LOUISIANA AGRICULTURE

THE MAGAZINE OF THE LOUISIANA AGRICULTURAL EXPERIMENT STATION

Spring 2002
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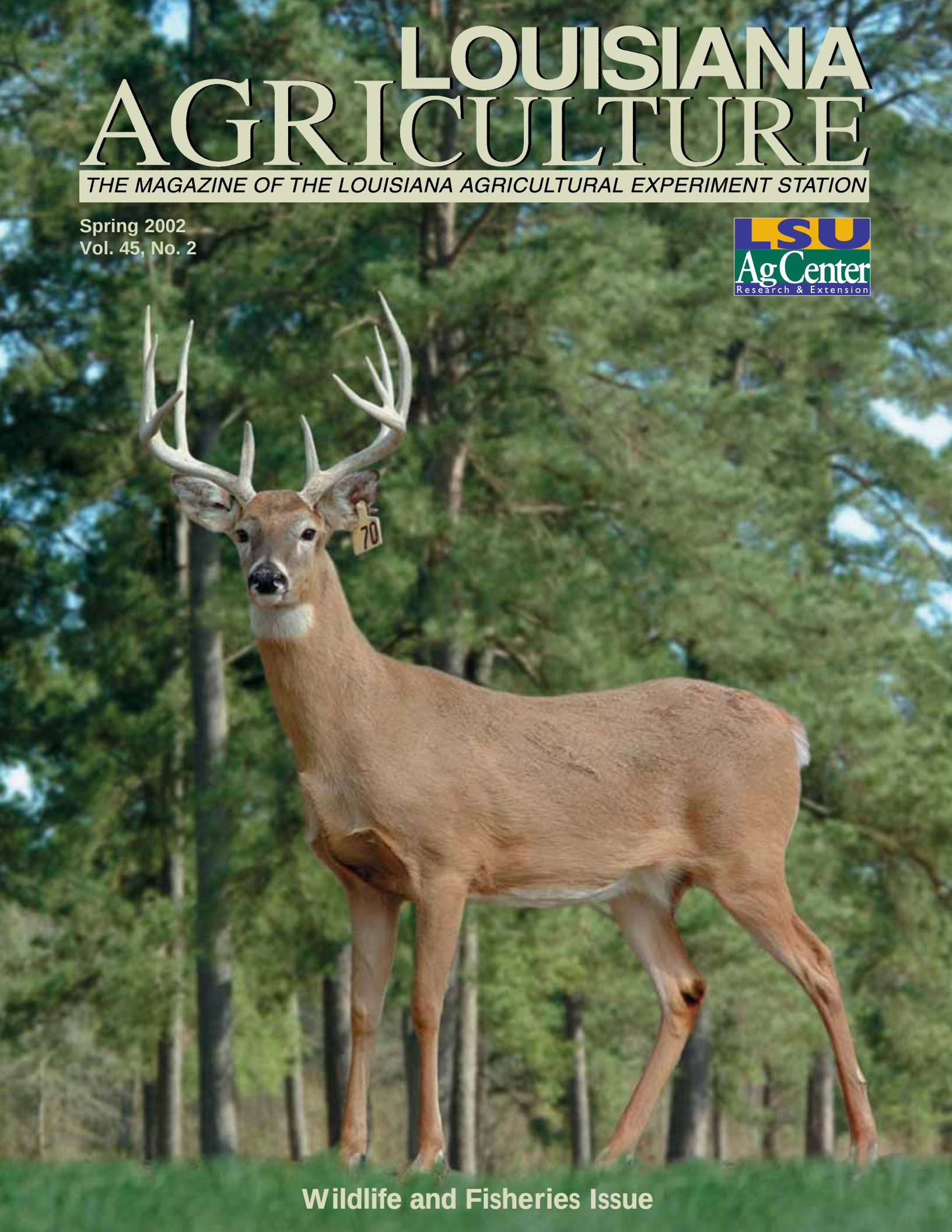
LSU AgCenter Research & Extension



Wildlife and Fisheries Issue

On the cover: *The LSU AgCenter moved its deer population from the Ben Hur Farm in Baton Rouge to the Idlewild Research Station near Clinton about 10 years ago, according to resident coordinator Dearl Sanders. The School of Renewable Natural Resources maintains about 75 to 100 adult deer at any one time on 35 acres in a number of different enclosures. These deer produce about 100 fawns per year, which are used as replacements or sold. The population supports research on deer management and veterinary science.*

Scientists Try to Save State from Salvinia

LSU AgCenter people were on the scene quickly when the invasive weed known as giant salvinia was found for the second time in Louisiana in a drainage canal north of Cameron in December 2001. Environmental agent Kevin Savoie, weed scientist Dearl Sanders and vice chancellor Paul Coreil used the news media to get the message to boaters that they can spread the pest by not cleaning their equipment as they move among waterways.

Later that month Seth Johnson, entomologist, released larvae of a weevil that eats only salvinia and no other plants as a means of biological control. He expects measurable results by December 2002 with "control certainly evident in two years."

Although there are herbicides that manage the plant somewhat, they are expensive and not used because nearby cattle drink from the streams.

The weed, also known as Salvinia molesta, was found in Louisiana for the first time at Toledo Bend Reservoir three years ago, and AgCenter scientists have been helping to keep it under check there. The plant, which is fast growing and causes thick, dense mats, threatens to clog waterways used in agricultural production and also destroys wildlife habitat. ■ **Linda Foster Benedict**

Photo by John Chaney

LSU AgCenter researchers Seth Johnson, at left, and Dearl Sanders empty salvinia, which contains weevil larva, into a test location in Cameron Parish. The researchers hope the weevil, which destroys salvinia, will help to control an outbreak of the troublesome weed. The researchers are standing in water covered with salvinia.

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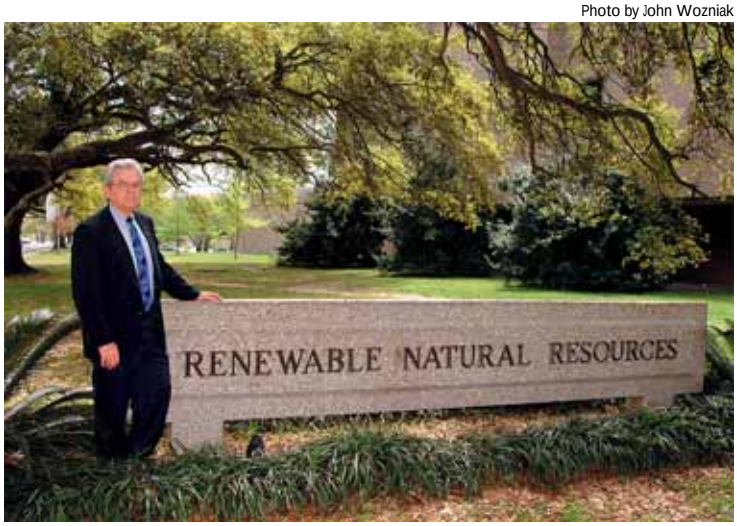
Bob Blackmon

Photo by John Wozniak



What used to be the School of Forestry, Wildlife and Fisheries is now the School of Renewable Natural Resources. Bob Blackmon is the director.

This issue of *Louisiana Agriculture* contains articles by members of the wildlife and fisheries faculty of the recently renamed School of Renewable Natural Resources. These articles reflect the growing breadth of the school's mission. While we have had wildlife and fisheries programs for many years, they, like the entire school, are expanding to include aesthetic and other values of nature. Indeed, the school is in a rather sharp transition from game management and forest commodity production to a more contemporary focus.

That new direction will eventually define natural values of the landscape as "commodities" worthy of the school's and the LSU AgCenter's resources, while maintaining the necessary level of work on the more traditional commodities common in production agriculture. This is entirely appropriate as the "values of nature" have huge economic, social and environmental impacts on the citizens of Louisiana.

The school is taking several important actions that reflect this new direction. For example, new curricula are being developed in the teaching program to better reflect the realities of the 21st century. These include new concentrations in ecosystem restoration, human dimensions, conservation biology and wetland science. Also in that mix are more traditional programs such as forest resource management, forest products, fisheries, wildlife ecology, aquaculture and wildlife law enforcement. Even these programs, however, will be delivered in ways reflective of contemporary environmental concerns and modern resource management.

On the research and outreach side of the school's mission, we are developing new programs that are integrative, contemporary and interdisciplinary. Likewise our Extension Natural Resources program is positioning itself to serve a broader range of resource interests in our state. Until fairly recently that group served mostly forestry and game management audiences. It is now moving to a more holistic mission that includes water, non-game wildlife, fish and many other natural resources.

AgCenter research in the school includes a rather wide array of activities, ranging from silviculture and ecology of forests to freshwater fisheries and various studies in wildlife biology and wood products. These projects serve client groups and "industries" that represent a major segment of Louisiana's economy. Currently, the renewable natural resource base accounts for more than half of the agricultural contribution to the economic welfare of the state. In addition, these resources are at the core of the cultural fabric of a majority of our citizens.

Specific research projects deal with long-term productivity of pine forests and the effect of forest management on environmental quality. Other forestry/forest products research is directed at ecology and physiology of forests, forest growth and yield, marketing and international trade, genetics, bottomland hardwoods, product development and testing, e-commerce and analysis of hazards and accident prevention in forests. A new area of emphasis is that of wood durability and protection of wood from the Formosan subterranean termite.

In the wildlife/fisheries area, the theme of this magazine, work is devoted to migratory waterfowl, the white-tailed deer, threatened species such as the Louisiana black bear and the bald eagle, and ecology and management of freshwater fisheries. The articles included herein are but a sample of that activity.

New is the school's work with best management practices (BMPs) and water quality. This spring, new and exciting research is getting under way to evaluate the effectiveness of BMPs. Forest landowners are apparently doing a good job of implementing BMPs, but the question remains: Are BMPs effective in improving water quality? Collaboration among fisheries faculty and the school's newly arrived watershed hydrologist will address this issue with support from the Louisiana Department of Environmental Quality.

As the school moves in a broader, more holistic direction, future research will be more interdisciplinary, more inclusive of many natural resources and conducted on a larger scale, including at the landscape level. The school will also focus more of its intellectual energy on coastal and wetland landscapes and bottomland forests, a natural for the school, given its location.

Providing the umbrella for this broadened mission is the new name, School of Renewable Natural Resources. That rubric will allow us to develop even more programs to address the needs of the natural commodities of our state and the needs of its citizens. ■

Bob Blackmon, Director, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

World Looks to Louisiana for Ivory-billed Woodpecker

Louisiana has been in the international spotlight because of a reported sighting of the ivory-billed woodpecker, a bird thought to have been extinct. The bird was never seen during the official 30-day search in January and February. However, search team members said they heard the unique tapping sounds made by the bird.

Separate from the official search, researchers from Cornell University had placed 12 tape recorders in the search area near the Pearl River in southeastern Louisiana. They took recordings for six weeks in February and March.

"They are now analyzing those recordings," said Vernon Wright of the LSU AgCenter's School of Renewable Natural Resources. "This will take time because special software has to be developed. We're not sure when the report will be finished."

With the findings from the report, the planning team, of which Wright is a member, will then decide on the next steps.

The search, sponsored by Zeiss Sports Optics, was the result of a sighting of the bird by LSU forestry student David Kullivan in 1999.

"People have called him a liar, but he knows enough to know what he saw," Wright said.

Before Kullivan, the last documented sighting of the ivory-billed woodpecker was in 1942, Wright said. It was seen in Tensas Parish at a location called the Singer Tract by Joseph T. Tanner. This area was logged during World War II, and the ivory-bills disappeared. Habitat loss is the main reason for the loss of North America's largest woodpecker.

"It was a bird of the bottomland swamp and needed extensive areas of good timber to furnish forage," Wright said.

The Pearl River Wildlife Management Area and the adjacent Bogue Chitto National Wildlife Refuge, while not ideal, could support a limited number of the birds, Wright said.

"The original habitat was virtually virgin woods, bottomland hardwoods, and that's long gone. But we're re-growing a lot of trees now, making sustaining the bird possible," he said.

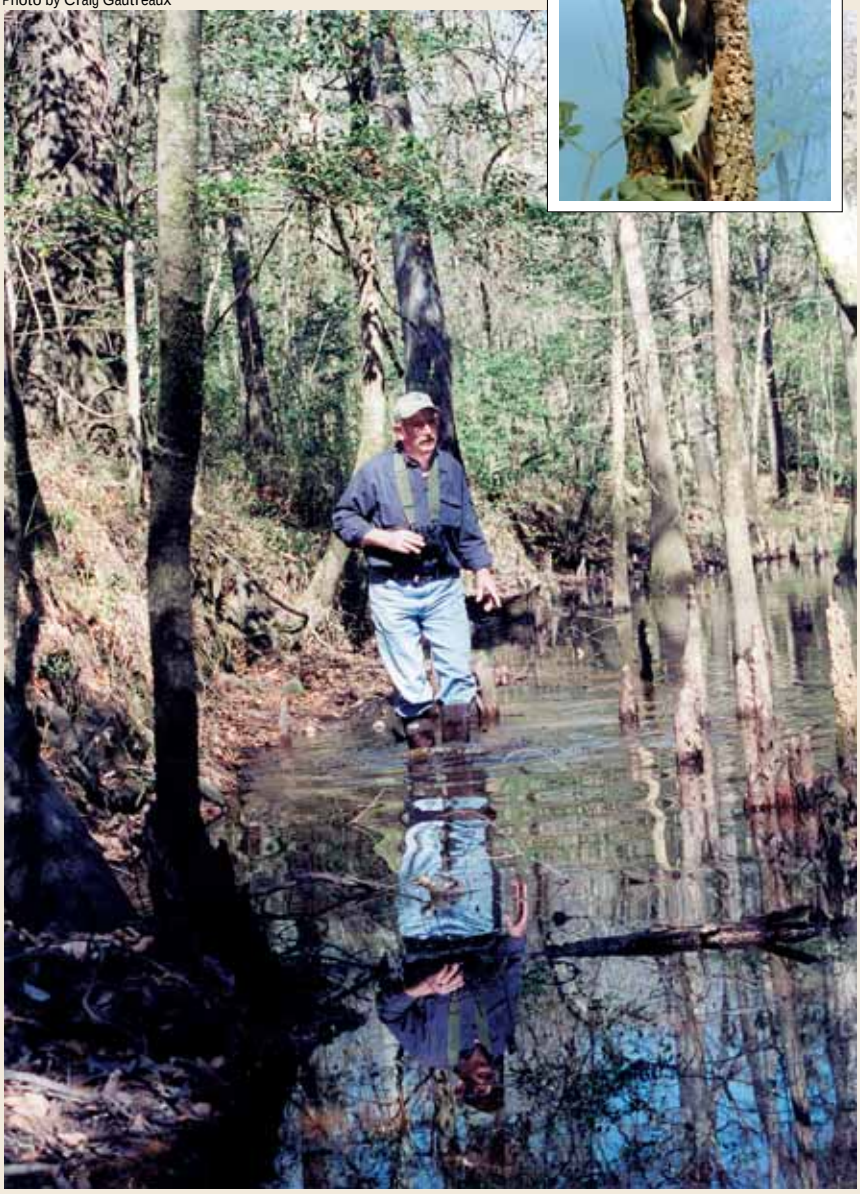
The six-member international search team also found tree bark scaling, the primary method used by the woodpecker to find food, and cavities that appeared larger than those normally used by the pileated woodpecker, another large bird common to both areas. However, the group concluded that there was insufficient evidence to say the bird exists.

According to Wright, the bird is about the size of a crow with a wingspan of nearly 3 feet. Its range extended from the Ohio River valley to the Gulf Coast and from North Carolina to eastern Texas. Surprisingly, a subspecies of the ivory-billed woodpecker was found in Cuba, but this species has been presumed extinct since the 1980s.

"It's possible the birds persevered somewhere else and moved in here," Wright said. "Nobody has been able to get a picture or record the calls of the bird. They may have been moving through. They may have moved on, or they may be here and we haven't stumbled on them yet." ■ **Craig Gautreaux**

Photo by John Wozniak

Photo by Craig Gautreaux



Vernon Wright is a member of the planning team trying to determine if the ivory-billed woodpecker still exists. He visited the search team several times while they were in Louisiana for 30 days in February and March of 2002.
Insert: *These are the mounted specimens of the ivory-billed woodpecker on display at LSU's Museum of Natural History.*

Swamp Things

Invasive Aquatic Plants in the Atchafalaya Basin

William Kelso

During the last century, the Atchafalaya Basin has evolved into a highly altered and regulated floodway of the lower Mississippi River. The basin still supports a complex mosaic of aquatic and terrestrial habitats, but this unique ecosystem continues to be threatened.

Rising floodwaters deliver huge amounts of Mississippi River and Red River sediment to the basin floodplain, and many areas have been covered by several meters of sediment since 1900. This sediment deposition, in conjunction with water management and resource development projects, has reduced inflow from the Atchafalaya River, impaired water circulation and altered flow patterns on the floodplain, and reduced water quality throughout portions of the lower basin during late spring and summer.

Many of the water management projects planned by the U.S. Army Corps of Engineers and the Louisiana Department of Natural Resources focus on increased delivery and movement of low-sediment water across the floodplain during the flood pulse to improve water quality for the basin's valuable crawfish and finfish resources. But, successive invasions of aggressive and competitively superior exotic aquatic plants over the past century threaten the integrity of the basin's aquatic habitats and may affect the benefits of improved water management.

Non-native aquatic plants such as common salvinia (*Salvinia minima*), water lettuce (*Pistia stratiotes*), watermilfoil (*Myriophyllum spicatum*), Brazilian elodea (*Egeria densa*) and alligatorweed (*Alternanthera philoxeroides*) can all be found in the basin. Water hyacinth (*Eichhornia crassipes*) and hydrilla (*Hydrilla verticillata*) have been, by far, the most successful invaders (Figure 1) and have the greatest potential to affect the ecology of the basin's aquatic systems.

Water Hyacinth, Hydrilla

Water hyacinth, apparently introduced in the United States in 1884, is a highly productive floating plant that can reproduce at an incredible rate under favorable conditions, doubling its surface area coverage every six to 15 days. Its aggressive growth can crowd out native floating plants such as frogbit (*Limnobium spongia*), and shading of the water surface by dense water hyacinth mats eliminates submerged native plants such as cabomba (*Cabomba caroliniana*) and coontail (*Ceratophyllum demersum*). Water hyacinth has become particularly problematic in Florida and Louisiana, resulting in extensive spraying and harvesting programs to maintain open waterways.

Sometime during the 1970s, hydrilla became established in the basin and has since become abundant in low-current habitats. Hydrilla has several characteristics that give it a competitive advantage over many native species. It can grow up to several centimeters per day, and high stem densities near the surface intercept most of the available sunlight, eliminating other plants. Hydrilla tolerates a wide range of pH, can photosynthesize at less than 1 percent of full sunlight, and can reproduce from fragmentation, seeds and underground tubers, which can survive extended periods out of water, ingestion by waterfowl and herbicides.

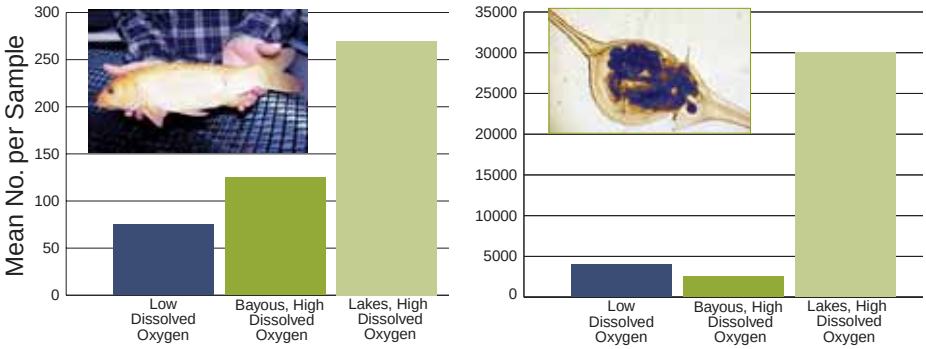
Hydrilla and water hyacinth now dominate the aquatic plant community in the basin, and expansion of these exotics has undoubtedly reduced the diversity and abundance of native aquatic plants. Dense stands of water hyacinth impair oxygenation of the underlying water column by reducing the air-water interface, minimizing wind-generated turbulence and virtually eliminating photosynthetic phytoplankton. By late summer, water hyacinth typically covers thousands of acres of basin aquatic habitats, causing extensive hypoxia, defined as levels of dissolved oxygen (DO) below 2 milligrams per

William S. Kelso, Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Figure 1. A dense bed of hydrilla (left), and the edge of a water hyacinth mat (right) from the Atchafalaya Basin. Note the black color of water under the hyacinth plants, indicative of low dissolved oxygen levels.

Photos by William Kelso

Figure 2. Average abundances of fish (left) and zooplankton (right) collected from water habitats in the lower Atchafalaya Basin.



liter. Habitats subjected to hypoxic DO conditions exhibit reduced abundance and diversity of zooplankton and fishes (Figure 2), with most invertebrates (larval insects and mysid shrimp) restricted to the feathery roots suspended under the water hyacinth plants.

Dense beds of hydrilla can have similar effects on DO concentrations. In the summer and fall, hydrilla beds are inhabitable only by organisms adapted to low or highly fluctuating DO levels. Even in shallow (1 meter deep) hydrilla beds, DO concentrations near the bottom often remain below 2 milligrams per liter throughout the day. Although daytime DO levels in the hydrilla canopy may be high, this habitat becomes hypoxic at night as plant respiration increases (Figure 3). These DO concentrations reduce the abundance and diversity of vegetation-dwelling invertebrates and juvenile fishes, and dense stands of hydrilla are virtually inaccessible to sportfish such as largemouth bass, which are unable to locate suitable prey.

Eradication Difficult

Non-native plants cause tremendous problems in aquatic ecosystems such as the Atchafalaya Basin, but their eradication presents a huge, if not insurmountable, task. Water hyacinth can be collected and crushed by large floating harvesters, but much of the basin is relatively inaccessible and difficult for the harvesters to maneuver through because of submerged cypress stumps. Disposal in non-aquatic areas would be necessary so that decomposing plants would not contribute to DO problems.

Mechanical control is similarly not feasible for hydrilla, partially because small cuttings resulting from any harvesting operation have the ability to sprout roots and create new plants. Although the Aquatic Weed Section of the Louisiana Department of Wildlife and Fisheries spends several hundred thousand dollars annually on a 2-4, D spraying program for water hyacinth, there is no effective chemical control for hydrilla in an ecosystem the size of the basin.

A major impediment to effective control is the annual flood pulse, which can carry water hyacinth plants and hydrilla cuttings to new basin habitats, creating new problem areas each year. If winter conditions are mild and the flood pulse is of typical magnitude, there is virtually no lake, bayou or canal in the basin that is not susceptible to colonization.

Biological Control

Biological control has been successful for some exotic plants, such as alligatorweed, which has been adequately controlled with a flea beetle and a stem-boring moth. Two weevils have been imported as control agents for water hyacinth, and although well-grazed leaves are evident on most plants by late summer, these weevils do not appear to be impairing the density or distribution of water hyacinth in the basin.

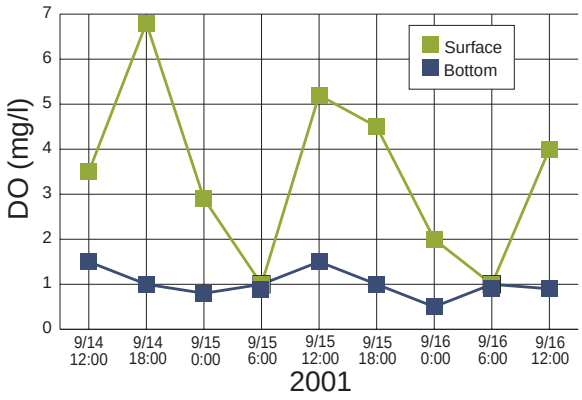
A stem weevil, two leaf-mining flies and an aquatic moth have been released in Florida to control hydrilla, but significant control by these insects is not evident. Grass carp have effectively eliminated hydrilla in Texas and Louisiana lakes, but the number of fish required for the Atchafalaya Basin would be prohibitive, and the effect on native plants and sport fisheries make this option inadvisable.

Drawdown can be an effective control method for hydrilla, and a multi-year drawdown program is being implemented by the Department of Wildlife and Fisheries to try to control hydrilla in Lake Henderson; unfortunately, drawdown of the rest of the basin is not possible.

Research Challenge

Fisheries research efforts at the LSU AgCenter focus on documenting the effects of these exotic plants on water quality and the abundance of basin organisms. For example, AgCenter researchers are investigating the effects of hydrilla infestation on food habits and growth of juvenile largemouth bass and the distribution of invertebrates in relation to water quality and position in the hydrilla beds, such as the edge or middle. These studies will provide information to better manage plant beds (dredge or lay down fiber mats to create more vegetation "edge," if it is better habitat) for fish and anglers.

Figure 3. Dissolved oxygen concentrations recorded at the surface and bottom (1 m depth) of a hydrilla bed in the Atchafalaya Basin during September 2001. Note the continual hypoxic conditions on the bottom and the nocturnal hypoxia at the surface.



In the absence of new biological control discoveries, it is apparent that the ecological effects caused by exotic aquatic plants will continue to alter water quality, food web structure, fisheries production and navigation in the Atchafalaya Basin. The evidence is overwhelming that exotic plants have the capacity to significantly affect the ecology of most aquatic systems in Louisiana, and the basin provides an exceptional example of a floodplain river ecosystem altered by the successful invasion of these aggressive aquatic weeds. ■

Three Louisiana Black Bear Cubs, Mama Relocated to Save Threatened Species

The three little bears squealed like baby pigs as they were pulled from the bosom of their unconscious mother, curled up in a steel cage in the back of a pickup truck.

Maria Davidson, a biologist with the Louisiana Department of Wildlife and Fisheries, carefully picked up the five-week-old male Louisiana black bear cubs and displayed them to the appreciative group of people gathered at the Red River/Three Rivers Wildlife Management Area.

The group included wildlife officials and researchers celebrating the successful capture of the mama bear from her home 120 miles north in the Tensas River National Refuge earlier that morning.

Now, they had to complete the second half of this risky procedure and release her to her new human-made den deep in the woods about a mile from this site and accessible only on foot or all-terrain vehicles.

This is the second year of a five-year project to establish a fourth population center in the state for the Louisiana black bear, according to Michael Chamberlain, a wildlife researcher with the LSU AgCenter studying the relocation process.

"Relocation is their only hope for survival," Chamberlain said, adding that the Louisiana black bear is listed as threatened under the Endangered Species Act.

This bear snared March 6, with the aid of a blow dart tranquilizer, was the fifth and only one for this year. The wildlife professionals have only a few weeks each year for the capture and release. They can do this only when there is no hunting season and the bears are in hibernation, Chamberlain said.

In March 2001, four mama bears and their nine cubs were moved to the Red River area, near the Mississippi River straight east of Alexandria. This area is in between the Tensas refuge to the north and the forested area around the Morganza spillway to the south. About 150 of the 300 bears left in the state still survive in these two areas.

"We're trying to close the gap," said Paul Davidson, executive director of the Louisiana Black Bear Conservation Committee, a group that includes representatives from many different agencies and institutions all dedicated to the animal's survival in Louisiana.

If the bears set up residency in this in-between spot, then this will expand their roaming area and allow a corridor for more intermingling and inevitably more cub production.

Maria Davidson, a biologist with the state Department of Wildlife and Fisheries, holds two of the male cubs.

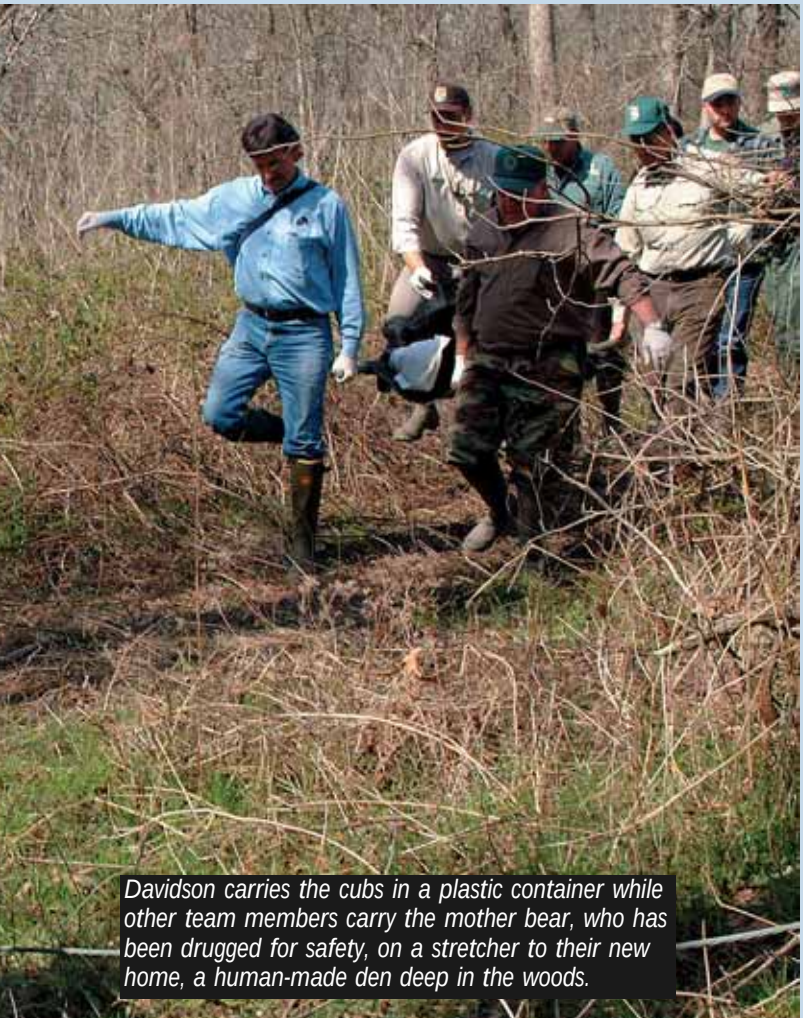
The Louisiana black bear was captured in the Tensas River National Refuge and taken in a cage in the back of a pickup truck to her new home in the Red River/ Three Rivers Wildlife Management Area.

It was a perfect day for relocation—partly sunny, temperatures in the 60s with a slight breeze and no mosquitoes.

Three men hoisted the 200-pound bear from the truck to the bed of a six-wheeled vehicle. They then hauled her over the bumpy terrain and through the thicket.

The rest of the entourage followed in a fleet of four-wheelers, including Maria Davidson holding on to the three cubs in a plastic carton. She had allowed the runt, weighing in at only 3 pounds, to nurse his mother for a short time before the jaunt.

"He needed a little extra to help him stand up to his two big bruiser brothers," she said with a chuckle. The other cubs were 5 pounds and 3 3/4 pounds.



Davidson carries the cubs in a plastic container while other team members carry the mother bear, who has been drugged for safety, on a stretcher to their new home, a human-made den deep in the woods.

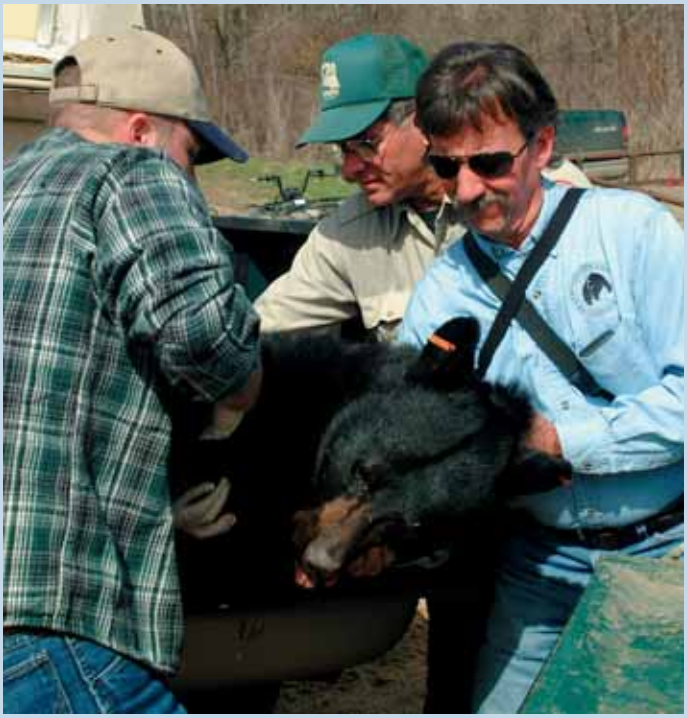
The new den was a wooden box with one side hinged so it could be lifted. Small openings in two sides served as windows.

"It looks like a dog house," said Kyle Van Why, the LSU AgCenter graduate assistant who works with Chamberlain. He had built the box and decorated the exterior with paintings of black bears and leaves. This and the white laminated sign he had posted to a nearby tree were to keep the den undisturbed by people who might accidentally stumble across it.

It took six of the men in the group, looking somewhat like pallbearers, to carry the bear on a stretcher from the vehicle to the den. Two of the wildlife officials then placed her in the box, took her vital signs to make sure she was OK and nestled her three cubs beside her.

Then, they nailed the box shut, covered it with tree limbs and walked away.

Photos by Mark Claesgens



The 200-pound bear was carefully moved from the pickup truck to a four-wheel drive vehicle to be carried into the woods.

After the mother bear is placed in the wooden box, which will serve as her new den, her cubs are placed with her.

Photos by Mark Claesgens

Graduate student Kyle Van Why, left, built the wooden box for the bear. He painted it to help people who might come upon it realize its purpose. Paul Davidson helped place the bear in the box.

Van Why places radio collars on the bears to help locate where they are. He keeps track of the bears for his research project.

"These bears have a tremendous homing instinct," Chamberlain said.

Because of this, scientists have found that the only way to achieve relocation is to move mothers with babies. Males will head back to where they came from.

"Their maternal instinct is stronger than their homing instinct," Paul Davidson said.

Once the relocated female awakens from hibernation, she chews and claws her way out of the wooden box to search for food for her young. If all goes as planned, she establishes a new home at Red River, and three of the females released in 2001 did that.

"That's considered a remarkable success," Chamberlain said.

The one that got away may have been heading back to her home in the Atchafalaya Basin, the third of three population pockets.

That bear has since established a new home about 60 miles south of Red River, and her two cubs, whom she abandoned under the stressful conditions, were successfully adopted by another bear, Chamberlain said.

Scientists keep track of the bears with radio collars. One of Van Why's duties is to collar and monitor them. He does this with the help of staff from Wildlife and Fisheries and works from their headquarters at the Red River site.

The leather and plastic collars are white so they stand out. Van Why also puts orange metal tags in the ears to help them look different from the black feral hogs that roam the same territory, and so hunters and farmers will take notice of them.

"This is the most progressive project of its kind in the country, because everybody's working together," Davidson said.

As part of Van Why's research, he has surveyed hunters, assessing their knowledge of the black bear and telling them about the project. Many of the professionals involved with the relocation give talks to groups about the Louisiana black bear.

"We couldn't do this without the help of the farmers and hunters," Davidson said.

The Louisiana black bear is a docile creature that poses no threat to humans. It once roamed throughout Louisiana, East Texas, Arkansas and Mississippi. The hope is that it will once again be established in the forests and wildlife areas along the Mississippi River in Louisiana and saved from extinction. ■ **Linda Foster Benedict**

'Teddy' Bear

Legend has it that the term "Teddy" bear resulted from a famously unsuccessful hunt of a Louisiana black bear by then U.S. President Theodore Roosevelt. On a visit to Sharkey County, Mississippi, in 1902, he was given the opportunity to shoot a bear. To make it easier, his hosts had captured a Louisiana black bear and tied it to a tree. Roosevelt refused to shoot a tied bear and ordered the bear released. To commemorate the occasion, local merchants began selling toy "Teddy" bears. ■

Last Chance

Restoring the Louisiana Black Bear in Louisiana

Michael J. Chamberlain

The Louisiana black bear was once distributed throughout eastern Texas, southern Arkansas, Louisiana and southern Mississippi. By the early 1900s, however, Louisiana black bear populations in this region were decimated from excessive harvest and habitat loss and degradation. Only about 300 Louisiana black bears are left in Louisiana, and they are restricted to the Tensas and Atchafalaya river basins and isolated sections along the Mississippi River corridor. A few Louisiana black bears live in the lower East Pearl River and the lower Pascagoula River basins in southern Mississippi.

Because of concern about the future of this species, three states – Louisiana, Mississippi and Texas – have listed the Louisiana black bear as protected. In 1992, further protection was provided through listing as threatened under the federal Endangered Species Act.

Through the cooperative efforts of state and federal agencies, research has been conducted on the Louisiana black bear for more than a decade. This research has detailed various aspects of bear activity, movements and habitat use. Using this database, a Black Bear Restoration Plan and a Black Bear Recovery Plan were developed in cooperation with the U.S. Fish and Wildlife Service and the Louisiana Black Bear Conservation Committee. The ultimate goal of conducting preliminary research and developing restoration and recovery plans is the delisting of the Louisiana black bear as protected and, ultimately, removal of it from threatened status.

Black Bear Locations

Louisiana black bears live in three places in Louisiana (Figure 1). The northernmost population is found in the Tensas River basin, and the southernmost population is in the lower Atchafalaya River basin. A third population is sandwiched between these two in the Morganza floodway system. To remove the Louisiana black bear from threatened status, an additional population must be established to provide the opportunity for movement of bears among existing populations. To accomplish that goal, the U.S. Fish and Wildlife Service, in cooperation with LSU AgCenter and the Louisiana Department of Wildlife and Fisheries, chose the Red River Wildlife Management Area and surrounding lands as the site for a bear restoration effort.

Restoration of rare species has recently become an important conservation technique, particularly for large mammals such as black bears. Success stories include the grizzly bear and gray wolf in the West. Black bears are capable of long-range movements, and

Michael J. Chamberlain, Assistant Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Louisiana Black Bear Facts

- Females have one to three cubs, usually two, and often only one the first time around. They have their first cubs at age 3.
- The female grows to about 150 to 175 pounds. The male can get up to twice that big, with a shoulder height of about 4 feet.
- The bear is of no danger to humans. If spotted, they will usually run away. They are by nature shy and docile. They can be a nuisance, however, when they raid garbage cans.
- They can live to about 15 to 18 years old.
- Some build their homes in trees, which makes it more difficult to capture them for relocation.
- The Louisiana black bear is a subspecies of the American black bear, which lives farther to the north and is slightly bigger in stature. The American black bear is not threatened or endangered.

Figure 1. The Louisiana black bear lives in the purple, blue and brown areas of the state. Wildlife officials are trying to establish a population in the green area and promote a corridor (yellow) of distribution.

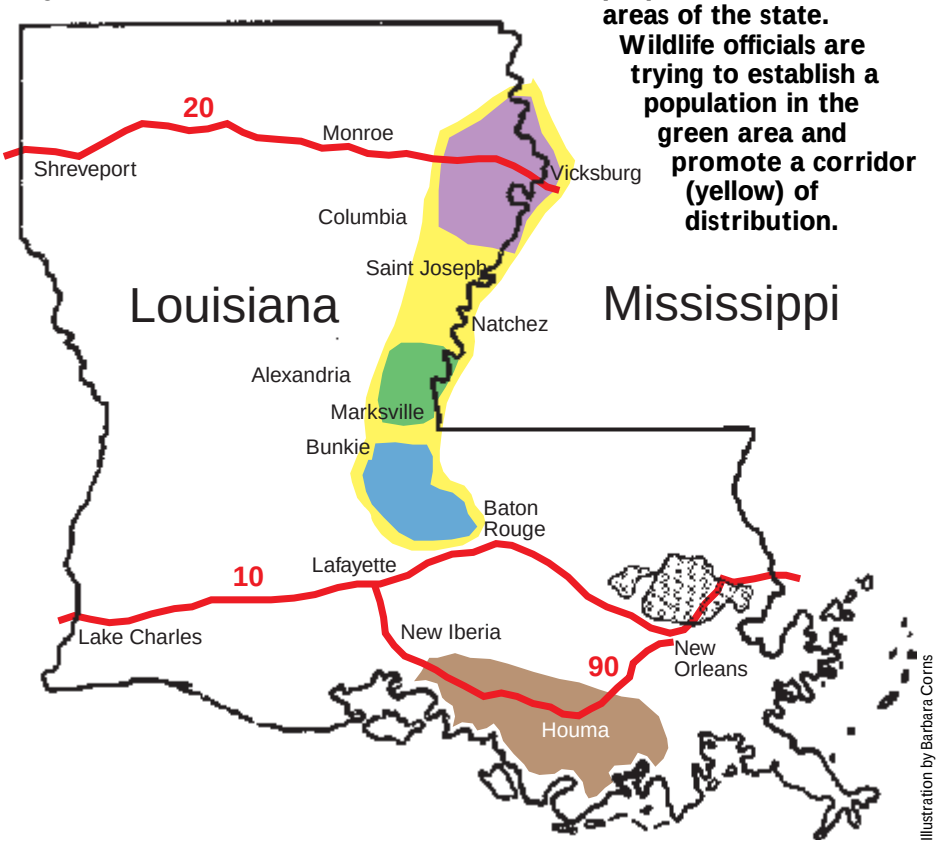


Illustration by Barbara Corns

Endangered Species Act

Legislation designed to protect specific species dates back to early history in the United States. However, the Endangered Species Act of 1966 was the first piece of legislation specifically addressing species with a threatened or endangered status. In 1973, the Endangered Species Act (ESA) was modified to include plants as well as animals. Overall, the ESA authorizes the Secretary of the Interior to determine which wildlife species are facing extinction in the United States. The act also prohibits the importation of endangered species and their products.

The ESA recognizes endangered and threatened species as components of our ecosystem and stresses that integrity of ecosystems hinges on maintaining these species of concern. Threatened and endangered species serve many purposes in our society, such as providing educational, historical and ecological values. The ESA even provides distinction between species that are threatened and endangered. For instance, protection as a threatened species means that the species, according to all the information available, are likely to go extinct. Endangered species are those faced with extinction in all or most of their distribution, requiring complete protection.

One important component of the ESA was that it recognized separate populations and subspecies as individual species, which offered protection for animals such as the Louisiana black bear. For instance, the American black bear is closely related to the Louisiana black bear, but is not threatened in most portions of its current range. On the other hand, the Louisiana black bear is threatened and without proper action has the potential to go extinct. Without the recognition of species status for the Louisiana black bear, no protection would have been afforded.

In many ways the ESA has served as preeminent legislation that has fostered and promoted new understanding and appreciation of many species, as well as providing protection under the laws of the United States. ■

Michael J. Chamberlain, Assistant Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

dispersal is often related to sex, age, population density and habitat quality. Subadult male bears are often forced to disperse because of competition with older males, whereas young females frequently establish home ranges within areas maintained by their mothers. Because of this life history strategy, natural expansion of bear populations is slower for females. Furthermore, natural expansion of the Louisiana black bear throughout Louisiana is hampered by habitat fragmentation and lack of suitable travel corridors. Because of these inhibiting factors, establishment of sustainable bear populations in isolated bottomland hardwood habitats is uncertain without human intervention.

'Soft Release'

Black bears have a strong homing tendency, which in the past has reduced the effectiveness of relocation projects designed to bolster populations. In fact, most previous translocation projects have failed because bears simply leave the area chosen for relocation immediately following the release. Recently, however, relocations of adult females with cubs have been successful. The technique is termed a "soft release" and likely works because movements of the female are restricted by maternal instincts that mandate she care for her cubs. As females remain on the release site, they become familiar with their surroundings and eventually establish a home range there.

Because this "soft release" method had been successful with other bear populations, LSU AgCenter researchers decided to try it with the Louisiana black bear. During March 2001, four female black bears and their nine cubs were removed from their winter dens and relocated to the Red River Wildlife Management Area. Two females were taken from the Tensas River basin population and two from the lower Atchafalaya River basin. Each female was fitted with a radio transmitter and placed within a den constructed by Fish and Wildlife Service personnel.

Following the release, each female was monitored intensively. To date, the relocation effort has been a success, and a considerable amount of information important to future releases and restoration of bear populations has been gathered. Three of the four females remained on the Red River Wildlife Management Area. The fourth abandoned her two cubs, which is not unusual for these bears under stressed conditions. She traveled about 60 miles to the southwest and has established a home base there. Because she did that, this is considered a success, too. Her two cubs were rescued and successfully adopted by a black bear mother in the lower Atchafalaya region. Cub survival for the species is about 50 percent.

Because of this project's success, a five-year research/restoration program has been initiated, with the ultimate goal of establishing a sustainable black bear population in the Red River Wildlife Management Area. Future releases will occur on the Three Rivers and Grassy Lake Wildlife Management Areas, as well as the Lake Ophelia National Wildlife Refuge. Also, AgCenter personnel will trap bears throughout the project to gather information on the effects of removing bears from source populations.

Project Success

With only 300 Louisiana black bears spread among three isolated regions, the chance for the species' survival in the state is bleak unless genetic exchange occurs among the populations. The only way to ensure this is to create an additional population to genetically link the two existing populations and to maintain critical habitat. About 150 of the bears live in the Atchafalaya Basin, an area fast becoming encroached upon by urban sprawl. Movement north is restricted by Highway 90. Some are killed by the fast-moving vehicles.

The establishment of an additional subpopulation of black bears on the Red River Wildlife Management Area offers a corridor between two of the bear subpopulations and the opportunity for cross-breeding and thus improved gene flow. Furthermore, the LSU AgCenter research program will provide knowledge about the processes affecting the Louisiana black bear and the ecology of the species. To date, information collected during the initial release has provided insight into use of land corridors by bears, as well as dynamics of bear movements following release. For instance, each female has traversed about 4,000 acres of the release site during her movements and has used a variety of habitats to fulfill daily requirements. Last, the black bear restoration program will provide a rare opportunity to assess the feasibility of using soft release relocation techniques to ensure persistence of the Louisiana black bear. ■

Gestation Lengths of Northern Versus Southern White-tailed Deer

Mark K. Johnson

Photos by John Wozniak

About 75 to 100 deer are maintained at the LSU AgCenter's Idlewild Research Station.

Producers and managers of deer work toward improved animal performance just as those who produce livestock. For deer, this can involve relocating animals from one part of the country to another in an effort to improve animal genetics and deer characteristics, such as size, antler development and reduced disease problems. During the last decade the problems associated with genetic mixing, controlled breeding and relocating northern deer to southern states have been the focus of a research program at the LSU AgCenter's Idlewild Research Station. Because of the differences in weather patterns and seasons, researchers need to know whether gestation lengths of northern deer are similar enough to those of southern deer to avoid breeding problems.

To estimate peak rutting for white-tailed deer populations, biologists sample gravid does during late winter and spring to examine fetuses. They use of the length of the fetus to estimate age in days since conception. However, no data have been available for the population of northern deer being studied at Idlewild. Thus, LSU AgCenter researchers conducted an experiment to determine whether average gestation periods of white-tailed deer from different geographic regions differ significantly.

All deer in the experiment were acquired as fawns and donated by conservation officers from Missouri and Louisiana. Sixty-eight Missouri does, 27 Louisiana does and six Missouri bucks were used. Before breeding, all does were fitted with a Heat Watch system (DDx, Inc.), which was designed to record breeding in cattle remotely. This estrus detection system uses transmitters sewn into patches that are then secured to the rear of each doe with a contact adhesive. A remote computer records signals when a buck mounts a doe. When multiple mounts occur, it is assumed that the last mounting was the conception date. Gestation lengths were determined by observing all births for each bred, captive doe.

Results of the study indicate that neither breeding dates nor gestation lengths were dramatically affected by age of the doe (yearling versus adult). Fawns occasionally breed, but fawns were not used in this experiment. The average Missouri doe bred a month or more earlier than the average doe from Louisiana. Missouri fawns were therefore born earlier than Louisiana fawns (Table 1). Gestation lengths were not affected by litter size or sex of fawn (Table 2). Origin of doe slightly affected gestation length, with the Louisiana deer gestating a few days longer than those from Missouri. However, Louisiana does also gestated during slightly warmer weather. Gestation in warmer weather could have reduced feed intake and subsequently slowed fetal development, increasing gestation length.

Even though sample sizes in many studies such as this one are small, the results of these studies indicate breeding periods and gestation lengths of northern and southern deer are very similar (193 to 205 days). Even though Louisiana does in this study bred nearly a month later (varies with herd) than Missouri does, bucks from either state will breed when the does are ready. Therefore, data, to date, indicate that producers who desire to improve the genetic performance of their white-tailed deer will not encounter breeding problems related to differences in breeding stocks. ■

Table 1. Mean breeding and fawning dates for white-tailed deer from Louisiana and Missouri maintained at the Idlewild Research Station.

Geographic Origin	N	Breeding Dates	Fawning Dates
Missouri			
Yearlings	17	25 Nov	6 June
Adults	18	22 Nov	3 June
Louisiana			
Yearlings	4	27 Dec	7 July
Adults	13	10 Jan	11 July

Table 2. Mean gestation lengths (days) for white-tailed deer in relation to age of doe, geographic origin, sex of fawn and litter size.

Deer Classification	N	Gestation Length
Geographic Origin		
Missouri		
Yearling	13	193
Adult	17	194
Louisiana		
Yearling	2	198
Adult	5	201
Fawn Sex		
Male	10	194
Female	6	192
Litter Size		
Single	28	193
Twins	22	198

Mark K. Johnson, Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

COASTAL RESTORATION:
Rebuilding Fishery Habitat

Megan La Peyre, Christina Bush and John Plunket

Many fishery species rely on estuaries as critical habitat during early life stages, including redfish, menhaden, shrimp, blue crab, croaker and flounder. Because of the economic importance of many of these fishery species, the success of many coastal restoration projects is partially determined by the habitat provided for them. Researchers from the LSU AgCenter and the U.S. Geological Survey Fish and Wildlife Cooperative Research Unit are involved in several studies investigating the effectiveness of marsh and shallow water estuarine restoration projects in restoring fishery habitat.

Within estuaries, vegetated habitats are often favored by juveniles because their decomposition products are the basis of the food web for small crustaceans, shellfish and juvenile fish, which in turn support larger fish and wildlife. Furthermore, coastal vegetation and other structured habitats such as oyster reefs provide valuable three-dimensional habitat that supply settlement substrate, shelter and food for a wide variety of important fishery species.

With coastal land loss in Louisiana averaging 30 square miles a year, consequences for shallow-water estuarine fishery habitats are unavoidable.

With coastal land loss in Louisiana averaging 30 square miles a year, consequences for shallow-water estuarine fishery habitats are unavoidable. The Coastal Wetlands Planning, Protection and Restoration Act of 1990 (Breaux Act), combined with other legislation, provide monetary support for Louisiana to implement a large-scale, coast-wide restoration program. While the ultimate goal of coastal restoration is to reverse land loss and restore damaged habitats, the means to achieve this goal effectively remain elusive.

In response, numerous restoration techniques have been and continue to be developed to replace lost habitat. Ranging from large-scale freshwater and sediment diversions, such as the Caernarvon diversion, to smaller scale restoration projects such as hydrologic manipulations, marsh re-vegetation, dredge spoil removal and reef creation, these restoration approaches have had various levels of success based on wide-ranging criteria. Thus, new ideas for restoration of estuarine habitats are continually being tried and tested.

Restoration ecology in the past has relied on the general working hypothesis called "field of dreams," which assumes that "if you build it, they will come." With increased focus on fish habitats resulting from the passage of the federal Sustainable Fisheries Act (1996), which requires the protection and conservation of habitats important to fishery species, managers and scientists alike have begun to examine this assumption. As a result, there is increased focus on the ability of many restoration projects to replace and restore fish habitat.

Two approaches that have generated recent interest involve (1) marsh restoration through terracing, which is hypothesized to restore marsh edge, reduce wave energies and encourage submerged aquatic vegetation growth, resulting in increased fish habitat, and (2) the creation of oyster reefs, which provide three-dimensional structure for increased shelter, food availability and settlement substrate for many fishery species.

Fish assemblages in terraced marsh

Among the different estuarine habitats, the marsh edge is hypothesized to be favored by juveniles for several reasons: (1) the vegetation reduces current and wave energy, (2) the structure of marsh vegetation provides areas for fish to hide from predators and (3) food availability is high at the marsh edge because nutrients and organic matter are released into the water from decaying plants on the marsh surface.

Terracing is a relatively new method of restoring marsh edge habitat that is gaining popularity as a means to restore shallow open water areas of Louisiana to vegetated marsh. Terracing is a restoration technique used to replace marsh and encourage sediment accretion in surrounding open water areas. Terraces are built in open water areas of the estuary where marsh previously existed, and the distance between marsh edges has been slowly increasing. Dredged materials are piled to form a discontinuous linear ridge that is planted with a tolerant and fast-growing marsh plant such as smooth cordgrass, *Spartina alterniflora*. Unlike spoil banks, which are continuous and rise above normal tides, terraces are discontinuous and flood at high tide. Multiple terraces are built in a pattern to maximize marsh edge habitat and decrease wave energy across the open water.

Constructing terraces gained popularity as a restoration and mitigation technique following reports that terraces near the Calcasieu Ship Channel on Sabine National Wildlife Refuge reversed shoreline erosion and created almost 17 acres of salt marsh with an interface of almost 5,000 feet. Terraces may also increase the abundance of submerged aquatic vegetation (SAV) and, hence, waterfowl, fish and invertebrates, but supporting data are unavailable.

The benefits of terraces to fishery species have not been well studied, although the technique is being heralded as one new and effective approach to restoring fish habitat. Beginning in the summer of 2001, LSU AgCenter researchers started examining the value of fish habitat provided by terraces built in 1999 at Sabine National Wildlife Refuge. Using a throw trap, the created terrace field and surrounding natural

Megan La Peyre, Adjunct Professor; Christina Bush and John Plunket, both graduate students, U.S. Geological Survey Fish and Wildlife Cooperative Research Unit, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

marsh areas have been sampled for fish and large invertebrates. The throw trap is a circular net thrown so that it traps all organisms in the water column in a 1 square meter area and has been used effectively in past studies to identify and compare assemblages of small fish using various shallow water habitats.

Samples are taken to represent the natural marsh edge, terraced marsh edge and open water habitat that would have been present before the terrace was built. Initial results suggest that terraces do increase habitat availability for fishery species, but the numbers of fish present may not be as high as at natural marsh edge habitat. Research is ongoing to increase our understanding of which species use the habitat provided by terraces. Researchers hope to identify aspects of the natural marsh and the created terraces that may be highly valued (used) by specific fish species and fish assemblages. The information gained from both the fishery portion and the submerged aquatic vegetation portion of the study can then be used to develop more effective means and patterns of marsh terracing and increase the effectiveness of our marsh restoration program.

Fish assemblages on restored oyster reefs

In subtidal estuarine areas, oyster bottoms may be particularly significant as fish habitat, because they often provide the only complex structure in the midst of flat mud bottoms. A number of studies indicate that oyster reef communities are highly diverse, supporting complex ecological communities that include species not found in adjacent areas of soft bottom habitat.

Bottom-dwelling fish such as blennies, gobies and toadfish are associated with oyster reefs, as are shrimp, crabs and many other invertebrates. Surveys of oceanic fish in other parts of the country have found that more than 70 species, including many economically important species such as red drum and seatrout, are often associated with three-dimensional oyster reef complexes.

The creation of artificial reefs in subtidal estuarine areas has become of increasing interest to many in Louisiana. In coastal Louisiana, dramatic land loss, changing salinity regimes and, in some areas, past shell-dredging activities have all affected the integrity and structure of many natural oyster reefs. One approach to coastal restoration that many, especially recreational fishing groups, are promoting is the creation of three-dimensional reefs in shallow-water areas where shell reefs once existed.

One approach to coastal restoration is the creation of three-dimensional reefs in shallow-water areas where shell reefs once existed.

Despite more extensive studies in other parts of the country, relatively few surveys of oyster reef fauna have taken place in Louisiana, and few data exist documenting distinct differences in the abundance, diversity and feeding habitats of fish and invertebrates on natural oyster bottoms versus mud bottoms.

In August 2001, three oyster and three mud-bottom habitat areas in middle Barataria Bay were identified using side-scan sonar data. Using several different gear types, oceanic fish and bottom-dwelling animals are being sampled monthly to quantify any potential differences in abundance and diversity of fish and invertebrates using these different habitats. Preliminary results have shown a greater abundance and diversity of pelagic fish species at oyster reefs than mud bottoms, although sampling is ongoing.

A related project being developed by AgCenter researchers and the Coastal Conservation Association involves comparing abundance and diversity of fish associated with created reefs. In Louisiana, intertidal and subtidal reefs are being created with limestone rocks and oyster shells. Given the proliferation of artificial reef programs in the Gulf of Mexico, it behooves us to document the role of reefs as habitat for fishery species and identify characteristics of natural and created reefs that may be attractive to fishery species.

Maximizing the effectiveness of coastal restoration projects involves an adaptive cycle of project development, implementation, evaluation and adjustment. Understanding the consequences of various new techniques on fishery habitat and understanding the relationship between specific habitat characteristics of natural and created habitats can only serve to increase the effectiveness and overall success of Louisiana's large-scale coastal restoration program. ■

Acknowledgments

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Cooperative Unit Adds Value to AgCenter

The U.S. Geological Survey Fish and Wildlife Cooperative Research Unit, also known as the Coop Unit, has been part of the wildlife and fisheries research program even longer than the LSU AgCenter has been its own separate campus of the LSU system. In 1962, officials from the federal government, the state and LSU signed an agreement to cooperate on wildlife research followed by a similar agreement for fishery research in 1963. Since then, these agreements have changed as has the federal bureaucracy and the AgCenter. Today, the U.S. Geological Survey, a division of the U.S. Department of Interior, and the state Department of Wildlife and Fisheries are the cooperators. The Coop Unit includes three researchers who each teach a course and supervise graduate students. They are Fred Bryan, Megan La Peyre and Alan D. Afton.

The Coop Unit expands the research capability of the AgCenter and helps it mesh with and guide state and national research goals. In addition to teaching and research, the faculty in the unit also provide technical services and short courses for the state. Louisiana is one of 40 states with this cooperative arrangement. ■ **Linda Foster Benedict**

Wetlands a

Knowledge of wetlands is becoming increasingly important to study and research about wildlife. Five areas of mutual concern are these:

1. Improving water quality is probably the most important wetland function.

It might seem strange that a wildlife biologist would not list wildlife habitat as the most important wetland function, but more people and dollars are affected by water quality than by wildlife. Many people use the word "filter" to describe how wetlands improve water quality, but "converting" is a more appropriate and descriptive term. Wetlands can convert pollutants into non-pollutants, and the converter is never used up. For example, excess nitrate fertilizer from urban lawns and farm fields can get into water bodies. This allows undesirable plants to out-compete desirable plants. These vegetative changes then cascade up the food web, harming other organisms.

Wetlands, however, can reverse this process. They can convert the nitrate back into nitrogen gas, which is then released into the atmosphere where it is harmless. Air is 79 percent nitrogen and 21 percent oxygen. Here's how it works:

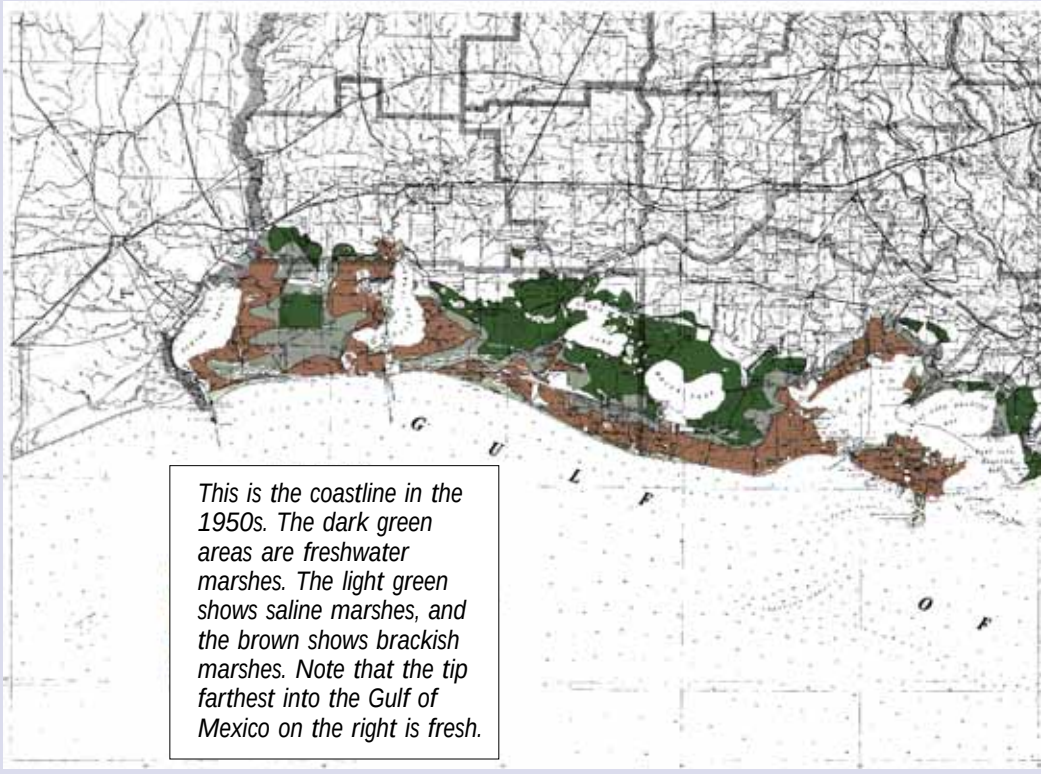
Soil microbes convert nitrate back into nitrogen gas in a process called denitrification. Denitrifying bacteria are active where oxic water (with oxygen) meets anoxic water (lacking oxygen). The zone of denitrification is tremendous in wetlands because it wraps around every tiny plant root and is there 24 hours a day, seven days a week unless frozen. The bottom sediments of some ponds, lakes and bays also can support denitrifying bacteria, but denitrification there does not approach rates observed in wetlands because there are no living plant roots releasing oxygen. Upland soils support trivial amounts of denitrification because conditions there do not favor denitrifying bacteria.

2. Wetland loss in coastal Louisiana is extensive.

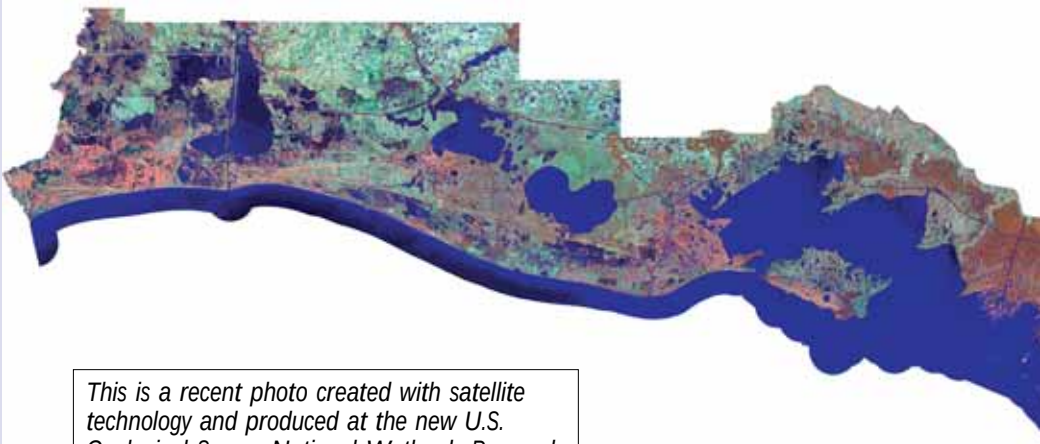
Although coastal wetland loss is still significant, the rate of loss has slowed somewhat since the 1960s. In the 1960s coastal Louisiana lost an acre every 20 minutes, but by the 1980s it took 32 minutes to lose an acre. Data for the 1990s are not yet available to determine whether coastal Louisiana continued to improve.

3. Wetland loss is primarily interior loss rather than shoreline erosion.

Figure 1. Louisiana Coastal Maps



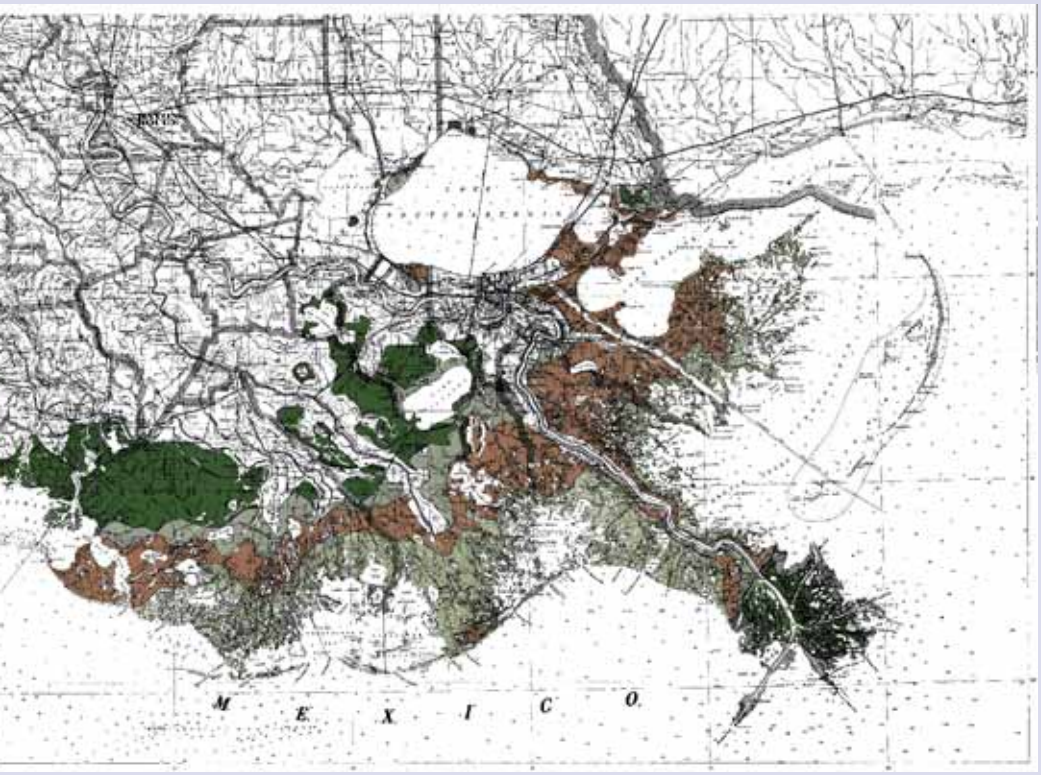
This is the coastline in the 1950s. The dark green areas are freshwater marshes. The light green shows saline marshes, and the brown shows brackish marshes. Note that the tip farthest into the Gulf of Mexico on the right is fresh.

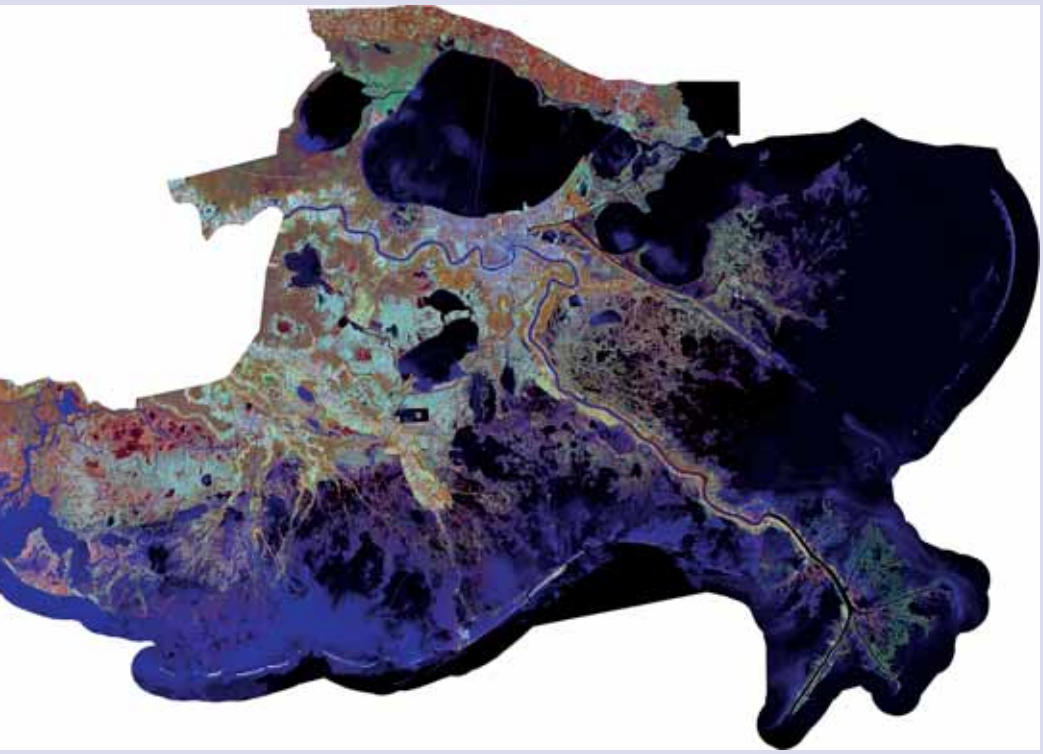


This is a recent photo created with satellite technology and produced at the new U.S. Geological Survey National Wetlands Research Center housed as part of the LSU AgCenter. The black is clear water with no sediment. The blue areas have more sediment.

Most people use the word "erosion" to describe wetland loss in coastal Louisiana and, indeed, Louisiana has some of the fastest eroding shorelines in the world. Little of Louisiana's wetland loss occurs because of erosion, however. A comparison of the state's legal shoreline and the state's physical shoreline (Figure 1) shows that in many areas, some wetland loss has occurred

rd Wildlife





on eroding shorelines, but most wetland loss occurs in the marsh interior, away from the eyes of hunters and fishers.

4. Some wetland loss is natural; some is artificial.

Wetland scientists, managers and landowners could probably exchange ideas for a week and yet not reach consensus on the proportion of wetland loss that is natural and the proportion that is artificial. Wetland loss is extremely complicated in the Mississippi River Deltaic Plain because of the Delta Lobe Cycle, which is a natural cycle of delta building and delta disappearance (Figure 2). Subsidence keeps this cycle going. The river has been building a new delta lobe about every 1,000 years since the end of the last Ice Age, about 6,000 years ago. This is a good time to start because then Louisiana's coastal wetlands were all shallow parts of the Gulf of Mexico rather than wetlands.

The current delta lobe, upon which New Orleans sits, started about 1,000 A.D. The previous one, Bayou Lafourche, started about 0 A.D. The delta lobe before that built most of St. Bernard Parish about 1,000 B.C. Around 2,000 B.C., the river ran through the area now occupied by Bayou Teche. Before then, the river built several delta lobes that subsequently subsided.

The Delta Lobe Cycle can be classified into four stages. Stage 1 is the initiation of a new delta lobe, and in Stage 4 the delta lobe has completely subsided and is under water. In Stage 1, the delta lobe is initially tiny but it grows to cover hundreds of square miles. All four stages of the Delta Lobe Cycle can be seen today on Louisiana's coast. Stage 4 can been seen in a 50-mile stretch from Tiger Shoal eastward. Stage 3 can be seen in the 50-mile sweep of the Chandeleur Islands. Stage 2 can be seen in the 80-mile stretch of coast from Grand Isle to Caillou Bay. Stage 1 is hardest to find because it is so small; it can be seen in the 5 miles of coast at the Wax Lake Outlet and at the mouth of the Atchafalaya River. Wetland loss is less complicated in the Chenier Plain, where the only natural cycle of erosion and gain occurs on the coast of the Gulf of Mexico. All wetland loss in the Chenier Plain is most likely artificial except that which occurs on the shore of the Gulf of Mexico, and some of that is probably accelerated by human activity.

5. Lack of significant wetland creation is completely artificial.

Wetlands have been subsiding and converting to shallow open water in southeast Louisiana for thousands of years, yet more than four million acres of wetlands accumulated in coastal Louisiana during that same time. Louisiana was able to accumulate wetlands despite natural wetland loss because wetland creation was always faster than wetland loss. Currently, wetland creation in coastal Louisiana is virtually insignificant. Before the flood

of 1972, the river was creating wetlands (at the expense of lakes) in the Atchafalaya swamp. Since 1972, the river has created some new wetlands at the mouths of the Atchafalaya River and the associated Wax Lake Outlet, but too few wetlands are being created to offset wetland loss elsewhere. If humans did not manage the division of water between the Mississippi River and Atchafalaya River at Simmesport, Louisiana, then natural wetland creation at the mouths of the Atchafalaya River and Wax Lake Outlet would be extensive. Those missing wetlands, and the commercial activities associated with them, are real but invisible costs of keeping the river from making the switch that it has made about every 1,000 years since the end of the last Ice Age. Figuring out how to manage the river for wetland creation as well as navigation and flood control is therefore a worthwhile goal. ■

Figure 1. The Delta Lobe Cycle is a natural cycle of building and disappearance. The river has been building a new delta lobe about every 1,000 years since the end of the last Ice Age, about 6,000 years ago. The "Modern" delta lobe, upon which New Orleans sits, started about 1,000 A.D. The previous one, Bayou Lafourche, started about 0 A.D. The delta lobe before that built most of St. Bernard Parish about 1,000 B.C. Around 2,000 B.C., the river ran through the area now occupied by Bayou Teche.

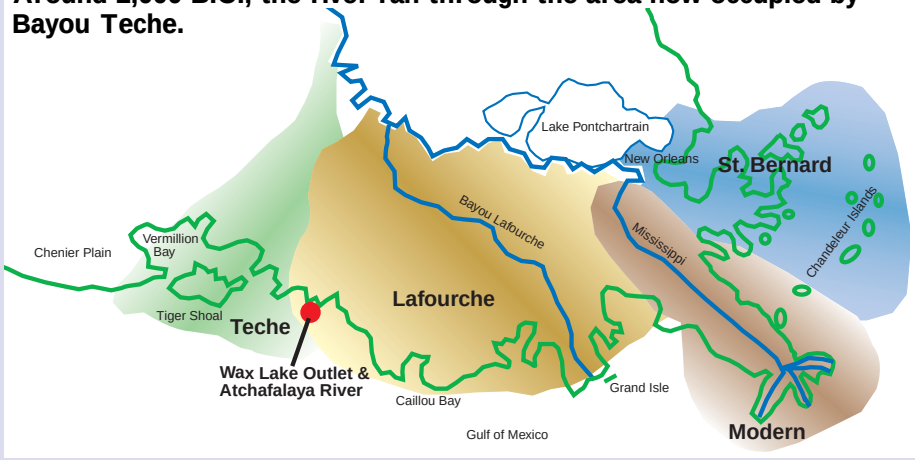


Illustration by Barbara Corns

J. Andrew Nyman, Assistant Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Hunting Lease Enterprises and Louisiana Landowners

Louisiana is blessed with a variety of game animals that provide recreational benefits for sports enthusiasts. Often overlooked is the benefit many landowners derive from allowing others to lease their land for hunting.

In 2001, reports compiled by county agents in Louisiana indicated that 5,891 private non-industrial landowners leased 7,233,514 acres of land for fee hunting. The total gross farm value of these operations was slightly more than $38.5 million. Hunting leases on these private lands averaged $5.32 per acre, with extreme variations depending upon location within the state, habitat quality and species involved. Marshlands in many of the southern parishes leased for $2 to $4 per acre, and some waterfowl areas in the Delta regions leased for $60 to $70 per acre. These high dollar waterfowl leases involved the leasing (for several thousand dollars) of individual blinds surrounded by moist soil areas that attract waterfowl. White-tailed deer are the major game animal for which much of the upland hunting lease activity revolves. Wild turkey, squirrel and rabbits are other upland game species that are hunted.

Private, non-industrial forest landowners have long realized the benefits from leasing lands. They are being joined in this endeavor by landowners involved in row crop agriculture. Low commodity prices in recent years and the large number of federal and state cost-sharing programs, which encourage the establishment of pine and hardwood timber stands, have led to the conversion of thousands of acres in Louisiana from traditional agricultural land to areas of productive wildlife habitat. An environmental benefit of this transformation is the reestablishment of timber and other forms of permanent cover on many acres of marginal farmland, cleared when farm commodity prices were high and little foresight was given to future trends.

There are three major types of hunting lease agreements that generally depend upon duration of the agreement and species of game allowable for harvest. Annual leases are the most common method of fee hunting in Louisiana. These leases involve the right to take all game species and are assessed on a per acre or lump sum basis in exchange for hunting rights on the property. Lessees and lessors that develop good relationships under these arrangements may see an annual lease develop into a multi-year or long-term lease.

Seasonal leases are a second type. They allow landowners to specify the species of game to be taken. In many cases seasonal leases involve the right for one group to hunt those species that have a fall hunting season such as deer, squirrel and rabbit, while allowing a second group to hunt wild turkeys in the spring. By identifying groups or individuals interested in hunting only certain species, a lessor may realize a higher profit than if all game species are included in one agreement.

Short-term hunting lease agreements are a third type. They involve daily, weekend or weekly hunts, referred to as "package" hunts. These agreements are most successful near populated areas where the demand for hunting opportunities is great but each hunter might be able to go hunting only a few times each season. A daily fee is charged, and the hunter pays only for the amount of time that was actually spent hunting.

Regardless of the lease arrangement, there are many benefits. Lessees benefit from greater enjoyment in their hunting experiences. Lessors benefit from increased revenue and protection on leased lands. Wildlife benefit by the improved habitat that results when lessors and lessees work together to provide what is needed for the managed species. ■

Don Reed, Associate Specialist, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Helping Farmers Make Bucks from Ducks

The LSU AgCenter is helping landowners find alternative ways to profit from their land through a program that capitalizes on natural resources and helps revitalize the state's rural economy. The new program is called the "Natural Resource-Based Enterprise Initiative."

"With the decline in agriculture productivity and urban encroachment, a lot of pressure is being put on rural landowners to find something else to do with their land," said Steve Hotard, LSU AgCenter forester.

"I want to retire some day," said David Paulk, explaining he knew he had to find an alternative to farming after commodity prices began falling and kept falling. "With the way (agricultural) prices look now, I'll never be able to (retire) unless I find some other way to earn money – and this looks like the way to go."

Paulk, who owns property in Catahoula and Tensas parishes, has opened 11,000 acres of his land for visitors to use for hunting and fishing.

"We've got a good area here for hunters and fishermen to come to," Paulk said. "I've set up deer stands and duck blinds, and all the hunters have to do is go out and wait for the game to come to them."

Visitors to Paulk's property also are provided with a place to stay and food to eat as part of the price they pay for their visit. All they have to bring are their guns and ammunition.

Paulk said faculty with the LSU AgCenter have been helpful in getting him on the right track with his relatively new operation.

"Programs like this help a lot," he said. "The (LSU AgCenter extension) agents have a lot more information at their hands and know a lot more about what needs to be done to get an operation like this off the ground."

Like Paulk, Wes Newman owns property in the Delta Region of Northeast Louisiana. Newman is converting his property in Catahoula and Concordia parishes into recreational facilities for hunting and fishing.

A retired catfish producer, Newman has Catahoula Parish property that is bordered by the Ouachita River – which makes it an attractive site for those interested in boating, fishing or sightseeing.

"After I retired, I had to find something to do," Newman said. "So I started doing a little here and there with my property and am turning it into a place where hunters and fishermen can come and relax."

Newman planted 450 acres of ponds to rice and has added 36,000 pounds of crawfish to the rice crop. He's also set duck blinds out in the ponds for hunters.

"We have people coming in from all over the United States," Newman said. "They can come here and hunt while we take care of the rest. We provide a place to stay and food to eat. All they have to do is hunt and fish."

Newman has a Web site set up for his operation – www.laduckhunting.com.

Hotard and David Neal, an LSU AgCenter county agent in Catahoula Parish, said operations such as Paulk's and Newman's are good for the state's economy and help lure out-of-state tourists.

"And this is all new money – money that would not otherwise be spent here," Hotard said. "We still want producers to farm productive land, but they can put their marginal land into recreational activities and still make money."

Hunters bring money into the whole economy as well as the facility they use, Neal said.

"The potential for economic development is phenomenal," Neal said. "People coming in from out of state will need supplies and other essentials. Everyone benefits from this."

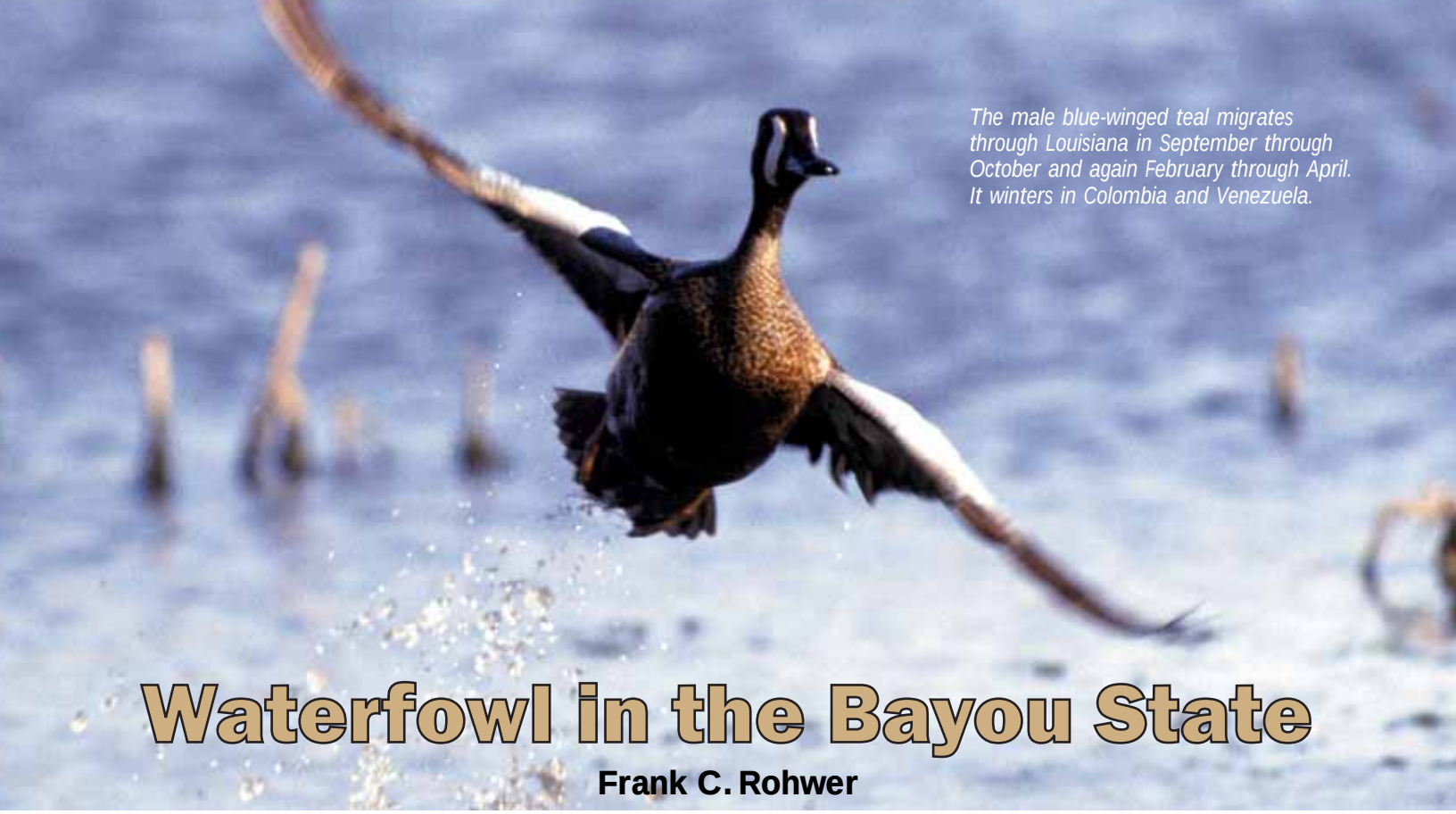
"Today's producers and landowners living in rural communities are being pressed by declining profitability from traditional agricultural operations, urban encroachment, demands for recreational services and access by the expanding population," Hotard said. "We're also seeing the rural community economy decline."

Photo by A. Denise Coolman

David Paulk, at right, has found a way to profit from his property by making it a recreational haven for hunters – thanks, in part, to ideas and assistance from LSU AgCenter faculty. Visitors have come from as far away as Arizona to hunt on Paulk's property in Tensas Parish and spend money in the state. This duck blind is just one of the advantages offered to visitors to Paulk's operation, "Wings and Racks." From left, Cory Paulk of Larto, Ricky Ward of Whiteville, N.C., and Jack Meares of Fair Bluff, N.C.

Hotard says such circumstances challenge the traditional quality of rural life and the sustainability of rural communities and the natural resource base. This program will strengthen the collaboration between the agricultural community, natural resource managers and local community economic development leaders through the development and marketing of existing natural and human resources, he said.

As part of these efforts, the LSU AgCenter also is working with the Delta Outdoors and Wildlife Association, which is comprised of businesses, landowners and producers, to develop, promote and market outdoor recreational activities in the Northeast and North Central regions of Louisiana. ■ **A. Denise Coolman**



The male blue-winged teal migrates through Louisiana in September through October and again February through April. It winters in Colombia and Venezuela.

Waterfowl in the Bayou State

Frank C. Rohwer

Photo by Frank C. Rohwer

An abundance of opportunities for fishing, bird watching, boating and hunting lends credence to Louisiana's claim as a "sportsman's paradise." If you are one of those enthusiasts who anticipates the 3 a.m. alarm, long drives, boat rides on dark and cool mornings knee-deep in mud and water, then you know that Louisiana is paradise for wildfowlers. The Bayou State is right at the bottom of the migratory funnel known as the Mississippi Flyway, one that tens of millions of ducks follow as they head south each fall. The state's coastal marshes, bays, bayous, beaver ponds, rice fields and flooded bottomland timber provide the wintering sites for millions of waterfowl. That makes for many opportunities for Louisiana residents and visitors to partake in duck watching or duck hunting.

The national scorecard on duck hunting bears witness to the abundance of ducks and the dedication of Louisiana wildfowlers. An average Louisiana duck hunter bags almost 25 ducks a year. Not only is that the highest harvest of all 50 states, but it is about four times the average yearly harvest of other U.S. hunters. Clearly, Louisiana is a great place for ducks and those who love to pursue them.

Frank C. Rohwer, Associate Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Pothole Habitat

There are scores of biologists working to assure an abundance of waterfowl to support the wildfowling tradition in Louisiana and other states in the migratory pathway. Duck populations fluctuate considerably, but mostly in response to conditions on the breeding grounds, especially wetlands. Most ducks that winter in Louisiana breed in what is known as the "pothole habitat" in the northern Midwest, especially North and South Dakota and the Canadian prairie provinces of Manitoba, Saskatchewan and Alberta. Potholes range in size from more than 40 acres to room-sized puddles. The smaller ponds are the most productive for ducks because they have a lot of edge, which is where you find the high protein insects that are food for breeding females and their fast-growing young. Because it is impossible to manage the water levels in ponds, biologists can only hope for abundant summer rains and winter snows. The current abundance of waterfowl reflects a seven-year period (1994-2000) of plentiful water, the longest continuous span of good breeding ground conditions since 1950, when the monitoring of wetlands began.

The major impediment to duck production on the prairies is high levels of nest loss to predators. The fate of most duck eggs is to be eaten by a red fox, raccoon or skunk, the three most serious egg predators. Of those three, the fox is the most devastating on ducks for two reasons. First, foxes are good at capturing incubating females at their nest. Most dabbling ducks, such as mallards, teal, pintail, gadwall (gray ducks) and wigeon, nest in the uplands. Their nests are on the ground hidden in grasses and small herbaceous plants. Foxes can track the scent upwind until they get close to the nest, then when the female flushes, the fox grabs her out of the air. The second trait of foxes that makes them particularly serious predators is that they cache eggs. This behavior is like squirrels with acorns. The fox removes eggs, one at a time, and hides them in the grass some distance from the nest. The eggs are hidden unbroken and typically not eaten until the following fall or winter.

Predator Triad

The fox-skunk-coon triad of predators has greatly benefited from the changes that settlers made when they reached the prairies. Raccoons are completely new to the prairies, and only extended their range to this part of North America after 1940. Red fox used to be rare, but they have replaced swift fox, which are now an endangered species. Skunks have also increased in numbers because of plentiful winter foods, such as sunflower seeds, and the ready

availability of den sites in old buildings and rock piles created by farming.

In some areas fewer than 5 percent of duck nests actually produce hatched eggs, so it is not surprising that most waterfowl management in the prairies is focused on improving nest success. While there is consensus that nest success is the limiting step to duck production, there is little agreement on the best management strategy to increase nest success. In the past couple of decades, the prevailing strategy was to make nests inaccessible. The most common form of management involved planting farmland back to grassland. The idea is to spread out the nests so they are hard to locate. With intensive agriculture, ducks are forced to concentrate nests in the remnant strips of cover that surround ponds or are along dirt roads. These strips are small enough that a predator can find nests easily.

Restoring grasslands is an effective approach, but it is more complicated than wildlife biologists initially expected. These small patches of grass, 40 to 200 acres of grass, are also ideal home ranges for predators, so nest success does not improve to levels that allow substantial duck production. It takes much bigger patches of grassland to improve nest success substantially. Wildlife managers do not have the funding to purchase the land necessary to convert back to something approximating the prairies. In 1985, however, the U.S. Department of Agriculture took a new tack with farm subsidies and decided to pay farmers to take highly erodible land out of production and grow grass instead of crops. The effect on wildlife has been significant. In the Dakotas there are now many millions of acres of grassland in the Conservation Reserve Program (CRP), and nest success in CRP areas is often 30 percent—a great number for ducks.

Photo by Frank C. Rohwer

This is an area in southern Manitoba in which the "pothole habitat" offers opportunities for ducks to build nests.

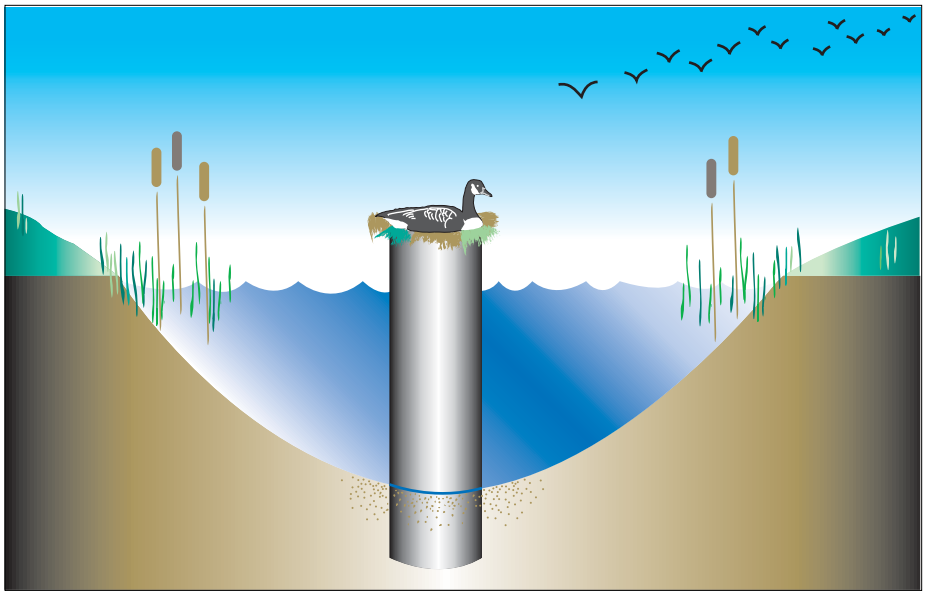


Illustration by Barbara Corns

Figure 1. One way to make nest sites inaccessible to predators is to place culverts in the potholes.

Lower Predation

Meanwhile, wildlife researchers are looking at other ways to increase duck production by lowering predation rates. One way is to make nests more inaccessible. Nest sites can be made by rolling grass between wire to make a tunnel. Grass and straw go inside the tunnel for nesting material, and the structure is mounted on a pole over the wetland. This safe nest site is acceptable to mallards, which have an 80 percent hatch rate in these structures. The down side is that nest tunnels require maintenance. One way to avoid having to reroll the grass in the wire is to use Astroturf. But mallards, like pro football players, prefer the real thing.

To avoid high maintenance, some managers have created nesting structures that grow their own cover. During a drought year, a 36-inch concrete culvert can be placed on end in the middle of one of the shallow potholes and filled with dirt (Figure 1). The culvert acts like a giant planter for weeds and grasses that serve as nesting cover, which is quite attractive to female mallards and Canada geese. The inaccessibility to mammalian predators means the females that nest on the culverts have an excellent chance to hatch their eggs. The large size and weight of culverts, however, mean that big equipment is required to dig them into dry pond beds, stand them upright and fill them with soil. Moreover, culverts are like the Titanic, not as durable as initially expected. As ponds thaw in the spring, the ice first melts at the shoreline. Then each pothole has its own iceberg. With a strong wind these smaller versions of high seas menaces can knock over the culverts.

Creating nesting islands is another way to make nest sites safer. Ducks are naturally attracted to islands in large

ponds, where they avoid most predators except mink. The problem with creating islands is that it is expensive to move dirt, even though it can be trucked on top of the ice in winter. Another problem with islands is that they tend to wash away quite rapidly. This problem is sometimes aggravated by Canada geese, which graze islands so heavily they remove most of the protective plant cover.

The general lack of success with getting nests out of harm's way has caused some to reconsider an older form of management—reduction of the predators. LSU AgCenter researchers have been involved in assessing the efficacy of trapping predators. The question was whether a trapper could remove enough predators from a large block of land (16 square miles) to improve nest success. A nonprofit waterfowl organization called the Delta Waterfowl Foundation contracted to have four 16-square mile blocks trapped. An AgCenter research team found more than 3,000 duck nests both on and off the trapped blocks. Nest success on the trapped blocks was a phenomenal 45 percent compared to 17 percent on the untrapped blocks. Songbird success was not altered, but the success of the ducks that nest in the wet margins of the ponds, such as redheads and canvasbacks, was doubled. In a subsequent collaborative Delta Waterfowl/LSU AgCenter project, researchers evaluated trapping of even larger chunks of habitat, 36-square-mile units. Trapping these large units yields even greater duck production because the elevated nest success is extended to such a large area.

Trapping proved so effective that some management agencies are slowly beginning to use this approach to waterfowl management. Of course, predator reduction is a much more controversial form of management than habitat restoration. However, waterfowl managers point out that hunters contribute millions of dollars each year to restore waterfowl habitat, yet much of this land produces few ducks because of the exceptional predation levels. Lethal predator management can never remove all the predators, but it allows ducks to achieve greater nest success.

LSU AgCenter researchers will continue to evaluate the efficacy of techniques used in waterfowl management. An important part of this is finding ways to enhance nest success on the prairies, knowing that the ducks from the Dakotas spend as much time in Louisiana in the winter as they do on their prairie nesting areas in the summer.

Two other LSU AgCenter research projects are these:

- Investigation into why pintails have not recovered to record population levels like other ducks.
- Also, AgCenter researchers have discovered that the effect of hunting on mallard numbers has been overestimated because biologists have gathered incorrect duck age ratios data. They are working on corrections for the age ratio data. This research will have an immediate impact on harvest regulations that affect all of the Mississippi Flyway. It appears that the faulty age ratio information was causing conservative regulations, so revised data should not involve any belt-tightening restrictions on harvest and may, in fact, result in more field days for Louisiana hunters. ■

Photo by Frank C. Rohwer

The female mallard always flies in front of the male mallard.

Reducing the Snow Geese Population

Waterfowl managers face an unusual situation with the mid-continent population of snow geese – there are just too many. Some estimates have the population of these geese that winter in the central part of the United States, especially in Louisiana and Texas, at more than 3 million. Only a few decades ago, wildlife professionals were still doing all they could to help these beleaguered geese rebound from overhunting in the early 1900s. For example, they closed seasons or restricted harvests. To improve habitat the U.S. Fish and Wildlife Service allocated money from the federal duck stamp program to purchase several refuges in wintering areas and on the migration route.

Then, something rather inadvertent happened about 30 years ago. The snow geese finally discovered the smorgasbord of modern agriculture and adjusted their behavior so that life in the winter became a lot easier. Traditionally, the geese wintered in coastal marsh areas where they used those short but very strong bills to dig the roots of marsh grasses for dinner. The first transition was to rice fields, where the geese could graze on weeds and eat the grain left behind by the combine. A decade later the geese had mastered field feeding and had diversified into wheat, corn, sorghum and practically any other field grain they encountered. The geese had also begun to graze in fall-seeded grain fields, especially winter wheat. Snow geese now feed in grain fields as soon as they reach the prairies in September, and they continue to use agricultural fields until they leave the prairies in April and May on their way to arctic breeding areas.

Many biologists think the shift in winter feeding has led to the overabundance of geese. Winter may be the time of year that sets the upper limit to goose populations. Now, the abundance of waste agricultural grain has provided snow geese with excellent forage and has improved the survival of wintering geese. The national wildlife refuges bought to protect habitat also help to increase survival. Therefore, more geese are returning to the Arctic to breed each spring. Those returning geese are in much better physical condition than was the case when geese did not use agricultural grain but foraged in marshland. Geese are large enough that they can pack a lot of food with them

The mid-continent population of snow geese has grown too large.

Photo by Frank C. Rohwer

when they leave the prairies. It is carried as large amounts of stored fat. This stored fat allows geese to lay more eggs and have higher nesting success than was possible when geese used natural habitats. Higher survival and birth rates mean a population is going to grow rapidly.

At first, this was a great success story for wildlife management. But too much of a good thing can turn out to be not so good. About 15 years ago biologists working with snow geese and other birds breeding in the Arctic tundra began to see some serious habitat degradation. When the snow geese get back to the Arctic they revert to feeding in their traditional style of grubbing out roots and rhizomes of sedges and grasses. There are now so many geese at some of the breeding colonies that vast acreages of formerly productive river delta habitats have been converted to mudflats. Because arctic growing seasons are short and the tundra so fragile, recovery of these mudflats may take several decades. The snow geese are able to keep moving, so local fauna bear the brunt of this habitat destruction.

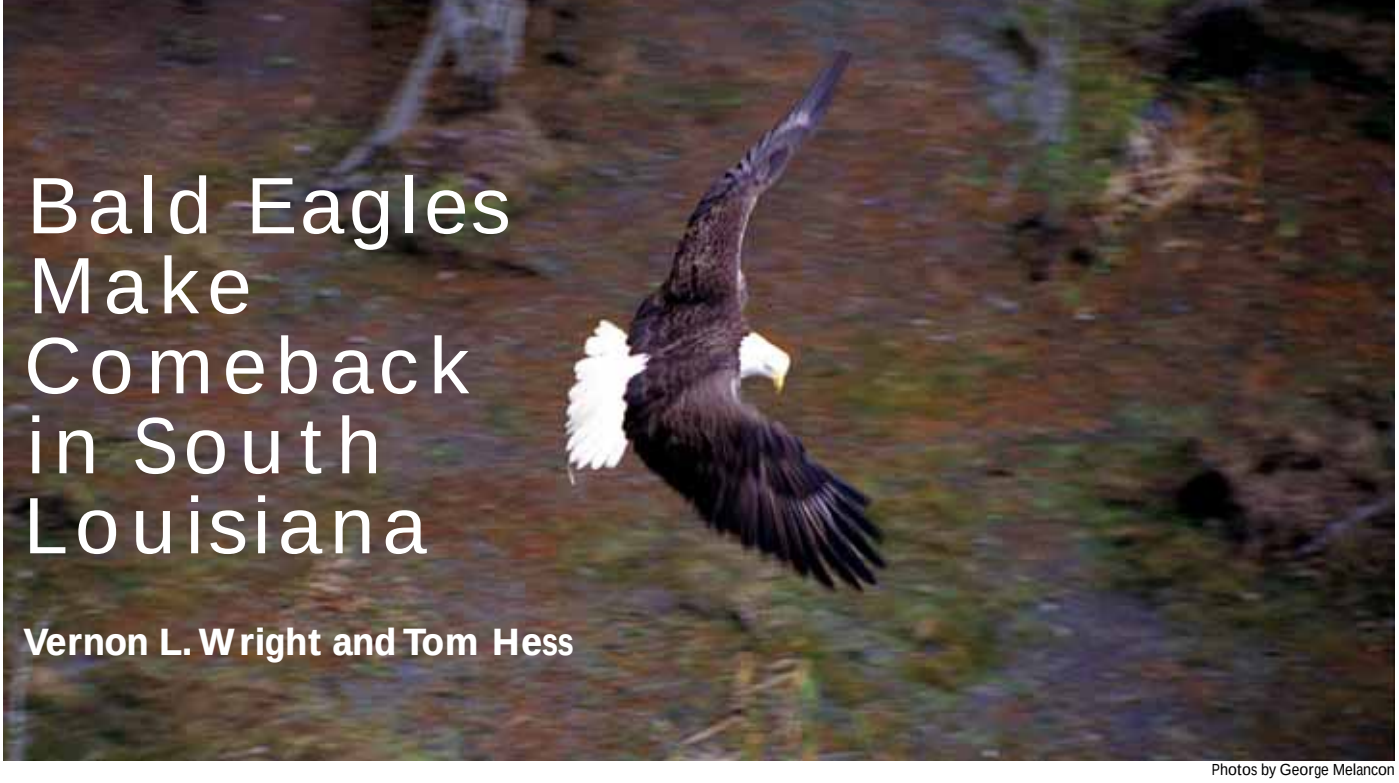
In the early 1990s, the habitat problems in the tundra started to get out of hand. The vast flocks of snow geese coming south were also causing some depredation problems for winter wheat farmers in the Mississippi Flyway. Studies of goose population dynamics strongly suggested that the best way to slow or reverse the growth of the snow goose population was to increase the mortality rate of adults. That sounds easy, but those who hunt snow geese know this is not so simple. Unlike Canada geese and white-fronted geese (also known as "specks"), snow geese are unpredictable and tend to stay in very large flocks. Both traits make hunting difficult.

This is the point where researchers with the U.S. Geological Survey and the LSU AgCenter became involved. They examined use of electronic calls, which had been illegal for all waterfowl hunting. This research showed that electronic calls would greatly aid snow goose hunters. The research design involved coordination with hundreds of hunters to organize experimental hunts where every 15 minutes they switched between using an electronic call and not using this call. When the electronic call was turned on, the harvest rates – geese shot per hour by a hunter – were 9.1 times the harvest without the electronic call. Based on this research, managers and policy-makers pushed for legalization of electronic calls for snow goose hunting. This occurred in 1999.

Another study by USGS and AgCenter researchers examined a potential concern with the use of electronic calls. Some managers, especially in southern Canada, feared that electronic calls for snow geese might attract Canada and white-fronted geese, which could elevate their harvest rates to unacceptably high levels. To test this idea the scientists did experimental hunts in Manitoba and Saskatchewan, Canada. Again, the results were dramatic. When the electronic snow goose call was being played, it proved to be a fairly strong deterrent to Canada and white-fronted geese. This research was instrumental in the decision by the Prairie Provinces of Canada to legalize electronic calls in an effort to increase snow goose harvest.

The big question is whether the increased hunting effort, which extends into the spring, is having the desired impact. The preliminary results are promising. Sport hunters have greatly increased their harvest of snow geese. More important, the population has declined somewhat since 1998. Meanwhile, scientists are continuing to undertake research on snow geese and other waterfowl to supply the information needed to manage waterfowl populations. ■

Frank C. Rohwer, Associate Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.



Bald Eagles Make Comeback in South Louisiana

Vernon L. Wright and Tom Hess

Photos by George Melancon

In the early 1900s, bald eagles were common throughout southern Louisiana, but the deleterious effects of DDT on the birds and their eggshells had placed the species on the endangered list by the 1970s. In 1972, only six or seven nesting territories remained in South Louisiana.

Thirty years later, the bald eagle is no longer even on the threatened species list (where it was placed in 1985). It is, however, still protected by state and federal laws. Today, possession of a bald eagle, alive or dead, merits a fine of from $500 to $20,000 with jail terms of up to two years. Possession of feathers is a crime, also.

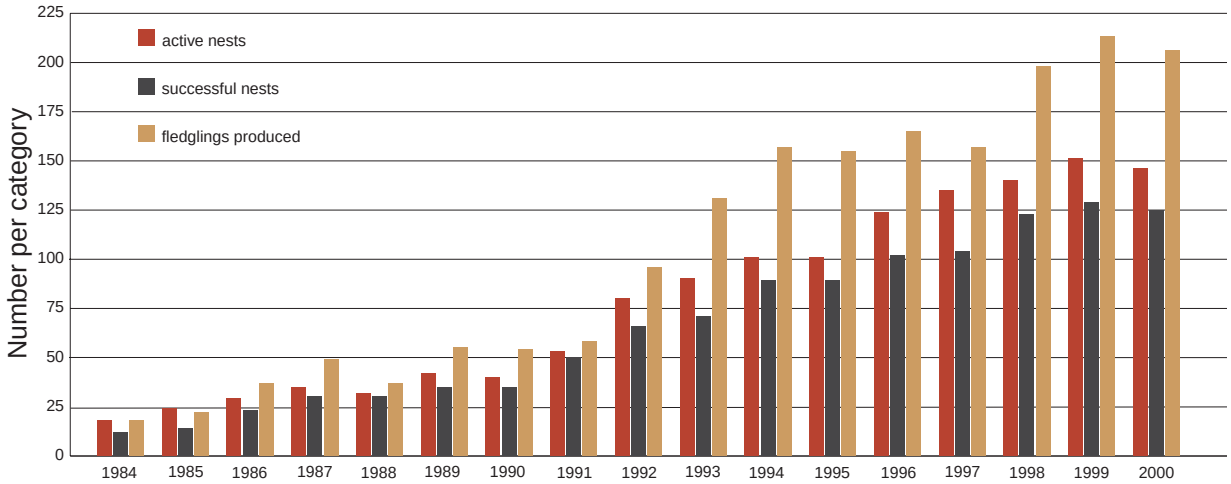
The comeback is credited in large part to law enforcement and decreased use of DDT. The Louisiana Department of Wildlife and Fisheries began aerial surveys to monitor nesting birds in 1984 (Figure 1). By 1985, the number of active nests had increased to 18. Today about 150 active nests exist. Most are between the Mississippi River and Vermilion Bay, with Terrebonne Parish topping the list with 54 known nesting sites (Figure 2).

South Louisiana's marshes are attractive to the fish-eating bald eagles, not only because of abundant food, but also because of the prevalence of large cypress trees. Because the eagles add to their large nests each year, nests can reach weights of several hundred pounds and diameters of 10 to 12 feet.

The eagles nest in South Louisiana during the winter, when pair activities include readying the nest and laying eggs. Most egg laying is completed in late November, and the eggs hatch around year's end. By March, most young have left the nest and soon thereafter most of the eagles will leave the state. October signals the

Vernon L. Wright, Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La., and Tom Hess, Biologist, Rockefeller Refuge, Fur and Refuge Division, Louisiana Department of Wildlife and Fisheries, Grand Chenier, La.

Figure 1. The bald eagle was placed on the threatened species list in 1985. Since then, a concerted effort has been made to bring back the numbers.



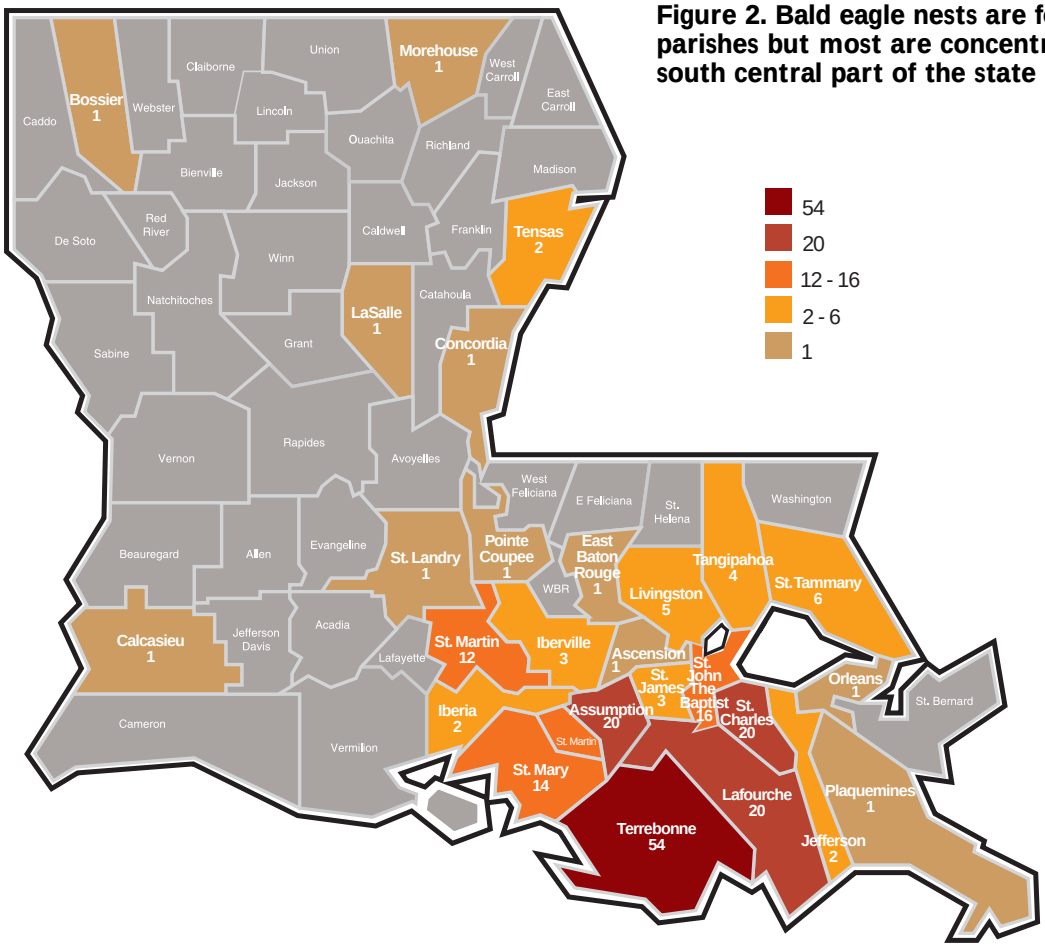


Figure 2. Bald eagle nests are found in many parishes but most are concentrated in the south central part of the state near the coast.

population's return to the state. Scientists think the birds spend the summer in northern states.

A 1,500-foot radius around each nest protects the birds from human activities between October 15 and May 15. Anyone who anticipates being within 1,500 feet of a bald eagle nest during this period must contact the Department of Wildlife and Fisheries or the U.S. Fish and Wildlife Service.

Scientists believe the birds will expand their range into parts of the Atchafalaya Basin and marginal habitats along the coast. As the bald eagle population grows and more young birds mature into breeding age, either they will have to wait for territories to become available as aged birds die or they will have to establish new nesting territories. In the meantime, Louisiana is an integral part of the recovery of this important species. ■

An adult bald eagle watches chicks in the nest in the top of a large cypress tree.

Restoration of Brown Pelicans to Louisiana

Vernon L. Wright, Tom Hess and Larry McNease

The brown pelican, once extinct in Louisiana, has successfully been restored to the state. These birds are seen frequently all along the Louisiana coast and have been reported as far inland as Baton Rouge in recent years.

The brown pelican is primarily a fish eater and will consume up to 4 pounds of fish per day. It flies slowly above the water and will dive for a fish from as high as 70 feet. Most of the diet consists of "rough" fish, those not generally eaten by humans, including mullet, menhaden and minnow-like fish.

The brown pelican nests in large colonies on islands along the coast. Many nests are in shallow depressions surrounded by a rim of soil and debris. Others are in bushes or trees and made of a base of interwoven sticks topped by a mound of grass. Egg laying usually peaks in March and April, when two or three chalky white eggs are laid. The helpless young must be cared for and fed by the parents for at least the 75 days it takes them to fledge, or learn to fly.

Before the 1950s, the brown pelican lived in the approximate area it resides now. But by 1963, it was eliminated, mainly by the use of pesticides, especially Endrin, a DDT relative.

Florida brown pelicans were reintroduced into the state from 1968 through 1980 after DDT was banned. When the first pelicans were brought back, some were rendered flightless by clipping their wing feathers. This created a resident group that helped keep the free-ranging birds from dispersing too far from the release site. Within two years of the release, the first breeding attempts were documented.

The original release sites were on islands in Barataria Bay. Grand Terre received birds for nine consecutive years, 1968-1976; North Island received birds for four years, 1977-1980; and Queen Bess Island received birds in several different years. Some young were moved from Queen Bess Island to Last Island from 1984 to 1986. Three islands (Queen Bess, North and Last) became productive colonies and produced young that colonized another 12 islands by 2001.

Photos by George Melancon

The brown pelican has now been restored to Louisiana and must be considered one of the success stories in wildlife management in the latter half of the 20th century.

From 1971 to 1992, 12,384 nests produced 18,547 fledglings (young birds that have reached the stage where they can fly) for an average of 1.5 young per nest. From 1993 through 2001, 103,727 nests produced 175,116 fledglings for an average of 1.65 young per nest. Eleven different sites have been used for nesting during these years, and seven different colonies were active in 2001.

Brown pelicans have relatively few natural enemies. Storms and high tides can flood the nests, but the birds will lay replacement eggs when nests are destroyed. Human disturbance on the nesting grounds can cause abandonment and must be monitored carefully.

The brown pelican recovery epitomizes a successful reintroduction program in wildlife biology. It shows that reintroducing species from other parts of their range into good habitat will allow the population to reestablish itself, once the contamination problem is solved. To maintain the population into the future will require a continual monitoring program. ■

Vernon L. Wright, Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.; Tom Hess, Biologist, and Larry McNease, now retired, Rockefeller Refuge, Fur and Refuge Division, Louisiana Department of Wildlife and Fisheries, Grand Chenier, La.

Louisiana Continues as Home for Alligators

Vernon L. Wright

Alligator populations in Louisiana have changed drastically during the last century in response to changes in management and in the environment. American alligators are strictly carnivorous reptiles whose native range was restricted to the southeastern part of the United States. They occur in a wide variety of aquatic habitats including rivers, streams, lakes and ponds but are most abundant in swamps and marshes.

Alligators are relatively torpid during the winter, surfacing only to breathe. In late winter and early spring, they will bask in the sun. By late April, they begin to feed vigorously. Mating occurs in April and May, and nest building and egg laying in June and early July. The female builds the nest using vegetation and mud found in the immediate vicinity. The marsh nests contain much vegetation and routinely reach 3 feet in height and 5 feet in diameter. Many nests in the swamps tend to be less bulky and have much mud and a few sticks. The eggs are laid in a hole toward the top of the nest and covered with nesting material. If the nests are flooded for more than 24 hours, the embryos will drown, a common source of nest loss in some years. Predation by mammals such as raccoons is common.

The eggs hatch in August or early September. The young alligators are 9 to 11 inches long and feed on insects and aquatic organisms until early October, when the alligators again become lethargic and cease feeding.

Young alligators grow rapidly and may grow a foot during the first year. During their first year, young alligators feed on insects and small aquatic organisms. As they grow larger, they eat more fish along with some snakes and amphibians. When they reach about 6 feet long, they add mammals and birds to the diet, although fish are always an important part. When they are about 6 feet long and 10 to 12 years old, the wild females start to nest. Once the females start to nest, growth slows considerably as energy is diverted to the 20 to 50 eggs laid each year. Few females ever reach 9 feet in length. The males, on the other hand, continue to grow, and 10-foot-long males weighing about 300 pounds are common. Males 11 and 12 feet long are harvested every year. Alligators longer than 13 feet are rare.

During the 1950s and early 1960s, alligators were harvested with no regulations. No records are available on the magnitude of the harvest, but anecdotal reports indicate that it was high, and the populations were depleted. Alligator harvest was banned during the mid and late 1960s but was reopened in 1972 in three parishes in southwestern Louisiana where the Department of Wildlife and Fisheries carefully regulated it. Harvest in this area has continued since then with two exceptions. One year in the early 1970s, there was no harvest because the regulations were slow in getting established. Another year in the early 1980s, there was a glut of alligators on the market. During the last few years, about 30,000 wild alligators have been harvested yearly in Louisiana.

Vernon L. Wright, Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Photo by George Melancon

Alligators are 9 to 11 inches long when they hatch in late August or early September and will immediately begin feeding on insects and small aquatic organisms. They will be almost 2 feet long when they are 1 year old.

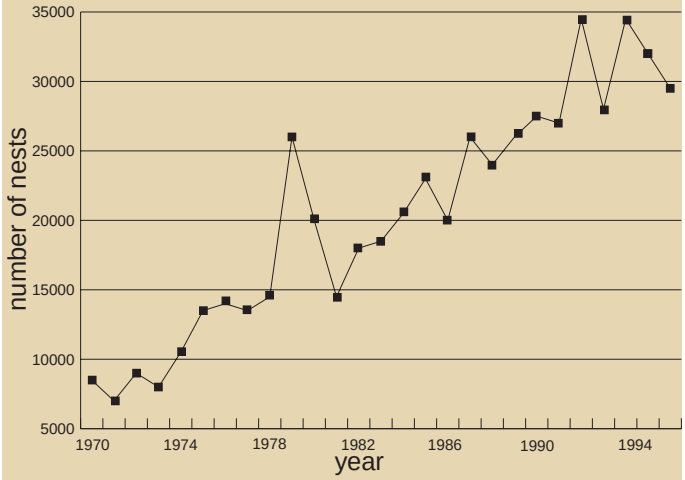
Eggs picked up in the wild are hatched in captivity, and these young are grown by alligator farmers.

Photos by George Melancon

Alligator nests in the marsh are conspicuous and can be counted from airplanes to give a good index to nesting populations.

A portion of the alligators reared on farms are tagged with metal toe tags and released in the areas where eggs were picked up.

Figure 1. The number of alligator nests has nearly tripled in the 25 years between 1970 and 1995.



The data available on alligator harvest include the length and sex of each animal harvested since the season was opened in 1972. The number of large animals being harvested has remained reasonably steady, which suggests that the harvest has not been excessive. An even better indicator of the health of the population is an aerial survey to count the nests in the marshes of Louisiana. Louisiana Department of Wildlife and Fisheries personnel use helicopters to count nests soon after the alligators build them.

The density of nests has increased about threefold since the nest surveys began in the early 1970s (Figure 1). This clearly indicates that the number of nesting females has increased; however, we do not know whether the proportion of females that nest each year is a constant. Many alligator specialists believe that a smaller percentage of females will nest during droughts.

During the late 1980s a new management program for alligators was initiated. Eggs are collected from nests found in the wild and then hatched in captivity. The first large-scale collection of eggs was in 1989 when 169,000 were collected. The eggs are then carefully transported to the hatching facility. The transport is critical, because turning the egg over after incubation starts will tear blood vessels and kill the embryo. Incubation occurs in temperature-controlled situations where the eggs and nest material are kept in baskets over warm water.

Research shows that incubation temperature is critical since more than 95 percent of those incubated at 85 degrees F are females, and most of those incubated at 90 degrees F are male. Equal numbers of those hatching at 88.5 degrees F are of each sex. Hatching occurs in 60 to 70 days, and the young are then moved in special temperature-controlled houses for rearing.

These hatchlings are then sold to alligator farmers who raise the young in heated houses until they are about 4 feet long. This takes about 15 months. Some of the alligators are returned to the landowner where the eggs were collected for release into the wild. The rest are sold for meat and hides. ■

PALLID STURGEON:
A Louisiana Living Fossil

D. Allen Rutherford

Photo by Chris Grondahl

The pallid sturgeon has a shovel-shaped snout and a protruding, toothless mouth with four sensory "whiskers." Sturgeons are more valuable for their eggs, from which caviar is made, than their flesh. Most sturgeons are either threatened or endangered.

Sturgeons have inhabited lakes, streams and rivers for millions of years. Worldwide there are 24 species of sturgeon, including the beluga sturgeon of the Caspian Sea, which can reach a length of more than 16 feet and weigh more than 1,000 pounds. The largest sturgeon in North America, the Pacific white sturgeon, can reach lengths of more than 20 feet, weigh more than 400 pounds and has been reported to live more than 100 years.

Although some sturgeons are distributed only in rivers, others are anadromous, moving from marine systems into fresh water to reproduce. There are four anadromous and four freshwater sturgeons in North America, with the anadromous Gulf sturgeon and freshwater shovelnose and pallid sturgeons found in Louisiana.

Sturgeons have been described as living fossils because of their ancient origins and primitive characteristics. These bizarre-looking fishes have several length-wise rows of bony scutes rather than scales, an asymmetrical tail and a cartilaginous skeleton. These primitive characteristics along with their shovel-shaped snout and protrusible toothless mouths with four sensory "whiskers" make the sturgeon family easy to identify.

Historically, sturgeons have been harvested commercially for their flesh, but they are usually sought out for their valuable eggs, from which the most prized caviar is made. These fishes are typically long-lived, with delayed maturity and infrequent spawning resulting in low numbers of young produced annually. Because of these unique life history characteristics, historic commercial harvesting practices and ongoing alterations to large riverine habitats, most sturgeons are either threatened or endangered. The Gulf sturgeon, listed as a federally threatened species, now inhabits the Pearl River in eastern Louisiana but is thought to have once lived in the Mississippi River. The pallid sturgeon was federally listed as an endangered species in 1990 and is found in the Mississippi, Atchafalaya and Red rivers. Interestingly, the endangered pallid sturgeon co-occurs and even hybridizes throughout its distribution with smaller and more abundant shovelnose sturgeon.

Pallid Sturgeon Decline

Pallid sturgeon were once widely distributed throughout the Mississippi River. In the last 50 years, there has been a drastic decline in pallid sturgeon abundance over much of their former range. This decline has been coincidental with reservoir construction on the Missouri River for flood control and the development of a series of 24 locks and dams on the upper Mississippi River to improve commercial navigation. These construction activities have greatly altered the river by lowering flow velocities and greatly reducing turbidity levels.

LSU AgCenter fisheries biologists, with funding from the U.S. Army Corps of Engineers, designed a study to help describe poorly understood habitat-use patterns for pallid sturgeon in the Atchafalaya River. To monitor sturgeon movements, fish were fitted with internal ultrasonic transmitters. Biologists surveyed the river by boat and were able to use a receiver to locate each fish by detecting the characteristic pinging from each implanted transmitter. Understanding biological requirements of any endangered species helps natural resource managers make recommendations that may result in the ultimate recovery and delisting of the species. Tracking fishes is labor intensive, but it allows biologists to monitor fish locations electronically and record habitat and water quality characteristics at each location over an extended period.

With the help of Atchafalaya River commercial fishermen, pallid, shovelnose and pallid-shovelnose hybrid sturgeon were collected with gill and hoop nets. From these collections, 26 pallid sturgeon were surgically implanted with transmitters and released after a short recovery period. After a one-week acclimation period, telemetry surveys were conducted to locate each tagged sturgeon. Each survey consisted of drifting over the deepest part of the river channel, stopping every 300 feet to 1,000 feet and submerging a directional hydrophone to detect the ultrasonic signal from each transmitter. Surveys of about 30 miles of Atchafalaya and Red

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river habitats took a minimum of five days to complete and were generally conducted at two-week intervals in a 28-month period in 1995-97.

Channel Profiles

When a pallid sturgeon was located, a bottom profile of the channel was taken 300 feet upstream and downstream, and these data were used to determine cross-sectional area and bottom slope. At each fish location, data were recorded on the river mile, river stage, water quality and habitat. Additionally, along each bottom profile, invertebrates were collected to determine the abundance of potential pallid sturgeon prey.

Movements of tagged pallid sturgeon showed that 44 percent remained in the same location on consecutive trips and exhibited extended periods of relative inactivity for up to six weeks. Pallid sturgeon movements were greatest when water temperatures ranged from 57.2-69.8 degrees F, which typically occurred in the fall and spring. All pallid sturgeon movement stopped when winter river temperature dropped below 45 degrees F. Movement studies of pallid sturgeon in northern rivers have reported significant associations between fish movements and moderate river temperatures, increasing river stages and low water clarity; however, these relationships were absent in our study because of the characteristic high summer water temperatures (69.8-89.6 degrees F) in the Atchafalaya River.

Pallid sturgeon preferred deep river areas (mean 49.9 feet; range 23-69 feet) with low bottom slopes (0-0.33 feet/foot) and sand substrates. Fish typically avoided shallow water habitats (less than 23 feet) and areas with high bottom slopes and greater flow velocities (faster than 0.98 feet/foot). Atchafalaya River bottom contours characteristically have a dune-like profile with 3-feet to 16-feet spacing between troughs and peaks. Pallid sturgeon typically select the low-slope, sandy-bottomed trough areas characterized by low current velocities. These low current troughs support low densities of invertebrates, so sturgeon typically select locations near areas with silt-clay substrates, higher current velocities and higher prey availability. This behavior allows pallid sturgeon to benefit from reduced energy costs associated with low flow velocity areas but remain close to an abundant source of food.

Humans Cause Change

Like most endangered species, pallid sturgeon populations suffer from human-induced habitat alterations. Because pallid sturgeon are adapted to large turbid rivers, free-flowing systems like the Atchafalaya River and, to a lesser extent, the lower Mississippi and Red rivers still maintain viable populations. Although we have no estimates of the number of pallid sturgeon in Louisiana, we do know that surveys of abundance throughout their historic range have shown great reductions at many locations and complete elimination at others. Movement patterns and habitat preferences described for pallid sturgeon in this study can provide natural resource managers with information to use to recreate or restore habitat loss throughout the historic distribution of the pallid sturgeon.

Scientists tend to focus efforts to save threatened and endangered organisms on large, high profile species like bald eagles and grizzly bears. But thousands of other plants and animals depend on the same habitats as listed species; habitat alteration and loss can be devastating to the biodiversity of any terrestrial or aquatic system. Species' extinctions have occurred throughout geologic time, but biologists are increasingly alarmed at the high rate of extinction associated with the pervasive effects of an ever-increasing human population. In this light, species like pallid sturgeon serve as bioindicators of environmental health, and restoration of productive populations of threatened and endangered species through protection and enhancement of degraded habitats will enable us to maintain the long-term productivity of Earth's ecosystems. ■

Pesticides and Wildlife

LSU AgCenter scientists conduct research to identify the best insecticides to manage sugarcane insect pests without causing damage to the environment. During the late 1950s and early 1960s, the Louisiana sugarcane industry relied exclusively on aerial sprays of the organochlorine insecticide, Endrin, averaging more than three applications per acre annually to control the sugarcane borer. During this period, the Louisiana brown pelican became extinct in this part of its range, and the American bald eagle was reduced to as few as six or seven nesting pairs in the 15-parish region spanned by the sugarcane industry. Biomagnification of the DDT-group of pesticides concentrating at higher levels of the food chain quickly became recognized as a major environmental issue. This helped to hasten the removal of organochlorine insecticide labels.

The reintroduction of the brown pelican together with improved pest management have become so successful that the pelicans are no longer on the endangered species list. More than 68 nesting pairs of bald eagles are now documented to maintain their territories within the sugarcane area of South Louisiana. In 2000, the bald eagle was finally removed from the threatened species list. Efforts by AgCenter scientists and others have contributed substantially to the major resurgence of wildlife in South Louisiana. Recently labeled pyrethroid insecticides fit better in the management system because they are environmentally friendly. However, they have the potential to enhance secondary pests with repeated applications. Because of the narrow range of activity and minimum environmental risk posed by Confirm (which now represents 70 percent of the sugarcane borer insecticide use), its product developers continue to receive environmental awards. ■

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Renovating Bobwhite Habitat Using Herbicides

The Northern bobwhite, a member of the quail family, has a long history in the southeastern United States and for decades has been a premiere game species of sports enthusiasts. Historically, bobwhite populations in the Southeast were associated with either agricultural areas or fire-maintained pine forests, such as the longleaf pine savannahs of the southeastern coastal plain. Historic bobwhite habitats have undergone considerable change, however, which overall has produced negative effects for bobwhite populations.

Although prescribed fire is crucial to maintain quality habitats in pine forests for bobwhite, its use has drastically declined across southeastern landscapes. Furthermore, bobwhite populations have been affected negatively by intensive forest management, mainly because vegetative conditions needed by bobwhites to reproduce successfully and survive are often not present in forests managed intensively for fiber production. Recent developments of selective herbicides capable of targeting specific plant species and promoting plants beneficial to many wildlife species have offered promise of promoting bobwhite populations in pine forests.

Within pine-dominated landscapes, bobwhite are typically associated with understory habitats containing abundant legumes and grasses. Although regular prescribed burning (at least every three years) can maintain habitats containing these resources, reductions in prescribed fire result in understory conditions dominated by woody saplings and vines. Imazypyr, a selective herbicide, reduces woody saplings and vines and promotes legumes and beneficial grasses. Thus, applying Imazypyr to understory vegetation within pine forests will likely improve habitat for bobwhite. Evidence to support this hypothesis has been based primarily on small-plot research. Because bobwhite populations are maintained across landscapes, however, the research needed to be expanded.

In September 2001, the LSU AgCenter initiated a three-year research program on the Jackson-Bienville Wildlife Management Area in north-central Louisiana. The goal is to examine bobwhite response to landscape-level management of pine habitats using selective herbicides like Imazypyr. During the study, Imazypyr will be applied to renovate understory conditions within pine forests. Following application, researchers will measure the bobwhite response, including habitat use, movements, survival, nesting ecology and chick foraging patterns within habitats manipulated with herbicides and other habitats used by bobwhites. Distribution and abundance of bobwhites across the entire landscape will be checked seasonally and compared to adjacent landscapes managed without herbicides.

With continual reductions in prescribed fire in pine forests, managers are constantly searching for techniques to allow them to best manage wildlife and other forest resources. This research program will provide needed information on the effects of applying selective herbicides on a wildlife species with a historic past and, we hope, a bright future in Louisiana.

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History of Insecticidal Control of the Sugarcane Borer (SCB)

Time Used	Chemical	Class	Problems with Use
Early 1950s	Ryania/Cryolite	Botanical/Inorganic	Poor control (30-45%)
1958-64	Endrin	Organochlorine	Environmental/ SCB resistance
1963-98	Guthion	Organophosphate	Environmental (Fish kills)
Late 1960s-1990	Azodrin	Organophosphate	Environmental (Bird kills)
1972-Present	Furadan	Carbamate	Seldom used because of hazard to applicator, environmental
*Mid 1980s	Baythroid	Pyrethroid	Enhance secondary pests
*1992	Pydrin, Asana	Pyrethroid	Enhance secondary pests
*2001	Fury	Pyrethroid	Enhance secondary pests
*1999	Confirm	Diacylhydrazine	No problems detected

*Still labeled for use.

Bald eagle nests can weigh several hundred pounds and grow to 10 to 12 feet in diameter because the birds add to the nests every year. "Chip" Graft from Lake Arthur, La., knows the skills of climbing to the nests to band the chicks.

Inside:

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