Patuxent Wildlife Research Center

Department of the Interior / U.S. Fish and Wildlife Service

The Patuxent Wildlife Research Center was established in 1936 as America's first national wildlife experiment station. And over the years, the Center's mission has remained unchanged—to help protect and conserve the Nation's wildlife and natural environment through research on critical environmental problems and issues.

Today, research at the Center and at its field stations throughout the United States focuses on problems of three Fish and Wildlife Service Programs: Environmental Contaminant Evaluation, Endangered Species, and Migratory Birds. The lands of the Center constitute an outdoor ecological laboratory where intensive studies have been going on since 1945.

The Center is located near Laurel, Maryland, midway between Washington and Baltimore. Most of the land it now occupies was originally part of the 10,000-acre estate acquired in 1658 by Major Richard Snowden, a Welsh immigrant. The land was cleared and cultivated, and over time, divided into smaller holdings. Eventually the soil was depleted. During the 1930's, much of the area was classed as submarginal farmland and taken over by the Resettlement Administration.

In 1936, President Roosevelt transferred 2,670 acres to the Bureau of Biological Survey, now the U.S. Fish and Wildlife Service. Snowden Hall, one of the old manor houses, was modified and reoccupied, and colonial-style laboratories were built. Research began with ecological studies of the flora and fauna of the area and with studies of the effects of the food resource and nutrition on wildlife populations.

The Center now occupies 4,700 acres in the Patuxent River valley. Its boundaries include upland forests of oak and pine, terrace woodlands, bottomland hardwood forests, brushy fields, and grassy meadows. Perhaps the finest scientific nature preserve near any metropolitan area, it supports a rich variety of wildlife. Portions of the Center set aside for experimental research now provide one of the few places in the United States where investigators have the space to raise and maintain the colonies of wild birds and other animals needed for large-scale controlled studies and the propagation and study of endangered species.

ON THE COVER—Patuxent's wetlands are part of the ecological diversity which makes it an ideal nature preserve, as well as a research center with activities ranging from the study of environmental contaminants to recovery of the endangered whooping crane.

Rich in history, the Center conducts its modern-day research in such stately buildings as Snowden Hall (left), C. Hart Merriam Laboratory (right inset) and in the outdoor laboratory the grounds provide (left inset).

Patuxent researchers have evaluated environmental contaminants for three decades—since wildlife showed sudden, sharp declines due to DDT.

Environmental Contaminant Evaluation

Research and experimental facilities occupy 19 buildings which are equipped to provide the capability for advanced studies in the laboratory sciences. The buildings also house a research library and offices for research and administrative staff.

Research to measure and predict the impact of environmental contaminants on wildlife began at the Center in 1945 with studies of DDT. The chemical had not yet been released for public use, and it was long before the nationwide concern over the environment.

From the beginning, the research was an integrated effort that focused on environmental problems and real exposure levels. Field research posed the questions and defined the problems; experimental studies measured effects under controlled conditions and established scientific proof. The team effort included scientists of many disciplines: chemists, physiologists, behaviorists, ecologists, and biometricians. As an array of new man-made chemicals was introduced in the 1950's research was expanded to evaluate the wildlife effects of many new compounds used extensively in public programs and for farm and garden pest control. Serious problems were soon evident. The long-lasting compounds were spreading through the environment and accumulating in the tissues of wild animals, sometimes to levels that caused mortality. But more subtle, as yet undetected effects were occurring.

By the 1960's, populations of peregrine falcons, ospreys, brown pelicans, and eagles had declined alarmingly. Birds in the field failed to produce enough young to maintain their numbers. It was discovered that thin shells and cracked eggs were correlated with residues of DDE, a breakdown product of DDT, in birds and eggs. But such correlations, although strong evidence,

DDT research and other experiments have been conducted with barn owls, among other susceptible species; one of the Center's gas chromatographs analyzes animal tissues for pesticides and other residues.

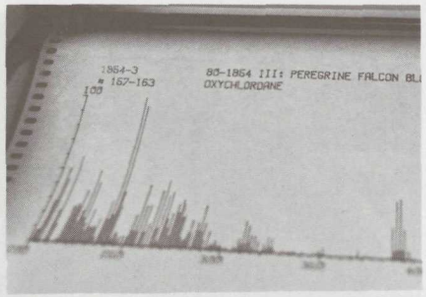
could not be held as proof. Convincing cause-and-effect evidence was provided by Patuxent experimental studies with mallard ducks. All the problems that had been seen in the field were produced in birds fed low doses of DDE, while the control-birds (those of the same age and kind, but fed untreated feed) produced normal eggs and healthy ducklings.

This key experiment was subsequently repeated and verified at Patuxent with kestrels, owls, and black ducks, and by scientists elsewhere with mallards. The chain of evidence was completed in the 1970's when field studies of pelicans and other species showed that populations increased as DDE residues in eggs declined, following reduced use and the ultimate ban of DDT.

Concern for the unintended adverse effects of pesticides has increased in recent years and much effort has been made by both government and industry to develop chemicals and integrated pest control systems that will minimize environmental damage. Patuxent scientists have contributed to this effort through field and experimental studies of newer compounds to help identify those that will have the fewest harmful effects.

A newer focus of the Center's research has been industrial chemicals such as lead, mercury, cadmium and petroleum which reach the environment as a result of mining smelting, energy development and other industrial processes. In one multi-generation experiment with mallards, scientists found that low levels of methyl mercury (similar to exposures in the wild) significantly impaired reproduction. In another experiment, investigators discovered that five microliters (30–40 microliters make up a single drop) of oil deposited on the shells of mallard duck eggs resulted in 98 percent embryo mortality. Results were verified in both field and laboratory studies of eiders and gulls, and in studies which showed that incubating hens could carry harmful amounts of oil on their feathers and damage their eggs.

Patuxent scientists have learned that less than a drop of oil placed on a mallard's egg kills the embryo; redheads and canvasbacks (above) are other ducks assessed for sensitivity to various contaminants. Black-crowned night herons (left inset) and starlings (right inset) are among 18 non-endangered species used in these studies.



With a Patuxent scientist at the controls, a mass spectrometer produces a print-out showing contaminant levels in a peregrine falcon's blood.

As many as 18 species of non-endangered birds are studied in Patuxent laboratories (and many more in the field). They include raptors such as barn owls, screech owls, and sparrow hawks. Starlings, red-winged blackbirds, and cowbirds substitute for the scarcer kinds of songbirds. Waterfowl include mallards, black ducks, canvasbacks, redheads, and hooded mergansers. Studies of a colony of black-crowned night herons help to understand the effects of contaminants on wading birds. Eastern bobwhite quail represent the galliform group, which includes pheasants, grouse and turkey.

Some investigations seek to find out how different combinations and levels of contaminants affect reproduction. With large numbers of birds available, it is possible to simulate actual exposures in the wild—feeding birds varying levels of contaminants over long periods of time. Other experiments determine what dosages may cause death. Still others gauge how long a contaminant remains in a bird's body and at what rate the substance is metabolized and excreted. Another range of tests, using specially designed equipment, precisely measures the effects of a contaminant on a bird's central nervous system and learning patterns.

Much of Patuxent's research requires painstaking, complex chemical analysis of residues in the tissues of birds and other animals. The Center's analytical laboratory is one of the most modern and best equipped in the nation. Using sophisticated instruments such as atomic absorption spectrophotometers, gas chromatographs and mass spectrometers, chemists analyze samples for pesticides, heavy metals and other chemicals. Analyses include samples as diverse as the tissues of black-crowned night herons from New Jersey, Canada geese from Oregon, roseate spoonbill eggs from Texas, alligator eggs from Florida, and earthworms from Pennsylvania. Bald eagles found dead anywhere in the United States are sent to the laboratory for chemical analysis.

As the threats from environmental contaminants have evolved and multiplied, the job of the Center has become more complex. The goals of the program, however, remain the same: to help protect wildlife populations and habitats by identifying harmful environmental contaminants and recommending procedures that will alleviate the problems.

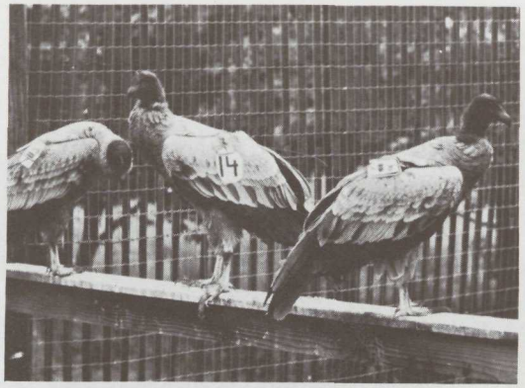
While whooping cranes are studied and propagated at Patuxent to complement field activities, other species, like the red wolf (shown tranquilized) are studied exclusively in the wild.

Endangered Wildlife Research

Tucked away in the woodlands and fields of Patuxent behind locked gates and electrified fences are some of the world's rarest wildlife—species such as whooping cranes, Mississippi sandhill cranes, and Aleutian Canada geese. Scientists are studying and propagating these species in order to better understand their biological requirements for survival.

The program, begun at the Center in 1965 as an outgrowth of efforts to rescue the whooping crane, has two primary approaches for enhancing the likelihood of survival of threatened and endangered wildlife. The first is ecological study of species in the field. Biologists are located at field stations from Puerto Rico through the contiguous United States to Hawaii. The second is research on the physiology, reproduction, behavior, nutrition, and veterinary aspects of animals threatened with extinction. These studies are conducted by scientists located at the Center and provide support to the field ecological studies. Captive propagation has an additional role as insurance against natural disaster that could wipe out existing wild populations.

Patuxent scientists stress that captive propagation is not a cure-all, but rather a useful—sometimes critical—supplement to management techniques and protective regulations. The major projects undertaken at the Center usually involve nearly extinct species—those that have dwindled to a handful, are restricted to a narrow range, and reproduce slowly. Thus, efforts to restore species such as the whooper, the Mississippi sandhill crane, the Puerto Rican parrot, and the California condor are complex and will probably continue for years.



Patuxent-raised Andean condors, themselves endangered, have been fitted with solar-powered radio transmitters and released for tracking to learn more about condor ecology, which will also aid attempts to restore the California condor.

To meet this challenge, new knowledge and innovative techniques have been developed. For example, egg production among endangered birds has been dramatically increased by removing eggs soon after they are laid. The birds then lay additional eggs. Whooping cranes in the wild, for example, typically lay two eggs each year, whereas whoopers in captivity have been induced to lay as many as 11! Also, California condors generally lay one egg every 2 years in the wild, but, through various techniques for enhancing production, captive Andean condors, at least, can produce two eggs each year, and masked bobwhites may lay 50 or 75 eggs in a season.

Other successful management techniques have been evolved. The normal breeding season of whooping cranes and Aleutian Canada geese has been lengthened by using special floodlights to simulate the longer daylight hours in far northern nesting grounds. New methods of artificial insemination have been devised to improve the fertility of whoopers and Mississippi sandhill cranes. In addition, a cryogenic semen bank (semen stored at —196° C) is being developed for various species of birds. Patuxent provides scientifically balanced diets, veterinary supervision, strict sanitation, roomy pens with ample cover, and an undisturbed environment—all needed to make these innovative approaches successful.

In developing husbandry and breeding methods, the scientists also rely on surrogates—common species that are closely related to their endangered relatives. Greater and Florida sandhill cranes are surrogates for the whoopers and Mississippi sandhill cranes, Andean condors (themselves endangered) for California condors, and eastern bobwhite quail for masked bobwhites. By using surrogates during development testing, unnecessary risks to the endangered species are avoided.

Patuxent researchers use artificial insemination to increase whooper reproduction in captivity (left), and transplant fertile eggs to sandhill crane nests in Idaho (above).

The ultimate goal of the program is to restore the numbers of presently endangered species in the wild. This difficult task requires truly innovative techniques. For example, a new flock of whooping cranes is being established at Grays Lake National Wildlife Refuge in Idaho by placing captive-produced whooper eggs in the nests of greater sandhill cranes. The sandhills act as foster parents for the newley-hatched whoopers. Young whooping cranes raised by sandhills at Patuxent—young which retain their wild instincts—also are being transplanted to the Idaho site.

The process is painstakingly slow, but there have been heartening successes: The Patuxent whooping crane colony numbers around 24 birds, and a new flock, in addition to the single established flock which migrates from Canada to Aransas National Wildlife Refuge in Texas, is gaining a foothold in Idaho. The young whoopers are learning a new migratory route from their foster sandhill crane parents, flying from Idaho to Bosque del Apache National Wildlife Refuge in New Mexico.

Over 60 Aleutian Canada geese at the Center are producing stock for release in their former habitat in the Aleutian Islands off Alaska. And masked bobwhites, which can be produced in the thousands each year, are gradually becoming reestablished in their old prairie range in Arizona. With the combination of habitat protection and propagation, Patuxent biologists in Puerto Rico have nearly doubled the Puerto Rrican parrot population, which reached a low point of some 23 birds in 1975. Such successes are hard won, but the reward is the survival of species that otherwise would surely disappear forever.

The whooper chicks that hatch in Idaho (right) are raised by surrogate sandhill cranes and learn their migration route from the sandhills (inset), a vital step in establishing a second wild flock.

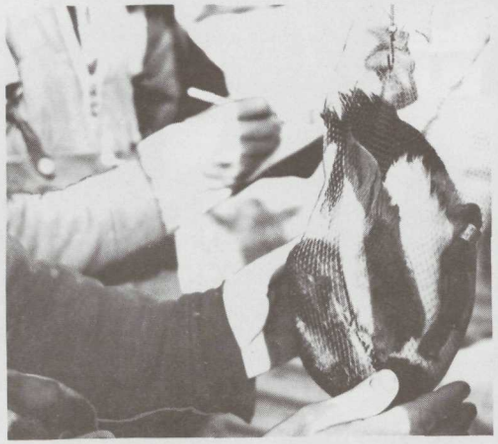
Canvasback ducks of the Chesapeake Bay may benefit from banding studies designed to show habitat preference by age and sex.

Migratory Bird Research

Research on migratory birds combines complex statistical analysis and traditional field work to generate information needed for the management and conservation of migratory species. Research on migratory birds at Patuxent plays several roles—devising methods of assessing the status of various species; investigating reasons for declines in particular bird populations; and developing data to aid in solving specific management problems.

Techniques of surveying game birds, for example, are far better perfected than those for censusing non-game species. So, biologists designed an annual breeding bird survey in which skilled and knowledgeable volunteers record calls of non-game species along some 1,700 carefully plotted road routes throughout the country. In addition, scientists seek ways to overcome such difficulties as accounting for birds that seldom call, or that live in roadless, inaccessible areas. Once the survey is thoroughly perfected and evaluated, it may become an important management tool in determining the distribution and upward or downward trends of non-game species.

If a species is dwindling in numbers, the research scientists determine what factors are involved and what measures might be taken to halt and reverse the decline. When it was discovered that the number of canvasback ducks was decreasing, the biologists focused on those birds wintering on the Chesapeake Bay. Each winter hundreds of canvasbacks are banded, weighed, and then released. By recapturing the banded birds and measuring changes in their condition, the biologists hope to gauge survival rates and obtain other important data. With this information, they can learn whether the population decrease is widespread or local, and whether deteriorating environmental conditions on the Bay might be responsible.



Canvasbacks are weighed, banded, and released as part of the Chesapeake Bay study.

Much of the research is carried out in the laboratory rather than in the field. Biological statisticians analyze existing information such as bird banding records, much like economists who study data from the Bureau of Labor Statistics. Using bird banding and recovery reports and harvest survey results, for example, the scientists developed sophisticated computer models showing that annual hunting regulations and harvests have not reduced overall survival rates of mallards, the most important North American waterfowl species.

Often migratory bird researchers are called on to investigate management problems. For example, concerns have been voiced that hunting mourning doves during September would endanger the survival of newly-hatched young. Accordingly, Patuxent's scientists designed an extensive study, in cooperation with some 30 State conservation departments, to determine the nesting success of mourning doves in areas where hunting was and was not permitted during the month of September. Results to date reveal no important difference in overall nesting success.

Finally, the researchers are trying to learn more about the habitat requirements of migratory birds. But instead of focusing on individual species, scientists now are looking at ecosystems and studying birds in different habitats. In a hardwood forest, for example, some species such as woodcock, are associated with brush and young trees. Other birds live in mature areas of the forest. Some are ground feeders, and still others inhabit the forest canopy. The complex task is to learn how various species interact with their habitats so managers can ensure that requirements of all birds are met.

Good urban planning can mean an increase in desirable songbirds.

Not all wildlife species need wilderness. Indeed, Patuxent's urban wildlife program, a part of the Fish and Wildlife Service's Migratory Bird Program, is showing that wildlife can thrive in cities and suburbs—given proper land use planning and building design.

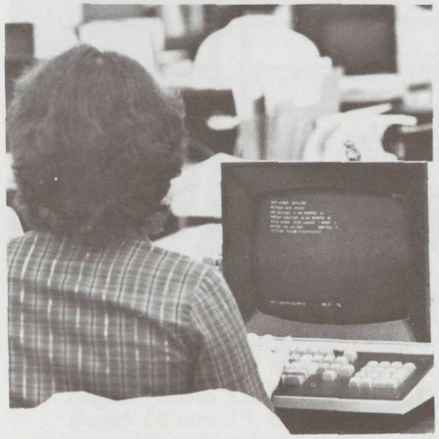
Urban wildlife research has used the "new town" of Columbia, Maryland, located between Baltimore and Washington, and other nearby urban areas, as a laboratory. A new bird counting technique, which surveys 100-yard square plots in a wide range of locations, has shown that populations are much denser in small, heavily landscaped lots than in larger, more open lawn areas. As apartments and houses rose in former farmland, some species increased and others declined. Field species such as meadowlarks, quail, and mourning doves became scarce, while cardinals, chipping sparrows, and other species increased.

Nuisance birds such as starlings and pigeons also are very much at home in urban settings. Yet these birds were not randomly scattered, but were concentrated in certain neighborhoods. Patuxent staff discovered that building design features in these areas attracted the birds—features such as boxed eaves and widely louvered vents that left spaces for nesting. Other similar neighborhoods where construction was better and certain design features were absent were free of nuisance species.

Several plots adjacent to housing that had been left in their natural state and were covered with underbrush and small trees were rich in wildlife. Studies are underway to learn how to develop such natural areas which would provide food and cover to birds and also be attractive to the people living nearby.

Results of these studies all point to the conclusion that wildlife and new development can coexist to provide a needed dimension to urban living.

Facing page. Biologists give advice to developers in order to enhance human-inhabited areas for wildlife. For example, mowed fields provide little habitat (top), but when allowed to grow into meadows (bottom) are likely to attract varied wildlife.



Specialists enter band report information into the lab's computer system which has some 39 million records on file.

Branch of Surveys
Office of Migratory Bird Management

Ornithological societies began accumulating bird banding records as long ago as 1902. Since then, more than 39 million birds have been banded. Most of the files containing these records, together with the records of some two million band recoveries, are now housed at the Center's modern Gabrielson Laboratory. This unique store of information is administered by the Office of Migratory Bird Management's Patuxent-based Branch of Surveys in cooperation with the Canadian Wildlife Service.

The banding records are widely used to manage the waterfowl resource, both in the United States and in Canada. The data are invaluable in determining the distribution, migratory routes, breeding age, productivity, territories, renesting efforts and other life history information for various species. Bird manuals, guides and other reference and research words draw heavily on the Patuxent banding records for such information. Biologists interested in the status of various species rely on the banding and recovery data on file here. For example, investigators documented the decline of East Cost osprey colonies from detailed banding and recovery data—a decline later traced to the effects of DDE on reproduction.

Each year approximately one million new banding reports flow into the Center from 2,000 officially certified master banders and approximately 2,000 sub-permittees. Each band number entry includes the bird's species, age, sex, and when and where it was banded. After the national bird banding records were turned over to the Bureau of Biological Survey in 1920, entries were put on file cards. Since the early 1960's, all

Of more than two million bands placed on birds annually, reports of 70,000 are submitted by researchers, hunters, and private citizens (left) to the Gabrielson Laboratory (inset), providing information for managing waterfowl and other bird species.

Biologists receive wings from cooperating hunters to get specialized information on each year's waterfowl harvest.

the information has been fed into computers, where it is readily available. Some 70,000 band recoveries are reported annually, and the location of each is pinpointed by using large scale maps for reference. The proportion of bands recovered varies widely between species. Recoveries of banded waterfowl may amount to 10 to 20 percent of the total number of banded but for seabirds or songbirds fewer than one band in 100 may be reported.

The Branch of Surveys also develops annual estimates of the waterfowl hunting harvest throughout the United States (including Alaska). To prepare these estimates, a record of the number of Migratory Bird Hunting and Conservation Stamps sold at each of 16,000 post offices throughout the country is obtained through the cooperation of the Postal Service. A questionnaire is then sent to a random sample of hunters who purchased their "Duck Stamps" at these post offices. Approximately 70,000 hunters responded to these questionnaires. From these data, biologists determine the percentage of stamp buyers who intended to hunt, the percentage who did hunt, their average seasonal bag of ducks, geese, and coots, as well as the average number of days of hunting recreation.

Finally, another group of cooperating hunters receives packets of envelopes with requests for one wing from every duck shot. Approximately 70,000 wings are received annually, and from these wings, biologists estimate the species, age, and sex composition of the previous year's waterfowl harvest and the geographic and chronological distribution of that harvest.

These data are used primarily as background information during the setting of hunting regulations, but many findings are also supplied to research biologists, wildlife managers, and others who need detailed information on the annual harvest of waterfowl.

Photographs

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Department of the Interior
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