temperature and movement sensors in association with ARGOS collected data.

Factors limiting survival of WGC mottled ducks potentially include harvest, lead exposure, disturbance, habitat loss or degradation, predators, and variations in climate patterns (Stutzenbaker 1988, Wilson 2007). Several studies have attempted to measure annual and periodic survival rates of WGC mottled duck populations. Historical banding data from 1965-1971 suggested annual survival rates of mottled ducks at 57.5% (Stutzenbaker 1988). Wilson et al. (2003) estimated annual survival rates to be 55.9% for male and 50.2% for female mottled ducks in the WGC population. More recent studies have estimated breeding season survival rates range from 63.3%-87.2% on Anahuac National Wildlife Refuge. Preliminary analyses from a telemetry study conducted by the Gulf Coast Joint Venture estimated annual survival rates to be 41% for after hatch-year (AHY) females and 48% for hatch-year females in Texas and Louisiana (HY). Compared with common waterfowl species these estimates are low (Wilson 2007). Johnson (2009) also concluded that survival rates of mottled ducks estimated from band-recovery data were low compared to those of most dabbling ducks, and Florida populations of mottled ducks (Varner et al. 2014). We established the encounter interval for survival analyses as 1 week and the experimental unit for survival was each radio-tagged bird. We estimated cumulative weekly survival which allowed us to further define periods of relative high and low mortality, which will enabled us to compare our survival estimates to previous and ongoing studies.

We employed known fate modeling in program MARK to assess the influence of potential mortality factors affecting mottled duck survival. Models tested included the following predictors: (1) time, (2) hunting and non-hunting periods, (3) biological time periods; individual covariate of (4) mass at time of capture was also incorporated. We used adjusted Akaike's Information Criterion (AICc) scores and weights to rank and assess models. Analyses indicate that survival rates remain below average for mottled ducks (12-38% annual rate of survival), when compared with other waterfowl species inhabiting the Gulf Coast. Primary periods of mortality included all periods of hunting and the molt biological time period. Drought conditions during 2011 also had negative impacts on overall survival rates of transmittered females.

Conservation of quality coastal habitats remains a high priority to potentially offset current survival rates of mottled ducks. Because of recent tropical climatic events and continual saltwater intrusion, current estimates of habitat use and selection by mottled ducks are unavailable for Texas and Louisiana Gulf Coast. Previous studies of habitat use by mottled ducks focused on specific biological time periods, did not consider effects of numerous anthropogenic alterations in the region, and occurred prior to the recent tropical events that caused major alterations in mottled duck habitats within the Texas Chenier Plain Region. Mottled duck habitat

use has been documented to be highly variable by past studies, with varied wetland types, land management practices and salinity regimes being documented (Stutzenbaker 1988). Managers need to have a better understanding of the role of habitat selection by mottled ducks to improve population management. We measured use and habitat selection based on habitat availability within the Texas Chenier Plain Region at fine, intermediate, and landscape scales. Our specific objectives include: 1) quantifying habitat use based on year and biological period (pairing, breeding, brood rearing, molt); 2) determining habitat selection for the Texas Chenier Plain Region; 3) comparing site- specific habitat metrics among locations across biological time periods; and 4) evaluating the effect of scale on habitat selection.

Habitat use was measured by taking values for land cover and salinity from within the buffered areas (250 m) surrounding used points. Habitat use data were analyzed using an analysis of variance to assess differences among marsh type for year, time of day, and month. Habitat selection analyses were completed using a generalized linear mixed modeling approach in R. Habitats considered locally available were limited to a 95% kernel density estimate for each individual, and landscape scale availability was merged home ranges for all individuals. Habitat use was closely tied to marsh type, with intermediate and brackish marsh being selected for the majority of locations (fresh marsh < 3%, intermediate marsh 29%, brackish marsh 46%, and 22% saline marsh. Mottled ducks also selected for grass dominated marshes with some use of emergent marsh. Freshwater habitats were available on the landscape; however, with drought conditions more freshwater wetlands were located farther inland than during normal or above average rainfall years. Habitat use was tied to salinity regime and water availability on the landscape with coastal marshes being selected for over adjacent ephemeral waters (e.g., stock tanks). Seasonal habitat selection varied based on average salinity and vegetative class within home ranges, with greatest sensitivity to salinity during breeding and brooding periods. Within season habitat use was extrapolated to identify potential high quality habitats based on local-scale selection patterns in the Texas Chenier Plain Region.

Habitat quality/quantity and disturbance were hypothesized to be important factors dictating mottled duck movements both spatially and temporally. Distance traveled, habitats used, and timing of movements by mottled ducks are widely unknown. Response to disturbance by mottled ducks inhabiting the upper Texas coast is also unknown. Because information on mottled duck movements is still widely unavailable, we documented weekly and seasonal movements of mottled ducks. In addition, we related variation in movement timing and distance with landscape habitat conditions (i.e., wetland availability), and disturbance. Specific study objectives were to 1) assess movement patterns among years, weeks, and biological time periods (fall, pairing, breeding, brood rearing, molt); 2) evaluate movements in relation to available habitat at the landscape level; 3) quantify movement patterns in association with high disturbance periods (e.g., periods of hunting); and 4) determine if changes in salinity regime or other habitat quality measure dictates movement patterns. To assess mottled duck movements, ArcGIS was employed to measure distances traveled weekly. Distances traveled were assessed using analysis of variance comparing among models containing independent variables of year, month, time of day, biological time period, season, and their respective interactions. Home range for each individual was also estimated and plotted using ArcGIS. Minimum convex polygons (95%) and kernel density estimators (50% and 90%) home ranges were also estimated. Analyses indicate that distances traveled by mottled ducks are short relative to other waterfowl <5,000 m on average. Movement occurrence, duration, and distance were linked to biological season, salinity regime,

and habitat conditions on the landscape (i.e., available wetlands). Home ranges were small with an average size of 1516 ha and 6566 hectares for 50% and 95% KDE home ranges, respectively.

To project the potential implications of climate change to the WGC population of mottled ducks. Home ranges were then overlaid by the Sea Level Affecting Marshes Model (SLAMM; USFWS 2011b), which predicts availability of future habitat types based on predicted sea level rise. We compared composition of habitat types within home ranges of individual mottled ducks (i.e., 2005) to expected available habitat types in 2050 and 2100. Overall, proportion of habitat classes differed among years, and there are substantive changes in available habitat projected. Under current SLAMM predictions mottled ducks are poised to lose over one half of their preferred habitat type, which will likely result in further population declines for this species by the 22nd Century.

The culmination of this research was development of a population demography model that spans the WGC Population of mottled ducks. An important concern in most ecological fields is determining factors singularly, concomitant, or synergistically operating as limiting factors constraining populations of interest (Peterson et al. 1998). The development of sophisticated system dynamics modeling software, has facilitated the use of this approach in ecological modeling (Faust et al. 2003a). Through the use of STELLA 10.0.0 a seasonal conceptual demographic model was constructed and parameterized with much of the data currently available on mottled ducks. The model was then evaluated based on available demographic rates (including data collected from this study). Following model validation, the relative importance/relatedness of various vital rates to the total population of WGC mottled ducks was assessed, and population persistence rates were calculated using IUCN criteria. Model simulations indicate that the probability of persistence to 100 years was 46%, with an average $\lambda = 0.383$. Eighty of the 140 simulations reached quasi-extinction rates of > 2500 individuals, and 77% of simulations met some IUCN criteria for the species to be listed as threatened, endangered or critically endangered. The model was sensitive to variation in all breeding parameters, which can be influenced by quality habitat management practices. As future population projections for the species are not improving and substantial habitat restoration efforts are needed to sustain and improve production for mottled ducks within the WGC Population. The model presented herein, assumes constant habitat conditions across time and does not incorporate future degradation of habitats. There are many additional exogenous factors that are not included in this model that should provide additional concern for the persistence of the WGC mottled duck population (e.g., sea-level rise, further declines in rice farming, declines in water available for habitat management.

Products:

Peer-reviewed Publications:

Moon, J.A., D.A. Haukos, and W.C. Conway. 2015. Mottled duck (*Anas fulvigula*) movements in the Texas Chenier Plain Region. Journal of the Southeastern Association of Fish and Game Agencies 2:255-261.

Thesis or Dissertation:

Moon, J.A. 2014. Mottled Duck (*Anas fulvigula*) ecology in the Texas Chenier Plain Region. Ph.D. Dissertation. Stephen F. Austin State University, Nacogdoches, TX. (Advisor: Haukos)

Presentations:

Haukos, D.A., J.A. Moon, and W.C. Conway. 2016. At what scale should mottled ducks be managed? Special Session: Evolution, Ecology, and Conservation of Monotypic Ducks, 7th North American Duck Symposium, Annapolis, MD. (Invited)

Moon, J., S. DeMaso, M. Brasher, W. Conway, and D. Haukos. 2016. A stochastic model to simulate mottled duck population dynamics. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.
Moon, J., S. Lehnen, K. Metzger, S. Sesnie, D. Haukos, and W. Conway. 2016. Integrating sea-level rise and anthropogenic change into mottled duck conservation. 7th North American Duck Symposium, Annapolis, MD.
Moon, J., D. Haukos, W. Conway, and S. Lehnen. 2014. Habitat selection of adult female mottled ducks in the Texas Chenier Plain Region. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.
Moon, J.A., D.A. Haukos, and W.C. Conway. 2014. Habitat selection by mottled ducks on the upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.
Moon, J.A., D.A. Haukos, and W.C. Conway. 2014. Movements by mottled ducks on the upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.
Moon, J.A., D.A. Haukos, W. Conway, and P. Walther. 2013. Movements of mottled ducks in the Texas Chenier Plain Region. 6th North American Duck Symposium, Memphis, Tennessee.
Moon, J.A., D.A. Haukos, W. Conway, and P. Walther. 2013. Habitat selection of mottled ducks in the Texas Chenier Plain. 6th North American Duck Symposium, Memphis, Tennessee.
Moon, J.A., D.A. Haukos, W. Conway, and P. Walther. 2013. Potential implications of climate change on the mottled duck. 6th North American Duck Symposium, Memphis, Tennessee. Poster
Moon, J.A., D.A. Haukos, and W. Conway. 2012. Potential climate change impacts to mottled ducks on the Chenier Plain Region of Texas. Texas Chapter of The Wildlife Society, Fort Worth, Texas.
Moon, J., D. Haukos, W. Conway, and P. Walther. 2011. Habitat use and movements of adult mottled ducks on the Texas Chenier Plain. Annual Meeting of The Texas Chapter of The Wildlife Society, San Antonio, Texas.

Title: **Environmental availability and lead exposure to mottled ducks (*Anas fulvigula*) in the Texas Chenier Plains region**

Funding: Environmental Protection Agency
Texas Tech University
U.S. Fish and Wildlife Service

Investigator: Stephen McDowell, M.S. Student, Stephen F. Austin State University

Advisor: Dr. David A. Haukos, Unit Leader

Completion: 2014

Mottled ducks (*Anas fulvigula*) are a non-migratory, dabbling waterfowl species dependent upon coastal marsh systems, including those on the Texas Chenier Plain National Wildlife Refuge Complex (TCPNWRC), and are considered a regional indicator species of marsh habitat quality. Populations on the upper Texas coast are experiencing long-term declines where estimates have decreased from >77,000 in 1971 to <30,000 in 2013. Loss of wetlands due to anthropogenic alteration and development are thought to be the primary causes of regional declines, but other factors such as drought, salt water intrusion, increased predator populations, exotic invasive plants, and Pb toxicosis may also play significant roles. Mottled ducks have long been known to be susceptible to Pb toxicosis. Research from the early 1970s, 1990s, and mid-2000s indicated that mottled ducks continued to exhibit elevated wing-bone Pb, decades after implementation of non-toxic shot regulations with wing-bone Pb concentrations reported as 11.6 and 18.4 parts per million (ppm) for Anahuac and McFaddin NWRs, respectively, where 40% of after-hatch-year (AHY) and 19% of hatch-year (HY) birds were considered exposed (>20 ppm). Although

current wing-bone Pb levels have decreased, they remain near those reported in mallards (*A. platyrhynchos*) and greater than levels in American black ducks (*A. rubripes*) and Northern pintails (A. acuta) in the early 1970s, prior to non-toxic shot requirements. While ingestion of Pb shot has long been considered the greatest source of Pb exposure to waterfowl, elevated Pb levels in sediment, vegetation, and invertebrates may be alternate sources of Pb exposure to mottled ducks. Soil is major sink of lead in the environment where approximately 60-70% of annual global atmospheric Pb emissions are estimated to be deposited directly onto the soil. Vegetation and invertebrates that mature in these soils may bio-accumulate enough Pb to be an additive source of Pb to waterfowl. Therefore, the objectives of this research were to 1) establish baseline blood Pb concentrations for all ages of mottled ducks on the TCPNWRC, 2) determine and compare the proportion of the sampled population that was exposed to Pb during summer and winter to potentially identify relevant temporal windows of exposure, 3) determine baseline Pb concentrations in soil, vegetation, and invertebrates on the TCPNWRC and adjacent, privately owned rice fields, 4) determine any environmental effects on soil, vegetation, and invertebrate Pb concentrations using multilinear regression, and 5) determine Pb shot densities on both the TCPNWRC and adjacent rice fields.

A total of 260 blood samples were collected from summer (n = 124) and winter (n = 136) mottled ducks during 2010 – 2012 on the TCPNWRC. Pb levels ranged from below detection limits to >12,000 µg/L, where >500 µg/L was associated with adverse health effects in waterfowl. We identified four plausible models where the interaction among age, sex, and season, year, site, and between age and season were included in the top-ranked models. Blood Pb concentrations were greatest in adult males, and were greater during winter, indicating a window of exposure to environmental Pb exists between the nesting and hunting season. Likewise, the percentage of exposed females increased from 14 – 47% from summer to winter, respectively. Identifying sources of environmental Pb is key to minimizing threats to mottled ducks throughout the upper Texas coast.

We collected 217 soil cores from 2010-2012 which, when separated into sections, resulted in 584 sub samples (Organic: n = 178, Middle: n = 206, Bottom: n = 200) analyzed for Pb. Pb concentrations ranged from 0.01-1,085.5 mg/kg with eight samples above background concentrations (>50 mg/kg) as set by the EPA. Soil Pb concentrations were typically greater on McFaddin NWR than on Anahuac NWR, and were greatest in the top 5 cm of the clay pan (i.e. middle layer) followed by the organic layer and the bottom layer. Soil Pb concentrations were likewise greater on the Complex than in the soils of the local, adjacent rice fields. While the global model was the only plausible model for overall soil core layers, individual layers relied on water presence, water depth, and salinity. No correlation existed between the organic and middle layers while a weak correlation existed between the organic and bottom layers and a strong correlation existed between the middle and bottom layers. Two Pb shot pellets were found in two core samples from the Complex, extrapolating out to >60,000 pellets/ha across the Complex.

We collected 168 vegetation samples (root: n = 119, seed: n = 28, widgeongrass: n = 21) during 2010-2012. Pb concentrations ranged from non-detection to 41.02 mg/kg with a geometric mean of 5.92 mg/kg. Pb concentrations were greatest in widgeongrass samples, followed by root samples and seed samples. Our models indicated that vegetation Pb concentrations were influenced by species, salinity, refuge, unit, and refuge unit. However, model performance was poor and did not provide reliable data on covariate influences. A weak correlation existed between root and seed Pb concentrations and, because widgeongrass samples were analysed separately, no correlation existed between widgeongrass and root or seed samples.

We collected 17 invertebrate samples from the Complex from 2010-2012. Due to a lack of individual mass, samples were combined based on refuge unit. Pb concentrations ranged from 0.21 mg/kg to 2.93 mg/kg with a geometric mean of 1.07 mg/kg.
Blood Pb concentrations remain elevated in mottled ducks despite Pb shot bans enacted >25 years prior. The increase in Pb concentrations from summer to winter suggest a temporal, persistent source of Pb exposure coinciding with the time that mottled ducks increase their use of local agricultural fields over which mourning dove (*Zenaida macroura*) are harvested using Pb shot. Due to the non-migratory behavior exhibited by mottled ducks, Pb shot availability and Pb concentrations with the soil, vegetation, and invertebrates may be a potential and persistent source of environmental Pb. While Pb shot availability is greater than densities considered dangerous to waterfowl (>50,000 pellets/ha), shot densities are based on two pellets and are not definitive. Though Pb concentrations were not greatly elevated in soil, vegetation, and invertebrates, persistent exposure to low level Pb concentrations can be detrimental to birds. With mottled duck population numbers continuing to decrease, blood Pb concentrations should continue to be monitored along with Pb shot availability in both local agricultural fields and in historic hunt areas on the Complex in order to better understand when and where mottled ducks are exposed to Pb.

Products:

Peer-reviewed Publications:

McDowell, S.K., W.C. Conway, D.A. Haukos, J.A. Moon, C.E. Comer, and I.K. Hung. 2015. Blood lead exposure concentrations in mottled ducks (*Anas fulvigula*) on the upper Texas coast. Journal of the Southeastern Association of Fish and Game Agencies 2:221-228.

Thesis or Dissertation:

McDowell, S.K. 2014. Environmental availability and lead exposure to mottled ducks (*Anas fulvigula*) in the Texas Chenier Plains region. Master's Thesis, Stephen F. Austin State University, Nacogdoches, Texas (Advisor: Haukos)

Presentations:

McDowell, S., W. Conway, C. Comer, D. Haukos, and J. Moon. 2014. Lead exposure concentrations in the blood of mottled ducks (*Anas fulvigula*) on the Texas Chenier Plains National Wildlife Refuge Complex. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

McDowell, S., W. Conway, C. Comer, and J. Moon. 2013. Blood lead concentrations in mottled ducks (*Anas fulvigula*) on the Texas Chenier Plain National Wildlife Refuge Complex. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

McDowell, S., W. Conway, C. Comer, and J. Moon. 2013. Potential exposure of mottled ducks (*Anas fulvigula*) to lead contaminated soil on the Texas Chenier Plains. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

McDowell, S.K., W. Conway, and D. Haukos. 2012. Potential exposure to environmental lead in mottled ducks (*Anas fulvigula*) on the Texas Chenier Plains National Wildlife Refuge Complex. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

2013

Title: **Habitat use and migratory origins of American woodcock wintering in east Texas**

Funding: Webless Migratory Game Bird Research Program
U.S. Fish and Wildlife Service
U.S. Geological Survey
Stephen F. Austin State University

Investigator: Daniel Sullins, M.S. Student, Stephen F. Austin State University

Advisor: Dr. David A. Haukos, Unit Leader

Completion: 2013

American woodcock (*Scolopax minor*) Singing Ground Surveys (SGS) indicate short-term population stabilization, but long-term declines since monitoring began in the 1960s (Cooper and Rau 2013). Multiple factors likely contribute to these declines; however, our inability to quantify woodcock population dynamics across its range makes it difficult to decipher these factors. Moreover, spatial coverage by the SGS of woodcock breeding grounds remains unevaluated and available data may not represent trends of the entire population(s). Quantification of habitat availability and use in regionally important wintering, breeding, and stopover sites, combined with estimates of connectivity among these sites is needed for a more holistic understanding of woodcock population dynamics. Therefore, the objectives of this study were to (1) use stable isotope techniques to estimate population sources and link connectivity among natal, summer, and winter ranges of hunter-harvested juvenile American woodcock and (2) estimate landscape level occupancy and population densities of American woodcock wintering in east Texas and their relationships with a Habitat Suitability Index (HSI) and habitat covariates.

Harvest and band recovery data, as well as recent telemetry and departure and arrival data, have provided insight into woodcock migration and movement patterns. However, the elusive use of dynamic early successional mesic habitats by woodcock has made it difficult to monitor populations and determine continental scale migratory connectivity. Identification of key regional population sources, or production areas, that contribute to winter harvest would be valuable for implementing new and updating current monitoring programs. Stable isotope analyses are an emerging means by which to link birds to specific regions, as ratios of stable isotopes vary among landscapes. Stable isotopes of hydrogen are commonly used in bird migration studies because feathers retain a fixed isotopic signature from the location of its growth, and can be linked to general geographic locations. Standardized stable hydrogen isotope ratios (δ2H) in feathers have been strongly correlated with long-term precipitation data at large geographic scales, where deuterium values in precipitation follows a gradient across North America where δ2Hp generally decreases from the southeast to the northwest.

In winter 2010 - 2011 and 2011 - 2012, S13 and P1 feathers from 494 individual wings were used for stable isotope analysis. Feather deuterium values from known natal origin (prefledged) woodcock (n = 43) were regressed with same location growing season precipitation deuterium ratios to create the δ2Hf isoscape used to make migratory assignments. Modeled growing-season precipitation deuterium values explained 79% ($r^2 = 0.79$, $P < 0.001$) of the variance in same location feather deuterium values ($\delta^2Hf = 0.98\delta Dp + 11.6$), indicating relatively good fit of continental scale deuterium signatures to woodcock feather origins. The poor relationship between S13 δ2Hf and expected deuterium values in precipitation ($r^2 = 0.22$) precluded early fall origin assignments. Deuterium values of the S13 feathers, molted in early fall, on average were 30.0 ‰ (SD = 15.4 ‰) greater than values in P1 feathers, which are molted at natal origins. Natal origin assignments, for all subsampled juvenile woodcock, were made using δ2H of P1 feathers. The greatest predicted proportion (64%) of the 2010 - 2011 and 2011 - 2012 harvest sample were assigned to cells in the northernmost (>44 °N) portion of both Central and Eastern Management Regions. Juvenile woodcock assignments were more uniformly distributed along

the Atlantic coast throughout the Eastern Region as opposed to in the Central region where most woodcock were assigned to origins within and north of the Great Lakes States. The proportions of all sampled juvenile woodcock assigned to regions north, within, and south of SGS coverage was 14%, 77%, and 9% respectively. This provides evidence that the SGS effectively surveys the majority of the population but that a significant number of harvested juveniles may have origins north of survey coverage.

Limiting habitats within or among winter, breeding, and migratory stopover sites have not been identified because habitat occupancy, population densities, availability of potentially suitable habitats, as well as migratory linkages among them are largely unknown throughout the annual cycle (Straw et al. 1994). Occupancy and densities of potentially available habitat in east Texas was estimated using GPS-tracked pointing dog surveys. Two study areas were selected based on land use and were representative of available land cover types in east Texas, one on a timber property in San Augustine County and one on the Davy Crockett National Forest in Houston and Trinity counties. Surveys were conducted on 24 - 0.5-km radius representative survey sites randomly selected based on soil texture and drainage class; surveys encompassed 82 forest stands within survey sites. American woodcock were sparsely distributed throughout study areas and occupied 70 to 90% of the 78.5 ha survey sites and approximately 40% of stands within each survey site. During woodcock surveys, 283 flush events were recorded. In 2010 - 2011, an average of 1.7 birds was flushed per survey on both study areas combined, and in 2011 - 2012, an average of 1.6 birds was flushed per survey on both study areas combined.

Of the surveyed stands, pine forests 1 – 3 m tall supported the greatest densities. Greatest occupancy rates occurred in stands with somewhat poorly drained soils to moderately-well drained soils and soil textures with greatest occupancy rates were loams; greatest woodcock densities occurred on silt loams, despite sandy loams being most available. In 2010 - 2011, estimated American woodcock population densities were 0.105 (SE = 0.0086) birds/ha and in 2011 - 2012 estimated densities were 0.067 birds/ha (SE = 0.007). Summed survey site abundance estimates were 196.66 woodcock (SE = 16.28) for 2010 - 2011 and 126.58 woodcock (SE = 14.14) for 2011 - 2012. Habitat suitability index scores (HSI) estimated for each stand were not good predictors of woodcock occupancy or density. However, singular variable and non-indexed components of the HSI were related to occupancy and density.

Weather conditions during the study were not typical and occupancy rates and densities were likely influenced by drought. At the onset of drought in 2010 - 2011, woodcock readily used available coverts along the edges of streams and wetlands holding residual moisture. Extensive drying of these areas throughout 2011 made them less suitable in winter 2011 - 2012 and woodcock densities along streamside and wetland habitats decreased. The widespread, but sparse distribution of woodcock in the Davy Crockett National Forest and on the Campbell timber property should be expected in similar habitats throughout eastern Texas and western Louisiana.

Products:

Peer-reviewed Publications:

Sullins, D.S., W.C. Conway, D.A. Haukos, K.A. Hobson, L.I. Wassenaar, C.E. Comer, and I.K. Hung. 2016. American woodcock migratory connectivity and post-juvenile dispersal as indicated by hydrogen isotopes. Journal of Wildlife Management 80:510-526.

Technical and Semi-Technical:

Sullins, D.S., and W.C. Conway. 2013. East Texas timberdoodles: winter in the pineywoods. Skydance 1:2-8. Woodcock Limited, Montoursville PA, USA.

Thesis or Dissertation:

Sullins, D.S. 2013. Habitat use and origins of American woodcock wintering in east Texas. Master's Thesis, Stephen F. Austin State University, Nacogdoches, Texas (Advisors: Conway/Haukos)

Presentations:

Sullins, D.S., W.C. Conway, D.A. Haukos, K.A. Hobson, L.I. Wassenaar, and C.E. Comer. 2015. American woodcock migratory connectivity as indicated by hydrogen isotopes. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Sullins, D., W. Conway, C. Comer, K. Hobson, and I. Wassenaar. 2013. American woodcock connectivity as indicated by hydrogen isotope. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas

Sullins, D.S., W.C. Conway, C.E. Comer, and D.A. Haukos. 2012. Research update: stable isotope use in American woodcock migratory research. USFWS. Woodcock Wingbee. Covington, LA. March 7, 2012.

Sullins, D.S., W.C. Conway, C.E. Comer, and D.A. Haukos. 2012. Research update: habitat use and migratory origins of American woodcock (Scolopax minor) wintering in east Texas. Louisiana woodcock chapter of the Ruffed Grouse Society. Annual Banquet. Baton Rouge, LA. February 3, 2012

Sullins, D.A., W. Conway, and D. Haukos. 2012. American woodcock (*Scolopax minor*) habitat suitability and occupancy in eastern Texas. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

Sullins, D.S., W.C. Conway, C.E. Comer, and D.A. Haukos. 2012. American woodcock (Scolopax minor) habitat suitability and occupancy in east Texas.5th Bright Ideas Conference. Stephen F. Austin State University, Nacogdoches, Texas. April 11, 2012.

Title: **Lead Exposure and Nesting Ecology of Black-necked Stilts on the Upper Texas Coast**

Funding: U.S. Fish and Wildlife Service
U.S. Geological Survey
Stephen F. Austin State University

Investigator: Thomas Riecke, M.S. Student, Stephen F. Austin State University

Advisor: Dr. David A. Haukos, Unit Leader

Completion: 2013

The black-necked stilt (*Himantopus mexicanus*) is a migratory shorebird of temperate and tropical America, occurring in fresh, intermediate, brackish, and saline wetland habitats throughout its range. Although studied extensively in western North America, its ecology, habitat use, movements, and even basic natural history remain poorly understood elsewhere. The objectives for this research were to 1) establish baseline blood Pb levels and evaluate factors potentially affecting blood Pb concentrations, 2) estimate nest success and evaluate factors potentially affecting nest success, and 3) characterize nest site selection of stilts nesting in managed wetlands on the upper Texas coast.

Adequate volume blood samples were collected from 166 stilts, of which 152 were used for data analyses. Of these, 79% (n = 120) exceeded lower threshold values for exposure (≥20 µg/dL) to Pb. Estimated blood Pb concentrations ranged from below detection limits to 109.1 µg/dL for all individuals, while median estimated blood Pb concentration was 27.5 µg/dL across all sexes, ages, and years. Despite consistent blood Pb exposure, toxic (3%) and potentially lethal (1%) exposure was rare or infrequent. As blood Pb is indicative of recent exposure, and HY stilts did not move long distances, blood Pb concentrations and high frequency of blood Pb exposure observed in HY stilts clearly indicate a local source of Pb contamination. Moreover, black-

necked stilt Pb absorption pathways remain unclear, where future studies should examine isotopic Pb exposure at broader scales on the Chenier, incorporate other avian foraging guilds and trophic levels, examine potential Pb exposure pathways, and attempt to elucidate the potential physiological effects of Pb exposure on waterbirds.

A total of 356 black-necked stilt nests were monitored among three wetland types in 2011-2012. Apparent nest success estimates ranged from 3-31%, and Mayfield estimates of nest success ranged from 0–4%. Nest success was best predicted by habitat type, substrate, colony size, presence of vegetation, nest cover, year, and a quadratic time trend, where predation was the primary cause of nest failure. Daily survival rate increased during the second year, where DSR was positively related to freshwater wetland habitats, mudflat substrates, nest cover and presence of vegetation, and negatively related to nests within medium and large colonies, and rice field and intermediate wetland habitats. Daily survival rate exhibited a concave quadratic pattern as related to time during season. Parameter likelihoods did not support other covariates; other models were not considered plausible. The historically low nest success observed during this study may not be representative of all habitat types on the upper Texas coast. Nest success is expected to vary among habitat type, hydrology, and predation pressure, which are presumably interrelated. Future studies of black-necked stilt nest success on the Texas coast should examine nest success at broader scales, particularly in relation to predator densities, habitat type, and landscape fragmentation, as well as experimental water management regimes in managed and natural wetlands.

Black-necked stilt nests and associated random points were best predicted by an additive model of nest concealment (presence of vegetation, nest cover) and substrate, and an interaction between these covariates. Nests were more likely to be placed on dry ground substrates, where nests on these substrates may have experienced decreased nest survival. Moreover, shorebird nest-site selection may indicate preference in diverse habitats (Anteau et al. 2012), where habitats in this study were significantly different, and nest-site selection drivers differed accordingly. Consistently low nest survival rates among habitat types, and high breeding propensity in habitat types which experienced low nest success (see Chapter II), indicate that stilts may not be able to effectively distinguish between suitable and unsuitable habitats and nest sites, and may be disproportionately selecting nest sites in which they experience decreased success. If these trends continue, constructed and agricultural wetlands may continue to have limited utility as shorebird breeding habitat on the Gulf Coast.

Products:

Peer-reviewed Publications:

Riecke, T.V., W.C. Conway, D.A. Haukos, J.A. Moon, and C.E. Comer. 2015. Baseline blood Pb levels of black-necked stilts on the upper Texas coast. Bulletin of Environmental Contamination 95(4):465-469.

Riecke, T.V., W. C. Conway, C.E. Comer, D.A. Haukos, and J.A. Moon. 2014. Red imported fire ants *Solenopsis invicta* cause black-necked stilt *Himantopus mexicanus* nest abandonment. Wader Study Group Bulletin 121:52-53.

Thesis or Dissertation:

Riecke, T.V. 2013. Lead Exposure and Nesting Ecology of Black-necked Stilts on the Upper Texas Coast . Master's Thesis, Stephen F. Austin State University, Nacogdoches, Texas (Advisors: Conway/Haukos)

Presentations:

Riecke, T.V., J.A. Moon, D.A. Haukos, J.S. Sedinger, W.C. Conway, and P.S. Walther. 2015. An integrated population model for mottled ducks in Texas: harvest, habitat, and survival. Annual meeting of the Western Section of the Wildlife Society, Santa Rosa, CA.

Riecke, T., W. Conway, C. Comer, and J. Moon. 2013. Causes of black-necked stilt nest failure at Anahuac National Wildlife Refuge. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Riecke, T., W. Conway, C. Comer, and J. Moon. 2013. Blood lead levels of black-necked stilts on the Texas Chenier Plain National Wildlife Refuge Complex. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Riecke, T.V., W. Conway, and D.A. Haukos. 2012. Nest success and nest site selection of black-necked stilts on the Texas Chenier Plain National Wildlife Refuge Complex. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

2012

Title: **Apparent Survival, Dispersal, and Abundance of Black-Tailed Prairie Dogs**
Funding: U.S. Geological Survey

Investigator: Amanda Goldberg, M.S. Student

Advisors: Dr. Jack F. Cully, Jr.

Completion: 2012

Black-tailed prairie dogs (*Cynomys ludovicianus*) are a species of management and conservation concern. Prairie dogs have lost both habitat and occupied area due to plague, which is caused by the bacterium Yersinia pestis, pest control, and habitat conversion to agricultural land. Our goals were to estimate survival rates and dispersal rates, and to compare methods for estimating abundance of black-tailed prairie dogs for both management and conservation. We trapped black-tailed prairie dogs at four small National Parks from April 2009 through August 2011. Prairie dogs were trapped and marked for two trapping sessions per year in order to estimate seasonal rates of apparent survival. Apparent survival rates were estimated using the package RMark in R to construct models for program MARK. We found estimates to vary according to field site, sex, year, and season (summer or winter). Possible reasons for the differences in survivorship among sites could be presence of disease, quality of forage, predation, or frequency of dispersal. Visual counts were also conducted each trapping session beginning in April of 2010 to estimate abundance. Mark-recapture, mark-resight, and visual counts were compared to determine which method would be the most effective for estimating abundance of prairie dogs. We found mark-resight to produce the most precise estimates of abundance. While it costs more money to conduct a mark-resight estimate than visual counts because of repeated sessions, they produced significantly different results from one another 75% of the time, which was especially apparent on sites that had some form of visual barriers such as tall vegetation and uneven ground. However, if further information is needed in terms of sex ratios, age ratios, or the exact number of prairie dogs, then mark-recapture is the only method that can be used. Land managers need to address the level of accuracy needed, topography, and vegetation height before choosing which sampling method is best for the prairie dog towns in question. Finally, we looked at rates of intercolony and intracolony dispersal by placing 149 VHF collars and 6 GPS collars on prairie dogs at three colonies. Intracolony dispersal was also monitored through visual observation and trapping records over the three years of the study. We found 23 intracolony and eight intercolony dispersal events. Combined, these three studies offer insight not only into monitoring of prairie dog populations but also potential influence by plague both within and among colonies of prairie dogs.

Products:

Peer-reviewed Publications:

Biggins, D.E., Ramakrishnan, S., Goldberg, A.R. and Eads, D.A., 2012. Black-footed ferrets and recreational shooting influence the attributes of black-tailed prairie dog burrows. Western North American Naturalist, 72(2), pp.158-171.

Thesis or Dissertation:

Goldberg, A.R. 2012. Apparent survival, dispersal, and abundance of black-tailed prairie dogs. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Goldberg, A., and J. F. Cully. 2011. Estimated Apparent Survival of Black-tailed Prairie Dogs at Four Small National Parks Using the Robust Design in Program MARK. American Society of Mammalogists Annual Meeting, Portland Oregon.

Goldberg, A., and J. F. Cully. 2011. Apparent Survival of Black-tailed Prairie Dogs at Four Small National Parks Using the Robust Design in Program MARK. 72nd Midwest Fish and Wildlife Conference, Des Moines, Iowa.

Title: **Small mammals in disturbed tallgrass prairie landscapes**
Funding: U.S. Department of Defense

Investigator: Derek A. Moon, M.S. Student

Advisors: Dr. Jack F. Cully, Jr.

Completion: 2012

Disturbance is defined as any discrete event that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment. Habitat use by an organism is based on its perception of where to maximize its own fitness, and can be altered in response to disturbance-induced changes in resources, substrate, or physical features modified by disturbance. Disturbance-induced changes to vegetation structure reshape a small mammal's surrounding physical environment and/or resources, and may influence its utilization of an area. Effective wildlife and resource management is dependent on a thorough understanding of how individual species and communities utilize their surroundings and how disturbance affects a species' response to changes in its surroundings.

We investigated seasonal habitat associations of three small mammal species and for overall species diversity across a gradient of military combat-vehicle disturbance intensities at the Fort Riley Military Reservation, Kansas. Deer mouse (*Peromyscus maniculatus*) abundance did not vary across a categorical gradient of disturbance created by military-combat vehicles, regardless of season. Western harvest mouse (*Reithrodontomys megalotis*) abundance was associated with more highly disturbed areas irrespective of season. Prairie vole (*Microtus ochrogaster*) abundance was associated with habitat that was less disturbed in the spring but more highly disturbed in the fall. Shannon diversity of the small mammal community was higher in the more highly disturbed areas regardless of season. This research shows that small mammals respond to disturbances created by military training with combat vehicles in a species-specific manner, and indicates that there may be differences in the effects of military training versus natural or agricultural disturbances on the abundance and diversity of small mammals. This is an important consideration given that the Department of Defense manages more than 12 million ha of land in the United States, and is charged under the Sikes Act with conserving natural resources on these lands, including biological diversity. Thus, the findings of other ecological research on the effects of disturbance on small mammals may not be directly applicable to the types of

disturbances that occur on military lands, which underscores the need for further research on the specific effects of military-training activities on species' responses.

Products:

Thesis or Dissertation:

Moon, D.A. 2012. Small mammals in disturbed tallgrass prairie landscapes. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Moon, Derek, and J. F. Cully. 2010. Small mammals in prairie ecosystems: scale dependent responses to disturbance. Annual meeting of the American Society of Mammalogists, Laramie, Wyoming.

Title: **Deer Density, Movement Patterns, and Group Dynamics on Quivira National Wildlife Refuge: Assessing Potential Risk for Disease Transmission**

Funding: U.S. Fish and Wildlife Service
Kansas Department of Wildlife, Parks and Tourism
U.S. Army Corps of Engineers

Investigators: Dr. Jonathan Conard, Post-Doctoral Research Associate
Kevin Blecha, Research Assistant

Project Supervisors: Dr. Philip S. Gipson
Dr. Jonathan Conard

Completion: 2012

Preliminary analysis of location data from 11 male deer collected from November 2007 – May 2009 indicates that patterns of habitat use by male deer are characterized by a high density of locations in a few core areas. The home range size of male deer varied seasonally, with minimum convex polygon home ranges of male deer being largest during the winter (January-April) and smallest during the summer (May-September). Home ranges of all male deer included portions of Quivira National Wildlife Refuge, although adjoining areas of private land were used frequently by male deer throughout the year. Disease transmission may depend on contact rates between deer. Our preliminary results suggest that contact between male deer was highest during winter and lowest during summer time periods. Preliminary analysis suggests that land-cover type may influence contact rates, with woodland and cultivated areas potentially being areas of high contact between deer. Additionally, we will estimate deer population density on Quivira National Wildlife Refuge using data collected from distance-sampling surveys and will use microsatellite data to determine if deer relatedness is correlated with spatial patterns of habitat use.

Products:

Peer-reviewed Publications:

Althoff, D. P., P. S. Gipson, G. Meggers, D. Hilly, and J. Sellers. 2007. White-tailed deer population trends on Quivira National Wildlife Refuge, 1989-2005. Proceedings of the 20th North American Prairie Conference, University of Nebraska at Kearney, July 23–26, 2006, edited by Joseph T. Springer and Elaine C. Springer. Pages 297-306.

Technical and Semi-Technical:

Conard, J.M. and R. Lauben. 2012. Patterns of habitat selection and densities of white-tailed deer at Quivira National Wildlife Refuge. Final Report.

Blecha, K.A., P. S. Gipson, J. M. Conard and J. Sellers. 2008. Deer of Quivira. Information Brochure, U.S. Fish and Wildlife Service, Quivira National Wildlife Refuge.

Presentations:

Althoff, D. P., and P. S. Gipson, G. Meggers, D. Hilly, and J. Sellers. 2006. 20th North American Prairie Conference. White-tailed deer population trends on Quivira National Wildlife Refuge, 1989-2005. Platform presentation.

Title: **Community Response to Use of Prescribed Grazing and Tebuthiuron Herbicide For Restoration of Sand Shinnery Oak Communities**

Funding: Grasslands Charitable Trust
Weaver Ranch
Texas Tech University

Investigator: Jennifer Zavaleta, M.S. Student, Texas Tech University

Advisors: Dr. David A. Haukos, Unit Leader
Dr. Clint Boal, Texas Tech University

Completion: 2012

The sand shinnery oak (*Quercus havardii*) mixed-grass community is an isolated, relict habitat located within short-grass prairie of the Southern High Plains. With the introduction of center-pivot agriculture, unmanaged grazing, oil and gas exploration and supression of the natural fire regime, the vegetation composition of the shinnery oak community has changed during the past century. Land managers have used herbicides (e.g., tebuthiuron) and a variety of grazing systems as tools to manage shinnery oak. Results show that at relatively low levels of tebuthiuron (0.60 kg/ha) and subsequent moderate grazing system, sand shinnery oak can be reduced and maintained at near historical levels without reapplying tebuthiuron because the tested management approach allowed grasses to remain competitive in the system. There was 91% less shinnery oak in untreated areas. The removal of shinnery oak made environmental soil moisture more available for grasses and forbs to germinate and grow. Grasses increased by 149% and forbs increased by 257% in treated areas as compared to untreated areas throughout the study period. In terms of visual obstruction, there was both an herbicide and grazing effect in April such that visual obstruction increased by 30% in treated areas as compared to untreated and decreased by 6.5% in grazed areas as compared to non-grazed areas. There was no significant herbicide effect of overall abundance of small mammals. However, there was a significant grazing effect such that there was 23% more abundance of small mammals in grazed areas as compared to non-grazed areas, which was likely driven by kangaroo rats. Areas that were treated with tebuthiuron and had moderate grazing statistically reached historical standards only during one year, but showed trends that were comparable to historical standards throughout the study compared to other treatment combinations. The largest difference between treated areas and historical standards was that treated areas had more forbs. The change from a shrub monoculture to a mixed-grass prairie changes the plant composition and structure and provides more niches for invertebrates, mammals and herptiles to fill.

Products:

Technical and Semi-Technical:

Zavaleta, J. 2013. An annotated bibliography of the lesser prairie-chicken. Western Association of Fish and Game Agencies, Tucson, AZ. 550 pp.

Thesis or Dissertation:

Zavaleta, J. 2012. Effects of grazing and herbicide treatments to restore degraded sand shinnery oak grasslands. Master's Thesis, Texas Tech University, Lubbock, TX. (Advisor: Haukos)

Presentations:

Zavaleta, J., B. Grisham, D. Haukos, and C. Boal. 2013. Invertebrates of sand shinnery oak communities and the influence on lesser prairie-chicken brood survival. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Zavaleta, J., P. Maloney, and D. Haukos. 2013. Understanding the human component for conservation in the sand shinnery oak grasslands. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Haukos, D.A. 2012. Restoration of sand shinnery oak grasslands using prescribed grazing and herbicides. Special Session "LCCs: Bridging the science-management gap symposia" 73rd Midwest Fish and Wildlife Conference (Invited), Wichita, Kansas.

Zavaleta, J.C., D.A. Haukos, and C. Boal. 2012. Community response to use of prescribed grazing and herbicide for restoration of sand shinnery oak grasslands. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

2011

Title: **Evaluation of Land Condition Trend Analysis as a component of the Integrated Training Area Management Program at Fort Riley, Kansas**

Funding: Department of Defense

Investigators: Dr. Philip S. Gipson, Unit Leader
Dr. Jeffrey S. Pontius, Department of Statistics
Dr. Donald P. Althoff, Research Assistant Professor
Dr. Stacy L. Hutchinson, Department of Biological and Agricultural Engineering
Dr. Shawn Hutchinson, Department of Geography

Completion: September 2011

The U.S. Army Construction Engineering Research Laboratories (USACERL) developed the Land Condition Trend Analysis (LCTA) program to obtain information on soil, vegetation, and wildlife resources to help determine impacts of military training and associated land uses. LCTA information should assist military managers make decisions on best use of land, scheduling of military activities, and long-term environmental planning. LCTA inventories may also provide standardized natural resource inventory information for installations across the continental U.S. and overseas. LCTA has been implemented on fifty-three (53) Army, National Guard, and Marine Corps installations since 1989. The program is projected to be used on additional installations in the future.

This research analyzes and interprets LCTA data from Fort Riley to help predict long term impacts of military training and associated land uses. Techniques to evaluate and improve vegetation and wildlife data collection on LCTA transects will be developed. Analysis of these data will determine the impacts of military training on the Fort Riley installation.

Previous LCTA Research:

Effectiveness of Land Condition Trend Analysis transects for monitoring wildlife abundance in areas used for military training

Investigator: Dr. Philip S. Gipson

Completion: September 2000

The Land Condition Trend Analysis (LCTA) program was developed by the U.S. Army Construction Engineering Research Laboratories to obtain information on soil, vegetation, and wildlife resources to better understand impacts of military training and related and uses. Vegetation responses to training were addressed in a study recently completed at Fort Riley, Kansas. That study demonstrated that data collection along LCTA transects could be valuable in predicting long germ impacts of military training upon native vegetation. A second project will address soils and their responses to erosion associated with military training. That study will use the USDA Water Erosion Prediction Project model to provide important tools for measuring soil loss and water runoff that can be monitored along LCTA transects. Now, with soil and vegetation being addressed, there is a need to develop and test methodology to determine changes in wildlife populations resulting from military training and associated development that can be obtained along LCTA transects and related monitoring sites. This project will determine the suitability of animal tracking stations to monitor the abundance of mammalian predators and other wildlife in response to military activities. These tracking stations can be placed on or adjacent to LCTA transects and in other areas of high human activity to monitor signs of wild animals. These data can easily be recorded when other LCTA data are collected.

Wild animal input variables for modeling responses of wildlife to military training in key habitats at Fort Riley, Kansas such as the number of visits to tracking stations by each species of animal before, during, and after military training activities will be determined. The efficacy of tracking stations for recording visits by wild animals including self-activated cameras, stations made from sifted soil, and stations made from smoked metal plates will be tested, along with the efficacy of a variety of chemicals and baits to attract mammalian predators. Correlations of visits by wild animals to tracking stations with responses to military training obtained directly by monitoring movements of wild animals fitted with collars containing radio transmitters will be modeled. Finally, the tracks of wild animals at monitoring stations in housing areas and other high human use areas will be correlated with visits to the sites by wild animals fitted with radio collars.

Products:

Peer-reviewed Publications:

Althoff, D. P., K. A. Blecha, P. B. Woodford, and P. S. Gipson. 2012. Use of low-level aerial photography for delineation of biological and physical features of a tallgrass prairie. North American Prairie Conference. 22:31-38.

Rivers, J.W., P.S. Gipson, D.P. Althoff, and J.S. Pontius. 2010. Long-term community dynamics of small land birds with and without exposure to extensive disturbance from military training activities. Environmental Management. 12: 203-216.

Althoff, D. P., P. S. Althoff, N. D. Lambrecht, P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2007. Soil properties and perceived disturbance of grasslands subjected to mechanized military training: evaluation of an index. Land Degradation & Development. 18:269-288.

Althoff, D. P., P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2006. Plant community and bare ground trends on Fort Riley, Kansas: Implications for monitoring of a highly disturbed landscape. Transactions of the Kansas Academy of Science. 109:101-119.

Althoff, D. P., J. W. Rivers, J. S. Pontius, P. S. Gipson, and P. B. Woodford. 2005. A comprehensive approach to identifying monitoring priorities of small landbirds on military installations. Environmental Management. 34:887-902.

Cully, J. F., Jr. and S. L. Winter. 2000. Evaluation of Land Condition Trend Analysis on a Kansas military training site. Environmental Management 25:625-633.

Technical and Semi-Technical:

Gipson, P.S., J.S. Johnson, and J.S. Pontius. 1999. Mammalian predator use of habitats and primitive roads in a prairie and forest ecotone on Fort Riley Military Reservation. Progress Report to the Integrated Training Area Management Program, Fort Riley, KS.

Thesis or Dissertation:

Bussen, P. 2009. Analysis of a Rapid Soil Erosion Assessment Tool. MS Thesis. Department of Biological and Agricultural Engineering, Kansas State University. (Advisor: S.L. Hutchinson)

Presentations:

Hutchinson, S.L. and J.M.S. Hutchinson. 2009. Validating the Kinematic Wave Approach for Rapid Soil Erosion Assessment: nLS Model Overview and Sensitivity Analysis Results. December 2009. SERDP and ESTCP Partners in Environmental Technology Technical Symposium & Workshop; Washington, DC.

Hutchinson, S.L., J.M.S. Hutchinson, and T.J. Vought, Jr. 2009. Validating the Kinematic Wave Approach for Rapid Soil Erosion Assessment and Improved BMP Site Selection (SI-2017). December 2007. Watershed Process and Management Side Meeting, SERDP and ESTCP Partners in Environmental Technology Technical Symposium & Workshop; Washington, DC.

Burkitt, J., K. Franke, J.M.S. Hutchinson, and S.L. Hutchinson. 2009. GIS-enabled Kinematic Wave Approach for Rapid Soil Erosion Assessment and Improved BMP Site Selection. Capitol Research Summit, Topeka, KS.

Burkitt, J., K. Franke, J.M.S. Hutchinson, and S.L. Hutchinson. 2009. GIS-enabled Kinematic Wave Approach for Rapid Soil Erosion Assessment and Improved BMP Site Selection. Kansas State University Graduate Research Forum; Manhattan, KS.

Blecha, K., D. P. Althoff and P. S. Gipson. 2006. 67th Midwest Fish & Wildlife Conference. Evaluating a relative change index based on 10-year moving estimates of bird population trends on Fort Riley, Kansas. Poster.

Conard, J.M., P.S. Gipson, and D.P. Althoff. 2006. Annual American Society of Agronomy International Meeting. Military vehicle training effects on amounts of bare ground and small mammal biodiversity. Platform presentation.

Conard, J.M., and P.S. Gipson. 2006. 138th Annual Meeting of the Kansas Academy of Science. Seasonal variation and timing of elk use of private lands adjacent to Fort Riley Military Reservation, Kansas. Platform presentation.

Gipson, P. S., D.P. Althoff, J.S. Pontius, and P.B. Woodford. 2006. 13th Annual Department of Defense Integrated Training Area Management Workshop. Assessing small mammal communities: development of field protocols. Poster.

Japuntich, R. D., D. P. Althoff, P. S. Gipson, and J. S. Pontius. 2006. 20th North American Prairie Conference. Monitoring small landbird communities in tallgrass prairie: an assessment of strip-transect and fixed-radius point counts. Platform presentation.

Althoff, D. P., R. D. Japtunich, P. S. Gipson, J. S. Pontius. 2005. 12th Annual Conference of The Wildlife Society. Reproductive success of grasshopper sparrows on a military installation. Platform presentation.

Althoff, D. P., P. S. Althoff, J. S. Pontius, P. S. Gipson, and P. B. Woodford. 2005. 14th Annual Department of Defense Intregrated Training Area Management Workshop. Identification of soil characteristics that facilitate assessment of ecosystem health on military training lands. Platform presentation.

Japuntich, R. D., B. E. Flock, and P. S. Gipson. 2005. 12th Annual Conference of The Wildlife Society. Owls in the forest and prairie ecotone of Kansas. Platform presentation.

Althoff, D. P., P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2004. 13th Annual Department of Defense Integrated Training Area Management Workshop. Use of a low-level aerial photography system to document disturbance and vegetation coverage on Fort Riley, Kansas. Platform presentation.

Japuntich, R., D. P. Althoff, P. S. Gipson, J. S. Pontius. 2004. 13th Annual Department of Defense Integrated Training Area Management Workshop. Strip transect and fixed-radius point counts for birds at Fort Riley Military Installation, Kansas. Platform presentation.

Althoff, D. P., P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2003. 12th Annual Department of Defense Integrated Training Area Management Workshop. Using LCTA vegetation data to monitor trends on Fort Riley: caveats from a conservative analysis approach. Platform presentation

Althoff, D. P., J. W. Rivers, P. S. Gipson, and J. S. Pontius. 2001. 8th Annual Conference of The Wildlife Society. Evaluation of long-term population trends of song birds on Fort Riley Military Base. Platform presentation.

Gipson, P.S., C.I. Vahl, J.S. Pontius, G.L. Zuercher, T.R. Livingston, and J.M. Conard. 2002. 82nd Annual Meeting of the American Society of Mammalogists. Trap size and trap density: effects on small mammal captures. Poster.

Pontius, J. S., P. S. Gipson, and C. I. Vahl. 2001. Department of Statistics, Kansas State University, Manhattan, KS. An improved sampling strategy to detect animal and plant responses to military training. Invited seminar.

Title: **Occurrence, Function, and conservation of Playa Wetlands: The Key to Biodiversity of the Southern Great Plains**

Funding: Environmental Protection Agency
Texas Tech University
U.S. Fish and Wildlife Service

Investigator: Lacrecia Johnson, Ph.D. Student, Texas Tech University

Advisor: Dr. David A. Haukos

Completion: 2011

Playas form the primary wetland system in the High Plains portion of the Southern Great Plains (SGP) and provide valuable ecosystem services and functions including being key sites for biodiversity. Current estimates of the number of playas within the SGP (Texas, New Mexico, Oklahoma, southwestern Kansas, southeastern Colorado) from historical soil surveys (pre-1970s), topographic maps, and field checks exceed 25,000. This number often gives the potentially mistaken impression that there are numerous, adequately functioning playas in the region that continue to meet ecological and societal needs. In addition, these historical estimates are used to generate samples of playas for a variety of natural resource survey and research efforts, which depend on the occurrence of functional playas to generate sound inferential results. During the time period of 1970-2008 an estimated 17% of playas have been physically lost from the SGP landscape. Through the application of the function matrix, none of the sampled playas were estimated to function at full functional capacity in the SGP. Seventy-three (47%) of playas were estimated to be partially functional and restorable. Partially functional and non-restorable due to cost playas were estimated at 12.9% or 20 playas, and 61 (39.4%) playas were partially functional and non-restorable because effective restoration techniques do not exist. The effect of buffers surrounding playa wetlands on water quality was evaluated as functions of buffer width and vegetation cover. TDS and TSS reached a combined maximum removal at 50 m, 49% and 72% respectively. Nitrate and phosphorus reached a combined maximum removal at a distance of 20 m, 49% and 33% respectively. Maximum removal of metals occurred at 40 m. Estimated percent reduction in runoff reaching the playas due to the presence of a buffer was

greatest for the native CRP cover type (-5.8%). A minimum buffer width of 40-50 m is necessary to maximize contaminant removal from runoff entering playa wetlands.

Products:

Peer-reviewed Publications:

Johnson, L.A., D.A. Haukos, L.M. Smith, and S.T. McMurry. 2012. Loss and modification of Southern Great Plains playas. Journal of Environmental Management 112:275-283

Johnson, L.A., D.A. Haukos, L.M. Smith, and S.T. McMurry. 2011. Jurisdictional loss of playa wetlands caused by reclassification of hydric soils on the Southern High Plains. Wetlands 31:483-492.

Technical and Semi-Technical:

Johnson, L., D.A. Haukos, L.M. Smith, and S. McMurry. 2011. Current status and function of Southern Great Plains playas wetlands and evaluation of buffer effectiveness: Implications for future conservation efforts. Final Report U.S. Environmental Protection Agency Cooperative Agreement CD-966441-01-0, Playa Lakes Joint Venture Project #445, U.S. Fish and Wildlife Service/U.S. Geological Survey Cooperative Agreement # 1434-HQ-07-RM-0068; TCRWFU RWO 67

Thesis or Dissertation:

Johnson, Lacrecia. 2011. Current status and function of playa wetlands on the Southern Great Plains. Ph.D. Dissertation, Texas Tech University, Lubbock, Texas (Advisor: Haukos)

Presentations:

Haukos, D.A., L.A. Johnson, L.M. Smith, and S. McMurry. 2011. Effectiveness of vegetative buffer areas surrounding playa wetlands. Ecology of Waterbird Migration and Playa Wetland Ecology Symposia, Rainwater Basin Joint Venture/Playa Lakes Joint Venture Research Symposium; Annual Meeting of The Waterbird Society, Grand Island, Nebraska.

Johnson, L., D. Haukos, L. Smith, and S. McMurry. 2010. Effectiveness of wetland buffers as a conservation tool for playas. 46th Annual Meeting of the Texas Chapter of The Wildlife Society, Galveston, Texas.

2010

- - - - -

2009

Title: **Genetic variability, demography, and habitat selection in a reintroduced elk (*Cervus elaphus)* population**

Funding: U.S. Department of Defense

Investigator: Jonathan Conard, Ph.D. Student, Kansas State University

Advisors: Dr. Philip S. Gipson

Completion: 2009

Understanding factors that influence genetic variability, demographic vital rates, and resource selection is important for conservation and management of wildlife populations. I examined factors influencing microsatellite variability, demographic vital rates, and habitat use for a reintroduced elk (*Cervus elaphus*) population at Fort Riley, Kansas based on data collected from 2003 – 2007. Levels of allelic richness, observed heterozygosity, and expected heterozygosity for the Fort Riley population were intermediate to other North American elk populations. Genetic variability in restored North American elk populations was not well explained by founding population size, number of founding populations, or number of years since the last translocation. I examined the influence of demographic vital rates on the rate of population

change (λ) to test the hypothesis that variability in calf survival has a greater influence on rates of population change than adult survival. Survival for prime-age adult elk had the highest stage-specific elasticity value, but life-stage simulation analysis indicated that variation in calf survival had the highest correlation with variation in λ. These results suggest that calf survival varies temporally and is the vital rate most directly related to variation in λ for this population. I assessed the relative influence of risk-related and resource-related factors on elk habitat selection by comparing predictor variables included in top resource selection function models at the landscape and home range scales. All predictor variables, with the exception of fall and spring prescribed burns, were included in top models across seasons at both spatial scales. Elk selected low elevation areas, gentle slopes, edge habitat, and areas close to streams at both spatial scales. At the landscape scale, elk generally avoided roads and preferred areas on or near Fort Riley. At both spatial scales, elk used riparian woodlands more frequently than grasslands and selected for agricultural crops when seasonally available. These findings do not support the idea that risk-related factors are the primary determinant of elk habitat use at the landscape scale as has been found for ungulates in areas with natural predators.

Products:

Peer-reviewed Publications:

Conard, J. M., B.K. Sandercock, P. S. Gipson, and W. B. Ballard. 2012. Factors influencing survival of female elk in a harvested population. Journal of Fish and Wildlife Management. Vol. 3, No. 2, pp. 199-208.

Conard, J. M. and P. S. Gipson. 2012. Foraging ecology of elk in a tallgrass prairie ecosystem. Southwestern Naturalist. 57:92-96.

Conard, J.M., Statham, M.J., Gipson, P.S. and Wisely, S.M., 2010. The influence of translocation strategy and management practices on the genetic variability of a reestablished elk (*Cervus elaphus*) population. Restoration Ecology, 18(s1), pp.85-93.

Conard, J. M., P. S. Gipson, and M. Peek. 2006. Historical and current status of elk in Kansas. Proceedings of the 20th North American Prairie Conference, University of Nebraska at Kearney, July 23–26, 2006, edited by Joseph T. Springer and Elaine C. Springer. Pages 307-312.

Thesis or Dissertation:

Conard, J.M. 2009. Genetic variability, demography, and habitat selection in a reintroduced elk (*Cervus elaphus*) population. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Gipson)

Presentations:

Conard, J.M., and P. S. Gipson. 2009. Demographic vital rates and population growth: rethinking the relationship in a harvested elk population. Ecological Society of America Annual Meeting, Albuquerque, NM.

Conard, J. M., and P. S. Gipson. 2007. Historical and current distribution of elk in Kansas. Kansas Chapter of The Wildlife Society Spring Meeting. Poster.

Conard, J.M., M. J. Statham, S. M. Wisely, and P. S. Gipson. 2007. Genetic structure of a reintroduced elk population. Midwest Fish and Wildlife Conference, Madison, WI.

Conard, J.M. and P.S. Gipson. 2006. Seasonal variation and timing of elk use of private lands adjacent to Fort Riley Military Reservation, Kansas. 138th Annual Meeting of the Kansas Academy of Science.

Conard, J.M., and P. S. Gipson. 2006. Status of elk in Kansas. 20th North American Prairie Conference. Poster.

Conard, J. M., and P.S. Gipson. 2006. Patterns of private land use by elk around Fort Riley Military Reservation. Kansas Chapter of The Wildlife Society Spring Meeting. Platform presentation.

Conard, J.M. and P.S. Gipson. 2005. Elk habitat selection in tallgrass prairie. American Society of Mammalogists meeting. Springfield, MO.

Conard, J.M. and P.S. Gipson. 2005 Elk Habitat use in tallgrass prairie. The Wildlife Society Meeting. Madison, WI.

Conard, J.M. 2005. The influence of patch configuration and landscape features on diurnal elk habitat use at Fort Riley, KS. Geospatial Research Showcase. Kansas State University Geographic Information Systems / Spatial Analysis Laboratory.

Conard, J.M., P.S. Gipson, and L.C. Bender. 2004. Elk in tallgrass prairie: home range size, habitat selection and movement patterns. Midwest Fish and Wildlife Conference.

Title: **Factors Affecting the Distribution and Detectability of River Otters in Eastern Kansas**

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Mackenzie Shardlow Jeffress

Advisor: Dr. Craig P. Paukert

Completion: 2009

The North American river otter (*Lontra canadensis*) was extirpated throughout much of its range but is now recovering in many areas. Consequently, there is a need to determine river otter occupancy and habitat associations. We conducted sign surveys from January to April 2008 and 2009 in eastern Kansas to assess how local- and landscape-scale habitat affects river otter occupancy and how survey methods and habitat affect the detectability of river otter sign. Multiple observers surveyed 3-9 400-m stretches of stream and reservoir shorelines for 110 randomly-selected sites and measured local-scale (within a 100 m buffer of site) habitat variables (e.g., stream order, sinuosity, proportion of land cover types) and landscape-scale (Hydrological Unit Code 14 watershed) habitat variables (e.g., road density, shoreline diversity, proportion of land cover types). We then modeled occupancy and detection probability as a function of these covariates using Program PRESENCE. The overall probability of occupancy accounting for detection probability was 0.329. The best-fitting model indicated river otter occupancy increased with the proportion of woodland cover and decreased with the proportion of cropland and grassland cover at the local scale. The best-fitting model also indicated occupancy increased with decreased shoreline diversity, waterbody density, and stream density at the landscape scale, possibly because of the influence of large reservoirs in the watershed. Occupancy was not affected by land cover or human disturbance at the landscape scale, perhaps due to our relatively homogeneous study area or because river otters are habitat generalists. Detection probability for 400-m surveys was highest in mud substrates ($p = 0.600$) and lowest in snow ($p = 0.180$) and litter substrates ($p = 0.267$). Detection probability for scat was more than double that for tracks, and detection probabilities were 17-64% lower for novice observers than experienced observers. Detection probability also increased with survey length. Sign surveys are a useful technique for monitoring many species, including river otters, and accounting for detection probability will improve estimation of occupancy. Furthermore, understanding the ecological factors and the scale important to river otter occurrence will be useful in identifying areas for restoration and management efforts.

Products:

Peer-reviewed Publications:

Jeffress, M. R., C. P. Paukert, J. B. Whittier, B. K. Sandercock, and P. S. Gipson. 2011. Scale-dependent factors affecting North American river otter distribution in the Midwest. American Midland Naturalist. 166:177-193.

Jeffress, M. R., C. P. Paukert, B. K. Sandercock, and P. S. Gipson. 2011. Factors affecting detectability of river otters during sign surveys. The Journal of Wildlife Management. 75: 1-7.

Technical and Semi-Technical:

Shardlow, M., C. Paukert, K. Blecha, and P. Gipson. 2009. Distribution and population status of river otters in eastern Kansas. Final Report to Kansas Department of Wildlife and Parks, Pratt.

Shardlow, M., P.S. Gipson, K.A. Blecha, and M. Peek. 2008. River otter distribution and population status in eastern Kansas. Information Brochure, Kansas Department of Wildlife and Parks.

Thesis or Dissertation:

Shardlow, M.R. 2009. Factors affecting the detectability and distribution of the North American river otter. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Presentations:

Shardlow, M. and C. Paukert. 2009. Factors affecting the detectability and occupancy of river otters in eastern Kansas. KSU Biology Student Research Forum, Manhattan, KS.

Shardlow, M. and C. Paukert. 2009. Seeing what was missed: evaluating detection probabilities from river otter sign surveys. The Wildlife Society Annual Meeting, Monterey, CA.

Shardlow, M., C. Paukert, and T. Cable. 2009. Furharvester sighting reports and opinions regarding river otters in Kansas. Kansas Natural Resources Conference, Wichita, KS.

Shardlow, M., and C. Paukert. 2008. Sign survey techniques for river otters: looking back and moving forward. Midwest Fish and Wildlife Conference, Columbus, OH.

Shardlow, M., C. Paukert, and P. Gipson. 2008. Factors affecting the distribution and detectability of river otters in Eastern Kansas. Midwest Furbearer Workshop. Olathe, KS.

Blecha, K. A., P.S. Gipson, M. Peek. 2007. Annual Midwest Furbearer Workshop. Occupancy Modeling of River Otter (*Lontra canadensis*) in Eastern Kansas. Platform presentation.

Title: **Behavioral Ecology of Grasshopper Mice and Deer Mice**

Investigator: Ron VanNimwegen

Advisor: Dr. Jack F. Cully, Jr.

Completion: 2009

Mating systems of grasshopper mice: three field seasons of telemetry data are complete (summer 2006 and 2007, winter 2007), and one season remains (summer 2008).
To determine the genetic mating system of grasshopper mice, we are developing a microsatellite library from blood and tissue samples to test for extra-pair paternity. Further screening in spring of 2008 and blood sampling in summer 2008 are required. Population-level analyses will be conducted in Fall 2008.

Dispersal patterns of grasshopper mice and deer mice: we have blood and animal samples from 2005-2007, and will complete sampling in summer 2008. The status of microsatellite library development is described above. Measures of relatedness within and among sampled populations will provide relative measures of gene flow between the two species. We will correlate genetic distances with various geographic distances (Euclidean, least-cost, and least-resistance), at two spatial scales: within-grassland and between grasslands (Cimarron and Comanche).

Progress and Results

Analysis of fine-scale movements indicates intra-sexual spacing mechanisms (territoriality) and inter-sexual overlap (pair bonding). Intra-sexual home ranges overlapped to a lesser degree during the breeding season ($X^2 = 547$, df = 1, $P < 0.001$), whereas inter-sexual overlap did not

differ with season (X^2 = 1.32, df = 1, P = 0.251). Our data support the presence of a socially monogamous mating system, congruent with previous observations from literature. Further sampling is required to increase the statistical power of our initial conclusions. The initial sequencing step of microsatellite development indicates that an adequate number of loci (8-12) can be obtained for further development (primer design, amplification, and screening for allelic variability). Most loci contain di-nucleotide repeats ranging between 5 and 20 base pairs in length, consistent with markers used in studies of closely related mammals. We are seeking funds to finish developing the library, after which population-level analyses will commence.

Products:

Peer-reviewed Publications:

Cully, J. F., Jr., S. K. Collinge, R. E. VanNimwegen, C. Ray, W. C. Johnson, B. Thiagarajan, D. B. Conlin, and B. E. Holmes. 2010. Spatial variation in keystone effects: Small mammal diversity associated with black-tailed prairie dog colonies. Ecography 33:667-677.

VanNimwegen, R. L., J. Kretzer, and J. F. Cully. 2008. Ecosystem Engineering by a colonial mammal: how black-tailed prairie dogs structure rodent communities. Ecology 89:3298-3305.

Thesis or Dissertation:

VanNimwegen, R.E. 2009. Behavioral Ecology of Grasshopper Mice and Deer Mice. Ph.D. (Posthumous). Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

VanNimwegen, R., J. F. Cully, and J. Kretzer, 2007. Ecosystem Engineering by a colonial mammal: How black-tailed prairie dogs small mammal communities. 87th Annual Meeting of the American Society of Mammalogists, Albuquerque, NM.

2008

Title: **Vegetation and Small Mammal Community Response to Military Track Vehicle Disturbance at Smoky Hills Air National Guard Bombing Range, Kansas**

Funding: U.S. Army Corps of Engineers, Construction Engineering Research Lab (CERL)

Investigator: Ryan Limb, Ph.D. Student, Oklahoma State University
Dr. Philip S. Gipson, Unit Leader, KSCFWRU
Dr. David Engle, Oklahoma State University

Completion: 2008

In the north central Oklahoma study, plant species richness declined with increased eastern redcedar canopy cover. However, the rate of decline in species richness closely followed that which was predicted by a species-area relationship. Furthermore, the decline was uniform among C3, C4 and forb species groups. Annual herbaceous above-ground production declined with increasing eastern redcedar canopy cover, but was most variable at intermediate canopy cover. These results indicate that eastern redcedar reduces species richness. However, canopy cover up to 80% does not impose an ecological threshold. In the central Kansas study, we used tracked vehicles to impose anthropogenic focal soil disturbance within a mixed-grass landscape extensively disturbed with livestock grazing or hay harvest. In both landscapes focal soil

disturbance had a larger influence on plant community composition than either livestock grazing or hay harvest. Moreover, combined focal and extensive disturbance did not have a greater effect than focal disturbance alone. Despite differences in initial plant species composition, successional trajectories following focal soil disturbance were similar between grazed and hayed communities, and both plant communities recovered from focal soil disturbance within two growing seasons. Tracked vehicle disturbance attracted preferential livestock grazing, which promoted structural heterogeneity within the plant community. However, the effect was ephemeral and only lasted one growing season.

Products:

Peer-reviewed Publications:

Limb, R F., D. M. Engle, S. D. Fuhlendorf, D. P. Althoff, and P. S. Gipson. 2010. Altered herbivore distribution associated with focal disturbance. Range Ecology and Management. 63: 253-257.

Limb, R.F., Engle, D.M., Bidwell, T.G., Althoff, D.P., Anderson, A.B., Gipson, P.S. and Howard, H.R., 2010. Restoring biopedturbation in grasslands with anthropogenic focal disturbance. Plant Ecology, 210(2), pp.331-342.

Technical and Semi-Technical:

Althoff, K. Blecha, P. Gipson, R. Limb, T. Bidwell, and D. Engle. 2009. Changes in vegetation, small mammal communities, and soil compaction associated with military training at the Smokey Hill Air National Guard Range, Kansas. Final Report to US Army Corps of Engineers, ERDC-CERL.

Thesis or Dissertation:

Limb, R. 2008. The effects of disturbance on grassland plant communities. Ph.D. Dissertation, Oklahoma State University. (Advisor: Terrence G. Bidwell).

Title: **Landscape genetics of deer and the potential spread of CWD in Kansas: A pilot study to examine deer density and hunting pressure as factors**

Funding: US Geological Survey

Investigator: Dr. Samantha Wisely, Division of Biology

Completion: 2008

Chronic wasting disease (CWD) is a prion caused wasting disease of cervids that is expanding its range in the U.S. There is an established focus in Colorado, Wyoming, and Nebraska, and in 2005 the first, and so far only, case was documented in northwestern Kansas. There is no documented disease risk to humans, but because of the potential of another prion disease, bovine spongiform encephalopathy (mad cow disease) to cause new variant Creutzfeldt-Jakob disease in humans, there is uncertainty of the safety of venison from infected deer. CWD also has the potential to reduce the value of the high quality trophy deer herd in Kansas, which could have negative impacts on an important tourist recreational activity. We identified two factors that may be correlated with transmission risk, density of groups (motivated by evidence that density of prairie dog colonies rather than density of prairie dogs per se is important for the transmission dynamics of plague), and hunting pressure, which cause deer to aggregate in large numbers in refugia where they are protected from hunting. Because disease transmission is often density dependent, the increased density in refugia may increase transmission rates. This is a pilot study to identify indices of genetic connectivity of white-tailed deer at nine study sites that vary in deer group density and hunting pressure.

Products:
Technical and Semi-Technical:
Completion report.
Presentations:
Statham, M., S.M. Wisely, A. Mattox, L. Fox, J. Cully. 2008. Landscape Genetics of Genetic Susceptibility of White-Tailed Deer to Chronic Wasting Disease: Implications for CWD Emergence across Kansas. International Conference on Emerging Infectious Diseases.

Title: **Biogeography and Molecular Epidemiology of the PRNP Gene in Kansas**

Funding: US Geological Survey

Investigator: Dr. Samantha Wisely, Division of Biology

Completion: 2008

This is an add-on to the CWD study above, and is in progress. The cervid PRNP gene has been identified as a genetic marker for increased risk of infection by CWD. This study will use the same samples to quantify the prevalence and spatial distribution of the PRNP gene in white-tailed deer in Kansas prior to CWD becoming established in the state. My role will be to incorporate the results of genetic analyses into the GIS.

Products:
Technical and Semi-Technical:
Completion report.
Presentations:
Wisely, S., M. Statham, A. Mattox, L. Fox, and J. Cully. 2008. Prevalence and biogeography of genetic susceptibility to Chronic Wasting Disease in white-tailed deer from Kansas. The Wildlife Society.

2007

- - - - -

2006

Title: **Community dynamics of rodents, fleas and plague associated with black-tailed prairie dogs**

Funding: US Geological Survey BRD NRPP
National Science Foundation
Kansas Department of Wildlife and Parks

Investigator: Bala Thiagarajan

Advisor: Dr. Jack F. Cully, Jr.

Completed: 2006

Black-tailed prairie dogs (*Cynomys ludovicianus*) are epizootic hosts for plague (*Yersinia pestis*); however, alternate enzootic hosts are important for the maintenance of the pathogen. We

determined small rodents and prairie dog associations and quantified rodent and flea relationships in the presence and absence of prairie dog colonies and plague. We identified potential alternate hosts and flea vectors for the maintenance and transmission of plague in the prairie ecosystem. This is the first multi-year study to investigate associations between prairie dogs, rodents and fleas across the range of the black-tailed prairie dog. Few rodent species associated with black-tailed prairie dogs and were found to be highly abundant on colonies. Rodent species implicated in plague were present at study areas with and without plague. *Peromyscus maniculatus* and *Onychomus leucogaster*, two widely occurring species, were more abundant in areas with a recent history of plague. Flea community characteristics varied within each study area in the presence and absence of prairie dogs. Based on flea diversity on rodents, and the role of rodents and fleas in plague, we identified *P. maniculatus* and *O. leucogaster* and their associated fleas, *Aetheca wagneri*, *Malareus telchinus*, *Orchopeas leucopus*, *Peromyscopsylla hesperomys*, and *Pleochaetis exilis* to be important for the dynamics of sylvatic plague in our study areas. *Peromyscus maniculatus* and *O. leucogaster* were consistently infected with Bartonella spp., another blood parasite. Presence of prairie dog fleas on other rodents at both off and on prairie dog colonies suggests the potential for intra and interspecific transmission of fleas between rodent hosts, and between other small rodents and prairie dog.

Products:

Peer-reviewed Publications:

Brinkerhoff, R.J., C. Ray, B. Thiagarajan, S. K. Collinge, J. F. Cully, Jr., B. Holmes, and K. L. Gage. 2008. Keystone hosts: Prairie dogs affect occurrence patterns of disease vectors on small mammals. Ecography 31:654-662.

T. Bala, Y. Bai, K. L. Gage, and J. F. Cully, Jr. 2008. Prevalence of *Yersinia pestis* in rodents and fleas associated with black-tailed prairie dogs at Thunder Basin National Grassland, Wyoming. Journal of Wildlife Diseases 44: 731-736.

Thiagarajan, B., J. F. Cully, Jr., T. M. Loughin, J. A. Montenieri, and K. L. Gage. 2008. Geographic variation in rodent-flea relationships in the presence of black-tailed prairie dog colonies. Journal of Vector Ecology 33:178-190.

Bai, Y., M. J. Kosoy, J. F. Cully, Jr., T. Bala, C. Ray, S. K. Collinge. 2007. Acquisition of nonspecific Bartonella strains by the northern grasshopper mouse (*Onychomys leucogaster*). FEMS Microbiol Ecol 61:438-448.

Thesis or Dissertation:

Thiagarajan, B. 2006. Community dynamics of rodents, fleas and plague associated with black-tailed prairie dogs. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Thiagarajan, B., J. F. Cully, Jr., and K. L. Gage. 2008. Ecology of rodents and fleas associated with black-tailed prairie dogs in areas with plague. Symposium on the Ecology of plague and its effects on wildlife, Fort Collins, CO.

Bala, T., J. F. Cully, T. M. Loughin, Y. Bai, M. Kosoy, and K. L. Gage. 2007. Prevalence of Bartonella species in rodents and fleas associated with black-tailed prairie dogs. 62nd Annual Meeting, International Conference on Diseases in Nature Communicable to Man, Madison, WI.

Bala, T., Ying Bai, Micheal Kosoy, Ken Gage, Tom Loughin and J. F. Cully, Jr. 2006. Prevalence of *Bartonella* in rodents and fleas associated with the black-tailed prairie dogs. 55th Annual Conference of the Wildlife Disease Association, University of Connecticut, Storrs, CT.

Title: **The effects of landscape configuration on northern bobwhite in southeastern Kansas**

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: Brian E. Flock, Ph.D. Student

Advisor: Dr. Philip S. Gipson

Completion: 2006

Northern bobwhite (*Colinus virginianus*) populations in much of the species range have been declining for the last 35 years. I trapped and equipped bobwhite with radio transmitters and tracked them during 2003-2005. I used these data to examine the effects of landscape configuration on survival as well as the habitat association of bobwhite in southeastern Kansas. I used the nest survival model in Program MARK to determine the effects of habitat configuration on weekly survival of radio equipped bobwhite during the Fall-Spring (1 October to 14 April) and the Spring-Fall (15 April to 30 September) at home range and 500 m buffer scales. Individual survival probability for the Fall-Spring period was 0.9439 (S.E. = 0.0071), and the most parsimonious model for the Fall-Spring period at the home range scale was B0 + percent woodland + percent cropland. At the 500 m buffer scale the most parsimonious model was B0 + percent Conservation Reserve (CRP) program land. The weekly survival probability for the Spring-Fall period was 0.9559 (S.E. = 0.0098). At the home range and 500 m buffer scales there were weak associations of habitat to survival during Spring-Fall with the most parsimonious model for both scales B0 + percent other. Using Euclidean Distances to measure distance from animal location to each habitat, I found that habitat selection was occurring during the Spring-Fall (Wilkes $\lambda = 0.04$, $F_{6,36} = 143.682$, $P < 0.001$) and Fall-Spring (Wilkes $\lambda = 0.056$, $F_{6, 29} = 81.99$, $P < 0.001$). During Spring-Fall bobwhite were associated with locations near cool-season grasses and during Fall-Spring preferred locations near woody cover. Bobwhite also showed habitat selection at a second more refined land use classification level for Spring-Fall (Wilkes $\lambda = 0.006$, $F_{16, 26} = 284.483$, $P < 0.001$) and Fall-Spring (Wilkes $\lambda = 0.004$, $F_{16, 19} = 276.037$, $P < 0.001$). During the Spring-Fall, bobwhites were associated with locations near cool-season grass pastures and roads and during Fall-Spring were associated with locations in close proximity to roads and CRP. Understanding the effects of habitat configuration on bobwhite is an important step in developing a broad-scale management plan.

Products:

Peer-reviewed Publications:

Flock, B. E., Gipson, P. S., Applegate, R. D., & Ballard, W. B. 2012. Distance-based habitat associations of northern bobwhites in a fescue-dominated landscape in Kansas. In Proceedings of the National Quail Symposium (Vol. 7, pp. 42-51).

Thesis or Dissertation:

Flock, B.E. 2006. The effects of landscape configuration on northern bobwhite in southeastern Kansas. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Gipson)

Title: **The Effects of Trapping Methods on Estimation of Population Parameters for Small Mammals**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas, Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Jeremy A. Baumgardt, M.S. Student

Advisor: Dr. Philip S. Gipson

Completion: 2006

Small mammal population and community studies are typically based on trapping. Removal and mark-recapture techniques are used to sample populations and estimate the probability of capture. The purpose of this study was to determine the effects of various sampling strategies on estimates of community and population level parameters. I used the removal-by-mark method and varied the number of traps used on a 1 ha grid to determine how the number of traps, duration of trapping, and level of replication affected estimates of species richness and abundance. No significant differences were detected in the estimated abundance or the precision of the estimate relative to the density of traps used for my spring captures, suggesting that the number of replicates in this season were too small relative to the high variability of the data. In fall, the estimated abundance increased with trap densities from nine trap stations per ha to 144 per ha for both prairie voles and deer mice, indicating that the lower densities of traps (nine to 100 per ha) were not sufficient to accurately survey these species. No trend was detected for western harvest mice abundance estimates, however the coefficient of variation of the abundance estimate steadily decreased with number of traps used. Increasing duration of trapping beyond four days generally did not change abundance estimates, suggesting that four days of trapping may be sufficient to accurately estimate abundance. Trap density had no effect on estimates of species richness. An increase in average number of species detected per grid with each of two additions of two days of trapping occurred for most densities of traps.

To determine if bait choice affected capture probability I used peanut butter, rat chow, and sunflower seeds as baits on separate trap grids using mark-recapture techniques. Bait type did not affect the capture probability for deer mice, but it did have a significant effect on the capture probability for western harvest mice. Sunflower seeds provided the highest estimated capture probability and peanut butter resulted in the lowest. Bait may affect capture probabilities for specialized feeders, but all three baits that I used were suitable for omnivorous species.

Products:

Peer-reviewed Publications:

Conard, J.M., J.A. Baumgardt, P.S. Gipson, and D.P. Althoff. 2008. The influence of trap density and sampling duration on the detection of small mammal species richness. Acta Theriologica 53 (2): 143-156.

Thesis or Dissertation:

Baumgardt, J.A. 2006. The effects of trapping methods on estimation of population parameters for small mammals. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Presentations:

Baumgardt, J. A., J. M. Conard, P. S. Gipson. 2004. 84th Annual Meeting of the American Society of Mammalogists. The influence of trap density on estimates of small mammal abundance, diversity, and species richness. Poster.

Baumgardt, J. A., J. M. Conard, P. S. Gipson, D. P. Althoff, J. S. Pontius, and P. B. Woodford. 2004. 13th Annual Department of Defense Integrated Training Area Management Workshop. Relationships between sampling effort and estimates of small mammal population parameters on Fort Riley, KS. Poster.

Title: **Reclamation of Native Tallgrass Prairie at the Kansas Army Ammunition Plant**

Funding: U.S. Department of Defense

Investigators: Tracey N. Johnson, M.S. Student
Dr. Brett S. Sandercock, Division of Biology

Completion: 2006

Cattle-grazing is a dominant land use in the United States, with more than 300 million hectares of land grazed each year. The habitat changes facilitated by cattle grazing can influence resource availability and habitat selection for associated wildlife. To investigate the potential for changes in traditional livestock management to restore native grassland and riparian habitat, we evaluated biological community responses to winter-grazing and livestock exclusion at the Kansas Army Ammunition Plant in southeastern Kansas. In grassland habitats, we combined winter-grazing by domestic cattle and discontinued fertilization in an attempt to restore pastures dominated by tall fescue to native tallgrass prairie and improve habitat for grassland-breeding birds. We observed a decrease in tall fescue and an increase in native, warm-season grasses in winter-grazed pastures compared to fertilized, year-round grazed pastures. Grassland-breeding bird responses to winter-grazing were species-specific. Dickcissels preferred winter-grazed pastures, while Eastern Meadowlarks and Grasshopper Sparrows tended to prefer year-round grazed pastures. Dickcissels were negatively correlated with the presence of cattle during the breeding season and the abundance of tall fescue. Grasshopper Sparrows were negatively correlated with native, warm-season grass abundance and visual obstruction, but were positively correlated with forb abundance. Henslow's Sparrows and Common Yellowthroats were detected breeding in low numbers on pastures that had been winter-grazed for five years. Our results suggest that winter-grazing and discontinued fertilization of agricultural grasslands can direct semi-natural plant communities toward tallgrass prairie and benefit some grassland-breeding birds.

In riparian habitats, livestock were excluded from 1996 to 2005. We measured bird community responses in grazed and ungrazed sites using baseline data collected in 1996-97 and post-treatment data collected in 2005-05. Riparian bird community data were analyzed using robust design mark-recapture models that allowed us to evaluate changes in bird species richness while accounting for differences in detectability among species. We detected increases in species richness in both ungrazed and grazed treatments. We observed few differences in community vital rates between treatments; however, we did detect differences in guild responses. The changes observed within both grazed and ungrazed riparian bird communities were likely influenced by regional fluctuations in species richness and composition.

Products:

Peer-reviewed Publications:

Johnson, T.N., and B.K. Sandercock. 2010. Restoring tallgrass prairie and grassland bird populations in tall fescue pastures with winter grazing. Rangeland Ecology and Management 63:679-688.

Johnson, T.N., R.D. Applegate, D.E. Hoover, P.S. Gipson, and B.K. Sandercock. 2009. Evaluating avian community dynamics in restored riparian habitats with mark-recapture models. Wilson Journal of Ornithology 121:22-40.

Johnson, T.N., and B.K. Sandercock. 2005. Winter grazing increases native prairie grasses in fescue-dominated pastures (Kansas). Ecological Restoration 23:115-116.

Thesis or Dissertation:

Johnson, T.N. 2006. Ecological restoration of tallgrass prairie: grazing management benefits plant and bird communities in upland and riparian habitats. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Sandercock)

2005

Title: **Spatial dynamics of a bacterial pathogen: Sylvatic plague in Black-tailed prairie dogs**

Funding: US Geological Survey, BRD NRPP Initiative

Investigator: Tammi L. Johnson, M.S. Student

Advisor: Dr. Jack F. Cully, Jr.

Completion: 2005

Black-tailed prairie dog (*Cynomys ludovicianus*) populations have declined by as much as 98% during the past 100 years. Several factors have contributed to this decline including intentional poisoning, habitat loss and sylvatic plague. During the past 60 years, plague may have been the most significant cause of decline Sylvatic plague is an exotic vector-borne disease caused by the bacterium *Yersinia pestis* and causes mortality rates approaching 100% in black-tailed prairie dog colonies. Plague epizootics in black-tailed prairie dogs are often widespread, with groups of colonies typically extirpated in a short period of time. Plague may be transmitted among prairie dog colonies via two mechanisms: (1) epizootic transmission, in which plague cycles among prairie dog colonies via the movement of infected prairie dog fleas by dispersing prairie dogs or perhaps the movement of infected fleas by predators such as coyotes, and (2) enzootic transmission, in which reservoir species such as northern grasshopper mice (*Onchomys leucogaster*) and deer mice (*Peromyscus maniculatus*), transmit infected fleas to prairie dogs. Our research aims to quantify the effects of sylvatic plague on the metapopulation structure of black-tailed prairie dog colony complexes and to determine if metapopulation structure, in turn influences the spread of plague among colonies.

We examined spatial patterns of colonies in areas with and without a history of plague to identify landscape scale effects of plague on black-tailed prairie dogs, as well as factors that influence intercolony transmission in complexes where plague was present. The presence of sylvatic plague in black-tailed prairie dog colonies significantly alters the spatial structure of colony complexes. Colony complexes with a history of plague are composed of smaller colonies with greater intercolony distances, while complexes where plague is absent are primarily composed of more large colonies in close proximity to neighboring colonies. We can conclude from this portion of the project that sylvatic plague increases the degree of colony isolation. Multistate modeling illustrated the mechanisms expected to have the most impact on intercolony transmission of plague. Colony area, distance to the nearest neighboring colony and distance to the nearest drainage, which may function as dispersal corridors, were the most important factors for predicting the probability of plague entering colonies.

Products:

Peer-reviewed Publications:

Johnson, T.L., J. F. Cully, Jr., S. K. Collinge, C. Ray, C. M. Frey, and B. K. Sandercock. 2011. Spread of plague among black-tailed prairie dogs is associated with colony spatial characteristics. Journal of Wildlife Management 75:357-368.

Cully, J. F., Jr., T. L. Johnson, S. K. Collinge, and C. Ray. 2010. Disease limits populations: Plague in black-tailed prairie dogs. Vector Borne and Zoonotic Diseases 10:7-15.

Augustine, D. J., M. R. Matchett, T. P. Toombs, J. F. Cully, Jr., T. L. Johnson, J. D. Sidle. 2008. Spatiotemporal dynamics of black-tailed prairie dog colonies affected by plague. Landscape Ecology 23:255-267.

Augustine, D. J., J. F. Cully, Jr., and T. L. Johnson. 2007. Influence of fire on black-tailed prairie dog colony expansion in shortgrass steppe. Rangeland Ecosystem Management 60:538-542.

Johnson, T. L., and J. F. Cully, Jr. 2005. Effects of colony connectivity on the spread of sylvatic plague (*Yersinia pestis*) in black-tailed prairie dogs across the Great Plains. Second Symposium proceedings: The history, ecology, and economy of the Thunder Basin prairie ecosystem. J. B. Haufler, ed. CD

Thesis or Dissertation:

Johnson, T.L. 2005. Spatial dynamics of a bacterial pathogen: Sylvatic plague in Black-tailed prairie dogs. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Cully, J. F. and T. L. Johnson. 2008. Plague regulates black-tailed prairie dog populations. Symposium on the Ecology of plague and its effects on wildlife, Fort Collins, CO.

Cully, J. F., and T. L. Johnson. 2007. Spatial dynamics of plague in three black-tailed prairie dog complexes. Annual Meeting of the Wildlife Disease Association, Estes Park, CO.

Johnson, T.L. and J.F. Cully, Jr. 2005. Colony Spatial Dynamics Influence the Transmission of Sylvatic Plague in Black-tailed Prairie Dogs. Featured Student Presenter, Wildlife Disease Association International Conference, Cairns, Queensland, Australia. *2005 Graduate Student Research Award.

Title: **Effects of experimental manipulation of coterie size on demography of Black-tailed prairie dogs in South Dakota**

Funding: US Geological Survey, BRD NRPP Initiative

Investigator: Lorri A. Newby, M.S. Student

Advisor: Dr. Jack F. Cully, Jr.

Completed: 2005

Life-history traits can be affected by density, especially in species restricted in range. Black-tailed prairie dogs (*Cynomys ludovicianus*) are restricted to an area occupied by three or four related females, one breeding male, and their offspring, which live within social groups called coteries. To test whether increasing or decreasing numbers affected growth, survival, reproduction, and dispersal, the number of juveniles in24 coteries within four colonies in Badlands and Wind Cave National Parks were manipulated by adding or removing juveniles or left as controls during the springs of 2002 and 2003. Growth was assessed by measuring the mass of juveniles and yearlings throughout subsequent summers. Daily mass gain for 346 juveniles did not differ significantly among treatments (increased: 4.18 g/day (S.D. = 1.47, n = 161); decreased: 4.23 g/day (S.D. = 1.34, n = 58); control: 4.21 g/day (S.D. = 1.49, n = 127)). Similarly, daily mass gain for 39 yearlings was not significantly different among treatments (increased: 1.08 g/day (S.D. = 1.12, n = 12); decreased: 1.46 g/day (S.D. = 1.42, n = 8); control: 1.205 g/day (S.D. = 1.51, n = 19)). Likewise the number of juveniles that survived into their next year was not significantly different among treatments (increased: 32% (n = 108); decreased: 36% (n = 53); control: 34% (n = 145)). Also, there were no significant differences among treatments in the number of adults or yearlings that were lactating the following year (adults - increased: 62% (n = 13), decreased: 68% (n = 19), control: 73% 9n = 15); yearlings - increased: 44% (n = 9), decreased: 30% (n = 10), control: 20% (n = 15)). Dispersal of yearling males was

not affected by manipulation. Though high variance in coterie densities yielded no statistically significant effects, juvenile and yearling growth, and yearling survival exhibited expected trends with growth and survival being lower in increased coteries and higher in decreased coteries. Density differences due to these manipulations may not have been pronounced enough to have significant effects on these demographic parameters. Future studies should increase differences among treatments to determine if these demographic parameters are density-dependent.

Products:

Thesis or Dissertation:

Newby, L.A. 2005. Effects of Experimental Manipulation of Coterie Size on Demography of Black-Tailed Prairie Dogs in South Dakota. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Title: **Evaluation of soil quality indicators following disturbance by an Abrams M1A1 main battle tank**

Funding: U.S. Department of Defense

Investigator: Peggy S. (Althoff) McBee, Ph.D. Student

Advisor: Dr. Stephen J. Thien, Department of Agronomy

Completion: 2005

Before the U.S. Forest Service of National Park Service ws established, the cavalry and engineers of the U.S. Army managed lands set aside as national parks (Hampton 1971). Today, the Department of Defense (DoD) is responsible for 10,117,141 ha (25,000,000) making it the fifth largest land steward among the federal agencies. These public lands are used for military reservations and installations which include artillery, bombing, missile ranges, and weapons testing grounds. Military training commonly results in and degradation, but specific protocols for assessing and predicting long-term environmental impact are lacking. Protocol to assess the impact of repeated disturbance and subsequent recovery is needed to balance training requirements against environmental quality. To develop methodology for assessing changes in soil quality associated with military training, a study evaluating disturbance resulting from tank maneuvers was initiated on Fort Riley Military Installation, Kansas. Understanding how military training impacts the environment improves decision-making for range control officers, and fosters responsible land stewardship, allowing land managers to be more proactive.

Our objective was to provide information about soil disturbance during tank maneuvers to land managers seeking to maintain environmental integrity and sustainability without compromising training requirements. Soil disturbance resulting from tank maneuvers was evaluated by identifying and quantifying physical, chemical, and biotic indicators of soil quality on two oil types (silty clay loam soil and silt loam soil) during dry and wet soil conditions. Disturbance treatments resulted from a 63-ton, M1A1 tank making five passes (single disturbance) over each plot in a figure-8 pattern in 2003. In 2004, one-half of the same figure-8 pattern on each plot received five additional tank passes (repeated disturbance) during the same soil moisture conditions (wet or dry) as in 2003. All plots were sampled within seven days following disturbance.

Effects of tank maneuvers on physical and biological variables depended on soil type and water content at the time of disturbance. Disturbance effects were greatest for wet soil conditions, repeated traffic, and track curves. Vegetation biomass one year following treatment remained reduced on both soil types. Sensitive indicators of belowground disturbance and recovery included compaction, active carbon, and soil faunal communities.

Products:

Thesis or Dissertation:

Althoff, P.S.S. 2005. Evaluation of soil quality indicators following disturbance by an Abrams M1A1 main battle tank. Ph.D. Dissertation. Department of Agronomy, Kansas State University. (Advisor: Thien)

Presentations:

Althoff, P. S., S. J. Thien, G. J. Kluitenberg, P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2005. 12th Annual Department of Defense Integrated Training Area Management Workshop. Evaluation of soil quality following disturbance created by an Abrams M1A1 Main Battle Tank. Platform presentation.

Title: **Landscape factors influencing the Presence of Migrant Forest Songbirds in the Kansas Flint Hills**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas

Investigator: Brooke M. Stansberry, M.A. Student

Advisor: Dr. J.M. Shawn Hutchinson, Department of Geography

Collaborators: Dr. Philip S. Gipson, Douglas Goodin, and Timothy Parker

Completion: 2005

Numerous studies have been conducted to determine whether forest-nesting migrant songbirds in eastern North America avoid, or are less likely to occur in, smaller forest patches. However, in the majority of these studies, avoidance of small patches could not be distinguished from avoidance of edges. This research reports a study that attempted to partially control for distance to closest edge when assessing patch area effects on bird occurrence. In a grassland-dominated landscape in the Flint Hills of Northeastern Kansas, landscape and patch-level predictors of species occurrence were analyzed using Aikaike's Information Criterion for small sample sizes (AICc). Survey points were clumped at particular study forest sites where public land was available, and were not random. Thus, to account for non-independence, 'site identity' was identified as a random effect in each analysis. To integrate this random effect into a logistic regression, generalized linear mixed models (SAS 8.0, GLIMMIX macro for PROC MIXED, binomial error and a logit link) were used. The dependent variable in these analyses was presence or absence (detected at least once versus never detected) of a bird species at a point count cir4cle. These analyses were conducted repeatedly, once for each model for each species. Many of the forest-nesting songbirds surveyed, were not particularly sensitive to landscape variables such as forest cover within 1 kilometer of the surveyed site or the size of the forest patch. However, three study species did show sensitivity to landscape variation in habitat. Black and White Warblers appeared more likely to occupy a forest patch if amount of forest cover on the landscape surrounding the patch was high. Both Northern Parulas and Red-eyed Vireos

avoided smaller forest patches and were3 influenced by the edge type adjacent to the forest patch (agricultural versus grassland). The interpretation of this pattern is clearest for Red-eyed Vireos, which occupied forest patches with grassland edges more consistently over a wider range of patch sizes. This suggests, that agricultural edges may limit suitability of forest patches for Red-eyed Vireo. This is a unique finding since no other study has compared agricultural edges to native prairie edges for forest birds.

Products:

Peer-reviewed Publications:

Parker, T. H., B.M. Stansberry, C. D. Becker, and P. S. Gipson. 2005. Edge and area effects of migrant forest songbirds. Conservation Biology. 19:1157-1167.

Parker, T. H., B. M. Stansberry, C. D. Becker, and P. S. Gipson. 2003. Do melanin or carotenoid pigmented plumage ornaments signal condition and predict pairing success in the Kentucky warbler? Condor. 105:663-671.

Stansberry, B. M., T. H. Parker, J. M. S. Hutchinson, C. D. Becker, and P. S. Gipson. 2003. Settlement patterns of forest birds in a prairie landscape. Papers of the Applied Geography Conferences. 26:479-487.

Thesis or Dissertation:

Stansberry, B.M. 2005. Landscape factors influencing the presence of migrant forest songbirds in the Kansas Flint Hills. Master's Thesis. Department of Geography, Kansas State University. (Advisor: Hutchinson)

2004

- - - - -

2003

Title: **Spatial variation in Brown-headed Cowbird (*Molothrus ater*) abundance and brood parasitism in Flint Hills Tallgrass Prairie**

Funding: Kansas Department of Wildlife, Parks and Tourism

Investigator: William E. Jensen, Ph.D. Student

Advisors: Dr. Jack F. Cully, Jr.

Completion: 2003

Environmental factors affecting habitat selection range from species-specific habitat requirements to general aspects of intraspecific competition. Different proximate factors may affect spatial patterns of host selection by the brood parasitic (*Molothrus ater*) brown-headed cowbird within grasslands. Here I examined how such factors might affect cowbird distribution among tallgrass prairie-woodland edge and tallgrass prairie interior habitats within the Flint Hills of eastern Kansas and Oklahoma. First, I experimentally tested the hypothesis that the presence of elevated perches—similar to those provided by trees and shrubs—increases the abundance of cowbirds in grasslands and their parasitism of grassland-nesting birds (Chapter 1). However, cowbird abundance and parasitism levels of dickcissel (*Spiza americana*) nests were similar among experimental perch plots, prairie interior plots (>100 m from wooded edges), and plots near (<100 m) wooded edges when averaged across eight study sites. As cowbird habitat use patterns might be distorted by density-dependence in their habitat selection, I also examined cowbird use of these three habitats in relation to geographic variation in cowbird abundance

across the Flint Hills (Chapter 2). Cowbird abundance and parasitism rates were higher near wooded edges than in prairie interior on study sites where cowbirds were less abundant and parasitic, but increased within open prairie interior at faster rates as the magnitude of these measures increased geographically. Experimental perch and open prairie habitats were used equally by cowbirds across the region. Density-dependent selection of edge and interior habitats by cowbirds might result from observed negative density-dependent effects of multiple parasitism on cowbird reproductive success. As local cowbird parasitism rates on dickcissel nests varied greatly across the region (from 0% to 92% of nests parasitized) an attempt was made to identify possible ecological correlates with local parasitism levels (Chapter 3). However, parasitism levels were unrelated to habitat structure at local and landscape scales and local host community attributes, being positively correlated only with local female cowbird density. Dickcissel reproductive success was negatively related to local cowbird parasitism levels. This study demonstrated that habitat-specific and overall cowbird parasitism levels can vary greatly with geographical variation in cowbird abundance, independently of geographical variation in habitat or host community attributes.

Products:

Peer-reviewed Publications:

Rivers, J.W., W.E. Jensen, K.L. Kosciuch, and S.I. Rothstein. 2010. Community-level patterns of host use by the Brown-headed Cowbird, a generalist brood parasite. Auk 127:263-273.

Jensen, W. E., and J. F. Cully, Jr. 2005. Density-dependent habitat selection by a brood-parasitic cowbird in tallgrass prairie. Oecologia 142:136-149.

Jensen, W. E., and J. F. Cully, Jr. 2005. Geographic variation in cowbird parasitism and dickcissel nesting success in great plains tallgrass prairie. The Auk 122:648-660.

Thesis or Dissertation:

Jensen, W.E. 2003. Spatial Variation in Brown-Headed Cowbird (*Molothrus ater*) Abundance and Brood Parasitism in Flint Hills Tallgrass Prairie. Ph.D. Dissertation, Division of Biology, Kansas State University. (Advisor: Cully)

Title: **Recreation Impacts on Avian Assemblages in the Niobrara River Corridor, Fort Niobrara National Wildlife Refuge**

Funding: U.S. Fish and Wildlife Service

Investigator: Christopher Anderson, M.S. Student

Advisors: Dr. C. Dustin Becker, Department of Horticulture, Forestry and Recreation Resources
Dr. Philip S. Gipson, Unit Leader

Completion: 2003

In the Sandhills of Nebraska, Fort Niobrara National Wildlife Refuge (FNNWR) is unique in having a federally designated Wild and Scenic River. Since 1961, recreation on the Niobrara River in the refuge has increased from several hundred to 30,000 people per year in 1997. Managers of the refuge are required to evaluate whether recreational activity affects wildlife.

Recreational impacts on wildlife are typically studied at the behavioral level, excluding community or population ramifications. During 2000-2002 I attempted to determine whether river recreation at FNNWR negatively affects local avifaunal community and population dynamics as well as examine immediate behavioral responses. During the 2000 breeding season, bird communities in riparian forests exposed to river recreation were compared to communities in riverside forests lacking recreation to determine if recreational presence alters community composition and spatial distribution. Presence and absence of birds were sampled via point counts. As described in Chapter 1, no apparent shift in species composition or spatial distribution was observed at the community level, refuting a predictive model.

Chapter 2 focuses on population effects of recreational activities, especially their potential to negatively impact breeding songbirds at FNNWR. Common Yellowthroat (Geothlypis trichas) was used as a model songbird due to it ubiquity and proximity to river recreation. Nests in recreated and non-recreated areas were monitored throughout the 2001-2002 breeding seasons. When nests could not be followed, a reproductive index was utilized. Neither method showed significant differences in breeding success in responses to river recreation. However, terrestrial predator communities exhibited major impacts on Common Yellowthroat productivity. Scent station studies indicated that predator activity increased during the breeding season. While river recreation had no major impact on community and population dynamics of birds in riparian forests, predation was unusually high in a common nesting species. Chapter 3 investigates behavioral responses in waterbirds to river recreation. A significant greater rate of flushing was observed in responses to recreational noise than in the absence of such disturbance. In conclusion, river recreation may provoke immediate behavioral responses in birds but had little effect on population and community level factors.

Products:

Thesis or Dissertation:

Anderson, C. D. 2003. Recreational pressure at Fort Niobrara National Wildlife Refuge: Potential impacts on avian use and seasonal productivity along the Niobrara River. Master's Thesis. (Advisor: Becker)

Presentations:

Anderson, C. D., C. D. Becker, P.S. Gipson, B. K. Sandercock, and D. A. Rintoul. 2003. American Ornithological Union Annual Meeting. Breeding success common yellowthroat (*Geothlypis trichas*) within a river corridor under recreation pressure. Platform presentation.

Title: **Responses of Small Mammals and Their Predators to Military Disturbance in Tallgrass Prairie**

Funding: U.S. Department of Defense

Investigator: Jonathan Conard, M.S. Student

Advisor: Dr. Philip S. Gipson

Completion: 2003

Small mammals and their mammalian and avian predators were studies in grassland habitat at Fort Riley, Kansas. The impact of military disturbance on small mammals was examined by trapping on flour plots in heavily disturbed areas and four plots in lightly disturbed areas during

winter, spring, summer fall (2002), and winter (2003). Vegetation was surveyed on the small mammal trapping plots for the fall (2002) and winter (2003) seasons to determine how vegetation structure impacted small mammal abundance and diversity. Each small mammal trapping whole plot (300 m x 300 m) included four subplots with different trap densities. Each subplot was 100 m x 100 m and was randomly assigned a trap density of 9 traps stations/ha, 16 trap stations/, 25 trap stations/ha, or 36 trap stations/ha, with two live traps at each station. Relative abundance, species richness, Shannon diversity (H'), catch/unit effort, and community composition of small mammals were compared between densities. Mammalian predators were surveyed seasonally using two tracking stations baited with fatty-acid scent tabs on each small mammal trapping plots. Avian predators were surveyed seasonally using a 10 km road survey in the lightly disturbed area and one in the heavily disturbed area. Species richness was lower in the heavily disbursed area during fall and winter (2002) ($P < .05$). Abundance of *Peromyscus maniculatus*, *Reithrodontomys megalotis*, and *Microtus ochrogaster* did not differ between heavily and lightly disturbed areas. *Blarina hylophaga* and *Sigmodon hispidus* were consistently more abundant in lightly disturbed areas. Shannon diversity (H') and species evenness (J') were not detectably different between areas during any season. Trap density was positively related to species richness and relative abundance, but negatively related to catch / unit effort. Trap density did not detectably influence estimates of Shannon diversity (H'), seasonal population trends, or proportional abundance of common small mammal species Coyotes (*Canis latrans*) were the most common mammalian predator detected in all seasons on both areas. Relative abundance of coyotes showed no marked differences between areas during any season. Diurnal raptor survey indicated generally higher raptor abundances in the heavily disturbed area during all seasons.

Products:

Thesis or Dissertation:

Conard, J.M. 2003. Responses of small mammals and their predators to military disturbance in tallgrass prairie. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Presentations:

Gipson, P. S., J. M. Conard, and A. B. Anderson. 2006. Annual American Society of Agronomy International Meeting. The role of munitions-impacted sites on military lands as refugia for wildlife. Platform presentation.

Conard, J. M., and P. S. Gipson. 2004. 65th Annual Midwest Fish and Wildlife Conference. Micro-habitat use by elk in the tallgrass prairie of east central Kansas. Platform presentation.

Gipson, P. S., J. M. Conard, and J. Baumgardt. 2004. 84th Annual Meeting of the American Society of Mammalogists. Coyote and diurnal raptor presence in relation to military training and small mammal abundance. Poster.

Conard, J. M., P. S. Gipson, J. S. Pontius, and G. L. Zuercher. 2003. 83rd Annual Meeting of the American Society of Mammalogists. The influence of trap density, vegetation structure, and anthropogenic disturbance on measures of small mammal diversity. Platform presentation

Title: **The genetic structure of greater prairie-chicken (*Tympanuchus cupido pinnatus*) populations in Kansas**

Funding: Division of Natural Resources, Fort Riley
Kansas Department of Wildlife and Parks

Investigator: Mayee Wong, M.S. Student

Supervisors: Dr. Jack F. Cully, Jr., David Jones and Roger Applegate

Completion: 2003

Research in greater prairie chicken ecology and natural history has been extensive since the 1930s. Little work has been done to investigate other aspects of the biology of the species. Molecular genetics provides a new tool to describe population dynamics. Investigation of the genetic system of greater prairie chickens is important in portions of their range where populations are still high and stable. This project will assess the genetic structure and diversity of greater prairie chickens in an area where extreme fragmentation and severe bottlenecks have not occurred. The distributions of greater prairie chickens in northeast Kansas is relatively contiguous and represents an ideal situation to investigate pre-bottleneck population structure. This project will address two questions: 1) what is the genetic structure of the population? 2) what is the heterozygosity of the species' population in Kansas? Blood will be collected from greater prairie chickens on two to three spring booming grounds from each of four geographic regions in Kansas: Riley County, Geary County, Lyon County, and Ottawa County. A genetic survey of this design will allow us to characterize how genetic variation is distributed in a nested hierarchical scheme: within a lek, among leks of a geographic region, and among geographic regions. By assessing degrees of genetic differentiation in an increasing geographic radius away from an individual greater prairie chicken, we hope to identify the population level that represents the most genetic diversity in a population. Allele frequencies from six polymorphic microsatellite loci will be used to calculate mean heterozygosities and allelic diversity per locus. Estimate of heterozygosity will be compared with results from surrounding states as well as with previous estimate made for a more limited area of Kansas. Genetic differentiation among groups will be tested for statistically significant differences.

Products:

Thesis or Dissertation:

Wong, M. 2003. High spatial homogeneity in a sex-biased mating system: The genetic population structure of greater prairie chickens (*Tympanuchus cupido pinnatus*) in Kansas, Missouri, and Nebraska. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Wong, M., and J.F. Cully,Jr. 1999. Geographic patterns of Greater Prairie Chicken (*Tympanuchus cupido*) genetic variability in Kansas, Oklahoma, and Missouri. 61st Midwest Fish and Wildlife Conference, Chicago, IL.

2002

Title: **Changes in Land Use Patterns and Their Effects on Rio Grande Turkeys in Southwestern Kansas**

Funding: Kansas Department of Wildlife and Parks

Investigator: Brian Spears, M.S. Student, Texas Tech Universithy

Advisor: Dr. Philip S. Gipson, Unit Leader
Dr. Warren B. Ballard, Texas Tech University
Roger Applegate, Kansas Department of Wildlife, Parks and Tourism
Dr. Mark Wallace, Texas Tech University

Completion: 2002

Rio Grande turkeys (*Meleagris gallopavo intermedia*) are distributed primarily through central Texas, Oklahoma and Kansas. Rio Grande turkeys have declined in the high plains and rolling plains of Texas and in southwest Kansas since the late 1970s as evidenced by declining turkey poult-hen counts. Approximately 50% of this area is used for production of crops such as wheat and corn, and 50% for cattle grazing. Turkey habitat is limited to rangeland-cropland borders, and riparian habitats. We propose to study habitat spatial relationships within five landscapes across the high plains and rolling plains of Texas (4 replicates) and southwestern Kansas (1 replicate), and relate these variables to population performance and distribution.

The objectives of this research were:

1) Examine the retention times of glued-on radiotransmitters on wild turkey poults in natural settings
2) Document Rio Grande wild turkey pre-flight poult daily survival from hatch to tree roosting
3) Examine Rio Grande wild turkey pre-flight poult habitat use and relates habitat use to poult survival.

Products:

Peer-reviewed Publications:

Spears, B. L., M. C. Wallace, W. B. Ballard, R. S. Phillips, D. H. Holdstock, J. H. Brunjes, M. Miller, R. D. Applegate, and P. S. Gipson. 2007. Habitat use and survival of pre-flight wild turkey broods. Journal of Wildlife Management 71:69-81.

Holdstock, D. P., M. C. Wallace, W. B. Ballard, J. H. Brunjes, R. S. Phillips, B. L. Spears, S. J. DeMaso, J. D. Jernigan, R. D. Applegate, and P. S. Gipson. 2006. Male Rio Grande turkey survival and movements in the Texas Panhandle and southwestern Kansas. Journal of Wildlife Management. 70:904-913.

Spears, B. L., K. L. Nicholson, R. T. Huffman, W. B. Ballard, M. C. Wallace, R. D. Applegate, and P. S. Gipson. 2006. Ecology of Rio Grande wild turkeys in southwest Kansas. Wildlife Bulletin 5. Kansas Department of Wildlife and Parks, Pratt, Kansas. 69 pages.

Spears, B. L., W. B. Ballard, M. C. Wallace, R. S. Phillips, D. H. Holdstock. J. H. Brunjes, M. Miller, R. D. Applegate, and P. S. Gipson. 2005. Survival of Rio Grande wild turkey chicks. Journal of Field Ornithology. 16:121-20.

Spears, B. L., W. B. Ballard, M. C. Wallace, R. S. Phillips, D. H. Holdstock, J. H. Brunjes, R. Applegate, P. S. Gipson, M. S. Miller, and T. Barnett. 2002. Retention times of miniature radiotransmitters glued to wild turkey poults. Wildlife Society Bulletin. 30:861-867.

Thesis or Dissertation:

Spears, B.L. 2002. Wild turkey pre-flight poult habitat characteristics and survival. Master's Thesis. Department of Wildlife Science, Texas Tech University. (Advisor: Ballard)

2001

Title: **Diets of mammalian predators on Fort Riley Military Base, Kansas**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas, and Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Troy R. Livingston, M. S. Student

Advisor: Dr. Philip S. Gipson

Collaborator: David P. Jones

Completion: 2001

The ecology of carnivore feces consumption (i.e., coprophagy) was investigated on Fort Riley, Kansas from January 2000 through December 2000. Feces from captive bobcats (Lynx rufus, captive coyotes (*Canis latrans*), and free ranging coyotes were randomly placed on tracking stations throughout woodland and prairie habitats to determine rates of coprophagy on known feces by local wildlife.

Rates of coprophagy on feces placed at tracking stations during winter and spring were 7 and 18%, respectively, while rates during autumn and summer were 32 and 50%, respectively. A variety of animal species were present at stations where coprophagy occurred including opossums (*Didelphis virginiana*), coyotes, bobcats, whitetail deer (*Odocoileus virginianus*), cottontail rabbits (*Sylvilagus floridanus*) and raccoons (*Procyon lotor*), and numerous insect and bird species.

Levels of coprophagy varied seasonally in relation to habitat type during summer and autumn and in relation to an interaction effect between feces type and habitat during spring ($P = 0.029$). Eighty percent of coyote feces consumed during spring were from prairie sites and 100% of bobcat feces consumed were in woodland habitats. The lowest rates of coprophagy occurred during winter 2000.

Highest rates of coprophagy occurred during summer with significant differences in levels of consumption occurring between habitat types. Sixty-seven percent of feces consumed were located in woodland habitats. Opossums were the most frequent visitors to coprophagy stations followed by insects.

There was a significant difference in the levels of coprophagy in prairie and woodlands during autumn 200 ($P = 0.01$). Feces were consumed nearly 3 times more often at stations located in woodland habitats than at stations located in prairie habitats, and opossums were the most frequent visitors to stations where coprophagy occurred.

High levels of coprophagy occurred on a seasonal basis at Fort Riley, Kansas. It was unclear what factors cause coprophagy in wildlife populations, however, coprophagy could bias ecological studies that rely upon feces as indicators of animal activity, habitat associations, diets, and species abundance because many feces would not be available for study.

Products:

Peer-reviewed Publications:

Livingston, T.R., P. S. Gipson, W.B. Ballard, D. M. Sanchez, and P. R. Krausman. 2005. Scat removal: a source of bias in feces-related studies. Wildlife Society Bulletin 33(1):172-178.

Gipson, P.S., T. R. Livingston, G.L. Zuercher and M. E. Howard. 2003. Responses of Opossums and Raccoons to Bobcat and Coyote Feces. Western North American Naturalist 63 (4) 538-540.

Howard, M. E., G. L. Zuercher, P. S. Gipson, and T. R. Livingston. 2002. Efficacy of feces as an attractant for mammalian carnivores. Southwestern Naturalist. 47:348-352.

Thesis or Dissertation:

Livingston, T.R. 2001. Coprophagy: An ecological investigation of the consumption of mammalian carnivore feces. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Presentations:

Gipson, P.S., M. E. Howard, T. R. Livingston, and G. L. Zuercher. 2000. 62nd Midwest Fish and Wildlife Conference. Mammalian carnivore scent attractants: standard fatty acid versus feces. Platform presentation.

Gipson, P.S., and T.L. Livingston. 1999. Dietary responses of coyotes to a windfall of carrion. 61st Midwest Fish and Wildlife Conference, Chicago, IL.

Title: **An Examination of the Bush Dog, *Speothos venaticus*, as Part of the Mammalian Predator Community in the Interior Atlantic Forest of Paraguay**

Funding: Kansas Cooperative Fisheries and Wildlife Research Unit;
Kansas State University, Division of Biology;
Department of Defense, Division of Natural Resources, Fort Riley, Kansas;
Sunset Zoological Park, Manhattan, Kansas;
Sedgwick County Zoological Park, Wichita, Kansas

Investigator: Gerald L. Zuercher, Ph.D. Student

Advisor: Dr. Philip S. Gipson

Collaborators: Dr. Robert D. Klemm, Director of Conservation and Research, Sunset Zoological Park;
Dr. George Stewart, College of Veterinary Medicine, Kansas State University

Completion: 2001

This project moved from theory on paper to reality in the field with a pilot inventory of predators by Gerald Zuercher and Philip Gipson on the Mbaracayu Forest Natural Reserve in eastern Paraguay, a 64,400-hectare reserve managed by the Fundacion Moises Bertoni (a conservation organization in Paraguay). This reserve is home to bush dogs as well as three other canids (maned wolf, Chrysocyon brachyurus; crab-eating fox, Cerdocyon thous; South American fox, (*Pseudalopex gymnocercus*), seven felids (jaguar, *Panthera onca*; puma, *Puma concolor*; ocelot, *Leopardus pardalis*; margay, *Leopardus wiedii*; oncilla, *Leopardus tigrina*; jaguarundi, *Herpailurus yagouarundi*; Geoffroy's cat, *Oncifelis geoffroyi*), two procyonids (crab-eating raccoon, *Procyon lotor*; South America coati, *Nasua nasua*), three mustelids (tayra, *Eira barbara*; grison, *Galictis cuja*; long-tailed otter, *Lontra longicaudus*), and two domestics (dog, *Canis familiaris*; cat, *Felis catus*). Field surveys of predators at Mbaracayu will include scent stations, nighttime spotlighting, vocalization surveys, scat collection, and habitat assessment. Additional research in Paraguay will include behavioral and physiological studies with captive predators at the Itaipu Binacional Fauna and Flora Museum, outside of Ciudad del Este, Paraguay. The largest captive colony of bush dogs (35) resides at this facility. Scat samples will be identified by isolating the cytochrome b (cytb) gene from mitochondrial DNA (mtDNA). Species specific differences in the nucleotide sequence of this determinant will make possible the identification of the defecator of field collected scat samples. This molecular laboratory

technique is presently being refined and validated on a predator complex at Fort Riley, Kansas, in conjunction with a larger predator study. Bobcats (Lynx rufus), coyotes (Canis latrans), raccoons (Procyon lotor), and domestic dogs and cats provide an ideal testing population.

Products:

Peer-reviewed Publications:

Zuercher, G. L., P. S. Gipson, and O. Carillo. 2005. Diet and habitat associations of *Speothos venaticus* in the Interior Atlantic Forest of eastern Paraguay. Oryx. 39:86-89.

Zuercher, G. L., P. S. Gipson, and G. C. Stewart. 2003. Identification of carnivore feces by local peoples and molecular analyses. Wildlife Society Bulletin 31:961-970.

Zuercher, G.L., P.S. Gipson, and T.R. Livingston. 2000. Técnicas no agresivas para estudios de mamíferos depredadores en el bosque Atlántico interior. Pages 119-121. In E. Cabrera, C. Mercolli, and R. Resquin, (eds). Manejo de Fauna Silvestre en Amazonia y Latinoamérica. Ricor Grafic S.A., Asunción, Paraguay.

Zuercher, G.L., P.S. Gipson, K.E. DeMatteo, J. Short, M.J. Caliendo, W. Wite, P Jones, J. McInturff, J. Tarbox, and B. Whitsitt. 2000. Determinación de esencias atractivas para la captura de Jagua Yvyguy (*Speothos venaticus*) y otros mamíferos depredadores Neotropicales. Pages 101-102. In E. Cabrera, C. Mercolli, and R. Resquin, (eds). Manejo de Fauna Silvestre en Amazonia y Latinoamérica. Ricor Grafic S.A., Asunción, Paraguay.

Thesis or Dissertation:

Zuercher, G.L. 2001. The ecological role of the Bush Dog, *Speothos venaticus*, as part of the mammalian predator community in the Interior Atlantic Forest of Paraguay. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Gipson)

Presentations:

Zuercher, G.L., J.M.S. Hutchinson, P.S. Gipson, R. Naidoo, and O. Carrillo. 2004.Defenders of Wildlife Carnivore Conference. Predators and their habitats revisited: a diverse carnivore community and their habitat associations in the Atlantic Forest of Paraguay. Platform presentation.

Gipson, P.S., and G.L. Zuercher, 2002. Defenders of Wildlife Carnivore Conference. Jaguar diets in eastern Paraguay: peccaries, livestock, and other carnivores. Platform presentation.

Zuercher, G., P.S. Gipson, and K. Hill. 2000. 80th Annual Meeting, American Society of Mammalogists. Durham, NH: Predators, prey, and habitat association in the Inland Atlantic Forest of Paraguay: a new paradigm.

Zuercher, G. L., P. S. Gipson, and O. Carrillo. 2000. Canid Biology and Conservation Conference, Oxford, England. Bush dogs (*Speothos venaticus*) in eastern Paraguay: a preliminary analysis of diet and habitat associations. Platform presentation.

Zuercher, G. L., P. S. Gipson, and K. Hill. 2000. Carnivores 2000. Denver, CO. A new paradigm for predator-habitat associations: neotropical felids in the Inland Atlantic Forest of eastern Paraguay. Platform presentation.

Zuercher, G. L., P. S. Gipson, G. C. Stewart, P. R. Krausman, D. M. Sanchez, M. I. Grinder, and M. E. Howard. 2000. 62nd Midwest Fish and Wildlife Conference. Molecular discrimination of sympatric Canis feces in an urban setting. Platform presentation.

Zuercher, G.L., P.S. Gipson, and T.L. Livingston. 1999. Técnicas no agresivas para estudio de mamíferos depredadores en el bosque atlántico interior. 4th Congreso Internacional Sobre Manejo de Fauna Silvestre en Amazonia y Latino America, Asuncion, Paraguay.

Zuercher, G.L., P.S. Gipson, K.E. DeMatteo, J. Short, M.J. Cliendo, E. Wite, P. Jones, J. McIntruff, J. Tarbox, and B. Whitsitt. 1999. Determinación de esencias atractivas para la captura de jagua yvguy (Speothos venaticus) y otros mamíferos depredadores neotropicales. 4th Congreso Internacional Sobre Manejo de Fauna Silvestre en Amazonia y Latino America, Asuncion, Paraguay.

Zuercher, G.L. and P.S. Gipson. 1998. Molecular biology: modern tools for non-invasively studying mammalian predators. Joint Fur Resources Workshop. St. Mary College, Leavenworth, KS.

Title: **Environmental impacts of reducing pesticides on Fort Riley**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas,

Investigator: Dr. Wayne A. Geyer, Department of Horticulture, Forestry & Recreation Resources

Collaborator: Dr. Philip S. Gipson

Completion: December 2001

The Natural Resources Division at Fort Riley has been notified that they must reduce pesticide use by 50% by the year 2000. Herbicides for vegetation control are the most widely used pesticide on the military base. Reduction of pesticide use, especially herbicides, could have an adverse effect on the environment as well as the Military Mission. Lowering the rate of application of currently used herbicides, 2, 4-D and Hyvar, by 50% could reduce plant control effectiveness to unacceptable levels. Alternative methods of vegetation management that meet the mandate of 50% pesticide reduction and are environmentally safe and feasible are needed. This project will assess the effectiveness and environmental impacts of an array of vegetation management tools.

Objectives:

1. Determine alternative chemicals for pesticide control.
2. Determine rates for vegetation management of application required to be effective.
3. Determine non-chemical alternatives for pesticide control
4. Determine environmental concerns.

Products:

Peer-reviewed Publications:

Geyer, W.A., W. H. Fick, J. Carlisle and J. Barbur. 2002. Weed Management on Military Storage Gravel Lots. Transactions of the Kansas Academy of Science 105 (1-2), pp 66-71.

Geyer, W.A., J. Carlisle, W. H. Fick and J. Barbur. 2000. Weed Management on Military Artillery Ranges. Transactions of the Kansas Academy of Science 103 (1-2), pp 58-63.

Title: **Bird and Mammal Responses to Conversion from Fescue Pastures to Native Tallgrass Prairie**

Funding: Kansas Department of Wildlife and Parks

Investigator: Amber Rucker Keller, M.S. Student

Advisor: Dr. Jack F. Cully, Jr., Assistant Unit Leader

Completion: 2001

I examined small mammal responses to a new method of converting fescue pastures to native tallgrass prairie at the Kansas Army Ammunition Plant near Parsons, Kansas. The conversion method include removing cattle from fescue pastures, halting nitrogen fertilization and implementing spring burning one year following cattle removal. Five treatments were identified

to study the trajectory of prairie restoration; 1) ungrazed, mowed native prairie, 2 currently grazed, unburned fescue pastures receiving annual nitrogen fertilizer and 3-5) fescue pastures from which cattle and fertilizer were removed on 1 Jan. of 1997, 1998, and 1999 with annual spring burning initiated one year following cattle removal. Small mammals were sampled on all five treatments to assess how this method of conversion affects small mammal populations.

Of the 11 species captured, the hispid cotton rat (*Sigmodon hispidus*), deer mouse (*Peromyscus maniculatus*) and white-footed mouse (*Peromyscus leucopus*) were the most abundant followed by the western harvest mouse (*Reithrodontomys megalotis*), least shrew (*Cryptotis parva*), plains harvest mouse (*Reithrodontomys montanus*), eastern woodrat (*Neotoma floridana*), Elliot's short-tailed shrew (*Blarina hylophaga*), prairie vole (*Microtus ochrogaster*), house mouse (*Mus musculus*) and eastern cottontail (*Sylvilagus floridanus*). The species captured and their relative abundances were associated with vegetation structure, plant litter and burning regime. Cotton rats were most abundant in restoration sites with relatively dense vegetation and were most associated with thick plant litter layer. Deer mice were present across most sites and responded positively to burning and grazing, while least shrews were most abundant in native prairie grasslands and were captured in other sites that were not grazed or burned. White- footed mice and eastern woodrats were found in or near woodlands. Western harvest mice were present in plots with considerable cover and plant litter and were not captured in currently grazed or newly burned sites, whereas plains harvest mice were most abundance in sites with relatively low vegetative cover.

Small mammal species richness and abundance of individuals were highest in 1998 and 1997 cattle removal sites and lowest in a grazed sites and a native prairie site. The vegetative structural heterogeneity present in the restoration sites likely provides the nesting areas, cover and food resources to support a variety of small mammal species. This study suggests that the fescue conversion method is effective in creating habitats where small mammal species can increase in richness and abundance.

Products:

Peer-reviewed Publications:

Keller, A. D., and J. F. Cully, Jr. 2002. Small mammal responses to tallgrass prairie restoration from fescue pastures (Kansas). Ecological Restoration 20:279-280.

Thesis or Dissertation:

Rucker, A.D. 2001. Conversion of tall fescue pastures to tallgrass prairie in southeastern Kansas: Small mammal responses. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Rucker, A. D. and J. F. Cully, Jr. 1999. Small mammal responses to conversion of fescue pastures to native tallgrass prairie in southeastern Kansas. American Society of Mammalogists, Seattle, WA.

2000

Title: **Determination of Coyote, Bobcat, and Raccoon Movements Based on Activity Transmitter Pulse Rates**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas, Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Trisha Snyder, M.S. Student

Advisor: Dr. Philip S. Gipson

Collaborator: David P. Jones

Completion: November 2000

Coyotes (*Canis Latrans*), bobcats (*Lynx rufus*), and raccoons (*Procyon lotor*) are important carnivores in the United States. Many studies have examined their home ranges, habitat use, and diet, but few have examined their activity patterns. In this investigation, injected-pulse activity transmitters were tested on coyotes, bobcats, and raccoons in zoos to determine their usefulness in field studies of the activity patterns of these species.

Prediction accuracies of the transmitters were calculated for coyotes, bobcats, and raccoons based on the pulse rates of the collars and simultaneous visual observation of the behavior of the carnivore. All coyotes, except one, had prediction accuracies above 76% correct in predicting active and inactive activity levels. Bobcats had prediction accuracies that were above 66%. All the raccoons tested, except one, had prediction accuracies below 67%.

Field tests were conducted on wild coyotes, bobcats, and raccoons to verify that the results obtained on captive carnivores were reproducible with wild carnivores. Results supported the conclusion that these collars could accurately determine activity of wild coyotes and bobcats in the field but were not accurate when used on raccoons.

Collars were also tested in the laboratory to determine if an orbital shaker could be used to anticipate differences in the prediction accuracy of individual collars and if these differences were correlated to the differences in prediction accuracy observed in the zoo tests. Differences in the sensitivity of the collars were quantified using the orbital shakers. However, these differences were not correlated with differences observed in the prediction accuracies.

Injected pulse activity transmitters probably can be used to accurately determine activity of wild coyotes and bobcats, but they are not appropriate for study of raccoon activity. Differences in the sensitivity of collars to movement may influence their accuracy when placed on a carnivore, but this could not be verified using an orbital shaker.

Products:

Thesis or Dissertation:

Snyder, P.R. 2000. Assessment of Activity Transmitters Based on Behavioral Observations of Coyotes, Bobcats, and Raccoons. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Presentations:

Snyder, T.R. 1998. The reliability of activity telemetry transmitters in studies of mammalian carnivores. Joint Fur Resources Workshop. St. Mary College, Leavenworth, KS.

Snyder, T.R., and P.S. Gipson. 1998. Preliminary determination of activity levels of mammalian predators based on activity transmitter pulse rates. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH.

Title: **Wild Turkey Crop Damage in the Flint Hills**

Funding: National Wild Turkey Federation

Investigator: Dr. Philip S. Gipson

Collaborators: Roger D. Applegate and Dr. Ted T. Cable

Completion: 2000

The reintroduction and restoration of the wild turkey in Kansas has been successful beyond the expectation of the Kansas Department of Wildlife and Parks. Almost all of the 105 Kansas counties have viable populations of wild turkeys and several regions of the state have such large populations that the limit of landowner tolerance is being approached. This is particularly true in the Flint Hills where landowners are no longer protective of their turkeys and a growing number do not like them.

During the last several years, wildlife damage complaints involving wild turkeys have dramatically increased. The most frequent wild turkey damage complaints have been eating the seed of emerging corn in the flint Hills during April according to conservation officers and county extension agents. This damage forces landowners to replant irregular patches on the edges of their fields.

Products:

Peer-reviewed Publications:

Applegate, R. D., P. S. Gipson, T. T. Cable, and K. R. Van Why. 2002. Attitudes of Kansas wild turkey hunters: National Wild Turkey Federation members vs nonmembers. Human Dimensions of Wildlife. 7:217-219.

Title: **Tooth Wear as a Method of Determining Age of Mammalian Predators**

Funding: Kansas Cooperative Fish and Wildlife Research Unit, Big Twelve Universities Research Fellowship

Investigators: Drs. Philip S. Gipson, Warren B. Ballard, Ronald M. Nowak, and L. David Mech

Completion: September 2001

Skulls and teeth of wolves from Alaska for which estimates of age were available were used to develop criteria for assigning wolves to age classes based on tooth wear and replacement. We also developed a figure describing tooth development that can be used in the field to estimate the age of live wolves or museum specimens by comparison with wear on their teeth. We then evaluated the accuracy and precision of tooth wear as an aging tool to estimate the ages of 30 wolves of known age from Minnesota and Ontario. Ages were also estimated for all examined wolves by Matson's Laboratory by sectioning canine and/or premolar teeth and counting annuli. Three readers independently compared wear on the incisors and canines in skulls from 30 known age wolves from Minnesota and Ontario to the Alaska collection and recorded age estimates. Age estimates by our team were, in most cases, within ± 2 years of the actual age of wolves. Our preliminary findings suggest that tooth wear can be a relatively accurate and precise technique for estimating the ages of living and dead wolves.

Products:

Peer-reviewed Publications:

Gipson, P.S., W.B. Ballard, R.M. Nowak, and L.D. Mech. 2000. Accuracy and precision of estimating age of gray wolves by tooth wear. Journal of Wildlife Management 64:752-758.

Presentations:

Gipson, P.S., W.B. Ballard, and R.M. Nowak. 1998. Estimating the age of gray wolves by tooth wear. 60th Midwest Fish and Wildlife Conference.

Title: **Status of feral hogs in Kansas and other midwestern states**

Funding: Kansas Department of Wildlife and Parks, Kansas Cooperative Fish and Wildlife Research Unit, and Department of Defense

Investigators: Dr. Philip S. Gipson, Charles D. Lee, Bill Hlavachick, and Tommie Berger

Collaborators: David P. Jones and James Luchsinger

Completion: 2006

Populations of feral hogs, *sus scrofa,* were reported during 1996 and 1997 by wildlife biologists and agriculture specialists with state and federal agencies in Colorado, Kansas, Missouri, Illinois, Indiana, Kentucky, and Ohio. These reports indicate that the range of feral hogs now extends farther north and west than previously reported. In Kansas, 3 established populations were investigated by the study team in the following areas: Fort Riley Military Reservation in Riley and Geary Counties, mined lands west of Pittsburg in Crawford County, and along tributaries of the Medicine Lodge River in Barber County. Thirteen additional reports of possible feral hogs were received from Kansas, including 19 hogs killed during 1996 in Morton County adjacent to the Cimarron National Grasslands. Five possible causes for expanding populations are being investigated: release of feral hogs to establish populations for hunting, colonization of new areas by feral hogs dispersing from established populations, feral hogs that escape from confinement by hunting clubs, hogs that become wild after escaping from swine producers or owners of pet hogs, and hogs that stray from domestic herds that are allowed to range freely.

Products:

Peer-reviewed and Scientific Publications:

Gipson, P. S., C. D. Lee, S. Wilson, J. R. Thiele, and D. Hobbick. 2006. Status of feral pigs, Sus scrofa, in Kansas and Nebraska. Proceedings of the 20th North American Prairie Conference, University of Nebraska at Kearney, July 23–26, 2006, edited by Joseph T. Springer and Elaine C. Springer. Pages 19-24.

Gipson, P.S., J.K. Veatch, R.S. Matlack, and D.P. Jones. 1999. Health status of a recently discovered population of feral hogs in the tall grass prairie region of Kansas. Journal of Wildlife Diseases. 35: 624-627.

Gipson, P.S., and C.D. Lee. 1999. Wild hogs in the Central United States: A new management challenge. Proceedings of the Feral Swine Symposium. 5:5-10.

Gipson, P.S., B. Hlavachick, and T. Berger. 1998. Range expansion by wild hogs across the central United States. Wildlife Society Bulletin. 26:279-286.

Gipson, P.S., B. Hlavachick, T. Berger, and C.D. Lee. 1997. Explanations for recent range expansions by wild hogs into midwestern states. Proceedings of the Great Plains Wildlife Damage Control Workshop. 13:148-150.

Gipson, P.S., R.S. Matlack, D.P. Jones, H.J. Abel, and A.E. Hynek. 1995. Feral pigs, *Sus scrofa*, in Kansas. Proceedings of the North American Prairie Conference 14: 93-95.

Richardson, C.D., P.S. Gipson, D.P. Jones, and J. Luchsinger. 1995. A long term management plan for feral pigs on Fort Riley Army Base, Kansas. Proceedings of the Eastern Wildlife Damage Control Conference. 7: 99-103.

Presentations:

Gipson, P. S., C. Lee, S. Wilson, J. Thiele, and D. Hobbick. 2006. 20th North American Prairie Conference. Status of feral pigs, *Sus scrofa*, in Kansas and Nebraska. Platform presentation.

Gipson, P. S. 2001. Wildlife Manitoba, Winnipeg, Canada. Ecology and management of feral swine. Invited seminar.

Gipson, P.S., C. Richardson, and D.P. Jones. 2000. Special poster session at the 65th North American Wildlife and Natural Resources Conference. Chicago, IL: Importance of credible population estimates in managing feral swine.

Gipson, P.S. 1999. Wild Hogs in Kansas and their impacts on wildlife. 50th Kansas Wildlife Federation Annual Meeting.

Gipson, P.S. 1999. Dynamics of newly established feral pig populations in Kansas and neighboring states. National Science Foundation sponsored program - "Research Experiences for Undergraduates." Manhattan, KS.

Gipson, P.S. 1999. Recent range expansions by feral hogs into the central United States. National Feral Swine Symposium, Fort Worth, TX.

Gipson, P. S. 1999. University of Kansas, Department of Systematics and Ecology, Lawrence, KS. Feral Hogs in the central United States: research opportunities and management challenges. Invited seminar.

Gipson, P.S., and C.D. Lee. 1999. Wild hogs in the central United States: a new management challenge. National Feral Swine Symposium, Fort Worth, TX.

Gipson, P.S., B. Hlavachick, T. Berger, C.D. Lee. 1997. Explanations for recent range expansions by wild hogs into midwestern states. Great Plains Wildlife Damage Control Workshop, Nebraska City, NE.

Gipson, P.S., B. Hlavachick, and T. Berger. 1996. Range expansion by feral hogs into the central Great Plains. 58th Midwest Fish and Wildlife Conference.

Gipson, P.S., D.P. Jones, J. Luchsinger, and C.D. Richardson. 1996. Reaching the decision: eradication or control of a feral pig population on Fort Riley, Kansas. Joint Meeting of the Kansas Academy of Sciences and Kansas Chapter of The Wildlife Society.

Gipson, P.S. and D.P. Jones. 1995. Population dynamics of feral pigs on Fort Riley Army Base, Kansas. Kansas Chapter of The Wildlife Society.

Richardson, C.D., P.S. Gipson, D.P. Jones, and J. Luchsinger. 1995. A long term management plan for feral pigs on Fort Riley Army Base, Kansas. Seventh Eastern Wildlife Damage Management Conference.

Title: **Effects of Size, Fragmentation, and Management of Prairie Remnants on Biodiversity and Sustainability**

Funding: U.S. Geological Survey, Biological Resources Division

Investigator: Anne C. Cully, Ph.D. Student

Advisors: Dr. Theodore Barkley, Division of Biology
Dr. Jack F. Cully, Jr., Assistant Unit Leader-Wildlife
Ronald Hiebert, National Park Service
George Godfrey, Haskell University

Completion: May 2000

Since European agricultural practices began on the Great Plains, the tall-grass prairie has declined in area between 82 - 99 %. These losses exceed those for any other major ecosystem in North America. In addition, genetic material representing the ecotypic differentiation of prairie species in varying parts of their ranges is being lost. Prairie preserves are scattered throughout the tall-grass area, and include private, state, and federal ownership and management. These preserves are particularly important to study existing prairie communities and the ecological

relationships within them. Presently, the preserves appear to be making a major contribution to the preservation of the vascular plant and insect diversity. However, the long-term sustainability of the present diversity is not known. This study addresses questions about changes in species diversity due to fragmentation and isolation. We are investigating three questions; 1) do plant and insect species richness and evenness increase as a function of prairie unit size; 2) do naturally fragmented units have higher richness and evenness than human fragmented units of the same size; and 3) will patches clustered in space have more similar species assemblages than similar size patches from more distant locations? We selected remnant tall-grass prairie patches from in and around Effigy Mounds National Monument, Iowa, and Wilson Creek National Monument, Missouri, within the Prairie Savannah Region, where small patches of prairie vegetation are naturally isolated. We also selected prairie sites from the Great Plains region in and around Pipestone National Monument, Minnesota, and Konza Prairie Research Natural Area, Kansas, where patches have been isolated by human activities such as farming and urbanization. Twenty-four sites in national and state parks and natural areas were visited during 1996. At thirteen of these sites, sampling transects were set up and data on plant species frequency, density, and abundance was collected. Plant identification and preliminary data analysis are underway in preparation for the 1997 field season. Data from sampling will be used to calculate species richness and diversity. Results will also provide baseline information on plant community composition, as well as information for developing protocols for management, restoration, and monitoring.

Products:

Peer-reviewed Publications:

Cully, A. C., J. F. Cully, Jr., and R D. Hiebert. 2003. Exotic plant species in tallgrass prairie fragments. Conservation Biology 17:990-998.

Thesis or Dissertation:

Cully, A.C. 2000. The effects of size and fragmentation on tallgrass prairie plant species diversity. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Barkley)

Presentations:

Cully, A.C., J.F. Cully, Jr., and R.D. Hiebert. 1999. The effects of size, fragmentation, species diversity, and seasonality on invasion of tallgrass prairie by non-native plant species. 5th International Conference on the Ecology of Invasive Alien Plants. La Maddalena, Sardinia, Italy.

Title: **Gap Analysis in Kansas**

Funding:
U.S. Geological Survey
Kansas Department of Wildlife and Parks
Kansas Data Access Center
U.S. Environmental Protection Agency
National Aeronautics and Space Administration

Investigators:
Dr. Jack F. Cully, Jr., Assistant Unit Leader-Wildlife
Dr. Glennis Kaufman, Division of Biology
Dr. John Harrington, Department of Geography
Dr. H. L. Seyler, Department of Geography
Kevin Price, Department of Agronomy
Ed Martinko, Kansas Biological Survey
Chris Lauver, National Park Service

Completion: May 2000

The mission of the Gap Analysis Program (GAP) is to provide regional assessments of the conservation status of native vertebrate species and natural land cover types and to facilitate the application of this information to land management activities. This is accomplished through the following five objectives:

1. Map the land cover of the United States
2. Map predicted distributions of vertebrate species for the U.S.
3. Document the representation of vertebrate species and land cover types in areas managed for the long-term maintenance of biodiversity
4. Provide this information to the public and those entities charged with land use research, policy, planning, and management
5. Build institutional cooperation in the application of this information to state and regional management activities.

GAP is conducted as state-level projects and is coordinated by the U.S. Geological Survey. It is a cooperative effort among regional, state, federal agencies, and private groups, as well as the three USGS-Biological Resources Division divisions of Research, Monitoring, and Information Services. In Kansas, Gap analysis is being conducted as a cooperative effort by Scientists at the University of Kansas, Kansas Biological Survey, and Kansas Applied Remote Sensing Laboratory, and Kansas State University, Division of Biology and Geography Department.

Products:

Technical and Semi-Technical:

Stewart, A., S. Egbert, C. Lauver, E. Martinko, K. Price, D. Peterson, S. Park, C. Blodgett, and J. Cully. 2000. Land cover mapping for GAP: a hybrid classification approach to identifying the vegetation of Kansas. Photogrammetry and Remote Sensing.

Cully, J. F., Jr., and G. A. Kaufman. 1997. Kansas: An example of Gap Partnering. Gap Analysis Bulletin 6:29-31.

Cully, J.F., Jr., and G. Kaufman. 1997. Partnerships. Gap Analysis Bulletin No. 6:53-56.

Presentations:

Cully, J.F., Jr., and G.S. Kaufman. 1999. Workshop in Kansas Gap Analysis for Kansas Department of Wildlife and Parks Senior Biologists. Kansas State University, Manhattan, KS. All day training session.

Cully, J.F., Jr., G.S. Kaufman, C. Woolley, and T. Hoernemann. 1999. Great Plains database/export system for vertebrate modeling and metadata management. 9th Annual National Gap Analysis Program Meeting, Duluth.

Gerlanc, N., R. Matlack, M. Wong, G. Kaufman, and J. Cully. 1998. Gap Analysis in Kansas. Meeting of the Kansas Herpetological Society, Lawrence, KS (Poster)

Hoch, G. 1996. An Introduction to Multi-temporal Remote Sensing as it is Being Used by KS GAP. Guest Lecturer. Emporia State University.

1999

Title: **Plant and Bird Communities of Black-tailed Prairie Dog Colonies and Non-colonized Areas in Southwest Kansas Southeast Colorado**

Funding: U.S. Forest Service / U.S. Fish and Wildlife Service

Investigator: Stephen L. Winter, M.S. Student

Advisor: Dr. Jack Cully

Completion: May 1999

This research was initiated to determine if plant and bird communities on black-tailed prairie dog (*Cynomys ludovicianus* Ord) colonies in southwest Kansas and southeast Colorado differed from those found on associated non-colonized areas. Vegetation height and density, and the cover and frequency of numerous plant species differed between prairie dog colonies and non-colonized areas that were co-dominated by mid-height grasses and shortgrasses. A comparison of prairie dog colonies with non- colonized areas that were dominated solely by shortgrasses did not reveal a difference in vegetation height and density. The number of species that differed in cover or frequency between prairie dog colonies and non-colonized shortgrass areas was less than when the comparison of prairie dog colonies was made with areas co-dominated by mid and shortgrasses. Plant species richness and diversity measures did not differ between prairie dog colonies and the non- colonized areas. Bird communities in 1996, following twelve months of drought conditions, were species poor relative to 1997. Fewer bird species were detected on prairie dog colonies than on non- colonized areas during both years. Burrowing owls were highly dependent on prairie dog colonies in region of this study, but there were several species for which prairie dog colonies were sub- optimal habitat. Horned lark habitat preference alternated between prairie dog colonies and non-colonized sites, probably in response to the influence of climatic variation on vegetation conditions. Fundamental differences in characteristic vegetation between semiarid shortgrass steppe and less arid regions of the Great Plains appear to contribute to regional differences in the influence of prairie dogs on plant and bird communities.

Products:

Peer-reviewed and Scientific Publications:

Winter, S.L., and J. F. Cully, Jr. 2007. Burrowing owl associations with black-tailed prairie dog colonies in southwestern Kansas and southeastern Colorado. Prairie Naturalist 39:69-75.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 2003. Breeding season avifauna of prairie dog colonies and non-colonized areas in shortgrass prairie. Transactions of the Kansas Academy of Science 106 (3 & 4):129-138.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 2002. Vegetation of prairie dog colonies and non-colonized shortgrass prairie. Journal of Range Management 55:502-508.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1999. Influence of prairie dog colonies and climatic variation on bird communities in Kansas shortgrass prairie. In: Proceedings of the Fifth Prairie Conservation and Endangered Species Conference (eds. Jeffrey Thorpe, Taylor Steeves, and Mike Gollop), Provincial Museum of Alberta.

Technical and Semi-Technical:

Winter, S.L. 1999. Plant and breeding bird communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. To the U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office and U.S. Forest Service, Cimarron and Comanche National Grasslands. Submitted by J.F. Cully, Jr.

Thesis or Dissertation:

Winter, S.L. 1999. Vegetation and breeding bird communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Winter, S.L., J.F. Cully, Jr., and R. Charlton. 1999. Bird monitoring program based on remotely sensed land cover classification in a Kansas prairie location. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1998. Influence of prairie dog colonies and climatic variation on bird communities in Kansas shortgrass prairie. Fifth Prairie Conservation and Endangered Species Conference. Saskatoon, Saskatchewan, Canada. (Poster)
Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1998. Influence of prairie dogs on vegetation in Kansas shortgrass prairie. Fifth Prairie Conservation and Endangered Species Conference. Saskatoon, Saskatchewan, Canada. (Poster)

Winter, S.L. and J.F. Cully, Jr. 1997. Avifaunal composition and relative abundance on black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado.
Annual Meeting of the Wilson Ornithological Society, Manhattan, KS. Poster presentation.
Winter, S.L., and J.F. Cully, Jr. 1997. Avian communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. Fourth Annual Conference of the Wildlife Society. Snowmass, CO. Oral presentation.
Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1997. Vegetation of black-tailed prairie dog colonies and non-colonized areas in the shortgrass steppe of southwest Kansas and southeast Colorado. Seventh International Theriological Congress, Acapulco, Guerrero, Mexico. Oral presentation.

Title: **The effects of black-tailed prairie dogs on shortgrass prairie diversity**

Funding: U.S. Fish and Wildlife Service

Investigator: Justin Kretzer, M.S. Student

Advisor: Dr. Jack F. Cully, Jr.

Completion: December 1999

I. Effects of black-tailed prairie dogs on reptile and amphibian community composition in shortgrass prairie habitats of Kansas Species diversity and abundance of reptiles and amphibians were measured on and off black-tailed prairie dog (*Cynomys ludovicianus*) colonies to determine the extent to which herpetological species composition in a shortgrass prairie ecosystem is affected by the presence of black-tailed prairie dog colonies. Ten species of reptiles and three species of amphibians were captured. Total amphibian and reptile abundance did not differ between prairie dog colonies and non-colonized shortgrass prairie sites, but species composition did. Reptile and amphibian mean species richness, evenness, and diversity were not different between treatments. However, the diversity of both treatments combined was considerably higher than the diversity on shortgrass prairie without prairie dogs. The mosaic pattern of prairie dog colonies on non-colonized prairie enhances landscape heterogeneity and contributes to greater reptile and amphibian diversity patterns in the shortgrass prairie biome of western Kansas than would occur without prairie dogs.

II. Effects of black-tailed prairie dogs on beetle community composition in shortgrass prairie habitats of Kansas Numerical abundance and diversity of surface-dwelling beetles were measured on and off black-tailed prairie dog (*Cynomys ludovicianus*) colonies to determine the extent to which families and species of Coleoptera area affected by the presence of black-tailed prairie dog colonies in a shortgrass prairie ecosystem. Relative abundance of beetles on and off prairie dog colonies were highly variable throughout 1996 and 1997. The total number of beetles captured, and relative abundance of the five 'major' families, were general greater on

prairie dog colonies. Relative abundance of the remaining 'minor' families were similar between treatments.

Each beetle family was categorized as a herbivore, decomposer, or predator. Differences in relative abundance of each trophic group were compared between treatments. We also examined the relative abundance of the five 'major' families independently to determine whether individual family response was consistent with the response of the entire trophic class. Although, all three feeding groups showed a positive response to prairie dog colonies, the phytophagous beetles were more sensitive to prairie dog activities than the other groups. Inconsistent responses among individual families within each feeding category were detected. Within the herbivore group, more Chrysomelidae were captured on prairie dog colonies in 1996 and 1997. In contrast, the number of Elateridae captured on prairie dog towns was greater during 1996, but not 1997; while in both years the number of phytophagous Scarabaeidae captured on prairie dog colonies was similar to non- colonized sites. Within the decomposer group, Tenebrionidae showed patterns that differed greatly depending on collection period. In contrast, relative abundance of Scarabaeidae categorized as decomposers showed the same positive response to prairie dog colonies as the Chrysomelidae. Carabidae was the most abundant predatory family, and was largely responsible for greater numbers of predatory beetles sampled on prairie dog colonies.

Richness, evenness, and diversity of Coleoptera families and of species belonging to the Carabidae and Scarabaeidae families were also compared between areas with and without prairie dogs. The most abundant beetle families and most abundant Scarabaeidae and Carabidae species responded positively to prairie dog colonies, resulting in high dominance on prairie dog colonies which reduced Shannon diversity values. Taxonomic richness on shortgrass prairie was enhanced by sampling a combination of areas with and without prairie dogs.

Products:

Peer-reviewed Publications:

Kretzer, J. A., and J. F. Cully, Jr. 2001. Black-tailed prairie dog effects on reptile and amphibian community composition in Kansas shortgrass prairie. Southwestern Naturalist 46:171-177.

Kretzer, J.E., and J. F. Cully, Jr. 2001. A new Kansas record for *Bolborhombus sallaei sallaei* Bates (*Coleoptera: Scarabaeidae*). Journal of the Kansas Entomological Society 74:56.

Kretzer, J. A., and J. F. Cully, Jr. 2001. Prairie dog effects on harvester ant species diversity and density. Journal of Range Management 54:11-14.

Technical and Semi-Technical:

Kretzer, J.E. 1999. Herpetological and coleopteran communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas. To the U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office and U.S. Forest Service, Cimarron and Comanche National Grasslands. Submitted by J.F. Cully, Jr.

Thesis or Dissertation:

Kretzer, J.E. 1999. Herpetological and Coleoptera Communities of Black-tailed Prairie Dog Colonies and Non-colonized Areas of Southwest Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Presentations:

Cully, J. F., Jr., J. E. Kretzer, and S. L. Winter. 1999. Black-tailed prairie dogs and species diversity of associated taxa in the Kansas shortgrass steppe. Ecological Society of America annual meeting. Spokane, WA. (Poster).

Kretzer, J.E., and J.F. Cully, Jr. 1997. The influence of black-tailed prairie dog (*Cynomys ludovicianus*) colonies on reptile and amphibian diversity in the shortgrass prairie of southwest Kansas. Seventh International Theriological Congress, Acapulco, Guerrero, Mexico. Oral Presentation.

Kretzer, J.E., and J.F. Cully, Jr. 1997. The influence of black-tailed prairie dog (*Cynomys ludovicianus*) colonies on reptile and amphibian diversity in the shortgrass prairie of southwest Kansas. Kansas Mammal Society, Emporia, KS. Oral presentation.

Kretzer J.E. and J.F. Cully, Jr. 1997. The influence of black-tailed prairie dog (*Cynomys ludovicianus*) colonization on reptile and amphibian diversity in the shortgrass prairie. Twenty-third Annual Student Research Forum, Division of Biology, Kansas State University, Manhattan, KS.

Title: **Seasonal Avian Use Patterns of Farmed Wetlands and Nest Predation Dynamics in Riparian Grasslands Dominated by Reed Canary Grass (*Phalaris arundinacea*)**

Funding: Environmental Protection Agency

Investigator: James W. Rivers, M.S. Student

Advisors: Drs. Ted T. Cable and Philip S. Gipson

Completed: October 1999

Playa wetlands provide critical habitat for a variety of organisms throughout the Southern Great Plains, yet many are impacted by current agricultural practices. Playa cultivation has the potential to affect wildlife use of these habitats, but most playa studies have failed to describe avian use of cropped playas in a seasonal context. Seasonal avian use patterns were examined in cropped playas in southwestern Kansas to determine which habitat characteristics influenced habitat use. In addition, the efficacy of two wetland assessment procedures, the Wetland Evaluation Technique (WET) and the Habitat Assessment Technique (HAT) in examining cropped playas as wildlife habitat were assessed. Birds were censused on 12 cropped playa wetlands (1998-99) and 6 control sites (1999) in Meade County, Kansas during spring, summer, and autumn. Avian richness was not significantly correlated with five measured habitat characteristics (i.e., plant richness, vegetation height, live cove r, wetland size, and the amount of water present). Avian use of cropped playas appeared to be related to food resources (e.g., aquatic invertebrates, seeds of moist-soil plants), particularly for obligate3 wetland species. Artificial nests containing House Sparrow eggs were placed in two riparian grasslands to examine how predation rates of sparrow eggs compared to depredation of natural grassland bird nests. Egg predation increased temporally on our study sites and the highest proportion of nests were depredated during the last field trial. Artificial nests baited with House Sparrow eggs experience similar depredation rates as natural Dickcissel nests. Neither the amount of concealment around the nest nor the distance to the nearest edge consistently affected predation rates. Instead, changes in vegetation density and vertical cover of study sites may have indirectly influenced predation by providing small mammals with favorable microhabitats.

Products:

Peer-reviewed and Scientific Publications:

Rivers, J.W. and T.T. Cable. 2003. Influence of nest concealment and distance to habitat edge on depredation rates of simulated grassland bird nests in southeast Kansas. Transactions of the Kansas Academy of Science 106(1 & 2):40-47.

Rivers, J.W. and T.T. Cable. 2003. Evaluation of farmed playa wetlands as avian habitat using survey data and two rapid assessment techniques. Transactions of the Kansas Academy of Science 106(3 & 4):155-165.

Rivers, J. W., D. P. Althoff, P. S. Gipson, and J. S. Pontius. 2003. Evaluation of a reproductive index to estimate dickcissel reproductive success. Journal of Wildlife Management. 67:137-144.

Thesis or Dissertation:

Rivers, J.W. 1999. Seasonal avian use patterns of farmed wetlands and nest predation dynamics in riparian grasslands dominated by reed canary grass (*Phalaris arundinacea*). Master's Thesis. Division of Biology, Kansas State University (Co-Advisors: Cable and Gipson)

Presentations:

Rivers, J. W., D.P. Althoff, P. S. Gipson, J. S. Pontius, and A. A. Abuzeineh. 2001. 63rd Midwest Fish and Wildlife Conference. Evaluation of an index method to measure dickcissel breeding success in northeastern Kansas. Platform presentation.

Rivers, J.W., T.T. Cable, and P.S. Gipson. 2000. Poster presented at the Kansas Ornithological Society, Overland Park, KS: The role of farmed wetlands as habitat for birds in Kansas.

Rivers, J.W., T.T. Cable, and P.S. Gipson. 2000. Poster presented at the 8th International Symposium on Society and Resource Management, Bellingham, WA: Avian use of farmed wetlands in Kansas.

Title: **Modeling soil erosion and surface runoff from military training land at Fort Riley, KS**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas,

Investigator: Dr. Prasanta K. Kalita, Department of Biological and Agricultural Engineering

Project Officer: Dr. Philip S. Gipson

Completion: October 1999

The USDA-Water Erosion Prediction Project (WEPP) is a new erosion prediction technology which predicts soil loss and sediment deposition from overland flow on hillslopes, soil loss and sediment deposition from concentrated flow in small channels, and sediment deposition in impoundments. The WEPP model computes spatial and temporal distribution of soil loss and deposition, and provides explicit estimates of when and where in a watershed or on a hillslope that erosion is occurring so that conservation measures can be selected to most effectively control soil loss and sediment yield.

Training lands on military installations are required to support realistic training exercises. Without high quality lands on which to train, the readiness of combat units may be compromised. One of the most widespread environmental compliance issues affecting training lands is nonpoint source pollution, which includes eroded soil and associated chemicals such as nitrate, phosphorus, and pesticides. Nonpoint source pollution is diffuse and intermittent, resulting from rainfall runoff.

Degraded and adversely impacted lands have their highest rates of runoff with subsequently increases in the sediment load and nutrient load of streams in the area. However, accurate estimation of runoff and sediment load from these lands is essential. Without the estimate of soil erosion and runoff from any particular activity on training lands, it is difficult to understand its impacts on the environment. Furthermore, without accurate information on the soil loss and runoff, the implementation of best management practices on these training lands becomes problematic. Therefore, soil loss and runoff need to be accurately determined on the training lands for proper management of such lands and to protect the environment while conducting military training activities. This project aims at determining soil erosion and runoff with a process based computer simulation model.

This Research Work Order consists of two phases. Phase One will be the development and refinement of the computer model for soil erosion and runoff. Phase Two will be the application and verification of results for the model. Implementation of Phase Two is depe3ndent upon the results achieved in Phase One.

Objectives

1. To determine climate input variables for modeling soil erosion and runoff at Ft. Riley, Kansas; daily precipitation, daily maximum and minimum temperatures, mean daily solar radiation, and mean daily wind direction and speed.
2. To model soil loss resulting from the interactions of weather and military activities at selected sub-watersheds at Fort Riley on an annual basis.
3. To model sediment deposition within and sediment yield from the selected sub-watersheds at Fort Riley on an annual basis.

Products:

Peer-reviewed Publications:

Kalita, P.K., L. Schieferek, S. Bhuyan, P. Woodford, and P. Gipson. 2001. Application of WEPP Model to Military Training Lands. Soil Erosion Research for the 21st Century, Proc. Int. Symp. (3-5 January 2001, Honolulu, HI, USA). Eds. J.C. Ascough II and D.C. Flanagan. St. Joseph, MI: ASAE. 701P0007.(doi:10.13031/2013.3351), pp. 119-122.

Technical and Semi-Technical:

Kalita, P., M. Hirschi, L. Schieferecke, S. Bhuyan, P. Woodford, and P. Gipson. 2000. WEPP model measures runoff and erosion on military training lands. Resource: engineering technology for a sustainable world. December: 13-14.

1998

Title: **Interspecific Relationships of Mammalian Predators on Fort Riley Military Reservation**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas, Corps of Engineers Research Laboratory, Champaign, Illinois, and Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Jan F. Kamler, M. S. Student

Advisor: Dr. Philip S. Gipson

Collaborator: David P. Jones

Completion: August 1998

The ecology and interspecific relationships of coyotes, bobcats, raccoons, and opossums were examined on Fort Riley Military Reservation, from April 1996 through March 1998. Radio-collars were placed on 13 coyotes, 10 bobcats, 18 raccoons, and 14 opossums to determine seasonal home range sizes and seasonal habitat use.

Male coyotes were the largest mammalian predators based on body weight (13.3 kg), followed by female coyotes (11.6 kg), male bobcats (11.1 kg), male raccoons (9.1 kg) female bobcats (8.3 kg), female raccoons (7.0 kg), male opossums (2.2 kg), and female opossums (2.1 kg).

Resident coyotes had relative small mutually exclusive home ranges (4.2 km^2), while transient (nomadic) coyotes had much larger home ranges (53.4 km^2) that overlapped each other, and the home ranges of the residents. The coyote density was high (0.9-1.0 coyotes/km^2), with transient coyotes making up 40-50% of the population.

Home ranges of adult resident bobcats overlapped among and between sexes, and the home range of an adult male bobcat (20.0 km^2) was considerably larger than the home ranges of females (7.5 km^2). Kitten bobcats had smaller home ranges than resident adults of the same sex, while transient bobcats had much larger home ranges (57.1 km^2) than resident adults.

Female raccoons had relatively small, overlapping home ranges (1.2 km,sup2) and adult male raccoons had larger, mutually exclusive home ranges (2.6 km^2). Home ranges of female opossums (0.5 km^2) were smaller than the home range of a male opossum (1.0 km^2) in spring-summer.

Coyotes were the most dominant mammalian predators on Fort Riley, and they influenced the home ranges, habitat use, mortality, social organization and/or food availability of bobcats, raccoons, and opossums. Habitats selected by coyotes remained consistent between seasons. However, bobcats, female raccoons, and probably opossums changed their habitat use in fall-winter, apparently in an effort to reduce contact and/or competition with coyotes during lean periods. Coyotes preyed upon opossums, female raccoons, and yearling raccoons during late winter-early spring, and the carrying capacity of bobcats was probably reduced by the high coyote density. The ecology of the predator community on Fort Riley was influenced by the specific needs of each species as well as the needs of other predator species that were present.

Products:

Peer-reviewed Publications:

Gipson, P. S., and J. F. Kamler. 2006. Density and minimum number of mesopredators on Fort Riley Military Reservation. Transactions of the Kansas Academy of Science 109:36-40.

Kamler, J. F., and P. S. Gipson. 2004. Survival and cause-specific mortality among furbearers in a protected area. American Midland Naturalist 151:27-34.

Kamler, J. F., and P. S. Gipson. 2003. Space and habitat use by male and female raccoons, Procyon lotor, in Kansas. Canadian Field-Naturalist 117:218-223.

Gipson, P. S., and J. F. Kamler. 2003. Capture locations of coyotes, *Canis latrans*, bobcats, *Lynx rufus*, and raccoons, *Procyon lotor*, relative to home range boundaries. Canadian Field-Naturalist 117:472-474.

Kamler, J. F., K. Keeler, G. Wiens, C. Richardson, and P. S. Gipson. 2003. Feral dogs, *Canis familiaris*, kill coyote, *Canis latrans*. Canadian Field-Naturalist 117:123-124.

Kamler, J. F., and P. S. Gipson. 2002. Sarcoptic mange on coyotes in northeastern Kansas. Prairie Naturalist 34:143-144.

Kamler, J. F., P. S. Gipson, and C. C. Perchellet. 2002. Seasonal food habits of coyotes in northeastern Kansas. Prairie Naturalist 34:75-83.

Gipson, P. S., and J. F. Kamler. 2002. Bobcat killed by a coyote. Southwestern Naturalist 47:511-513.

Gipson, P. S., and J. F. Kamler. 2001. Survival and home ranges of opossums in northeastern Kansas. Southwestern Naturalist. 46:178-182.

Kamler, J. F., C. Richardson, and P. S. Gipson. 2000. Comparison of standard and modified Soft Catch traps for capturing coyotes, bobcats, and raccoons. Proceedings of the Wildlife Damage Management Conference 9:77-84.
Kamler, J.F., and P.S. Gipson. 2000. Home range, habitat selection, and survival of Bobcats, *Lynx rufus*, in a Prairie Ecosystem in Kansas. The Canadian Field-Naturalist. 114:388-394.
Kamler, J.F., and P.S. Gipson. 2000. New record of a porcupine and armadillo in Riley County, Kansas. Transactions of the Kansas Academy of Science. 103: 55-57.
Kamler, J.F., and P.S. Gipson. 2000. Space and habitat use of resident and transient coyotes. Canadian Journal of Zoology 78:2106-2111.
Kamler, J.F., P.S. Gipson, and T.R. Snyder. 2000. Dispersal characteristics of young bobcats from northeastern Kansas. Southwestern Naturalist 45:543-546.

Technical and Semi-Technical:

Gipson, P. S., J. S. Johnson, and J. S. Pontius. 2001. Scent stations: a non-invasive tool to determine habitat selection and use of primitive roads by mammals. Final report to the United States Army, Fort Riley, Kansas.
Gipson, P.S., and J.F. Kamler. 1997. Interspecific relationships of mammalian predators on Fort Riley Military Reservation. Progress Report to the Conservation Division, Fort Riley, Kansas. 17pp.

Thesis or Dissertation:

Kamler, J.F. 1998. Ecology and interspecific relationships of mammalian predators on Fort Riley Military Reservation, Kansas. Master's Thesis. Division of Biology, Kansas State University. 150 pages. (Advisor: Gipson)

Presentations:

Gipson, P.S., J.S. Johnson, and J.S. Pontius. 1999. Mammalian predator habitat use and responses to primitive roads in a prairie and forest ecotone. 61st Midwest Fish and Wildlife Conference, Chicago, IL.
Kamler, J. F., and P. S. Gipson. 1998. 24th Annual Research Forum. Kansas State University, Manhattan, KS. Home range size and habitat use among bobcats, coyotes, raccoons and opossums. Platform presentation.
Kamler, J.F. and P.S. Gipson. 1997. Home range and habitat use among bobcats, coyotes, raccoons, and opossums. 24th Annual Student Research Forum, Division of Biology, Kansas State University, Manhattan, KS.
Kamler, J.F., P.S. Gipson, and D.P. Jones. 1997. Home range size and habitat use among bobcats, coyotes, raccoons and opossums. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.
Kamler, J.F., P.S. Gipson and D.P. Jones. 1996. Interactions of mammalian predators on Fort Riley Military Reservation. Annual Meeting of the Kansas Chapter of The Wildlife Society and Kansas Academy of Science, Emporia, KS.

Below is a sub-project of the Ecology of Predators on Fort Riley above. This was added as a Mod to the RWO project.

Title: **Parasites on Predator Mammals**

Funding: Department of Defense, Division of Natural Resources, Fort Riley, Kansas, Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Dr. Michael W. Dryden, DVM, College of Veterinary Medicine, KSU

Completion: August 1998

Objectives: To determine the parasite burdens of mammalian predators located on Fort Riley Military Base, the potential for transmission of these parasites between wildlife, humans, dogs and cats and the effect of parasites upon the health of the wildlife.
No Products found.

Title: **Famous Damaging Wolves and Credibility of Early Wildlife Literature**

Funding: Kansas Cooperative Fish and Wildlife Research Unit

Investigators: Dr. Philip S. Gipson, Warren B. Ballard, and Ronald Nowak

Completion December 1998

Early literature about famous wolves (*Canis lupus*) has negatively influenced public perceptions of wolves and their reintroduction into regions of North American where they were extirpated early this century. We evaluated the credibility of 59 published accounts of famous damaging wolves. Many famous wolves were reported to be much older than they actually were and they did not live long enough to have caused reported damage to livestock and game animals. Wolf kill rates on free-ranging livestock appeared inflated in comparison to recently published kill rates on native ungulates and livestock. Surplus killing of sheep and goats could account for some high kill rates reported for those species, but surplus killing of free-ranging longhorn cattle probably did not occur, except in unusual circumstances. Some famous wolves may actually have been dog (*C. familiaris*) x wolf hybrids or possibly dog x coyote (*C. latrans*) hybrids. We documented instances where early authors fabricated stories concerning famous wolves. Much of the literature published prior to 1945 about damaging wolves, and some as recently as 1970, is not credible. Caution should be exercised when using early literature about wolves as a basis for decisions about wolf reintroductions, depredation rates, and other management issues.

Products:

Peer-reviewed Publications:

Gipson, P.S., and W.B. Ballard. 1998. Accounts of famous North American wolves. The Canadian Field-Naturalist. 112:724-739.

Gipson, P.S., W.B. Ballard, and R.M. Nowak. 1998. Famous North American wolves and the credibility of early wildlife literature. Wildlife Society Bulletin. 26:808-816.

Presentations:

Gipson, P. S. 1999. Fisheries and Wildlife Department, Utah State University, Logan, UT. Impacts of famous damaging wolves on current predator management. Invited seminar.

Gipson, P. S. 1998. Student Chapter of The Wildlife Society, Kansas State University, Manhattan, Kansas. Is the literature about damaging wolves credible? Invited seminar.

Title: **Evaluation of Wildlife Management Practices on the Fort Riley Military Installation**

Funding: U.S. Department of Defense

Investigator: L. Andrew Madison, Ph.D. Student

Advisor: Dr. Robert J. Robel

Completion: 1998

Food plots have been demonstrated to benefit bobwhites during the winter. This project was initiated to examine among bobwhites near and far from food plots: 1) hunting vulnerability, 2) over-winter survival, and 3) movements, habitat use, and home range size. In addition, the metabolizable energy and palatability of several seed species recommended for planting in food plots for bobwhites were examined.

Bobwhites near and far from food plots were equipped with radio-transmitters and tracked from October through March during 3 field seasons on 2 separate study areas on Ft. Riley, Kansas. Over-winter survival was greater for bobwhites near food plots in the first field season, but during all other field seasons bobwhites near and far from food plots experienced < 15% survival. Hunter harvests were proportionally greater near food plots during the second field season, but the overall hunter harvest rate was < 40% most field seasons. Bobwhite movements averaged 224 m day^{-1} across Ft. Riley and were only significantly greater near food plots during the second field season in 1 study area. Home range size of bobwhites averaged 33 ha across Ft. Riley and during the second field season in 1 study area were greater near food plots and during the final field season in 1 study area were greater in non-food plot sites. Habitat use of bobwhites varied little between food plot and non-food plot sites. In general, bobwhites avoided open prairie and preferred flood plots, forested areas, and thickets.

The metabolizable energy and palatability of bobwhite soybeans (*Glycine max*), buckwheat (*Fagopyrum esculentum*), dove proso millet (*Panicum milaceum*), Egyptian wheat (*Sorghum bicolor*), Florida beggarweed (*Desmodium floridanum*), Illinois bundleflower (*Desmanthus illinoensis*), Oklahoma game bird peas (*Vigna sinensis*), partridge peas (*Cassia fasiculata*), sesbania (*Sesbania exaltata*), switchgrass (*Panicum virgatum*), and WGF sorghum (*Sorghum vulgare*) were examined. Bobwhites remained weight stable (weight varying < 3%) while consuming bobwhite soybeans, dove proso millet, Florida beggarweed, Oklahoma game bird peas, and WGF sorghum. Bobwhites did not remain weight stable while consuming all other seed species, with the worst weight losses observed among bobwhites feeding on Illinois bundleflower and sesbania.

Products:

Peer-reviewed Publications:

Madison, L.A., R.J. Robel, and D.P. Jones. 2002. Hunting Mortality and Overwinter Survival of Northern Bobwhites Relative to Food Plots in Kansas. Wildlife Society Bulletin 30: 1120-1127.

Madison, L.A., and R.J. Robel. 2001. Energy Characteristics and Consumption of Several Seeds Recommended for Northern Bobwhite Food Plantings. Wildlife Society Bulletin 29: 1219-1227.

Madison, L. A. and P. S. Gipson. 1995. Wildlife damage control in Kansas: Private operators and public agencies. Proceedings of the Eastern Wildlife Damage Management Conference 7:44-49.

Thesis or Dissertation:

Madison, L.A. 1998. Influence of food plots on the over-winter survival, hunting vulnerability, and movement patterns on Northern bobwhites with notes on the metabolizable energy of food plots grains. Ph.D. Dissertation, Division of Biology, Kansas State University. (Advisor: Robel)

1997

Title: **Landscape and fine scale habitat associations of the Loggerhead shrike and Henslow's sparrow on Fort Riley Military Reservation, Kansas.**

Funding: Department of the Army

Investigator: Heidi L. Michaels, M.S. Student

Supervisor: Dr. Jack F. Cully, Jr.

Completion: May 1997

The Loggerhead shrike (*Lanius ludovicianus*) and the Henslow's sparrow (*Ammodramus henslowii*) are two grassland bird species that have experienced significant declines in the eastern United States during the last 30 years. As a result of these declines, these two species were listed as candidate species by the U.S. Fish and Wildlife Service in 1995. In order to facilitate the development of a proactive management plan for these species, the breeding habitat selection of Loggerhead shrikes and Henslow's sparrows was studied on Fort Riley Military Reservation, in northeast Kansas. This study was developed with three major objectives in mind: 1) to determine the distribution and habitat selection of Loggerhead shrikes and Henslow's sparrows on Fort Riley at both the fine scale (the scale of individual territories) and the landscape scale (the scale of the entire study site) 2) to determine if a relationship exists between the intensity of military training disturbance to the vegetation and habitat selection by Loggerhead shrikes and Henslow's sparrows 3) to provide recommendations for the proactive management of these two species at Fort Riley. In 1995 and 1996, breeding shrikes and Henslow's sparrows were located during monthly surveys at 119 permanent points. Project is complete. Four manuscripts have been submitted for publication.

Products:

Peer-reviewed Publications:

Cully, J. F., Jr. and H. L. Michaels. 2000. Henslow's sparrows habitat associations on Kansas tallgrass prairie. Wilson Bulletin 112: 115-123.

Michaels, H.L., and J.F. Cully, Jr. 1998. Landscape and fine scale habitat associations of the Loggerhead Shrike. Wilson Bulletin 110(4):747-482.

Thesis or Dissertation:

Michaels, H.L. 1997. Landscape and Fine Scale Habitat of the Loggerhead Shrike and Henslow's Sparrow on Fort Riley Military Reservation, Kansas. Master's Thesis. Division of Biology, Kansas State University. 109 pp. (Advisor: Cully)

Presentations:

Cully, J.F., Jr. and H.L. Michaels. 1997. Avian diversity and the intermediate disturbance hypothesis at Fort Riley Army Reserve, Kansas. Annual Meeting of the Wilson Ornithological Society, Manhattan, KS.

Michaels, H.L., and J. F. Cully, Jr. 1996. Habitat Selection by breeding Loggerhead shrikes and Henslow's sparrows in tallgrass Prairie. Annual Meeting of the Ecological Society of America, Providence, RI.

Title: **Use of satellite remote sensing to monitor training activities on Ft. Riley Army Reservation, KS.**

Funding: Ft. Riley Army Reservation, Department of Natural Resources

Investigator: Greg Hoch, M.S. Student

Advisor: Dr. Jack F. Cully, Jr.

Completion: December 1997

Traditionally, natural vegetation communities, especially grasslands, have been difficult to identify with remote sensing. In the past several years multi-temporal imaging, using multiple images across a single growing season, has been used to identify agricultural crops with a high degree of accuracy. The KS Gap Analysis Program is using this technique in its state-wide land cover survey. The method uses differing phenological patterns of the dominant species within a plant community to identify that community. This study was conducted on the Fort Riley Army Reservation (FRAR) near Manhattan KS. The goal of the project was to develop methodologies for differentiating between C3 and C4 grassland communities and to test whether satellite remote sensing can be used to accurately identify and monitor the impacts of military training on the land surface. The boundaries of the FRAR were clipped from the larger Landsat Thematic Mapper scene. Bands 3, 4, 5, 7 (red, NIR, midIR, midIR) were stacked and two dates, late June and mid August 1993 were georeferenced and overlaid. Water, bare ground, and woody vegetation were identified and masked. Multiple ISODATA clustering algorithms were used to determine the best classification results. A combination of field work and Land Condition Trend Analysis (LCTA) data from 1989, 1993, and 1995 were used to validate and ground-truth the classified map. Preliminary results suggest that we can discriminate between areas that have greater than or less than 40-45% disturbance from military activity with accuracies ranging from 65-80%; however, it was not possible to distinguish between different grassland types.

Products:

Peer-reviewed Publications:

Hoch, G. A., and J. F. Cully, Jr. 1999. Effects of temporal variability in ground data collection on classification accuracy. Geocarto International 14:5-11.

Thesis or Dissertation:

Hoch, G.A. 1997. Mapping and monitoring of disturbance from military training at Fort Riley Kansas and an investigation into the stability of grassland ecotones using satellite remote sensing. Master's Thesis. Division of Biology, Kansas State University. 69 pp. (Advisor: Cully)

Presentations:

Hoch, G. 1996. Using Remote Sensing to Identify Herbaceous Plant Communities in the Tallgrass Prairie at Fort Riley. KSU Ecology Research Group.

Hoch, G. 1996. Is Heterogeneity an Intrinsic Quality of the Landscape? 8th Annual Konza Prairie LTER Workshop.

Title: **Effects of livestock grazing on the avifauna, vegetation and habitat quality of two southeastern Kansas riparian habitats**

Funding: Kansas Department of Wildlife and Parks

Investigator: David E. Hoover, M.S. Student

Supervisor: Dr. Philip S. Gipson

Collaborators: Alan Hynek and Dr. Ted Cable

Completion: December 1997

Research has shown that cattle grazing in western riparian areas can alter vegetation structure and composition, and avian species composition. There is a paucity of information concerning the effects of cattle grazing or the benefits of cattle exclusion on riparian habitats in the eastern

Great Plains. Mr. Hoover examined vegetation structure and composition as well as avian relative abundance, species richness, and species diversity in grazed and recently fenced closed canopy riparian woodlands in southeastern Kansas. To further investigate avian assemblages responses to cattle exclusion, Hoover compared relative abundances of nesting guilds between the grazed and fenced riparian areas.

Total understory vegetation cover, grass cover, and litter cover was significantly higher (P<0.10) on the fenced study sites while bare ground was significantly higher on the grazed study sites. Height of herbaceous vegetation was greater (P<0.10) on the fenced study sites, however, there was a significant year by treatment interaction. Total species richness was slightly higher in the grazed study sites when compared to the fenced study sites.

Total avian abundance, species richness, and species diversity was similar ($P\geq$0.10) between the grazed and fenced study sites. The brown-headed cowbird (Molothrus ater) was more abundant in the grazed study sites (P<0.10). Grazed and fenced study sites exhibited high species overlap, indicated by a high Horn's index of community similarity value, during both years of the study. The majority of the species (56%) recorded belonged to the cavity or shrub nesting guild. Abundance of the ground nesting guild was higher (P<0.10) in the grazed study sites, but this was likely an artifact of the data since the only two species belonging to the guild were rare in occurrence, thus an effect of sample size.

Products:

Peer-reviewed Publications:

Hoover, D. S., P. S. Gipson, J. S. Pontius, and A. E. Hynek. 2001. Short-term effects of cattle exclusion on riparian vegetation in southeastern Kansas. Transactions of the Kansas Academy of Science. 104(3-4): 212-222.

Technical and Semi-Technical:

Gipson, P.S. 1997. Fencing riparian buffer zones in southeastern Kansas: Impacts on the breeding avifauna, vegetation, and habitat quality. Progress report to the Kansas Department of Wildlife and Parks. 4pp.

Hoover, D.E. and P.S. Gipson. 1997. Fencing riparian buffer zones in southeastern Kansas: Impacts on breeding avifauna, vegetation, and habitat quality. Final report to the Kansas Department of Wildlife and Parks. 59pp.

Thesis or Dissertation:

Hoover, D.A. 1997. Vegetation and breeding bird assemblages in grazed and ungrazed riparian habitats in southeastern Kansas. Master's Thesis. Division of Biology, Kansas State University. 59 pp. (Advisor: Gipson)

Presentations:

Hoover, D.E., and P.S. Gipson. 1997. Plant community structure and avian composition of grazed and ungrazed riparian habitats in southeastern Kansas. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Hoover, D.E., and P.S. Gipson. 1997. Influence of livestock exclusion on riparian vegetation and breeding avifauna in southeastern Kansas. 23th Annual Student Research Forum, Division of Biology, Kansas State University, Manhattan, KS.

Hoover, D.E. 1996. Riparian livestock grazing: an overview and study methodology. Kansas Department of Wildlife and Parks Annual Wildlife Workshop. Wichita, Kansas.

Title: **Survival and cause-specific mortality of swift fox, *Vulpes velox*, on crop and range lands in western Kansas.**

Funding: Kansas Department of Wildlife and Parks

Investigator: Raymond S. Matlack, M. S. Student

Supervisor: Dr. Philip S. Gipson

Completion: October 1997

Because of reduction in numbers and range of the swift fox *(Vulpes velox)* the U. S. Fish and Wildlife Service was petitioned to list the species as threatened or endangered under the Endangered Species Act. The petitioner listed reduction of habitat due to agricultural conversion of land as a possible cause of the reductions. However, in western Kansas, swift foxes have been found to make substantial use of crop land throughout the year. The goal of this project is to examine and compare survival and cause-specific mortality of foxes resident on crop land and adjacent range land habitats. Fifty-two adult swift fox were captured and equipped with radio collars, 25 on range land and 27 on crop land during 1994 and 1995. No significant differences were found in survival or apparent cause of death for swift fox between the two habitats. Coyotes and vehicle collisions accounted for 35% (7/20) and 25% (5/20) of swift fox deaths, respectively. In addition, no differences were found for any of the morphological measurements made (ear length, hind foot length, tail length, total length, and body mass) except for body mass. Foxes resident on range land had greater body mass (x=2.27 Kg) than foxes resident on crop land (x=2.11 Kg; n=66, P<0.01).

Products:

Peer-reviewed Publications:

Matlack, R.S., P.S. Gipson, and D.W. Kaufman. 2000. The swift fox in rangeland and cropland in western Kansas: relative abundance, mortality, and body size. The Southwestern Naturalist 45: 221-225.

Technical and Semi-Technical:

Matlack, R.S., and P.S. Gipson. 1997. Swift foxes on rangeland and cropland in western Kansas. Final report to the Kansas Department of Wildlife and Parks.

Thesis or Dissertation:

Matlack, R.S. 1997. The swift fox in rangeland and cropland in western Kansas: Relative abundance, mortality, and body size. Master's Thesis. Division of Biology, Kansas State University. 30 pp. (Advisor: Gipson)

Presentations:

Matlack, R.S., P.S. Gipson, and D.W. Kaufman. 1996. Is crop land suitable habitat for swift foxes in western Kansas? 58th Midwest Fish and Wildlife Conference.

Matlack, R. S. 1996. Survival and mortality factors of Swift foxes in western Kansas. Annual Meeting of the Kansas Chapter, The Wildlife Society.

Title: **Abundance and Nesting Success of Neotropical Migrants Breeding in the Tallgrass Prairie**

Funding: U.S. Fish and Wildlife Service

Investigator: Timothy H. Parker, M.S. Student

Advisor: Dr. John L. Zimmerman

Completion: 1997

Recent studies have suggested that bird species are able to coexist in communities where they can minimize nest predation by segregating nest sites between species. Martin has found evidence supporting this hypothesis in forested ecosystems. My student established the presence of nest site segregation among shrub-nesting species on the tallgrass prairie. However, I found

no support for the prediction that systematic searching of nest sites by predators is maintaining this nest site segregation. Univariate comparisons of successful to depredated nests based on vegetation variables associated with a-priori hypotheses found no differences. Also, multivariate methods utilizing many variables were unable to isolate any predictors of depredation. There is therefore no support for the role of systematic nest predators in maintaining the next site segregation found in this community. Species coexistence in this case appears to be a function of something other than segregation of nest sites.

Products:

Peer-reviewed Publications:

Parker, T.H. 1999. Responses of Bell's Vireos to Brood Parasitism by the Brown-Headed Cowbird in Kansas. The Wilson Bulletin 111:409-504.

Technical and Semi-Technical:

Zimmerman, J.L. 1995. The avian community of the tallgrass prairie and the effects of fire, grazing, and drought. Final Report.

Thesis or Dissertation:

Parker, T.H. 1997. Nest predation and its relationship to nest placement in tallgrass prairie shrub patches. M.S. Thesis, Division of Biology, Kansas State University. (Advisor: Zimmerman)

Title: **Effects of fire and bison grazing on abundance of the Lonestar tick (*Amblyomma americanum*) at the Konza Prairie Research Natural Area.**

Funding: NSF, Kansas Cooperative Fish and Wildlife Research Unit, McNair Scholars Program

Investigators: Justin Kretzer, Jody Hadacheck, undergraduates

Supervisor: Dr. Jack F. Cully, Jr.

Completion: December 1997

In Kansas, ticks are economically important as vectors of human diseases such as Lyme disease and Rocky Mountain Spotted Fever, and because of their impacts on domestic livestock growth. This study was designed to determine how burning the prairie at different intervals would affect Lonestar tick (*Amblyomma americanum*) populations in the presence of large ungulates, and where they are absent. Rangeland treatments that benefit cattle are important to wildlife as well, because they may control wildlife food resources as well as cover. One-year burn intervals effectively reduce Lonestar tick abundances below levels found at sites burned at four or twenty-year intervals. The presence of bison did not have a significant effect on tick populations. This may be because of the presence of large numbers of white-tailed deer (*Odocoileus virginianus*) on both grazed and ungrazed watersheds.

Products:

Peer-reviewed Publications:

Cully, J.F., Jr. 1999. Lone star tick abundance, fire, and bison grazing in tallgrass prairie. Journal of Range Management 52:139-144.

1996

Title: **Responses of ring-necked pheasants to Conservation Reserve Program fields during courtship and brood rearing in the High Plains**

Funding: Kansas Department of Wildlife and Parks
Nebraska Game and Parks Commission
South Dakota Department of Game, Fish and Parks
American Friends of the Game Conservancy
U.S. Fish and Wildlife Service

Investigator: William K. Smith, M.S. Student

Advisor: Dr. Philip S. Gipson

Collaborators: Kevin E. Church, Roger Applegate, and Steve Riley

Completion: December 1996

The Conservation Reserve Program (CRP) established by the 1985 Farm Bill was expected to restore declining ring-necked pheasant *(Phasianus colchicus)* populations. However, pheasants responded in a variety of ways to CRP in Midwestern states. Most pheasant research in North America had addressed habitat use during nesting and winter periods. Responses to CRP and other habitats may also be important during other periods of the year. This study was initiated to estimate pheasant numbers and habitat use during courtship and brood rearing in areas with high (25%) and low (5%) levels of CRP in Kansas, Nebraska, and South Dakota during 1994 and 1995. Spot-mapping and radio telemetry were used to estimate breeding pheasant numbers and habitat use by territorial males during courtship. Road-driven routes were used to estimate numbers of pheasant broods and habitat use. Number of territorial males were similar on high and low CRP study areas in Kansas and Nebraska ($P > 0.05$) during both years. In South Dakota, there were more territorial males on high CRP study sites than on low CRP study sites during both years ($P < 0.05$). There were no differences in numbers of males with and without harems, sizes of harems, and the number of cover types per territory on high and low CRP study sites in the 3 states ($P > 0.05$). Males in all 3 states established territories along edges between residual cover and open ground or short vegetation. Number of broods were not significantly different on high and low CRP study areas in Kansas and Nebraska during both years ($P > 0.05$). There were more broods on high CRP study sites than on low CRP study sites in South Dakota during both years ($P > 0.05$). Brood sizes within the 3 states did not differ significantly ($P > 0.05$). Broods in Kansas and Nebraska preferred CRP ($P < 0.05$) on several study areas, while brood in South Dakota only preferred CRP on low CRP areas during 1994. Differences in CRP management, age, and local farm practices in each state may be responsible for the observed trends.

Peer-reviewed Publications:

Applegate, R. D., B. E. Flock, P. S. Gipson, M. W. McCoy, and K. E. Kemp. 2002. Home range of ring-necked pheasants in northwestern Kansas. The Prairie Naturalist. 34:21-29.

Smith, W.K., K.E. Church, J.S. Taylor, D.H. Rusch, and P.S. Gipson. 2001. Modified decoy trapping of male ring-necked pheasant (*Phasianus colchicus*) and northern bobwhite (*Colinus virginianus*). Game and Wildlife Science. 18:581-586.

Technical and Semi-Technical:

Gipson, P. S., B. E. Flock, R. D. Applegate, M. W. McCoy, and K. E. Kemp. 2001. Macro and micro-habitat use by ring-necked pheasants in northwestern Kansas. Final report to the Kansas Department of Wildlife and Parks.

Smith, W.K., and P.S. Gipson. 1997. Responses of pheasant to Conservation Reserve Program fields during courtship and brood rearing. Final report to the Kansas Department of Wildlife and Parks.

Thesis or Dissertation:

Smith, W.K. 1996. Responses of ring-necked pheasants to the Conservation Reserve Program (CRP) during courtship and brood rearing in the western Great Plains. M.S. Thesis, Kansas State University, Manhattan. 76 pp. (Advisor: Gipson)

Presentations:

Smith, W.K., P.S. Gipson, and K. Church. 1996. Landscape level effects of the Conservation Reserve Program on territorial male pheasant in the High Plains. 58th Midwest Fish and Wildlife Conference.

Arnold, E.C. and P.S. Gipson. 1996. Success of artificial pheasant nests on Conservation Reserve Program grassland and wheat and fallow croplands. 58th Midwest Fish and Wildlife Conference.

McCoy, M.W. and P.S. Gipson. 1996. Habitat selection by pheasants at the landscape level: the relative importance of Conservation Reserve Program lands. 58th Midwest Fish and Wildlife Conference.

Arnold, E.C., K.E. Church, and P.S. Gipson. 1995. Use of artificial pheasant clutches as an index to brood production rates of game birds. Perdix VII: International Symposium on Partridges, Quails, and Pheasants in the Western Palearctic and Neartic.

Title: **An uneven-age silvicultural model for Mexican spotted owl habitat**

Funding: Kansas Cooperative Fish and Wildlife Research Unit

Investigators: Dr. Carl Fiedler, Assistant Professor, University of Montana
Dr. Jack Cully, Assistant Unit Leader, Wildlife

Completion: October 1995

The Mexican spotted owl (MSO) was listed as a threatened species under the Endangered Species Act in 1993 because of continued habitat destruction from even-age timber management. MSO habitat is characterized as mature to old-growth forest in pine-oak or mixed-conifer with moderate to high canopy closure, complex structure, abundent dead and down woody debris, and variance in stand density. Silvicultural prescriptions that can promote or sustain these conditions were not generally available. Forest managers do not usually promote such conditions because of concerns regarding reduced tree growth, fire hazard, and parasite and disease problems. We developed a prescription that incorporates three distinctive features: A measure of tree density that accounts for tree size, a diameter distribution that retains greater than 20% greater basal area and three times as many large trees as traditional approaches, and high horizontal and vertical stand diversity. Our approach begins with the regulated forest at basal area (ba) ~ 19.8 m^2/ha. After 12.5 years (ba) ~ 24.5 m^2/ha, and after 25 years (ba) ~ 31.6 m^2/ha. The MSO Recovery plan set a target for owl habitat of 30.6 m^2/ha, with 49 trees per ha in large trees (>45 cm diameter at breast height). At the end of our projected 25 year growth cycle, we would meet the basal area requirements but fall short in the number of large trees. However, there would be sufficient trees in another 10 years, as the next smaller size class grows to 45 cm.

Products:

Peer-reviewed Publications:

Fiedler, C.E., and J. F. Cully, Jr. 1995. A silvicultural approach to develop Mexican spotted owl habitat in southwest forests. Western Journal of applied Forestry 10:144-148.

Title: **Genetic diversity of reptile ticks on the Galapagos Islands**

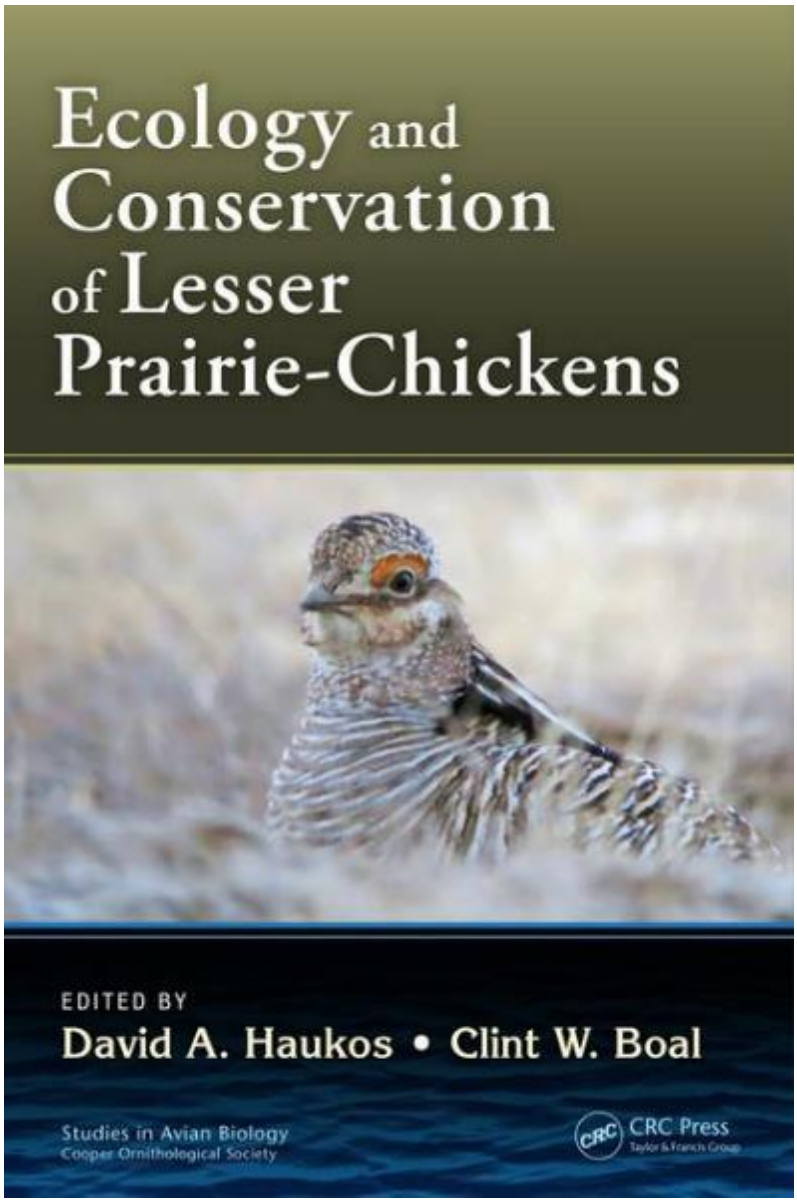
Funding: Kansas Cooperative Fish and Wildlife Research Unit

Investigator: Dr. Jack F. Cully, Jr., Assistant Unit Leader-Wildlife
Mayee Wong, Research Technician
Dr. Srinivas Kambhampati, Department of Entomology

Completion: June 1998

Galapagos ticks are known to occur on a number of reptile hosts, including marine iguanas (*Amblyrhynchus cristatus* subspecies), land iguanas (*Conolophus subcristatus* subspecies), and lava lizards (*Tropidurus* spp). However, little is known about the species composition of ticks on the archipelago, relationships of ticks to their vertebrate hosts, or the evolution of tick populations on different islands. We hypothesize that ticks on reptile hosts confined to single islands - such as land iguanas and lava lizards - show low rates of gene flow among their populations and high rates of divergence. Alternatively, high rates of gene flow and little genetic divergence is expected among tick populations found on the more wide ranging marine iguanas. Our objectives are to: 1) collect ticks from marine and land iguanas, and lava lizards at nine islands; 2) identify tick species and describe tick/host relationships demographics among islands and reptile hosts; 3) survey genetic variation within and among tick populations and species from different hosts and different islands. Ticks were collected and preserved for genetic analysis from Santa Cruz, Isabela, Santiago, Pinzon, Santa Fe, Plaza Sur, and Rabida islands of the Galapagos in October 1993. Preliminary genetic analysis of specimens began in fall 1995. Polymerase chain reaction (PCR) and DNA sequencing is currently being developed to determining the genetic structure of tick populations from different host species and different islands.

SPECIFIC RESEARCH PRODUCTS



Peer-Reviewed Publications
Books and Book Chapters
Technical Publications
Theses and Dissertations
REU Students
Presentations
1995 - 2016

Peer-Reviewed and Scientific Publications

2016

Albanese, G., and D.A. Haukos. 2016. A network model framework for prioritizing wetland conservation in the Great Plains. Landscape Ecology *In Press*

Earl, J.E., S.D. Fuhlendorf, D. Haukos, A.M. Tanner, D. Elmore, and S.A. Carleton. 2016. Characteristics of lesser prairie-chicken (*Tympanuchus pallidicinctus*) long-distance movements across their distribution. Ecosphere *In Press*

Fritts, S.F., B.A. Grisham, D.A. Haukos, C.W. Boal, M.A. Patten, D.H. Wolfe, C.E. Dixon, R.D. Cox, and W.R. Heck. 2016. Long-term evaluation of lesser prairie- chicken nest ecology in response to grassland restoration at two spatial scales. Journal of Wildlife Management 80:527-539.

Fritts, S.R., B.A. Grisham, R.D. Cox, C.W. Boal, C.A. Hagen, D.A. Haukos, P. McDaniel, and A.N. Erickson. 2016. Influence of vegetation structure and composition on lesser prairie-chicken demographics following an intense drought. Rangeland Ecology and Management *In Press*

Grisham, B.A., A.J. Godar, C.W. Boal, and D.A. Haukos. 2016. An assessment of lesser prairie-chicken nest microclimate and nest survival among three ecoregions. Condor *In Press*

Hellgren, E.C, D.J. Austen, D.A. Haukos, J.R. Mawdsley, J.F. Organ, and B.K. Williams. 2016. Barriers and bridges in reconnecting natural resources science and management: summary of a workshop. Transactions of the North American Wildlife and Natural Resources Conference 81: *In Press*

Kennedy, C. G., M. E. Mather, J. M. Smith, J. T. Finn, L. A. Deegan. 2016. Discontinuities concentrate mobile predators: Quantifying organism-environment interactions at a seascape scale. Ecosphere 7(2):e01226. 10.1002/ecs2.1226.

McMullin, S. L, V. DiCenzo, R. Essig, C. Bonds, R. DeBruyne, M. Kaemingk, M. Mather, C. Myrick, Q. Phelps, T. Sutton, J. Triplett. Are we preparing the next generation of fisheries professionals to succeed in their careers? A survey of AFS members. Fisheries. (Accepted)

Robinson, S.G., D.A. Haukos, D.S. Sullins, and R.T. Plumb. 2016. Use of free water by nesting lesser prairie-chickens. Southwestern Naturalist *In Press*

Robinson, S.G., D.A. Haukos, R.T. Plumb, C.A. Hagen, J.C. Pitman, J.M. Lautenbach, D.S. Sullins, J.D. Kraft, and J.D. Lautenbach. 2016. Lack of lesser prairie-chicken mortality due to fence collisions in Kansas and Colorado. Journal of Wildlife Management. *In Press*

Ross, B.E., D. Haukos, C. Hagen, and J. Pitman. 2016. The relative contribution of climate to changes in lesser prairie-chicken abundance. Ecosphere 7(6):e01323. 10.1002/ecs2.1323

Ross, B.E., D.A. Haukos, C.A. Hagen, and J.C. Pitman. 2016. Landscape composition creates a threshold influencing lesser prairie-chicken population resilience to extreme drought. Global Ecology and Conservation 6:179-188.

Sullins, D.S., W.C. Conway, D.A. Haukos, K.A. Hobson, L.I. Wassenaar, C.E. Comer, and I.K. Hung. 2016. American woodcock migratory connectivity and post-juvenile dispersal as indicated by hydrogen isotopes. Journal of Wildlife Management 80:510-526.

Waldman, J., K. Wilson, M. E. Mather, N. P. Snyder. 2016. Can resilience theory help guide restoration of anadromous fishes? Fisheries 41:3, 116-126.

2015

Andersson, K., Davis, C.A., Harris, G. and Haukos, D.A., 2015. An assessment of non-breeding waterfowl surveys on National Wildlife Refuges in the Central Flyway. Wildlife Society Bulletin, 39(1), pp.79-86.

Caldas, M.M, M. Sanderson, M. Mather, M. Daniels, J. Bergtold, J. Aistrup, J.H. Stamm, D. Haukos, K. Mankin, A. Sheshukov, and D. Carr-Lopez. 2015. Bringing culture into sustainability science research and policy. Proceedings National Academy of Sciences 112:8157-8159.

Fencl, J. S., M. E. Mather, K. H. Costigan, and M. D. Daniels. 2015. How Big of an Effect Do Small Dams Have? Using Geomorphological Footprints to Quantify Spatial Impact of Low-Head Dams and Identify Patterns of Across-Dam Variation. PloS one, 10(11), e0141210.

Grisham, B.A., C.W. Boal, N.R. Mitchell, T.S. Gicklhorn, P.K. Borsdorf, D.A. Haukos, and C. Dixon. 2015. Evaluation of capture techniques on lesser prairie-chicken trap injury and survival. Journal of Fish and Wildlife Management 6:318-326.

Haukos, D.A. 2015. Estimates of annual survival of mottled ducks from band-recovery data in the Western Gulf Coast population. Journal of the Southeastern Association of Fish and Game Agencies 2:214-220.

Haukos, D.A., C.W. Boal, S. Carleton, and B. Grisham. 2016. Roles of Cooperative Research Units in contemporary conservation of natural resources. Transactions of the North American Wildlife and Natural Resources Conference 80: In Press

Kearns, B., P. Walther, W. Conway, and D. Haukos. 2015. Factors affecting fat content in mottled ducks on upper Texas Gulf Coast. Journal of the Southeastern Association of Fish and Game Agencies 2:274-280.

Mapes, R.L., DuFour, M.R., Pritt, J.J. and Mayer, C.M., 2015. Larval fish assemblage recovery: a reflection of environmental change in a large degraded river. Restoration Ecology, 23(1), pp.85-93.

McDowell, S.K., W.C. Conway, D.A. Haukos, J.A. Moon, C.E. Comer, and I.K. Hung. 2015. Blood lead exposure concentrations in mottled ducks (*Anas fulvigula*) on the upper Texas coast. Journal of the Southeastern Association of Fish and Game Agencies 2:221-228.

Moon, J.A., D.A. Haukos, and W.C. Conway. 2015. Mottled duck (*Anas fulvigula*) movements in the Texas Chenier Plain Region. Journal of the Southeastern Association of Fish and Game Agencies 2:255-261.

Riecke, T.V., W.C. Conway, D.A. Haukos, J.A. Moon, and C.E. Comer. 2015. Baseline blood Pb levels of black-necked stilts on the upper Texas coast. Bulletin of Environmental Contamination 95(4):465-469.

Rigby, E.A., and D.A. Haukos. 2015. Duckling survival, fecundity, and habitat selection of mottled duck broods on the upper Texas Gulf Coast. Journal of the Southeastern Association of Fish and Game Agencies 2:156-163.

Winder, V.L., K.M. Carrlson, A.J. Gregory, C.A. Hagen, D.A. Haukos, D.C. Kesler, L.C. Larsson, T.W. Matthews, L.B. McNew, M.A. Patten, J. C. Pitman, L.A. Powell, J.A. Smith, T. Thompson, D.H. Wolfe, and B.K. Sandercock. 2015. Ecological correlates of female space use in ten populations of prairie chickens. Ecosphere 6(9):166. http://dx.doi.org/10.1890/ES14-00536.1

2014

Boal, C.W., Grisham, B.G., Haukos, D.A., Zavaleta, J.C., and Dixon, Charles, 2014, Lesser prairie-chicken nest site selection, microclimate, and nest survival in association with vegetation response to a grassland restoration program: U.S. Geological Survey Open-File Report 2013–1235, 35 p.

Clark, R., K. Guyn, D. Haukos, J. Fleskes, J. Austin, and M. Miller. 2014. Northern Pintail (*Anas acuta*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Daniel, D.W., Smith, L.M., Haukos, D.A., Johnson, L.A. and McMurry, S.T., 2014. Land use and conservation reserve program effects on the persistence of playa wetlands in the High Plains. Environmental science & technology, 48(8), pp.4282-4288.

Hagy, H.M., S.C. Yaich, D.A. Haukos, W.C. Johnson, C.R. Loesch, F. Reid, J. Simpson, S. Stephens, R.W. Tiner, B. Werner, and G. Yarris. 2014. Wetland issues affecting waterfowl conservation in North America. Wildfowl Special Issue 4:343-367.

Riecke, T.V., W. C. Conway, C.E. Comer, D.A. Haukos, and J.A. Moon. 2014. Red imported fire ants *Solenopsis invicta* cause black-necked stilt *Himantopus mexicanus* nest abandonment. Wader Study Group Bulletin 121:52-53.

Rigby, E., and D.A. Haukos. 2014. A matrix model for mottled ducks (*Anas fulvigula*) on the western Gulf Coast of Texas. Southeastern Naturalist 13(Special Issue 5):26-40.

Smith, J. M., S. P. Wells, M. E. Mather, and R. M. Muth. 2014. Fish biodiversity sampling in stream ecosystems: a process for evaluating the appropriate types and amount of gear. Aquatic Conservation: Marine and Freshwater Ecosystems 24 338–350.

2013

Albanese, G., and Davis, C. A. 2013. Broad-scale relationships between migratory shorebirds and landscapes in the southern Great Plains. The Auk 130:88-97.

Gerken, J., and C. Paukert. 2013. Fish community and habitat factors associated with the distribution of Topeka shiner (*Notropis topeka*) in Kansas streams. Journal of Freshwater Ecology http://dx.doi.org/10.1080/02705060.2013.792754.

Grisham, B.A., C.W. Boal, D.A. Haukos, D.M. Davis, K.K. Boydston, C. Dixon, and W.R. Heck. 2013. The predicted influence of climate change on lesser prairie-chicken reproductive parameters. PLoS ONE 8(7): e68225. doi:10.1371/journal.pone.0068225.

Hagen, C.A., B.A. Grisham, C.W. Boal, and D.A. Haukos. 2013. A meta-analysis of lesser prairie-chicken nest and brood-rearing habitats. Wildlife Society Bulletin 37:750-758.

Mather, M. E., J. T. Finn, C. G. Kennedy, L. A. Deegan, and J. M. Smith.. 2013. What happens in an estuary does not stay there: patterns of biotic connectivity resulting from long term ecological research. Oceanography 26:168–179.

O'Connell, J., L. Johnson, B. Beas, L. Smith, S. McMurry, and D. Haukos. 2013. Predicting dispersal-limitation in plants: Optimizing planting decisions for isolated wetland restoration in agricultural landscapes. Biological Conservation 159:343-354.

O'Connell, J., L. Johnson, L. Smith, S. McMurry, D.W. Daniel, and D. Haukos. 2013. Effects of agriculture tillage and sediment accumulation on emergent plant communities in playa wetlands of the U.S. High Plains. Journal of Environmental Management 120:10-17.

Pirius, N.E., C.W. Boal, D.A. Haukos, M.C. Wallace, and R.W. Perez. 2013. Winter habitat use and movements of lesser prairie-chickens in west Texas. Wildlife Society Bulletin 37:759-765.

Rosen, D.J., A.D. Casekey, W.C. Conway, and D.A. Haukos. 2013. Vascular flora of the Southern High Plains of Texas and eastern New Mexico. Journal of The Botanical Research Institute of Texas 7:595-602.

Rosenblatt, A.E., Heithaus, M.R., Mather, M.E., Matich, P., Nifong, J.C., Ripple, W.J. and Silliman, B.R., 2013. The roles of large top predators in coastal ecosystems: new insights from long term ecological research. Oceanography 26:156–167.

Saalfeld, S.T, W.C. Conway, D.A. Haukos, and W.P. Johnson. 2013. Seasonal variation in offspring sex ratio in the snowy plover. Western North American Naturalist 73:60-71.

Smith, J. M and M. E. Mather. 2013. Beaver dams maintain native fish biodiversity by increasing habitat heterogeneity throughout a low-gradient stream network. Freshwater Biology 58: 1523-1538.

2012

Albanese, G., Davis, C. A., and B.W. Compton. 2012. Spatiotemporal scaling of N. American continental interior wetlands: Implications for shorebird conservation. Landscape Ecology 27:1465-1479.

Althoff, D. P., K. A. Blecha, P. B. Woodford, and P. S. Gipson. 2012. Use of low-level aerial photography for delineation of biological and physical features of a tallgrass prairie. North American Prairie Conference. 22:31-38.

Behney, A.C., B.A. Grisham, C.W. Boal, H.A. Whitlaw, and D.A. Haukos. 2012. Sexual selection and mating chronology of lesser prairie-chickens. Wilson Journal of Ornithology 124:96-105.

Beldon, J., B. Hanson, L. Smith, S. McMurry, and D. Haukos. 2012. Assessment of the effects of farming and conservation programs on pesticide deposition in High Plains Wetlands. Environmental Science and Technology 46:3424-3432.

Biggins, D.E., Ramakrishnan, S., Goldberg, A.R. and Eads, D.A., 2012. Black-footed ferrets and recreational shooting influence the attributes of black-tailed prairie dog burrows. Western North American Naturalist, 72(2), pp.158-171.

Conard, J. M. and P. S. Gipson. 2012. Foraging ecology of elk in a tallgrass prairie ecosystem. Southwestern Naturalist. 57:92-96.

Conard, J. M., B.K. Sandercock, P. S. Gipson, and W. B. Ballard. 2012. Factors influencing survival of female elk in a harvested population. Journal of Fish and Wildlife Management. Vol. 3, No. 2, pp. 199-208.

Faust, D.R., N. Knowles, E. McGruder, D.A. Haukos, G.P. Cobb, J.D. Maul, T.A. Anderson, and P.N. Smith. 2012. Inorganic and organic contaminants in sediments from an urban playa and associated toxicity among Hyalella azteca. Toxicology and Environmental Chemistry 94:1746-1757.

Ferry, K. H., and M. E. Mather. 2012. Spatial and temporal diet patterns of young adult and subadult striped bass feeding in Massachusetts estuaries: trends across scales. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 4:30–45.

Fischer, J., C. Paukert, and M. Daniels. 2012. Fish community response to habitat alteration: impacts of sand dredging in the Kansas River. Transactions of the American Fisheries Society 141:1532-1544.

Flock, B. E., Gipson, P. S., Applegate, R. D., and Ballard, W. B. 2012. Distance-based habitat ssociations of northern bobwhites in a fescue-dominated landscape in Kansas. In: Proceedings of the National Quail Symposium (Vol. 7, pp. 42-51).

Haukos, D.A. 2012. Wetland Ecosystems (Book Review). Ecology 93:215-216.

Hitchman, S.M., Reyns, N.B., and A.R. Thompson. 2012. Age-specific association of larval bocaccio, *Sebastes paucispinis*, with Southern California Bight spawning habitats. Marine Ecology Progress Series. 465: 227-445.

Hitchman, S.M., N.B. Reyns, and A.R. Thompson. 2012. Larvae define spawning habitat of bocaccio rockfish, Sebastes paucispinis, within and around a large southern California marine reserve. Marine Ecology Progress Series 465:227-242.

Hoogland, J. L., J. F. Cully, L. S. Rayor, and J. P. Fitzgerald. 2012 (August). Conflicting research on the demography, ecology, and social behavior of Gunnisons prairie dogs (*Cynomys gunnisoni*). Journal of Mammalogy.

Hooten, M.B, B.E. Ross, and C.K. Wikle. 2012. Optimal spatio-temporal monitoring designs for characterizing population trends. Gitzen, R.A., J.J. Millspaugh, A.B. Cooper, and D.S. Licht (eds.). In: Design and Analysis of Long-Term Ecological Monitoring Studies. pp. 443-459.

Johnson, L.A., D.A. Haukos, L.M. Smith, and S.T. McMurry. 2012. Loss and modification of Southern Great Plains playas. Journal of Environmental Management 112:275-283.

Mather, M.E., H. J. Frank. J. M. Smith, R. D. Cormier, R. M. Muth, and J. T. Finn. 2012. Assessing freshwater habitat of adult anadromous alewives at multiple scales: a common challenge for fish and watershed restoration. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science, 4:1, 188-200.

Mattson, B.J, M.C. Runge, J.H. Devries, G.S. Boomer, J.M. Eadie, D.A. Haukos, J. P. Fleskes, D.N. Koons, W.E. Thogmartin, and R. J. Clark. 2012. A prototypical modeling framework for integrated harvest and habitat management of North American waterfowl: case-study of northern pintail metapopulation dynamics. Ecological Modeling 225:146-158.

O'Connell, J., L. Johnson, L. Smith, S. McMurry, and D. Haukos. 2012. Land-use and conservation programs on wetland plant communities of the semi-arid United States Great Plains. Biological Conservation 146:108-115.

Rigby, E., and D. Haukos. 2012. Breeding Season Survival and Breeding Incidence of Female Mottled Ducks on the Upper Texas Gulf Coast. Waterbirds 35:260-269.

Ross, B.E., M. Hooten, and D.N. Koons. 2012. An accessible method for implementing hierarchical models with spatio-temporal abundance data. PLoS ONE 7(11).

Saalfeld, S.T, W.C. Conway, D.A. Haukos, and W.P. Johnson. 2012. Selection and spacing patterns of snowy plover nests in the Southern High Plains of Texas. Journal of Wildlife Management 76:1703-1711.

Saalfeld, S.T, W.C. Conway, D.A. Haukos, and W.P. Johnson. 2012. Alleviation of nest thermal extremes by incubating snowy plovers in the Southern High Plains of Texas. Wader Study Group Bulletin. 119:77-83.

Saalfeld, S.T, W.C. Conway, D.A. Haukos, and W.P. Johnson. 2012. Recent declines in apparent survival and survey counts of snowy plover breeding in the Southern High Plains of Texas. Wilson Journal of Ornithology 124:79-87.

Schloesser, J.T., Paukert, C.P., Doyle, W.J., Hill, T.D., Steffensen, K.D. and Travnichek, V.H., 2012. Fish assemblages at engineered and natural channel structures in the lower Missouri River: implications for modified dike structures. River Research and Applications, 28(10), pp.1695-1707.

Schloesser, J.T., Paukert, C.P., Doyle, W.J., Hill, T.D., Steffensen, K.D. and Travnichek, V.H., 2012. Heterogeneous detection probabilities for imperiled Missouri River fishes: implications for large-river monitoring programs. Endangered Species Research, 16(3), pp.211-224.

Sidle, J. G., D. J. Augustine, D. H. Johnson, S. D. Miller, J. F. Cully, Jr. and R. P. Reading. 2012. Aerial surveys adjusted by ground surveys to estimate area occupied by black-tailed prairie dog colonies. Wildlife Society Bulletin 36:248-256.

Tsai, J.S., L.S. Venne, L.M. Smith, S.T. McMurry, and D.A. Haukos. 2012. Influence of local and landscape characteristics on avian richness and density in wet playas of the Southern Great Plains, USA. Wetlands 32:605-618.

2011

Frank, H. F, M. E. Mather, J. M. Smith, R. M. Muth, J. T. Finn. 2011. Role of origin and release location in pre-spawning movements of anadromous alewives. Fisheries Management and Ecology 18(1):12–24.

Jeffress, M. R., C. P. Paukert, J. B. Whittier, B. K. Sandercock, and P. S. Gipson. 2011. Scale-dependent factors affecting North American river otter distribution in the Midwest. American Midland Naturalist. 166:177-193.

Jeffress, M. R., C. P. Paukert, B. K. Sandercock, and P. S. Gipson. 2011. Factors affecting detectability of river otters during sign surveys. The Journal of Wildlife Management. 75:144-150.

Johnson, L.A., D.A. Haukos, L.M. Smith, and S.T. McMurry. 2011. Jurisdictional loss of playa wetlands caused by reclassification of hydric soils on the Southern High Plains. Wetlands 31:483-492

Johnson, T.L., J. F. Cully, Jr., S. K. Collinge, C. Ray, C. M. Frey, and B. K. Sandercock. 2011. Spread of plague among black-tailed prairie dogs is associated with colony spatial characteristics. Journal of Wildlife Management 75:357-368.

Johnson, W.P, M.B. Rice, D.A. Haukos, and P. Thorpe. 2011. Factors influencing the occurrence of inundated playa wetlands during winter on the Texas High Plains. Wetlands 31;1287-1296.

Marschall, E. A., M. E. Mather, D. L. Parrish, G. W. Allison, J. McMenemy. 2011. Migration delays caused by anthropogenic barriers: dams, temperature, and success of migrating salmon smolts.

McRoberts, J.T., M.J. Butler, W.B. Ballard, H.A. Whitlaw, D.A. Haukos, and M.C. Wallace. 2011. Detectability of lesser prairie-chicken leks: a comparison of surveys from aircraft. Journal of Wildlife Management 75:771-778.

McRoberts, J.T., M.J. Butler, W.B. Ballard, M.C. Wallace, H.A. Whitlaw, and D.A. Haukos. 2011. Response of lesser prairie-chickens on leks to aerial surveys. Wildlife Society Bulletin 35:27-31.Ecological Applications, 21: 3014–3031.

Paukert, C.P., Pitts, K.L., Whittier, J.B. and Olden, J.D., 2011. Development and assessment of a landscape-scale ecological threat index for the Lower Colorado River Basin. Ecological Indicators, 11(2), pp.304-310.

Saalfeld, S.T, W.C. Conway, D.A. Haukos, and W.P. Johnson. 2011. Nest success of Snowy Plovers (*Charadrius alexandrinus*) in the Southern High Plains of Texas. Waterbirds 34:389-399.

Smith, J. S., and M. E. Mather. 2011. Using assemblage data in ecological indicators: a comparison and evaluation of commonly available statistical tools. Ecological Indicators 13: 253-262.

Smith, L.M., D.A. Haukos, S.T. McMurry, T. LaGrange, and D. Willis. 2011. Influence of ecosystem services provided by playa wetlands in the High Plains: potential influences of USDA conservation programs and practices. Ecological Applications 21:582-592.

Smith, L.M., N.H. Euless, Jr., and D.A. Haukos. 2011. Are isolated wetlands isolated? National Wetlands Newsletter 33(5) 26-27.

Strecker, A., J. Olden, J. Whittier, and C. Paukert. 2011. Defining conservation priorities for freshwater fishes according to taxonomic, functional, and phylogenetic diversity. Ecological Applications 21(8):3002-3013.

2010

Antolin, M.F., D.E. Biggins, C.J. Brand, J. F. Cully, L.E. Ellison, K.L. Gage, and T.E. Rocke. 2010. Eds. Special Issue: Symposium on the Ecology of Plague and its Effects On Wildlife. Vector-borne and Zoonotic Diseases 10(1):1-103.

Bouska, W. W., and C. P. Paukert. 2010. Effects of visible implant elastomer mark color on the predation of red shiners by largemouth bass. Fisheries Management and Ecology 17:294-296.

Bouska, W. W., and C. P. Paukert. 2010. Road crossing designs and their impact on fish assemblages of Great Plains streams. Transactions of the American Fisheries Society 139:214-222.

Bouska, W. W., T. Keane, and C. P. Paukert. 2010. The effects of road crossing design on geomorphology and classification of prairie streams. Journal of Freshwater Ecology 25:499-506.

Conard, J.M., Statham, M.J., Gipson, P.S. and Wisely, S.M., 2010. The influence of translocation strategy and management practices on the genetic variability of a re-established elk (*Cervus elaphus*) population. Restoration Ecology, 18(s1), pp.85-93.

Cully, J. F., Jr., S. K. Collinge, R. E. VanNimwegen, C. Ray, W. C. Johnson, B. Thiagarajan, D. B. Conlin, and B. E. Holmes. 2010. Spatial variation in keystone effects: Small mammal diversity associated with black-tailed prairie dog colonies. Ecography 33:667-677.

Cully, J. F., Jr., T. L. Johnson, S. K. Collinge, and C. Ray. 2010. Disease limits populations: Plague in black-tailed prairie dogs. Vector Borne and Zoonotic Diseases 10:7-15.

Dinehart, S.K., L.M. Smith, S.T. McMurry, T.A. Anderson, P.N. Smith, and D.A. Haukos. 2010. Acute and chronic toxicity of Roundup Weathermax® and Ignite®280 SL to larval *Spea multiplicata* and *S. bombifrons* from the Southern High Plains, USA. Environmental Pollution 158:2610-2617.

Eitzmann, J. L., and C. P. Paukert. 2010. Longitudinal differences in habitat complexity and fish assemblage structure of a Great Plains River. American Midland Naturalist 163:14-32.

Eitzmann, J. L., and C. P. Paukert. 2010. Urbanization in a Great Plains river: effects on fishes and food webs. River Research and Applications 26:948-959.

Haukos, D.A., S. Martinez, and J. Hetzel. 2010. Characteristics of pair ponds used by mottled ducks on the Chenier Plain of coastal Texas. Journal of Fish and Wildlife Management 1:93-101.

Johnson, T.N., and B.K. Sandercock. 2010. Restoring tallgrass prairie and grassland bird populations in tall fescue pastures with winter grazing. Rangeland Ecology and Management 63:679-688.

Limb, R F., D. M. Engle, S. D. Fuhlendorf, D. P. Althoff, and P. S. Gipson. 2010. Altered herbivore distribution associated with focal disturbance. Range Ecology and Management. 63: 253-257.

Limb, R.F., Engle, D.M., Bidwell, T.G., Althoff, D.P., Anderson, A.B., Gipson, P.S. and Howard, H.R., 2010. Restoring biopedturbation in grasslands with anthropogenic focal disturbance. Plant Ecology, 210(2), pp.331-342.

Mather, M. E, J. T. Finn, S. M. Pautzke, D. Fox, T. Savoy, H. M. Brundage III, L. A. Deegan, R. M. Muth. 2010. Destinations, routes, and timing of adult striped bass on their southward fall migration: implications for coastal movements. Journal of Fish Biology 77: 2326–2337.

Pautzke, S. M., M. E. Mather, J. T. Finn, L. A. Deegan, R. M. Muth. 2010. Seasonal use of a New England estuary by foraging contingents of migratory striped bass. Transactions of the American Fisheries Society 139: 257–269.

Pool, T. K., J. D. Olden, J. B. Whittier, and C. P. Paukert. 2010. Environmental drivers of fish functional diversity and composition in the Lower Colorado River Basin. Canadian Journal of Fisheries and Aquatic Sciences 67:1791-1807.

Rice, M., D. Haukos, J. Dubvosky, and M. Runge. 2010. Survival and recovery band-recovery models for northern pintails of North America. Journal of Wildlife Management 74:778-787.

Rivers, J.W., W.E. Jensen, K.L. Kosciuch, and S.I. Rothstein. 2010. Community-level patterns of host use by the Brown-headed Cowbird, a generalist brood parasite. Auk 127:263-273.

Rivers, J.S., P.S. Gipson, D.P. Althoff, and J.S. Pontius. 2010. Long-term community dynamics of small landbirds with and without exposure to extensive disturbance from military training activities. Environmental Management 45:203-216.

Saalfeld, S.T., W.C. Conway, D.A. Haukos, M.B. Rice, S.L. Jones, and S.D. Fellows. 2010. Multiscale habitat selection by long-billed curlews (*Numenius americanus*) breeding in the United States. Waterbirds 33:148-161.

Smythe, L., and D.A. Haukos. 2010. Density of grassland birds in sand shinnery oak communities treated with tebuthiuron and grazing in eastern New Mexico. Restoration Ecology 18:215-223.

White, K., J. Gerken, C. Paukert, and A. Makinster. 2010. Fish community structure in natural and engineered habitats in the Kansas River. River Research and Applications 26:797-805.

2009

Bai, Y., M. Y. Kosoy, C. H. Calisher, J. F. Cully, Jr., and S. K. Collinge. 2009. Effects of Rodent Community Diversity and composition on prevalence of an endemic bacterial pathogen - Bartonella. Biodiversity 10:3-11.

Fischer, J.R., and C. P. Paukert. 2009. Spatial scale of stream fish assemblage and abundance estimates: effects of sampling effort, community structure, and habitat heterogeneity. Canadian Journal of Fisheries and Aquatic Sciences 66:277-290.

Johnson, T.N., R.D. Applegate, D.E. Hoover, P.S. Gipson, and B.K. Sandercock. 2009. Evaluating avian community dynamics in restored riparian habitats with mark-recapture models. Wilson Journal of Ornithology 121:22-40.

Paukert, C. P., and *A. S. Makinster. 2009. Longitudinal patterns in flathead catfish relative abundance and length at age within a large river: effects of an urban gradient. River Research and Applications 25:861-873.

Pullen, R. R., W. W, Bouska, S. Campbell, and C. P. Paukert. 2009. Intestinal helminths of *Cyprinella lutrensis* in Deep Creek, Kansas; prevalence and spatial distribution estimates for *Bothriocephalus acheilognathi* (the Asian fish tapeworm) and *Rhabdochona canadensis*. Journal of Parasitology 95(5):1224-1226.

Strakosh, T. R., K. B. Gido, and C. S. Guy. 2009. Effects of American water willow establishment on density, growth, diet, and condition of age-0 largemouth bass in Kansas reservoirs. Transactions of the American Fisheries Society 138:269-279.

Whittier, J. B., and D. M. Leslie, Jr. 2009. Survival and movement of chicks of the Least Tern (Sterna antillarum) on an alkaline flat. Southwestern Naturalist 54:176-181.

2008

Augustine, D. J., M. R. Matchett, T. P. Toombs, J. F. Cully, Jr., T. L. Johnson, J. D. Sidle. 2008. Spatiotemporal dynamics of black-tailed prairie dog colonies affected by plague. Landscape Ecology 23:255-267.

Brinkerhoff, R.J., C. Ray, B. Thiagarajan, S. K. Collinge, J. F. Cully, Jr., B. Holmes, and K. L. Gage. 2008. Keystone hosts: Prairie dogs affect occurrence patterns of disease vectors on small mammals. Ecography 31:654-662.

Brinkley, P., J. R. Fischer, and C. P. Paukert. 2008. Effects of fixative on total length of small bodies stream fishes. Journal of Freshwater Ecology 23:471-473.

Carrera, R., W. B. Ballard, P. S. Gipson, B.T. Kelly, P.R. Krausman, M.C. Wallace C. Villalobos and D.B. Wester. 2008. Comparison of Mexican Wolf and Coyote Diets in Arizona and New Mexico. Journal of Wildlife Management 72:376-381.

Conard, J.M., J.A. Baumgardt, P.S. Gipson, and D.P. Althoff. 2008. The influence of trap density and sampling duration on the detection of small mammal species richness. Acta Theriologica 53 (2): 143-156.

Davis, N, and C. P. Paukert. 2008. Impact of gravel bar scalping on Neosho madtom populations from the Lower Neosho River, Kansas. Journal of Freshwater Ecology 23:501-511.

Doyle, W., C. P. Paukert, A. Starostka, and T. D. Hill. 2008. A comparison of four sampling gears used to collect shovelnose sturgeon in the Lower Missouri River. Journal of Applied Ichthyology 24:637-642.

Fischer, J. R., and C. P. Paukert. 2008. Historical and current environmental influences of an endemic Great Plains fish. American Midland Naturalist 159:364-377.

Fischer, J. R., and C. P. Paukert. 2008. Habitat relationships with fish assemblages in least disturbed Great Plains regions. Ecology of Freshwater Fish 17:597-609.

Makinster, A.S., and C. P. Paukert. 2008. Effects and utility of minimum length limits and mortality caps for flathead catfish in discrete reaches of a large prairie river. North American Journal of Fisheries Management 28:97-108.

Paukert, C. P., J. Schloesser, J. Eitzmann, J. Fischer, K. Pitts, and D. Thornbrugh. 2008. Effect of instream sand dredging on fish communities in the Kansas River USA: current and historical perspectives. Journal of Freshwater Ecology 23:623-633.

Petersen, J. H., D. L. DeAngelis, and C. P. Paukert. 2008. Developing bioenergetics and life history models for rare and endangered species. Transactions of the American Fisheries Society. 137:244-253.

T. Bala, Y. Bai, K. L. Gage, and J. F. Cully, Jr. 2008. Prevalence of *Yersinia pestis* in rodents and fleas associated with black-tailed prairie dogs at Thunder Basin National Grassland, Wyoming. Journal of Wildlife Diseases 44: 731-736.

Thiagarajan, B., J. F. Cully, Jr., T. M. Loughin, J. A. Montenieri, and K. L. Gage. 2008. Geographic variation in rodent-flea relationships in the presence of black-tailed prairie dog colonies. Journal of Vector Ecology 33:178-190.

VanNimwegen, R. L., J. Kretzer, and J. F. Cully. 2008. Ecosystem Engineering by a colonial mammal: how black-tailed prairie dogs structure rodent communities. Ecology 89:3298-3305.

2007

Althoff, D. P., P. S. Althoff, N. D. Lambrecht, P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2007. Soil properties and perceived disturbance of grasslands subjected to mechanized military training: evaluation of an index. Land Degradation & Development. 18:269-288.

Augustine, D. J., J. F. Cully, Jr., and T. L. Johnson. 2007. Influence of fire on black-tailed prairie dog colony expansion in shortgrass steppe. Rangeland Ecosystem Management 60:538-542.

Bai, Y., M. J. Kosoy, J. F. Cully, Jr., T. Bala, C. Ray, S. K. Collinge. 2007. Acquisition of nonspecific Bartonella strains by the northern grasshopper mouse (*Onychomys leucogaster*). FEMS Microbiol Ecol 61:438-448.

Eitzmann, J. L., A. S. Makinster, and C. P. Paukert. 2007. Distribution and growth of blue sucker in a Great Plains, USA river. Fisheries Management and Ecology 14:255-262.

Kamler, J. F., W. B. Ballard, M. C. Wallace, R. L. Gilliland, and P. S. Gipson. 2007. Dietary overlap of swift foxes and coyotes in northwestern Texas. American Midland Naturalist 158:140-147.

Kamler, J. F., W. B. Ballard, M. C. Wallace, and P. S. Gipson. 2007. Diets of swift foxes in continuous and fragmented prairie in northwestern Texas. Southwestern Naturalist 52:504-510.

Kostelnick, J. C., D. L. Peterson, S. L. Egbert, K. M. McNyset, and J. F. Cully. 2007. Ecological niche modeling of black-tailed prairie dog habitats in Kansas using geographic information systems (GIS), remote sensing, and the genetic algorithm for rule-set prediction (GARP). Transactions of the Kansas Academy of Sciences 110:187-200.

Olson, N. W., C. S. Guy, and K. D. Koupal. 2007. Interactions among three top-level predators in a polymictic Great Plains reservoir. North American Journal of Fisheries Management 27:268-278.

Paukert, C. P., and J. H. Petersen. 2007. Simulated effects of temperature warming on rainbow trout and humpback chub in the Colorado River, Grand Canyon. Southwestern Naturalist 52:234-242.

Paukert, C. P., M. McInerny, and R. Schultz. 2007. Current and historical black bass regulations in North America. Fisheries (Bethesda): 32(2):62-72.

Spears, B. L., M. C. Wallace, W. B. Ballard, R. S. Phillips, D. H. Holdstock, J. H. Brunjes, M. Miller, R. D. Applegate, and P. S. Gipson. 2007. Habitat use and survival of pre-flight wild turkey broods. Journal of Wildlife Management 71:69-81.

Winter, S.L., and J. F. Cully, Jr. 2007. Burrowing owl associations with black-tailed prairie dog colonies in southwestern Kansas and southeastern Colorado. Prairie Naturalist 39:69-75.

2006

Althoff, D. P., P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2006. Plant community and bare ground trends on Fort Riley, Kansas: Implications for monitoring of a highly disturbed landscape. Transactions of the Kansas Academy of Science. 109:101-119.

Althoff, D. P., P. S. Gipson, G. Meggers, D. Hilly, and J. Sellers. 2006. White-tailed deer population trends on Quivira National Wildlife Refuge, 1989-2005. Proceedings of the 20th North American Prairie Conference, University of Nebraska at Kearney, July 23–26, 2006, edited by Joseph T. Springer and Elaine C. Springer. Pages 297-306.

Baldwin, R. A., P. S. Gipson, G. L. Zuercher, and T. R. Livingston. 2006. The effect of precipitation covers over scent-stations on visitations by wildlife. Transactions of the Kansas Academy of Science. 109:3-10.

Bernot, R. J., W. K. Dodds, M. C. Quist, and C. S. Guy. 2006. Temperature and kairomone induced life history plasticity in coexisting Daphnia. Aquatic Ecology 40:361-372.

Bertrand, K. N., K. B. Gido, and C. S. Guy. 2006. An evaluation of single-pass versus multiple-pass backpack electrofishing to estimate trends in species abundance and richness in prairie streams. Transactions of the Kansas Academy of Science 109:131-138.

Conard, J. M., and P. S. Gipson. 2006. Spatial and seasonal variation in wildlife-vehicle collisions. Prairie Naturalist. 38:251-260.

Conard, J. M., P. S. Gipson, and M. Peek. 2006. Historical and current status of elk in Kansas. Proceedings of the 20th North American Prairie Conference, University of Nebraska at Kearney, July 23–26, 2006, edited by Joseph T. Springer and Elaine C. Springer. Pages 307-312.

Franssen, N. R., K. B. Gido, C. S. Guy, J. A. Tripe, S. J. Shrank, T. R. Strakosh, K. N. Bertrand, C. M. Franssen, K. L. Pitts, and C. P. Paukert. 2006. Effects of floods on fish assemblages in an intermittent prairie stream. Freshwater Biology 51:2072-2086.

Gipson, P. S., and J. F. Kamler. 2006. Density and minimum number of mesopredators on Fort Riley Military Reservation. Transactions of the Kansas Academy of Science 109:36-40.

Gipson, P. S., C. D. Lee, S. Wilson, J. R. Thiele, and D. Hobbick. 2006. Status of feral pigs, *Sus scrofa*, in Kansas and Nebraska. Proceedings of the 20th North American Prairie Conference, University of Nebraska at Kearney, July 23–26, 2006, edited by Joseph T. Springer and Elaine C. Springer. Pages 19-24.

Holdstock, D. P., M. C. Wallace, W. B. Ballard, J. H. Brunjes, R. S. Phillips, B. L. Spears, S. J. DeMaso, J. D. Jernigan, R. D. Applegate, and P. S. Gipson. 2006. Male Rio Grande turkey survival and movements in the Texas Panhandle and southwestern Kansas. Journal of Wildlife Management. 70:904-913.

Krausman, P. R., M. I. Grinder, P. S. Gipson, G. L. Zuercher, and G. C. Stewart. 2006. Molecular identification of coyote feces in an urban environment. Southwestern Naturalist. 51:122-126.

Proboszcz, S. L., and C. S. Guy. 2006. Use of habitat enhancement structures by spotted bass in natural and experimental streams. The Prairie Naturalist 38:223-238.

Reed, J. E., W. B. Ballard, P. S. Gipson, B. T. Kelly, P. R. Krausman, M. C. Wallace, and D. B. Wester. 2006. Diets of free-ranging Mexican gray wolves in Arizona and New Mexico. Wildlife Society Bulletin. 34:1127-1133.

Spears, B. L., K. L. Nicholson, R. T. Huffman, W. B. Ballard, M. C. Wallace, R. D. Applegate, and P. S. Gipson. 2006. Ecology of Rio Grande wild turkeys in southwest Kansas. Wildlife Bulletin 5. Kansas Department of Wildlife and Parks, Pratt, Kansas. 69 pages.

2005

Althoff, D. P., J. W. Rivers, J. S. Pontius, P. S. Gipson, and P. B. Woodford. 2005. A comprehensive approach to identifying monitoring priorities of small landbirds on military installations. Environmental Management. 34:887-902.

Collinge, S. K., W. C. Johnson, C. Ray, R. Matchett, J. Gersten, J. F. Cully, Jr., K. L. Gage, M. L. Kosoy, J. E. Loye, and A. P. Martin. 2005. Testing the generality of a trophic cascade model for plague. Ecohealth 2:1-12.

Collinge, S. K., W. C. Johnson, C. Ray, R. Matchett, J. Gersten, J. F. Cully, Jr., K. L. Gage, M. L. Kosoy, J. E. Loye, and A. P. Martin. 2005. Landscape structure and plague occurrence in black-tailed prairie dogs. Landscape Ecology 20:941-955..

Jensen, W. E., and J. F. Cully, Jr. 2005. Density-dependent habitat selection by a brood-parasitic cowbird in tallgrass prairie. Oecologia 142:136-149.
Jensen, W. E., and J. F. Cully, Jr. 2005. Geographic variation in cowbird parasitism and dickcissel nesting success in great plains tallgrass prairie. The Auk 122:648-660.
Johnson, T. L., and J. F. Cully, Jr. 2005. Effects of colony connectivity on the spread of sylvatic plague (Yersinia pestis) in black-tailed prairie dogs across the Great Plains. Second Symposium proceedings, The history, ecology, and economy of the Thunder Basin prairie ecosystem. J. B. Haufler, ed. CD
Johnson, T.N., and B.K. Sandercock. 2005. Winter grazing increases native prairie grasses in fescue-dominated pastures (Kansas). Ecological Restoration 23:115-116.
Lee, C. D., P. S. Gipson., and J. Wilson. 2005. In-burrow application of Rozol to manage black-tailed prairie dogs. Proceedings of the Wildlife Damage Control Conference. 11:349-353.
Livingston, T.R., P. S. Gipson, W.B. Ballard, D. M. Sanchez, and P. R. Krausman. 2005. Scat removal: a source of bias in feces-related studies. Wildlife Society Bulletin 33(1):172-178.
Parker, T. H., B.M. Stansberry, C. D. Becker, and P. S. Gipson. 2005. Edge and area effects of migrant forest songbirds. Conservation Biology. 19:1157-1167.
Schoenebeck, C. W., T. R. Strakosh, and C. S. Guy. 2005. Effect of block nets and time of day on backpack electrofishing catches in Kansas reservoirs. North American Journal of Fisheries Management 25:604-608.
Spears, B. L., W. B. Ballard, M. C. Wallace, R. S. Phillips, D. H. Holdstock. J. H. Brunjes, M. Miller, R. D. Applegate, and P. S. Gipson. 2005. Survival of Rio Grande wild turkey chicks. Journal of Field Ornithology. 16:121-20.
Strakosh, T. R., J. L. Eitzmann, K. B. Gido, and C. S. Guy. 2005. The response of water willow, *Justicia americana*, to different inundation and desiccation regimes. North American Journal of Fisheries Management 25:1476-1485.
Winter, S.L., and J. F. Cully, Jr. 2005. Lack of brown-headed cowbird nest parasitism in a shortgrass region. Prairie Naturalist 37:43-45.
Zuercher, G. L., P. S. Gipson, and O. Carillo. 2005. Diet and habitat associations of *Speothos venaticus* in the Interior Atlantic Forest of eastern Paraguay. Oryx. 39:86-89.

2004

Bernot, R. J., W. K. Dodds, M. C. Quist, and C. S. Guy. 2004. Spatial and temporal variability of zooplankton in a Great Plains reservoir. Hydrobiologia 525: 101-112.
Bernot, R. J., W. K. Dodds, M. C. Quist, and C. S. Guy. 2004. Larval fish-induced phenotypic plasticity of coexisting Daphnia: an enclosure experiment. Freshwater Biology 49:87-97.
Braaten, P. J., and C. S. Guy. 2004. First-year growth, condition, and size-selective winter mortality of freshwater drum in the lower Missouri River. Transactions of the American Fisheries Society 133:385-398.
Cavitt, J. F., A. T. Pearse, and J. F. Cully, Jr. 2004. The effects of food supplementation on nest attentiveness: is incubation mate feeding adaptive? Wilson Bulletin.
Horton, T. B., C. S. Guy, and J. Pontius. 2004. Influence of tracking interval on estimations of movement and habitat use. North American Journal of Fisheries Management 24: 690-696.

Kamler, J. F., and P. S. Gipson. 2004. Survival and cause-specific mortality among furbearers in a protected area. American Midland Naturalist 151:27-34.
Pearse, A. T., J. F. Cavitt, and J. F. Cully, Jr. 2004. Effects of food supplementation on female nest attentiveness and incubation Mate-feeding in two sympatric wren species. Wilson Bulletin: 116(1), pp.23-30.
Quist, M. C., J. L. Stephen, C. S. Guy, and R. D. Schultz. 2004. Age structure and mortality of walleyes in Kansas reservoirs: applications for establishing realistic management objectives. North American Journal of Fisheries Management 24:990-1002.
Quist, M. C., C. S. Guy, and R. J. Bernot. 2004. Anti-predator behavior of larval walleyes and saugeyes. Transactions of the Kansas Academy of Science: 69-76.
Quist, M.C., K. R. Pember, C. S. Guy, and J. L. Stephen. 2004. Variation in larval fish communities: implications for management and sampling designs in reservoir systems. Fisheries Management and Ecology 11:107-116.
Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2004. Factors related to growth and survival of larval walleyes: implications for recruitment in a southern Great Plains reservoir. Fisheries Research 67:215-225.
Sanchez, D. M., P. R. Krausman, T. R. Livingston, and P. S. Gipson. 2004. Persistence of carnivore scat in the Sonoran Desert. Wildlife Society Bulletin. 32:366-372.

2003

Cully, A. C., J. F. Cully, Jr., and R D. Hiebert. 2003. Exotic plant species in tallgrass prairie fragments. Conservation Biology 17:990-998.
Gipson, P. S., and J. F. Kamler. 2003. Capture locations of coyotes, *Canis latrans*, bobcats, *Lynx rufus*, and raccoons, *Procyon lotor*, relative to home range boundaries. Canadian Field-Naturalist 117:472-474.
Gipson, P. S., E. E. Bangs, T. N. Bailey, D. K. Boyd, H. D. Cluff, D. W. Smith, and M. D. Jiminez. 2003. Color patterns among wolves in western North America. Wildlife Society Bulletin 30:821-830.
Gipson, P.S., T. R. Livingston, G.L. Zuercher and M. E. Howard. 2003. Responses of Opossums and Raccoons to Bobcat and Coyote Feces. Western North American Naturalist 63 (4) 538-540.
Goeckler, J. M., M. C. Quist, J. A. Reinke, and C. S. Guy. 2003. Population characteristics and evidence of natural reproduction of blue catfish in Milford Reservoir, Kansas. Transactions of the Kansas Academy of Sciences 106:149-154.
Kamler, J. F., K. Keeler, G. Wiens, C. Richardson, and P. S. Gipson. 2003. Feral dogs, *Canis familiaris*, kill coyote, *Canis latrans*. Canadian Field-Naturalist 117:123-124.
Kamler, J. F., and P. S. Gipson. 2003. Space and habitat use by male and female raccoons, Procyon lotor, in Kansas. Canadian Field-Naturalist 117:218-223.
Kamler, J. F., K. Keeler, G. Wiens, C. Richardson, and P. S. Gipson. 2003. Feral dogs, *Canis familiaris*, kill coyote, *Canis latrans*. Canadian Field-Naturalist. 117:123-124.
Parker, T. H., B. M. Stansberry, C. D. Becker, and P. S. Gipson. 2003. Do melanin or carotenoid pigmented plumage ornaments signal condition and predict pairing success in the Kentucky warbler? Condor. 105:663-671.

Quist, M. C., C. S. Guy, R. D. Schultz, and J. L. Stephen. 2003. Latitudinal comparisons of walleye growth in North America and factors influencing growth of walleyes in Kansas reservoirs. North American Journal of Fisheries Management 23:677-692.

Quist, M. C., C. S. Guy, and J. L. Stephen. 2003. Recruitment dynamics of walleyes (*Stizostedion vitreum*) in Kansas reservoirs: generalities with natural systems and effects of a centrarchid predator. Canadian Journal of Fisheries and Aquatic Sciences 60:830-839.

Quist, M. C., P. A. Fay, C. S. Guy, A. K. Knapp, and B. N. Rubenstein. 2003. Effects of military training on terrestrial and aquatic communities on a grassland military installation. Ecological Applications 13:432-442.

Rivers, J. W., D. P. Althoff, P. S. Gipson, and J. S. Pontius. 2003. Evaluation of a reproductive index to estimate dickcissel reproductive success. Journal of Wildlife Management. 67:137-144.

Schrank, S. J., and C. S. Guy. 2003. Competitive interactions between age-0 bighead carp and paddlefish. Transactions of the American Fisheries Society 132:1222-1228.

Stansberry, B. M., T. H. Parker, J. M. S. Hutchinson, C. D. Becker, and P. S. Gipson. 2003. Settlement patterns of forest birds in a prairie landscape. Papers of the Applied Geography Conferences. 26:479-487.

Winter, S. L., J. F. Cully, Jr., and J. S. Pontius. 2003. Breeding season avifauna of prairie dog colonies and non-colonized areas in short-grass prairie. Transactions, Kansas Academy of Science 106:129-138.

Zuercher, G. L., P. S. Gipson, and G. C. Stewart. 2003. Identification of carnivore feces by local peoples and molecular analyses. Wildlife Society Bulletin. 31:961-970.

2002

Applegate, R. D., B. E. Flock, P. S. Gipson, M. W. McCoy, and K. E. Kemp. 2002. Home range of ring-necked pheasants in northwestern Kansas. The Prairie Naturalist. 34:21-29.

Applegate, R. D., P. S. Gipson, T. T. Cable, and K. R. Van Why. 2002. Attitudes of Kansas wild turkey hunters: National Wild Turkey Federation members vs nonmembers. Human Dimensions of Wildlife. 7:217-219.

Braaten, P. J., and C. S. Guy. 2002. Life history attributes of fishes along the latitudinal gradient of the Missouri River. Transactions of the American Fisheries Society 131:931-945.

Cully, J. F., Jr. 2002. Plague in black-tailed prairie dogs: implications for management at Thunder Basin National Grassland. Symposium proceedings, The history, ecology, and economy of the Thunder Basin prairie ecosystem. N. Geehan and J. B. Haufler, eds.

Fritz, K.M., Tripe, J.A. and Guy, C.S., 2002. Recovery of three fish species to flood and seasonal drying in a tallgrass prairie stream. Transactions of the Kansas Academy of Science, 105(3), pp.209-218.

Geyer, W.A., W. H. Fick, J. Carlisle and J. Barbur. 2002. Weed Management on Military Storage Gravel Lots. Transactions of the Kansas Academy of Science 105 (1-2), pp 66-71.

Gido, K.B., Guy, C.S., Strakosh, T.R., Bernot, R.J., Hase, K.J. and Shaw, M.A., 2002. Long-term changes in the fish assemblages of the Big Blue River basin 40 years after the

construction of Tuttle Creek Reservoir. Transactions of the Kansas Academy of Science, 105(3), pp.193-208.
Gipson, P. S., and J. F. Kamler. 2002. Bobcat killed by a coyote. Southwestern Naturalist 47:511-513.
Guy, C. S., R. A. Schultz, and C. A. Cox. 2002. Variation in gonad development, growth, and condition of white bass in Fall River Reservoir, Kansas. North American Journal of Fisheries Management 22:643-651.
Guy, C. S., R. D. Schultz, and M. A. Colvin. 2002. Ecology and management of white bass Morone chrysops. North American Journal of Fisheries Management 22:606-608.
Horton, T.B. and Guy, C.S., 2002. Habitat use and movement of spotted bass in Otter Creek, Kansas. In American Fisheries Society Symposium (Vol. 31, pp. 161-171).
Howard, M. E., G. L. Zuercher, P. S. Gipson, and T. R. Livingston. 2002. Efficacy of feces as an attractant for mammalian carnivores. Southwestern Naturalist. 47:348-352.
Kamler, J. F., and P. S. Gipson. 2002. Sarcoptic mange on coyotes in northeastern Kansas. Prairie Naturalist 34:143-144.
Kamler, J. F., P. S. Gipson, and C. C. Perchellet. 2002. Seasonal food habits of coyotes in northeastern Kansas. Prairie Naturalist 34:75-83.
Keller, A. D., and J. F. Cully, Jr. 2002. Small mammal responses to tallgrass prairie restoration from fescue pastures (Kansas). Ecological Restoration 20:279-280.
Madison, L.A., R.J. Robel, and D.P. Jones. 2002. Hunting Mortality and Overwinter Survival of Northern Bobwhites Relative to Food Plots in Kansas. Wildlife Society Bulletin 30: 1120-1127.
Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Seasonal variation in condition, growth, and food habits of walleyes in a Great Plains reservoir and simulated effects of an altered thermal regime. Journal of Fish Biology 61:1329-1344.
Schrank, S.J. and Guy, C.S., 2002. Age, growth, and gonadal characteristics of adult bighead carp, *Hypophthalmichthys nobilis*, in the lower Missouri River. Environmental Biology of fishes, 64(4), pp.443-450.
Schultz, R. D., C. S. Guy, and D. A. Robinson. 2002. Recruitment of white bass in Kansas reservoirs: relations to reservoir hydrology and gizzard shad. North American Journal of Fisheries Management 22:671-676.
Spears, B. L., W. B. Ballard, M. C. Wallace, R. S. Phillips, D. H. Holdstock, J. H. Brunjes, R. Applegate, P. S. Gipson, M. S. Miller, and T. Barnett. 2002. Retention times of miniature radiotransmitters glued to wild turkey poults. Wildlife Society Bulletin. 30:861-867.
Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 2002. Vegetation of prairie dog colonies and non-colonized shortgrass prairie. Journal of Range Management 55:502-508.

2001

Cox, C. A., R. A. Schultz, and C. S. Guy. 2001. Diets of white bass in Fall River Reservoir, Kansas. Journal of Freshwater Ecology. 16:429-433.
Cully, J. F., Jr. and E. S. Williams. 2001. Interspecific comparisons of sylvatic plague in prairie dogs. Journal of Mammalogy 82:894-905.

Gipson, P. S., and J. F. Kamler. 2001. Survival and home ranges of opossums in northeastern Kansas. Southwestern Naturalist. 46:178-182.
Hoover, D. S., P. S. Gipson, J. S. Pontius, and A. E. Hynek. 2001. Short-term effects of cattle exclusion on riparian vegetation in southeastern Kansas. Transactions of the Kansas Academy of Science. 104(3-4): 212-222.
Kretzer, J. A., and J. F. Cully, Jr. 2001. Black-tailed prairie dog effects on reptile and amphibian community composition in Kansas shortgrass prairie. Southwestern Naturalist 46:171-177.
Kretzer, J. A., and J. F. Cully, Jr. 2001. Prairie dog effects on harvester ant species diversity and density. Journal of Range Management 54:11-14.
Kretzer, J.E., and J. F. Cully, Jr. 2001. A new Kansas record for *Bolborhombus sallaei sallaei* Bates (*Coleoptera: Scarabaeidae*). Journal of the Kansas Entomological Society 74:56.
Madison, L.A., and R.J. Robel. 2001. Energy Characteristics and Consumption of Several Seeds Recommended for Northern Bobwhite Food Plantings. Wildlife Society Bulletin 29: 1219-1227.
Miller, S. D., and J. F. Cully, Jr. 2001. Black-tailed prairie dog (*Cynomys ludovicianus*) Conservation: Introduction to the Special Section. Journal of Mammalogy 82:889-893.
Quist, M. C., and C. S. Guy. 2001. Growth and mortality of prairie stream fishes and relations with instream habitat. Ecology of Freshwater Fish. 10:88-96.
Quist, M. C., R. J. Bernot, C. S. Guy, and J. L. Stephen. 2001. Seasonal variation in population characteristics of gizzard shad. Journal of Freshwater Ecology. 16(4): 641-646.
Schrank, S. J., C. S. Guy, M. R. Whiles, and B. L. Brock. 2001. Influence of instream and landscape-level factors on the distribution of Topeka shiners *Notropis topeka* in Kansas streams. Copeia 2001 (2)413-421.
Schrank, S. J., P. J. Braaten, and C. S. Guy. 2001. Spatiotemporal variation in density of larval bighead carp in the lower Missouri River. Transactions of the American Fisheries Society 130:809-814.
Smith, W.K., K.E. Church, J.S. Taylor, D.H. Rusch, and P.S. Gipson. 2001. Modified decoy trapping of male ring-necked pheasant (*Phasianus colchicus*) and northern bobwhite (*Colinus virginianus*). Game and Wildlife Science. 18:581-586.

2000

Bister, T.J., D.W. Willis, M.L. Brown, R.M. Neumann, S.M. Jordan, C.S. Guy, and M.C. Quist. 2000. Proposed standard weight (*Ws*) equations and standard length categories for 18 warmwater nongame and riverine fish species. *North American Journal of Fisheries Management* 20:570-574.
Burlingame, M.N., and C.S. Guy. 2000. Diversity among anglers in Kansas: A focus on channel catfish anglers. *Catfish 2000 Proceedings.*
Cully, J. F., Jr. and S. L. Winter. 2000. Evaluation of Land Condition Trend Analysis on a Kansas military training site. Environmental Management 25:625-633.
Cully, J. F., Jr. and H. L. Michaels. 2000. Henslow's sparrows habitat associations on Kansas tallgrass prairie. Wilson Bulletin 112:115-123.
Cully, J. F., Jr., L. G. Carter, and K. L. Gage. 2000. New records of sylvatic plague in Kansas. Journal of Wildlife Diseases 36:389-392.

Delp, J.G., J.S. Tillma, M.C. Quist, and C.S. Guy. 2000. Age and growth of four centrarchid species in southeastern Kansas streams. *Journal of Freshwater Ecology* 15:475-478.

Geyer, W.A., J. Carlisle, W. H. Fick and J. Barbur. 2000. Weed Management on Military Artillery Ranges. Transactions of the Kansas Academy of Science 103 (1-2), pp 58-63.

Gipson, P.S., W.B. Ballard, R.M. Nowak, and L.D. Mech. 2000. Accuracy and precision of estimating age of gray wolves by tooth wear. Journal of Wildlife Management 64:752-758.

Horton, T.B., J.S. Tillma, and C.S. Guy. 2000. Vulnerability of spotted bass to angling in Kansas streams. *Journal of Freshwater Ecology* 15:7-11.

Kamler, J.F., and P.S. Gipson. 2000. Home range, habitat selection, and survival of Bobcats, *Lynx rufus,* in a Prairie Ecosystem in Kansas. *The Canadian Field-Naturalist*. 114:388-394.

Kamler, J.F., and P.S. Gipson. 2000. New records of a porcupine and armadillo in Riley County, Kansas. Transactions of the Kansas Academy of Science. 103: 55-57.

Kamler, J.F., and P.S. Gipson. 2000. Space and habitat use of resident and transient coyotes. Canadian Journal of Zoology 78:2106-2111.

Kamler, J.F., P.S. Gipson, and T.R. Snyder. 2000. Dispersal characteristics of young bobcats from northeastern Kansas. Southwestern Naturalist 45:543-546.

Kamler, J. F., C. Richardson, and P. S. Gipson. 2000. Comparison of standard and modified soft catch traps for capturing coyotes, bobcats, and raccoons. Proceedings of the Eastern Wildlife Damage Management Conference. 9:64-69.

Matlack, R.S., P.S. Gipson, and D.W. Kaufman. 2000. The swift fox in rangeland and cropland in western Kansas: relative abundance, mortality, and body size. *The Southwestern Naturalist.* 45(2):221-225.

Stewart, A., S. Egbert, C. Lauver, E. Martinko, K. Price, D. Peterson, S. Park, C. Blodgett, and J. Cully. 2000. Land cover mapping for GAP: a hybrid classification approach to identifying the vegetation of Kansas. Photogrammetry and Remote Sensing

Winter, S.L., R.E. Charlton, and J.F. Cully, Jr. 2000. A new county breeding record for black-billed magpies: Symptom of habitat changes in a grassland landscape. Bulletin of the Kansas Ornithological Society 51:25-28.

1999

Ballard, W.B., and P.S. Gipson. 1999. Wolf. Chapter in Demarais, S., and P. Krausman (eds). Ecology and Management of Large Mammals in North America. Prentice Hall.

Braaten, P.J., and C.S. Guy. 1999. Relations between physicochemical factors and abundance of fishes in tributary confluences of the lower channelized Missouri River. Transactions of the American Fisheries Society. 128: 1213-1221.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1999. Comparison of age and growth estimates for river carpsuckers using scales and dorsal fin ray sections. North American Journal of Fisheries Management 19:786-792.

Cully, J. F., Jr. 1999. Lone star tick abundance, fire, and bison grazing in tallgrass prairie. *Journal of Range Manage*ment 52:139-144.

Cully, J. F., Jr., P. R. Lemons, II, and R. D. Applegate. 1999. Results of a wild turkey release in Kansas tallgrass prairie. *Prairie Naturalist* 31: 33-41.

Gipson, P.S., J.K. Veatch, R.S. Matlack, and D.P. Jones. 1999. Health status of a recently discovered population of feral hogs in the tall grass prairie region of Kansas. Journal of Wildlife Diseases. 35: 624-627.

Gipson, P.S., and C.D. Lee. 1999. Wild hogs in the Central United States: A new management challenge. Proceedings of the Feral Swine Symposium. 5:5-10.

Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1999. Exemption of bass tournaments from regulations: an opinion survey. North American Journal of Fisheries Management. 19:188-191.

Hoch, G. A., and J. F. Cully, Jr. 1999. Effects of temporal variability in ground data collection on classification accuracy. Geocarto International 14:5-11.

Pegg, M.A., K. Pope, C.S. Guy, and P. Fricano. 1999. Evaluation of current professional certification use. *Fisheries* 24(10):24-26.

Quist, M.C., and C.S. Guy. 1999. Variation in population characteristics of shovelnose sturgeon in the Kansas River. The Prairie Naturalist. 31:65-74.

Quist, M.C., J.S. Tillma, M.N. Burlingame, and C.S. Guy. 1999. Overwinter habitat use of shovelnose sturgeon in the Kansas River. Transactions of the American Fisheries Society. 128:522-527.

Tripe, J.A., and C.S. Guy. 1999. Spatial and temporal variation in habitat and fish community characteristics in a Kansas Flint Hills stream. Ecology of Freshwater Fish. 18:216-226.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1999. Influence of prairie dog colonies and climatic variation on bird communities in Kansas shortgrass prairie. *In:* Proceedings of the Fifth Prairie Conservation and Endangered Species Conference (eds. Jeffrey Thorpe, Taylor Steeves, and Mike Gollop), Provincial Museum of Alberta.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1999. Influence of prairie dogs on vegetation in Kansas shortgrass prairie. *In:* Proceedings of the Fifth Prairie Conservation and Endangered Species Conference (eds. Jeffrey Thorpe, Taylor Steeves, and Mike Gollop), Provincial Museum of Alberta.

1998

Gipson, P.S., and W.B. Ballard. 1998. Accounts of famous North American wolves. The Canadian Field-Naturalist. 112:724-739.

Gipson, P.S., W.B. Ballard, and R.M. Nowak. 1998. Famous North American wolves and the credibility of early wildlife literature. Wildlife Society Bulletin. 26:808-816.

Gipson, P.S., B. Hlavachick, and T. Berger. 1998. Range expansion by wild hogs across the central United States. Wildlife Society Bulletin. 26:279-286.

Guy, C.S., and S. L. Denson-Guy. 1998. Identifying and addressing variations in learning styles. *Fisheries* (Bethesda) 9:14-15.

Kamler, J.F., D.S. Pennock, C. Welch, and R.J. Pierotti. 1998. Variation in morphological characteristics of the white-footed mouse (*Peromyscus leucopus*) and the deer mouse (*P. maniculatus*) under allotopic and syntopic conditions. American Midland Naturalist 140:170-179.

Michaels, H.L., and J.F. Cully, Jr. 1998. Landscape and fine scale habitat associations of the Loggerhead Shrike. Wilson Bulletin 110(4):747-482.

Quist, M.C., and C.S. Guy. 1998. Population characteristics of channel catfish from the Kansas River, Kansas. Journal of Freshwater Ecology. 13(3):351-359.

Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (Ws) equation and length categories for shovelnose sturgeon. North American Journal of Fisheries Management. 18:992-997.

Tillma, J.S., C.S. Guy, and C.S. Mammoliti. 1998. Relations among habitat and population characteristics of spotted bass in Kansas streams. North American Journal of Fisheries Management. 18:886-893.

Tillma, J.S., and C.S. Guy. 1998. Growth of spotted bass in Kansas streams and impoundments. *The Prairie Naturalist*. 30:144-149.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1999. Influence of prairie dog colonies and climatic variation on bird communities in Kansas shortgrass prairie. *In:* Proceedings of the Fifth Prairie Conservation and Endangered Species Conference (eds. Jeffrey Thorpe, Taylor Steeves, and Mike Gollop), Provincial Museum of Alberta, Occasional Paper No. 24

1997

Braaten, P.J., and C.S. Guy. 1997. Stranding of *Pentagenia vittigera* following flow reductions in the lower Missouri River. Journal of Freshwater Ecology 12:493-494.

Cully, J.F., Jr., A.M. Barnes, T.J. Quan, and G. Maupin. 1997. Dynamics of plague in a Gunnison's prairie dog colony complex from New Mexico. Journal of Wildlife Diseases 33(4):706-719.

Cully, J.F., Jr. 1997. Growth and Life History Changes in Gunnison's prairie dogs after a plague epizootic. Journal of Mammalogy 78(1):146-157.

Gipson, P.S., B. Hlavachick, T. Berger, and C.D. Lee. 1997. Explanations for recent range expansions by wild hogs into midwestern states. Proceedings of the Great Plains Wildlife Damage Control Workshop. 13:148-150.

Gipson, P.S., C.D. Lee, M.L. Burenheide, J.F. Kamler, J.E. Kretzer, D.J. Martin, C.C. Perchellet, C.M. Willemssen, and J. Wiens. 1997. Experimental rodent control at the Beef Cattle Research Center, Kansas State University. Proceedings of the Great Plains Wildlife Damage Control Workshop. 13:117-123.

Tillma, J.S., and C. S. Guy. 1997. Catch rates and size structure of two ictalurids sampled in varying sizes of hoop nets. Journal of Freshwater Ecology 12:315-319.

Waters, D.S., C. S. Guy, and C. P. Clouse. 1997. Coded wire tag movement in paddlefish rostrums. Transactions of the American Fisheries Society 126:338-342.

1996

Cully, J.F. Jr. 1996. Book Review: Wobeser, G.A. Investigations and management of disease in wild animals. Plenum Press, New York, 256 pp. Journal of Mammalogy 77:904-907.

Cully, J. F., Jr. 1996. Black-tailed prairie dogs: key to the shortgrass prairie ecosystem. The Plains Keeper 10:2.

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1996. Coded wire tag loss from paddlefish: A function of study location. North American Journal of Fisheries Management 16:931-934.

Guy, C. S., D. W. Willis, and R. D. Schultz. 1996. Comparison of catch per unit effort and size structure of white crappies collected with trap nets and gill nets. North American Journal of Fisheries Management 16:947-951.

Hughes, J.P. and P.S. Gipson. 1996. Perceptions of wildlife damage by Conservation Reserve Program contract holders in Riley County, Kansas. Proceedings of the Vertebrate Pest Control Conference.

Knight, P.J., S.G. Lucas, and A.C. Cully. 1996. Early Pleistocene plants from the Albuquerque area, New Mexico. Southwestern Naturalist 41: 207-217.

Wiens, J. R., C. S. Guy, and M. L. Brown. 1996. A revised standard weight (W_s) equation for spotted bass. North American Journal of Fisheries Management 16:958-959.

1995

Block, W.M., F. Clemente, J. F. Cully, Jr., J.L. Dick, A.B. Franklin, J.L. Ganey, F.P. Howe, W.H. Moir, S.L. Spangle, S.E. Rinkevich, D.L. Urban, J.P. Ward, Jr., G.C. White, and R. Vahle. USDI Fish and Wildlife Service. 1995. Recovery Plan for the Mexican Spotted Owl (Strix oxidentalis lucida): Vol 1. Albuquerque, NM. 172 pp.

Fiedler, C.E., and J. F. Cully, Jr. 1995. A silvicultural approach to develop Mexican spotted owl habitat in southwest forests. Western Journal of applied Forestry 10:144-148

Guy, C. S., and D. W. Willis. 1995. Population characteristics of black crappies in South Dakota waters: a case for ecosystem-specific management. North American Journal of Fisheries Management 15:754-765.

Guy, C. S., and D. W. Willis. 1995. Growth of crappies in South Dakota waters. Journal of Freshwater Ecology 10: 151-161.

Guy, C. S., and S. L. Denson-Guy. 1995. An introduction to learning and teaching styles: Making the match. Fisheries (Bethesda) 20(3):18-20.

Madison, L.A., and P.S. Gipson. 1995. Wildlife damage control in Kansas: private operators and public agencies. Proceedings of the Eastern Wildlife Damage Control Conference. 7: 44-49.

Neumann, R.M., C.S. Guy, and D.W. Willis. 1995. Precision and size structure of juvenile percichthyid samples collected with various gears from Lake Texoma. North American Journal of Fisheries Management 15:956-962.

Richardson, C.D., P.S. Gipson, D.P. Jones, and J. Luchsinger. 1995. A long term management plan for feral pigs on Fort Riley Army Base, Kansas. Proceedings of the Eastern Wildlife Damage Control Conference. 7: 100-103

1994

Gipson, P.S., Matlack, R., Jones, D.P., Abel, H.J. and Hynek, A.E., 1994. Feral pigs, *Sus scrofa*. In Kansas. Proceedings of the North American Prairie Conference (Vol. 14, pp. 93-95).

Van Zee, B. E., C. S. Guy, and D. W. Willis. 1994. Electrofishing injury rates for largemouth bass, smallmouth bass, and bluegills collected with pulsed DC and high output, pulsed AC. Proceedings of the South Dakota Academy of Science 73:43-50.

Books and Book Chapters

2017

Albanese, G., and D. Haukos. 2017. Toward a theory of connectivity among depressional wetlands of the Southern Great Plains: resiliency to natural and anthropogenic disturbance within a wetland network. In Press in E. Beever, S. Prange, and J. Franklin (editors). Disturbance Ecology and Biological Diversity: Context, Nature, and Scale. CRC Press/Taylor and Francis Group

2016

Haukos, D.A., and C.W. Boal (editors). 2016. Ecology and Conservation of Lesser Prairie-Chickens. Studies in Avian Biology, No. 48, CRC Press, Boca Raton, FL. 371 pp.

Haukos, D.A., and J.C. Zavaleta. 2016. Habitat. Pages 99-132 in D.A. Haukos, and C.W. Boal (editors). Ecology and Conservation of Lesser Prairie-Chickens. Studies in Avian Biology (no. 48), CRC Press, Boca Raton, FL.

Haukos, D.A., J.C. Pitman, G.M. Beauprez, and D.D Schoeling. 2016. Harvest. Pages 133-158 in D.A. Haukos, and C.W. Boal (editors). Studies in Avian Biology (no. 48), CRC Press, Boca Raton, FL.

Haukos, D.A., A. Flanders, C.A. Hagen, and J.C. Pitman. 2016. Lesser Prairie-Chickens of the Sand Sagebrush Prairie. Pages 281-298 in D.A. Haukos, and C.W. Boal (editors). Ecology and Conservation of Lesser Prairie-Chickens. Studies in Avian Biology (no. 48), CRC Press, Boca Raton, FL.

Boal, C.W., and Haukos, D.A. 2016. The Lesser Prairie-Chicken: a brief introduction to the grouse of the Southern Great Plains. Pages 1-12 in D.A. Haukos, and C.W. Boal (editors). Ecology and Conservation of Lesser Prairie-Chickens. Studies in Avian Biology (no. 48), CRC Press, Boca Raton, FL.

Grisham, B.A., J.C. Zavaleta, A.C. Behney, P.K. Borsdorf, D.R. Lucia, C.W. Boal, and D.A. Haukos. 2016. Ecology and Conservation of Lesser Prairie-Chickens in Sand Shinnery Oak Prairies. Pages 315-344 in D.A. Haukos, and C.W. Boal (editors). Ecology and Conservation of Lesser Prairie-Chickens. Studies in Avian Biology (no. 48), CRC Press, Boca Raton, FL.

2014

Fencl, J.S. 2014. Slender Madtom. Pp. 287-288 in Eberle, M.E. and D. Edds (editors), Kansas Fishes. University Press of Kansas, Lawrence.

Fencl, J.S. 2014. Rock Bass. Pp. 358-359 in Eberle, M.E. and D. Edds (editors), Kansas Fishes. University Press of Kansas, Lawrence.

Hitchman, S.M. 2014. Freshwater Drum In M.E. Eberle and D. Edds (Eds.), Kansas Fishes (pp. 557-559). University Press of Kansas. Lawrence, KS.

2013

Haukos, D.A. 2013. Wetland Sampling Design and Logistics. Pages 1-48 In: Wetland Techniques, Volume I: Foundations. J.T. Anderson and C. A. Davis (editors). Springer, New York, New York.

Schultz, R. D., A. L. Fowler, J. M. Goeckler, and M. C. Quist. 2013. Comparisons of growth for hybrid striped bass in North America. Pages 219-227 in J. S. Bulak, C. C. Coutant, and J. A. Rice, editors. Biology and management of inland striped bass and hybrid striped bass. American Fisheries Society, Symposium, Bethesda, Maryland.

2012

Mather, M. E., D. L. Parrish, J. M. Dettmers. Now that you have great results, where should you submit your manuscript? 2012. Pages 121-124 *in* Scientific Communication for Natural Resources Professionals (Cecil Jennings, Thomas E. Lauer, and Bruce Vondracek, editors), American Fisheries Society, Bethesda, MD.

Smith, L.M., D.A. Haukos, and S. McMurry. 2012. High Plains Playas. Pages 299-311 In: Wetland Habitats of North America: Ecology and Conservation Concerns, D. Batzer and A. Baldwin (editors). University of California Press, Berkeley, CA.

2011

Haukos, D.A. 2011. Use of tebuthiuron to restore sand shinnery oak grasslands of the Southern High Plains. Pages 103-124 In Mohammed Naguib and Abd El-Ghany Hasaneen (Ed.), Herbicides – mechanisms and mode of action. ISBN: 978-953-307-744-4, InTech, Available from: http://www.intechopen.com/articles/show/title/use-of-tebuthiuron-to-restore-sand-shinnery-oak-grasslands-of-the-southern-high-plains

2010

Isermann, D. and C. P. Paukert. 2010. Regulating harvest. Pages 185-212 in: W. A. Hubert and M. C. Quist, editors. Inland Fisheries Management in North America, third edition. American Fisheries Society, Bethesda, Maryland.

Paukert, C. P and D. Galat. 2010. Large warmwater rivers. Pages 699-730 in: W. A. Hubert and M. C. Quist, editors. Inland Fisheries Management in North America, third edition. American Fisheries Society, Bethesda, Maryland.

2009

Gerken, J., and C. Paukert. 2009. Threats to paddlefish habitats. Pages 173-184 in: C. P. Paukert and G. Scholten, editors. Paddlefish management, propagation, and conservation in the 21st century: building from 20 years of research and management. American Fisheries Society, Bethesda, Maryland.

Hansen, K. A., and C. P. Paukert. 2009. Current management of paddlefish sport fishes. Pages 277-290 in: C. P. Paukert and G. Scholten, editors. Paddlefish Management,

Propagation, and Conservation in the 21st Century: Building from 20 years of Research and Management. American Fisheries Society, Bethesda, Maryland.
Paukert, C. P., and G. Scholten, editors. 2009. Paddlefish Management, Propagation, and Conservation in the 21st Century: Building from 20 years of Research and Management. American Fisheries Society, Bethesda, Maryland.
Peterson, J. T., and C. P. Paukert. 2009. Converting nonstandard fish sampling data to standardized data. Pages 195-214 in: S. A. Bonar, D. W. Willis, and W. A. Hubert, editors. Standardized Sampling Methods in North America. American Fisheries Society, Bethesda, Maryland.
Quinn, S. P., and C. P. Paukert. 2009. Centrarchid fisheries. Pages 312-339 in: S. J. Cooke and D. P. Phillip, editors. Centrarchid Fishes: Diversity, Biology, and Conservation. Blackwell Science, London.

2008

Collinge, S. K., C Ray, and J. F. Cully, Jr. 2008. Effects of disease on keystone species, dominant species, and their communities. Pps 129-144. In: Ostfeld, Evener, and Keesing (eds.) Infectious Disease Ecology: Effects of Ecosystems on Disease and of Diseases on Ecosystems. Princeton University Press.
Gerken, J. E. and G. L. Adams. 2008. Habitat use of grotto sculpin (*Cottus carolinae*) a troglomorphic fish in Perry County, Missouri. Proceedings of the National Cave and Karst Management Symposium.

2006

Cully, J. F., Jr., D. E. Biggins, and D. S. Seery. 2006. Conservation of black-tailed prairie dogs in areas with a history of sylvatic plague. Chapter 11 in Conservation of the Black-tailed Prairie Dog. J. L. Hoogland (ed).

2000

Zuercher, G.L., P.S. Gipson, and T.R. Livingston. 2000. Técnicas no agresivas para estudios de mamíferos depredadores en el bosque Atlántico interior. Pages 119-121. In E. Cabrera, C. Mercolli, and R. Resquin, (eds). Manejo de Fauna Silvestre en Amazonia y Latinoamérica. Ricor Grafic S.A., Asunción, Paraguay.
Zuercher, G.L., P.S. Gipson, K.E. DeMatteo, J. Short, M.J. Caliendo, W. Wite, P Jones, J. McInturff, J. Tarbox, and B. Whitsitt. 2000. Determinación de esencias atractivas para la captura de Jagua Yvyguy (Speothos venaticus) y otros mamíferos depredadores Neotropicales. Pages 101-102. In E. Cabrera, C. Mercolli, and R. Resquin, (eds). Manejo de Fauna Silvestre en Amazonia y Latinoamérica. Ricor Grafic S.A., Asunción, Paraguay.

1998

Ballard, W.B., and P.S. Gipson. 1999. Wolf. Chapter in Demarais, S., and P. Krausman (eds). Ecology and Management of Large Mammals in North America. Prentice Hall.

1996

Guy, C. S., H. L. Blankenship, and L. A. Nielsen. 1996. Tagging and marking. Pages 353-383 *in* B. R. Murphy and D. W. Willis, editors. Fisheries Techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Cully, A.C. 1996. Knowlton's cactus (*Pediocactus knowltonii*) reintroduction. *In* Strategies for reintroduction of endangered species. Pps 401-410. (Falk, D.A., C.I. Millar, and M. Olwell, *eds.*), Island Press.

1995

Gipson, P.S. and D.E. Brillhart. 1995. The coyote: An indicator species of environmental change on the Great Plains. Pages 305-307 in LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac., eds. 1995. Our living resources: A report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Services, Washington, DC. 530 pp.

Gipson, P.S. 1995. Wolves and the wolf literature: A credibility gap. Pages 346-353 in McIntyre, R. (ed.). War against the wolf: America's campaign to exterminate the wolf. Voyageur Press, Stillwater, MN. 495 pp.

1994

Green, J.S. and P.S. Gipson. 1994. Feral Dogs. Pages 123-129 in Hygnstrom, S.E. and R.M. Timm (eds.). Prevention and control of wildlife damage. University of Nebraska, Lincoln, NE. 310 pages.

Gipson, P.S. and R.F. Reidinger, Jr. 1994. Obtaining assistance to control wildlife damage. Pages 19-24 in Hygystrom, S.D. and R.M. Timm (eds.). Prevention and control of wildlife damage. University of Nebraska, Lincoln, NE. 310 pages.

Paul, W.J. and P.S. Gipson. 1994. Wolves. Pages 77-81 in Hygnstrom, S.E. and R.M. Timm (eds.). Prevention and control of wildlife damage. University of Nebraska, Lincoln, NE. 310 pages.

Technical Reports and Popular Publications

2015

Mather, M., K. Gerber, Z. Peterson. 2015. Assessing distribution and movement of blue catfish in Kansas reservoirs. Final Report to Kansas Wildlife, Parks, and Tourism.

2013

Sullins, D.S., and W.C. Conway. 2013. East Texas timberdoodles: winter in the pineywoods. Skydance 1:2-8. Woodcock Limited, Montoursville PA, USA.

Zavaleta, J. 2013. An annotated bibliography of the lesser prairie-chicken. Western Association of Fish and Game Agencies, Tucson, AZ. 550 pp.

2012

Conard, J.M. and R. Lauben. 2012. Patterns of habitat selection and densities of white-tailed deer at Quivira National Wildlife Refuge. Final Report

Haukos, D.A. 2012. Mottled Duck Focal Species Plan. U.S. Fish and Wildlife Service, Regional Migratory Bird Office, Albuquerque, New Mexico. 25pp.

2011

Johnson, L., D.A. Haukos, L.M. Smith, and S. McMurry. 2011. Current status and function of Southern Great Plains playas wetlands and evaluation of buffer effectiveness: Implications for future conservation efforts. Final Report U.S. Environmental Protection Agency Cooperative Agreement CD-966441-01-0, Playa Lakes Joint Venture Project #445, U.S. Fish and Wildlife Service/U.S. Geological Survey Cooperative Agreement # 1434-HQ-07-RM-0068; TCRWFU RWO 67

Smith, L.M., S. T. McMurry, J. O'Connell, and D.A. Haukos. 2011. Influence of U. S. Department of Agriculture Programs and Conservation Practices on Ecological Services Provided by Playa Wetlands in the High Plains; CEAP Wetlands Final Report to the USDA.

2010

Albanese, G. Davis, C. A. 2010. Monitoring distribution and habitat-use patterns of migrant shorebirds and assessing habitat quality of isolated wetlands in the mixed-grass prairie region. ODWC Final Report, 1801 N Lincoln, OKC, OK 73105. 46pp.

Albanese, G., Burris, L. Skagen, S. K. 2010. Implications of climate change for avian conservation in Great Plains landscapes. Great Plains Landscape Conservation Cooperative, USFWS. 68pp.

Cully, J. F., Jr. 2010. Black-tailed Prairie Dog Colony Mapping at the Kiowa and Rita Blanca National Grasslands. Project Report to the U.S.D.A., Forest Service, Cibola National Forest, Agreement Number Agreement Number 09-CS-11030300-012, Albuquerque, NM.

Whittier, J. B., and C. P. Paukert. 2010. Analysis of Movement of Relocated Humpback Chub in Shinumo Creek. Preliminary Report. National Park Service, Grand Canyon National Park.

2009

Bouska, W. W., C. P. Paukert, and T. Keane. 2009. Inventory and assessment of road-stream crossings for aquatic organism passage, with recommendations for culvert design. Final report, Kansas Department of Transportation, KTRANS Program, Project Number KSU 07-6, Topeka.

Gerken, J., and C. Paukert. 2009. Factors Influencing Threatened and Endangered Fishes in the Great Plains. Annual Performance Report to US Fish and Wildlife Service.

Paukert, C.P., J.L. Eitzmann, and J.E. Gerken. 2009. Distribution and Abundance of Fishes in the Kansas River. Final Report, Kansas Department of Wildlife and Parks, Project Number T-15-R-1, Pratt, Kansas.

Pigg, R. M., and J. F. Cully, Jr. 2009. Status and Management of Black-tailed Prairie Dogs on Small Cultural Parks of the Western Great Plains. Annual Report to U.S.G.S. N.R.P.P. Program and National Park Service.

Proffer, M., and C. P. Paukert. 2009. Zooplankton dynamics in Marion Reservoir. Report Submitted to US Army Corps of Engineers, Tulsa District, and Kansas Department of Wildlife and Parks, Emporia.

Shardlow, M., C. Paukert, K. Blecha, and P. Gipson. 2009. Distribution and population status of river otters in eastern Kansas. Final Report to Kansas Department of Wildlife and Parks, Pratt.

2008

Blecha, K.A., P. S. Gipson, J. M. Conard and J. Sellers. 2008. Deer of Quivira. Information Brochure, U.S. Fish and Wildlife Service, Quivira National Wildlife Refuge.

2007

Bouska, W. W. 2007. Stream crossings and fish conservation. Fisheries 32 (12): 609.

Paukert, C. P. 2007. Kaw River's big cats. Kansas Department Wildlife and Parks Magazine 64 (4):16-24.

Paukert, C. P., and J. T. Schloesser. 2007. Comparison of shovelnose sturgeon lengths collected in monofilament and multifilament gill nets. Report submitted to the US Fish and Wildlife Service, Columbia, MO.

Paukert, C. P., C. Berry, and K. Pope. 2007. Topeka shiner 5-year review and workshop. Summary report provided to the US Fish and Wildlife Service, Manhattan KS. 90 pages.

Schloesser, J. T., and C. P. Paukert. 2007. Walleye harvest restrictions to minimize gizzard shad impingement. Final report submitted to Wolf Creek Nuclear Operating Corporation. 27 January 2007.

VanNimwegen, R. 2007. Award-winning commitment. Nature 447:610.

2006

Whittier, J. B., C. P. Paukert, and K. Gido. 2006. Development of an Aquatic GAP for the Lower Colorado River Basin. Maxwell et al., editors. Gap Analysis Bulletin No. 14 USGS/BRD/Gap Analysis Program. Moscow, Idaho.

2003

Guy, C. S., W. K. Dodds, M. C. Quist, and R. J. Bernot. 2003. Stocking success and factors influencing survival and growth of stocked walleyes. Kansas Department of Wildlife and Parks, Project F-45-R-2, Emporia.

2002

Quist, M. C., E. Ryce, and T. Strakosh. 2002. An old and new face for the student subsection. Fisheries 27(2) 30-31.

2001

Gipson, P. S., B. E. Flock, R. D. Applegate, M. W. McCoy, and K. E. Kemp. 2001. Macro and micro-habitat use by ring-necked pheasants in northwestern Kansas. Final report to the Kansas Department of Wildlife and Parks.

Gipson, P. S., J. S. Johnson, and J. S. Pontius. 2001. Scent stations: a non-invasive tool to determine habitat selection and use of primitive roads by mammals. Final report to the United States Army, Fort Riley, Kansas.

Kalita, P., M. Hirschi, L. Schieferecke, S. Bhuyan, P. Woodford, and P. Gipson. 2000. WEPP model measures runoff and erosion on military training lands. Resource: engineering technology for a sustainable world. December: 13-14.

Van Why, K. R., R. D. Applegate, T. T. Cable, and P. S. Gipson. 2001. Survey of wild turkey hunters: experiences, opinions, and satisfactions. Kansas State University Agricultural Experiment Station and Cooperative Extension Service, Report 874. 25 pp.

2000

Guy, C.S., and M.R. Whiles. 2000. Assessment of physicochemical and landscape features influencing Topeka shiner (*Notropis topeka*) distribution in Kansas streams. Final Report, U.S. Geological Survey.

1999

Gipson, P.S., J.S. Johnson, and J.S. Pontius. 1999. Mammalian predator use of habitats and primitive roads in a prairie and forest ecotone on Fort Riley Military Reservation. Progress Report to the Integrated Training Area Management Program, Fort Riley, KS.

Kretzer, J.E. 1999. Herpetological and coleopteran communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas. To the U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office and U.S. Forest Service, Cimarron and Comanche National Grasslands. Submitted by J.F. Cully, Jr.

Quist, M. C., and C. S. Guy. 1999. Structure and function of fish communities on Fort Riley Military Reservation. Completion Report, Directorate of the Environment and Safety, Fort Riley Military Reservation, Fort Riley, Kansas.

Winter, S.L. 1999. Plant and breeding bird communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. To the U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office and U.S. Forest Service, Cimarron and Comanche National Grasslands. Submitted by J.F. Cully, Jr.

1998

Burlingame, M.N., and C.S. Guy. 1997. 1995 Kansas licensed angler use and preference survey and attitudes toward angling by secondary education students. Kansas Department of Wildlife and Parks, Final Report, Project F-37-R.

Gipson, P.S., and J.F. Kamler. 1997. Interspecific relationships of mammalian predators on Fort Riley Military Reservation. Progress Report to the Conservation Division, Fort Riley, Kansas. 17pp.

Gipson, P.S. 1997. Fencing riparian buffer zones in southeastern Kansas: Impacts on the breeding avifauna, vegetation, and habitat quality. Progress report to the Kansas Department of Wildlife and Parks. 4pp.

Hoover, D.E. and P.S. Gipson. 1997. Fencing riparian buffer zones in southeastern Kansas: Impacts on breeding avifauna, vegetation, and habitat quality. Final report to the Kansas Department of Wildlife and Parks. 59pp.

Pegg, M.A., L. Coyle, C.L. Pierece, P.J. Braaten, M. Doeringsfeld, and C.S. Guy. 1998. Age and growth of Missouri River benthic fishes. Pages 175-199 *in* Young, B.A., T.L. Welker, M.L. Wildhaber, C.R. Berry, and D. Scarnecchia, editors. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone rivers. 1997

Annual Report of Missouri River Benthic Fish Study, PD-95-5832, U.S. Army Corps of Engineers.
Tripe, J.A., and C.S. Guy. 1998. Seasonal variation of fish population characteristics in a warmwater stream. Kansas Department of Wildlife and Parks, Final Report, Project F-24-R.
Wiens, J.R., and C.S. Guy. 1997. Streambank revetment. Kansas State University, Technical Bulletin MF-2294, Manhattan.

1997

Braaten, P.J., and C.S. Guy. 1997. Section: Channelized II, Kansas. Pages 239-244 *in* D.J. Dieterman, M.P. Ruggles, M.L. Wildhaber, and D.L. Galat, editors. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. 1996 Annual Report of Missouri River Benthic Fish Study, PD-95-5832. U.S. Army Corps of Engineers.
Cully, J. F., Jr., and G. A. Kaufman. 1997. Kansas: An example of Gap Partnering. Gap Analysis Bulletin 6:29-31.
Cully, J.F., Jr., and G. Kaufman. 1997. Partnerships. Gap Analysis Bulletin No. 6, pp 53-56.
Matlack, R.S., and P.S. Gipson. 1997. Swift foxes on rangeland and cropland in western Kansas. Final report to the Kansas Department of Wildlife and Parks.
Quist, M.C. 1997. Diversity and the fisheries student. Fisheries 22(1):34.
Roper, Donna C., and Michael G. Hill Archaeological Survey for the Land Condition Trend Analysis (LCTA) Program, Fort Riley, Kansas. Department of Sociology/Anthropology/Social Work, Kansas State University, Manhattan, Kansas. Submitted to the U.S. Army Construction Engineering Research Laboratories. 1997. 71 pages.
Smith, W.K., and P.S. Gipson. 1997. Responses of pheasant to Conservation Reserve Program fields during courtship and brood rearing. Final report to the Kansas Department of Wildlife and Parks.
Tillma, J.S., and C.S. Guy. 1997. Evaluation of spotted bass populations in Kansas streams. Kansas Department of Wildlife and Parks, Final Report, Project F-27-R.

1996

Cully, J.F., Jr. 1996. Black-tailed prairie dogs: key to the shortgrass prairie ecosystem. Plains Keeper 10:2.
Guy, C. S., C. F. Blodgett, and K. P. Price. 1996. Feasibility of using geographical information system to assess licensed angler data. Completion Report, Kansas Department of Wildlife and Parks, Pratt.
Guy, C. S., W. D. Duffy, R. S. Holland, and R. W. Wiley. 1996. Review of the *Transactions of the American Fisheries Society*: Results of an author survey. Completion Report, American Fisheries Society, Bethesda, Maryland.
Smith, W. K. 1996. Use of Conservation Reserve Program lands by ring-necked pheasants in the high plains of Kansas, Nebraska, and South Dakota. Phase 1 Final Report to Kansas Department of Wildlife and Parks. Pratt, KS. 76 pp.

1995

Block, W. M., F. Clemente, J. F. Cully, Jr., J. L. Dick, Jr., A. B. Franklin, J. L. Ganey, F. P. Howe, W. H. Moir, S. L. Spangle, S. E. Rinkevich, D. L. Urban, R. Vahle, J.P. Ward, and G. C. White. 1995. Recovery plan for the Mexican spotted owl. U.S.D.I., Fish and Wildlife Service, Albuquerque, 172 pp.

Braaten, P. J., and C. S. Guy, editors. 1995. Population structure and habitat use of benthic fishes along the Missouri River. Corps of Engineers, Annual Report PD-95-5832.

Gipson, P.S. and R.F. Reidinger, Jr. 1995. Obtaining assistance to control wildlife damage. Pages A-19-24 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, editors. Prevention and control of wildlife damage, 2 volumes. University of Nebraska Cooperative Extension, Animal and Plant Health Inspection Service, Great Plains Agricultural Council. 822 pages.

Green, J.S. and P.S. Gipson. 1995. Feral dogs. Pages C-77-81 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, editors. Prevention and control of wildlife damage, 2 volumes. University of Nebraska Cooperative Extension, Animal and Plant Health Inspection Service, Great Plains Agricultural Council. 822 pages.

Paul, W.J. and P.S. Gipson. 1995. Wolves. Pages C-123-129 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, editors. Prevention and control of wildlife damage, 2 volumes. University of Nebraska Cooperative Extension, Animal and Plant Health Inspection Service, Great Plains Agricultural Council. 822 pages.

Theses and Dissertations

2015

Fencl, J.S. 2015. How big of an effect do small dams have?: using ecology and geomorphology to quantify impacts of low-head dams on fish biodiversity. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Mather)

Gerber, K.M. 2015. Tracking blue catfish: quantifying system-wide distribution of a mobile fish predator throughout a large heterogeneous reservoir. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Mather)

Gerken, J.E. 2015. Fish and invertebrate community response to flow magnitude in the Kansas River. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Paukert)

Kearns, B.V. 2015. Patterns and pathways of lead contamination in mottled ducks (*Anas fulvigula*) and their habitat. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Haukos)

Lautenbach, J.M. 2015. Lesser prairie-chicken reproductive success, habitat selection, and response to trees. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

Peterson, Z.J. 2015. Quantifying patterns and select correlates of the spatially and temporally explicit distribution of a fish predator (Blue Catfish, *Ictalurus furcatus*) throughout a large reservoir ecosystem. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Mather)

Plumb, R.T. 2015. Lesser prairie-chicken movement, space use, survival, and response to anthropogenic structures in Kansas and Colorado. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

Robinson, S. 2015. Landscape ecology, survival and space use of lesser prairie-chickens. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

2014

McDowell, S.K. 2014. Environmental availability and lead exposure to mottled ducks (*Anas fulvigula*) in the Texas Chenier Plains region. Master's Thesis, Stephen F. Austin State University. (Advisors: Conway/Haukos)

Moon, J.A. 2014. Mottled Duck (*Anas fulvigula*) ecology in the Texas Chenier Plain Region. Ph.D. Dissertation. Stephen F. Austin State University (Advisors: Conway/Haukos)

Pigg, R.M. 2014. Patterns and Processes of Dispersal of Black-Tailed Prairie Dogs in a Heavily Managed Landscape of the Great Plains Landscape Conservation Cooperative. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Cully)

Spencer, D.A. 2014. A Historical Record of Land Cover Change of the Lesser Prairie-chicken Range in Kansas. Master's Thesis. Department of Geography, Kansas State University. (Advisor: Daniels)

Stetter, A.P. 2014. Nest-site Selection, Duckling Survival, and Blood Parasite Prevalence of Lesser Scaup Nesting at Red Rock Lakes National Wildlife Refuge. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Haukos)

2013

Kennedy, C. 2013. Habitat Heterogeneity Concentrates Predators in the Seascape: Linking Intermediate-Scale Estuarine Habitat to Striped Bass Distribution. Master's Thesis. University of Massachusetts-Amherst. (Advisor: Mather)

Riecke, T.V. 2013. – Lead exposure and nesting ecology of black-necked stilts (*Himantopus mexicanus*) on the Upper Texas Coast. Master's Thesis. Stephen F. Austin State University (Advisors: Conway/Haukos)

Sullins, D.A. 2013. – Habitat use and origins of American woodcock wintering in east Texas. Master's Thesis. Stephen F. Austin State University (Advisors: Conway/Haukos)

2012

Fischer, J.L. 2012. Influence of sand dredging on habitat and fish communities of the Kansas River. Master's Thesis. Division of Biology, Kansas State University. (Co-Advisors: Paukert and Gido)

Goldberg, A.R. 2012. Apparent survival, dispersal, and abundance of black-tailed prairie dogs. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Moon, D. Small mammals in disturbed tallgrass prairie landscapes. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Smith, Joseph. 2012. Beaver dams maintain native fish biodiversity via altered habitat heterogeneity in a coastal stream network: Evaluating gear, quantifying fish assemblages, and testing ecological hypotheses. Ph.D. Dissertation. University of Massachusetts, Amherst, MA. (Advisor: Mather)

Zavaleta, Jennifer. 2012. Effects of grazing and herbicide treatments to restore degraded sand shinnery oak grasslands. Master's Thesis, Texas Tech University, Lubbock,TX. (Advisor: Haukos)

2011

Burak, Matt. 2011. Developing Standardized Metrics to Quantify the Temporal Distribution of Migrating Anadromous Herring: Comparing Adult Returns Across Coastal Rivers. Master's Thesis. University of Massachusetts, Amherst, MA. (Advisor: Mather)

Johnson, Lacrecia. 2011. Current status and function of playa wetlands on the Southern Great Plains. Ph.D. Dissertation, Texas Tech University, Lubbock Texas. (Advisor: Haukos)

2010

Severson, A.M. 2010. Effects of zebra mussel *(Dreissena polymorpha*) invasion on the aquatic community of A Great Plains reservoir. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

2009

Bussen, P. 2009. Analysis of a Rapid Soil Erosion Assessment Tool. MS Thesis. Department of Biological and Agricultural Engineering, Kansas State University. (Advisor: S.L. Hutchinson)

Conard, J.M. 2009. Genetic variability, demography, and habitat selection in a reintroduced elk (*Cervus elaphus*) population. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Gipson)

Shardlow, M.R. 2009. Factors affecting the detectability and distribution of the North American river otter. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

VanNimwegen, R.E. 2009. Behavioral ecology of grasshopper mice and deer mice. Ph.D. Posthumous. Division of Biology, Kansas State University. (Advisor: Cully)

2008

Bouska, W. W. 2008. Road crossing designs and their impact on fish assemblages and geomorphology of Great Plains streams. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Eitzmann, J.L. 2008. Spatial habitat variation in a Great Plains river: effects on the fish assemblage and food web structure. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Limb, R. 2008. The effects of disturbance on grassland plant communities. Ph.D. Dissertation, Oklahoma State University. (Advisor: Terrence G. Bidwell)

Pitts, K.L. 2008. Assessing threats to native fishes of the Lower Colorado River Basin. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Schloesser, J.T. 2008. Large river fish community sampling strategies and fish associations to engineered and natural river channel structures. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

2007

Althoff, P.S.S. 2007. Indicators of disturbance and recovery of a tallgrass prairie ecosystem following military vehicle traffic. Ph.D. Dissertation. Department of Agronomy, Kansas State University. (Advisor: Thien)

Fischer, J.R. 2007. Structural organization of Great Plains stream fish assemblages: Implications for sampling and conservation. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

2006

Baumgardt, J.A. 2006. The effects of trapping methods on estimation of population parameters for small mammals. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Flock, B.E. 2006. The effects of landscape configuration on northern bobwhite in southeastern Kansas. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Gipson)

Johnson, T.N. 2006. Ecological restoration of tallgrass prairie: grazing management benefits plant and bird communities in upland and riparian habitats. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Sandercock)

Makinster, A.S. 2006. Flathead catfish population dynamics in the Kansas River. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Paukert)

Strakosh, T.R. 2006. Effects of water willow establishment on littoral assemblages in Kansas reservoirs: Focus on Age-0 largemouth bass. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Gido)

Thiagarajan, B. 2006. Community dynamics of rodents, fleas and plague association with black-tailed prairie dogs. Ph.D. Dissertation. Division of Biology, Kansas State University. (Advisor: Cully)

2005

Althoff, P.S.S. 2005. Evaluation of soil quality indicators following disturbance by an Abrams M1A1 main battle tank. Master's Thesis. Department of Agronomy, Kansas State University. (Advisor: Thien)

Johnson, T.L. 2005. Spatial dynamics of a bacterial pathogen: Sylvatic plague in Black-tailed prairie dogs. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Newby, L.A. 2005. Effects of experimental manipulation of coterie size on demography of Black-tailed prairie dogs in South Dakota. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Stansberry, B.M. 2005. Landscape factors influencing the presence of migrant forest songbirds in the Kansas Flint Hills. Master's Thesis. Department of Geography, Kansas State University. (Advisor: Hutchinson)

2004

- - -

2003

Anderson, C. D. 2003. Recreational pressure at Fort Niobrara National Wildlife Refuge: Potential impacts on avian use and seasonal productivity along the Niobrara River. Master's Thesis. (Advisor: Becker)

Conard, J.M. 2003. Responses of small mammals and their predators to military disturbance in tallgrass prairie. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Jensen, W.E. 2003. Spatial variation in Brown-headed Cowbird (*Molothrus ater*) abundance and brood parasitism in Flint Hills Tallgrass Prairie. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Cully)

Proboszcz, S.L. 2003. Evaluation of habitat enhancement structure use by spotted bass in natural and experimental streams. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Wong, M. 2003. High spatial homogeneity in a sex-biased mating system: The genetic population structure of greater prairie chickens (*Tympanuchus cupido pinnatus*) in Kansas, Missouri, and Nebraska. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

2002

Quist, M.C. 2002. Abiotic factors and species interactions that influence recruitment of walleyes in Kansas reservoirs. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Guy)

Spears, B.L. 2002. Wild turkey pre-flight poult habitat characteristics and survival. Master's Thesis. Department of Wildlife Science, Texas Tech University. (Advisor: Ballard)

2001

Livingston, T.R. 2001. Coprophagy: An ecological investigation of the consumption of mammalian carnivore feces. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Rucker, A.D. 2001. Conversion of tall fescue pastures to tallgrass prairie in southeastern Kansas: Small mammal responses. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Zuercher, G.L. 2001. The ecological role of the Bush Dog, *Speothos venaticus*, as part of the mammalian predator community in the Interior Atlantic Forest of Paraguay. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Gipson)

2000

Braaten, P.J. 2000. Growth of fishes in the Missouri River and Lower Yellowstone River, and factors influencing recruitment of freshwater drum in the lower channelized Missouri River. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Guy)

Cully, A.C. 2000. The effects of size and fragmentation on tallgrass prairie plant species diversity. Ph.D. Dissertation. Division of Biology, Kansas State University (Advisor: Barkley)

Horton, T.B. 2000. Habitat Use and Movement of Spotted Bass in Otter Creek, Kansas. Master's Thesis. Division of Biology, Kansas State University (Advisor: Guy)

Schrank, S.J. 2000. Population Characteristics of Bighead Carp *Hypophthalmichthys nobilis* Larvae and Adults in the Missouri River and Interspecific Dynamics with Paddlefish *Polyodon spathula*. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Snyder, P.R. 2000. Assessment of Activity Transmitters Based on Behavioral Observations of Coyotes, Bobcats, and Raccoons. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Tripe, J.A. 2000. Density, growth, mortality, food habits, and lipid content of age-0 largemouth bass in El Dorado Reservoir, Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

1999

Kretzer, J.E. 1999. Herpetological and Coleoptera Communities of Black-tailed Prairie Dog Colonies and Non-colonized Areas of Southwest Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Quist, M.C. 1999. Structure and function of fish communities in streams on Fort Riley Military Reservation. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Rivers, J.W. 1999. Seasonal avian use patterns of farmed wetlands and nest predation dynamics in riparian grasslands dominated by reed canary grass (*Phalari arundinacea*). Master's Thesis. Division of Biology, Kansas State University (Co-Advisors: Cable and Gipson)

Winter, S.L. 1999. Vegetation and breeding bird communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

1998

Kamler, J.F. 1998. Ecology and interspecific relationships of mammalian predators on Fort Riley Military Reservation, Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

1997

Burlingame, M.N. 1997. 1995 Kansas licensed angler use and preference survey and attitudes towards angling by secondary education students. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

Hoch, G.A. 1997. Mapping and monitoring of disturbance from military training at Fort Riley Kansas and an investigation into the stability of grassland ecotones using satellite remote sensing. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Hoover, D.A. 1997. Vegetation and breeding bird assemblages in grazed and ungrazed riparian habitats in southeastern Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Matlack, R.S. 1997. The swift fox in rangeland and cropland in western Kansas: Relative abundance, mortality, and body size. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Gipson)

Michaels, H.L. 1997. Landscape and Fine Scale Habitat of the Loggerhead Shrike and Henslow's Sparrow on Fort Riley Military Reservation, Kansas. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Cully)

Tillma, J.S. 1997. Characteristics of spotted bass in southeast Kansas streams. Master's Thesis. Division of Biology, Kansas State University. (Advisor: Guy)

1996

Smith, W.K. 1996. Responses of ring-necked pheasants to the Conservation Reserve Program (CRP) during courtship and brood rearing in the western Great Plains. M.S. Thesis, Kansas State University, Manhattan. (Advisor: Gipson)

Wiens, J.R. 1996. Effects of tree revetments on the abiotic and biotic components in two Kansas streams. M.S. Thesis, Kansas State University, Manhattan. (Advisor: Guy)

Research Experience for Undergraduates (REU) Students

Robert Harris III (2015) - Carleton College - The Effect of Management Regime on Sex Ratios among Regal Fritillary (Speyeria idalia) Populations in the Central Great Plains (Mentors: Gene Albanese, David Haukos)

Lindsay Arick (2015) - University of Central Florida - Do confluences affect predator distribution in an temperate estuary? (Mentor: Martha Mather)

Casie Lee (2013) - University of California, Berkeley - The Thrill of Victory, the Agony of Defeat: Developing and Testing a Standard Protocol for Field Estimates of Short Term Growth in Fish Predators. (Mentor: Martha Mather)

Nervalis Medina-Echevarria (2012) - University of Puerto Rico in Humacao - Adult Regal Fritillary (*Speyeria idalia*) density among fire and grazing regimes at Konza Prairie with notes on the occurrence patterns of its host plant, Prairie Violet (Viola pedatifida). (Mentors: Gene Albanese, and David Haukos).

Judith Patterson (2011) - University of Illinois at Urbana-Champaign - Can crayfish influence ecosystem function?: exploring crayfish movement using PIT tags and mobile and stationary antennas (Mentor: Martha Mather)

Katherine White (2008) - Cornell University, NY - Evaluating fish habitat usage in the Kansas River at species and community levels (Mentors: Craig Paukert and Joe Gerken)

Auctavia Grant (2007) - Grambling State University, LA - The effects of grazing on Konza Prairie butterflies (Mentor: Jodi Whittier)

Andrea Marie Severson (2007) - Utah State University, UT - High water habitat: Fish populations in two Kansas River backwater areas (Mentor: Craig Paukert)

Jeffrey Eitzmann (2005) - Kansas State University, KS - Spatial and temporal patterns of blue suckers (*Cycleptus elongatus*) in the Kansas River, Kansas (Mentor: Craig Paukert)

Kristen Pitts (2004) - University of Wisconsin at La Crosse, WI - Effects of flooding on the fish distribution on Kings Creek, Kansas (Mentor: Craig Paukert)

Renae Schmitt (2000) - Creighton University, NE - The association between Brown-Headed Cowbird foraging and ungulate grazing on native tallgrass prairie (Mentor: Jack Cully)

Alexandra Latham (1999) - Illinois Wesleyan University, IL - Brown-headed Cowbird parasitism rates on ground nesting birds of the tallgrass prairie in bison-grazed and ungrazed habitats (Mentor: Jack Cully)

Hope Phillips (1999) - College of Saint Benedict, MN - Evaluation of population estimation by removal sampling in King's Creek (Mentor: Christopher Guy)

Sophie Parker (1998) - Wellesley College, MA - Dogs as models in the study of predator olfaction (Mentor: Phil Gipson)

Jamie S. Johnson (1997) - Michigan Technical University, MI - Habitat preferences of mammalian predators in the Flint Hills of Kansas (Mentor: Phil Gipson)

Aaron Pearse (1997) - Kansas State University, KS - Effects of food supplementation on incubation behavior of Bewick's Wrens (*Thryomanes bewickii*) and House Wrens (*Troglodytes aedon*) (Mentor: John Cavitt and Jack Cully)

Presentations

2016

Ashbaugh, H.M., W.C. Conway, D.P. Collins, D.A. Haukos, and C.E. Comer. 2016. Heavy metal concentrations within breeding snowy plovers in saline lakes of the Southern Great Plains of Texas, New Mexico, and Oklahoma. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.

Becker, T., A. Ahlers, and D. Haukos. 2016. A retrospective surveillance study of avian disease outbreaks in Kansas. Kansas Natural Resource Conference, Wichita, KS.

De la Piedra, Sylvia, Carlos Portillo-Quintero, Blake A. Grisham, Clint W. Boal, David A. Haukos, and Willard R. Heck. 2016. Time series analysis of remote sensing data as a management tool for the conservation of the lesser prairie-chicken (*Tympanuchus pallidicinctus*). 2016 Student Conference on Conservation Science - New York.

Duffie, L.E., C.E. Comer, W.C. Conway, D.A. Haukos, D.P. Collins, K.W. Farrish, R.J. Masse, and R.J. Taylor. 2016. Environmental mercury availability and accumulation in wetland sediments and blood of snowy plovers in the Southern Great Plains. Annual Meeting of the Society of Wetland Scientists, Corpus Christi, TX.

Duffie, L.E., C.E. Comer, W.C. Conway, D.A. Haukos, D.P. Collins, K.W. Farrish, R.J. Masse, and R.J. Taylor. 2016. Mercury concentrations in wetland sediments and blood of snowy plovers in the Southern Great Plains. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.

Fritts, S.R., B.A. Grisham, R.D. Cox, C.W. Boal, D.A. Haukos, and P. McDaniel. 2016. Assessing potential synergies between drought and grazing on lesser prairie-chicken demography. Annual Meeting of The Wildlife Society, Raleigh, North Carolina.

Fritts, S.R., B.A. Grisham, R.D. Cox, C.W. Boal, D.A. Haukos, and P. McDaniel. 2016. Influence of vegetation structure and composition on lesser prairie-chicken abundance, survival, and recruitment following an intense drought. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.

Fritts, S.R., B. A. Grisham, R. D. Cox, C. W. Boal, D. A. Haukos, P. McDaniel. 2016. Hierarchical modeling of lesser prairie-chicken demographic response to weather and grazing. Society of Range Management Annual Conference. Corpus Christi, TX.

Gerber, K. M., M. E. Mather, J. M. Smith, and Z. Peterson. 2016. Identifying overall, seasonal, and diel patterns for reservoir-wide distribution of Blue Catfish: filling critical gaps for fish ecology and fisheries management. American Fisheries Society. Kansas City, MO.

Godar, A.J., B.A. Grisham, B.E. Ross, C.W. Boal, S.R. Fritts, C.P. Griffin, C.A. Hagen, D.A. Haukos, M.A. Patten, and J.C. Pitman. 2016. Rangewide assessment of the influence of climate change on lesser prairie-chicken population persistence. North American Ornithological Congress, Washington, D.C.

Godar, A.J., B.A. Grisham, C.P. Griffin, S.R. Fritts, C.W. Boal, D.A. Haukos, J.C. Pitman, M.A. Patten, and C.A. Hagen. 2016. The influence of weather parameters on lesser prairie-chicken rangewide nest survival. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.

Godar, A.J., B.A. Grisham, B.E. Ross, C.W. Boal, C.P. Griffen, C.A. Hagen, D.A. Haukos, M.A. Patten, and J.C. Pitman. 2016. Incorporating contemporary statistical methods into long-

term ecological data: a case study on Lesser Prairie-Chickens. Kansas Natural Resource Conference, Wichita, KS.

Griffin, C.P., A.J. Godar, S.R. Fritts, D.U. Greene, B.A. Grisham, C.W. Boal, D.A. Haukos, J.C. Pitman, G.M. Beauprez, M.A. Patten, and C.A. Hagen. 2016. A range-wide assessment on the influence of anthropogenic structure dispersion and land cover patch size on lesser prairie-chicken lek attendance. NAOC, Washington, D.C.

Griffin, C.P., A.J. Godar, S.R. Fritts, B.A. Grisham, C.W. Boal, D.A. Haukos, J.C. Pitman, G.M. Beauprez, M.A. Patten, and C.A. Hagen. 2016. A range-wide assessment of the influence of anthropogenic features and landcover patterns on lesser prairie-chicken lek attendance. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.

Haukos, D.A., J.A. Moon, and W.C. Conway. 2016. At what scale should mottled ducks be managed? Special Session: Evolution, Ecology, and Conservation of Monotypic Ducks, 7th North American Duck Symposium, Annapolis, MD. (Invited)

Hitchman, S.M., M.E. Mather, J.M. Smith and J.S. Fencl. 2016. Viewing streams as a habitat mosaic; implications for riverscape ecology and stream conservation. American Fisheries Society. Kansas City, MO.

Kraft, J.D., D. Haukos, C. Hagen, and J. Pitman. 2016. Are larger pastures and sparser herds the way to manage grassland birds? A case-study of the lesser prairie-chicken. Annual Meeting of The Wildlife Society, Raleigh, NC. (Invited)

Kraft, J.D., D. Sullins, and D.A. Haukos. 2016. Evaluation of lesser prairie-chicken brood habitat selection across categorical habitats. Kansas Natural Resource Conference, Wichita, KS.

Kraft, J.D., D. Sullins, and D.A. Haukos. 2016. Dynamic interactions of Conservation Reserve Program, native grasslands, and lesser prairie-chicken habitat selection. Kansas Natural Resource Conference, Wichita, KS.

Kraft, J.D., D. Haukos, and C. Hagen. 2016. Implications of pasture area, grazing strategy, and region on lesser prairie-chicken habitat selection and vegetation. Annual Meeting of the Society of Range Management, Corpus Christi, TX.

Lane, T. C., J. A. Moon, B. A. Grisham, D. M. Head, D. A. Haukos, W. C. Conway. 2016. Habitat selection by waterfowl wintering at Anahuac National Wildlife Refuge. Annual meeting of the Texas Chapter of The Wildlife Society, San Antonio, Texas.

Lautenbach, J., D. Haukos, and C. Hagen. 2016. Satisfying the quilt work of habitat needs of the lesser prairie-chicken: the role of patch-burn grazing. Annual meeting of The Wildlife Society, Raleigh, NC.

Lautenbach, J., J. Lautenbach, and D. Haukos. 2016. Using patch-burn grazing to maintain prairie for lesser prairie-chickens. Kansas Natural Resource Conference, Wichita, KS.

Lautenbach, J., D. Haukos, R. Plumb, J. Pitman, and C. Hagen. 2016. Effects of tree encroachment on lesser prairie-chickens. Annual Meeting of the Midwest Fish and Wildlife Conference, Grand Rapids, MI.

Lautenbach, J., J. Lautenbach, and D. Haukos. 2016. Lesser prairie-chicken habitat and movement response to patch-burn grazing. Annual Meeting of the Midwest Fish and Wildlife Conference, Grand Rapids, MI.

Lautenbach, J., J. Lautenbach, and D. Haukos. 2016. Killing trees and maintaining prairie for lesser prairie-chickens through patch-burn grazing. Annual Meeting of the Society of Range Management, Corpus Christi, TX

Lipp, T., A. Gregory, and D. Haukos. 2016. Influence of sound on nesting ecology and home range characteristics of the lesser prairie-chicken. Annual Meeting of the Midwest Fish and Wildlife Conference, Grand Rapids, MI.

Luginbill, J., S.M. Hitchman and M.E. Mather. 2016. Effective aquatic conservation requires fisheries research for the "scape". American Fisheries Society. Kansas City, MO.

Malone, W.E.A., and D.A. Haukos. 2016. The influence of watershed condition on avian use of dry playa wetlands. Kansas Natural Resource Conference, Wichita, KS.

Mapes, R. L., M.E. Mather. Location, location, location: Incorporating spatial context into fisheries research. American Fisheries Society Meeting, Kansas City, MO, August 2016.

Mather, M.E., J. M. Smith. C. G. Kennedy, and R. T. Taylor. 2016. Mobile organisms in the 'scape': patterns, consequences, and challenges. American Fisheries Society. Kansas City, MO.

McCullough, K.E., G. Albanese, and D.A. Haukos. 2016. Re-thinking regal fritillary conservation and management: habitat characteristics and the impact of disturbance regime on an imperiled grassland butterfly. Annual meeting of The Wildlife Society, Raleigh, NC.

McCullough, K., G. Albanese, and D.A. Haukos. 2016. Habitat characteristics and the impact of disturbance regime on an imperiled grassland butterfly: re-thinking regal fritillary (*Speyeria idalia*) conservation and management. Kansas Natural Resource Conference, Wichita, KS.

Moon, J., S. DeMaso, M. Brasher, W. Conway, and D. Haukos. 2016. A stochastic model to simulate mottled duck population dynamics. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, TX.

Moon, J., S. Lehnen, K. Metzger, S. Sesnie, D. Haukos, and W. Conway. 2016. Integrating sea-level rise and anthropogenic change into mottled duck conservation. 7th North American Duck Symposium, Annapolis, MD.

Ogden, S. 2016. Grassland bird and butterfly responses to summer fire: Species- and community-level analyses tell different, yet encouraging stories. Annual Graduate Research Forum, Division of Biology.

Ogden, S. 2016. Patterns of Butterfly Community Composition in Response to Sericea lespedeza Control Using Fire and Grazing. Kansas Natural Resources Conference, Wichita, KS.

Ogden, S. 2016. Grassland Bird Community Response to Sericea lespedeza Control Using Fire and Grazing. Society for Range Management Annual Conference, Corpus Christi, TX.

Ogden, S., D. Haukos, K.C. Olson, J. Alexander, and J. Lemmon. 2016. Grassland bird community response to sericea lespedeza control using fire and grazing. Annual Meeting of the Midwest Fish and Wildlife Conference, Grand Rapids, MI

Ogden, S., D.A. Haukos, K.C. Olson, and J. Alexander. 2016. Birds, butterflies, and burning: wildlife response to summer fire used for invasive plant control in tall-grass prairie. Annual Meeting of The Wildlife Society, Raleigh, NC.

Peterson, Z., M. E. Mather, J. M. Smith, and K. M. Gerber. 2016. Correlates of the whole-system distribution of a reservoir predator (Blue Catfish, Ictalurus Furcatus). American Fisheries Society. Kansas City, MO.

Plumb, R.T., J.M. Lautenbach, S.G. Robinson, J.D. Kraft, D. Sullins, J. Lautenbach, D.A. Haukos, J.L. Winder, J.C. Pitman, C.A. Hagen, and D. Dahlgren. 2016. Lesser prairie-chicken space use response to anthropogenic structures among landscapes. North American Congress for Conservation Biology, Madison, WI. (Invited)

Robinson, S., R. Plumb, D. Haukos, C. Hagen, J. Pitman, and B. Sandercock. 2016. Come rain or no water, I will survive: nonbreeding lesser prairie-chicken survival and space use. North American Ornithological Congress, Washington, D.C.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2016. Combining multiple data sources to determine drought and land-use impacts on lesser prairie-chickens. North American Ornithological Congress, Washington, D.C.

Ross, B.E., D. Haukos, and P. Walther. 2016. Drivers of mottled duck pairs on the upper Texas Gulf Coast. 7th North American Duck Symposium, Annapolis, MD.

Skidmore, C., K.E., McCullough, G. Albanese, and D.A. Haukos. 2016. A distribution modeling approach to monarch butterfly density, host plant occurrence, and preferred habitat in the Flint Hills. Annual meeting of The Wildlife Society, Raleigh, NC.

Smith, J.M., M.E. Mather and Hitchman, S.M. 2016. Operationalizing riverscapes. American Fisheries Society. Kansas City, MO.

Smith, J. M., M. E. Mather, and K. M. Gerber. 2016. Seasonal and diel patterns of depth and temperature distribution of Blue Catfish in Milford Reservoir, Ks. American Fisheries Society. Kansas City, MO.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2016. Impacts of Conservation Reserve Program grasslands on lesser prairie-chicken populations in the northern extent of their range. Kansas Natural Resource Conference, Wichita, KS.

Sullins, D.S., and D.A. Haukos. 2016. Available foods and diets of lesser prairie-chickens in native and CRP grasslands of Kansas and Colorado. Kansas Natural Resource Conference, Wichita, KS.

Sullins, D.S., and D.A. Haukos. 2016. Lesser prairie-chicken foraging in native and CRP grasslands of Kansas and Colorado. Annual Meeting of The Wildlife Society, Raleigh, NC.

Sullins, D.S., D.A. Haukos, J. Kraft, J. Lautenbach, J. Lautenbach, R. Plumb, S. Robinson, and B. Ross. 2016. Conservation planning for lesser prairie-chickens among reproductive and survivorship landscapes of varying anthropogenic influence. North American Congress for Conservation Biology, Madison, WI. (Invited)

Sullins, D.S., and D.A. Haukos. 2016. Lesser prairie-chicken foraging in native and CRP grasslands of Kansas and Colorado. Annual Meeting of the Society of Range Management, Corpus Christi, TX.

Whitson, M.D., W.C. Conway, D.A. Haukos, and D. Collins. 2016. Seed bank potential of moist-soil managed fallow rice fields on the upper Texas coast. 7th North American Duck Symposium, Annapolis, MD.

Whitson, M.D., T.V. Riecke, W.C. Conway, D.A. Haukos, J.A. Moon, and P. Walther. 2016. Waterfowl identification skills by duck hunters on the upper Texas coast. 7th North American Duck Symposium, Annapolis, MD.

2015

Albanese, G., and D. Haukos. 2015. A framework for understanding connections within dense broad-scale habitat networks: prioritizing wetlands for conservation within a dynamic landscape. Annual meeting of the Society of Wetland Scientists, Providence, RI.

Ashbaugh, H.M., W.C. Conway, D.P. Collins, D.A. Haukos, and D. Klein. 2015. Snowy plover exposure to metals in sediment and water from saline lakes of the Southern Great Plains. Annual meeting of the Texas Chapter of The Wildlife Society, Corpus Christi, TX.

Becker, T., P. McBee, and D. Haukos. 2015. Occurrence and predictions of avian disease outbreaks in Kansas. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Becker, T., P. McBee, and D. Haukos. 2015. Occurrence and prediction of avian disease outbreaks in Kansas. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Duffie, L.E., W.C. Conway, C.E. Comer, D.A. Haukos, D.P. Collins, S.T. Saalfeld, and H.M. Ashbaugh. 2015. The potential roles of primary molt and parasite loads in declining snowy plovers in the Southern Great Plains. Annual Meeting of the New Mexico Ornithological Society, Roswell, NM.

Duffie, L.E., W.C. Conway, C.E. Comer, H.M. Ashbaugh, D.A. Haukos, and D.P. Collins. 2015. Primary feather molt in incubating snowy plovers in the Southern High Plains. Annual meeting of the Texas Chapter of The Wildlife Society, Corpus Christi, TX.

Fencl J.S., Mather M.E., Smith J.M., and S.M. Hitchman. 2015. Quantifying river fragmentation: impacts of low-head dams on geomorphology and fish biodiversity in the Neosho River, Kansas. 75th Midwest Fish and Wildlife Conference; Indianapolis, Indiana.

Fritts, S.R., B.A. Grisham, R.D. Cox, C.W. Boal, D.A. Haukos, and P. McDaniel. 2015. Hierarchical modeling of lesser prairie-chicken lek attendance, survival, and recruitment, in response to grazing and weather. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Fritts, S.F., B.A. Grisham, C.W. Boal, D.A. Haukos, M.A. Patten, C.E. Dixon, and W.R. Heck. 2015. Long-term evaluation of lesser prairie-chicken nest ecology in response to grassland restoration at two spatial scales. Annual Meeting of The Wildlife Society, Winnipeg, Manitoba.

Gerber, K.M. and M.E. Mather. 2015. A high retention methodology for surgically implanting telemetry tags in catfish. 2015 Kansas Natural Resource Conference, Wichita, KS.

Gerber, K.M., M.E. Mather, J.M. Smith, and Z. Peterson. 2015. Distribution patterns of individual fish predators (Blue Catfish) in a Midwestern reservoir. 75th Midwest Fish and Wildlife Conference, Indianapolis, IN.

Godar, A.J., C.P. Griffin, S.R. Fritts, B.A. Grisham, C.W. Boal, D.A. Haukos, J.C. Pitman, and C.A. Hagen. 2015. The influence of weather parameters on lesser prairie-chicken nest survival. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Godar, A.J., B.A. Grisham, C.W. Boal, and D.A. Haukos. 2015. Does microclimate explain regional variation in lesser prairie-chicken nest survival? Annual meeting of the Texas Chapter of The Wildlife Society, Corpus Christi, TX.

Godar, A.J., B.A. Grisham, C.W. Boal, and D.A. Haukos. 2015. Does microclimate explain regional variation in lesser prairie-chicken nest survival? Kansas Natural Resource Conference, Wichita.

Griffin, C.P., A.J. Godar, S.R. Fritts, B.A. Grisham, C.W. Boal, D.A. Haukos, and J.C. Pitman. 2015. A range-wide assessment of the influence of anthropogenic features on lesser prairie-chicken lek attendance. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Griffin, C.P., A.J. Godar, B.A. Grisham, C.W. Boal, D.A. Haukos, J.C. Pitman, and C.A. Hagen. 2015. A range-wide assessment of the influence of weather on lesser prairie-chicken demographic parameters. Annual meeting of the Texas Chapter of The Wildlife Society, Corpus Christi, TX.

Griffin, C.P., A.J. Godar, B.A. Grisham, C.W. Boal, and D.A. Haukos. 2015. Does weather influence lesser prairie-chicken demographic parameters is proportionately in the sand shinnery oak prairie compared to the sand sagebrush prairie? Joint Annual Meeting of the AZ/NM American NM Wildlife Societies, Las Cruces, NM.

Grisham, B.A., A.J. Godar, C.W. Boal, and D.A. Haukos. 2015. An assessment of lesser prairie-chicken nest microclimate and nest survival among three ecoregions. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Haukos, D., C. Boal, S. Carleton, and B. Grisham. 2015. Roles of Cooperative Research Units in contemporary conservation of natural resources. North American Wildlife & Natural Resources Conference, Omaha, NE. (Invited)

Haukos, D.A. 2015. History and function of the Cooperative Research Unit system. National Military Fish and Wildlife Association, North American Wildlife & Natural Resources Conference, Omaha, NE (Invited)

Haukos, D.A. 2015. Use of network analysis to identify wetlands critical to the playa system: prioritizing wetlands for conservation within a dynamic wetland landscape. Natural Resources and Environmental Sciences, Seminar Series, Kansas State University, Manhattan, KS (Invited)

Hitchman, S.M., M.E. Mather, J.M. Smith and J.S. Fencl. 2015. Are riffles keystone habitats in a low-gradient prairie stream?; implications for riverscape ecology and stream conservation. American Fisheries Society. Portland, Oregon.

Kraft, J.D., and D.A. Haukos. 2015. Landscape level habitat selection of female lesser prairie-chickens in western Kansas and eastern Colorado. International Grouse Symposium, Reykjavík, Iceland.

Kraft, J.D., D. Haukos, J. Pitman, and C. Hagen. 2015. Identifying drivers of lesser prairie-chicken habitat selection within western Kansas grazed lands. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Kraft, J.D., J. Lautenbach, D. Haukos, J. Pitman, and C. Hagen. 2015. Female lesser prairie-chicken response to grazing in western Kansas grasslands. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Kraft, J.D., J. Lautenbach, D. Haukos, J. Pitman, and C. Hagen. 2015. Female lesser prairie-chicken response to grazing in western Kansas grasslands. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Kraft, J.D., S.G. Robinson, R.T. Plumb, and D.A. Haukos. 2015. Landscape characteristics of home ranges of lesser prairie-chickens. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Kraft, J.D., J. Lautenbach, D.A. Haukos, J.C. Pitman, and C.A. Hagen. 2015. Female lesser prairie-chicken response to grazing practices in western Kansas grasslands. Annual Meeting of the Society of Range Management, Sacramento, CA.

Kraft, J.D., J. Lautenbach, D.A. Haukos, and J.C. Pitman. 2015. Seasonal habitat selection by female lesser prairie-chickens in varying landscapes. Kansas Natural Resource Conference, Wichita.

Lautenbach, J., and D. Haukos. 2015. Effect of pyric herbivory on vegetation composition with management implications for lesser prairie-chickens. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Lautenbach, J., R. Plumb, D. Haukos, J. Pitman, and C. Hagen. 2015. Effects of tree encroachment on lesser prairie-chickens. Annual Meeting of The Wildlife Society, Winnipeg, Manitoba.

Lehrter, R., M. E. Mather, M. Daniels. 2015. Fish biodiversity as a component of ecosystem function and indicator of environmental degradation in a Great Plains river. Governor's Water Conference, Poster.

Lipp, T., A. Gregory, and D. Haukos. 2015. Influence of sound on nest placement and success of the lesser prairie-chicken. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Malone, W.E.A., D.A. Haukos, and M.D. Daniels. 2015. Our essential freshwater source: estimating the occurrence and function of playa wetlands in western Kansas. Governor's Water Conference, Manhattan, Kansas.

Malone, W., and D.A. Haukos. 2015. The influence of watershed condition on avian use and diversity of playa wetlands in western Kansas. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Malone, W., and D.A. Haukos. 2015. The influence of watershed condition on avian use and diversity of playa wetlands in western Kansas. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas. (poster)

Malone, W.E.A., and D.A. Haukos. 2015. The influence of watershed condition on avian use of dry playa wetlands. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK. (poster)

Mapes. R. M., and M. E. Mather. 2015. Using the land mosaic concept to test how habitat heterogeneity alters the distribution of young-of-year largemouth bass in a Great Plains reservoir. North Central Division, American Fisheries Society, Indianapolis, IN.

Mapes, R., M. E. Mather, J. M. Smith, S. M. Hitchman, A. Earl, J. Romine. 2015. Is all heterogeneity created equal? how types of habitat heterogeneity differentially alter distribution, abundance, and diets of age-0 largemouth bass. American Fisheries Society, Portland, OR.

Mapes, R.L. Collection, and identification of larval fish. Kansas State University, American Fisheries Society Student Sub-Unit. Research, Manhattan, KS, April 2015.

Mapes, R.L. and Mather, M.E. Habitat and resource use of age-0 largemouth bass in a Great Plains reservoir. Lake Erie Center Brown Bag Seminar. University of Toledo – Lake Erie Center, July 2015.

Mather, M. E., R. Taylor, C. G. Kennedy, J. M. Smith, L. A. Deegan, J. T. Finn, K. M. Gerber. 2015. Trade-offs between site fidelity and local dispersal create heterogeneity in consumer-mediated habitat linkages in a disturbed seascape. Ecological Society of America, Baltimore, MD. (Symposium speaker and organizer).

McCullough, K., G. Albanese, and D.A. Haukos. 2015. Gradient habitat modeling of regal fritillary (*Speyeria idalia*) and larval host plant using distribution modeling approach with notes on life history attributes. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Nichter, A., T. Lipp, D. Haukos, and A. Gregory. 2015. Effects of anthropogenic noise on male lesser prairie-chicken lek attendance. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Ogden, S., D. Haukos, K. Olson, and J. Lemmon. 2015. Response of grassland passerine communities to tall-grass prairie restoration using summer fire and sheep grazing. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Ogden, S., D. Haukos, K.C. Olson, and J. Lemmon. 2015. Response of grassland passerine communities to tall-grass prairie restoration with summer fire and sheep grazing. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Ogden, S., D. Haukos, K.C. Olson, J. Alexander, and J. Lemmon. 2015. Grassland nesting bird community response to Sericea Lespedeza using fire and grazing. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Plumb, R.R., J.M. Lautenbach, S.G. Robinson, J.D. Kraft, D. Sullins, D.A. Haukos, J.C. Pitman, C.A. Hagen, and D. Dahlgren. 2015. Lesser prairie-chicken space use response to anthropogenic structures. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Plumb, R.R., J.M. Lautenbach, S.G. Robinson, J.D. Kraft, D. Sullins, D.A. Haukos, J.C. Pitman, C.A. Hagen, and D. Dahlgren. 2015. Lesser prairie-chicken space use response to anthropogenic structures among landscapes. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Riecke, T.V., J.A. Moon, D.A. Haukos, J.S. Sedinger, W.C. Conway, and P.S. Walther. 2015. An integrated population model for mottled ducks in Texas: harvest, habitat, and survival. Annual meeting of the Western Section of the Wildlife Society, Santa Rosa, CA.

Robinson, S., R.T. Plumb, J.M. Lautenbach, D.S. Sullins, J.D. Kraft, D.A. Haukos, C.A. Hagen, and J.C. Pitman. 2015. Functional relationships among lesser prairie-chicken survival, habitat type, and landscape fragmentation. International Grouse Symposium, Reykjavik, Iceland.

Robinson, S.G., and D.A. Haukos. 2015. The influence of habitat composition and configuration on lesser prairie-chicken survival rates in Kansas. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Robinson, S., R.T. Plumb, J.M. Lautenbach, D.S. Sullins, J.D. Kraft, and D.A. Haukos. 2015. Attributing landscape characteristics to lesser prairie-chicken survival in Kansas and Colorado. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Robinson, S., R. Plumb, D. Haukos, S. Carleton, A. Meyers, and J. Reitz. 2015. There is no space like home:space use of nonbreeding lesser prairie-chickens. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Robinson, S.G., R.T. Plumb, J.M. Lautenbach, D.A. Haukos, S. Carleton, A. Meyers, and J. Reitz. 2015. Space use by nonbreeding lesser prairie-chickens. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Robinson, S.G., D.A. Haukos, and J.C. Pitman. 2015. Nonbreeding season movement and space use of lesser prairie-chickens in Kansas. Kansas Natural Resource Conference, Wichita.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2015. Extreme drought events and changes in land cover interact to reduce resilience of the lesser prairie-chicken. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2015. Combining multiple data sources to determine drought and land-use impacts on lesser prairie-chickens. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2015. The relative influence of climate variability and landscape change on lesser prairie-chicken populations. Annual Meeting of The Wildlife Society, Winnipeg, Manitoba.

Sullins, D.S., and D.A. Haukos. 2015. Lesser prairie-chicken diets during brooding and winter. Annual Meeting of the Kansas Ornithological Society, Emporia, KS.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2015. Regional demographic variability for lesser prairie-chickens in Kansas and Colorado. Biennial meeting of the Prairie Grouse Technical Council, Nevada, Missouri.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2015. Regional demographic variability for lesser prairie-chickens in Kansas and Colorado. Annual meeting of the Central Mountains and Plains Section of The Wildlife Society, Manhattan, Kansas.

Sullins, D.S., W.C. Conway, D.A. Haukos, K.A. Hobson, L.I. Wassenaar, and C.E. Comer. 2015. American woodcock migratory connectivity as indicated by hydrogen isotopes. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Sullins, D.S., D.A. Haukos, and B.K. Sandercock. 2015. Population demographic sensitivity for the threatened lesser prairie-chicken. Joint meeting of American Ornithologists' Union and Cooper Ornithological Society, Norman, OK.

Sullins, D.S., and D.A. Haukos. 2015. Optimal nesting substrate drives lesser prairie-chicken habitat use in Kansas and Colorado. Kansas Natural Resource Conference, Wichita.

Taylor, R., M. E. Mather, C. G. Kennedy, J. M. Smith, K. M. Gerber. 2015. Confluence network dynamics can create a spatial mosaic of predator interactions. Poster, Ecological Society of America, Baltimore, MD.

2014

Catchcart, C.N., J. Brant, R. Mathews, G. Zurschmeide, M Troia, C. Ruffing and S.M. Hitchman. 2014. Long term fish community diversity and abundance in a Kansas River oxbow lake. Midwest Fish and Wildlife Conference. Kansas City, MO.

Fencl, J.S., M.E. Mather, S.M. Hitchman and J.M. Smith. 2014. Quantifying impacts of river fragmentation: How low-head dams alter geomorphology, fish biodiversity, and habitat in the Neosho River, Kansas, American Fisheries Society Meeting, Quebec, Canada.

Fencl, Jane, Martha Mather, Sean Hitchman and Joseph Smith. 2014. Quantifying impacts of river fragmentation: how low-head dams affect distributions of fish biodiversity and habitat in the Neosho River, Kansas. Graduate Student Research Forum, Division of Biology, Kansas State University.

Fencl, J. S., K. H. Costigan, M. E. Mather and S. M. Hitchman. 2014. How long is the dam footprint?: Applying methodology that quantifies the geomorphic extent of low-head

dams in the Neosho River basin, KS. Kansas Natural Resources Conference, Wichita, KS.

Gerber, K.M., M.E. Mather, J.M. Smith, and Z. Peterson. 2014. Patterns of variability in the distribution and movement of individual fish predators in a heterogeneous aquatic ecosystem. Presentation. 144th Annual AFS Conference, Quebec City, Quebec, Canada.

Gerber, Kayla, Martha Mather, Joseph Smith and Zach Peterson. 2014. Distribution and movement of predators in a heterogeneous aquatic ecosystem. Graduate Student Research Forum, Division of Biology, Kansas State University.

Griffin, C., A. Godar, B. Grisham, C. Boal, and D. Haukos. 2014. "Does weather influence lesser prairie-chicken demographic parameters disproportionately in the sand shinnery oak prairie compared to the sand sagebrush prairie?" Annual Meeting of the Oklahoma Ornithological Society, Stillwater, Oklahoma. Outstanding Student Poster.

Grisham, B., J. Lautenbach, R. Plumb, J. Kraft, J. Reitz, D. Sullins, C. Conring, A. Godar, C. Griffin, C. Boal, and D. Haukos. 2014. Does microclimate explain spatial variation in lesser prairie-chicken nest survival? Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Haukos, D. 2014. Status of prairie-chickens in Kansas. Konza LTER Docent Training, January 2014 (Invited)

Haukos, D.A. and G. Albanese. 2014. Conservation of Playa Wetlands at the Appropriate Scale - Using Networks to Identify Critical Playas. Department of Natural Resources Management Seminar, Texas Tech University, (Invited).

Haukos, D. Annual survival, recovery rates, and movements of mottled ducks banded on the western Gulf Coast. 2014. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Haukos, D. Summary of science behind impacts of wind power development on lesser prairie-chickens. 2014. Lesser Prairie-Chicken and Wind Energy: Pathways to Conservation & Compliance, American Wind Wildlife Institute, Broomfield, Colorado (Invited)

Hitchman, S.M., M.E. Mather, J.M. Smith and J.S. Fencl. 2014. Does heterogeneity in habitat type, size, and arrangement influence patterns of fish biodiversity in the Neosho River, Kansas? American Fisheries Society. Quebec City, Quebec, Canada.

Hitchman, Sean, Martha Mather, Jane Fencl and Joseph Smith. 2014. Heterogeneity influences patters of fish biodiversity at multiple scales. Graduate Student Research Forum, Division of Biology, Kansas State University.

Hitchman, S.M., M.E. Mather, J.M. Smith, and J.S. Fencl. 2014. Do FRAGSTATS sink or swim?; calculating metrics of heterogeneity for aquatic macrohabitat within the Neosho River, KS. Kansas Natural Resources Conference, Wichita, KS.

Kearns, B., S. McDowell, J. Moon, and D. Haukos. 2013. Spatial analysis and ecological risk assessment for lead exposure in Gulf Coast waterfowl: does environmental lead represent an ecological trap? Annual Meeting of the Ecological Society of America. Minneapolis, Minnesota.

Kearns, B., P. Walther, and D. Haukos. 2014. Developing a body condition index for mottled ducks on the upper Texas Gulf Coast. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Kearns, B., S. McDowell, J. Moon, W. Conway, and D. Haukos. 2014. The legacy of lead: developing new methods for assessing lead contamination and wildlife exposure risks in

Gulf Coast wetland habitats. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Kearns, B., S. McDowell, J. Moon, E. Rigby, and D. Haukos. 2014. Identifying landscape-level indicators of environmental contaminants that affect wildlife: a species distribution approach. Midwest Fish and Wildlife Conference, Kansas City, MO.

Kearns, B., P. Walther. W. Conway, and D. Haukos. 2014. A body condition index for non-breeding mottled ducks on the upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Impacts of tree encroachment on lesser prairie-chickens. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Survival and habitat selection of lesser prairie-chicken chicks and broods. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Differences in successful and unsuccessful nests of lesser prairie-chickens in Kansas and Colorado. Kansas Natural Resource Conference, Wichita, Kansas.

Lautenbach, J., R. Plumb, D. Haukos, and J. Pitman. 2014. Nest site location by lesser prairie-chickens in Kansas and Colorado. Midwest Fish and Wildlife Conference, Kansas City, MO.

McDowell, S., W. Conway, C. Comer, D. Haukos, and J. Moon. 2014. Lead exposure concentrations in the blood of mottled ducks (*Anas fulvigula*) on the Texas Chenier Plains National Wildlife Refuge Complex. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Mitchell, N., P. Borsdorf, C. Dixon, B. Grisham, D. Haukos, and C. Boal. 2014. Evaluation of capture techniques on lesser prairie-chicken trap injury. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Moon, J., D. Haukos, W. Conway, and S. Lehnen. 2014. Habitat selection of adult female mottled ducks in the Texas Chenier Plain Region. Annual meeting of the Texas Chapter of The Wildlife Society, Austin, TX.

Moon, J.A., D.A. Haukos, and W.C. Conway. 2014. Habitat selection by mottled ducks on the upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Moon, J.A., D.A. Haukos, and W.C. Conway. 2014. Movements by mottled ducks on the upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Peterson, Z.J., M.E. Mather, K.M. Gerber, and J.M. Smith. 2014. Evaluating the adequacy of fish-habitat data for the blue catfish. Upcoming Presentation. 144th Annual AFS Conference, Quebec City, Quebec, Canada.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, and D. Dahlgren. 2014. Breeding season habitat patch use by female lesser prairie-chickens in Kansas and Colorado. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, and D. Dahlgren. 2014. Effects of habitat patch use on breeding season survivorship of lesser prairie-chickens in Kansas and Colorado. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Breeding season space use dynamics of female lesser prairie-chickens in Kansas and Colorado. Symposium on Animal Movement and the Environment, Raleigh, North Carolina.

Plumb, R.T., J. Lautenbach, B. Ross, D. Spencer, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Past, Present, and Future: using historical and information to guide conservation decisions for an iconic prairie grouse of the southwestern Great Plains. Regional Pheasants Forever and Quail Unlimited Conference, Wichita, Kansas.

Plumb, R.T., J. Lautenbach, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Breeding season home-range characteristics of female lesser prairie-chickens in Kansas and Colorado. Kansas Natural Resource Conference, Wichita, Kansas.

Plumb, R., Lautenbach, J., R. Plumb, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Nest site location by lesser prairie-chickens in Kansas and Colorado. Midwest Fish and Wildlife Conference, Kansas City, MO.

Plumb, R., Lautenbach, J., R. Plumb, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2014. Effects of habitat patch selection on breeding season survivorship of lesser prairie-chickens in Kansas and Colorado. Midwest Fish and Wildlife Conference, Kansas City, MO.

Rigby, E., and D. Haukos. 2014. Duckling Survival and Habitat Selection for Mottled Ducks on the Upper Texas Gulf Coast. Mottled Duck Symposium, Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, Destin, Florida.

Robinson, S., R. Plumb, J. Lautenbach, D. Haukos, and J. Pitman. 2014. Nonbreeding season movement and habitat use of lesser prairie-chickens in Kansas. Joint meeting of American Ornithologists' Union, Cooper Ornithological Society, and Society of Canadian Ornithologists, Estes Park, Colorado.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2014. Changes in lesser prairie-chicken abundance in Kansas. Kansas Natural Resource Conference, Wichita, Kansas.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2014. The relative influence of drought and habitat on lesser prairie-chickens. Society for Conservation Biology, Missoula, Montana.

Ross, B., D. Haukos, C. Hagen, and J. Pitman. 2014. Combining multiple data sources to determine climate and land-use impacts on lesser prairie-chickens. Annual Meeting of The Wildlife Society, Pittsburgh, Pennsylvania.

Spencer, D., M. Daniels, and D. Haukos. 2014. A historical record of land cover change of the lesser prairie-chicken range in Kansas. Midwest Fish and Wildlife Conference, Kansas City, MO.

Stetter, A., J. Warren, and D. Haukos. 2014. Nest-site selection by scaup at Red Rock Lakes National Wildlife Refuge. Midwest Fish and Wildlife Conference, Kansas City, MO.

Stetter, A., J. Warren, and D. Haukos. 2014. Duckling survival at the edge of scaup range in Montana. Midwest Fish and Wildlife Conference, Kansas City, MO.

2013

Grisham, B., J. Zavaleta, C. Boal, and D. Haukos. 2013. Management of lesser prairie-chicken populations in shinnery oak-grasslands: priorities and future directions. Annual Meeting of the Texas Chapter of The Wildlife Society, Houston, Texas.

Grisham, B., C. Boal, D. Haukos, and W. Heck. 2013. Population demography of lesser prairie-chicken populations in shinnery oak grassland communities of New Mexico and Texas. Annual Meeting of the Society for Range Management (Invited), Oklahoma City, Oklahoma.

Haukos, D.A. 2013. Ecology and Conservation of Temporary Wetlands. Webinar, Natural Resource Conservation Service, (Invited).

Haukos, D.A. 2013. Lesser prairie-chicken response to restoration of sand shinnery oak grasslands in eastern New Mexico. Annual Meeting of the Society for Range Management (Invited), Oklahoma City, Oklahoma.

Haukos, D.A. 2013. Changing Landscapes and Grassland Birds: Effects and Conservation Strategies. Annual Meeting of the Colorado Chapter of The Wildlife Society (Invited Plenary), Colorado Springs, Colorado.

Haukos, D.A. 2013. The Future Role of Playa Wetlands for Waterfowl. 6th North American Duck Symposium, (Invited), Memphis, Tennessee

Haukos, D.A., J. Moon, and W. Conway. 2013. Survival of Mottled Ducks in the Texas Chenier Plain Region. 6th North American Duck Symposium, Memphis, Tennessee.

Kearns, B., D. Haukos, J. Moon, and E. Rigby. 2013. Species distribution in environmental decision-making: characterizing the efficacy of different models for use in habitat and wildlife management. Annual Meeting of the Society for Conservation GIS. Monterey, California.

Kearns, B., S. McDowell, J. Moon, and D. Haukos. 2013. Spatial analysis and ecological risk assessment for lead exposure in Gulf Coast waterfowl: does environmental lead represent an ecological trap? Annual Meeting of the Ecological Society of America. Minneapolis, Minnesota.

McDowell, S., W. Conway, C. Comer, and J. Moon. 2013. Blood lead concentrations in mottled ducks (*Anas fulvigula*) on the Texas Chenier Plain National Wildlife Refuge Complex. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

McDowell, S., W. Conway, C. Comer, and J. Moon. 2013. Potential exposure of mottled ducks (*Anas fulvigula*) to lead contaminated soil on the Texas Chenier Plains. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Moon, J.A., D.A. Haukos, W. Conway, and P. Walther. 2013. Movements of mottled ducks in the Texas Chenier Plain Region. 6th North American Duck Symposium, Memphis, Tennessee.

Moon, J.A., D.A. Haukos, W. Conway, and P. Walther. 2013. Habitat selection of mottled ducks in the Texas Chenier Plain. 6th North American Duck Symposium, Memphis, Tennessee.

Moon, J.A., D.A. Haukos, W. Conway, and P. Walther. 2013. Potential implications of climate change on the mottled duck. 6th North American Duck Symposium, Memphis, Tennessee. Poster

Pigg, RM, SM Wisely, C Lee, JF Cully, Jr. 2013. Broad-scale patterns of connectivity among black-tailed prairie dog colonies in a heavily managed landscape. American Society of Mammalogists Conference, Philadelphia, PA.

Plumb, R., J. Lautenbach, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2013. Adult female survival of lesser prairie-chickens in Kansas and Colorado. Biennial Prairie Grouse Technical Council Meeting, Crookston, MN

Plumb, R., J. Lautenbach, D. Haukos, J. Pitman, J. Augustine, K. Oxenrider, and D. Dahlgren. 2013. Breeding season movements of adult female lesser prairie-chickens in Kansas and Colorado. Biennial Prairie Grouse Technical Council Meeting, Crookston, MN

Riecke, T., W. Conway, C. Comer, and J. Moon. 2013. Causes of black-necked stilt nest failure at Anahuac National Wildlife Refuge. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Riecke, T., W. Conway, C. Comer, and J. Moon. 2013. Blood lead levels of black-necked stilts on the Texas Chenier Plain National Wildlife Refuge Complex. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Ross, B.E., M.B. Hooten, J.M. DeVink, and D.N. Koons. 2013. How biotic and abiotic factors affect spatio-temporal population dynamics of scaup. Ecology and Conservation of North American Waterfowl. Memphis, Tennessee.

Smith, J.M., M.E. Mather, S.M. Hitchman and J.S. Fencl. 2013. An evaluation of metrics that quantify the composition of fish communities in aquatic systems. Midwest Fish and Wildlife Conference. Wichita, KS.

Stetter, A., D. Haukos, and J. Warren. 2013. Parasitemia, health, and reproduction in lesser scaup at Red Rock Lakes National Wildlife Refuge. 6th North American Duck Symposium, Memphis, Tennessee.

Stetter, A., J. Warren, and D. Haukos. 2013. Duckling survival at the edge of scaup range in Montana. Annual Meeting of The Wildlife Society, Milwaukee, Wisconsin.

Sullins, D., W. Conway, C. Comer, K. Hobson, and I. Wassenaar. 2013. American woodcock connectivity as indicated by hydrogen isotope. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Whitson, M., W. Conway, C. Comer, and J. Moon. 2013. Vegetation and waterfowl response to temporal inundation variation in moist-soil managed fallow rice fields on the upper Texas Coast. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas. Poster.

Zavaleta, J., B. Grisham, D. Haukos, and C. Boal. 2013. Invertebrates of sand shinnery oak communities and the influence on lesser prairie-chicken brood survival. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

Zavaleta, J., P. Maloney, and D. Haukos. 2013. Understanding the human component for conservation in the sand shinnery oak grasslands. Annual Meeting of The Texas Chapter of The Wildlife Society, Houston, Texas.

2012

Albanese, G. 2012 (Invited speaker). A multi-scale examination of stopover habitat use by migrant shorebirds in the southern Great Plains. The Wildlife Society's 19th Annual Conference, Portland, OR.

Albanese, G., and Davis, C. A. 2012. Broad-scale relationships between migratory shorebirds and landscapes in the southern Great Plains. 9th Intercol International Wetlands Conference. Orlando, FL.

Albanese, G., and Davis, C. A. 2012. A comparative examination of within wetland and wetland context characteristics on stopover habitat use by migrant shorebirds: Is the neighborhood important? 9th Intercol International Wetlands Conference. Orlando, FL.

Albanese, G., Davis, C. A., and B. Compton. 2012. Spatiotemporal scaling of continental interior wetlands: Implications for shorebird conservation. International Association for Landscape Ecology 2012 annual symposium. Newport, RI.

Finn, J. T., M. E. Mather, M. K. Burak, R. M. Muth, J. B. Kim, and M. Sutherland. 2012. Evaluating new approaches to modeling data sets with many zeros: an example using anadromous fish counts. Ecological Society of America Meeting, Portland, OR.

Fischer, J., C. Paukert, and M. Daniels. 2012. Influence of in-stream and watershed alterations on sandbars and islands in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Gerber, K. M., M. E. Mather, Z. Peterson, J. M. Smith, J. Reinke, J. Goeckler. 2012. Where are those $$#@@ fish?; Distribution and movement of a top predator (blue catfish) in a large, highly-variable Midwestern reservoir. Midwest American Fisheries Society Meeting, Wichita, KS.

Grisham, B.A., C. Boal, and D.A. Haukos. 2012. The predicted influence of climate change on lesser prairie-chicken reproductive parameters. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

Haukos, D.A. 2012. Emerging issues related to diseases of migratory birds in the Great Plains. Annual meeting of the Disease Committee, Midwest Association of State Wildlife and Fisheries Agencies, Manhattan, Kansas.

Haukos, D.A. 2012. Playas of the Llano Estacado. Southern Plains Conference, Ogallala Commons, Muleshoe, Texas.

Haukos, D.A. 2012. Restoration of sand shinnery oak grasslands using prescribed grazing and herbicides. Special Session "LCCs: Bridging the science-management gap symposia" 73rd Midwest Fish and Wildlife Conference (Invited), Wichita, Kansas.

Haukos, D.A. 2012. The Great Plains LCC – Connections and Complexity. Joint Meeting of GPLCC Steering Committee and Science Team (Invited), Lubbock, Texas.

Mather, M. E., R. M. Muth, and H. J. Frank. 2012. Using the Adopt-A-Fish Program to Get Stakeholders Hooked on Conservation. North American Congress for Conservation Biology, Invited Speaker, Symposium, Oakland, CA.

Mather, M. E. Spatial patterns of striped bass. 2012. All Scientists Meeting, Plum Island Long Term Ecological Research, Woods Hole, MA. Invited

Mattson, B., M. Runge, R. Clark, J. Eadie, D. Haukos, J. Fleskes, W. Thogmartin, and K. Gynn. 2012. A modeling framework to integrate harvest and habitat management of North American waterfowl: case-study of northern pintail metapopulation dynamics. 19th Annual Conference, The Wildlife Society, Portland, Oregon.

McDowell, S.K., W. Conway, and D. Haukos. 2012. Potential exposure to environmental lead in mottled ducks (Anas fulvigula) on the Texas Chenier Plains National Wildlife Refuge Complex. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

McRoberts, J.T., W. Ballard, H. Whitlaw, M. Butler, M. Wallace, and D. Haukos. 2012. Aerial surveys for lesser prairie-chicken leks: detectability and disturbance response. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

Moon, J.A., D.A. Haukos, and W. Conway. 2012, Potential climate change impacts to mottled ducks on the Chenier Plain Region of Texas. Texas Chapter of The Wildlife Society, Fort Worth, Texas.

Peterson, Z., K. Gerber., M. E. Mather, and J. Smith. 2012. Quantifying spatially-explicit patterns in a large reservoir: an approach for determining associations between a top fish predator and physical habitat. Midwest American Fisheries Society Meeting, Wichita, KS. Poster

Riecke, T.V., W. Conway, and D.A. Haukos. 2012. Nest success and nest site selection of black-necked stilts on the Texas Chenier Plain National Wildlife Refuge Complex. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

Smith, J. M., M. E. Mather, J. Fencl, and S, M. Hitchman. 2012. Stopping biodiversity loss: An evaluation of metrics that quantify the composition of fish communities in aquatic ecosystems. Midwest American Fisheries Society Meeting, Wichita, KS.

Sullins, D.A., W. Conway, and D. Haukos. 2012. American woodcock (*Scolopax minor*) habitat suitability and occupancy in eastern Texas. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

Zavaleta, J.C., D.A. Haukos, and C. Boal. 2012. Community response to use of prescribed grazing and herbicide for restoration of sand shinnery oak grasslands. 48th Annual Meeting, Texas Chapter of The Wildlife Society, Fort Worth, Texas.

2011

Albanese, G., and Davis, C. A. 2011. Spatiotemporal scaling of continental interior wetlands: Implications for shorebird conservation. Waterbird Society 2011 annual meeting. Grand Island, NE.

Boal, C., D. Haukos, and B. Grisham. 2011. Understanding the ecology, habitat use, phenology and thermal tolerance of nesting lesser prairie-chickens to predict population level influences of climate change. Great Plains Landscape Conservation Cooperative, Fort Robinson, Nebraska.

Daniel, D., S. McMurry, L. Smith, and D. Haukos. 2011. Effects of Conservation Reserve Program on size, sediment depth, and volume loss in playa wetlands. 36th Annual Great Plains Limnology Conference, Texhoma, Texas.

Daniels, M. K., J. Fischer, K. Costigan, J. Gerken, and C. Paukert. 2011. Making sense of an intensively modified sediment regime: measuring the relative impact of in-channel dredging amidst reservoir trapping and network-scale incision in the Kansas River basin. International Symposium on the Interactions between Sediment and Water. Dartington, England.

Fischer, J. J. Gerken, C. Paukert, and M. Daniels. 2011. Habitat and fish community response to sand dredging in a large Great Plains river. American Fisheries Society Annual Meeting, Seattle, WA.

Fischer, J., C. Paukert, J. Gerken, and M. Daniels. 2011. Influence of sand dredging on fish communities in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Fischer, J., J. Gerken, C. Paukert, and M. Daniels. 2011. Habitat and fish community response to sand dredging in a large Great Plains river. Midwest Fish and Wildlife Conference, Des Moines, IA.

Gerken, J., and C. Paukert. 2011. Age-specific demography of silver carp: implications for management and control. American Fisheries Society Annual Meeting, Seattle, WA.

Gerken, J., and C. Paukert. 2011. Can silver carp be controlled? Population level response to various management regimes. Midwest Fish and Wildlife Conference, Des Moines, IA.

Gerken, J., and C. Paukert. 2011. The importance of high flows and floodplain inundation for fish and invertebrates of the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Goldberg, A., and J. F. Cully. 2011. Estimated Apparent Survival of Black-tailed Prairie Dogs at Four Small National Parks Using the Robust Design in Program MARK. American Society of Mammalogists Annual Meeting, Portland Oregon.

Goldberg, A., and J. F. Cully. 2011. Apparent Survival of Black-tailed Prairie Dogs at Four Small National Parks Using the Robust Design in Program MARK. 72nd Midwest Fish and Wildlife Conference, Des Moines, Iowa.

Grisham, B., C. Boal, and D. Haukos. 2011. A ten year assessment of herbicide treatment and grazing on nest site selection and daily nest survival of lesser prairie-chickens in New Mexico. Prairie Grouse Technical Council, Hays, Kansas.

Grisham, B., C. Boal, and D. Haukos. 2011. Thermal ecology of nesting lesser prairie-chickens and the potential implications of climate change. 18th Annual Meeting of The Wildlife Society, Waikoloa, Hawaii.

Grisham, B., C. Boal, and D. Haukos. 2011. Thermal tolerances of nesting lesser prairie-chickens and the potential population level influence of climate change. Joint Meeting of the Association of Field Ornithologists, Cooper Ornithological Society, and the Wilson Ornithological Society, Kearney, Nebraska.

Grisham, B., C. Boal, and D. Haukos. 2011. Understanding the thermal tolerance of nesting lesser prairie chickens to predict population level influence of climate change. Annual Meeting of the Texas Chapter of The Wildlife Society, San Antonio, Texas.

Haukos, D.A. 2011. Migratory Bird Program and National Wildlife Refuges: a partnership. Texas Coastal NWR Biologists meeting, Rockport, Texas.

Haukos, D.A. 2011. The High Plains: Connecting Ecosystems. Great Plains Landscape Conservation Cooperative Science Team Meeting, Oklahoma City, Oklahoma.

Haukos, D.A. 2011. 2011 Water Issues Forum: Kansas in Transition. Kansas Water Board, Hays, Kansas.

Haukos, D.A. 2011. The High Plains: making sense of a complex system. Webinar, Great Plains Landscape Conservation Cooperative, September 2011. (Invited).

Haukos, D.A. 2011. The influence of playa wetlands on High Plains biodiversity. Ecology of Waterbird Migration and Playa Wetland Ecology Symposia, Rainwater Basin Joint Venture/Playa Lakes Joint Venture Research Symposium; Annual Meeting of The Waterbird Society, Grand Island, Nebraska.

Haukos, D.A., and E. Rigby. 2011. A matrix population model for mottled ducks on the western Gulf Coast of Texas. The West Gulf Coast Plain and Big Thicket Science Conference, Nacogdoches, Texas.

Haukos, D.A., and P.McDaniel. 2011. Use of grazing management to restore lesser prairie-chicken habitat in eastern New Mexico. Prairie Grouse Technical Council, Hays, Kansas.

Haukos, D.A., L.A. Johnson, L.M. Smith, and S. McMurry. 2011. Effectiveness of vegetative buffer areas surrounding playa wetlands. Ecology of Waterbird Migration and Playa Wetland Ecology Symposia, Rainwater Basin Joint Venture/Playa Lakes Joint Venture Research Symposium; Annual Meeting of The Waterbird Society, Grand Island, Nebraska.

Kennedy, C. G., M. E. Mather, J. T. Finn, L. A. Deegan. 2011. The geomorphic complexity of a New England estuary and its role in shaping seasonal habitat use and site fidelity of striped bass on a foraging migration. Annual meeting of the American Fisheries Society, Seattle, WA.

Kennedy, C. G., M. E. Mather, J. T. Finn, L. A. Deegan. 2011. The complexity of habitat complexity: how physical features of a New England estuary shape seasonal habitat use of migratory striped bass. CERF meeting, FL.

Mather, M. E. 2011. Migratory fish in estuarine landscapes: can anadromous fish provide a general ecological framework for understanding distribution, habitat use, and movement? North American Benthological Society, Providence, RI.

Mather, M. E., J. M. Smith, J. Gerken, J. Patterson. 2011. Can animal movement change the outcome of ecological interactions in a grassland ecosystem? Grasslands in an International Context, Symposium, Kansas State University, Manhattan, KS.

Mattson, B., M. Runge, R. Clark, J. Eadie, D. Haukos, J. Fleskes, W. Thogmartin, and K. Gynn. 2011. A modeling framework to integrate harvest and habitat management of North American waterfowl: case-study of northern pintail metapopulation dynamics. 18th Annual Meeting of The Wildlife Society, Waikoloa, Hawaii.

McMurry, S., L. Smith, and D. Haukos. 2011. Sedimentation and volume loss in cropland, grassland, and CRP playas. Ecology of Waterbird Migration and Playa Wetland Ecology Symposia, Rainwater Basin Joint Venture/Playa Lakes Joint Venture Research Symposium; Annual Meeting of The Waterbird Society, Grand Island, Nebraska.

McRoberts, J.T., W. Ballard, H. Whitlaw, M. Butler, M. Wallace, and D. Haukos. 2011. Detectability of lesser prairie-chicken lets from aerial surveys. 18th Annual Meeting of The Wildlife Society, Waikoloa, Hawaii.

Moon, J., D. Haukos, W. Conway, and P. Walther. 2011. Habitat use and movements of adult mottled ducks on the Texas Chenier Plain. Annual Meeting of The Texas Chapter of The Wildlife Society, San Antonio, Texas.

O'Connell, J., L. Smith, S. McMurry, and D. Haukos. 2011. Effects of land management on plant communities of playa wetlands. Ecology of Waterbird Migration and Playa Wetland Ecology Symposia, Rainwater Basin Joint Venture/Playa Lakes Joint Venture Research Symposium; Annual Meeting of The Waterbird Society, Grand Island, Nebraska.

Pigg, R., T. Johnson, and J. F. Cully. The influence of landscape features on the disease ecology of sylvatic plague. Fifth Biennial Meeting of the International Biogeographical Society, 7-11 January 2011. Crete.

Pigg, R., T. Johnson, and J. F. Cully. The influence of landscape features on the disease ecology of sylvatic plague. 72nd Midwest Fish and Wildlife Conference, Des Moines, Iowa, 4-7 December 4-7, 2011.

Smith, L., D. Haukos, and S. McMurry. 2011. Ecosystem services and playas of the U.S. Great Plains. Joint Meeting of Society of Wetland Scientists, Wetpol, and Wetland Biogeochemistry Symposium, Prague, Czech Republic.

Smith, L., D. Haukos, and S. McMurry. 2011. Ecosystem services provided by High Plains playas; status and needs. Special Session CEAP-Wetlands, Soil and Water Conservation Society, Washington, D.C.

2010

Bouska, W. W., and C. P. Paukert. 2010. Road crossing designs, their effect on prairie stream fishes, and an update on the Topeka shiner. Dakota Chapter of the American Fisheries Society annual meeting, Spearfish, SD.

Burak, M. K., M. E. Mather, J. T. Finn, J. B. Kim, and R. M. Muth. 2010. Identification of the timing and magnitude of anadromous alewife spawning migrations in three coastal Massachusetts rivers. Northeastern Division American Fisheries Society, Newton, MA.

Conway, W., and D. Haukos. 2010. Distributional records of tiger beetles (*Coleoptera:Cicindelidae*) in saline lakes of the Southern High Plains of Texas. Bright Ideas Conference, Stephen F. Austin State University, Nacagdoches, Texas.

Conway, W., and D. Haukos. 2010. Tiger beetles (Coleoptera:Cicindelidae) in saline lakes of the Southern High Plains of Texas. Annual Meeting Southwestern Association of Naturalists, Junction, Texas.

Cormier, R., H. J, Frank, M. E. Mather, R. M. Muth, J. M. Smith, J. T. Finn. 2010. Relationship between movements of anadromous alewives and large- and small-scale habitat features. Northeastern Division American Fisheries Society, Newton, MA.

Cully, J., R. Pigg, and A. Goldberg. 2010. Sustainability of black-tailed prairie dogs at small culture parks of the western Great Plains. 22nd North American Prairie Conference, Cedar Falls, Iowa.

Fischer, J., C. Paukert, J. Gerken, and M. Daniels. 2010. Fish community response to habitat alteration: impacts of sand dredging in the Kansas River. Midwest Fish and Wildlife Conference, St. Paul, MN.

Frank, H. J. M. E. Mather, S. M. Pautzke, J. M. Smith, R. M. Muth, J. T. Finn. 2010 Encouraging stakeholder participation in restoration research: The adopt-a-herring program. Invited Presentation Restoration of American Shad and River Herring in Atlantic Coastal Waters, Annual Meeting, American Fisheries Society, Pittsburgh, PA.

Gerken, J. E., and C. P. Paukert. 2010. Fish recruitment in the Kansas River: the role of flow, habitat, and urbanization. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J., and C. Paukert. 2010. Floods and fishes: examining the role of high flows on fish and invertebrates in a large Great Plains River. Midwest Fish and Wildlife Conference, St. Paul, MN.

Gerken, J., and C. Paukert. 2010. Testing the flood pulse concept: The importance of floodplain inundation on fish and invertebrates of a Great Plains river. American Fisheries Society Annual Meeting, Pittsburgh, PA.

Haukos, D.A. 2010, Playa wetland ecology and management, Workshop, Kansas Wildlife and Parks, Great Bend, Kansas

Haukos, D.A. 2010. Demographic model development for northern pintails of North America. Central Flyway Waterfowl Technical Committee, March 2010, Tulsa, Oklahoma and July 2010, Norman, Oklahoma.

Haukos, D.A. 2010. Demographic model development for northern pintails of North America. Mississippi Flyway Waterfowl Technical Committee, Mobile, Alabama.

Haukos, D.A. 2010. High Plains wetlands: connections, concerns, and conservation. Seminar, Department of Wildlife and Fisheries, South Dakota State University, Brookings, South Dakota.

Haukos, D.A. 2010. Mottled duck focal species plan, Central Flyway Waterfowl Technical Committee, Norman, Oklahoma and Mississippi Flyway Waterfowl Technical Committee, Mobile, Alabama.

Haukos, D.A. 2010. Playa ecology, management, and threats, Workshop, Kansas Alliance for Wetlands and Streams, Garden City, Kansas

Haukos, D.A. 2010. Playa ecology: their historical value and current issues, Invited Presentation - Water, Water Everywhere, But Will There Be A Drop To Drink, A Symposium on the Use and Misuse of Water on the Llano Estacado Through Time, Historical Society of New Mexico, Hobbs, New Mexico

Haukos, D.A. 2010. Status and research of mottled ducks on the Texas Chenier Plain NWR Complex, USFWS Biologists and Managers Meeting, Port Arthur, Texas.

Johnson, L., D. Haukos, L. Smith, and S. McMurry. 2010. Effectiveness of wetland buffers as a conservation tool for playas. 46th Annual Meeting of the Texas Chapter of The Wildlife Society, Galveston, Texas.

Kennedy, C. G., M. E. Mather, J. T. Finn, L. A. Deegan, and S. M. Pautzke. 2010. Determining acoustic receiver range in a shallow northeastern estuary with complex bathymetry: the role of habitat, depth and tide. Southern New England Chapter, American Fisheries Society, Groton, CT.

Mammoliti, K., J. Gerken, and C. Paukert. 2010. Population characteristics of channel catfish in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Mammoliti, K., W. Bouska, and C. Paukert. 2010. Seasonal stockpiling of prairie stream fishes below road crossings in the flinthills of Kansas. Kansas Natural Resources Conference, Wichita, KS.

Mather, M. E., H. J. Frank, J. M. Smith, R. M. Muth, J. T. Finn. 2010. Understanding the role of origin and release location in behavior and habitat use of pre-spawning alewives to improve the efficiency of restoration. Invited Presentation Restoration of American Shad and River Herring in Atlantic Coastal Waters, Annual Meeting, American Fisheries Society, Pittsburgh,PA

Mather, M. E., M. K. Burak, J. T. Finn, R. M. Muth, J. B. Kim, K. H. Ferry. 2010. Counting anadromous fish at remote fishways in small coastal streams: a review of past uses of video monitoring with an evaluation of a new system. Northeastern Division American Fisheries Society, Newton, MA.

Mather, M.E., E.A. Marschall*, and D.L. Parrish. 2010. Predicting interactive effects of climate change and dams on success of downstream-migrating salmon. Fish and Climate Change, The Fisheries Society of the British Isles Annual Symposium, Belfast, UK.

Moon, Derek, and J. F. Cully. 2010. Small mammals in prairie ecosystems: scale dependent responses to disturbance. Annual meeting of the American Society of Mammalogists, Laramie, Wyoming.

O'Connell, J., L. Smith, S. McMurry, and D. Haukos. 2010. Conservation effects of catchment land management on playa communities of playa wetlands in the short-grass prairie ecoregion. Annual Meeting of the Society of Wetland Scientists.

Paukert, C. 2010. Fish and fish habitat in the Kansas River. Midwest Fisheries Student Colloquium, Manhattan, KS.

Paukert, C. and A. Severson. 2010. Zooplankton community characteristics in El Dorado Reservoir: response to zebra mussel invasion. Kansas Natural Resources Conference, Wichita, KS.

Paukert, C. 2010. Fish and fish habitat in the Kansas River: what have we learned? Kansas Natural Resources Conference, Wichita, KS.

Paukert, C. and J. Gerken. 2010. The Importance of secondary channels to mainchannel fishes in the Kansas River. Big River Confab, Jefferson City, MO.

Saalfeld, S., W. Conway, D. Haukos, and W. Johnson. 2010. Nest success of Snowy Plovers in the Southern High Plains of Texas. Annual Meeting Wilson Ornithological Society.

Saalfeld, S., W. Conway, D. Haukos, and W. Johnson. 2010. Nest site selection of snowy plovers in the Southern High Plains of Texas. 46th Annual Meeting of the Texas Chapter of The Wildlife Society, Galveston, Texas.

Severson, A. and C. Paukert. 2010. Zooplankton community response to zebra mussel invasion in a Kansas reservoir. Midwest Fisheries Student Colloquium, Manhattan, KS.

Smith, J. M., M. E. Mather, R. M. Muth and J. T. Finn. 2010. Beaver-dam alterations of fish assemblages in coastal watersheds: Implications of fragmentation on ecosystem function. National meeting, Ecological Society of America, Pittsburgh, PA.

Wells, S. P., J. M. Smith, M. E. Mather, R. M. Muth, and J. T. Finn. 2010. An approach to evaluating the combination of gear that representatively samples fish assemblages in small coastal streams. Northeastern Division American Fisheries Society, Newton, MA.

White, K., J. Gerken, C. Paukert, and A. Makinster. 2010. Fish community structure in natural and engineered habitats in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

2009

Bouska, W., and C. Paukert. 2009. Passage of prairie fishes through different crossing designs and water velocities in an experimental stream. Kansas Natural Resources Conference, Wichita, KS.

Burkitt, J., K. Franke, J.M.S. Hutchinson, and S.L. Hutchinson. 2009. GIS-enabled Kinematic Wave Approach for Rapid Soil Erosion Assessment and Improved BMP Site Selection. Capitol Research Summit, Topeka, KS.

Burkitt, J., K. Franke, J.M.S. Hutchinson, and S.L. Hutchinson. 2009. GIS-enabled Kinematic Wave Approach for Rapid Soil Erosion Assessment and Improved BMP Site Selection. Kansas State University Graduate Research Forum; Manhattan, KS.

Conard, J.M., and P. S. Gipson. 2009. Demographic vital rates and population growth: rethinking the relationship in a harvested elk population. Ecological Society of America Annual Meeting, Albuquerque, NM.

Cully, J. F. 2009. Plague, Prairie Dogs and Black-footed Ferrets. Rita Blanca Ferret Introduction Workshop, U.S. Fish and Wildlife Service, U.S.D.A., Forest Service, Clayton, NM.

Gerken, J. E., and C. P. Paukert. 2009. Effects of urbanization on recruitment of Riverine fishes. 70th Midwest Fish and Wildlife Conference, Springfield, IL.

Gerken, J. E., and C. P. Paukert. 2009. Topeka shiners status and trends in Kansas. 70th Midwest Fish and Wildlife Conference, Springfield, IL.

Gerken, J., and C. Paukert. 2009. Spatial variation in the recruitment patterns of three riverine fishes in the Kansas River. American Fisheries Society Annual Meeting, Nashville, TN.

Gerken, J., and C. Paukert. 2009. Spatial variation in the recruitment patterns of three riverine fishes in the Kansas River. KSU Biology Student Research Forum, Manhattan, KS.

Gerken, J., W. Bouska, and C. Paukert. 2009. Effects of instream habitat and fish communities on the endangered Topeka shiner in Kansas streams. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J.E., and C.P. Paukert. 2009. Impacts of a low-head dam on fish communities in the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J.E., and C.P. Paukert. 2009. Factors impacting Topeka shiner distribution in Kansas. American Fisheries Society Midwest Student Colloquium, Annual Meeting, Ames, IA.

Gerken, J.E., and C.P. Paukert. 2009. Impacts of a low-head dam on a Great Plains River Fish Community. American Fisheries Society Midwest Student Colloquium, Annual Meeting, Ames, IA.

Hutchinson, S.L. and J.M.S. Hutchinson. 2009. Validating the Kinematic Wave Approach for Rapid Soil Erosion Assessment: nLS Model Overview and Sensitivity Analysis Results. December 2009. SERDP and ESTCP Partners in Environmental Technology Technical Symposium & Workshop; Washington, DC.

Hutchinson, S.L., J.M.S. Hutchinson, and T.J. Vought, Jr. 2009. Validating the Kinematic Wave Approach for Rapid Soil Erosion Assessment and Improved BMP Site Selection (SI-2017). December 2007. Watershed Process and Management Side Meeting, SERDP and ESTCP Partners in Environmental Technology Technical Symposium & Workshop; Washington, DC.

Kretschmann, A., S. Bonar, K. Young, J. Whittier, C. Paukert, and D. Guertin. 2009. Using Geographic Information Systems to delineate native fish and sport fish management areas in the Verde River watershed, Arizona. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

Paukert, C. P. 2009. Alteration of stream and rivers its effects on fishes: can we reverse the trend? Department of Natural Resources Ecology and Management, Iowa State University, Ames, IA.

Paukert, C. P. 2009. Conservation of stream and river fishes: from landscape to local influences. University of Missouri, Department of Fisheries and Wildlife. Columbia, MO.

Paukert, C. P. 2009. From zebra mussels to river otters: update of the Cooperative Fish and Wildlife Research Unit. Kansas Department of Wildlife and Parks, Fish and Wildlife Division meeting, Salina, KS.

Paukert, C. P., and A. M. Severson. 2009. Using long-term data to determine the effects of zebra mussels on reservoir sport fishes. 70th Midwest Fish and Wildlife Conference, Springfield, IL.

Paukert, C., W. Bouska, and T. Keane. 2009. Road crossing design and their impacts of fish assemblages and geomorphology of Great Plains streams. Kansas Transportation Engineering Conference, Manhattan, KS.

Peterson, J. and C. Paukert. 2009. Converting non-standard fish sampling data to standardized data. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

Peterson, J., and C. Paukert. 2009. Converting non-standard fish sampling data to standardized data. American Fisheries Society Annual Meeting, Nashville, TN.

Pool, T., J. Olden, J. Whittier, and C. Paukert. 2009. Riverscape patterns and environmental drivers of functional diversity and composition of fish communities in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

Prebyl, T., T. Mosher, C. Paukert, and S. Wisely. 2009. Identifying the strain of a record largemouth bass using a DNA-sequencing approach. Kansas Natural Resources Conference, Wichita, KS.

Scholten, G., and C. Paukert. 2009. Life history, status, and management of paddlefish. American Fisheries Society Annual Meeting, Nashville, TN.

Severson, A. and C. Paukert. 2009. Zebra Mussel Invasion and Zooplankton in a Great Plains Reservoir: Cause for Concern? American Water Resources Association Annual Water Resources Conference, Seattle, WA.

Severson, A., and C. Paukert. 2009. Does zebra mussel presence affect abundance and condition of reservoir fishes in a Kansas reservoir? American Fisheries Society Annual Meeting, Nashville, TN.

Severson, A., and C. Paukert. 2009. Effects of zebra mussel invasion on fish abundance and condition in a Kansas reservoir. KSU Biology Student Research Forum, Manhattan, KS.

Severson, A., and C.P. Paukert. 2009. Impacts of zebra mussels on fishes in El Dorado Reservoir. Kansas Natural Resources Conference, Wichita, KS.

Shardlow, M. and C. Paukert. 2009. Factors affecting the detectability and occupancy of river otters in eastern Kansas. KSU Biology Student Research Forum, Manhattan, KS.

Shardlow, M. and C. Paukert. 2009. Seeing what was missed: evaluating detection probabilities from river otter sign surveys. The Wildlife Society Annual Meeting, Monterey, CA.

Shardlow, M., C. Paukert, and T. Cable. 2009. Furharvester sighting reports and opinions regarding river otters in Kansas. Kansas Natural Resources Conference, Wichita, KS.

Whittier, J., C. Paukert, and J. Olden. 2009. Modeling local and watershed drivers of native and non-native fishes in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

2008

Bouska, W. W. and C. P. Paukert. 2008. Effects of road crossing design on movement and species composition of Great Plains stream fishes. Kansas Natural Resources Conference, Wichita, KS.

Bouska, W. W. and C. Paukert. 2008. Effects of road crossing design on movement and species composition of Great Plains stream fishes. First Annual Midwest Student Fisheries Colloquium, Lincoln, NE.

Bouska, W., and C. Paukert. 2008. Fish on the move: effects of culvert design on the passage of Great Plains stream fish. Midwest Fish and Wildlife Conference, Columbus, OH.

Bouska, W., and C. Paukert. 2008. Road crossing designs and their impact on movement and diversity of Great Plains stream fishes. American Fisheries Society Annual Meeting, Ottawa, Canada.

Bouska, W., and C. Paukert. 2008. The effects of crossing design and water velocity on the movement of Great Plains lotic fishes. Midwest Fish and Wildlife Conference, Columbus, OH.

Cully, J. F. and T. L. Johnson. 2008. Plague regulates black-tailed prairie dog populations. Symposium on the Ecology of plague and its effects on wildlife, Fort Collins, CO.

Davis, N. and C. Paukert. 2008. An assessment of Neosho madtom related to gravel harvest from the Neosho River, Kansas. Kansas Natural Resources Conference, Wichita, KS.

Eitzmann, J. L., and C. P. Paukert. 2008. Effects of anthropogenic changes on food web dynamics in a Great Plains river. Kansas Natural Resources Conference, Wichita, KS.

Fischer, J. R., and C. P. Paukert. 2008. Habitat relationships with fish assemblages in minimally disturbed Great Plains regions. Dakota and Iowa Chapter of the American Fisheries Society Joint Annual Meeting, Sioux Falls, SD.

Fischer, J., and C. Paukert. 2008. Habitat relationships with fish assemblages in minimally disturbed Great Plains regions. American Fisheries Society Annual Meeting, Ottawa, Canada.

Gerken, J. E., and C. P. Paukert. 2008. Fish recruitment in the Kansas River: the role of flow, habitat, and urbanization. Kansas Natural Resources Conference, Wichita, KS.

Gerken, J., and C. P. Paukert. 2008. Effects of a low-head dam on the fish community of a large Great Plains river. Southwestern Association of Naturalists, Memphis, TN.

Gerken, J., and C. Paukert. 2008. Effects of a low-head dam on the fish community of a large Great Plains River. American Fisheries Society Annual Meeting, Ottawa, Canada.

Gerken, J., and C. Paukert. 2008. Fish community changes associated with a low-head dam in a large Great Plains river. Midwest Fish and Wildlife Conference, Columbus, OH.

Gerken, J., W. Bouska, and C. Paukert. 2008. Factors influencing the endangered Topeka shiner in Kansas streams. Midwest Fish and Wildlife Conference, Columbus, OH.

Japuntich, R., S. M. Borthwick, S. J. Hayes, and C. P. Paukert. 2008. Impacts of big game browse and drought on the mountain shrub community in Southwestern Colorado. 15th annual Wildland Shrub Symposium, Bozeman, MT.

Mammoliti, K., J. Gerken, and C. Paukert. Population characteristics of channel catfish in the Kansas River. Kansas Natural Resources Conference, Wichita, KS. Poster

Mammoliti, K., W. Bouska, and C. Paukert. Seasonal stockpiling of prairie stream fishes below road crossings in the flinthills of Kansas. Kansas Natural Resources Conference, Wichita, KS. Poster

Paukert, C. P., and J. Eitzmann. 2008. Food web dynamics of a Great Plains river: effects of habitat alteration. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ.

Paukert, C. and A. Severson. Zooplankton community characteristics in El Dorado Reservoir: response to zebra mussel invasion. Kansas Natural Resources Conference, Wichita, KS.

Paukert, C. Fish and fish habitat in the Kansas River: what have we learned? Kansas Natural Resources Conference, Wichita, KS.

Paukert, C. P. 2008. Effects of human alteration on stream and river fishes: what we know and what are we doing about it? Kansas State University, Division of Biology Seminar Series.

Paukert, C. P. 2008. Using long-term data to assess the distribution of a rare fish: lessons from the Colorado River. Midwest Fish and Wildlife Conference, Columbus, OH.

Paukert, C. P., and J. Whittier. 2008. Effects of invasive species in freshwater fisheries. 5th World Fisheries Congress, Yokohama, Japan.

Peterson, J., and C. Paukert. 2008. Converting non-standard fish sampling data to standardized data. American Fisheries Society Annual Meeting, Ottawa, Canada.

Pitts, K.L., C. Paukert, and J. Whittier. 2008. Alteration of flow regime and its influence on fish assemblages within the Lower Colorado River Basin. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ.

Pitts, K.L., C. Paukert, and J. Whittier. 2008. Evaluation of an ecological risk index in quantifying threats to fishes. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ.

Pitts, K.L., C. Paukert, and J. Whittier. 2008. Utility of an ecological risk index to assess threats to native fishes: insights from the Verde River Basin, Arizona. Kansas Natural Resources Conference, Wichita, KS.

Pitts, K. L., C. P. Paukert, and J. B. Whittier. 2008. Assessing anthropogenic threats to fishes in the Lower Colorado River Basin. American Fisheries Society Annual Meeting, Ottawa, Canada.

Pitts, K. L., C. Paukert, and J. Whittier. 2008. Evaluation of an ecological risk index in quantifying threats to fishes. Western Division of the American Fisheries Society Annual Meeting, Portland, OR.

Pitts, K. L., C. Paukert, and J. Whittier. 2008. Utility of an ecological risk index to assess threats to native fishes: insights from the Verde River Basin, Arizona. First Annual Midwest Student Fisheries Colloquium, Lincoln, NE.

Schloesser, J. T., and C. P. Paukert. 2008. The use of occupancy modeling to aid the Missouri River pallid sturgeon monitoring program. Missouri River Natural Resources Conference, Nebraska City, NE.

Schloesser, J. T., C. Paukert, W. Doyle, T. Hill, G. Mestl, and V. Travnichek. 2008. Comparison of sampling gear detection probabilities and variability for Missouri River fishes. Kansas Natural Resources Conference, Wichita, KS.

Schloesser, J., C. Paukert, W. Doyle, T. Hill, G. Mestl, and V. Travnichek. 2008. Detection and occupancy probabilities for monitoring Missouri River fishes. American Fisheries Society Annual Meeting, Ottawa, Canada.

Severson, A., J. Schloesser, J., K. Pitts, J. Eitzmann, and C. Paukert. 2008. Abundance and size structure of fishes in main and secondary channels of the Kansas River. First Annual Midwest Student Fisheries Colloquium, Lincoln, NE.

Severson, A., J. Schloesser, K. Pitts, J. Eitzmann, and C. Paukert. 2008. Abundance and Growth of Fishes in Main and Secondary Channels of the Kansas River. Kansas Natural Resources Conference, Wichita, KS.

Shardlow, M., and C. Paukert. 2008. Sign survey techniques for river otters: looking back and moving forward. Midwest Fish and Wildlife Conference, Columbus, OH.

Shardlow, M., C. Paukert, and P. Gipson. 2008. Factors affecting the distribution and detectability of river otters in Eastern Kansas. Midwest Furbearer Workshop. Olathe, KS.

Statham, M., S.M. Wisely, A. Mattox, L. Fox, J. Cully. 2008. Landscape Genetics of Genetic Susceptibility of White-Tailed Deer to Chronic Wasting Disease: Implications for CWD Emergence across Kansas. International Conference on Emerging Infectious Diseases.

Thiagarajan, B., J. F. Cully, Jr., and K. L. Gage. 2008. Ecology of rodents and fleas associated with black-tailed prairie dogs in areas with plague. Symposium on the Ecology of plague and its effects on wildlife, Fort Collins, CO.

White, K., J. Gerken, C. Paukert, and A. Makinster. Fish community structure in natural and engineered habitats in the Kansas River. Kansas Natural Resources Conference, Wichita, KS. Poster

Whittier, J.B., C.P. Paukert, K.L. Pitts, and J. Olden. 2008. Building a classification hierarchy for the Lower Colorado River Basin to provide an ecological basis for selecting conservation areas. Arizona/New Mexico Joint Annual Meeting, Prescott, AZ.

Whittier, J. B., C. P. Paukert, and J. D Olden. 2008. Spatial patterns in the distribution and conservation of imperiled fishes in the Lower Colorado River Basin. American Fisheries Society Annual Meeting, Ottawa, Canada.

Whittier, J., C. Paukert, and J. Olden. 2009. Modeling local and watershed drivers of native and non-native fishes in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Albuquerque, NM.

Whittier, J., C. Paukert, K. Pitts, and J. Olden. 2008. Development and classification of watershed boundaries to aid conservation efforts in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Portland, OR.

Whittier, J., C. Paukert, K. Pitts, and J. Olden. 2008. Spatial patterns in the distribution and conservation of imperiled fishes in the Lower Colorado River Basin. Western Division of the American Fisheries Society Annual Meeting, Portland, OR.

Winders, K., and C. Paukert. 2009. Reduction in the abundance and condition of native fishes after invasion of white perch. Kansas Natural Resources Conference, Wichita, KS.

Wisely, S., M. Statham, A. Mattox, L. Fox, J. Cully. 2008. Prevalence and biogeography of genetic susceptibility to Chronic Wasting Disease in white-tailed deer from Kansas. The Wildlife Society, Monterey, CA.

2007

Bala, T., J. F. Cully, T. M. Loughin, Y. Bai, M. Kosoy, and K. L. Gage. 2007. Prevalence of Bartonella species in rodents and fleas associated with black-tailed prairie dogs. 62nd Annual Meeting, International Conference on Diseases in Nature Communicable to Man, Madison, WI.

Blecha, K. A., P.S. Gipson, M. Peek. 2007. Annual Midwest Furbearer Workshop. Distribution and population status of river otters in eastern Kansas. Platform presentation.

Bouska, W., and C. P. Paukert. 2007. Impacts of Road Crossings on Prairie Stream Fishes. Midwest Fish and Wildlife Conference, Madison, WI 11 December 2007.

Conard, J.M., M. J. Statham, S. M. Wisely, and P. S. Gipson. 2007. Genetic structure of a reintroduced elk population. Midwest Fish and Wildlife Conference, Madison, WI.

Conard, J. M., and P. S. Gipson. 2007. Historical and current distribution of elk in Kansas. Kansas Chapter of The Wildlife Society Spring Meeting. Poster.

Cully, J. F., and T. L. Johnson. 2007. Spatial dynamics of plague in three black-tailed prairie dog complexes. Annual Meeting of the Wildlife Disease Association, Estes Park, CO.

Eitzmann, J. L., and C. P. Paukert. 2007. Evaluation of multiple gears to assess a Great Plains river fish community. American Fisheries Society Annual Meeting, San Francisco, CA.

Eitzmann, J., and C. Paukert. 2007. Electrofishing and hoopnetting gear comparisons for fish communities in the Kansas River, Kansas. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Fischer, J. R., and C. P. Paukert. 2007. Spatial scale of stream fish assemblages and abundance estimates: effects of sampling effort, community structure, and habitat heterogeneity. American Fisheries Society Annual Meeting, San Francisco, California.

Fischer, J., and C. Paukert. 2007. Historical and current environmental influences on an endemic Great Plains fish. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Fischer, J., and C. Paukert. 2007. Sampling effort required to estimate species richness in wadeable Great Plains streams with a towed electrofishing. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Paukert, C. P., and A. S. Makinster. 2007. Flathead catfish population dynamics in the Kansas River: implications for management. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Paukert, C. P. 2007. Kansas River fishes: what do we know? Friends of the Kaw Annual Board Meeting, Lawrence, KS.

Paukert, C. P. 2007. You can't always get what you want: sampling challenges for rivers in the Great Plains. University of Kansas Field Station and Ecological Reserves Seminar Series, Lawrence, KS.

Paukert, C. P. 2007. Are the Kansas River fishes in peril? Lower Kansas River basin Watershed Restoration and Protection Strategy Meeting, Lawrence, KS.

Paukert, C. P., J. Eitzmann, J. Fischer, K. Pitts, J. Schloesser, and D. Thornbrugh. 2007. Fish community and habitat differences in dredges and undredged sites on the Lower Kansas River. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Pitts, K. L., C. P. Paukert, and J. B. Whittier. 2007. Development and Assessment of an Ecological Risk Index for Fishes in the Verde River Basin, Arizona. Midwest Fish and Wildlife Conference, Madison, WI.

Pitts, K. L., C. P. Paukert, and J. W. Whittier. 2007. Hydrologic variability in the Lower Colorado River Basin: implications for fish conservation. American Fisheries Society Annual Meeting, San Francisco, CA.

Schloesser, J. T., C. P. Paukert, W. Doyle, T. Hill, G. Mestl, and V. Travnichek. 2007. Probability of detection and catch rate variability by gear type for Missouri River fishes. Midwest Fish and Wildlife Conference, Madison, WI.

Schloesser, J. T., D. E. Haines, and C. P. Paukert. 2007. Walleye harvest restrictions to reduce gizzard shad impingement. Kansas, Nebraska, Iowa Tri-State American Fisheries Society Meeting, Council Bluffs, IA.

Schloesser, J., J. Finley, C. Paukert, W. Doyle, and T. Hill. 2007. Comparison between push trawl and mini fyke nets to sample shallow water fish communities. American Fisheries Society Annual Meeting, San Francisco, CA.

Schloesser, J., J. Finley, C. Paukert, W. Doyle, and T. Hill. 2007. Comparison between push trawl and mini fyke nets to sample shallow water fish communities. Missouri River Natural Resource Conference, Nebraska City, NE.

Severson, A. 2007. High-water habitat: fish populations in two Kansas River backwaters. Research Experience For Undergraduates Student Research Symposium, Manhattan, KS.

VanNimwegen, R., J. F. Cully, and J. Kretzer, 2007. Ecosystem Engineering by a colonial mammal: How black-tailed prairie dogs small mammal communities. 87th Annual Meeting of the American Society of Mammalogists, Albuquerque, NM.

Whittier, J. B., C. P. Paukert, K. L. Pitts, and J. D. Olden. 2007. The Lower Colorado River aquatic GAP project-an update. Arizona-New Mexico American Fisheries Society Annual Meeting, Albuquerque, NM.

Whittier, J. W., C. P. Paukert, K. L. Pitts, and J. D. Olden. 2007. Lower Colorado River aquatic GAP: meeting the needs of stakeholders. National GAP Meeting, Asheville, NC.

2006

Althoff, D. P., and P. S. Gipson, G. Meggers, D. Hilly, and J. Sellers. 2006. 20th North American Prairie Conference. White-tailed deer population trends on Quivira National Wildlife Refuge, 1989-2005. Platform presentation.

Bala, T., Ying Bai, Micheal Kosoy, Ken Gage, Tom Loughin and J. F. Cully, Jr. 2006 Prevalence of *Bartonella* in rodents and fleas associated with the black-tailed prairie dogs. 55th Annual Conference of the Wildlife Disease Association, University of Connecticut, Storrs, CT.

Blecha, K., D. P. Althoff and P. S. Gipson. 2006. 67th Midwest Fish & Wildlife Conference. Evaluating a relative change index based on 10-year moving estimates of bird population trends on Fort Riley, Kansas. Poster.

Brinkley, P., J. Fischer, and C. P. Paukert. 2006. Effect of fixative on total length of small-bodied stream fish. 31st Kansas Chapter of the American Fisheries Society Annual Meeting, Hays, KS.

Conard, J.M., P.S. Gipson, and D.P. Althoff. 2006. Annual American Society of Agronomy International Meeting. Military vehicle training effects on amounts of bare ground and small mammal biodiversity. Platform presentation.

Conard, J.M., and P.S. Gipson. 2006. Seasonal variation and timing of elk use of private lands adjacent to Fort Riley Military Reservation, Kansas. 138th Annual Meeting of the Kansas Academy of Science. Platform presentation.

Conard, J. M., and P. S. Gipson. 2006. Status of elk in Kansas. 20th North American Prairie Conference. Poster.

Conard, J. M., and P.S. Gipson. 2006. Patterns of private land use by elk around Fort Riley Military Reservation. Kansas Chapter of The Wildlife Society Spring Meeting. Platform presentation.

Eitzmann, J. L., and C. P. Paukert. 2006. Comparison of electrofishing and trammel netting of shovelnose sturgeon in the Kansas River. 67th Midwest Fish and Wildlife Conference, Omaha, NE.

Eitzmann, J., A. Makinster, and C. P. Paukert. 2006. Blue sucker population dynamics in a shallow, Great Plains river. American Fisheries Society Annual Meeting, Lake Placid, NY.

Eitzmann, J., A. Makinster, and C. P. Paukert. 2006. Population dynamics of blue suckers in the Kansas River, Kansas. 31st Kansas Chapter of the American Fisheries Society Annual Meeting, Hays, KS.

Fischer, J. R., and C. P. Paukert. 2006. Environmental influences structuring Great Plains stream fish assemblages. 67th Midwest Fish and Wildlife Conference, Omaha, NE.

Fischer, J. R., and C. P. Paukert. 2006. Historical and environmental influence on an endemic Great Plains fish. 67th Midwest Fish and Wildlife Conference. Omaha, NE.

Fischer, J., and C. P. Paukert. 2006. Factors influencing lotic fish-habitat relationships in the Great Plains. American Fisheries Society Annual Meeting, Lake Placid, NY.

Fischer, J., and C. P. Paukert. Habitat use of stream fishes in South Central Kansas. Kansas State University Biology Graduate Student Research Forum, Manhattan, KS.

Fischer, J., and C. P. Paukert. 2006. Environmental influences of stream fish in the Nebraska Sandhills. Nebraska Chapter of the AFS Annual Meeting, Gretna, NE.

Fischer, J., and C. P. Paukert. 2006. Fish habitat relationships in South Central Kansas. 31st Kansas Chapter of the American Fisheries Society Annual Meeting, Hays, KS.

Gipson, P. S., J. M. Conard, and A. B. Anderson. 2006. Annual American Society of Agronomy International Meeting. The role of munitions-impacted sites on military lands as refugia for wildlife. Platform presentation.

Gipson, P. S., C. Lee, S. Wilson, J. Thiele, and D. Hobbick. 2006. 20th North American Prairie Conference. Status of feral pigs, *Sus scrofa*, in Kansas and Nebraska. Platform presentation.

Gipson, P. S., D.P. Althoff, J.S. Pontius, and P.B. Woodford. 2006. 13th Annual Department of Defense Integrated Training Area Management Workshop. Assessing small mammal communities: development of field protocols. Poster.

Houchin, R., P. S. Gipson, and W. B. Ballard, M. Wallace, D. Wester, J. Bonner, R. Huffman, and G. Hall. 2006. 20th North American Prairie Conference. Coyote diet in the Texas Panhandle and southwestern Kansas. Platform presentation.

Japuntich, R. D., D. P. Althoff, P. S. Gipson, and J. S. Pontius. 2006. 20th North American Prairie Conference. Monitoring small landbird communities in tallgrass prairie: an assessment of strip-transect and fixed-radius point counts. Platform presentation.

Whittier, J. B., C. P. Paukert, and K. B. Gido. 2006. Development of an aquatic GAP for the Lower Colorado River Basin. Arizona/New Mexico American Fisheries Society Annual Meeting, Flagstaff, AZ

2005

Althoff, D. P., R. D. Japtunich, P. S. Gipson, J. S. Pontius. 2005. 12th Annual Conference of The Wildlife Society. Reproductive success of grasshopper sparrows on a military installation. Platform presentation.

Althoff, D. P., P. S. Althoff, J. S. Pontius, P. S. Gipson, and P. B. Woodford. 2005. 14th Annual Department of Defense Intregrated Training Area Management Workshop. Identification of soil characteristics that facilitate assessment of ecosystem health on military training lands. Platform presentation.

Althoff, P. S., S. J. Thien, G. J. Kluitenberg, P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2005. 12th Annual Department of Defense Integrated Training Area Management Workshop. Evaluation of soil quality following disturbance created by an Abrams M1A1 Main Battle Tank. Platform presentation.

Conard, J.M. and P.S. Gipson. 2005. Elk habitat selection in tallgrass prairie. American Society of Mammalogists meeting. Springfield, MO.

Conard, J.M. and P.S. Gipson. 2005 Elk Habitat use in tallgrass prairie. The Wildlife Society Meeting. Madison, WI.

Conard, J.M. 2005. The influence of patch configuration and landscape features on diurnal elk habitat use at Fort Riley, KS. Geospatial Research Showcase. Kansas State University Geographic Information Systems / Spatial Analysis Laboratory.

Eitzmann, J., A. Makinster, and C. P. Paukert. 2005. Spatial and temporal patterns in blue suckers in the Kansas River, Kansas. American Fisheries Society Annual Meeting, Anchorage, AK.

Japuntich, R. D., B. E. Flock, and P. S. Gipson. 2005. 12th Annual Conference of The Wildlife Society. Owls in the forest and prairie ecotone of Kansas. Platform presentation.

Johnson, T.L. and J.F. Cully, Jr. 2005. Colony Spatial Dynamics Influence the Transmission of Sylvatic Plague in Black-tailed Prairie Dogs. Featured Student Presenter, Wildlife Disease Association International Conference, Cairns, Queensland, Australia. *2005 Graduate Student Research Award.

Whittier, J. B., C. P. Paukert, and K. B. Gido. 2005. Development of an aquatic GAP for the Lower Colorado River Basin. National GAP Meeting, Reno, NV.

2004

Althoff, D. P., P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2004. 13th Annual Department of Defense Integrated Training Area Management Workshop. Use of a low-level aerial photography system to document disturbance and vegetation coverage on Fort Riley, Kansas. Platform presentation.

Baumgardt, J. A., J. M. Conard, P. S. Gipson. 2004. 84th Annual Meeting of the American Society of Mammalogists. The influence of trap density on estimates of small mammal abundance, diversity, and species richness. Poster.

Baumgardt, J. A., J. M. Conard, P. S. Gipson, D. P. Althoff, J. S. Pontius, and P. B. Woodford. 2004. 13th Annual Department of Defense Integrated Training Area Management Workshop. Relationships between sampling effort and estimates of small mammal population parameters on Fort Riley, KS. Poster.

Conard, J. M., and P. S. Gipson. 2004. Elk in tallgrass prairie: home range size, habitat selection and movement patterns. 65th Annual Midwest Fish and Wildlife Conference. Platform presentation.

Gipson, P. S., J. M. Conard, and J. Baumgardt. 2004. 84th Annual Meeting of the American Society of Mammalogists. Coyote and diurnal raptor presence in relation to military training and small mammal abundance. Poster.

Japuntich, R., D. P. Althoff, P. S. Gipson, J. S. Pontius. 2004. 13th Annual Department of Defense Integrated Training Area Management Workshop. Strip transect and fixed-radius point counts for birds at Fort Riley Military Installation, Kansas. Platform presentation.

Zuercher, G.L., J.M.S. Hutchinson, P.S. Gipson, R. Naidoo, and O. Carrillo. 2004. Defenders of Wildlife Carnivore Conference. Predators and their habitats revisited: a diverse carnivore community and their habitat associations in the Atlantic Forest of Paraguay. Platform presentation.

2003

Althoff, D. P., P. S. Gipson, J. S. Pontius, and P. B. Woodford. 2003. 12th Annual Department of Defense Integrated Training Area Management Workshop. Using LCTA vegetation data to monitor trends on Fort Riley: caveats from a conservative analysis approach. Platform presentation

Anderson, C. D., C. D. Becker, P.S. Gipson, B. K. Sandercock, and D. A. Rintoul. 2003. American Ornithological Union Annual Meeting. Breeding success common yellowthroat (*Geothlypis trichas*) within a river corridor under recreation pressure. Platform presentation.

Conard, J. M., P. S. Gipson, J. S. Pontius, and G. L. Zuercher. 2003. 83rd Annual Meeting of the American Society of Mammalogists. The influence of trap density, vegetation structure, and anthropogenic disturbance on measures of small mammal diversity. Platform presentation

Gipson, P.S., and J.M. Conard. 2003. 65th Annual Midwest Fish and Wildlife Conference. Spatial and seasonal variation in wildlife and vehicle collisions. Platform presentation.

2002

Bernot, R. J., M. C. Quist, W. K. Dodds, and C. S. Guy. 2002. Spatial and temporal variation in water chemistry, phytoplankton, and zooplankton characteristics in Glen Elder Reservoir. Annual Meeting of the Kansas Department of Wildlife and Parks–Fisheries Division, Wichita, Kansas, PLATFORM (INVITED)

Gipson, P.S. 2002. Texas Tech University, Department of Range, Wildlife and Fisheries, Lubbock, Texas. Color patterns of wolves in western North America. Invited seminar

Gipson, P.S., C.I. Vahl, J.S. Pontius, G.L. Zuercher, T.R. Livingston, and J.M. Conard. 2002. 82nd Annual Meeting of the American Society of Mammalogists. Trap size and trap density: effects on small mammal captures. Poster.

Gipson, P.S., E.E. Bangs, M.D. Jimenez, T.N. Bailey, D.K. Boyd, H.D. Cluff, and D.W. Smith. 2002. Defenders of Wildlife Carnivores Conference. Progressive color changes in wolves with advancing age. Platform presentation.

Gipson, P.S., and G.L. Zuercher, 2002. Defenders of Wildlife Carnivore Conference. Jaguar diets in eastern Paraguay: peccaries, livestock, and other carnivores. Platform presentation.

Goeckler‡, J. M., M. C. Quist, J. A. Reinke, and C. S. Guy. 2002. Population characteristics and evidence of natural reproduction of blue catfish in Milford Reservoir, Kansas. Annual Midwest Fisheries Conference, Bettendorf, Iowa. PLATFORM

Goeckler‡, J. M., M. C. Quist, J. A. Reinke, and C. S. Guy. 2002. Population characteristics of blue catfish in Milford Reservoir. 27th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. PLATFORM

Quist, M. C. 2002. Abiotic and biotic factors influencing recruitment of walleyes in southern Great Plains reservoirs. Department of Zoology and Physiology, University of Wyoming, Laramie, Wyoming. PLATFORM (INVITED)

Quist, M. C., C. S. Guy, and J. L. Stephen. 2002. Abiotic factors and species interactions that influence recruitment of walleyes in reservoirs. 132nd Annual Meeting of the American Fisheries Society, Baltimore, Maryland. PLATFORM

Quist, M. C., R. J. Bernot, C. S. Guy, and J. L. Stephen. 2002. Seasonal variation in condition, growth, and food habits of walleye in Glen Elder Reservoir and potential effects of climate change on growth. 132nd Annual Meeting of the American Fisheries Society, Baltimore, Maryland. POSTER

Quist, M. C., K. R. Pember‡, C. S. Guy, and J. L. Stephen. 2002. Spatial and temporal variation in ichthyoplankton from Glen Elder Reservoir. 27th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. PLATFORM

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Seasonal variation in condition, growth, and food habits of walleyes in a Great Plains reservoir and simulated effects of an altered thermal regime. 27th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. POSTER

Quist, M. C., C. S. Guy, M. A. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2002. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system. 27th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, Kansas. POSTER

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2002. Walleyes in Kansas reservoirs: a focus on Glen Elder Reservoir. Annual Meeting of the Kansas Department of Wildlife and Parks–Fisheries Division, Wichita, Kansas. PLATFORM (INVITED)

2001

Althoff, D. P., J. W. Rivers, P. S. Gipson, and J. S. Pontius. 2001. 8th Annual Conference of The Wildlife Society. Evaluation of long-term population trends of song birds on Fort Riley Military Base. Platform presentation.

Bernot, R. J., M. C. Quist, W. K. Dodds, and C. S. Guy. 2001. Predator-induced life history shifts of Daphnia in a Kansas reservoir. 27th Annual Forum for Student Research, Kansas State University, Division of Biology, Manhattan, Kansas. PLATFORM

Bernot, R. J., M. C. Quist, W. K. Dodds, and C. S. Guy. 2001. Predator-induced life history shifts of Daphnia in a Kansas reservoir. Annual Meeting of the American Society of Limnology and Oceanography, Albuquerque, New Mexico. PLATFORM

Gipson, P. S. 2001. Kansas State University, Division of Biology, Manhattan, Kansas. Ecology of wolves: New insight into predation, age, and color. Invited seminar.

Pontius, J. S., P. S. Gipson, and C. I. Vahl. 2001. Department of Statistics, Kansas State University, Manhattan, KS. An improved sampling strategy to detect animal and plant responses to military training. Invited seminar.

Gipson, P. S. 2001. Wildlife Manitoba, Winnipeg, Canada. Ecology and management of feral swine. Invited seminar.

Guy, C. S., and M. C. Quist. 2001. Potential influence of harvest of shovelnose sturgeon populations in the Missouri River system: A case for pro-active management. Missouri Department of Conservation shovelnose sturgeon commercial harvest closure workshop. Invited.

Quist, M. C., C. S. Guy, M. A. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri and Yellowstone Rivers. 5th Annual Missouri River Natural Resource Conference.

Quist, M. C., C. S. Guy, M. S. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system: a case for pro-active management. 131st Annual Meeting of the American Fisheries Society.

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2001. Seasonal variation in condition, growth, and food habits of walleyes in a Great Plains reservoir and simulated effects of an altered thermal regime. 63rd Annual Midwest Fish and Wildlife Conference, Des Moines, Iowa. POSTER

Quist, M. C., C. S. Guy, M. A. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system: a case for pro-active management. 131st Annual Meeting of the American Fisheries Society, Phoenix, Arizona. POSTER

Quist, M. C., C. S. Guy, M. A. Pegg, P. J. Braaten, C. L. Pierce, and V. H. Travnichek. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system: a case for pro-active management. 5th Annual Conference on Natural Resources of the Missouri River Basin, Great Falls, Montana. PLATFORM

Quist, M. C., and C. S. Guy. 2001. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system. Missouri Department of Conservation, Shovelnose Sturgeon Commercial Harvest Workshop, Jefferson City, Missouri. PLATFORM (INVITED)

Quist, M. C. 2001. Relationships between walleyes and white crappies in Kansas reservoirs. The Wildlife Society, Kansas State University, Manhattan, Kansas. PLATFORM (INVITED)

Quist, M. C., and C. S. Guy. 2001. Growth and mortality of prairie stream fishes: relations with fish communities and instream habitat. 26th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Pittsburgh, Kansas. POSTER

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2001. Dynamics of larval white bass in a large Kansas reservoir. 26th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Pittsburgh, Kansas. POSTER

Rivers, J. W., D.P. Althoff, P. S. Gipson, J. S. Pontius, and A. A. Abuzeineh. 2001. 63rd Midwest Fish and Wildlife Conference. Evaluation of an index method to measure dickcissel breeding success in northeastern Kansas. Platform presentation.

2000

Bernot, R. J., M. C. Quist, W. K. Dodds, and C. S. Guy. 2000. Temporal and spatial variability in zooplankton communities in Glen Elder Reservoir. 26th Annual Forum for Student Research, Kansas State University, Division of Biology, Manhattan, Kansas. PLATFORM

Braaten, P.J., M.A. Pegg, C.S. Guy, and C.L. Pierce. 2000. Population dynamics of benthic fishes in the Missouri and lower Yellowstone Rivers. 130th Annual Meeting of the American Fisheries Society.

Gipson, P. S., E. E. Bangs, T. N. Bailey, D. K. Boyd, D. W. Smith, M. D. Jimenez, and D. Cluff.. 2000. White wolves (*Canis lupus*): observations and explanations. 62nd Midwest Fish and Wildlife Conference. Minneapolis, MN.

Gipson, P.S., M. E. Howard, T. R. Livingston, and G. L. Zuercher. 2000. 62nd Midwest Fish and Wildlife Conference. Mammalian carnivore scent attractants: standard fatty acid versus feces. Platform presentation.

Gipson, P.S., C. Richardson, and D.P. Jones. 2000. Special poster session at the 65th North American Wildlife and Natural Resources Conference. Chicago, IL: Importance of credible population estimates in managing feral swine.

Guy, C.S., S.J. Schrank, M.R. Whiles, and B.R. Brock. 2000. Influence of instream, and landscape-level factors on the distribution of Topeka shiners in Kansas Streams. 62nd Midwest Fish and Wildlife Conference.

Guy, C.S., S.J. Schrank, M. Whiles, and B. Brock. 2000. Assessment of physicochemical, biological, and landscape level factors influencing presence or absence of Topeka shiner populations in Kansas streams, Topeka shiner recovery plan meeting, Invited.

Guy, C.S., R.D. Schultz, and C.A. Cox. 2000. Variation in gonad development, growth, and condition of white bass in Fall River Reservoir, Kansas. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium.

Guy, C.S. 2000. Fisheries research at Kansas State University, Kansas Department of Wildlife and Parks, Fisheries Division Meeting.

Horton, T.B., and C.S. Guy. 2000. Habitat use and movement patterns of spotted bass in a Kansas stream. 130th Annual Meeting of the American Fisheries Society.

Howard, M. E., P. S. Gipson, T. R. Livingston, and G. L. Zuercher. 2000. Mammalian carnivore scent attractants: standard fatty acid versus feces. 62nd Midwest Fish and Wildlife Conference. Minneapolis, MN.

Livingston, T. R., P. S. Gipson, P. R. Krausman, and D. M. Sanchez. 2000. Carnivores and coprophagy: implications for fecal-based dietary analysis. 62nd Midwest Fish and Wildlife Conference. Minneapolis, MN.

Quist, M.C., and C.S. Guy. 2000. Growth and mortality of prairie stream fishes and relations with instream habitat. 62nd Midwest Fish and Wildlife Conference.

Quist, M.C., and C.S. Guy. 2000. Spatial and temporal distribution of larval white bass in a Kansas reservoir. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium.

Quist, M.C., P.A. Fay, C.S. Guy, A.K. Knapp, B.N. Rubenstein, and C. Phillips. 2000. The influence of disturbance from military training on terrestrial aquatic linkages in a tall grass prairie ecosystem. 65th North American Wildlife and Natural Resource Conference, National Military Fish and Wildlife Association, Rosemont, Illinois.

Quist, M. C., C. S. Guy, R. J. Bernot, and J. L. Stephen. 2000. Dynamics of larval white bass in a large Kansas reservoir. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium, St. Louis, Missouri. POSTER

Quist, M. C. 2000. Characteristics of successful fish and wildlife graduate students. The Wildlife Society, Kansas State University, Manhattan, Kansas. PLATFORM (INVITED)

Quist, M. C., and C. S. Guy. 2000. Growth and recruitment of walleyes *Stizostedion vitreum* and interactions with white crappies *Pomoxis annularis* and gizzard shad *Dorosoma cepedianum* in reservoir systems. 26th Annual Forum for Student Research, Kansas State University, Division of Biology, Manhattan, Kansas. PLATFORM

Quist, M. C., C. S. Guy, J. L. Stephen, and R. D. Schultz. 2000. Growth, mortality, and recruitment of walleyes and interactions with white crappies and gizzard shad in Kansas

reservoirs. 25th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Manhattan, Kansas. PLATFORM

Rivers, J.W., T.T. Cable, and P.S. Gipson. 2000. Poster presented at the Kansas Ornithological Society, Overland Park, KS: The role of farmed wetlands as habitat for birds in Kansas.

Rivers, J.W., T.T. Cable, and P.S. Gipson. 2000. Poster presented at the 8th International Symposium on Society and Resource Management, Bellingham, WA: Avian use of farmed wetlands in Kansas.

Schrank, S.J., and C.S. Guy. 2000. Bighead carp in the Missouri River. Asian carp management and control workshop, Invited.

Schrank, S.J., and C.S. Guy. 2000. Bighead carp life history characteristics in the lower Missouri River. 130th Annual Meeting of the American Fisheries Society.

Schultz, R.D., C.S. Guy, and D.A. Robinson, Jr. 2000. Recruitment of white bass in Kansas reservoirs: relations to reservoir hydrology and gizzard shad. 130th Annual Meeting of the American Fisheries Society, Ecology and Management of White Bass Poster Symposium.

Zuercher, G., P.S. Gipson, and K. Hill. 2000. 80th Annual Meeting, American Society of Mammalogists. Durham, NH: Predators, prey, and habitat association in the Inland Atlantic Forest of Paraguay: a new paradigm.

Zuercher, G. L., P. S. Gipson, and O. Carrillo. 2000. Canid Biology and Conservation Conference, Oxford, England. Bush dogs *(Speothos venaticus*) in eastern Paraguay: a preliminary analysis of diet and habitat associations. Platform presentation.

Zuercher, G. L., P. S. Gipson, and K. Hill. 2000. Carnivores 2000. Denver, CO. A new paradigm for predator-habitat associations: neotropical felids in the Inland Atlantic Forest of eastern Paraguay. Platform presentation.

Zuercher, G. L., P. S. Gipson, G. C. Stewart, P. R. Krausman, D. M. Sanchez, M. I. Grinder, and M. E. Howard. 2000. 62nd Midwest Fish and Wildlife Conference. Molecular discrimination of sympatric Canis feces in an urban setting. Platform presentation.

1999

Bister, T.J., D. W. Willis, M.L. Brown, R.M. Neumann, S.M. Jordan, C.S. Guy, and M.C. Quist. 1999. Proposed standard weight (*Ws*) equations for 19 game and non-game fishes. 129th Annual Meeting of the American Fisheries Society (Poster)

Bister, T.J., D.W. Willis, M.L. Brown, R.M. Neumann, S.M. Jordan, C.S. Guy, and M.C. Quist. 1999. Development of standard weight (*Ws*) equations for 18 game and non-game fishes. 35th annual Meeting of the Dakota Chapter, American Fisheries Society (Poster).

Braaten, P.J., and C.S. Guy. 1999. Growth, mortality and sources of larval freshwater drum in the lower channelized Missouri River. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society.

Braaten, P.J., and C.S. Guy. 1999. Growth, mortality and sources of larval freshwater drum in the lower channelized Missouri River. 129th Annual Meeting of the American Fisheries Society.

Braaten, P.J. 1999. Overwinter survival and growth of age-0 freshwater drum in the channelized Missouri River. 61th Midwest Fish and Wildlife Conference. Chicago, IL (Poster).

Cully, A.C., J.F. Cully, Jr., and R.D. Hiebert. 1999. The effects of size, fragmentation, species diversity, and seasonality on invasion of tallgrass prairie by non-native plant species. 5th International Conference on the Ecology of Invasive Alien Plants. La Maddalena, Sardinia, Italy.

Cully, J.F., Jr. 1999. Cross species comparison of plague in prairie dogs. Workshop for the Interstate Working Group to develop a National Conservation Strategy for the black-tailed prairie dog. Phoenix, AZ.

Cully, J.F., Jr. 1999. Cross species comparison of plague in Prairie dogs. Southwest Plague Workshop. Fort Collins, CO.

Cully, J.F., Jr., and G.S. Kaufman. 1999. Workshop in Kansas Gap Analysis for Kansas Department of Wildlife and Parks Senior Biologists. Kansas State University, Manhattan, KS. All day training session.

Cully, J.F., Jr., G.S. Kaufman, C. Woolley, and T. Hoernemann. 1999. Great Plains database/export system for vertebrate modeling and metadata management. 9th Annual National Gap Analysis Program Meeting, Duluth.

Cully, J. F., Jr., J. E. Kretzer, and S. L. Winter. 1999. Black-tailed prairie dogs and species diversity of associated taxa in the Kansas shortgrass steppe. Ecological Society of America annual meeting. Spokane, WA. (Poster).

Gipson, P. S. 1999. Fisheries and Wildlife Department, Utah State University, Logan, UT. Impacts of famous damaging wolves on current predator management. Invited seminar.

Gipson, P.S. Wild Hogs in Kansas and their impacts on wildlife. 1999. 50th Kansas Wildlife Federation Annual Meeting.

Gipson, P.S. 1999. Dynamics of newly established feral pig populations in Kansas and neighboring states. National Science Foundation sponsored program - "Research Experiences for Undergraduates." Manhattan, KS.

Gipson, P.S. 1999. Recent range expansions by feral hogs into the central United States. National Feral Swine Symposium, Fort Worth, TX.

Gipson, P.S., J.S. Johnson, and J.S. Pontius. 1999. Mammalian predator habitat use and responses to primitive roads in a prairie and forest ecotone. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Gipson, P.S., and T.L. Livingston. 1999. Dietary responses of coyotes to a windfall of carrion. 61st Midwest Fish and Wildlife Conference, Chicago, IL.

Gipson, P. S. 1999. University of Kansas, Department of Systematics and Ecology, Lawrence, KS. Feral Hogs in the central United States: research opportunities and management challenges. Invited seminar.

Gipson, P.S., and C.D. Lee. 1999. Wild hogs in the central United States: a new management challenge. National Feral Swine Symposium, Fort Worth, TX.

Guy, C.S. 1999. Effects of growth, mortality, and recruitment on stock density index values. 61th Midwest Fish and Wildlife Conference. Chicago, IL. (Poster)

Horton, T. 1999. Habitat use of spotted bass in a southeast Kansas stream. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Horton, T.B., and C.S. Guy. 1999. Vulnerability of spotted bass to angling in Kansas streams. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society (Poster).

Quist, M.C., C.S. Guy, J.L. Stephen, and R.D. Schultz. 1999. Abundance of age-0 walleyes and interactions with gizzard shad, white crappie, black crappie, and adult walleyes in Kansas reservoirs. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Quist, M.C., and C.S. Guy. 1999. The effects of large-scale disturbance from military activity on instream habitat and fish community characteristics in streams on Fort Riley Military Reservation. 129th Annual Meeting of the American Fisheries Society.

Quist, M.C., and C.S. Guy. 1999. The influence of military training activities on physicochemical habitat and fish community structure and function in Flint Hills streams. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society.

Quist, M. C., C. S. Guy, and J. L. Stephen. 1999. The influence of light shock on mortality of walleye fry. Annual Meeting of the Walleye Technical Committee of the North Central Division, American Fisheries Society, Davenport, Iowa. PLATFORM

Quist, M. C., and C. S. Guy. 1999. The influence of military training activities on physicochemical habitat and fish community structure and function in Flint Hills streams. 24th Annual Meeting of the Kansas Chapter of the American Fisheries Society, Emporia, Kansas, February 20. PLATFORM

Rucker, A. D. and J. F. Cully, Jr. 1999. Small mammal responses to conversion of fescue pastures to native tallgrass prairie in southeastern Kansas. American Society of Mammalogists, Seattle, WA.

Schrank, S.J., and C.S. Guy. 1999. Population and reproductive characteristics of bighead carp in the lower Missouri River. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Schrank, S.J. and C.S. Guy. 1999. Spatial and temporal variation in abundance of bighead carp in the channelized Missouri River. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society. (Poster).

Tripe, J.A., C.S. Guy, and R.E. Marteney. 1999. Density, growth, and food habits of age-0 largemouth bass in a Kansas reservoir. 24th Annual Meeting of the Kansas Chapter, American Fisheries Society.

Winter, S.L., J.F. Cully, Jr., and R. Charlton. 1999. Bird monitoring program based on remotely sensed land cover classification in a Kansas prairie location. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Wong, M., and J.F. Cully, Jr. 1999. Geographic patterns of Greater Prairie Chicken (*Tympanuchus cupido*) genetic variability in Kansas, Oklahoma, and Missouri. 61th Midwest Fish and Wildlife Conference. Chicago, IL.

Zuercher, G.L., P.S. Gipson, and T.L. Livingston. 1999. Técnicas no agresivas para estudio de mamíferos depredadores en el bosque atlántico interior. 4th Congreso Internacional Sobre Manejo de Fauna Silvestre en Amazonia y Latino America, Asuncion, Paraguay.

Zuercher, G.L., P.S. Gipson, K.E. DeMatteo, J. Short, M.J. Cliendo, E. Wite, P. Jones, J. McIntruff, J. Tarbox, and B. Whitsitt. 1999. Determinación de esencias atractivas para la captura de jagua yvguy (*Speothos venaticus*) y otros mamíferos depredadores neotropicales. 4th Congreso Internacional Sobre Manejo de Fauna Silvestre en Amazonia y Latino America, Asuncion, Paraguay.

1998

Braaten, P.J., and C.S. Guy. 1998. Physiochemical determinants of fish abundance in tributary confluences of the lower channelized Missouri River. 2nd Annual Conference on Natural Resources of the Missouri River Basin, Nebraska City, NE.

Braaten, P.J., and C.S. Guy. 1998. Growth, mortality and sources of freshwater drum larvae in the lower Missouri River. 60th Midwest Fish and Wildlife Conference.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1998. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Cully, J. F., Jr. 1998. How big must a prairie be for prairie birds? 60th Annual Midwest Fish and Wildlife Conference. Cincinnati, OH. Grassland bird symposium oral presentation.

Gerlanc, N., R. Matlack, M. Wong, G. Kaufman, and J. Cully. 1998. Gap Analysis in Kansas. Meeting of the Kansas Herpetological Society, Lawrence, KS (Poster)

Gipson, P.S., W.B. Ballard, and R.M. Nowak. 1998. Estimating the age of gray wolves by tooth wear. 60th Midwest Fish and Wildlife Conference.

Gipson, P. S. 1998. Student Chapter of The Wildlife Society, Kansas State University, Manhattan, Kansas. Is the literature about damaging wolves credible? Invited seminar.

Guy, C.S. 1998. Missouri River Benthic Fishes Project, Kansas Department of Wildlife and Parks Fisheries and Wildlife Division Meeting, Invited.

Guy, C.S., P.J. Braaten, M.A. Pegg, and C.L. Pierce. 1998. Growth and condition of benthic fishes in the Missouri River. 2nd Annual Conference on Natural Resources of the Missouri River Basin, Nebraska City, NE.

Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1998. Exemption of bass tournament anglers from Kansas fishing regulations: An opinion survey. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Horton, T.B., J.S. Tillma, and C.S. Guy. 1998. Vulnerability of spotted bass to angling in Kansas streams. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH (Poster).

Kamler, J. F., and P. S. Gipson. 1998. 24th Annual Research Forum. Kansas State University, Manhattan, KS. Home range size and habitat use among bobcats, coyotes, raccoons and opossums. Platform presentation.

Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (*Ws*) equation for shovelnose sturgeon. 2nd Annual Conference on Natural Resources of the Missouri River Basin, Nebraska City, NE.

Quist, M.C., C.S. Guy, M.N. Burlingame, and J.S. Tillma. 1998. Population characteristics and overwinter habitat use of shovelnose sturgeon. 128th Annual Meeting of the American Fisheries Society, Hartford, CT. August 25. PLATFORM

Quist, M.C., C.S. Guy, and P.J. Braaten. 1998. Standard weight (*Ws*) equation for shovelnose sturgeon. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society. Fayetteville, AR.

Quist, M.C., and C.S. Guy. 1998. Structure and function of fish communities and relations with training activities on Fort Riley Military Reservation. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH.

Schrank, S.J., P.J. Braaten, and C.S. Guy. 1998. Spatial and temporal variation in abundance of bighead carp in the channelized Missouri River. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH (Poster).

Snyder, T.R. 1998. The reliability of activity telemetry transmitters in studies of mammalian carnivores. Joint Fur Resources Workshop. St. Mary College, Leavenworth, KS.

Snyder, T.R., and P.S. Gipson. 1998. Preliminary determination of activity levels of mammalian predators based on activity transmitter pulse rates. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH.

Tripe, J.A., C.S. Guy, and R. Marteney. 1998. Structure and dynamics of age-0 fish in the littoral zone of El Dorado reservoir. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Tripe, J.A. and C.S. Guy. 1998. Density, growth, and food habits of age-0 largemouth bass in a Kansas reservoir. 60th Midwest Fish and Wildlife Conference, Cincinnati, OH.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1998. Influence of prairie dog colonies and climatic variation on bird communities in Kansas shortgrass prairie. Fifth Prairie Conservation and Endangered Species Conference. Saskatoon, Saskatchewan, Canada. (Poster)

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1998. Influence of prairie dogs on vegetation in Kansas shortgrass prairie. Fifth Prairie Conservation and Endangered Species Conference. Saskatoon, Saskatchewan, Canada. (Poster)

Zuercher, G.L. and P.S. Gipson. 1998. Molecular biology: modern tools for non-invasively studying mammalian predators. Joint Fur Resources Workshop. St. Mary College, Leavenworth, KS.

1997

Braaten, P.J. and C.S. Guy. 1997. Adult fishes associated with tributary confluences in the Lower Missouri River. 127th Annual Meeting of the American Fisheries Society.

Braaten, P.J., C.S. Guy, and the Missouri River Benthic Fishes Consortium. 1997. Habitat use and population dynamics of benthic fishes along the Missouri River. Annual Meeting of the Kansas Chapter of the American Fisheries Society, poster.

Braaten, P.J., M.N. Doeringsfeld, and C.S. Guy. 1997. Precision of aging river Carpsuckers using scales and dorsal fin rays. 1st Annual Conference on Natural Resources of the Missouri River Basin, Columbia, Missouri.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1997. Temporal dynamics of fish abundance in tributary confluences of the lower Missouri River. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Braaten, P.J., and C.S. Guy. 1997. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Braaten, P.J., M.R. Doeringsfeld, and C.S. Guy. 1997. Temporal dynamics of fish abundance in tributary confluences of the lower Missouri River. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Burlingame, M.N., C.S. Guy, and T.D. Mosher. 1997. 1995 Kansas licensed angler use and preference survey and attitudes toward angling by secondary education students. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Burlingame, M.N., C.S. Guy, and T.D. Mosher. 1997. 1995 Kansas Resident Licensed Angler Use and Preference Survey: An analysis by management region. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Burlingame, M.N., C.S. Guy, and T.D. Mosher. 1997. 1995 Kansas Licensed Angler Use and Preference Survey and attitudes toward angling by secondary education students. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Cully, J.F., Jr. Introductory Remarks. 1997. Seventh International Theriological Congress, Acapulco, Guerrero, Mexico.

Cully, J.F., Jr. Plague and prairie dogs. 1997. Seventh International Theriological Congress, Acapulco, Guerrero, Mexico. Oral presentation.

Cully, J.F., Jr. and H.L. Michaels. 1997. Avian diversity and the intermediate disturbance hypothesis at Fort Riley Army Reserve, Kansas. Annual Meeting of the Wilson Ornithological Society, Manhattan, KS.

Gipson, P.S. and R. Applegate. 1997. Population surveys: what do we need to know in order to manage wildlife? Annual Meeting of the Kansas Chapter of the Wildlife Society, Wichita, KS.

Gipson, P.S., B. Hlavachick, T. Berger, C.D. Lee. 1997. Explanations for recent range expansions by wild hogs into midwestern states. Great Plains Wildlife Damage Control Workshop, Nebraska City, NE.

Gipson, P.S., C.D. Lee, M.L. Burenheide, J.F. Kamler, J.E. Kretzer, D.J. Martin, C.C. Perchellet, C.M. Willemssen, and J. Wiens. 1997. Experimental rodent control at the Beef Cattle Research Center, Kansas State University. Great Plains Wildlife Damage Control Workshop, Nebraska City, NE.

Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1997. Exemption of bass tournament anglers from Kansas fishing regulations: An opinion survey. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Guy, C.S., M.N. Burlingame, T.D. Mosher, and D.D. Nygren. 1997. Exemption of bass tournament anglers from Kansas fishing regulations: An opinion survey. Joint Annual Meeting of the Kansas, Arkansas, and Oklahoma Chapters of the American Fisheries Society.

Hoover, D.E., and P.S. Gipson. 1997. Plant community structure and avian composition of grazed and ungrazed riparian habitats in southeastern Kansas. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Hoover, D.E., and P.S. Gipson. 1997. Influence of livestock exclusion on riparian vegetation and breeding avifauna in southeastern Kansas. 23th Annual Student Research Forum, Division of Biology, Kansas State University, Manhattan, KS.

Kamler, J.F., P.S. Gipson, and D.P. Jones. 1997. Home range size and habitat use among bobcats, coyotes, raccoons and opossums. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Kamler, J.F. and P.S. Gipson. 1997. Home range and habitat use among bobcats, coyotes, raccoons, and opossums. 24th Annual Student Research Forum, Division of Biology, Kansas State University, Manhattan, KS.

Kretzer, J.E., and J.F. Cully, Jr. 1997. The influence of black-tailed prairie dog (*Cynomys ludovicianus*) colonies on reptile and amphibian diversity in the shortgrass prairie of southwest Kansas. Seventh International Theriological Congress, Acapulco, Guerrero, Mexico. Oral Presentation.

Kretzer, J.E., and J.F. Cully, Jr. 1997. The influence of black-tailed prairie dog (*Cynomys ludovicianus*) colonies on reptile and amphibian diversity in the shortgrass prairie of southwest Kansas. Kansas Mammal Society, Emporia, KS. Oral presentation.

Kretzer J.E. and J.F. Cully, Jr. 1997. The influence of black-tailed prairie dog (*Cynomys ludovicianus*) colonization on reptile and amphibian diversity in the shortgrass prairie.

Twenty-third Annual Student Research Forum, Division of Biology, Kansas State University, Manhattan, KS.

Lee, C.D., P.S. Gipson, M.L. Burenheide, J.F. Kamler, J.E. Kretzer, D.J. Martin, C.C. Perchellet, C.M. Willemssen, and J. Wiens. 1997. Experimental rodent control at the Beef Cattle Research Center, Kansas State University. Eighty-fourth Annual Cattleman's Day, Manhattan, Kansas (poster presentation).

Quist, M.C. and C.S. Guy. 1997. Structure and function of Channel Catfish and Shovelnose Sturgeon in the Upper Kansas River. Annual Meeting of the Kansas Chapter of the American Fisheries Society, Wichita, KS.

Quist, M. C., and C. S. Guy. 1997. Structure and function of channel catfish and shovelnose sturgeon populations in the upper Kansas River. Annual Meeting of the Kansas Department of Wildlife and Parks–Fisheries Division, Wichita, Kansas. PLATFORM (INVITED)

Quist, M.C., J.S. Tillma, M.N. Burlingame, and C.S. Guy. 1997. Overwinter habitat use by shovelnose sturgeon in the Kansas River. 59th Midwest Fish and Wildlife Conference, Milwaukee, WI.

Quist, M. C., and C. S. Guy. 1997. Stream sampling and fish communities on Fort Riley Military Reservation. Fort Riley Natural Resources Department, Fort Riley Military Reservation, Kansas. PLATFORM (INVITED)

Tillma, J.S., C.S. Guy, and C.S. Mammoliti. 1997. Abiotic and biotic factors influencing Spotted Bass in southeast Kansas streams. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Tripe, J.A., and C.S. Guy. 1997. Spatial and temporal variability of fish population characteristics in a warmwater stream. 59th Midwest Fish and Wildlife Conference.

Tripe, J.A., and C.S. Guy. 1997. Long-term sampling in Kings Creek. 8th Annual Konza Prairie Workshop.

Tripe, J.A., C.S. Guy, and C.S. Mammoliti. 1997. Spatial and temporal variability of fish population characteristics in a warmwater stream. Annual meeting of the Kansas Chapter of the American Fisheries Society.

Tripe, J.A., and C.S. Guy. 1997. Growth, food habits, and lipid composition of Age-0 Largemouth Bass in El Dorado Reservoir. Wichita Bass Club Meeting.

Wiens, J.R. and C.S. Guy. 1997. Tree Revetments in Kansas: how well do they work? Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Winter, S.L. and J.F. Cully, Jr. 1997. Avifaunal composition and relative abundance on black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. Annual Meeting of the Wilson Ornithological Society, Manhattan, KS. Poster presentation.

Winter, S.L., and J.F. Cully, Jr. 1997. Avian communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado. Fourth Annual Conference of the Wildlife Society. Snowmass, CO. Oral presentation.

Winter, S.L., J.F. Cully, Jr., and J.S. Pontius. 1997. Vegetation of black-tailed prairie dog colonies and non-colonized areas in the shortgrass steppe of southwest Kansas and southeast Colorado. Seventh International Theriological Congress, Acapulco, Guerrero, Mexico. Oral presentation.

1996

Arnold, E.C. and P.S. Gipson. 1996. Success of artificial pheasant nests on Conservation Reserve Program grassland and wheat and fallow croplands. 58th Midwest Fish and Wildlife Conference.

Braaten, P. J., and C.S. Guy. 1996. Stranding of *Pentagenia vittigera* Following Flow Reductions in the Lower Missouri River. 58th Midwest Fish and Wildlife Conference, poster.

Burlingame, M.N., and C.S. Guy. 1996. Kansas Resident Licensed Angler Use and Preference Survey: A Typological Analysis. 58th Midwest Fish and Wildlife Conference.

Cully, J.F., Jr. 1996. Density compensation in a Gunnison's prairie dog population reduced by plague. 58th Midwest Fish and Wildlife Conference.

Cully, J.F., Jr. 1996. La Crosse Virus: an example of a vector transmitted parasite under selection for reduced virulence. Annual meeting of the Ecological Society of America, Providence, R.I.

Cully, J. F., Jr., and C. L. Fiedler. 1996. An uneven-age timber management program to restore Mexican spotted owl habitat. Annual Meeting of the Cooper Ornithological Society, San Diego, and Third Annual Conference of the Wildlife Society, Cincinnati, Poster.

Fiedler C. L., and J. F. Cully, Jr. 1996. Developing Mexican spotted owl habitat in southwest forests using silviculture. Annual Meeting, Society for Ecological Reconstruction., New Brunswick, NJ.

Gipson, P.S., W.B. Ballard, and R.M. Nowak. 1996. Famous damaging wolves and the credibility of wildlife literature. Third Annual Conference of The Wildlife Society.

Gipson, P.S., B. Hlavachick, and T. Berger. 1996. Range expansion by feral hogs into the central Great Plains. 58th Midwest Fish and Wildlife Conference.

Gipson, P.S., D.P. Jones, J. Luchsinger, and C.D. Richardson. 1996. Reaching the decision: eradication or control of a feral pig population on Fort Riley, Kansas. Joint Meeting of the Kansas Academy of Sciences and Kansas Chapter of The Wildlife Society.

Guy, C. S., and S. L. Denson-Guy. 1996. An Introduction to Learning Styles: Meeting the Needs of Graduate Students in the Classroom. 126th Annual Meeting of the American Fisheries Society, Dearborn, Michigan.

Guy, C. S. 1996. Predator-Prey Interactions in Small Impoundments: Implications for Fisheries Management. The Wildlife Society Student Chapter Conclave.

Hoch, G. 1996. Using Remote Sensing to Identify Herbaceous Plant Communities in the Tallgrass Prairie at Fort Riley. KSU Ecology Research Group.

Hoch, G. 1996. Is Heterogeneity an Intrinsic Quality of the Landscape? 8th Annual Konza Prairie LTER Workshop.

Hoch, G. 1996. An Introduction to Multi-temporal Remote Sensing as it is Being Used by KS GAP. Guest Lecturer. Emporia State University.

Hoover, D.E. 1996. Riparian livestock grazing: an overview and study methodology. Kansas Department of Wildlife and Parks Annual Wildlife Workshop. Wichita, Kansas.

Kamler, J.F., P.S. Gipson and D.P. Jones. 1996. Interactions of mammalian predators on Fort Riley Military Reservation. Annual Meeting of the Kansas Chapter of The Wildlife Society and Kansas Academy of Science, Emporia, KS.

Kamler, J.F., P.S. Gipson and D.P. Jones. 1996. Interactions of mammalian predators on Fort Riley Military Reservation. Annual Meeting of the Kansas Chapter of The Wildlife Society and Kansas Academy of Science, Emporia, KS.

Lee, C. and P.S. Gipson. 1996. Private nuisance wildlife control: is there a future in Kansas? 58th Midwest Fish and Wildlife Conference.

Matlack, R.S., P.S. Gipson, and D.W. Kaufman. 1996. Is crop land suitable habitat for swift foxes in western Kansas? 58th Midwest Fish and Wildlife Conference.

McCoy, M.W. and P.S. Gipson. 1996. Habitat selection by pheasants at the landscape level: the relative importance of Conservation Reserve Program lands. 58th Midwest Fish and Wildlife Conference.

Michaels, H.L., and J. F. Cully, Jr. 1996. Habitat Selection by breeding Loggerhead shrikes and Henslow's sparrows in tallgrass Prairie. Annual Meeting of the Ecological Society of America, Providence, RI.

Smith, W.K., P.S. Gipson, and K. Church. 1996. Landscape level effects of the Conservation Reserve Program on territorial male pheasant in the High Plains. 58th Midwest Fish and Wildlife Conference.

Tillma, J.S., and C.S. Guy. 1996. Abiotic and Biotic Factors Influencing Spotted Bass *Micropterus punctulatus* in Southeast Kansas Streams. 58th Midwest Fish and Wildlife Conference.

Tillma, J. S., C. S. Guy, and J. Milligan. 1996. Catch Rates of Channel Catfish and Flathead Catfish in Two Sizes of Hoop Nets, Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Tripe, J.A., and C.S. Guy. 1996. Spatial and Temporal Variability of Fish Population Characteristics in a Warmwater Stream. 58th Midwest Fish and Wildlife Conference.

Tripe, J.A., and C. S. Guy. 1996. Long-term sampling in Kings Creek. 8th Annual Konza Prairie Workshop.

Warren, J. R., and C. S. Guy. 1996. Effects of tree revetments on the abiotic and biotic components in three Kansas streams. 8th Annual Konza Prairie Workshop.

Waters, D.S., C. S. Guy, and C.P. Clouse. 1996. Coded Wire Tag Movement in Paddlefish Rostrums. 58th Midwest Fish and Wildlife Conference, poster. Third Annual Conference of the Wildlife Society, Cincinnati, OH.

Waters, S. D., C. S. Guy, and C. P. Clouse. 1996. Movement of Coded Wire Tags in Paddlefish, Annual Meeting of the Kansas Chapter of the American Fisheries Society, poster.

Wiens, J.R., and C.S. Guy. 1996. Effects of Tree Revetments on Fish Populations and Channel Morphometry in Two Kansas Streams. 58th Midwest Fish and Wildlife Conference.

1995

Arnold, E.C., K.E. Church, and P.S. Gipson. 1995. Use of artificial pheasant clutches as an index to brood production rates of game birds. Perdix VII: International Symposium on Partridges, Quails, and Pheasants in the Western Palearctic and Neartic.

Cully, A. C. 1995. Application of the Endangered Species Act. Annual Meeting of the Kansas Chapter, The Wildlife Society.

Cully, J. F., Jr. 1995. Managing biodiversity: What does it mean? Annual Meeting of the Kansas Chapter, The Wildlife Society.

Gipson, P.S. and D.P. Jones. 1995. Population dynamics of feral pigs on Fort Riley Army Base, Kansas. Kansas Chapter of The Wildlife Society.

Gipson, P.S. 1995. Role of the Kansas Cooperative Fish and Wildlife Research Units and how it relates to the National Biological Service. Annual Meeting of Kansas Association of Conservation Districts.

Gipson, P., C. Richardson, D.P. Jones, H. J. Able, and J. Luchsinger. 1995. Status of feral pigs, *Sus scrofa,* at Fort Riley, Kansas. Annual Meeting of the Kansas Chapter, The Wildlife Society.

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1995. Effects of Study Location on Tag Loss From Paddlefish, 57th Midwest Fish and Wildlife Conference.

Guy, C. S., D. W. Willis, and R. D. Schultz. 1995. Evaluation of catch per unit effort and size structure of white crappies collected with trap nets and gill nets. Multidimensional approaches to reservoir fisheries management, Third Reservoir Fisheries Symposium, Chattanooga, Tennessee.

Guy, C. S. 1995. Current and Proposed Stream Research Projects at Kansas State University: The Unit's Perspective. Annual Meeting of the Kansas Chapter of the American Fisheries Society, Invited paper.

Guy, C. S., R. D. Schultz, and C. P. Clouse. 1995. Effects of Study Location on Tag Loss From Paddlefish. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Hoch, G., and D. Krohne. 1995. Demography of populations of Peromyscus leucopus in fragmented habitat. Annual Meeting of the Kansas Chapter, The Wildlife Society.

Madison, L.A. and P.S. Gipson. 1995. Wildlife damage control in Kansas: private operators and public agencies. Seventh Eastern Wildlife Damage Management Conference.

Matlack, R.S., P.S. Gipson, and L.B. Fox. 1995. Survival and cause specific mortality of swift foxes in western Kansas. Prairie States Ecology Conclave.

Matlack, R. S. 1995. Survival and mortality factors of Swift foxes in western Kansas. Annual Meeting of the Kansas Chapter, The Wildlife Society.

Michaels, H. L. 1995. The red wolf: The successful management of an endangered species. Annual Meeting of the Kansas Chapter, The Wildlife Society.

Richardson, C.D., P.S. Gipson, D.P. Jones, and J. Luchsinger. 1995. A long term management plan for feral pigs on Fort Riley Army Base, Kansas. Seventh Eastern Wildlife Damage Management Conference.

Tillma, J. S., C. S. Guy, and J. Milligan. 1995. Catch Rates of Channel Catfish and Flathead Catfish in Two Sizes of Hoop Nets, 57th Midwest Fish and Wildlife Conference, poster.

Warren, J. R., C. S. Guy, and M. L. Brown. 1995. Development of a Standard Weight-Equation for Spotted Bass using the RLP-Technique. Annual Meeting of the Kansas Chapter of the American Fisheries Society.

Wiens, J.R., C. S. Guy, and M. L. Brown. 1995. Proposed Revision of the Standard Weight (*Ws*) Equation for Spotted Bass, 57th Midwest Fish and Wildlife Conference, poster.

1994

Warren, J. R., and C. S. Guy. 1994. Effects of tree revetments on the abiotic and biotic components in three Kansas streams. 6th Annual Konza Prairie Workshop.

Table 4. List of graduate students for the Kansas Cooperative Fish and Wildlife Research Unit 1991 – 2016.

Student	PI/Advisor	Year Graduated	Degree Received	Thesis or Dissertation Title	Current Position
Althoff, Peggy S. Shaw (McBee) - M.S.	Thien	2005	M.S.	Evaluation of soil quality indicators following disturbance by an Abrams M1A1 main battle tank.	
Althoff, Peggy S. Shaw (McBee) - Ph.D.	Thien	2007	Ph.D.	Indicators of disturbance and recovery of a tallgrass prairie ecosystem following military vehicle traffic	
Anderson, Christopher D.	Gipson, Becker, Cable, Rintoul	2003	M.S.	Recreational pressure at Fort Niobrara National Wildlife Refuge: Potential impacts on avian use and seasonal productivity along the Niobrara River. Major Prof: D. Becker	
Baumgardt, Jeremy	Gipson	2006	M.S.	The effects of trapping methods on estimation of population parameters for small mammals	Postdoctoral Research Associate, Texas A&M University
Becker, Thomas	Haukos	current			Horticulture & Natural Resources Department
Bouska, Kristen Pitts	Paukert	2008	M.S.	Assessing threats to native fishes of the Lower Colorado River Basin	Ecologist, U.S. Geological Survey, Columbia, MO
Bouska, Wesley	Paukert	2008	M.S.	Road crossing designs and their impact on fish assemblages and geomorphology of Great Plains streams	Program Operations Assistant Manager, U.S. Fish and Wildlife Service
Braaten, Patrick J.	Guy	2000	Ph.D.	Growth of fishes in the Missouri River and Lower Yellowstone River, and factors influencing recruitment of freshwater drum in the lower channelized Missouri River	Research Fish Biologist, USGS Columbia Environmental Research Center, Fort Peck, MT
Burak, Matthew	Mather	2011	M.S.	Developing Standardized Metrics to Quantify the Temporal Distribution of Migrating Anadromous Herring: Comparing Adult Returns Across Coastal Rivers	Fisheries Biologist, Louis Berger, Business Management Consultant
Burlingame, Matthew	Guy	1997	M.S.	1995 Kansas licensed angler use and preference survey and attitudes towards angling by secondary education students	Fish Biometrician, Indiana Department of Natural Resources
Bussen, Patrick	Hutchinson, Stacy	2009	M.S.	Analysis of a Rapid Soil Erosion Assessment Tool	
Conard, Jonathan (M.S.)	Gipson	2003	M.S.	Responses of small mammals and their predators to military disturbance in tallgrass prairie	Associate Professor of Biology; Department Chair of Natural Sciences & Mathematics

Conard, Jonathan (Ph.D.)	Gipson	2009	Ph.D.	Genetic variability, demography, and habitat selection in a reintroduced elk (Cervus elaphus) population	Associate Professor of Biology; Department Chair of Natural Sciences & Mathematics
Cully, Anne C.	Cully	2000	Ph.D.	The effects of size and fragmentation on tallgrass prairie plant species diversity	Retired
Eitzmann, Jeff	Paukert	2008	M.S.	Spatial habitat variation in a Great Plains river: effects on the fish assemblage and food web structure	Vice President of Operations, Falcon Drilling, Inc.
Fencl, Jane	Mather	2015	M.S.	How big of an effect do small dams have?: using ecology and geomorphology to quantify impacts of low-head dams on fish biodiversity	Ph.D. program, University of Washington, Freshwater Ecology & Conservation Lab
Fischer, Jason	Paukert	2012	M.S.	Influence of sand dredging on habitat and fish communities of the Kansas River	Fisheries Technician, USGS Great Lakes Science Center Headquarters in Ann Arbor, MI
Fischer, Jesse	Paukert	2007	M.S.	Structural organization of Great Plains stream fish assemblages: Implications for sampling and conservation	Postdoctoral Researcher, North Carolina Cooperative Fish & Wildlife Research Unit
Flock, Brian E.	Gipson	2006	Ph.D.	The effects of landscape configuration on northern bobwhite in southeastern Kansas	Wildlife Diversity Coordinator, and Bats, Herps, and SWAP Coordinator, Tennessee Wildlife Resources Agency
Gerber, Kayla	Mather	2015	M.S.	Tracking blue catfish: quantifying system-wide distribution of a mobile fish predator throughout a large heterogeneous reservoir	Fisheries Biology, Kentucky Department of Fish and Wildlife Resources
Gerken, Joe	Paukert	2015	Ph.D.	Fish and invertebrate community response to flow magnitude in the Kansas River	Assistant Professor, Santa Fe College, Gainesville, FL (online)
Goldberg, Amanda	Cully	2012	M.S.	Apparent survival, dispersal, and abundance of black-tailed prairie dogs	Ph.D. program, University of Idaho
Hitchman, Sean	Mather	current			
Hoch, Greg A.	Cully	1997	M.S.	Mapping and monitoring of disturbance from military training at Fort Riley, Kansas and an investigations into the stability of grassland ecotones using satellite remote sensing	Prairie Habitat Ecologist, Minnesota Department of Natural Resources
Hoover, David E.	Gipson	1997	M.S.	Vegetation and breeding bird assemblages in grazed and ungrazed riparian habitats in southeastern Kansas	Small Game Coordinator, Missouri Department of Conservation
Horton, Travis B.	Guy	2000	M.S.	Habitat use and movement of spotted bass in Otter Creek, Kansas	Fisheries Manager, Montana Fish, Wildlife & Parks, Bozeman, MT
Jeffress, Mackenzie Shardlow	Paukert	2009	M.S.	Factors affecting the detectability and distribution of the North American river otter	Wildlife Diversity Biologist, Nevada Department of Wildlife

Jensen, William E.	Cully	2003	Ph.D.	Spatial variation in Brown-headed Cowbird (Molothrus ater) abundance and brood parasitism in Flint Hills Tallgrass Prairie	Associate Professor, Emporia State University
Johnson, Lacrecia	Haukos	2011	Ph.D.	Current status and function of playa wetlands on the Southern Great Plains	Zone Biologist, Sonoran and Chihuahuan Deserts, Southwest Natural Resources Inventory and Monitoring, National Wildlife Refuge System
Johnson, Tammi	Cully	2005	M.S.	Spatial dynamics of a bacterial pathogen: Sylvatic plague in Black-tailed prairie	Division of Biological Sciences, University of Montana, Missoula, Montana
Johnson, Tracey N.	Sandercock	2006	M.S.	Ecological restoration of tallgrass prairie: grazing management benefits plant and bird communities in upland and riparian habitats	Assistant Professor, Department of Fish and Wildlife Services, University of Idaho
Kamler, Jan F.	Gipson	1998	M.S.	Ecology and interspecific relationships of mammalian predators on Fort Riley Military Reservation, Kansas	Panthera, Leopard Program, Southeast Asia Coordinator. Affiliated with the Wildlife Conservation Research Unit (WildCRU), University of Oxford since 2004.
Kearns, Brian	Haukos	2015	Ph.D.	Patterns and pathways of lead contamination in mottled ducks (Anas fulvigula) and their habitat	Staff Geospatial Scientist at Waterborne Environmental, Inc., Washington D.C. Metro area
Kennedy, Cristina	Mather	2013	M.S.	Habitat Heterogeneity Concentrates Predators in the Seascape: Linking Intermediate-Scale Estuarine Habitat to Striped Bass Distribution	Coastal Habitat and Water Quality Specialist, MA Office of Coastal Zone Management
Kraft, John	Haukos	current			
Kretzer, Justin E.	Cully	1999	M.S.	Herpetological and coleopteran communities of black-tailed prairie dog colonies and non-colonized areas in southwest Kansas	Unknown
Lautenbach, Jonathan	Haukos	current			
Lautenbach, Joseph	Haukos	2015	M.S.	Lesser prairie-chicken reproductive success, habitat selection, and response to trees	Assessment Biologist, Sault Ste Marie Tribe of Chippewa Indians
Lehrter, Richard	Mather	current			
Limb, Ryan	Bidwell, T.G.	2008	M.S.	The effects of disturbance on grassland plant communities	Assistant Professor, North Dakota State University
Livingston, Troy R.	Gipson	2001	M.S.	Coprophagy: An ecological investigation of the consumption of mammalian carnivore feces	Unknown. Last known U.S. DOD Fort Riley
Madison, L. A. "Andy"	Robel	1998	Ph.D.	Dissertation: Influence of food plots on the over-winter survival, hunting vulnerability, and movement patterns of Northern	

				Bobwhites with notes on the metabolizable energy of food plot grains	
Makinster, Andy	Paukert	2006	M.S.	Flathead catfish population dynamics in the Kansas River	Rental Sales Specialist, Border Equipment. Formerly Native Fish Project coordinator, AZ Game and Fish Department, also Fisheries Biologist, Aquatic Environmental Services, Inc.
Malone, Willow	Haukos	current			
Mapes, Robert	Mather	current			
Matlack, Raymond S.	Gipson	1997	M.S.	The swift fox in rangeland and cropland in western Kansas: Relative abundance, mortality, and body size	Associate Professor, West Texas A&M University, Canyon, TX
McCullough, Kelsey	Haukos	current			
McDowell, Steve	Haukos	2014	M.S.	Environmental availability and lead exposure to mottled ducks (Anas fulvigula) in the Texas Chenier Plains region	Wetland/Waterfowl Specialist, Texas Parks and Wildlife Department, Port Arthur, TX
Michaels, Heidi L.	Cully	1997	M.S.	Landscape and fine scale habitat of the Loggerhead Shrike and Henslow's Sparrow on Fort Riley Military Reservation, Kansas	Unknown
Moon, Derek	Cully	2012	M.S.	Small mammals in disturbed tallgrass prairie landscapes	KDWPT, Milford Wildlife Area Office
Moon, Jena	Haukos	2014	Ph.D.	Mottled Duck (Anas fulvigula) ecology in the Texas Chenier Plain Region	Southwest Natural Resources Inventory and Monitoring, National Wildlife Refuge System
Newby, Lorri A. (now Murray)	Cully	2005	M.S.	Effects of experimental manipulation of coterie size on demography of Black-tailed prairie dogs in South Dakota	Accountant, Yellowstone Park Service Stations
Ogden, Sarah	Haukos	current			
Parker, Timothy H.	Zimmerman	1997	M.S.	Nest predation and its relationship to nest placement in tallgrass prairie shrub patches	
Peterson, Zachary	Mather	2015	M.S.	Quantifying patterns and select correlates of the spatially and temporally explicit distribution of a fish predator (Blue Catfish, Ictalurus furcatus) throughout a large reservoir ecosystem	Fisheries Biologist, Bob Lusk Outdoors, Whitesboro, TX
Pigg, Rachel	Cully	2014	Ph.D.	Patterns and Processes of Dispersal of Black-Tailed Prairie Dogs in a Heavily Managed Landscape of the Great Plains Landscape Conservation Cooperative	Assistant Professor, Presbyterian College, Clinton, South Carolina

Plumb, Reid	Haukos	2015	M.S.	Lesser prairie-chicken movement, space use, survival, and response to anthropogenic structures in Kansas and Colorado	California Department of Fish and Wildlife, Montague, CA 96064
Press, Bobi (now Naylor)	Bloomquist, Leonard	1996	M.S.	An Analysis of the Wildlife Habitat Evaluation Program (Dept. of Sociology, Anthropology & Social Work)	
Proboszcz, Stanley L.	Guy	2003	M.S.	Evaluation of habitat enhancement structure use by spotted bass in natural and experimental streams	Fisheries Biologist, Watershed Watch Salmon Society, Coquitlam, BC
Quist, Michael C.	Guy	1999	M.S.	Structure and function of fish communities in streams on Fort Riley Military Reservation	Assistant Unit Leader-Fisheries, Idaho Cooperative Fish and Wildlife Research Unit
Quist, Michael C.	Guy	2002	Ph.D.	Abiotic Factors and Species Interactions that Influence Recruitment of Walleyes in Kansas Reservoirs	Assistant Unit Leader-Fisheries, Idaho Cooperative Fish and Wildlife Research Unit
Riecke, Thomas	Haukos	2013	M.S.	Lead exposure and nesting ecology of black-necked stilts (Himantopus mexicanus) on the Upper Texas Coast	Ph.D. program, Natural Resources and Environmental Science, University of Nevada-Reno
Rivers, James W.	Cable & Gipson	1999	M.S.	Seasonal avian use patterns of farmed wetlands and nest predation dynamics in riparian grasslands dominated by reed canary grass (Phalaris arundinacea)	Assistant Professor, Senior Research, Oregon State University
Robinson, Samantha	Haukos	2015	M.S.	Landscape ecology, survival and space use of lesser prairie-chickens	Ph.D. program, Virginia Tech Shorebird Program
Rucker, Amber (now Keller)	Cully	2001	M.S.	Conversion of tall fescue pastures to tallgrass prairie in southeastern Kansas: Small mammal responses	Certified Instructor, REFIT Revolution (fitness instructor), St. Peters, MO. Formerly Coordinator of School Services, Botanical Research Institute of Texas
Schloesser, Joshua	Paukert	2008	M.S.	Large river fish community sampling strategies and fish associations to engineered and natural river channel structures	Fish Biologist, U.S. Fish and Wildlife Service, Ashland Fish and Wildlife Conservation Office
Schrank, Sally J.	Guy	2000	M.S.	Population characteristics of bighead carp Hypophthalmichthys nobilis larvae and adults in the Missouri River and interspecific dynamics with paddlefish Polyodon spathula	Director of Development, The Nature Conservancy, Bozeman, MT
Severson, Andrea	Paukert	2010	M.S.	Effects of zebra mussel (Dreissena polymorpha) invasion on the aquatic community of A Great Plains reservoir	Environmental Protection Specialist, Western Area Power Administration (WAPA)
Smith, Joseph	Mather	2012	Ph.D.	Beaver dams maintain native fish biodiversity via altered habitat heterogeneity in a coastal stream network: Evaluating gear, quantifying fish assemblages, and testing ecological	Post-doctoral Research Associate, University of Washington

				hypotheses	
Smith, William K.	Gipson	1996	M.S.	Responses of ring-necked pheasants to Conservation Reserve Program fields during courtship and brood rearing in the high plains	Wildlife Ecologist, Coordinator of Private Lands Program, South Dakota Game, Fish and Parks
Snyder, Patricia R.	Gipson	2000	M.S.	Assessment of activity transmitters based on behavioral observations of coyotes, bobcats, and raccoons	Manhattan, KS
Spears, Brian	Mark Wallace	2002	M.S.	MS thesis, Texas Tech University, Wild turkey pre-flight poult habitat characteristics and survival	Restoration Program Manager, US Fish and Wildlife Service, Fairhope, AL
Spencer, David	Daniels, M.	2014	M.S.	A Historical Record of Land Cover Change of the Lesser Prairie-chicken Range in Kansas	GIS Cartographer, Eastview Geospatial
Stansberry, Brooke	Shawn Hutchinson	2005	M.S.	Landscape Factors Influencing the Presence of Migrant Forest Songbirds in the Kansas Flint Hills	Fish and Wildlife Biologist, US Fish and Wildlife Service, Wood River, NE
Stetter, Andrew	Haukos	2014	M.S.	Nest-site Selection, Duckling Survival, and Blood Parasite Prevalence of Lesser Scaup Nesting at Red Rock Lakes National Wildlife Refuge	Wildlife Biologist, US Fish and Wildlife Service
Strakosh, Timothy R.	Guy, Gido	2006	Ph.D.	Effects of water willow establishment on littoral assemblages in Kansas reservoirs: Focus on Age-0 largemouth bass	Fish Biologist, U.S. Fish & Wildlife Service, Atlanta, GA
Sullins, Daniel (M.S.)	Conway/Haukos	2013	M.S.	Habitat use and origins of American woodcock wintering in east Texas	Graduated from Stephen F. Austin State University
Sullins, Daniel (Ph.D.)	Haukos	current			
Taylor, Ryland	Mather	current			
Thiagarajan, Bala	Cully	2006	Ph.D.	Community dynamics of rodents, fleas and plague associated with black-tailed prairie dogs	Artist, Wood Dale, Illinois
Tillma, Jeff S.	Guy	1997	M.S.	Characteristics of spotted bass in southeast Kansas streams	Stream Habitat Specialist, Minnesota Department of Natural Resources
Tripe, Jeffry A.	Guy	2000	M.S.	Density, growth, mortality, food habits, and lipid content of age-0 largemouth bass in El Dorado Reservoir, Kansas	Basehor, KS
VanNimwegen, Ron	Cully	2009	Ph.D.	Behavioral ecology of grasshopper mice and deer mice	N/A
Whitson, Mike	Haukos	current			Texas Tech University
Wiens, Jennifer R.	Guy	1996	M.S.	Effects of tree revetments on the abiotic and biotic components in two Kansas streams	McPherson, KS
Winter,	Cully	1999	M.S.	Plant and breeding bird communities of	U.S. Fish and Wildlife Service, Winona,

Stephen L.				black-tailed prairie dog colonies and non-colonized areas in southwest Kansas and southeast Colorado	Minnesota
Wong, Mayee	Cully	2003	M.S.	High spatial homogeneity in a sex-biased mating system: The genetic population structure of greater prairie chickens (Tympanuchus cupido pinnatus) in Kansas, Missouri, and Nebraska	Hawaii Department of Health
Zavaleta, Jennifer	Haukos	2012	M.S.	Effects of grazing and herbicide treatments to restore degraded sand shinnery oak grasslands	Ph.D. program, University of Michigan, Natural Resources Policy
Zuercher, Gerald L.	Gipson	2001	Ph.D.	The ecological role of the Bush Dog, Speothos venaticus, as part of the mammalian predator community in the Interior Atlantic Forest of Paraguay	Department Head & Professor, Department of Natural and Applied Sciences, University of Dubuque