

Biennial Report
2009-2010

**Texas Cooperative Fish and
Wildlife Research Unit**



Front cover photograph: MS graduate student Nick Pirius tracks lesser prairie-chickens at sunrise in west Texas. (Credits for this and other pictures in report: Texas Unit and affiliated staff and students.)

Contents

Introduction	2
Accomplishments at a Glance	3
Cooperators and Personnel	4
Coordinating Committee	4
Unit Staff	4
Unit Contact Information	4
Texas Tech University	5
Texas Parks and Wildlife	5
Federal Agencies	5
Other Institutions	5
Unit Students	6
Unit-Affiliated Students	6
Undergraduate Students and Field Technicians	6
Unit and Affiliated Student Theses and Dissertations	7
Unit and Affiliated Student Honors and Awards	7
Terrestrial Research	8
Completed Projects	8
Ongoing Projects	13
Aquatic Projects	19
Completed Projects	19
Ongoing Projects	22
Unit Activities	24
Journal Articles	24
Presentations	25
Workshops Organized	29
Unit Staff Awards	29

Introduction

The Cooperative Research Units Program is a partnership among the U.S. Geological Survey, host universities, state natural resource agencies, the Wildlife Management Institute and the U.S. Fish and Wildlife Service. Its purpose is to facilitate collaborative research and education activities related to natural resource management and conservation. The Texas Cooperative Fish and Wildlife Research Unit was established in 1988 and first staffed in 1989. Its host university is Texas Tech University and its cooperating state agency is Texas Parks and Wildlife Department. Unit scientist positions include a Unit Leader and two Assistant Leaders. Dr. Reynaldo Patiño currently serves as Unit Leader and Drs. Clint Boal and Tim Grabowski as Assistant Unit Leaders in Wildlife and Fisheries, respectively. Mrs. Tammi Barnett has served as the Unit's Administrative Business Assistant since October of 2009, and Mrs. Tonya Pinkerton served in this role in fiscal year 2009.

The academic and research expertise of the Texas Unit covers aquatic and terrestrial ecosystems, and specific fields of interest include fisheries and wildlife management, aquatic and wildlife ecology, aquatic habitat restoration, community ecology, ecophysiology, ecotoxicology, reproductive biology, and fish culture. Contributions to these fields are made possible by the efforts not only of unit scientists but also our many university faculty cooperators. The present biennial report details the activities and accomplishments of the Texas Unit for the period covering fiscal years 2009 and 2010.

The Texas Unit works with a wide array of cooperators including university, federal, state, and foreign scientists and resource managers to advance its mission of conducting research, educating graduate students, and providing technical assistance. During the present reporting period, funds to support Unit and Unit-affiliated

projects were provided by the U.S. Geological Survey, Texas Parks and Wildlife Department, National Park Service, U.S. Department of Agriculture, U.S. Fish and Wildlife Service, U.S. Department of Defense, U.S. Agency for International Development, and other governmental and non-governmental organizations.

We thank our many partners and collaborators for their invaluable contributions to our unit's programs. Please feel free to contact us with comments or requests for additional information.

*The Scientists and Staff of the
Texas Cooperative Fish & Wildlife Research Unit*

Accomplishments at a Glance

In September 2010, after a 7-year-long vacancy, the Assistant Unit Leader-Fisheries position was assumed by Dr. Timothy B. Grabowski. Dr. Grabowski, himself a graduate of the Cooperative Research Units Program (South Carolina), is interested in the environmental biology, conservation and management of marine and freshwater fishes. His arrival at the Texas Unit coincides with increased operational and research collaborations between the unit and Texas Parks and Wildlife Department.

Research conducted by the Texas Unit focuses on natural resource issues of concern to the State of Texas and also addresses transboundary questions of national and international relevance. In the last fiscal year biennium (FY 2009-2010), the Texas Unit conducted or facilitated 41 active research projects with a total funding level of \$4.7 million, an amount which includes \$1.7 million in new fund commitments. Unit scientists participated in 20 of these projects as either principal or co-principal investigators. The Texas Unit is especially pleased with the role it has played in facilitating the research of faculty cooperators from multiple departments and colleges across Texas Tech University. The Unit's overall research productivity is in large part due to the contributions from its cooperators.

Unit scientists have maintained and in some cases enhanced consultations with cooperators and other agencies and institutions to stay current on their research needs, and have also organized workshops and symposia that address cooperator interests. One salient example during the present reporting period is the Structured Decision Making Workshop hosted by the Texas Unit and attended by administrators and biologists from Texas Parks and Wildlife Department as well as a number of unit doctoral students.

In 2009-2010, service to the profession included unit scientist participation in scientific society panels and journal editorial boards. Unit scientists also served in national peer-review panels, advisory committees and board of directors for agencies or foundations such as The National Science Foundation, U.S. Environmental Protection Agency, and The Raptor Research Foundation. Their services were recognized in the form of several USGS-CRU and university awards.

In addition to their academic service as primary advisors for graduate (unit) students, unit scientists also served on multiple graduate student and university committees and taught advanced undergraduate and graduate level courses. Unit students and staff are the key to the success of the Unit's research program. Sixteen graduate students were supervised by two unit scientists and 5 completed their degree programs during the present reporting period. Three postdoctoral scholars and one research associate also participated in sponsored research supervised by unit scientists. Seventeen scientific papers were published and 34 presentations were delivered by unit scientists, staff, and students during the present reporting period.

Several unit students were recognized during 2009-2010 for their research and academic achievements. Nick Pirius and Tony Roberts received scholarships from the Houston Safari Club, and Brad Strobel and Matt VanLandeghem received graduate fellowships from the Welder Wildlife Foundation and Texas Tech University, respectively.

Cooperators and Personnel

COORDINATING COMMITTEE

- **Texas Parks and Wildlife**
Dr. Ross Melinchuk
Deputy Executive Director, Natural Resources
- **Texas Tech University**
Dr. Taylor Eighmy
Vice President for Research
- **U.S. Geological Survey**
Dr. Jim Fleming
Unit Supervisor
- **U.S. Fish and Wildlife Service**
Dr. Paul Barrett
Regional Science Advisor, Region 2

UNIT CONTACT INFORMATION

Texas Cooperative Fish and Wildlife Research Unit

Agricultural Sciences Building, Rm 218
15th and Boston
Lubbock, TX 79409-2120
(806) 742-2851 (voice)
(806) 742-2946 (fax)
txcoop@ttu.edu
<http://www.tcfwru.ttu.edu/>

UNIT STAFF

- **U.S. Geological Survey**
Dr. Reynaldo Patiño, Unit Leader
Dr. Clint Boal, Assistant Unit Leader-Wildlife
Dr. Tim Grabowski, Assistant Unit Leader-Fisheries
- **Texas Tech University**
Dr. Xin Deng, Senior Research Associate
Dr. Bibek Sharma, Postdoctoral Research Associate
Dr. Ali Reza, Postdoctoral Research Associate
Mr. Sean Kyle, Research Associate
Mrs. Tammi Barnett, Administrative Business Assistant

TEXAS TECH UNIVERSITY

- **Biological Sciences**
Dr. John Zak
- **Center for Geospatial Technology**
Dr. Lucia Barbato
Dr. Kevin Mulligan
- **Geosciences**
Dr. Katharine Hayhoe
- **Natural Resources Management**
Dr. Warren Ballard
Dr. Matt Butler
Dr. Brad Dabbert
Dr. Ernest Fish
Dr. Gad Perry
Dr. Sandra Rideout-Hanzak
Dr. Chris Taylor
Dr. Mark Wallace
Dr. Dave Wester
- **Plant and Soil Science**
Dr. Richard E. Zartman
Dr. Wayne H. Hudnall
- **Water Resources Center**
Dr. Ken Rainwater

TEXAS PARKS AND WILDLIFE

- **Inland Fisheries**
Dr. Bob Betsill
Mr. John Clayton
Mr. Bobby Farquhar
Mr. Mukhtar Farooqi
Ms. Loraine Fries
Mr. Greg Southard
- **Wildlife Division**
Dr. Craig Farquhar
Dr. David Holdermann
Mr. Robert Perez
Ms. Heather Whitlaw

FEDERAL AGENCIES

- **Fish and Wildlife Service**
Dr. David Haukos (R2)
Mr. Duane Lucia (R2)
Mr. Erik Orsak (R1)
- **U.S. Geological Survey**
Dr. David Andersen
Dr. David Alvarez
Dr. Kathy Echols
Dr. Steve Goodbred
Dr. Jill Jenkins
Mr. Tom Leiker
Ms. Jennifer Morace
Dr. Elena Nielsen
Dr. Carl Orazio
Dr. Michael Rosen

OTHER INSTITUTIONS

- **Clark County/Southern Nevada Water Authority, Nevada**
Dr. Doug Drury
Dr. Shane Snyder
- **Oklahoma State University**
Dr. Loren Smith
Dr. Scott McMurry
- **Texas A&M Kingsville**
Dr. William Kuvlesky, Jr.
Dr. Fidel Hernandez
- **Texas Agrilife Resources and Extension Center**
Dr. Dale Rollins
- **Tokyo University of Marine Sciences and Technology, Japan**
Dr. Goro Yoshizaki
Dr. Carlos Strüssmann
- **Universidad Juárez Autónoma de Tabasco, México**
Dr. Wilfrido Contreras

UNIT STUDENTS

Ph.D. Candidates

- Blake Grisham (Wildlife)
- Ben Skipper (Wildlife)
- Bibek Sharma (Fisheries – graduated)
- Prakash Sharma (Biology)
- Brad Strobel (Wildlife)
- Jamie Suski (Biology)
- Leticia Torres (Biology)
- Matt VanLandeghem (Fisheries)

M.S. Candidates

- Adam Behney (Wildlife – graduated)
- Swapna Medichetti (Biology – left program)
- Matt Meyer (Biology – graduated)
- Rebecca Perkins (Wildlife)
- Nicholas Pirius (Wildlife)
- Tony Roberts (Wildlife – graduated)
- Evonne Schroeder (Wildlife - graduated)
- Brandi Welch (Biology)

UNIT-AFFILIATED STUDENTS

Ph.D. Candidates

- Matt Campbell (Biology – graduated)
- Stretch Compton (Fisheries)
- Dale Kane (Wildlife, Texas A&M-Kingsville)
- Doug Holt (Wildlife)
- Hongtao Ma (Biology – graduated)
- Myriam Moreno (Natural Resources, Universidad Autónoma de Chihuahua, México – graduated)
- Ali Reza (Wildlife – graduated)
- Song Tang (Environmental Toxicology)
- Jose Thekkiniath (Biology)
- Jose Villanueva (Range – graduated)
- Yoji Yamamoto (Fisheries, Tokyo University of Marine Science and Technology – graduated)

M.S. Candidates

- Maria de J. Contreras García (Biology, Universidad Juárez Autónoma de Tabasco, México)
- Kelly Janice (MS, Biology)
- Ron Milgator (MS, Texas A&M-Kingsville)
- Krista Mougey (MS, Wildlife)
- Jennifer Timmer (MS, Wildlife)
- Juan Manuel Vidal Lopez (Biology, Universidad Juárez Autónoma de Tabasco, México – graduated)
- Josh Turner (Wildlife, TAMU-Kingsville)
- Chris van Nice (Interdisciplinary Studies)
- Ada Warren (Interdisciplinary Studies)
- Sarah Wulff (Wildlife)

UNDERGRADUATE STUDENTS AND FIELD TECHNICIANS

- Philip Borsdorf
- Cody Craig
- Jimmy Huddleston
- Trevor Gicklehorn
- Kristen Muru
- Lucas Schilder
- Andrew Spiegel
- Preston Stewart
- Austin Teague
- Seydou Toe



Dr. Clint Boal and Raptor Ecology and Management Class - 2008

Unit (*) and Affiliated Student Theses and Dissertations

***Behney, A.** 2009. Predation and reproductive behavior of lesser prairie-chickens at leks in the Texas Southern High Plains. M.S. Thesis, Texas Tech University, Lubbock, TX.

Haralson, K. 2010. Microbial and Nutrient Soil Dynamics in a Chihuahuan Desert Banded Grassland System. M.S. Thesis, Texas Tech University, Lubbock, TX.

***Meyer, M.** 2009. Development and application of a fish embryo assay for studies of surface water toxicity in the Brazos River. M.S. Thesis, Texas Tech University, Lubbock, TX.

McRoberts, J. 2009. Aerial surveys for Lesser Prairie-Chicken leks: detectability and disturbance response. M.S. Thesis, Texas Tech University, Lubbock, TX.

***Roberts, A.** 2009. Avian community response to large-scale wildfires in the Texas panhandle. M.S. Thesis, Texas Tech University, Lubbock, TX.

***Schroeder, E.** 2010. Annual productivity and survival of birds in different vegetation communities of the Welder Wildlife Refuge. M.S. Thesis, Texas Tech University, Lubbock, TX.

***Sharma, B.** 2008. Effects of cadmium at low concentrations on anuran growth and development. Ph.D. Dissertation, Texas Tech University, Lubbock, TX.

Yang, X. 2010. Asymptotic properties of exponentiated weibull distribution. M.S. Thesis, Texas Tech University, Lubbock, TX.

Unit (*) and Affiliated Student Honors and Awards

***Nick Pirius**, M.S. student

- Houston Safari Club Scholarship (2010).

***Tony Roberts**, M.S. student

- Houston Safari Club Scholarship (2008-2009).

***Brad Strobel**, Ph.D. student

- Rob and Bessie Welder Wildlife Foundation Student Fellowship (2005-2009).
- Houston Safari Club Scholarship (2008-2009)

***Matt VanLandeghem**, Ph.D. student

- AT&T Chancellor's Fellowship, Graduate School, Texas Tech University, 2010-2014.



Newly hooded Dr. Bibek Sharma and graduate advisor Dr. Reynaldo Patino

Terrestrial Research

Completed Projects



Aerial surveys for prairie-chickens



Releasing radio-tagged Swift Fox



Wild Turkey

Aerial Surveys for Lesser Prairie-Chicken Leks

Traditionally, lesser prairie-chicken populations are monitored by ground-based surveys and counts at leks (areas where males assemble and compete for breeding opportunities). This labor-intensive approach is limited by access to private land and road coverage, potentially rendering it a poor index of abundance. Our objectives were to evaluate aerial survey techniques and determine lek detectability. We conducted a total of 58 aerial survey flights during spring 2007–2008 in the Texas Panhandle and eastern New Mexico. We determined that a total of 305 active leks were available for detection and found detectability was 89.8% from an R-44 helicopter, 72.3% from an R-22 helicopter, and 32.7% from a Cessna 172 airplane. We believe aerial surveys provide an efficient and effective technique for monitoring and detecting prairie chicken leks.

Unit Project Number

TPW 14

Investigators

Warren Ballard, Matt Butler, Mark Wallace, David Haukos, Heather Whitlaw

Student

Jon McRoberts

Funding

Texas Parks and Wildlife Department

Project Period

3/2004 – 12/2011

Evaluation of Distance Sampling for Rio Grande Turkeys from Roads in Texas

Rio Grande wild turkey populations have declined across much of Texas. We conducted road-based distance sampling surveys to estimate wild turkey flock encounter rates and to determine survey effort required to obtain adequate sample sizes for distance sampling in four ecoregions of Texas. We used turkey decoys to evaluate effects of distance to a flock, flock size, and vegetative cover on detectability. Triangulated locations from radio telemetry of turkeys were used to identify time periods in which road-based surveys would be most appropriate. Our data suggest that the most appropriate time to conduct road-based distance sampling was 1 December–15 March during morning or afternoon. Our results suggested road-based surveys conducted during these periods should yield generally unbiased results.

Unit Project Number

TPW 16

Investigators

Warren Ballard, Mark Wallace, Mathew J. Butler

Student

Devin Erxleben

Funding

Texas Parks and Wildlife Department

Project Period

09/2006 – 08/2009



Lekking male Lesser Prairie-Chicken

Evaluation of Oil-Gas Infrastructure for Potential Increased Risk of Raptor Predation on Lesser Prairie-Chickens

Lesser prairie-chickens (LEPCs) have experienced significant population declines within the past century. Some studies attribute this decline to LEPC avoidance of anthropogenic vertical structures that may increase presence of raptors and predation risk. We used video recordings and direct observations to monitor raptor presence and predation attempts at LEPC leks with and without man-made structures nearby. During 650 hours of data collection there were no successful predation attempts and there was no difference in raptor presence at leks with (0.08/hour) and without structures (0.11/hour). The most common species attempting to capture LEPCs were northern harriers. Our data indicate raptor predation upon LEPCs at leks is uncommon.

Unit Project Number

TPW 17

Investigator

Clint Boal

Student

Adam Behney

Funding

Texas Parks and Wildlife Department

Project Period

11/2006 – 03/2009

Part B. Avian Studies and Lesser Prairie-Chicken Ecology During Pre- and Post-Construction Periods

Wind energy development can result in direct wildlife mortality and habitat loss. The substantive potential for wind energy development in the Great Plains has increased the need for pre-construction assessments and mitigation to lessen the potential impacts of wind energy development. We examined avian diversity, density and flight heights throughout the year at a future wind farm site in the Texas High Plains. Average flight heights of 29 species were within the potential rotor swept zone (32–124 m). Raptor and waterfowl groups were at greatest risk of collision with wind turbines. We detected the most avian species in agricultural areas, and moderate avian diversity at playa wetlands and prairie dog towns. Breaks, playa wetlands, and prairie dog town cover types provide habitat to unique segments of the avian community in this region, and their importance should be considered when sighting wind energy centers.

Unit Project Number

TPW 22

Investigator

Matthew Butler, Warren Ballard,

Kathy Boydston

Student

Sarah Wulff

Funding

Texas Parks and Wildlife Department

Project Period

04/2008 – 08/2010

Improving Lesser Prairie-Chicken Lek Surveys on Private Lands

Lesser prairie-chicken populations have been monitored with listening surveys along established road systems. A primary assumption of the method is that booming LEPC can be heard by surveyors up to 1 mile from a lek. We evaluated how far surveying listeners can hear booming under varying environmental conditions. We measured booming intensity (dB) on prairie-chicken leks and transferred digital recordings to electronic game callers. Game callers were set to match the intensity (dB level) of male prairie-chickens and programmed to play in a continuous loop to create trial leks. Observers walked transects towards the trial leks from the 4 cardinal directions starting up to 3.2 km away. Observers stopped for 3 minutes every 100 m and recorded if the trial lek was detected, direction and speed of the wind, ambient temperature, and relative humidity. The best predictor of lek detection was distance from the lek. We also found a relationship between wind speed and detection probability, with detections decreasing 4 – 19% with each 1 km/hr increase in wind speed. Many surveys were conducted during calm wind conditions which may explain the lack of wind speed as a predictor in half of the models.

Unit Project Number

TPW 25

Investigator

Warren Ballard, Matt Butler

Student

R. Douglas Holt

Funding

Texas Parks and Wildlife

Project Period

02/2008 – 08/2010

Assessment of Pintail Band-Recovery Data

We tested band-recovery models to estimate survival and recovery rates of northern pintails with the added parameters of temporal periods and region. We tested for differences in survival between these variables, age and sex. We used Program MARK to compare 15 different models for each region to estimate survival and recovery rates. Our analysis was based on 352,252 banding and 24,370 recovery records. Of the resulting groupings, the grouping of three regions similar to the administrative Flyway boundaries was the most parsimonious for describing pintail derivation. The best model indicated that survival varied with age, sex, and region with additive time and interactive time effects. For all age and sex classes, the eastern region had the lowest survival rate point estimates whereas the central and western region estimates were similar. Across age and sex classes, immature females had the lowest annual survival estimates whereas adult males had the greatest. We recommend that future work on development of pintail banding activities focus on the three regions found using the MRPP analysis.

Unit Project Number

RWO 58

Investigator

Loren Smith

Research Associate

Mindy Rice

Funding

U.S. Fish and Wildlife Service

Project Period

01/2005 – 12/2008

Recruitment and Habitat Use of Mottled Ducks (*Anas fulvigula*) on the Upper Texas Gulf Coast

Surveys of mottled duck populations in Texas suggest steep declines over the last 20 years. We investigated mottled duck recruitment and female survival during the breeding season and gathered information on habitat use to guide management decisions. We used radio telemetry to estimate survival rates and habitat use and movements of females and duck broods in the the Texas Chenier Plain National Wildlife Refuge Complex. Our top model for the breeding season estimated female survival at 75.5%. The estimate for duckling survival (66.9% for a 30-day period) was greater than expected and high compared to a previous estimate of 41.1% in Texas. Duckling survival was high, but recruitment estimates were low and implied negative population growth. Current recommendations for brood habitat characteristics are supported by our study. Managers should encourage connectivity of brood areas and should be particularly attuned to the effects of drought. Local refugia during drought are critical as adult mottled duck habitat and can reduce the need for dispersal of adult mottled ducks from coastal refuges.

Unit Project Number

RWO 62

Investigator

Loren Smith

Student

Elizabeth Rigby

Funding

U.S. Fish and Wildlife Service

Project Period

01/2006 – 12/2009

High-Resolution Projects to Estimate the Impacts of Climate Change on Birds in the Southeast

We examined how the southeastern U.S. climate is likely to be affected by emissions from human activities. Uncertainty regarding fossil fuel consumption and other societal choices was accounted for by using a lower emissions scenario (SRES B1), and a higher emissions scenario (SRES A1fi) to drive statistically-downscaled simulations from three global climate models. These simulations were used to project changes in 14 bird-related secondary climate indicators during breeding and pre-breeding periods for 121 Breeding Bird Survey routes in the Southeast. As climate changes, seasonal and annual temperatures are projected rise, with corresponding impacts on secondary indicators. Depending on the scenario, mid-century temperatures may increase 3°F to 6°F, and end-of-century temperatures may increase 5°F to 10°F. Summer temperatures may experience the most dramatic change, up to 14°F warmer, under the higher emissions scenario. Increases in heavy rainfall days (more than 1.5 inches of rain in 24 hours) are projected to occur during the spring breeding period, as are increases in average precipitation across the entire domain.

Unit Project Number

RWO 71

Investigators

Katharine Hayhoe, Jeff VanDorn

Funding

U.S. Geological Survey

Project Period

10/2008 – 08/2010

Playa Lakes Mapping and Climate Change Analysis

Playa wetlands provide critical habitat for local wildlife and migratory birds. To support the National Wetlands Inventory, the first goal of this study was to complete the mapping of playa wetlands across 52 counties on the Southern High Plains. The wetlands were mapped by extracting the hydric soils from the SSURGO database, overlaying these polygons on NAIP imagery, and editing the shape of each polygon to fit the playa signature. Each playa was then classified based on the Cowardin wetlands classification system. Once the playa database was complete, the second goal of this study was to assess the potential impact of climate change. The results from this analysis suggest that the water regime of playas is strongly influenced by the east-west regional precipitation gradient. The playa wetlands mapped in this study are available for download through the NWI Wetlands Mapper.

Unit Project Number

RWO 73

Investigators

Kevin Mulligan, Lucia Barbato

Students

Jake Warren, Jordan McAlister, Elizabeth Leatherwood, Nick Hensley, Nichole McKenna, Jay Davis, Jack Phelps, John Jones, Skylar Sowder, Lonnie Hill

Funding

U.S. Fish and Wildlife Service/National Wetlands Inventory

Project Period

05/2009 – 06/2010

Abundance, Habitat Use, and Seasonal Activity Patterns of Texas Horned Lizards

We documented home range sizes, survival, and habitat preferences of Texas horned lizards at two locations in Texas. Preliminary analyses suggest microhabitat at lizard locations and random plots did not differ substantively. Some management practices appear to be beneficial for this species. No horned lizards were detected in areas where mechanical removal of Ashe Juniper had not been conducted in the past. Although horned lizards moved in and near the edge of recently burned areas, they appeared to avoid areas recently burned areas that lacked forb or grass cover. Smaller burns that affect part of an inhabited patch would be preferable to a whole-unit burn in lizard habitat. Tree removal creates more suitable habitat for horned lizards than areas where woody vegetation encroachment continues.

Unit Project Numbers

OA 50 and OA 59

Investigators

Gad Perry, David Wester

Students

Wes Anderson, Krista Mougey, Emily Henry

Funding

Texas Army National Guard

Project Period

03/2004 – 12/2011



Painted Bunting

Avian Productivity and Survivorship on the Welder Wildlife Refuge

Declining populations of breeding birds have been reported across the United States and Canada. The Monitoring Avian Productivity and Survivorship (MAPS) program was established to identify the causes of population changes through long-term population monitoring. We established two banding stations on the Welder Wildlife Refuge to create a permanent MAPS station for long-term population monitoring. During the 2007 and 2008 breeding seasons (May – August), 241 and 211 birds were banded with Northern Cardinals, Painted Buntings, and White-eyed Vireos being the most common species. We recaptured 25 individuals. After completion of this project, Welder Wildlife Foundation will continue to run the Mesquite Pasture banding station for longterm avian community monitoring.

Unit Project Number

OA 55

Investigator

Clint Boal

Student

Evonne Schroeder

Funding

Welder Wildlife Foundation

Project Period

01/2007 – 12/2009

Avian Community Response to Large-Scale Wildfire in the Texas Panhandle

In March 2006 large-scale wildfires burned over 900,000 acres of range lands east of Amarillo, Texas. We conducted a subsequent study of wintering and breeding season bird community response to the fires. In 2007 and 2008 we conducted breeding bird surveys on burned and unburned mixed-grass prairie, and burned and unburned shortgrass prairie. Avian diversity was higher on unburned shortgrass in 2007 but was the same across study sites by 2008. Diversity in mixed-grass was relatively equal across burn histories and years. Grasshopper sparrows were much more abundant on unburned mixed-grass sites whereas lark sparrows and horned larks were more abundant on burned sites in 2007, but they had equal abundances across treatments by 2008. Grasshopper and Cassin's sparrows had lower nest success on unburned plots in 2007. All other species had similar nest success rates across burn histories and years. It appears that the avian community composition among burned areas had returned to that found in unburned areas within 3 years following the fire.

Unit Project Number

OA 56

Investigators

Clint Boal, David Wester, Sandra Rideout-Hanzak

Student

Anthony J. Roberts

Funding

U.S. Department of Agriculture

Project Period

09/2006 – 08/2009

Lesser Prairie-Chicken Ecology During Pre- and Post-Construction of Wind Energy Facilities

Lesser prairie-chickens (LPC) are a prairie grouse species that inhabits portions of Texas, New Mexico, Oklahoma, Colorado, and Kansas. LPC populations have declined by 97% across their historic range due to altered habitat and land use practices and are currently a candidate species under the Endangered Species Act. Much of the current LPC occupied habitat in the Texas Panhandle overlaps with land suitable for wind energy development. This presents a need for proactive cooperation between wildlife managers and wind energy developers to prevent ecological or regulatory hazards to all stakeholder groups. We are evaluating the hypotheses that LPCs are especially sensitive to wind development because of their aversion toward vertical structures, a need for large tracts of undeveloped prairie to maintain viable populations, and their sensitivity to a wide range of anthropogenic disturbances. In spring 2008 we commenced aerial and ground surveys, which will continue in spring 2009. Additional management practices and measures will be initiated once leks are located.

Unit Project Number

OA 58

Investigators

Warren Ballard, Matthew Butler

Student

Jon McRoberts

Funding

Iberdrola Renewables

Project Period

04/2008 – 08/2010



After-effects of wild fire



Transporting deer



Banding Northern Bobwhite

Terrestrial Research

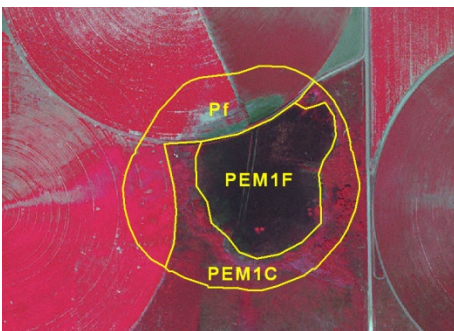
Ongoing Projects



Male Lesser Prairie-Chicken



Students banding American Kestrels



GIS imagery of playa classification

Reproductive Ecology and Survival of Lesser Prairie-Chickens in the Southern High Plains of Texas

Survival of Lesser prairie-chicken (LEPC) broods from hatch to the next breeding season has been identified as the main demographic parameter affecting population size. We are assessing these parameters in the Southern High Plains of Texas. To date, we have determined fates for 33 nests. Mean clutch size was 7.5 eggs and the mean date for the initiation of incubation was 13 May. Brood survival probabilities were a function of a quadratic time trend, daily temperature, and relative humidity. The probability of a brood surviving from 1 June – 1 Aug. was 0.01 (± 0.03). A model incorporating season was most supported. However there was model support for age, mass, and age and mass interaction. The probability of hen survival during 15 Mar. – 31 Aug. was 0.75 (± 0.07). Nest success in our study was higher compared to other studies. As with other studies, canids and raptors are a main cause of death for nesting LEPC hens. The cause for low chick survival in our study is unknown, but unfavorable weather (hail storms, heavy rain, high winds) early in the brooding season and predation are likely mortality factors.

Unit Project Number

TPW 19

Investigator

Clint Boal

Students

Blake Grisham, Philip Borsdorf

Funding

Texas Parks and Wildlife Department

Project Period

01/2008 – 12/2012

Patch Occupancy Patterns of Swift Fox in Texas

The swift fox is associated with short and mixed grass systems of the southern Great Plains. Our study focuses on the genetic structure and diversity throughout the species range to identify the influence of different forms of fragmentation on genetic interchange and long-term viability of distinct groups. Analysis of 589 swift fox blood, hair and tissue samples from across the current range revealed evidence of panmixia with limited genetic structure at local levels. Differences between groups are significant, implying reduced dispersal between regions. Both natural and anthropogenic habitat fragmentation seem to have resulted in boundaries between genetically distinct groups. We are now testing the relationship between genetic and landscape barriers in a statistical framework to further elucidate the association between habitat fragmentation, dispersal, and genetic structure in the swift fox and provide insight into the influence of habitat fragmentation on other grassland-specific species of the Great Plains.

Unit Project Number

TPW 20

Investigators

Warren B. Ballard, Lisette P. Waits, Matthew A. Cronin, Phillip Gipson, Nancy McIntyre, John Young

Student

Donelle Schwalm

Funding

Texas Parks and Wildlife Department

Project Period

09/2007 – 08/2011

Brood Ecology and Habitat Use of Lesser Prairie-Chickens in the Texas Panhandle

Lesser prairie-chickens (LEPC) have experienced dramatic range-wide declines since the early 1800's attributed to factors such as conversion of native rangeland for agriculture, mineral, gas, and oil exploration and the infrastructure associated with these activities. The population decline and lack of information regarding LEPC life history requirements have prompted increased emphasis on ecological studies of the species. We began a year-round study of LEPC ecology in the northeast panhandle of Texas. Trapping began during March 2008. Adult LEPCs were fitted with radio-collars and tracked throughout the nesting season. We captured 47 birds and radio-marked 25 males and 8 females. Nests were located by daily monitoring of radio-collared females. The study is continuing through the over-winter period of 2008. Over-winter tracking of the birds will continue through the over-winter period of 2009. Monitoring of all radio-marked birds will be continued through fall of 2010.

Unit Project Numbers

TPW 21

Investigators

Warren Ballard, Matthew Butler

Students

Doug Holt, Curtis Kukal

Funding

Texas Parks and Wildlife Department

Project Period

09/2007 – 08/2012

Winter Ecology and Habitat Use of Lesser Prairie-Chickens in West Texas

Populations of lesser prairie-chickens (LEPC) have declined by >90% over the last century and, in Texas, are thought to be at or near all time lows. Sound management and conservation strategies for LEPCs are necessary to ensure the long-term persistence of the species, but basic ecological information is required for development of such strategies. Currently, there remains a paucity of information on many aspects of the ecology of LEPC. We are assessing the winter ecology and habitat use of LEPCs in west Texas. There are few data on this aspect of LEPC ecology, but is of critical importance in terms of managing a declining candidate species that is occupying a landscape progressively being fragmented by energy development and agricultural crop production. This study is being conducted concurrent to a study examining brood ecology and survival. However, even high juvenile production will not have a positive influence on population trends if we do not understand winter habitat needs and ensure they are met. This study will allow managers to better understand habitat needs and pursue sound management actions for the conservation of LEPCs.

Unit Project Number:

TPW 23

Investigator

Clint Boal

Student

Nicholas Pirius

Funding

Texas Parks and Wildlife Department

Project Period

09/2008 – 08/2011

Grassland Bird Response to Patch Burning-Grazing Effects on Sand Sagebrush-Mesquite Rangeland

Great Plains wildlife has evolved with fire and grazing interacting to create shifting landscapes of disturbed and undisturbed habitats, and patches that vary in time since the last disturbance. Our objective is to compare grassland bird response to four treatments in a sand sagebrush-mesquite rangeland: winter burning, summer burning, rotational grazing system with no burning, and grazing combined with winter patch burning. The study is on the Matador Wildlife Management Area. Radio telemetry will be used to determine habitat selection and use, nest-site selection and nest fate of the northern bobwhite quail, a species of great ecological and economic importance. Preliminary analysis indicates survival was 18.4% and 8.6% through the months of February through July in 2009 and 2010, respectively; while nest success was 50% and 60%. We hope to provide insights for a more ecologically beneficial method of grazing sand sagebrush grasslands.

Unit Project Number

TPW 24

Investigators

Brad Dabbert, David Wester, Michael Janis, Donald Ruthven, Derrick Holdstock, Sandra Rideout-Hanzak

Student

Sean Yancey

Funding

Texas Parks and Wildlife

Project Period

09/2008 – 08/2012

Overwinter Ecology of Lesser Prairie-Chickens in Northeast Texas Panhandle

Information on lesser prairie-chicken ecology during their overwinter period is lacking and what is available may focus too intently on descriptions of grain use. This study will go beyond this to determine how habitat affects survivorship during the overwinter period. Furthermore, this study will test two important assumptions regarding prairie-chicken habitat management during the overwinter period: 1) habitat quality increases with increased habitat heterogeneity and 2) non-tree edge density does not affect survivorship. Empirical support for overwinter habitat management regimes is essential for LEPC habitat managers. The study began in late September 2008.

Unit Project Number

TPW 26

Investigators

Warren Ballard, Matthew Butler

Students

Doug Holt, Curtis Kukal

Funding

Texas Parks and Wildlife Department

Project Period

04/2008 – 09/2011



Female Lesser Prairie-Chicken

Lesser Prairie-Chicken Population Distribution in Relation to Potential Wind Energy Developments

The objective of this study is to use line transect-based aerial surveys to estimate the current density of lesser prairie-chicken (LEPC) leks within the Texas Panhandle. We are flying transects in randomly-selected 20.25 square mile blocks classified into four strata based on wind energy development potential. We are using spatial distance sampling to model the relationship between lek density, anthropogenic disturbance, and habitat composition. We flew 97 survey blocks in the northeastern and central Panhandle during spring 2010 and made 55 prairie-chicken observations. We ground-truthed 64% of these detections to confirm lek activity and 30 of the detections were probable/confirmed leks. On average 3.0 birds were seen during each detection (1-17 LEPCs). Our preliminary data yielded density estimates of 1.9 leks/100 km² and 8.9 LEPCs/100 km² for our sampling frame. During spring 2011, we plan to fly ≥95 survey blocks in the southwest and west-central regions of the Panhandle.

Unit Project Number

TPW 27

Investigators

Warren Ballard, Matthew Butler, Heather Whitlaw

Student

Jennifer Timmer

Funding

Texas Parks and Wildlife Department

Project Period

02/2010 – 08/2011

Status and Function of Playa Wetlands

The objectives of our study are to (1) compare the historical and current occurrence and loss of function (hydrology, water quality, and biodiversity) of playa wetlands of the Southern Great Plains (SGP) due to anthropogenic factors; (2) estimate the reduction of playas based on USDA soil reclassification; (3) construct predictive models of playa wetlands using field and GIS data; (4) evaluate biodiversity in relation to playa loss; and (5) evaluate the effectiveness of playa buffers. We randomly selected playas within varying land use categories and landowner contacts were initiated to receive permission to access 172 selected playas in the SGP. Ongoing preliminary analyses to estimate the reduction of potentially jurisdictional playas based on soil reclassification suggests an estimated 50% decrease in playa numbers and area due to soil reclassification; playas with cultivated watersheds had a greater rate of hydric soil reclassification compared to grassland playas.

Unit Project Number

RWO 67

Investigators

Mark Wallace, Loren Smith, Scott McMurry

Student

Lacrecia Johnson

Funding

U.S. Fish and Wildlife Service

Project Period

01/2007 – 12/2010

Effects of Grassland Restoration Efforts on Soil Resources in Degraded Tabosa Grasslands at Big Bend NP

The low elevation grasslands in the Chihuahuan Desert in Big Bend National Park are important for hydrologic and ecological processes and nutrient cycling across large areas of the Chihuahuan Desert. These grasslands have changed due to overgrazing and periods of drought. Restoration is hindered by the low amount of precipitation and high evaporation rates. Once vegetation is reduced, soil temperatures increase and links between plant productivity and microbial dynamics decline, increasing plant loss and subsequent soil erosion. The current restoration efforts for this project were initiated in May 2006 using a combination of erosion control blankets, hydro-seeding and coarse woody debris obtained from management efforts to modify soil temperatures. After four years, the debris dam approach has established soil microbial and nutrient conditions that mimic those observed under intact tabosa grass areas on-site. Work is currently underway to analyze the data collected from the previous two years.

Unit Project Number

RWO 70

Investigator

John Zak

Students

Kyle Haralson, Polo Ortiz

Funding

National Park Service

Project Period

08/2008 – 09/2010

Integrated Assessment of Climate and Landscape Change in the Southeast United States

This research is part of a larger initiative known as the Southeast Regional Assessment Project (SERAP). The specific focus of this sub-section of the SERAP project is to develop high-resolution climate projections that can be used to evaluate the potential impacts of climate change on the Southeast region. During the first year of this project we successfully prepared a generalized downscaling code and global climate model-based input files to be used to downscale climate projections to a regular one-eighth degree grid. Initial downscaling simulations were completed for daily maximum temperature, minimum temperature, and precipitation. Secondary indices were calculated including projected changes in number of cold and hot days, dry days, and heavy rainfall events corresponding to global mean temperature increases ranging from 1 to 3°C.

Unit Project Number

RWO 74

Investigators

Katharine Hayhoe, Rodica Gelca

Students

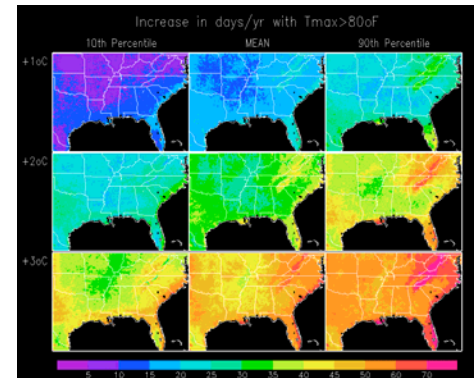
Caleb Crow, Xiaohui Yang

Funding

U.S. Geological Survey

Project Period

10/2009 – 09/2011



High resolution climate mapping

Development and Dissemination of High-Resolution National Climate Change Dataset

The purpose of this project was to create a comprehensive web-based dataset of high-resolution climate change projections to assess the impacts of climate change on ecosystems in the continental United States. The dataset has been generated by applying advanced statistical downscaling methods to a comprehensive selection of global climate model simulations from the IPCC AR4 database. The resulting database will enable impact assessments to be based on the same common data set, allowing consistent results to be compared across regions and ecosystems.

Unit Project Number

RWO 76

Investigators

Katharine Hayhoe, Rodica Gelca

Students

Caleb Crow, Xiaohui Yan

Funding

U.S. Geological Survey

Project Period

10/2009 – 09/2011

Thermal Ecology of Nesting Lesser Prairie-Chickens and the Potential Implications of Climate Change

Climate change is anticipated to bring 1) increased maximum and minimum temperatures, 2) reduced frequency, but greater intensity, of precipitation events, and 3) earlier spring phenology to the Southern Great Plains. These changes may positively or negatively influence lesser prairie-chickens. Our study objectives are to examine phenology and the thermal aspects of prairie-chickens nesting in Texas and New Mexico. We found that nests are maintained at consistent temperature and humidity levels compared to extensive daily variation in ambient conditions. The stable condition of nests appears to be more closely associated with presence of the hen than nest location. Nests are kept warmer throughout most of the 24-hr period, but are kept significantly cooler than mid-day ambient temperatures, which are in the range that increases potential for egg death. Nest humidity is also kept within tolerances for egg survival when external humidity is typically less than 10%. Our study may reveal important drivers of nesting habitat selection by prairie-chickens and potential influences of climate change.

Unit Project Number

RWO 78

Investigators

Clint Boal

Student

Blake Grisham

Funding

U.S. Fish and Wildlife Service

Project Period

05/2010 – 09/2012

Quantifying Key Drivers of Climate Variability and Change for Puerto Rico and the Caribbean

Conservation planners need robust climate change projections to prioritize and plan for future actions. Downscaling approaches are commonly used to translate regional projections from global models into local projections. These methods assume global models can reproduce the primary modes of climate variability over the region of interest. Caribbean locations are particularly sensitive to ocean and atmosphere climate dynamics that affect sea surface temperatures and precipitation patterns. This project aims to answer three key research questions: 1) What are the most important large-scale atmospheric features that affect precipitation and temperature variability over the Caribbean? 2) Which global climate models are best able to simulate these features and their relationship to surface precipitation and climate variability over the Caribbean? 3) Is there any difference between the high-resolution projections resulting from a large group of climate models vs. the projections resulting from a smaller group of models that have proven able to simulate the relationship between large-scale circulation and surface climate over the Caribbean.

Unit Project Number

RWO 80

Investigators

Katharine Hayhoe, Jung-Yee Ryu

Funding

U.S. Geological Survey

Project Period

08/2010 – 07/2011

Reproductive Success and Annual Habitat Preference by Red-shouldered Hawks in Southern Texas

The ideal despotic distribution hypothesis predicts an individual will select the highest quality territory in regards to its long-term reproductive potential. This hinges upon an ability to accurately assess territory quality, an assumption that is difficult to meet under temporally and spatially variant environments. We assessed the ideal despotic distribution hypothesis (IDDH) with a 5 year data set for resident Red-shouldered Hawks. Our results were consistent with the predictions of the IDDH that the proportion of years a territory supported a nesting attempt was negatively related to the relative nest initiation dates. However, our data show that proportion of years a territory supported a nesting attempt was unrelated to the average number of eggs laid and negatively related to the average number of young fledged annually. While the proportion of years a territory supported a nesting attempt varied, annual reproductive success of breeding hawks was positively associated with the number of pairs observed. Our results suggest that reproductive success was heavily influenced by stochastic events that violate the IDDH assumption of perfect knowledge by individuals.

Unit Project Number

OA 52

Investigator

Clint Boal

Student

Bradley Strobel

Funding

Welder Wildlife Foundation

Project Period

09/2005 – 05/2011

Ecology and Conservation of Avian Species in the East Caribbean

The Caribbean islands are important stopping and feeding habitat for neotropical migrant songbirds. Little information is available on migrant ecology in the eastern Caribbean. I am examining species composition of neotropical migrants moving through the British Virgin Islands, and the potential influences of weather and climate change on the time of arrival and their physical condition. The primary migrant (>80%) is the blackpoll warbler, but numerous other species occur on migration concurrent with this species. Notable numbers of Swainson's thrush and red-eyed vireo suggests these species are more common in the eastern Caribbean than common knowledge or field guides would suggest, or they are expanding their west Caribbean migration routes eastward. Resident bird species are also subject to climate conditions and change. Longterm mark-recapture studies of resident species (bananaquits, pearly-eyed thrashers, zenaida doves) are being conducted to assess influences of weather patterns on reproduction and age- and sex-specific survival. A graduate level course in tropical ecology is co-taught by the PI during the field component of this study.

Unit Project Number

OA 53

Investigator

Clint Boal

Funding

Falconwood Foundation

Project Period

12/2005 – 12/20012

Assessing Aggressive and Passive Behaviors of Urban Nesting Mississippi Kites

Mississippi Kites have become a common breeding raptor in many urban areas of the southern Great Plains. Some individuals aggressively defend nest sites against pedestrians who venture into breeding areas, thus causing wildlife-human conflict. We initiated a study to examine patterns of aggression in a population of kites breeding in Lubbock, TX. We are focusing on landscape and human activity characteristics of kite nesting areas that may be predictive of aggressive behaviors, and examined correlates of site and mate fidelity with aggressive behaviors. Aggressive and passive nest sites were similar for most variables measured except for nest-tree height and distance to nearest building. Nests sites where aggressive behaviors were consistent were more likely to be re-occupied by at least one individual from the previous year than passive nests (83 vs. 33%, respectively). Additionally, mate fidelity was greater at aggressive nests than passive nests. Taken together, our data suggest that aggression in kites is shaped more by characteristics of individual kites than by environmental features such as vegetation and anthropogenic structures.

Unit Project Number

OA 65

Investigator

Clint Boal

Student

Ben Skipper

Funding

Intramural

Project Period

01/2009 – 05/2012

Parental Care and Provisioning Rates by Mississippi Kites

Land conversion into urbanized areas necessitates a greater understanding of the ecology and conservation of urban adaptable wildlife. Mississippi kites are an abundant urban dwelling raptor and adding to the limited body of knowledge on the species' ecology will facilitate a greater understanding of urban ecosystems. We are assessing factors influencing urban occupancy by identifying prey items and quantifying provisioning rates of male and female kites to nestlings. In 2010, 140 hrs of direct observations were conducted at 5 nests in Lubbock, TX. We observed 281 prey deliveries at rate of 2.0 deliveries /nest/hour. Male and females made 41% and 51% of prey deliveries, and unidentified individuals accounted for 8%. Cicadas comprised 41% of identified deliveries, followed by dragonflies (38%), and grasshoppers (6%). Results suggest that the diets of kites are heavily dominated by cicadas and dragonflies during the nesting season. Our observed provisioning rate did not vary significantly with time of day or with parental sex indicating equitable provisioning effort throughout the day and between parents.

Unit Project Number

OA 67

Investigator

Clint Boal

Student

Brandi Welch

Funding

Intramural

Project Period

06/2010 – 05/2012

Aquatic Research

Completed Projects



Building a Snook hatchery in Tabasco



Common Snook from Rio Grande



Collecting fish in the lower Colorado River

Development of Snook Seed Production for Application in Aquaculture and Restocking of Over-fished Populations

The goal of this study is to promote the development of aquaculture for snook to reduce fishing pressure on wild stocks as well as to produce fingerlings for restocking purposes. Inspection of fat snook (*Centropomus parallelus*) captured from coastal waters off Tabasco, México, showed its breeding period to be from October through March. Implants or injections of synthetic hormones (GnRHa) in wild-caught specimens induced ovulation and fertilization of the eggs. Similar observations were obtained with wild-caught common snook (*C. undecimalis*). These results provide information useful to the establishment of techniques for spawning snook. An educational and extension objective of the project was to organize the Second International Symposium on the Biology and Culture of Snooks. This was held in July 2009 in Villahermosa, Tabasco, Mexico. Twenty-seven speakers from the United States, Mexico and other Latin American countries presented papers. Audience members included university professors and students, agency personnel, and fish culturists.

Unit Project Number

OA 57

Investigators

Wilfrido Contreras-Sánchez, Reynaldo Patiño

Student

Maria Contreras-García

Funding

Intramural

Project Period

04/2007 – 09/2009

Biomarkers of endocrine and reproductive disruption in fish of Lake Mead and the lower Colorado River

Lake Mead reservoir is critical habitat for the endangered razorback sucker, but it receives municipal/industrial runoff and wastewater that generates an environmental contaminant gradient of concern to fish health. We used common carp as a surrogate for razorback sucker to examine spatiotemporal differences in fish health within the reservoir and downstream. Fish were collected from Las Vegas Wash (LVW), Las Vegas Bay (LVB, mixing zone between LVW and the reservoir), Overton Arm (OA, reference site), and Willow Beach (WB, downstream of the dam) in 2007-2008. We examined an array of factors to assess health of fish. The influence of season on morpho-physiological condition was greatest at OA followed by LVB, LVW and WB, indicating phenological variability among the target fish populations. The morpho-physiological condition of male carp can be ranked in descending order according to study site as follows: OA>LVB>LVW/WB; generally reflecting the contaminant gradient in the system.

Unit Project Number

RWO 65

Investigators

Reynaldo Patiño, Steve Goodbred, Erik Orsak, Jill Jenkins, Michael Rosen

Students

Prakash Sharma, Leticia Torres

Funding

Southern Nevada Public Land Management Act

Project Period

01/2007 – 06/2010

Influence of U.S.D.A. Programs on Ecological Services Provided by Playa Wetlands in the High Plains

We compiled agricultural and hydrologic data for 46 counties in our study area from the USDA-NASS, TASS, NOAA, NCDC, and TWDB datasets. Groundwater pumpage was positively correlated with changes in irrigated land between 1992-1997 and 1997-2002. Pumpage was more strongly correlated with growing season precipitation than annual precipitation. Increases in pumpage may be due to less precipitation (13% less) in 1997-2002 compared to 1992-1997. Changes in crops selected by the farmers could also influence pumpage. Frequency and precision of the land use and crop data collected by the USDA are not sufficient to accurately quantify irrigation water use. To increase the accuracy, the agricultural statistics should be gathered on an annual basis and utilize the information from all farmers in each county, not just a surveyed subset. Future changes in groundwater management in Texas will likely lead to annual reporting of irrigation pumping or restrictions on annual water use.

Unit Project Number

RWO 66

Investigators

Ken Rainwater, Kevin Mulligan, Lucia Barbato, Richard Zartman, Wayne Hudnall

Students

Rahish Khatri, Ada Warren, Chris Van Nice

Funding source

U.S. Geological Survey, U.S. Department of Agriculture

Project Period

01/2007 – 01/2010

Effects of Cadmium at Low Concentrations on Anuran Growth, Development and Sex Differentiation

Cadmium (Cd) is a heavy metal of natural and anthropogenic origin that can occur in aquatic environments. It reportedly has endocrine disrupting properties. The objective of this study was to clarify effects and mechanisms of Cd on early growth, development and sex determination of the African clawed frog (*Xenopus laevis*). Embryos-tadpoles were exposed to Cd at concentrations bracketing environmentally relevant values. Subjects were also exposed to Cd (10 µg/L) alone or in combination with the natural estrogen, estradiol-17β (1 µg/L). A novel bimodal effect on tadpole growth was observed with inhibitory modes occurring at Cd concentrations below or above 85 µg/L. Time to metamorphosis was delayed when exposed to Cd, E2 or their combination. Exposure to Cd did not affect sex ratios, suggesting Cd does not possess estrogen-like properties. Cadmium was also unable to potentiate the feminizing effects of estradiol-17β. Our findings indicate Cd affects tadpole development and growth but is not a xenoestrogen in amphibians. Cd-dependent delayed time and size at metamorphosis could potentially affect survival, growth, and reproductive.

Unit Project Number

OA 60

Investigators

Reynaldo Patiño

Student

Bibek Sharma

Funding

Intramural

Project Period

5/2005 – 12/2008

Development and Application of a Fish Embryo Bioassay for Studies of Surface Water Quality

The Double Mountain Fork (DMF) of the Brazos River consists of North (NF) and South Forks (SF). The NF receives urban runoff and wastewater effluent and has experienced toxic blooms of golden alga (GA) (*Prymnesium parvum*) in winter. Conductivity/salinity, total hardness, pH, temperature and turbidity were measured in DMF water; we used a zebrafish (*Danio rerio*) embryo assay to determine ichthyotoxicity. Five NF and three SF sites were sampled multiple times from March 2008 to March 2009. Analyses (PCA) identified hardness and conductivity/salinity as variables that best differentiate NF (higher levels) from SF habitat. For the bioassay, embryos were reared with or without “DADPA,” a compound that enhances GA toxin activity. Ichthyotoxicity was generally higher in NF water, especially in winter. DADPA generally enhanced toxicity of NF but not SF water. There was a positive association between water hardness and ichthyotoxicity. Physicochemistry and ichthyotoxicity of DMF water are spatiotemporally associated in a manner suggesting an involvement of GA toxin and point to water hardness as a novel factor influencing toxin activity in the field.

Unit Project Number

OA 61

Investigators

Reynaldo Patiño

Student

Matt Meyer

Funding

Intramural

Project Period

01/2007 – 08/2009

Developmental Toxicity of PBDE-47 Flame Retardant in Fish

Polybrominated flame retardants (PBDEs) have been used in many commercial products to reduce the risk of accidental fire. These compounds leach easily and therefore are ubiquitous in the environment. Given their structural similarity to thyroid hormones (TH), PBDEs have the potential to cause disruption of the thyroid endocrine system. This study examined the effects of orally administered PBDE-47 on growth, gonad development, and thyroid condition of zebrafish during the juvenile-to-adult transition. At the highest PBDE-47 concentration tested, lower body weights were observed in males but not females after 120 days of treatment. However, neither gonad developmental stage nor thyroid condition were affected in males or females. These observations suggest the existence of male-specific effects of PBDEs on zebrafish growth that are not mediated by TH. Also, unlike other recent studies with teleosts, the present study found no effects of PBDE-47 on the reproductive development of zebrafish.

Unit Project Number

RWO 68

Investigators

Reynaldo Patiño, Carl Orazio

Student

Leticia Torres

Funding

U.S. Geological Survey

Project Period

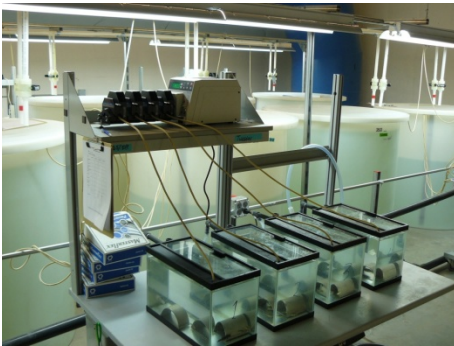
06/2007 – 09/2008



A tug of war on the Columbia River

Aquatic Research

Ongoing Projects



Experimental aquaria in Nevada



Anomalous tissue growth in Common Carp from lower Colorado River



Fish-kill caused by golden alga

Chemical Contaminants and Fish Endocrine and Reproductive Conditions in Lake Mead National Recreation Area – Wastewater Study

Wastewater effluents often contain trace quantities of compounds that may cause endocrine disruption in organisms. One of the drainage basins for Lake Mead, Las Vegas Wash, draws a majority of its water from treated effluents raising concerns for fish health. The goal of this study is to identify the potential effects of wastewater effluent on population level traits and the endocrine systems of fishes. Different concentrations of wastewater were achieved by dilution with reconstituted water. Fish were exposed to tertiary-treated (conventional) effluent (CE) or CE further treated by ultrafiltration and ozonation (ET). Preliminary analysis suggests levels of vitellogenin, which is normally only found in female fish, are slightly higher in males exposed to CE compared ET effluent. Male secondary sexual characters and gonads revealed no treatment effects. These results point toward a very subtle estrogenic activity of CE which is removed by the enhanced treatment.

Unit Project Number

RWO 69

Investigators

Reynaldo Patiño, Erik Orsak, Shane Snyder, Doug Drury

Postdoctoral associates

Xin Deng, Bibek Sharma

Students

Jamie Suski, Susanna Blunt (UNLV)

Funding

Southern Nevada Public Land Management Act

Project Period

07/2007 – 09/2010

Biomarkers of Exposure to Endocrine-Disrupting Chemicals in Largescale Sucker of the lower Columbia River

Urbanization, industrialization and agricultural development in the lower Columbia River has exposed fishes and wildlife to a variety of contaminants. The overall objectives of the study are to determine the effect of contaminants on the health of the fish, and to determine the relative sensitivity of several biomarkers to contaminant exposure. The study includes localities directly affected by urban inputs coming from Portland and the Willamette River, as well as an upstream reference site that is not under such stressors. Fish were sampled in 2009 – 2010. Most fish from an impacted site presented levels of vitellogenin higher than the reference site. Vitellogenin is a sensitive biomarker of exposure to xenoestrogens, such as PCBs and OCs. Analyses of extracts from passive samplers showed that the average concentration of PCBs was almost twice at impacted sites compared to the reference site. Additional analyses of fish health condition are currently in progress.

Unit Project Number

RWO 72

Investigators

Reynaldo Patiño, Jill Jenkins, Elena Nilsen, Jennifer Morace

Student

Leticia Torres

Funding

U.S. Geological Survey

Project Period

02/2009 – 09/2011

Modeling and Projecting the Influence of Climate Change on Texas Surface Waters and Their Aquatic Biotic Communities

To provide insight into climate change impacts on surface water and aquatic biota, we are using high-resolution climate projections to model regional impacts of climate change on the temperature and other characteristics of surface waters. Our objectives are to 1) gather historical water quality and temperature data for selected reservoirs; 2) develop downscaled statistical models to project water temperature patterns, and 3) to assess the impact of predicted change on fish populations and communities based on thermal tolerances of selected species. We are assessing a possible relationship of changing water quality and temperature with the recent spread of invasive golden alga. To date, a statewide data integration task has been completed resulting in a comprehensive reservoir water quality database that can be of immediate use to resource managers.

Unit Project Number

RWO 75

Investigators

Reynaldo Patiño, Katharine Hayhoe, Chris Taylor, William Asquith

Research Associates

Tom Burley, Sean Kyle, Rodica Gelca, Ali Reza, and Kristin Grabowski

Students

Matt VanLandeghem, Marshall Bailey, Swapna Medichetti

Funding

U.S. Geological Survey

Project Period

02/2009 – 09/2011

Incidence and Characterization of Intersex, Testicular Tumors, and Reproductive Condition in Common Carp as Indicators of Water Quality and Fish Health in Lake Mead National Recreation Area

Water quality in Lake Mead National Recreation Area (LAME) is affected by influx of treated wastewater, known contaminants from historic military and commercial industrial complexes, as well as contaminants from urban irrigation. Wastewater from a fish hatchery may also add contaminants to the river system. Drought has lowered lake levels more than 100 ft, possibly concentrating contaminants. The goal of this study is to more fully characterize the incidence of gonadal abnormalities previously observed in male fish from LAME. Estimates will be determined on the extent and spatial distribution of the problem. Relevant biomarkers of sperm quality will be provided, including markers of DNA damage. This information cannot be extracted from previous studies because they were not designed to address the relevant questions. Samples have been collected and analysis is currently in progress.

Unit Project Number

RWO 77

Investigators

Reynaldo Patiño, Michael Rosen, David Alvarez, Jill Jenkins, Erik Orsak, Steven Goodbred

Student

Prakash Sharma

Funding

U.S. Geological Survey/National Park Service

Project Period

05/2010 – 09/2012

Role and Mechanisms of Action of Thyroid Hormone during Gonadal Sex Differentiation and Development in Zebrafish

During development, the gonads of zebrafish first develop as ovaries and, in presumptive males, later transform into testes. The induction of hyperthyroid condition [high thyroid hormone (TH) levels] in zebrafish larvae yield male-biased populations and accelerates the timing of puberty; hypothyroid condition (low TH levels) result in female-biased populations. The overarching hypothesis is that TH plays a major role in differentiation and development of the reproductive system in zebrafish. The objectives of this study are to confirm the regulation of sex ratio by TH and to establish its mechanisms; examine the regulation of gonadal formation (puberty) by TH and to establish its mechanisms; and determine the regulation of reproductive condition by TH in adult males and its mechanisms. Fish at various stages of development will be artificially rendered hypo- or hyperthyroid and the effects on the reproductive system and on expression of genes associated with sex determination will be examined. Results of this study will provide novel information on the endocrine regulation of gonadal sex differentiation in teleosts.

Unit Project Number

OA 66

Investigators

Reynaldo Patiño

Student

Prakash Sharma

Funding

Intramural

Project Period

07/2007 – 12/2012

Unit Activities

Journal Articles

UNIT PERSONNEL

Atkinson, M. A., W. P. Kuvlesky, Jr., C. W. Boal, L. A. Brennan, and F. Hernandez. 2009. Breeding biology of sympatric red-tailed hawk, white-tailed hawk, and crested caracara populations in south Texas. *Journal of Raptor Research* 43:50–56.

Anderson, W. M., G. E. Sorensen, J. D. Lloyd-Strovas, R. J. Arroyo, J. A. Sosa, S. J. Wulff, B. D. Bibles, C. W. Boal, and G. Perry. 2010. Distribution and Habitat Use by the Critically Endangered Stout Iguana (*Cyclura pinguis*) on Guana Island, British Virgin Islands. *Reptiles and Amphibians* 17:5-10.

Boal, C. W. 2008. Hacked nestling Mississippi kite (*Ictinia mississippiensis*) survives six years and demonstrates philopatry. *Bulletin of the Texas Ornithological Society* 41:66–68.

Boal, C. W., C. L. Haralson, and W. H. Howe. 2008. Status of golden eagles in the Texas panhandle. *Journal of Raptor Research* 42:220–224.

Campbell, M. D., R. Patiño, J. Tolan, R. Strauss, and S. L. Diamond. 2009. Sub-lethal effects of catch and release fishing: measuring capture stress, fish impairment, and predation risk using a condition index. *Ices Journal of Marine Science* 63: 513-521.

Grier, H. J., M. C. Uribe Aranzábal, and R. Patiño. 2009. The ovary, folliculogenesis, and oogenesis in teleosts. In *Reproductive Biology and Phylogeny of Fishes*, Chapter 2 (B.G.M. Jamieson, ed.), Volume 8A. Science Publishers, Enfield, New Hampshire, USA.

Hull, J. M., B. N. Strobel, C. W. Boal, A. C. Hull, C.R. Dykstra, A. M. Irish, A. M. Fish, and H. B. Ernest. 2008. Comparative phylogeography and population genetics within *Buteo lineatus* reveals evidence of distinct evolutionary lineages. *Molecular Phylogenetics and Evolution* 39:988–996.

Reiter, M. E., C. W. Boal, and D. E. Andersen. 2008. Anurans in a subarctic tundra landscape near Cape Churchill, Manitoba, Canada. *Canadian Field-Naturalist*: 122:129-137.

Pruett, A. L., C. W. Boal, M. C. Wallace, H. A. Whitlaw, and J. D. Ray. 2009. Black-tailed prairie dog colony distribution, densities, and association with playa lakes in the Southern High Plains. *Southwestern Naturalist* 54:19–23.

Pruett, A. L., C. W. Boal, M. C. Wallace, H. A. Whitlaw, and J. D. Ray. 2010. Small mammal associations with black-tailed prairie dog colonies in the Southern High Plains. *Southwestern Naturalist* 55:50-56.

Rosen, M. R., D. A. Alvarez, S. L. Goodbred, T. J. Leiker, and R. Patiño. 2010. Sources and distribution of organic compounds using passive samplers in Lake Mead National Recreation Area, Nevada and Arizona, and their implications for potential effects on aquatic biota. *Journal of Environmental Quality* 39: 1161-1172.

Sharma, B., and R. Patiño. 2009. Effects of cadmium on growth, metamorphosis and gonadal sex differentiation in tadpoles of the African clawed frog, *Xenopus laevis*. *Chemosphere* 76:1048-1055.

Sharma, B., and R. Patiño. 2010. Effects of Cadmium, Estradiol-17 β and their interaction on gonadal condition and metamorphosis of male and female African clawed frog, *Xenopus laevis*. *Chemosphere* 79: 499-505.

Strobl-Mazzulla, P. H., C. Lethimonier, M. M. Guiguen, M. Karube, J. I. Fernandino, G. Yoshizaki, R. Patiño, C. A. Strüssmann, O. Kah, and G. M. Somoza. 2008. Brain aromatase (Cyp19A2) and estrogen receptors, in larvae and adult pejerrey fish *Odontesthes bonariensis*. Neuroanatomical and functional relations. *General and Comparative Endocrinology* 158: 191-201.

Strobel, B. N., and C. W. Boal. 2010. Regional variation in diets of breeding Red-shouldered Hawk. *Wilson Journal of Ornithology* 122:68-74.

Strobel, B. N., and C. W. Boal. 2010. Red-shouldered Hawk nesting habitat preference in south Texas. *Journal of Fish and Wildlife Management* 1:33-37.

Thompson, T. R., C. W. Boal, and D. Lucia. 2009. Grassland bird associations with introduced and native grass Conservation Reserve Program fields in the Southern High Plains. *Western North American Naturalist* 69:481-490.

AFFILIATED FACULTY and STUDENTS

Butler, D. J., S. P. Haskell, W. B. Ballard, M. C. Wallace, C. J. Britton, and M. H. Humphreys. 2009. Differences in timing of birth, birthing sites, and bedding sites in sympatric populations of deer. *Southwestern Naturalist* 54:261-271.

Butler, M. J., W. B. Ballard, R. D. Holt, and H. A. Whitlaw. 2010. Sound intensity of booming in lesser prairie-chickens. *Journal of Wildlife Management* 74: 1160–1162.

Erxleben, D. R., M. J. Butler, W. B. Ballard, M. C. Wallace, J. B. Hardin, and S. J. DeMaso. 2010. Encounter rates from road-based surveys of Rio Grande wild turkeys in Texas. *Journal of Wildlife Management* 74:1134-1140.

Erxleben, D. R., M. J. Butler, W. B. Ballard, M. C. Wallace, M. J. Peterson, N. J. Silvy, W. P. Kuvlesky Jr., D. G. Hewitt, S. J. DeMaso, J. B. Hardin, and M. K. Dominguez-Brazil. 2010. Wild turkey association to roads: Implications for distance sampling. *European Journal of Wildlife Research*: online.

Haskell, S. P., W. B. Ballard, M. C. Wallace, M. H. Humphrey, and D. A. Butler. 2010. Postpartum group cohesion of sympatric deer species in west Texas. *Journal of Wildlife Management* 74: 1686-1692.

Haskell, S. P., D. A. Butler, W. B. Ballard, M. J. Butler, M. C. Wallace, and M. H. Humphrey. 2010. Deer density estimation in west-central Texas: old versus new ground techniques with mark-resight as a comparative baseline. *Proceeding of the Western States and Provinces Deer and Elk Workshop* 7:30-47.

Holt, R. D., M. J. Butler, W. B. Ballard, and C. A. Kukal. 2010. Disturbance of lesser prairie-chickens by ring-necked pheasants in Hemphill County, Texas. *Western North American Naturalist*: 241-244.

McRoberts, J. T., W. B. Ballard, M. J. Butler, H. A. Whitlaw, K. Boydston, and A. H. Swift. 2009. Lesser prairie chicken conservation and wind development in the Texas panhandle: a case for proactive wildlife management. Pages 71–73 in S. S. Schwartz, editor. *Proceedings of the Wind Wildlife Research Meeting VII*. National Wind Coordinating Collaborative, 28–29 October 2008, Milwaukee, Wisconsin, USA.

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw and D. A. Haukos. 2009. Aerial surveys for prairie grouse: detectability, disturbance response, and distance sampling. *Proceedings of Annual Conference of Southeast Association of Fish and Wildlife Agencies* 62: in press.

Rice, M. B., W. B. Ballard, E. R. Fish, N. McIntyre, and D. Holdermann. 2009. The importance of accurate landuse/landcover maps for assessing habitat utilization by black bear (*Ursus americanus*) in the Trans-Pecos region of Texas. *Wildlife Biology in Practice* 4:48-56.

Rice, M. B., W. B. Ballard, E. B. Fish, N. E. McIntyre, and D. Holdermann. 2010. Habitat-distribution modeling of a recolonizing black bear population in the Trans-Pecos Region of Texas. *Canadian Field-Naturalist*: in press.

Presentations

UNIT PERSONNEL

Behney, A., C. W. Boal, H. A. Whitlaw, and D. Lucia. 2008. Predation on lesser prairie-chickens at leks in West Texas. 15th Annual Meeting of The Wildlife Society, Miami, FL.

Behney, A., C. W. Boal, H. A. Whitlaw and D. Lucia. 2009. Predation on lesser prairie-chickens at leks in west Texas. Meeting of the lesser prairie-chicken interstate working group, Lubbock, TX.

Boal, C. W. 2009. Capture rates and condition of autumn migrant blackpoll warblers in the British Virgin Islands. Annual Meeting of the Cooper Ornithological Society, Tucson, AZ.

Boal, C. W., A. Miller, B. Grisham, M. Butler and W. Ballard. 2009. Influence of wind energy development on wildlife in Texas: looking before you leap. *Blowing in the*

wind: future of wind energy development in Texas conference, Lubbock, TX.

Giovanni, M. D., C. W. Boal, and H. A. Whitlaw. 2008. Ferruginous hawk nest survival in the Texas panhandle: addressing observer-based disturbance and other sources of uncertainty. Annual Meeting of the Raptor Research Foundation, Missoula, MT.

Haralson, C. L., C. W. Boal, and C. Farquhar. 2008. Breeding ecology of white-tailed hawks on the Texas barrier islands. Annual Meeting of the Raptor Research Foundation, Missoula, MT.

Hull, J. M., B. N. Strobel, C. W. Boal, H. B. Ernest, A. M. Irish, A. C. Hull, A. M. Fish, and C. R. Dykstra. 2008. Conservation, taxonomic status, and genetic differentiation among red-shouldered hawk subspecies. Annual Meeting of the Raptor Research Foundation, Missoula, MT.

Grier, H. J., I. Quagio-Grassiotto, M. C. Uribe, and R. Patiño. 2009. Switching "postovulatory follicle complex" for "postovulatory follicle". Fourth International Workshop on Gonadal Histology of Fishes, Cadiz, Spain.

Grier, H. J., M. C. Uribe, and R. Patiño. 2009. Saltwater Perciformes: from oögonia to pelagic eggs. Fourth International Workshop on Gonadal Histology of Fishes, Cadiz, Spain.

Grisham, B., N. Pirius, C. W. Boal, H. Whitlaw, and D. Lucia. 2008. Reproductive ecology and survival of lesser prairie-chickens in the Southern High Plains of Texas. Prairie Grouse Working Group Meeting, Portales, NM.

Grisham, B., C. W. Boal, D. Lucia, H. A. Whitlaw, and K. Boydston. 2009. Reproductive ecology and survival of lesser prairie-chickens on the Southern High Plains of Texas. Meeting of the lesser prairie-chicken interstate working group, Lubbock, TX.

Huber, C. G., K. A. Pope, and R. Patiño. 2009. Habitat preferences of juvenile common snook in the lower Rio Grande/Bravo del Norte. Second International Symposium on the Biology and Culture of Snooks, Villahermosa, Tabasco, Mexico.

Jenkins, J. A., R. Draugelis-Dale, B. E. Eilts, E. Orsak, R. Patiño, and S. Goodbred. 2009. Assessment of reproductive condition of two fish species in Lake Mead

National Recreation Area. 30th Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA.

Meyer, M., and R. Patiño. 2009. Use of the zebrafish embryo in studies of harmful algal blooms. Graduate Student Research Poster Competition, Texas Tech University Graduate School, Lubbock, TX.

Meyer, M., and R. Patiño. 2009. Use of the zebrafish embryo in studies of harmful algal blooms. Golden Alga International Symposium and Texas Chapter of the American Fisheries Society, Fort Worth, TX.



Presentation by MS graduate student Matt Meyer, 2009 Golden Alga International Symposium, Fort Worth, Texas

Milgalter, R. A., W. P. Kuvlesky, Jr., C. W. Boal, L. Brennan, D. G. Hewitt, and E. J. Redecker. 2009. The nesting ecology of three sympatric raptors in south Texas. The Wildlife Society 16th Annual Conference, Monterrey, CA.

Moreno, M.V., M. Sosa, R. Patiño, A. Benavides, S. V. Miranda, A. D. Rubio, and L. Leal. 2009. Concentrations of arsenic and mercury in bluegill, channel catfish and common carp from three water reservoirs in the State of Chihuahua. Tenth International Conference on the Biogeochemistry of Trace Metals, Chihuahua, Mexico.

Moreno, M.V., M. Sosa, R. Patiño, S. V. Miranda, A. D. Rubio, and L. Leal. 2009. Development of an accurate methodology for the determination of arsenic and heavy metals in freshwater fish tissues. European Winter Conference on Plasma Spectrochemistry, Graz, Austria.

Orsak, E., R. Patiño, S. Goodbred, J. A. Jenkins, M. Rosen, and L. Torres. 2009. Endocrine and gonadal condition of male largemouth bass from Lake Mead, Nevada. 30th Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA.

Patiño, R. 2009. NSF's CAREER Program. Texas Tech University Office of Research Services, Lubbock, TX (Brown Bag Seminar Speaker).

Patiño, R. 2010. NSF CAREER Program. Texas Tech University Office of the Vice President for Research, Lubbock, TX (Panel member).

Patiño, R., S. L. Goodbred, E. Orsak, J. A. Jenkins, and M. R. Rosen. 2009. Assessment of endocrine and gonadal condition of male largemouth bass from Lake Mead National Recreation Area. Lake Mead Science Symposium, Las Vegas, NV.

Patiño, R., S. L. Goodbred, E. Orsak, J. A. Jenkins, and M. R. Rosen. 2009. Endocrine and Gonadal Condition of Male Common Carp in the Lake Mead National Recreation Area (2007-2008). Lake Mead Science Symposium, Las Vegas, NV.

Patiño, R., S. L. Goodbred, E. Orsak, J. A. Jenkins, M. Rosen, L. Torres, and P. Sharma. 2009. Endocrine and gonadal condition of male common carp from various locations in the Lake Mead National Recreation Area. 30th Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA.

Roberts, A. J., C. W. Boal, S. Rideout-Hanzak, D. B. Wester, H. A. Whitlaw, and R. W. Weiser. 2008. Effects of the East Amarillo Complex wildfires on avian communities. 15th Annual Meeting of The Wildlife Society, Miami, FL.

Rosen, M., R. Patiño, J. A. Jenkins, E. Orsak, and S. Goodbred. 2009. Challenges for Lake Mead Ecosystem Health and Resource Management in the 21st Century. 30th Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA.

Sharma, P., and R. Patiño. 2010. Role and mechanism of action of thyroid hormone during gonadal sex differentiation in zebrafish (*Danio rerio*). Texas Tech Association of Biologists Annual Graduate Forum, Lubbock, TX.

Schroeder, E., C. W. Boal, and S. Glasscock. 2009. Avian abundance, species richness and diversity in two vegetation communities in the Texas coastal bend. 44nd Annual Meeting of the Texas Chapter of The Wildlife Society, Lubbock, TX.

Schroeder, E., C. W. Boal, S. Glasscock, and G. Perry. 2009. Nestling diets of two sympatric woodpeckers in the Texas coastal bend. The Wildlife Society 16th Annual Conference, Monterrey, CA.

Skipper, B., and C. W. Boal. 2010. Productivity, nesting success, and site occupancy of urban Mississippi kites. 46th Annual Meeting of the Texas Chapter of The Wildlife Society, Galveston, TX.

Skipper, B., and C. W. Boal. 2010. Breeding performance and site occupancy of urban nesting Mississippi Kites. 57th Annual Meeting of the Southwestern Association of Naturalists, Junction, TX.

Strobel, B. N., and C. W. Boal. 2008. Implications of regional spatial variation in prey use by breeding red-shouldered hawks. Annual Meeting of the Raptor Research Foundation, Missoula, MT.

Torres, L., and R. Patiño. 2010. Biomarker assessment in largescale sucker (*Catostomus macrocheilus*) exposed to endocrine disrupting compounds in the Columbia River Basin, Oregon. Graduate Student Research Poster Competition, Texas Tech University Graduate School, Lubbock, TX.

Xin, D., B. Stanford, D. D. Douglas, E. Orsak, L. Orphan, S. Snyder, and R. Patiño. 2009. Testing of Las Vegas Municipal Effluent (Clark County, Nevada) for Endocrine and Reproductive Effects to Fathead Minnow. Lake Mead Science Symposium, Las Vegas, NV.

AFFILIATED FACULTY and STUDENTS

Ballard, W. B., J. McRoberts, M. Butler, S. Wulff, K. Boydston, H. Whitlaw, and A. Linehan. 2009. Wind energy development and potential impacts on wildlife. Annual meeting of the Society of Range Management. Albuquerque, NM.

Butler, M, W. Ballard, and J. McRoberts. 2009. Potential impact of wind energy development on wildlife of the

southern Great Plains. Texas Chapter of The Wildlife Society. Lubbock, TX.

Butler, M. J., W. B. Ballard, M. C. Wallace, S. J. DeMaso, and J. B. Hardin. 2009. A long-term study of Rio Grande wild turkey ecology on the southern Great Plains. Annual meeting of the Texas Chapter of the Wildlife Society. San Antonio, TX.

Butler, M., J. McRoberts, W. Ballard, H. Whitlaw, K. Boydston, and A. Swift. 2009. Lesser prairie-chicken conservation and wind development in the Texas Panhandle: a case for proactive wildlife management. 2009 Annual Meeting-lesser prairie-chicken interstate working group. Lubbock, TX.

Butler, M. J., W. B. Ballard, and J. T. McRoberts. 2009. Potential impacts of wind energy development on wildlife of the Southern Great Plains. Blowin' in the Wind: the Future of Wind Turbine Farms. Lubbock, TX.

Butler, M. J., J. T. McRoberts, W. B. Ballard, H. A. Whitlaw, K. K. Boydston, and A. H. Swift. 2009. Lesser prairie-chicken conservation and wind development in the Texas Panhandle: a case for proactive wildlife management. Northeast Nevada Wind Energy Impact Research Meeting, U.S. Bureau of Land Management and Northeastern Nevada Stewardship Group Sage Grouse Pod. Elko, NV.

Erxleben, D. R., M. J. Butler, W. B. Ballard, M. C. Wallace, and J. B. Hardin. 2009. Evaluation of road-based surveys of Rio Grande wild turkeys in Texas. Texas Chapter of The Wildlife Society. Lubbock, TX.

Holt, R. D., W. B. Ballard, C. B. Dabbert, C. W. Boal, M. J. Butler, H. A. Whitlaw, and D. A. Haukos. 2009. Breeding season ecology of lesser prairie-chickens in the northeast Texas Panhandle. Prairie Grouse Technical Conference. Portales, NM.

Holt, D., W. Ballard, B. Dabbert, C. Boal, H. Whitlaw, D. Haukos, and C. Kukal. 2009. Lesser prairie-chicken brood ecology in the Texas Panhandle. 2009 Annual Meeting-lesser prairie-chicken interstate working group. February 12, 2009. Lubbock, TX.

Kukal, C. A., R. D. Holt, W. B. Ballard, M. J. Butler, H. A. Whitlaw, and M. C. Wallace. 2009. The over-winter ecology of lesser prairie-chickens in the northeast Texas

Panhandle. Prairie Grouse Technical Conference. Portales, NM.

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw, and D. A. Haukos. 2009. Aerial surveys for prairie grouse leks: detectability and disturbance response. 56th Annual Meeting of the Southwestern Association of Naturalists. Monterrey, Nuevo León, Mexico.

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw, and D. A. Haukos. 2009. Aerial surveys for lesser prairie-chicken leks: detectability and disturbance response. Lesser Prairie-Chicken Interstate Working Group Annual Meeting. Lubbock, TX.

McRoberts, J. T., W. B. Ballard, M. J. Butler, H. A. Whitlaw, K. K. Boydston, and A. H. Swift. 2008. Lesser prairie-chicken conservation and wind development in the Texas Panhandle. VII Annual Wind and Wildlife Research Meeting. Milwaukee, WI.

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw, and D. A. Haukos. 2008. Aerial surveys for prairie grouse leks: detectability and disturbance response. 8th Annual Meeting of the South Eastern Association for Fish and Wildlife Agencies. Corpus Christi, TX.

McRoberts, J. T., M. J. Butler, W. B. Ballard, H. A. Whitlaw, D. A. Haukos, and M. C. Wallace. 2009. Aerial surveys for lesser prairie-chick leks: detectability and disturbance response. Prairie Grouse Technical Conference. Portales, NM.

McRoberts, J., M. Butler, W. Ballard, M. Wallace, H. Whitlaw, and D. Haukos. 2009. Aerial surveys for lesser prairie-chicken leks: detectability and disturbance response. 2009 Annual Meeting Lesser Prairie-Chicken Interstate Working Group. February 12, 2009. Lubbock, TX.

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw, and D. A. Haukos. 2009. Aerial surveys for prairie grouse leks: detectability and disturbance response. 8th Annual Texas Tech Graduate Student Research Poster Competition. Lubbock, TX.

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw, and D. A. Haukos. 2008. Aerial surveys for prairie grouse leks: detectability, disturbance

response, and distance sampling. 15th Annual Conference of The Wildlife Society. Miami, FL.

Schwalm, D. L., W. B. Ballard, L. P. Waits, and H. A. Whitlaw. 2009. An assessment of genetic structure among swift fox populations in the United States. Texas Chapter of The Wildlife Society. Lubbock, TX.

Schwalm, D., W. Ballard, L. Waits, M. Cronin, and J. Young. 2010. An assessment of genetic structure and diversity among swift fox populations in the United States. American Society of Mammalogy. Laramie, WY.

Yancey, S., D. Wester, S. Rideout-Hanzak, M. Janis, and D. Ruthven. 2010. Grassland bird response to patch burning-grazing on sand sagebrush-mesquite rangeland. Texas Chapter of The Wildlife Society 46th Annual Meeting, Lubbock, TX.

Zak, J. C., C. Bell, D. Tissue and J. Sirotnak. 2010. The Pine Canyon Watershed Program, USGS-Desert LCC Workshop, Sul Ross State University, Alpine, TX.

Workshops Organized

UNIT PERSONNEL

Structured Decision Making Approach to Natural Resources Management. 2010. Instructor, Dr. Mike Conroy (Georgia Unit, retired); Assistant, Dr. Clint Boal (Texas Unit).

Second International Symposium on the Biology and Culture of Snooks. 2009. Co-organizers: Dr. Wilfrido Contreras-Sanchez (Universidad Juárez Autónoma de Tabasco) and Dr. Reynaldo Patiño (Texas Unit).

Program MARK 2-day Workshop. 2009. Instructor, Dr. Brent Bibles (Utah State University); Organizer, Dr. Clint Boal (Texas Unit).

Unit Staff Awards

CLINT BOAL

Faculty Research Award, College of Agriculture Sciences and Natural Resources, Texas Tech University, 2010
STAR Awards in 2009 and 2010 for research productivity

REYNALDO PATIÑO

College of Agricultural Sciences and Natural Resources
Outstanding Researcher Award, 2010



*Structured Decision Making Workshop
Kerr Wildlife Management Area, Texas*



*Biology and Culture of Snooks Symposium
Division of Biological Sciences, Universidad Juárez
Autónoma de Tabasco, Villahermosa, Tabasco, México*

Texas Cooperative Fish and Wildlife Research Unit

22 YEARS OF SERVICE

The Texas Cooperative Fish and Wildlife Research Unit was established at Texas Tech University in 1988 and first staffed in 1989. The unit is part of the National Cooperative Research Units Program that resides within the U.S. Geological Survey, and its mission is to conduct and facilitate research and education activities related to natural resource management and conservation. Unit cooperators include Texas Tech University, Texas Parks and Wildlife Department, Wildlife Management Institute, U.S. Fish and Wildlife Service, and U.S. Geological Survey.

