COOPERATIVE RESEARCH UNITS

CONOR MCGOWAN/ALABAMA UNIT

2011 YEAR IN REVIEW

In Fiscal Year (FY) 2011, the Cooperative Research Units (CRU) Program operated with an enacted budget of $19.1 M, which represented a net decrease of $0.2 M from the enacted budget of $19.3 M in FY 2010. Most of FY 2011 was under a continuing resolution with final full-year budget approval delayed until early spring. At present, CRU is operating under a fully funded budget of $18.8 M for FY 2012, which represents a decrease of an additional $0.3 M from FY 2011 and a cumulative decrease of approximately $0.5 M from FY 2010. The President's proposed budget for FY 2013 is $18.9 M, which is similar to the FY 2012 enacted program budget.

Fiscal Year	Enacted budget ($M)	Change from previous year
2007	$14.8	—
2008	$16.2	$1.4
2009	$16.9	$0.7
2010	$19.3	$2.4
2011	$19.1	−$0.2
2012	$18.8	−$0.3

STAFFING

With program cooperators, CRU intensified the effort to rebuild science capacity in 2011 by hiring 15 new assistant unit leaders in Georgia (2), Maine, Massachusetts, Missouri (2), New Mexico, New York, Oregon, Pennsylvania, South Carolina, South Dakota (2), and Wyoming (2). Two new unit leaders were hired into the program in Iowa and Kansas. At present, a vacant assistant unit leader position is being filled in Alaska as well. The strategic effort of CRU and its cooperators to rebuild science capacity was based on increased funding levels provided to CRU from FY 2007 to FY 2010. CRU realized a cumulative $4.5 M funding increase over these years. Overall, CRU's cooperator-focused hiring efforts through 2011 have reduced in number the Units with vacancies from 19 in 2008 to 9 in 2012 (projected). Further discussion and analysis of CRU hiring trends is found on page 3 of this report.

contents

Above photo: Red Knots and horseshoe crabs. In 2011, USGS scientists led an effort to develop an adaptive management framework for the management of the horseshoe crab harvest in Delaware Bay that explicitly accounts for Red Knot conservation needs, see story page 7.

2011 YEAR IN REVIEW *CONTINUED*

NOBORU NAKAMURA/ YAMASHINA INSTITUTE FOR ORNITHOLOGY

GLENN R. VANBLARICOM/WASHINGTON UNIT

Top: A Short-Tailed Albatross with a satellite transmitter attached to its back; part of a satellite tracking study conducted on Torishima Island, Japan, by Paul Sievert of the Massachusetts Unit and collaborators from the Yamashina Institute for Ornithology and Oregon State University.

Bottom: A group of endangered black abalone in the rocky intertidal zone of San Nicolas Island, California. Glen VanBlaricom and researchers from the Washington Unit are participating in a cooperative research and monitoring program on this species with biologists from the NOAA National Marine Fisheries Service, the U.S. Navy, and the University of Washington.

OPERATIONS

CRU continued to invest significant funding in Units for operational support, safety equipment and training, diversity, and for research vehicles. CRU continues to prioritize operational funds for safety needs. Start-up funds are also provided to new Unit scientists and include incentive funds to work with cooperators. Collectively, the strong budget-based investments in new staff, along with the multi-year investments in new equipment, have Units well poised to address the expanding needs of state and federal cooperators in the future.

SUPPORT TO DIVERSITY

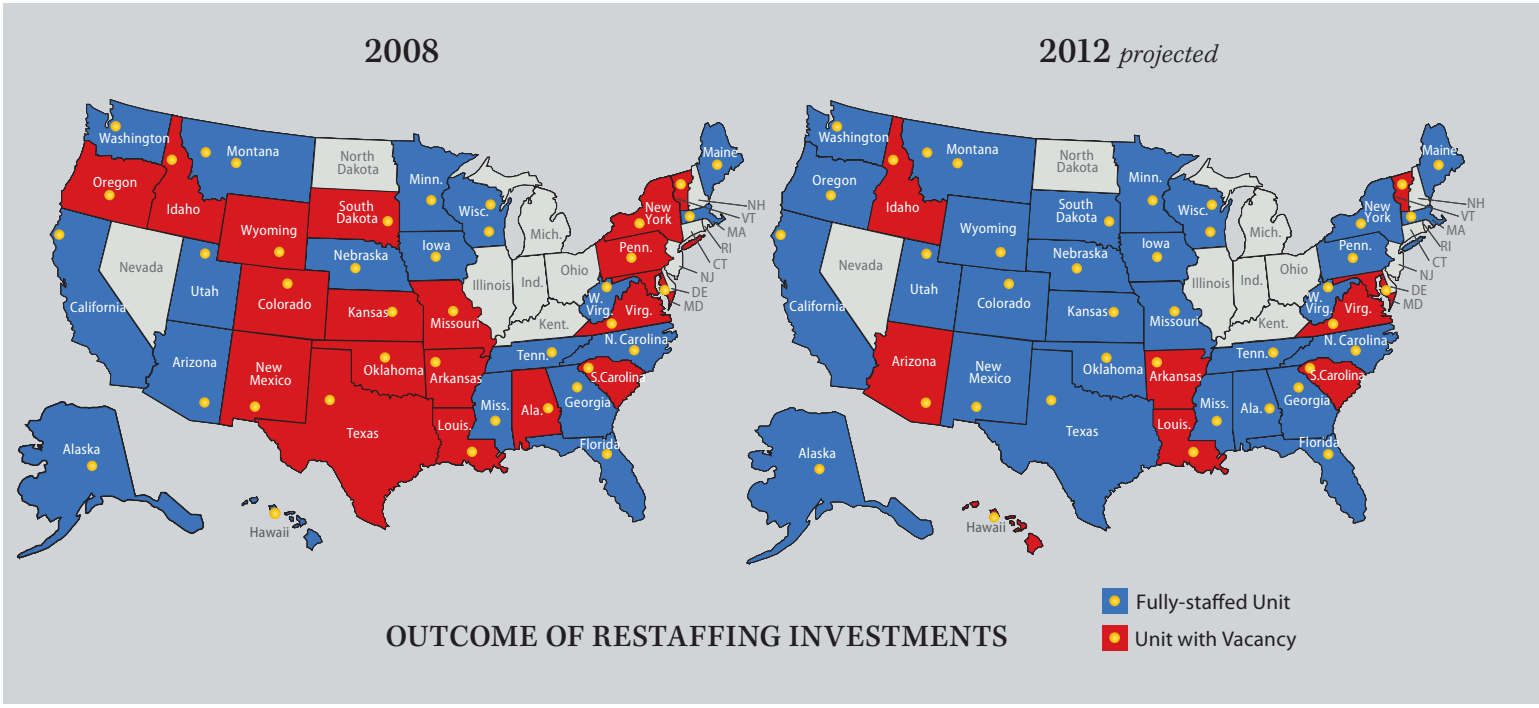
CRU continued its support of two minority education and training programs, including the National Cooperative Fisheries Scholars Program (NCFSP) at the University of Arkansas, Pine Bluff (UAPB), and the program to support minority training at the University of Arizona, Tucson. Leaders and faculty involved with the NCFSP from UAPB participated in a symposium on minority education and training at the national American Fisheries Society Meeting in 2011 in Seattle. The NCFSP is a flagship minority training and education program providing full four-year academic support to selected individuals attending UAPB. CRU will continue to prioritize its support of minority education and training programs through 2012.

SCIENCE AND DECISIONS CENTER

In 2010, USGS Director Marcia McNutt established a new Science and Decisions Center, co-located in the Ecosystems Mission Area and the Energy and Minerals and Environmental Health Mission Area in USGS. Co-directed by Ken Williams and Carl Shapiro, the Center's strategic focus is advancing the use of science in natural resources management. Its mission is to provide an institutional voice and coordination point for decision science in USGS, with an emphasis on adaptive management, ecosystem services, resilience and sustainability, and their interconnections. The Center is closely linked to CRU through its leadership and a shared vision of partner-driven science.

NATIONAL CONSERVATION LEADERSHIP INSTITUTE

Discussions were recently initiated between Ken Williams and the staff and board members of the National Conservation Leadership Institute (NCLI) about a more proactive involvement of the federal agencies participating in this leadership training program. Funding commitments from CRU have been matched by USGS to help cover funding shortfalls for the Institute, with the hope and expectation that other participating agencies will make similar commitments. This important leadership training program is closely aligned with the training and education mission of CRU. The NCLI Board is exploring a more formal role for CRU in NCLI leadership development and training.



OUTCOME OF RESTAFFING INVESTMENTS

REBUILDING SCIENCE CAPACITY

In 2011, CRU continued its strategic emphasis to rebuild science capacity in the program. Following the hiring of 9 new Unit scientists in 2010, CRU filled an additional 17 positions in 2011 for a two-year total of 26 vacancies filled. The aggressive hiring strategy is necessary to offset the effects of continuing staff retirements of which 19 have occurred between 2007 and 2011.

	HIRES		RETIREMENTS		
Year	Yearly	Cumulative	Yearly	Cumulative	Yearly net change
2007	0	0	3	3	−3
2008	1	1	5	8	−7
2009	3	4	4	12	−8
2010	9	13	4	16	−3
2011	17	30	3	19	11

A number of CRU scientists remain retirement eligible in 2012, and an average of 3 to 4 retirements per year are likely into the future. Retirements will erode gains in science capacity achieved over the last several years (since 2010) if funding is unavailable to replace staff. The current program funding level of about $19 M should enable CRU to replace retiring staff on a selected basis, if the recent trend of budget decreases since 2010 does not continue.

The net result of the increased hiring effort is that 31 of the 40 Units are currently fully staffed. A hiring action is underway in Alaska to fill the vacant assistant unit leader position, which will bring the Alaska Unit to full staffing. Two of the other Units with one remaining vacancy (Idaho and Louisiana) have three existing Unit scientists on staff. The three-year cumulative restaffing effort, completed in close coordination with Unit cooperators, has reduced the number of Units with vacancies from 19 (in 2008) to 9 (by mid-2012).

CRU's cooperator-focused restaffing effort was made possible by the significant budget increase in the program's enacted budget from FY 2008 ($16.2 M) to FY 2010 ($19.3 M). The increased appropriation was invested largely in scientist positions as well as in materials and equipment with an emphasis on safety. The net results of these complementary efforts are that many Units are restaffed, retooled, and poised to address expanding cooperator needs in the future. CRU will continue to evaluate the opportunity to fill remaining vacant positions based on budget deliberations for 2013 and beyond.

PROGRAM PERSONNEL CHANGES

NEW HIRES 2011–2012

Scott Carleton ..... *New Mexico Assistant Unit Leader*

Anna Chalfoun ..... *Wyoming Assistant Unit Leader*

Katie Dugger ..... *Oregon Assistant Unit Leader*

Mitchell Eaton ..... *New York Assistant Unit Leader*

Larry Gigliotti ..... *South Dakota Assistant Unit Leader*

David Haukos ..... *Kansas Unit Leader*

Brian Irwin ..... *Georgia Assistant Unit Leader*

Robert Klaver ..... *Iowa Unit Leader*

Katherine McFadden ..... *South Carolina Assistant Unit Leader*

Shawn McKinney ..... *Maine Assistant Unit Leader*

Clinton Moore ..... *Georgia Assistant Unit Leader*

Amanda Rosenberger ..... *Missouri Assistant Unit Leader*

Allison Roy ..... *Massachusetts Assistant Unit Leader*

Joshua Stafford ..... *South Dakota Assistant Unit Leader*

William Walter ..... *Pennsylvania Assistant Unit Leader*

Annika Walters ..... *Wyoming Assistant Unit Leader*

Elisabeth Webb ..... *Missouri Assistant Unit Leader*

REASSIGNMENTS, 2011

Courtney Conway ..... *Assistant Unit Leader, Arizona, to Unit Leader, Idaho*

Brad Griffith ..... *Assistant Unit Leader to Unit Leader, Alaska*

Cindy Loftin ..... *Assistant Unit Leader to Unit Leader, Maine*

RETIREMENTS, 2011

William B. Krohn ..... *Maine Unit Leader*

David Otis ..... *Iowa Unit Leader*

J. Michael Scott ..... *Idaho Unit Leader*

SIMON FITZWILLIAM/FLORIDA UNIT

A young rice rat, captured in the salt marshes along the Gulf Coast of Florida in the Lower Suwannee National Wildlife Refuge, as part of a study by Florida Unit researchers designed to aid in the conservation and management of Florida's biodiversity by using predictions from down-scaled Atmosphere-Ocean General Circulation Models in combination with ecological modeling.

AMANDA WADDLE/FLORIDA UNIT

Occasional anomalies are observed when handling large numbers of wild animals. Polydactylism in this alligator hatchling from Lake Apopka, Florida, was observed by Amanda Waddle of the Florida Unit during a study designed to measure ecosystem health to aid in shoreline restoration efforts by the St. Johns River Water Management District and Natural Resources Conservation Service.

SEAN PETERSON/MINNESOTA UNIT

Radio-marked Golden-Winged Warbler fledgling, first day off the nest, in southeastern Manitoba, photographed as part of a Minnesota Unit study of Golden-Winged Warbler habitat use and demography in the upper Midwest.

PROGRAM PERFORMANCE

WYOMING UNIT

ACHIEVING THE UNIT MISSION

In 2011, Unit scientists and their cooperators advanced the mission of the CRU program through joint research, education, technical assistance, and science support. Unit scientists completed 793 projects for federal and state partners. Unit scientists and their students remained actively engaged in service to professional societies delivering 662 presentations. Many of these presentations were invited seminars, indicating that Unit scientists and their research are held in high regard by the scientific and management communities. CRU's service to university cooperators continued to be strong, with 75 academic classes taught in 2011 and additional workshops and short courses delivered to partners and cooperators.

Each year, over 500 students engage in graduate education and training in natural resources conservation through the CRU program. About 15 percent of these students graduate each year and enter the natural resources management workforce as employees of state and federal agencies, NGOs, and universities. Eighty-four graduate degrees were awarded to Unit students in 2011, which is consistent with the long-term trend.

productivity summary, 2011

peer-reviewed publications	349
invited seminars	56
workshops and short courses	25
research projects	793
papers presented	684
academic courses taught	75
number of students	582
master's degrees awarded	61
doctoral degrees awarded	23

Above photo: Left to right, Wyoming Unit researchers Nate Bowersock, Travis Zaffarano, Trent Roussin, Arthur Middleton (Ph.D. student), and Abigail Nelson (Master's student), with two wolves sedated for GPS-collaring, as part of a study of wolf-elk interactions in northwest Wyoming. Researchers captured and GPS-collared 24 wolves and 93 elk for this study, which was conducted within the partially migratory Clarks Fork elk herd. The project is being conducted by the Wyoming Unit in cooperation with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service.

STRATEGIC DIRECTIONS

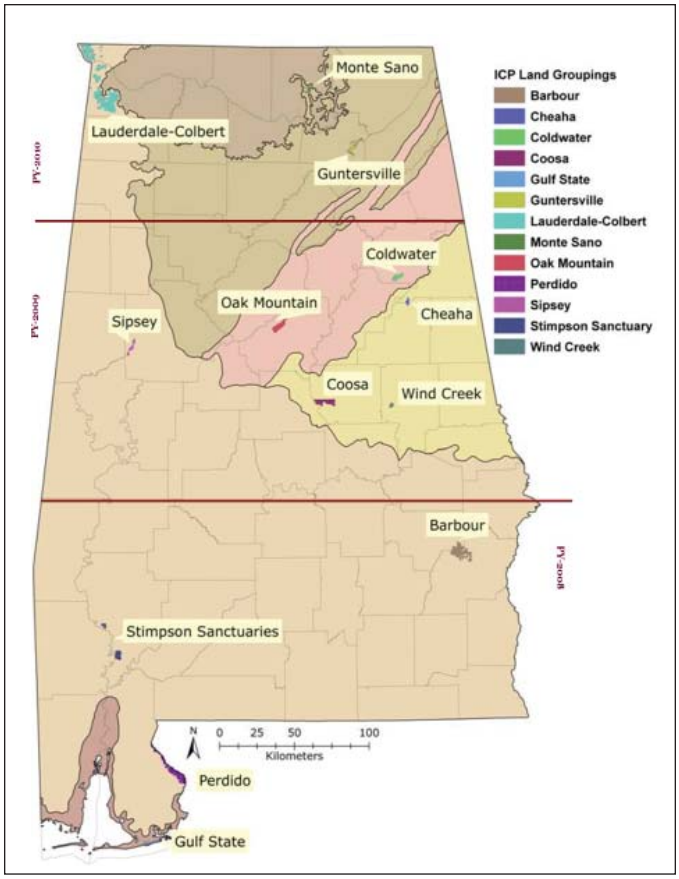
SCIENCE-BASED DECISION MAKING INITIATIVE

PROGRESS AND ACCOMPLISHMENTS

Since 2009, CRU has advanced the strategic initiative of science-based decision making to better integrate research, education, and technical assistance with the conservation and management of natural resources. The initiative focuses on applying the complementary approaches of structured decision-making (SDM) and adaptive management (AM) to provide a scientific basis for management decision-making. CRU has also worked with university cooperators to offer graduate-level courses in SDM/AM, and has invested in data-driven, decision support research to train graduate students as future practitioners. Many of the new hires recently recruited into CRU have experience, or an interest, in applying SDM/AM approaches to natural resource management challenges.

Since 2009, in partnership with the U.S. Fish and Wildlife Service (USFWS), National Conservation Training Center (NCTC), CRU has sponsored SDM/AM training for 62 state cooperators from 20 units and 44 CRU scientists from 24 units. The training offered includes a variety of week-long courses and targeted workshops. Several states, including New York, Montana, and Alabama, have advanced beyond the introductory level, and working with Unit staff, have applied SDM/AM approaches to real-world management problems. As funding allows, CRU will continue to partner with NCTC to support SDM/AM training to build capacity to respond to increasingly complex management challenges in the future.

Following are project summaries for two SDM/AM efforts developed through CRU sponsorship of NCTC training of Unit scientists and their state cooperators. These projects highlight the benefits of using structured processes to address complex and multi-faceted natural resources management challenges.



The Alabama Unit led a collaborative effort with university researchers, and state agency biologists, involving 11 graduate students to conduct comprehensive inventories of wildlife and their habitats on these 13 state-owned parks and wildlife management areas. The results were used to develop models for comparing the effects of multiple management strategies on agency conservation objectives.

DECISION ANALYSIS FOR MANAGING STATE LANDS IN ALABAMA

Scientists and collaborators at the Alabama Unit are working closely with the Alabama Department of Conservation and Natural Resources to determine how to best manage state lands to conserve over 300 species designated as Greatest Conservation Need (GCN) in Alabama's Comprehensive Wildlife Conservation Strategy. The overall goal of the five-year project is to provide a science-based plan for the conservation of GCN species and the habitats that support them in Alabama managed state lands. Additional goals are to: (1) establish a protocol and baseline for monitoring GCN species for inventory and conservation planning; (2) identify and better understand the issues affecting the conservation of GCN species; (3) provide guidance for maintaining or increasing populations of GCN species; and (4) foster collaborative relationships among public and private stakeholders.

The state-wide project is using a SDM approach to evaluate trade-offs between different management actions to achieve management goals and designated uses, while simultaneously enhancing habitat for rare and declining species. The project included an intensive outreach effort consisting of five, two-day workshops with agency personnel, managers, researchers, and other stakeholders to elicit management needs and objectives and to compile information needed for the development of decision support tools. Information derived from these workshops was coupled with species distribution data from field sampling and assembled using a state-space modeling approach. The models projected the effects of management alternatives on land cover (100-year timeframe). Habitat models were combined with projected land cover to predict the distribution of 300+ species. This new approach incorporates species conservation objectives directly into the assessment of land management decisions. This project is nearing completion and the final report will be available in 2012.

STRUCTURED DECISION-MAKING FOR MONITORING PROGRAM PLANNING

Pennsylvania Unit scientists Duane Diefenbach and Tyler Wagner have worked with state cooperators on several natural resource challenges using a SDM/AM framework. Both Unit scientists and their state colleagues attended introductory SDM training at the NCTC, which resulted in follow-up SDM projects with three state cooperators. The summary below illustrates how use of a SDM approach has resulted in substantial cost savings to Unit cooperators and benefitted research and monitoring programs.

MANAGING DEER ON STATE FORESTS

The Pennsylvania Bureau of Forestry (BOF) manages over 2 million acres of state forest land in Pennsylvania and has struggled for over 50 years with deer densities that resulted in impaired forest regeneration. About 8 years ago, a deer management assistance program (DMAP) created by the Pennsylvania Game Commission (PGC) allowed the BOF to obtain property-specific permits for hunters to harvest additional antlerless deer. The BOF had established a monitoring program that required foresters to walk hundreds of miles of transects every spring, where they counted deer pellets and seedlings and collected other data. This effort was basically an omnibus monitoring program lacking measures tied to specific objectives.

In 2010, the Pennsylvania Unit facilitated a workshop for Tioga State Forest staff to establish a decision model for implementing DMAP and setting license allocations. This workshop was in response to concerns that the BOF had an inconsistent approach for implementing DMAP among forest districts and encountered resistance from staff, because of the time required to implement the monitoring program. The workshop was a two-and-a-half-day event with the most difficult and time-consuming part being the identification of objectives. Once this critical, but often overlooked, step was accomplished the remaining work was comparatively easy and eye-opening for agency staff. A truly "Aha!" moment occurred when the group used a consequences table to select a vegetation monitoring program to best meet objectives among a half-dozen potential protocols. The selected program turned out to be an existing program within the agency.

DUANE DIEFENBACH/PENNSYLVANIA UNIT

Managing deer populations in balance with habitat has been controversial in Pennsylvania for decades. Pennsylvania Unit researchers are working with agency cooperators to use structured decision-making and adaptive management tools to identify objectives and successful management scenarios.

Crafting the final decision model required another dozen meetings and conference calls to finalize. Within about 9 months, an acceptable model had been developed along with a plan for vegetation monitoring. The timing was perfect (for BOF staff) because the PGC, in response to increasing hunter complaints, required a DMAP management plan before the BOF could enroll lands in DMAP. The SDM process and the decision model were essential features of the final management plan. One benefit of applying the SDM approach is that the agency has realized at least a 60 percent cost savings for monitoring. The SDM process also ensures increased cooperation from staff biologists who are empowered through participation in the program. Being able to implement changes and understand how the revised monitoring program helps state biologists make time- and cost-saving decisions are significant benefits of the SDM approach.

ADAPTIVE MANAGEMENT IN ACTION

In February 2012, the Atlantic States Marine Fisheries Commission (ASMFC) formally implemented an adaptive management (AM) framework for the Interstate Fishery Management Plan used to manage horseshoe crab harvest in the Delaware Bay region. This project began as a NCTC SDM workshop in 2007 and included fishery managers, scientists, and stakeholders from a variety of organizations, including the ASMFC, USFWS, and USGS. USGS scientists Conor McGowan (Alabama Unit), Dave Smith (Leetown Science Center), and Jim Nichols (Patuxent Wildlife Research Center) led the effort by developing the adaptive management framework and models, and conducting analyses to support the AM framework. The scientists determined the high importance of horseshoe crab eggs to the diet of migrating Red Knots, an at-risk shorebird. This suggested that horseshoe crabs in Delaware Bay could be managed to improve Red Knot populations by accounting for the dietary needs of Red Knots when setting crab harvest allocations. The AM framework incorporates the abundance of Red Knots and horseshoe crabs with multiple decision alternatives to set optimal harvest levels of horseshoe crabs among the four states - New Jersey, Delaware, Virginia, and Maryland - that harvest horseshoe crabs from Delaware Bay.

RESEARCH HIGHLIGHTS

The research highlights presented below focus on a subset of the many issues in which Unit scientists are engaged across the nation in service to state and federal cooperators. The selected projects highlight CRU's work on waterfowl and science associated with recreationally important fisheries; research on wetland function; new and innovative ways of improving the rigor of monitoring; and the application of new technology to understand and resolve critical questions related to fish passage and river management. CRU cooperator-focused research remains strongly geared toward solving real-world management problems, in addition to pushing the frontiers of science itself.

JOSEPH ZYDLEWSKI/MAINE UNIT

Maine Unit graduate student Ann Grote with radio-tagged American shad.

New Technologies To Inform American Shad Restoration

Joseph Zydlewski, Maine Unit

The Penobscot River in Maine historically supported an abundance of migratory fishes including American shad. Scientists at the Maine Unit have been working to understand the current status of American shad and the scope for recovery after the planned 2014 removal of two main-stem dams as part of the Penobscot River Restoration Project. Because the lowermost dam (Veazie Dam) is at the head of tide, spawning habitat for shad is limited. Removal of Veazie Dam and the next up-river dam is anticipated to open up the vast majority of American shad spawning habitat in the river. The size of the current population is the most significant uncertainty in recovery planning. Teaming up with The Nature Conservancy and the North Carolina Unit in 2009, M.S. student Ann Grote began to blend old and new technologies to inform managers of the current state of American shad in the Penobscot River. The goals of this study are to address two main data gaps: characterization of adult shad migratory behavior and characterizing the existing river specific run.

The work underway uses Dual-Frequency Identification Sonar (DIDSON). DIDSON works like an ultrasound camera, allowing researchers to "view" fish at night and in turbid water. A DIDSON camera recorded a continuous video record of fish approaching the base of Veazie Dam. The recordings proved effective for identifying species, measuring the size of fish, and developing size distributions in a system where sampling methods are limited due to the presence of threatened and endangered species. The scientists found that in addition to Atlantic salmon and river herring, large numbers of American shad approach the dam, but do not use the fishway. Ultimately an index of fish abundance at the base of the dam will be developed based solely on DIDSON encounters.

In the last two years, more conventional approaches have been used to assess habitat use and behavior of American shad. In 2010 and 2011 migrating adults were captured via boat electrofishing for telemetry work and to collect age, length-frequency, and spawning information. Radio telemetry was used in the upper river to characterize residence time and identify probable spawning areas. Acoustic telemetry efforts exploited an extensive acoustic array cooperatively deployed and maintained by the Maine Unit, the University of Maine and NOAA Fisheries. This array tracked adults leaving the Penobscot River and entering the ocean, presumably after spawning. Together these approaches have provided managers with critical information for the restoration of American shad in Maine.

North Carolina Unit scientists, with the help of volunteers from the North Carolina Wildlife Resources Commission, use the "Bird Radio" point count simulation system to evaluate and validate current point count sampling methods.

TED SIMONS/NORTH CAROLINA UNIT

Lesser Scaup drake with leg band.

ALAN AFTON/LOUISIANA UNIT

Bird Radio

Ted Simons, North Carolina Unit

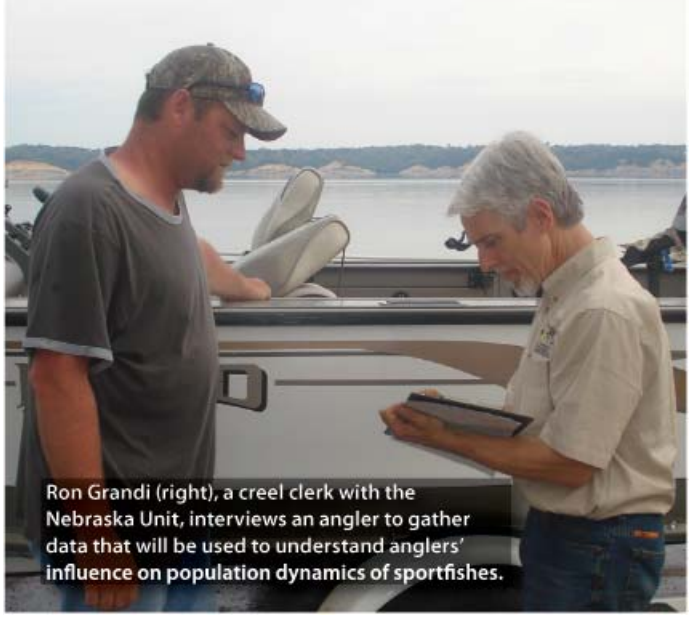
Much ecological research and management is based on counts of animals. In many cases potential biases in these counts are ignored because count detection probabilities are not estimated directly. The use of unadjusted counts in population estimates is a problem in wildlife management that spans the spectrum of animal sampling from local studies to continental scale monitoring programs. It is estimated that there are a minimum of 2,000 state, local, and national bird and amphibian monitoring programs that rely on data from unadjusted point count censuses.

Scientists at the North Carolina Unit are working to improve three metrics that are widely used by ecologists in assessing animal populations. These metrics are abundance, species richness, and the proportion of area occupied by a particular species. The goal of the research is to derive methods for incorporating estimates of detection probability into these metrics. The approach combines theory and method development with an experimental bird song simulation system, "Bird Radio," to evaluate and validate current point count sampling methods, and to identify factors affecting the bias and precision of diversity and abundance estimates. From 2005 to 2008, North Carolina Unit scientists used the "Bird Radio" system in a series of experiments to simulate avian census conditions when most birds are identified by sound, conducting over 5,000 simulated point counts with 50 observers. They found that factors affecting detection probabilities on auditory counts, such as ambient noise, can cause substantial biases in count data. Distance sampling data are subject to substantial measurement error due to the difficulty of estimating the distance to a sound source when visual cues are lacking. Misclassification errors are also inherent in time-of-detection and occupancy methods due to the difficulty of accurately identifying and localizing sounds during a count. The scientists' findings demonstrate that the uncertainty surrounding estimates of avian diversity and abundance based on distance, double-observer, and time of detection sampling methods is much higher than is currently assumed by practitioners. Development of reliable avian sampling methods is essential before extensive monitoring programs are established.

Migration, Habitat Use, and Survival of Female Lesser Scaup

Alan Afton, Louisiana Unit

Louisiana Assistant Unit Leader Alan Afton and collaborators are conducting a long-term study of migration energetics and habitat use of Lesser Scaup, an important waterfowl species in the Mississippi flyway. The first research objective was to map spring migration corridors of females captured and radio-marked on Pool 19 of the Mississippi River, and then document fall migration corridors and affiliations of breeding and wintering areas. These data should be useful in identifying and prioritizing important regions and areas in North America for Lesser Scaup habitat conservation and management. The second objective is to estimate migratory flight parameters of radio-marked females and the proportion of time individuals of varying body mass spend within the upper-Midwest and subsequently in prairie Canada. These data will be used to: (1) help determine the relative importance of stopover areas in the upper-Midwest, and (2) assess potential bias in scaup population estimates from the May Waterfowl and Habitat Survey. A third objective is to quantitatively describe habitats used by females throughout the annual cycle, utilizing remote-sensing and other GIS data. These results will provide guidance to managers for acquisition, protection, and management of important habitats within specific regions and areas of North America. The fourth objective is to band a large sample of Lesser Scaup annually at Pool 19 to estimate annual survival and provide opportunity for direct estimates of harvest rates using new techniques. Annual survival will be estimated in relation to body mass at capture and compared between years with liberal and restrictive scaup bag limits, using current and historical banding data. Finally, the fifth objective is to provide opportunity for university students, agency and NGO personnel, and other interested individuals to: (1) obtain banding experience; (2) learn techniques for capturing, handling, and marking diving ducks; and (3) interact and discuss current wildlife management issues with a diverse group of waterfowl researchers, biologists, and managers. Agency biologists are concerned that recent university graduates generally lack waterfowl banding experience, and accordingly this project provides training and experience for 5–20 university students annually.



Ron Grandi (right), a creel clerk with the Nebraska Unit, interviews an angler to gather data that will be used to understand anglers' influence on population dynamics of sportfishes.

TONY BARADA/NEBRASKA UNIT

Leg-banded female Snail Kite at nest with nestlings.

WILEY KITCHENS/FLORIDA UNIT

Angler Participation Patterns and Influence on Fish Populations

Kevin Pope, Nebraska Unit

Angling is an important factor influencing managed fish populations. Unfortunately, fisheries practices rarely incorporate patterns of angler participation in management strategies. Angler behaviors are complicated and poorly understood, but the benefits of including even the basic patterns, such as the spatial and temporal patterns of angler use, may have important implications for fisheries management. Anglers are influenced by numerous factors when selecting fishing sites. An interplay exists between angler participation and quality of a fish population within a region. Differences among population dynamics of fish should increase the variability in fish densities within a region, whereas the movement of anglers among waterbodies (from lower-density fish population to higher-density fish population) is likely to reduce or dampen the variability in fish densities within a region. Unlike fishery management efforts that in general operate on a local scale, i.e., single lake, these counteractive forces act on a regional scale. Incorporation of spatial and temporal patterns in angler participation into fishery management will require a shift in focus from a waterbody-specific management to regional management. This shift in focus would be facilitated by an understanding of angler-participation patterns within a region.

Unit scientists from Nebraska, in cooperation with the Nebraska Game and Parks Commission, are working to better understand angler participation and its influence on fish populations both locally and regionally. Components of this study include development of models that describe: (1) patterns of angler participation within a region and (2) fish population responses to different harvest regulations. Study findings should help biologists better determine appropriate waterbody-specific management objectives within a region, given the dynamic nature of angler participation and its interrelationship with fish populations.

Everglade Snail Kite Population Studies

Wiley Kitchens, Florida Unit

The Everglade Snail Kite is a highly imperiled, endangered raptor whose current range in the United States is restricted to major freshwater wetlands in central and south Florida. The kite is an extreme dietary specialist foraging almost exclusively on freshwater apple snails inextricably tying both to the considerable hydrologic and vegetative variability characterizing these systems. The Florida Unit has been conducting long term population studies (since 1996) with the objectives of defining the environmental factors regulating the kite population in order to provide the USFWS and the Florida Fish and Wildlife Conservation Commission with information to optimize conservation strategies. The specific objectives are to: (1) estimate population demographic parameters with an emphasis on survival, particularly as influenced by environmental variables such as wetland hydrology and habitat quality over space and time; (2) determine the dynamics of age structure changes of the kite population as related to population viability; (3) evaluate the movement patterns of snail kites, including rates, locations, demographic costs, and environmental correlates; (4) estimate population trends over time; (5) develop a protocol for future monitoring, particularly tactical studies examining factors driving spatial aspects of reproductive variability across the range; and (6) collaboratively participate in the development of an individually based simulation model for tracking snail kite population responses to future restoration scenarios for the Everglades.

The study area includes the entire range of the kite in Florida (the south Florida freshwater wetlands from south of Orlando to the southern Everglades). Radio-telemetry and mark-resighting (approximately 2,800 banded birds) techniques are being used to estimate demographic parameters, track movement patterns, and estimate population size. More recently, scientists have explored social network models to assess landscape connectivity as related to movement patterns and spatially structured viability analyses based on network use patterns. Results of this long-term, multi-scale research on kites are important for conserving this sentinel species of the Florida Everglades.

Blake Grisham, Texas Unit Ph.D. student, with a Lesser Prairie-Chicken.

CLINT BOAL/TEXAS UNIT

Swans in flight at Klamath Basin National Wildlife Refuge Complex.

U.S. FISH AND WILDLIFE SERVICE

Lesser Prairie-Chicken Nesting Ecology and Climate Change

Clint Boal, Texas Unit

Once widely distributed in Texas, New Mexico, Oklahoma, Kansas, and Colorado, Lesser Prairie-Chicken populations have been dramatically reduced. These reductions are attributed to a variety of landscape changes, most notably habitat loss through conversion of native prairie to agricultural crop production. Lesser Prairie-Chicken , now a species of high conservation concern, persist only in small and fragmented populations that face continued threats. Texas Unit scientists have been conducting a multi-faceted research program studying the ecology of Lesser Prairie-Chicken in west Texas since 2007. The centerpiece of this research is an ongoing long-term study of nesting ecology and survival, as affected by environmental conditions, and how to adapt management to ameliorate detrimental weather patterns driven by the El Nino–La Nina Southern Oscillations. Of particular concern is the tolerance of prairie-chicken nests to heat and aridity associated with drought and predicted climate change. Researchers are assessing the thermal and humidity profiles of nests compared to ambient conditions and attempting to identify the ambient thresholds beyond which nesting hens cannot compensate and nests fail. Preliminary results also suggest direct solar radiation may play a more important role in thermal stress of hens than ambient temperature. This may be an important factor in identifying how to best manage for vegetation composition to provide adequately sheltered nest sites. Another pressing question is the role of surface water in reproduction. Due to groundwater pumping, there are no longer any natural sources of surface water in the study area. Researchers are experimentally assessing the influence of available surface water on hen health and clutch size. Under excessively arid conditions, chicks in particular may be subject to dehydration mortality by evapotranspiratory water loss due to small size and proximity to hot soil surfaces. Thus, researchers are testing two designs of wildlife water catchments for use by prairie-chicken adults and chicks. These results will provide insights into tolerances of nesting prairie-chickens to drought and aridity, and how managers may adapt conservation efforts to provide resources facilitating prairie-chicken persistence.

Klamath Basin Wetland Restoration

Walter Duffy, California Unit

Deteriorating water quality in Upper Klamath Lake has a negative effect on the entire Klamath Basin ecosystem. Annual cyanobacteria blooms result in severe dissolved oxygen fluctuations, basic pH, elevated ammonia concentrations and increased levels of algal toxins. Declining water quality in Upper Klamath Lake has been implicated in mortality of juvenile federally listed Lost River and shortnose suckers and occasional adult fish kills. Poor water quality in the lake also influences the lower Klamath River, affecting federally listed coho salmon, Chinook salmon, and other fish species.

Water quality of Upper Klamath Lake is central to restoration of the Klamath River and is influenced by runoff from the Sprague, Williamson, and Wood Rivers. Although Upper Klamath Lake was historically eutrophic because of phosphorus-rich volcanic soils, today it is hyper-eutrophic (over enriched) due to external nutrient loading. Drainage of 10,000 ha of wetlands historically surrounding the lake is thought to have contributed to eutrophication.

Unit Leader Walt Duffy and students, in collaboration with faculty at Humboldt State University and Colorado State University, and agency scientists, are evaluating the potential for improving water quality in Upper Klamath Lake through wetland restoration. They are developing a SWAT model (soil and water assessment tool) for the Sprague, Williamson, and Wood River basins that will evaluate the cumulative amount and spatial distribution of restored wetlands needed to improve water quality in the lake. Scientists will also consider how projected water quality ecosystem services may change with future climate in the region. This strategic approach will inform managers of the success of conservation programs in providing ecosystem services and help guide future conservation planning.

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