

ENDANGERED *Species* BULLETIN

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When we hear the term “partners” applied to wildlife conservation, what often comes to mind are the many groups that we work with outside of the U.S. Fish and Wildlife Service: states and other federal agencies, non-governmental organizations, private landowners, and industry. In this special edition of the Bulletin, however, we celebrate conservation partnerships within the Service family, specifically highlighting the successes achieved through collaboration between the Endangered Species and Fisheries and Habitat Conservation programs. We are proud to celebrate the hard work all Service employees do as they promote the recovery and conservation of America’s native species and their habitats. We hope you will enjoy the articles you are about to read.



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On the Cover

The Southeast population of the wood stork, an endangered bird, is showing signs of recovery due to habitat conservation.

Photo by Wayne Lasch



The Endangered Species Bulletin is now an on-line publication. Three electronic editions are posted each year at www.fus.gov/endangered/bulletin.html, and one print edition of highlights will be published each year. To be notified when a new on-line edition has been posted, you can sign up for our list-serve by clicking on "E-Mail List" on the Bulletin web page.

The Bulletin welcomes manuscripts on a wide range of topics related to endangered species. We are particularly interested in news about recovery, habitat conservation plans, and cooperative ventures. Please contact the Editor before preparing a manuscript. We cannot guarantee publication.

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Please send us your comments and ideas! E-mail them to us at esb@fus.gov.

Fisheries and Habitat Conservation

by Amy DeWeerd and
Tiffany Parson

Helping to Avoid Listing and Promote Recovery



Our mission is to provide leadership in sustaining and enhancing fish, wildlife, and their habitats for the benefit of the American people and to engage citizens in the shared stewardship of our Nation's natural resources.



The Nature Conservancy

The Fish and Wildlife Service's Fisheries and Habitat Conservation (FHC) Program works in a multitude of ways to recover animals and plants listed under the Endangered Species Act and to restore populations of native species to avoid the need for future listings. One of the Service's most diverse programs, FHC works for healthy fish and wildlife populations, healthy habitats, healthy people, and a healthy economy.

Division of Habitat and Resource Conservation

- Branch of Advanced Planning and Habitat Conservation
- Branch of Resource Management Support
- Branch of Habitat Assessment

The Division of Habitat and Resource Conservation implements various programs to conserve and protect endangered species. It works with federal, state, and local partners to develop comprehensive, science-based restoration and/or conservation planning for infrastructure development and other activities that support Endangered Species Program priorities, as well as those for migratory birds and the National Fish Habitat Action Plan. States and other partners use the National Wetlands Inventory's digital wetlands maps and status and trends information for conservation issues.

The division also provides support and guidance for Service implementation of the Coastal Barrier Resources Act, Marine Mammal Protection Act, and Sikes Act.

For more information, visit <http://www.fws.gov/habitatconservation>.

Division of Environmental Quality

- Branch of Environmental Response and Restoration
- Analytical Control Facility
- Branch of Environmental Contaminants
- Branch of Invasive Species

This division is a national leader dedicated to protecting fish, wildlife, and their habitats from pollution's harmful effects. It works with partners to 1) conserve trust resources and their supporting habitats through contaminant prevention, 2) restore and recover trust resources and supporting habitats harmed by environmental contamination and other stressors, and 3) provide environmental contaminant expertise and high-quality scientific data to support sound management of trust resources. Additionally, we work with partners to 1) prevent the introduction and spread of aquatic nuisance species (ANS), 2) detect and rapidly respond to new introductions, 3) control established ANS where possible, 4) increase public awareness of invasive species issues through education and outreach programs, and 5) through the regulatory process, prevent the importation and interstate transport of injurious wildlife species.

For more information, go to: <http://www.fws.gov/contaminants>.

Division of Fish and Wildlife Management and Habitat Restoration

- Branch of Fish and Wildlife Management Assistance
- Branch of Habitat Restoration



Pete Pattavina/USFWS

Left photo: The green pitcher plant (*Sarracenia oreophila*) is an endangered carnivorous plant that depends on wetlands.

Opposite page photo: Using National Resource Damage Assessment and Restoration settlement funds from a PCB-contaminated site, the Fox River/Green Bay Natural Resource Trustee Council supported the Nature Conservancy's project to acquire and restore native habitat in the Mink River watershed.

The Fish and Wildlife Management Assistance and Habitat Restoration programs deliver scientific information to federal partners, states, tribes, landowners, and others for cooperative projects. Through the Partners for Fish and Wildlife and National Fish Passage programs, we work with a diversity of interests to restore and improve fish and wildlife habitat. The division also manages Alaska subsistence fisheries, and works with tribes to coordinate fish and wildlife management. The Coastal Program and National Coastal Wetlands Conservation Grant Program are respon-

sible for evaluating and mapping important habitats, restoring degraded habitats, and providing grants to states for coastal wetlands conservation.

For more information, go to: <http://www.fws.gov/fisheries/FWSMA>.

Division of the National Fish Hatchery System

- Branch of Hatchery Operations and Maintenance
- Branch of Budget and Performance Management
- Branch of the Aquatic Animal Drug Approval Partnership

As the national leader in fish propagation and rearing techniques, genetic and broodstock management, refugia, fish health, and research, the National Fish Hatchery System works with partners to restore and maintain fish and other aquatic organisms, such as toads, salamanders, mussels, insects, and plants. The division manages 70 federal hatcheries. Its seven Fish Technology Centers are leaders in science-based management, developing new technology for aquaculture. Nine Fish Health Centers monitor the health of aquatic animals in hatchery facilities and in the wild. The Aquatic Animal Drug Approval Partnership assists in acquiring drug approvals from the Food and Drug Administration benefiting aquaculture programs, commerce, and conservation.

For more information, go to: <http://www.fws.gov/fisheries/nfhs/contact.htm>.

The articles in this special edition of the Endangered Species Bulletin show how these complementary programs work to help prevent the need to list species and promote species recovery.

Amy DeWeerd and Tiffany Parson are fish and wildlife biologists in the Service's FHC Program. They are co-chairs for FHC's 2007 annual Congressional outreach event.



by Dave Stout

Species Recovery through Habitat and Resource Conservation



Andrew King, USFWS

Conserving hibernating clusters of the endangered Indiana bat will be enhanced through streamlining the environmental review process in Ohio.

The Division of Habitat and Resource Conservation (HRC) is often the first Fish and Wildlife Service program engaged to prevent the decline of species so that they will not need Endangered Species Act protection. But if a species is listed, HRC is also frequently instrumental in its conservation. We accomplish this by ensuring that federal navigation, flood control, energy, and transportation projects are designed to minimize adverse environmental impacts on fish and wildlife and their habitats. A few of our recent environmental successes include:

Bringing Back the Platte

Described by early explorers as “a mile wide and a foot deep,” Nebraska’s

Platte River provided a cornucopia of habitats for species now endangered, like the whooping crane (*Grus americana*), least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), and pallid sturgeon (*Scaphirhynchus albus*). These creatures and many others occurred commonly in the Platte River valley until people began altering the landscape.

Cities diverted river water to quench the thirst of growing populations, and farmers took more to provide for an expanding agricultural economy. By the early 1980s, more than 70 percent of the river’s annual flow was being diverted for human uses. What was once a mile-wide river with countless unvegetated sandbars and wet meadows took on the closed form of an eastern forest. Something clearly needed to happen before the open Platte River environment and the species it supported remained only in history books.

What began as the Platte River Management Joint Study evolved into an agreement among the governors of Colorado, Nebraska, and Wyoming, and the Department of the Interior for the management of endangered species habitats along the central Platte River in Nebraska. The agreement ensures adequate instream flows, enhancement and restoration of degraded habitats, and facilitation of water development activities in the basin.

Tourists throng along the river to view the seasonal spectacle of skies full of cranes and other migratory birds, and they bring more than \$30 million a year



Photo courtesy of Penobscot River Restoration Trust

The once “mile wide and foot deep” Platte River has been reduced in size from upstream water withdrawals. The newly-enacted interstate agreement should bring back much of the habitat used by endangered birds that has been lost to vegetation encroachment.



Veazie Dam, one of the dams to be removed to enhance fish passage.

into the local economy. Public attitudes are changing; people no longer see the Platte as simply a source of irrigation water but as a centerpiece of Nebraska's cultural and natural heritage.

Restoring an Atlantic Fishery

Our reviews of Federal Energy Regulatory Commission dam licensing laid the groundwork for restoring Atlantic salmon and other migratory fish in Maine's Penobscot River. The HRC activities have resulted in an innovative agreement involving the Service, the state of Maine, the Penobscot Indian Nation, the dam's owner, and several non-governmental organizations. The Penobscot River Restoration Project calls for three of the dams on the lower part of the Penobscot watershed to be sold to the Penobscot River Restoration Trust, which is made up of non-governmental organizations and the Penobscot Indian Nation. Two of the dams will be removed, and the third will be decommissioned and equipped with a novel fish bypass system. By recycling generating turbines from the removed dams to other projects in the watershed, coupled with other modifications, Pennsylvania Power and Light will replace over 90 percent of the

power that would be lost from the dam removals. The project began in 2005, with dam removals and other improvements scheduled to occur as early as 2009.

Streamlining Transportation in Ohio

The Ohio Department of Transportation (DOT) and the Service's Ohio Ecological Services Field Office have worked in recent years to streamline the environmental review of federal transportation projects in Ohio. Interagency consultations evaluated potential effects on endangered species such as the Indiana bat (*Myotis sodalis*). In 2006, they agreed on an approach that eliminates the need for Service review of transportation projects that both parties agree are innocuous. Now, the Ohio DOT coordinates with the Service on only half as many projects, allowing both agencies to focus on higher priority consultations—those more important to fish and wildlife conservation.

Dave Stout, Chief of the Division of Habitat and Resource Conservation in the Service's Arlington, Virginia, national headquarters office, can be reached at 703-358-2161.

Fish and Wildlife Management Assistance

by John Castellano, Jarrad
Kosa, Lauren Ris, and
Leslie Hartsell

*T*he Fish and Wildlife Management Assistance (FWMA) Program plays a vital role in restoring and maintaining the Nation's fish and wildlife resources. It functions like a general practitioner in the medical field; its biologists monitor the health of fish and wildlife, diagnose ailments, prescribe remedies, refer specific problems to specialists, and coordinate diverse efforts to restore and maintain health. The program helps to avoid the need for listing actions under the Endangered Species Act (ESA)—in other words, it keeps the patient out of the intensive care unit. The American people benefit from healthier ecosystems and enhanced fishing and other recreational opportunities.

In 64 FWMA offices throughout the country, over 300 fish and wildlife biologists work with other federal agencies, states, tribes, foreign governments, and private citizens to restore, manage, and

conserve native fish and wildlife and their habitats. Here are a few examples:

Coaster Brook Trout

The “coaster” brook trout (*Salvelinus fontinalis*) spends most of its time in the nearshore waters of the upper Great Lakes, migrating into streams to spawn. Spending part of its life in open waters, it grows much larger than brook trout that live entirely in streams. It once was abundant along the shores and in the tributaries of Lake Superior. However, during the past century, populations were severely depleted and in some cases eliminated, requiring urgent action to prevent the need for listing this fish under the ESA.

To begin the restoration process, FWMA and its partners developed the Brook Trout Restoration Plan for Lake Superior. Guided by the plan, FWMA works with a variety of interests to



Apache trout

USFWS



Niangua darter

conduct coaster brook trout surveys and habitat assessments, propagate the coasters in the National Fish Hatchery System and state hatcheries, collaborate with the National Wildlife Refuge System to develop the Whittlesey Creek National Wildlife Refuge to protect stream habitat, and restore habitat by funding fish passage projects on two Indian reservations. As a result, coasters are now returning to historic streams in the upper Great Lakes.

Apache Trout

Native Apache trout (*Oncorhynchus apache*) in the southwestern United States were once on the verge of extinction and were listed as endangered. Those populations that remained were found only on lands of the White Mountain Apache Tribe in eastern Arizona.

In cooperation with the tribe and other interests, FWMA biologists initiated activities to locate remnant populations, identify and restore habitat, and work with national fish hatcheries to reestablish self-sustaining stocks. In all, FWMA identified genetics of 13 existing populations of Apache trout, removed non-native trout from parts or entire reaches of 14 streams, identified eight natural barriers that protect existing populations from non-native trout, constructed 30 barriers in 26 streams to protect new

populations of Apache trout, established eight new populations in restored habitat, and restored portions of 21 streams.

As a result, self-sustaining Apache trout populations now exist in 21 streams comprising over 140 miles (225 kilometers) of historic habitat. A continuing success story, the Apache trout has improved in status enough to be reclassified from endangered to threatened, and it is on the verge of becoming the first fish species to be delisted through recovery.

Niangua Darter

The Niangua darter (*Etheostoma nianguae*), a Missouri fish, became a threatened species in 1985 when reservoir construction blocked upstream movement and sent it into decline.

Niangua darters live in the riffle-pool complex of clear upland creeks and small rivers in the Osage River basin and rely on continuously flowing streams with silt-free gravel and rock bottoms. Once occurring widely in the southern portion of the Osage River watershed, Niangua darters are now found only in a few small, fragmented populations. Another cause of the population fragmentation was poorly designed low-water road crossings that block Niangua darter movement. These conditions made the darter increasingly sensitive to environ-

mental extremes (primarily drought), and the fragmentation has resulted in reduced or eliminated gene flow and genetic diversity.

Despite these challenges, the Fish and Wildlife Service and its partners are working to protect and increase Niangua darter populations. To date, 16 projects and 54 surveys have been completed within watersheds that support the species. Most have resulted from cooperative efforts with the Partners for Fish and Wildlife Program. Restoration projects include developing or improving riparian areas, stabilizing banks along highly eroded streams, constructing alternative watering sources for livestock, and modifying or replacing stream crossings within the darter's range.

Cooperators across the Nation are looking to the FWMA program to help meet their needs for monitoring, coordinating, and implementing fish and wildlife management and restoration plans. We will continue to work across borders of states, Indian reservations, and other nations to conserve fish and wildlife resources.

John Castellano, Jarrad Kosa, Lauren Ris, and Leslie Hartsell are fish and wildlife biologists in the Fish and Wildlife Management Assistance Program.

Partnerships for Shared Stewardship

by Leopoldo Miranda-Castro



Photo courtesy of the Botanical Society of America

Brighamia rockii is one of the listed plants found on Mokapu Island (opposite page).

Two of the Fish and Wildlife Service's most popular and effective programs for voluntary, citizen and community-based conservation initiatives are the Partners for Fish and Wildlife and Coastal programs. They are a bridge to owners and managers of non-federal lands for development of partnerships to benefit trust species. The approach is simple: engage willing partners to conserve wildlife values on their property through the use of non-regulatory incentives.

The Partners Program is active in all 50 states, the Commonwealth of Puerto Rico, the U.S. Virgin Islands, and other trust territories. It is the Service's premier program for cooperative conservation with private landowners, farmers, ranchers, and resource-based industries. Between 2003 and 2006, the program implemented over 500 projects benefiting threatened and endangered species. The Coastal Program focuses on large-scale, long-term collaborative resource planning and implementation in high-priority coastal areas.

Through our partnerships, we have worked to conserve coastal and interior wetlands, streams and rivers, marshes and estuaries, and upland grasslands and forests from coast to coast. As of 2006, the two programs have:

- restored or enhanced more than 850,000 acres (344,000 hectares) of coastal and interior wetlands;
- restored or enhanced more than 1.9 million acres (0.8 million ha) of coastal and interior prairie, shrub, and forest upland habitat;
- restored or enhanced more than 8,500 miles (13,675 kilometers) of riparian and instream habitat;

- protected more than 1.2 million acres (0.5 million ha) of habitat through conservation easements;
- implemented more than 41,000 landowner and cooperative agreements; and
- leveraged federal tax dollars by a ratio of at least 4 to 1 through partnerships.

Most of these projects benefit threatened and endangered species as well as candidates for listing. The following case studies show how the programs work:

Beaver Cave Project

Cave systems in the Southeast provide essential habitat for a number of listed bats, fish, and invertebrates, as well as candidate species. The Beaver Cave beetle (*Pseudanophthalmus major*) is endemic to the Beaver Cave system in Harrison County, Kentucky. Until 2006, it was a candidate for listing under the Endangered Species Act. The landowner approached the Partners Program, Kentucky Department of Fish and Wildlife Resources, and Natural Resources Conservation Service to design and implement a conservation project that removed the need to list this species. This project would not have been possible without planning and collaboration among the landowner, several Service programs, the Natural Resources Conservation Service, the Farm Service Agency, the Kentucky Division of Conservation, the Kentucky Department of Fish and Wildlife Resources, the Kentucky Nature Preserves Commission, and the Kentucky Division of Forestry.

The Partners Program provided technical assistance and funding for a major



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The gate at Beaver Cave gate protects this underground ecosystem.

stream crossing, built in conjunction with the Farm Service Agency's Conservation Reserve Program, to help exclude cattle from the stream, thereby reducing sediment and animal waste in the water. The landowner reorganized his cattle grazing regime to exclude livestock from Beaver Creek tributaries on his property. The Kentucky Division of Conservation then assisted in installing a feeding area. The Kentucky Department of Fish and Wildlife Resources, using federal funds, provided an additional stream crossing. The Natural Resources Conservation Service partially funded the installation of a gate to protect the cave and cleaned out a sediment-filled sinkhole.

Most of the animal waste and sediments from the dairy operation have been removed and or filtered from the tributary flowing into Beaver Creek. This action greatly improved water quality in the Licking River watershed and aided in restoration of the listed fanshell (*Cyprogenia stegaria*) and clubshell (*Pleurobema clava*) mussels.

Pacific Species

In the U.S. Pacific islands, the Coastal Program works with landowners, nonprofit groups, government agencies, and others on habitat protection and

restoration, biological surveys, restoration research and planning, and environmental education. Its area of responsibility includes hundreds of islands distributed over thousands of square miles of ocean and covers over 6,500 miles (10,500 km) of coastline. Pacific island coasts and nearshore environments include over 90 percent of the U.S. coral reefs and a range of unique, tropical habitat types that support many endemic species, hundreds of which are listed as threatened or endangered.

In support of the Service's 2005 Seabird Conservation Plan for the Pacific Region, the Coastal Program played a central role in funding and coordinating projects to eradicate non-native rats on two Hawaii offshore islets, Lehua and Mokapu. Introduced rats eat a wide variety of native organisms, including seabirds, plants, insects, and inter-tidal invertebrates. Rat eradication reduces predation and benefits the following endangered (E), threatened (T), and candidate (C) species that currently inhabit the islets:

- Newell's shearwater (T) *Puffinus auricularis*
- Dark-rumped petrel (E) *Pterodroma phaeopygia sandwichensis*

- *Peucedanum sandwicense* (T)
(Mokapu is designated critical habitat for this plant species.)
- Band-rumped storm petrel (C)
Oceanodroma castro

Both islets are designated state seabird sanctuaries, and they support native plants and invertebrates as well. Mokapu Island is designated critical habitat for three listed plants: *Brighamia rockii* (E), *Tetramolopium rockii* (T), and *Peucedanum sandwicense* (T), although only the latter currently grows on the island. A possible future initiative could include the reintroduction of these species.

The Partners and Coastal programs produce similar accomplishments and share a common vision of citizen-centered conservation through partnerships. Each program has a unique niche and focus for carrying out the Nation's conservation responsibilities. We will continue to work with our public and private partners to assist in reaching national goals for the conservation of federal trust species.

For more information, visit www.fws.gov/partners or www.fws.gov/coastal.

Leopoldo Miranda-Castro is a wildlife biologist in the Service's Arlington, Virginia, headquarters office.

** Case studies narrative information was adapted from project descriptions originally written in the Habitat Information Tracking System (HabITS) by Brent Harrel (Partners Coordinator in Kentucky) and Chris Swenson (Pacific Islands Coastal Coordinator).*



Eric VanderWerf

Introduced rats on Mokapu Island in Hawaii were damaging native bird populations.

The Environmental Contaminants Program

by Cindy Schexnider



Gus Van Vliet

Marbled murrelet

The Fish and Wildlife Service has been studying the effects of contaminants on fish and wildlife since the agency's earliest days, but the Environmental Contaminants Program did not begin to take form until the 1950s, when increasing awareness of pollution problems spurred the American public to demand action. Then, in 1962, Rachel Carson, a former Service employee, captured national attention with her landmark book, *Silent Spring*, which described the widespread harmful effects of pesticides on the environment. Carson's alarming message—that the effects of these substances on wildlife serve as indicators of what may ultimately jeopardize our own health—struck a chord with the American public.

Many believe that Carson's book inspired the modern environmental movement and prompted the develop-

ment of many of the pollution prevention laws that are in place today. After her book was published, Congress passed the National Environmental Policy Act and pollution prevention laws such as the Clean Water Act; Clean Air Act; Federal Insecticide, Fungicide and Rodenticide Act; Safe Drinking Water Act; Toxic Substances Control Act; and the "Superfund" toxic waste cleanup law also known as the Comprehensive Environmental Response, Compensation, and Liability Act.

Today, the Service's Environmental Contaminants Program includes contaminants specialists stationed at more than 75 locations around the country. These scientists are on the front lines in the fight against pollution. They specialize in detecting toxic chemicals; addressing their effects; preventing harm to fish, wildlife, and their habitats; and remov-



Olympic Coast National Marine Sanctuary

Old-growth habitat at Cape Flattery is now being protected for the marbled murrelet and other wild life.



Douglas Zimmer/USFWS

Dancers from the Makah Tribe celebrated the agreement to protect old-growth habitat.

ing toxic chemicals and restoring habitat when prevention is not possible. They are experts on oil and chemical spills, pesticides, water quality, hazardous materials disposal, and other aspects of pollution biology. Integrated into all other Service activities, the Service's contaminants specialists often work in partnership with other agencies and organizations that rely on our expertise.

An example of the program's work can be seen in our response to an oil spill off the U.S. Pacific Northwest coast that posed a serious threat to a population of marbled murrelets (*Brachyramphus marmoratus*). These small seabirds live in nearshore marine environments from California to Alaska and are the only seabird to nest in mature coastal forests. Extensive losses of such habitat led to a decline in marbled murrelet numbers along the West Coast, resulting in the 1992 listing of the Washington, Oregon, and California population as threatened under the Endangered Species Act.

On July 22, 1991, the Chinese freighter Tuo Hai hit and sank the Japanese fishing vessel Tenyo Maru near the entrance to the Straits of Juan de Fuca, which separates Washington State and Vancouver Island, Canada. The Tenyo Maru released much of the 452,600 gallons (1.7 millions liters) of fuel oil and diesel aboard, oiling a large swath of the coasts of Washington and Oregon. The spill killed over 20,000 sea birds, including marbled murrelets.

Under the 1990 Oil Pollution Act (OPA), natural resource trustees (selected Federal agencies, States and Tribes) hold

the parties responsible for an oil spill liable for injury to natural resources and to restore those injured resources. The trustees involved in the Tenyo Maru spill included the Department of the Interior (represented by the Service's Environmental Contaminants Program), the State of Washington, and the Makah Tribe. Through the natural resource damage assessment and restoration (NRDAR) process under the OPA, the trustees quantified the natural resource injuries and, with public input, determined the appropriate restoration projects.

Because habitat loss is the greatest threat to marbled murrelets, most of the Tenyo Maru restoration projects focused on habitat protection and enhancement. The trustees used approximately \$4.7 million of the settlement funds to permanently protect and restore over 900 acres (365 hectares) of coastal forest in three parcels. These included 220 acres (90 ha) of rare coastal old growth forest currently supporting nesting marbled murrelets, as well as high-quality second growth forest and younger stands of trees that will serve as a buffer to the old-growth stands and eventually grow into mature forests. One parcel is now a part of the Willapa National Wildlife Refuge, while two others are being managed under a 200-year land use agreement with the Makah Tribe. All of these areas are now protected from logging, development, and other activities detrimental to the recovery of marbled murrelets. The trustees also provided funding to survey potential marbled murrelet nesting areas, which through our partners has resulted

in increased protection of another 3,000 acres (1,215 ha) of mature forest habitat in Washington.

In August 2006, the trustees held a commemoration to share completion of the restoration projects with the public and to inform them of the needs of Washington and Oregon's seabirds. Held on the Makah Reservation, where two of the newly protected old-growth forest tracts are located, the ceremony included tribal traditions, complete with a smoked salmon feast, tribal dancing, and blessings for the newly protected land.

A final summary of the entire restoration can be found at <http://www.fws.gov/westwafwo/index.html>.

Cindy Schexnider is an Environmental Contaminant Specialist in the Service's Western Washington Fish and Wildlife Office.

Clearing the Water for Mussels

by George Noguchi, Tom Augspurger, and Jim Dwyer

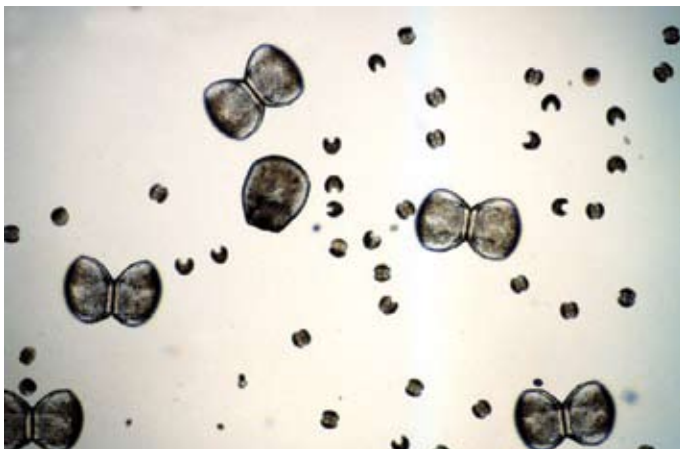
*I*n cooperation with our partners, the Fish and Wildlife Service's Environmental Contaminants Program provides the science needed to improve water quality for restoring freshwater mussels—our Nation's largest group of threatened and endangered animals.

There is wide agreement that North America's native freshwater mussels are in decline (Master et al. 2000, Lydeard et al. 2004). Of the nearly 300 native species, 35 are considered extinct (Turgeon et al. 1998), and 70 are listed as threatened or endangered in the U.S. under the Endangered Species Act. Although many environmental problems contributed to the decline of freshwater mussels, water pollution is among the leading factors limiting their recovery (Richter et al. 1997, Strayer et al. 2004). Improving water quality will be necessary to restore many imperiled populations, and biologists working to recover mussels have looked to toxicologists for help in identifying specific pollutants. The Native Mussel Conservation Committee (1998) has issued explicit calls for determining mussel pollutant sensitivities and determining if water quality criteria and standards are sufficient for recovery.

Scientists in the Service's Environmental Contaminants Program and researchers from the U.S. Geological Survey (USGS) have answered this call by refining methods for growing young mussels and testing their sensitivity to water pollutants. As is the case with most other species, it is the very youngest mussels that are at highest risk, but the unique life history characteristics of mussels required the development of new and refined testing methods. Environmental Contaminants and USGS scientists worked with others to develop an international consensus on test methods, which was approved by the American Society for Testing and Materials (2006). Applying those methods has yielded ample data to conclude that early life stages of mussels are highly sensitive to some common water pollutants (notably ammonia and copper), of intermediate sensitivity to others like chlorine, and relatively tolerant of some other compounds. We have learned that young mussels are more sensitive to ammonia and copper than many other species, including those that are commonly used to establish water quality standards (Augspurger et al. 2003, March

Photo (left): Newly released mussels, called glochidia, are microscopic and cannot swim or crawl. Their only behavior is to close just at the right time when they come in contact with a fish gill. The larger glochidia in this photo are ¼ mm.

Photo (right): Freshwater mussels are important to aquatic ecosystems because they filter large volumes of water and serve as food for many animals, such as the raccoons that were responsible for this kill on the Verdigris River, Kansas.



Photos courtesy of Union Gallery (<http://unionid.missouristate.edu>)

et al. 2005). This finding raises concerns as to whether or not the current standards for regulating ammonia and copper are adequate for protecting mussels.

Because of ongoing coordination with our Federal partners*, the Environmental Contaminants Program has worked with the Environmental Protection Agency (EPA) and the National Marine Fisheries Service towards ensuring that data from mussel tests are used when water quality criteria are established. Because of the new data, EPA is evaluating the current criterion for ammonia, and the Service's Endangered Species Program now has science-based water quality thresholds to guide recovery efforts.

Hansen and Johnson (1999) highlighted freshwater mussels as a group of animals for which cooperation among conservation biologists and environmental toxicologists is crucial for meeting long-term conservation goals. The Service's Environmental Contaminants Program biologists are conservation biology-focused toxicologists who have embraced this challenge to improve test methods, define specific pollutants of concern, and work with others to implement practical, science-based recommendations. By providing sound science and using it to guide regulations, the Service is fulfilling its responsibility to restore and conserve our valuable natural resources.

* *Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service, and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and the Endangered Species Act. February 22, 2001.*

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George Noguchi, Tom Augspurger, and Jim Dwyer are biologists with the Service's Environmental Contaminants Program.



One of the unique life history characteristics of mussels is the "parasitic" stage when glochidia attach to the gills of host fish. The glochidia eventually metamorphose into juvenile mussels, drop off the fish, and begin feeding on algae. This photo shows glochidia attached to fish gills.

The Lake Apopka Agreement

by Heath Rauschenberger

*F*rom November 1998 through early April 1999, a bird die-off occurred on the north shore of Lake Apopka, Florida. The deaths occurred on former farmlands that had been purchased to reduce nutrient run-off into the lake by the St. Johns River Water Management District and the Natural Resources Conservation Service (NRCS). An estimated 680 birds died, mostly American white pelicans (*Pelecanus erythrorhynchos*) and wading birds, including over 40 endangered American wood storks (*Mycteria americana*).

The die-off ultimately was attributed to organochlorine pesticide (OCP) poisoning from dieldrin, toxaphene, and DDT and its metabolites that were applied over many years when the fields had been used for crop production. The birds were exposed by eating OCP-contaminated fish that had moved from ditches into flooded fields in the eastern part (Unit 2) of the restoration area. In response, Unit 2 was drained, and other areas east of the Apopka Beauclair Canal were kept dry by pumping the water off

the fields and back into the lake. After an investigation involving numerous federal and state agencies, the District, the U.S. Department of Justice, and the Fish and Wildlife Service reached an agreement in 2003.

The Lake Apopka agreement was based on cooperative efforts to assess the impact of the die-off to avian wildlife and to examine appropriate restoration options. In reaching the agreement, the Service and the District used Natural Resource Damage Assessment and Restoration (NRDAR) program principles. Under the Comprehensive Environmental Response, Compensation and Liability Act, the NRDAR program provides criteria that ensure restoration actions 1) focus on the protection and enhancement of affected species, 2) are sufficient to compensate for total estimated losses (including lost reproductive potential), and 3) encourage sustainable populations.

One immediate and significant benefit of the agreement was that the District paid \$10 million towards the purchase of 8,450 acres (3,420 hectares) that



Birds are now doing well on this restored habitat.

Jim Peterson/St. Johns River Water Management District



The Southeast breeding population of wood storks is showing signs of recovery with over 10,000 breeding pairs. The recovery is being accomplished by external partnerships, such as those with the state of Florida and the St. Johns River Water Management District, and internal partnerships such as those with the Service's Environmental Contaminants Program.

at the time were home to the second largest wood stork colony in northeast Florida. This property is now owned by the state of Florida and managed for wood storks and other wetland wildlife. The District has also monitored all wood stork colonies located on its lands (over 600,000 acres, or 243,000 ha) and provided support for the revision of the Habitat Management Guidelines for the Wood Stork in the Southeast Region, originally published in 1990. In addition, the District hosted a conference in 2004 on pesticide toxicosis and avian mortality issues, where information was presented regarding the die-off and strategies for preventing similar occurrences in the future.

Another important benefit of the agreement was the establishment of a joint District-Service working group that meets regularly with the common goal of safely restoring Lake Apopka's north shore marsh. The group is composed of District scientists, engineers, and managers; Service contaminant, recovery, and restoration program biologists; and NRCS restoration managers. The group began working prior to the 2003 agreement with the goal of developing ways to safely move forward with restoration.

The group's hard work has restored 7,200 acres (2,915 ha) of Lake Apopka's north shore marsh in areas where OCP contamination is low to moderate. Restoration was made possible by managing water levels in a way that inhibits the establishment of fish populations and discourages foraging by fish eating birds, which is accomplished by promoting the growth of dense wetland vegetation. To validate the effectiveness of these measures, the District and the Service conducted extensive studies. These field and laboratory studies have examined OCP levels in soils, invertebrates, amphibians, fish, and birds. Evaluating



James A. Rodgers, Jr., Florida Fish and Wildlife Conservation Commission

the effects of restoration activity on wood storks has been accomplished by using egrets as surrogate species. The lake restoration efforts, including those on the north shore, have reduced phosphorus levels by 62 percent and improved water clarity in Lake Apopka by 68 percent, leading to a resurgence of eel grass and other aquatic plants.

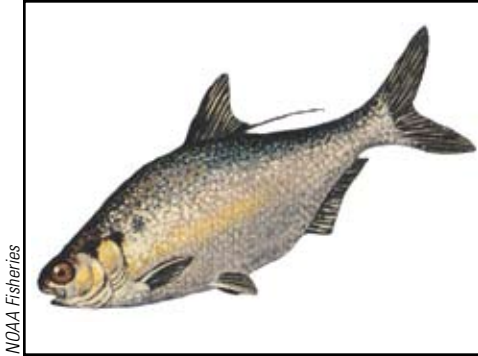
The southeast breeding population of wood storks is showing signs of recovery and for the first time since the early 1960s over 10,000 breeding pairs were documented during the 2006 nest census. Through the Lake Apopka agreement, the District, NRCS, and the Service have significantly contributed to the recovery of this endangered species by acquiring quality habitat and improving restoration science. Lessons learned from the north shore of Lake Apopka will benefit other restoration efforts across the country that are working to convert drained agricultural lands back to wetlands, including certain areas in the Everglades that are contaminated with OCPs. Indeed, as the wood stork population continues to grow, providing quality wetland habitat across its range will be important but difficult given that Florida's human population is expected to exceed 28 million by 2030. However challenging, we must find ways to restore habitat and ensure its quality if the wood stork is to take its place alongside other species that have completely recovered and dodged the bullet of extinction.

Dr. Heath Rauschenberger is an environmental contaminants biologist with the Service's North Florida Ecological Services Field Office in Jacksonville, Florida and a member of the Lake Apopka Working Group.

Waterbirds, including wood storks, died from organochloride pesticide exposure on north shore of Lake Apopka, Florida, in 1998-99. Investigations by the Service's Environmental Contaminants and Law Enforcement Programs led to an approximately \$40 million settlement to restore wood storks and other injured birds.

Developing Barriers to Biological Invasions

by Bob Pitman



NOAA Fisheries

The pathways used by non-native species are not always obvious. Many problematic species, diseases, and parasites have been transferred to new locations as undetected (and unplanned) hitchhikers. As many as 80 percent of endangered species may be threatened by pressure from non-native species.

Where sufficient documentation was available, introduced species were cited as contributing factors in 48 of the 69 fish listings made through 1991 under the Endangered Species Act. The Fish and Wildlife Service takes the position that no introductions are accidental, just unplanned. Responsible people and agencies evaluate their actions and take appropriate steps to make sure only intended species or materials are introduced. In fact, Executive Order 13112, issued in February 1999, states: "Each Federal agency whose actions may affect the status of invasive species shall not authorize, fund, or carry out actions that it believes are likely to cause or promote

the introduction or spread of invasive species in the United States or elsewhere." Unintended introductions result from failure to manage pathways and remove entrained organisms (e.g., those that enter through ballast water in ships).

The planning formula developed by industry to prevent food contamination has been adapted by the Service and its partners to help prevent unintended introductions of species and diseases. Hazard Analysis and Critical Control Points (HACCP) planning uses common-sense methods to help biologists and managers systematically identify hitchhikers (or hazards) and define actions that reduce the risk of spreading them through specific pathways.

In the early 1990s, gizzard shad (*Dorosoma cepedianum*) hitched a ride in a stocking of largemouth bass (*Micropterus salmoides*) fingerlings from Inks Dam National Fish Hatchery in Texas across the Continental Divide to Morgan Lake on the Navajo Reservation



The unplanned introduction of gizzard shad (above) into the Colorado River system may affect efforts to recover the Colorado pikeminnow (right) and other native fishes.



USFWS

in northwest New Mexico. Gizzard shad are prolific and ubiquitous throughout most of their native range, the Mississippi River basin. In their non-native habitat, they quickly multiplied from the small numbers introduced with the large-mouth bass and spread downstream to the Colorado River and Lake Powell. Biologists expect continued population expansion within the Colorado River system. We do not know how this non-native species will affect interagency efforts to restore native endangered fishes of the Colorado: the razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and Colorado pike minnow (*Ptychocheilus lucius*).

The Service responded to its error by making HACCP a permanent fixture to prevent future unplanned introductions. Universal use of the HACCP concept develops multiple layers of prevention and biological security for critical habitats and species. Planning support is

provided by the Service at www.HACCP-NRM.org.

The Aquatic Invasive Species Program within the Service's Fisheries and Habitat Conservation Program contributes to the recovery of threatened and endangered species by working to prevent additional introductions and controlling established invaders.

Bob Pitman, a Regional Aquatic Invasive Species Coordinator in the Service's Albuquerque, New Mexico, Regional Office, can be reached at bob_pitman@fus.gov.

Zebra mussels (*Dreissena polymorpha*) probably moved from European waters to the Great Lakes via ballast water in large ships. The small mussels, shown here encrusting a larger native mussel, have invaded many other U.S. waters, causing economic and environmental harm.

Alaskans are “Pulling Together”

by Dennis R. Lassuy

“Dithering and endangering are often linked.” (Soulé 1986)

When we hear about “invaders,” we often imagine the danger these interlopers pose is obvious and immediate. However, newly introduced species may not become invasive for decades after they arrive. In 1993, biologist W.R. Courtenay warned that “every introduction must be viewed as a potential biological ‘time bomb’ waiting to explode at some future time.” That same year, a national review of invasive species risks and management approaches (OTA 1993) added that “rapid response is essential.”

In this story, Alaskans are already pulling together – no dithering here!

Purple loosestrife (*Lythrum salicaria*), an ornamental plant of Eurasian origin, had been known in Alaska for years, but it was not considered problematic because it had not spread beyond cultivation. That changed in October 2005 with the news that Alaska’s first wild population of this wetland plant had

been discovered in an Anchorage area stream, Chester Creek.

Whether this invader’s newfound ability to spread to the wild was the result of local adaptation or global climate change, a potentially damaging invasion had begun. An initial weed pull was organized less than a week later, and last fall, partners from Girl Scouts to gardeners to state and federal conservation agencies “pulled together” with the Municipality of Anchorage in an attempt to halt the invasion before its impact spread to Alaska’s globally important wetlands.

Chester Creek flows from the Chugach Mountains through the heart of Anchorage and on into Cook Inlet, its course connecting mountain to sea and neighborhood to neighborhood. Not so long ago, a healthy population of silver salmon (*Oncorhynchus kisutch*) could be found in this stream, but their numbers began to decline greatly. By creatively bringing the prevention, rapid response, planning and restoration capabilities of a number of Service programs together with the passion and skills of our partners, we are working to prevent further decline and restore this largely urban watershed to health.

Being able to see the flash of silver salmon, whether along Arctic Boulevard in Chester Creek or in any other of the many streams that pass through city neighborhoods, is the goal of “Salmon in the City,” an ambitious partnership involving Anchorage, the Service, and many other government, private business, and individual citizen partners (<http://www.muni.org/salmoninthecity>).

The mouth of Chester Creek is the site of one of several projects in this watershed aimed at improving life for silver



Michael Shepard/USFWS

This stand of purple loosestrife threatened native salmon populations.

salmon and city residents. This project, supported through the Fish Passage and Partners for Fish and Wildlife programs and coordinated with the Southeast Sustainable Salmon Program, Coastal America, and other partners, will help Anchorage deal with troublesome culverts, poor existing fish ladders, and missing stream meanders. A few stream miles and several neighborhoods further up the watershed, another project supported through the Partners and Private Stewardship Grant programs seeks to recreate pools and meanders and restore native riparian vegetation. An intact stream from mouth to headwaters will restore that flash of silver, but only if we do not allow preventable threats from undoing our shared efforts.

And that is how the story of salmon restoration connects to the purple loosestrife invasion. The site of that invasion was between the two stream restoration projects. We could not let this invasion so fully overgrow native vegetation that it would block fish passage and push out native wildlife. So we pulled together.

With support from the Aquatic Invasive Species Program and the Coastal Program, the Service joined the Municipality of Anchorage and Anchorage Parks Foundation to create a

Citizen Weeds Warriors campaign, and the purple loosestrife pull was its signature event. This citizen-based campaign resulted in more than 120 volunteers putting in over 200 hours of labor and collecting more than 140 bags of invasive plants.

The Girl Scouts who helped with the pull also studied the value of native biodiversity and learned about other invasive species threats while earning their Invasive Species Patch (which happens to feature purple loosestrife). The Service's Alaska Regional Director Tom Melius and Anchorage Mayor Mark Begich together presented these future conservation leaders with their badges.

Another invader of the Anchorage area is the northern pike (*Esox lucius*), a voracious species of predatory fish that can wipe out a trout population or a salmon run in short order. The Aquatic Invasive Species Program, again working with the Coastal Program and in collaboration with the Alaska Department of Fish and Game, has developed public service announcements and other outreach tools to prevent its further spread and avoid declines in any other native fish species that might fall prey to this invader.

Maintaining diverse, self-sustaining fish populations capable of supporting



Alaska Department of Fish and Game

An invasive northern pike devouring a native trout.

recreational and commercial fisheries and a subsistence culture, and providing the nutrients that feed entire ecosystems, are essential to Alaska. Since no single Service program can do this alone, we reach across programs and to our many partners to achieve meaningful and lasting results.

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Dennis R. Lassuy is the Invasive Species Program Supervisor for the Alaska Region and is based in the Regional Office in Anchorage, Alaska.



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Volunteers are rehabilitating the riparian zone along this Town Center creek.

by Robert Bakal

NFHS Responds to an Emerging Conservation Challenge

A fish disease known as Viral Hemorrhagic Septicemia (VHS) is an emerging issue with important implications for people, commerce, recreation, and conservation. As is frequently the case, the National Fish Hatchery System's (NFHS) aquatic animal health experts are among the Nation's first responders to provide effective surveillance, diagnostic, and management capabilities when disease outbreaks occur.

The disease made big news in the summer of 2006 when it was implicated as the cause of massive fish kills in the Great Lakes. Scores of dead fish – sport fish and those with commercial

value – fouled the lake shores in Ohio, Michigan, New York, and Ontario. It is caused by an aquatic rhabdovirus, of which four strains have been identified. Three strains occur mainly in Europe and Japan, while the fourth has been found only in fish in North America, Japan, and Korea. First reported in the United States in 1988 in the Pacific Northwest, the virus was subsequently found in both wild and hatchery-raised salmon, Pacific herring, and Pacific cod populations off the coast of Alaska, Canada, and Washington. A sub-type of the North American virus has also been isolated from Atlantic herring and Greenland halibut in the Atlantic Ocean.

The ability of the VHS virus to cause disease varies by strain and by affected fish species. Our understanding of the virus changed drastically in 2005. Freshwater drum, previously thought not to be susceptible to the virus, suffered a massive die-off on Canada's side of the St Lawrence River. Later that year, the virus was isolated from a large muskellunge die-off in Lake Ontario. In December 2005, a VHS outbreak occurred on the U.S. side of the Great Lakes when round



Photo courtesy of Cornell University

Dr. Paul Bowser, Professor of aquatic animal medicine at Cornell University, holds a muskellunge believed to have perished from VHS.

goby, a non-native fish species, died en masse. Scientists, suspicious of VHS, then analyzed stored tissue samples of muskellunge that perished in 2003 in Lake St. Clair and found that they died from the disease, which marks the first known VHS outbreak in Great Lakes waters. Fourteen of the fish species that died in the Great Lakes in 2006 were previously not known to be susceptible to the VHS virus, and it appears the North American sub-strain of the virus is the cause.

How VHS arrived in the Great Lakes is not known, but it appears to be a recent arrival. It may have come from ballast water purged by shipping vessels, or it could have been carried by fish species that migrate to and from the ocean. Birds may also play a role in spreading the virus, as could anglers, recreational boaters, and even biologists if they fail to properly disinfect boats and gear moved between waters. Another potential vector is the movement of commercially caught baitfish. Emerald shiner, the most popular baitfish harvested from the Great Lakes, are susceptible to the VHS virus.

The manner in which massive numbers of multiple fish species in the Great Lakes have died from a virus formerly thought to affect solely marine species speaks to how populations of animals react in their first encounter with a new disease-causing pathogen. It also indicates that the virus has mutated in some manner. We do not know whether this mutation occurred before or after the virus was introduced into the Great Lakes watershed.

Currently, at least 40 freshwater and marine species are susceptible to the North American strain of the VHS virus. They include salmon, trout, pike, muskellunge, black basses, perch, walleye, drum, herring, cod, smelt, flatfishes, and others. Preliminary studies looking at Chinook salmon, steelhead, and lake trout in the Great Lakes show them to be susceptible to this new sub-strain of the virus, demonstrating significant levels of mortality. While the impact to sport fish

has been graphically evident in many large-scale fish kills, the potential impacts on threatened and endangered species is unknown. But the broad host range of the virus, coupled with the large kills, suggests strong actions are needed to prevent this virus from moving into other populations.

Fish that survive VHS infections can be lifelong carriers, capable of spreading the virus. Inoculating fish in the wild is impossible; control methods for VHS currently rely on fish health surveillance programs and measures such as eradication and fallowing culture facilities (removing fish and water, then letting the facilities dry for a time). The virus could move to new species and new waters outside the Great Lakes drainages. The Division of the NFHS employs Hazard Analysis and Critical Control Points planning to prevent the spread of the virus.














The issue of VHS is a serious one, and with experience as a guide, the NFHS will address it as it did the emergence of Largemouth Bass Virus and Spring Viremia of Carp Virus. We are already working on another front of animal health with the emergence of *Batrachochytrium dendrobatidis*, commonly called chytrid fungus. This fungus has caused worldwide declines and extinctions of amphibian species. In the U.S., the Chiricahua leopard frog, mountain yellow-legged frog, California red-legged frog, and Wyoming toad have each had populations devastated by the fungus.

The Division of the NFHS works with its partners, the Department of the Interior, and the Congress to find creative ways to deal with these emerging conservation issues in a rapid, efficient, and effective manner.

Dr. Robert Bakal, DVM, is the Aquatic Animal Health Coordinator, Division of the National Fish Hatchery System. He can be reached at robert_bakal@fws.gov

BOX SCORE

Listings and Recovery Plans as of January 29, 2007

GROUP	ENDANGERED		THREATENED		TOTAL LISTINGS	U.S. SPECIES W/ PLANS
	U.S.	FOREIGN	U.S.	FOREIGN		
 MAMMALS	69	255	13	20	357	54
 BIRDS	76	175	15	6	272	80
 REPTILES	14	65	23	16	118	35
 AMPHIBIANS	13	8	10	1	32	16
 FISHES	75	11	62	1	149	98
 SNAILS	25	1	11	0	37	30
 CLAMS	62	2	8	0	72	69
 CRUSTACEANS	19	0	3	0	22	18
 INSECTS	47	4	10	0	61	33
 ARACHNIDS	12	0	0	0	12	6
ANIMAL SUBTOTAL	412	521	155	44	1,132	439
 FLOWERING PLANTS	570	1	143	0	714	605
 CONIFERS	2	0	1	2	5	3
 FERNS AND OTHERS	26	0	2	0	28	28
PLANT SUBTOTAL	598	1	146	2	747	636
GRAND TOTAL	1,010	522	301	46	1,879*	1,075

TOTAL U.S. ENDANGERED: 1,010 (412 animals, 598 plants)

TOTAL U.S. THREATENED: 301 (155 animals, 146 plants)

TOTAL U.S. LISTED: 1,311 (567 animals**, 744 plants)

* Separate populations of a species listed both as Endangered and Threatened are tallied once, for the endangered population only. Those species are the argali, chimpanzee, leopard, Stellar sea-lion, gray wolf, piping plover, roseate tern, green sea turtle, saltwater crocodile, and olive ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.

** Eleven U.S. animal species and five foreign species have dual status.

ENDANGERED
Species
BULLETIN

*U.S. Department of the Interior
 Fish and Wildlife Service
 Washington, D.C. 20240*

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