United States Department of Agriculture
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Wildlife Services
NWRC
National Wildlife Research Center

Research Update Summer 2007

Wildlife Services

Vision and Strategic Goals

The U.S. Department of Agriculture's Wildlife Services (WS) program provides Federal leadership in managing problems caused by wildlife. Four important goals have been identified as part of WS' strategic plan to improve the coexistence of people and wildlife: Developing Methods, Providing Wildlife Services, Information and Communication, and Valuing and Investing in People. This research update contains short summaries of WS National Wildlife Research Center (NWRC) activities supporting these goals that occurred between October 1, 2006 and May 31, 2007.

For a more comprehensive description of the NWRC's research and related activities, please visit the Center's website at http://www.aphis.usda.gov/ws/nwrc.

Spotlight on NWRC Rice Research

Blackbird Damage

"John, if we get this compound registered, and get it for rice, I'm going to have a bronze statue made of you," declared Dwight Hardee, rice producer and member of the Louisiana Rice Association, "and we're going to put it right here outside my house."

Hardee's comments to John Cummings, NWRC Research Wildlife Biologist, indicate some of the frustrations involved in developing new tools for managing blackbird damage to rice. They also reflect gratitude for the hard-work and persistence shown by NWRC scientists in trying to fulfill objectives of the rice research project at the Center.

Rice work at NWRC is, in fact, a story not only of research but of relationships.

"I've been involved in rice work for more than 15 years, starting in the early '90s," noted Cummings. "I've kind of grown up with the rice farmers, and from a personal standpoint, it's been a great relationship because I've made good friends. Some are fun; some are very hardcore – giving you trouble about why you aren't progressing as fast as they'd like."

"They've also been very helpful from a political standpoint and very supportive," he added.

Dr. Mark Tobin, NWRC Agriculture and Resource Protection Program Manager, agrees. "I think John and his group have really leveraged their resources to bring in additional funding from cooperators, stakeholders, and private companies."

Blackbirds damage about $21 million dollars worth of rice annually in several rice-growing states. Before NWRC and Wildlife Services (WS) Operations became involved in rice work, farmers primarily tried to haze birds out of fields. They were virtually empty-handed when combating millions of birds at both planting and harvest. NWRC's research benefits the whole rice-growing area of the mid-south, including Texas, Louisiana, Missouri, and Arkansas. Research has focused on identifying local and regional movement patterns of blackbirds; on development of more effective nonlethal methods, particularly repellents; and on maintaining and updating Wildlife Services supportive data for using toxicants such as DRC-1339. Additional studies have looked at reducing impacts to nontarget species and chemical residues in the environment.

History of Rice Research

The Center has worked on blackbird damage to rice for decades. Some of the work was done at the Bowling Green, KY, and Gainesville, FL, field stations, and some at the Center's previous headquarters in Denver, CO. Cummings has worked with blackbirds since the 1970s, and with blackbirds in rice since the early 1990s.

"I especially remember the first study of my career," he said, "because I had never in my life traveled out of the state of Colorado. Within two weeks of coming to work for the Bird Program, I was on my way to Mayville, WI, to work on sweet corn and blackbirds. My involvement in rice damage came about in 1992-93 with DRC-1339 – the toxicant that we use to manage blackbirds. EPA (the U.S. Environmental Protection Agency) had requested additional data on the product and that's where I got involved.

"Additionally, about 1994, there was a congressional directive that mandated WS Operations to do blackbird management work in a couple Louisiana parishes – Vermillion and Calcasieu. Along with that, the Center was directed to do research on the problem. The original directive wasn't big – probably about $150,000 – but it carried on for years."

In the mid-1990s, when the Center first instituted a project management system, all blackbird work-both in rice and in sunflowers – was consolidated under one project. In 1999, blackbird work was split into separate rice and sunflower projects. The first rice research project lasted from FY00-FY04, and was renewed in FY05. It has successfully met its objectives.

Successes

In chemical-screening work at NWRC in the 1960s-1980s, thousand of chemicals were screened by Don Cunningham, Ed Schafer and others in hopes of identifying useful repellents or toxicants. This screening resulted in identification of the toxicant DRC-1339, and the repellent, Mesurol (methiocarb). DRC-1339 was eventually registered with EPA for use on blackbirds as a result of cooperative studies between NWRC and a private company. Mesurol was registered for grapes, cherries, corn seed and other crops, including, for a short time, rice. Shortly after Mesurol's registration, carbamates such as methiocarb came under increased scrutiny by EPA. EPA's request for additional studies to support continued registration proved to be cost-prohibitive and the registration was dropped by both the government and private sectors.

In the 1990s and 2000s, under the rice research project, more than 100 individual protocols were developed at NWRC for research to expand management strategies for reducing blackbird damage to rice. Two important objectives of the projective were to develop an effective nonlethal repellent and to keep DRC-1339 as a blackbird management tool by instituting studies to respond to EPA data requests.

Though not yet registered with EPA, a repellent that has shown promise in recent studies is anthraquinone (marketed as Flight Control® by Arkion). In the early to mid-2000s, funding has been lacking for studies necessary to comply with EPA registration data requirements, and registration for anthraquinone has been delayed. However, there is renewed interest in anthraquinone because of its recent registration for Canada geese on turf and a potential registration for its use as a seed treatment on corn for cranes and pheasants. NWRC scientists hope to pursue studies in the coming year to facilitate registration of this product for rice.

In addition to uncovering promising repellents, under rice project objectives, NWRC has developed a standardized, bioenergetics-based model for estimating target take of birds on DRC-1339 bait sites. NWRC has also collected data to help support registration of DRC-1339 for use on blackbird staging areas in rice-growing regions.

"We've gone beyond what EPA required," said Cummings, speaking of DRC-1339. "We've done considerable nontarget acute toxicity work; we've redone a lot of the earlier toxicity data that were based on smaller samples."

"John has conducted laboratory and field studies on not only the effectiveness of DRC-1339, but also on modification to the application equipment so it works more efficiently," noted Tobin. "This is a joint effort with the Missouri WS program."

Another useful tool developed under blackbird/rice project objectives is a bird mass-marking technique. The technique involves aerially spraying a DayGlo® paint pigment on large roosts of millions of blackbirds. Multiple colors can be used to identify individual roosting sites, and marking success is usually more than 90%.

"We've gotten very good at marking large concentrations of birds," said Cummings. "In one season, we were able to identify which areas up north had birds migrating to Louisiana. We were also able to track where the roosting birds dispersed to in the spring. The information has been used in NEPA (National Environmental Policy Act) documents to help support the use of DRC-1339."

A Cooperative Effort

Cummings' work with individuals and organizations has expanded cooperation among stakeholders, farmers, producers, and other interested groups. The blackbird management program that was initiated in Louisiana has now expanded to other states including Texas and Missouri.

Both Cummings and Tobin also acknowledge the many contributions from others at the Center and in Wildlife Services Operations including research biologist Scott Werner; John Eisemann in the NWRC Registration Unit; Jerry Hurley and Tom Primus, NWRC chemists who contributed to bait formulations and residues analyses; Jean Bourassa and his GIS work; Mike Avery and his employees at the Gainesville, FL, field station who helped on mass-marking sprays; and WS Operations personnel who assisted in field collections.

A Biologist and Blackbirds

Though blackbirds cause extensive damage to rice and are responsible for the loss of millions of dollars every year, biologist Cummings still maintains an appreciation for the species.

"I love them," he said. "The red-winged blackbird is my favorite bird. I think the males are beautiful, especially in massive flocks. Many years ago, when I was working in a big cattail marsh in Illinois, there were probably over 1 million male red-winged blackbirds. When they would leave in the morning they would look like a big smokestack. They would just appear on the horizon and move different directions up and down and pretty soon they would come right at you – it was an incredible sight to see."

Going Forward

NWRC rice work is a research success story. Maintaining partnerships with rice cooperators and shareholders and ensuring availability of tools for rice farmers and producers will remain significant elements of future Center efforts to protect American agriculture.

Center Update

NWRC Realigns Research Programs

In May 2007, NWRC realigned its organizational structure and related Project Management system to better address WS Program, Agency and Departmental priorities. This new project alignment permits NWRC to continue to effectively address both the current and rapidly emerging new priorities of APHIS, the WS Program and the Center in the area of human-wildlife conflict mitigation.

Though the vision and goals of the new APHIS Strategic Plan for 2007-2012 still highlight agricultural and plant health, they also encourage a stronger emphasis on invasive species, emerging wildlife diseases, such as avian influenza, and emergency response. These APHIS goals are consistent with USDA's 2005-2010 Strategic Plan priorities to "Enhance Protection and Safety of the Nation's Agricultural and Food Supply," and "Reduce the Number and Severity of Agricultural Pests and Disease Outbreaks."

As a result of this new emphasis, the Center's current research projects have been realigned under three new Research Programs:

- Agriculture and Resource Protection – focuses on reducing wildlife damage to crops, aquaculture facilities, and timber resources; developing new repellents; reducing predation losses to livestock and property damage; and examining the ecology, behavior and management of mammalian predators.

- Invasive Species and Technology Development – develops methods for reducing invasive species damage to native wildlife and ecosystems; and encompasses studies for pesticide registration, formulation chemistry, chemical analysis, benefit-cost analysis and wildlife contraceptive development.

- Wildlife Disease – explores ways to reduce the spread of diseases and their transmission from wildlife to humans and domestic animals; monitors wildlife pathogens; provides risk assessments for agriculture and human health and safety; and assists WS operations in surveillance and monitoring efforts.

Construction Update – NWRC's 43-acre headquarters campus is located on Colorado State University land in Fort Collins, CO. During fiscal year 2007, several planning and construction activities took place, related to completing the Master Plan for the NWRC site.

- **Invasive Species Research Building** – On December 6, 2006, WS celebrated the opening of its new 25,000-sq-ft Invasive Species Research Building (ISRB). More than 100 people attended the opening ceremony, including representatives from USDA, General Services Administration (GSA), Everitt/Keenan Associates and Colorado State University (CSU).

  The facility, built by the GSA and Everitt/Keenan Associates (a private developer),

expands upon NWRC's existing capabilities to conduct wildlife research by providing a state-of-the-art facility to properly care for and study invasive wildlife. The ISRB also enhances NWRC's ability to study the ecology, biology, behavior and physiology of invasive wildlife species and to develop management tools and strategies for mitigating their damage and controlling their spread. The building is designed to simulate temperature and humidity ranges from temperate to tropical ecosystems. The flexibility of these environmental controls allows for the year-round study of invasive wildlife species. Examples of invasive species NWRC will study in the facility include nutria; Norway, roof and Gambian giant pouched rats, European starlings; brown treesnakes and Caribbean tree frogs.

- **Biosafety Level-3 Suite** – In early 2007, the Biosafety Level-3 (BSL-3) laboratory suite opened at the NWRC Fort Collins campus. The new 2,500-sq-ft suite is located in the existing Animal Research Building (ARB) and includes two large animal research rooms, six smaller animal rooms, a virology laboratory, and showers and autoclave rooms for decontamination of staff and clothing. The suite contains four levels of protection for the safety of NWRC staff and the surrounding community, as well as air locks and separate HEPA (high efficiency particulate air) filtered air-ventilation systems.

  NWRC's Master Plan includes the development of a larger Wildlife Disease Research Building. Until the completion of that building in 2010, the smaller BSL-3 suite in the Center's ARB provides an intermediate solution to WS BSL-3 research needs. Wildlife disease biologists are able to (1) study the ecology and epidemiology of endemic, emerging and foreign animal diseases in wildlife, (2) carry out research concerning management of wildlife diseases impacting U.S. agriculture and human health and safety, (3) determine host ranges of pathogens, and (4) carry out vaccine efficacy and challenge studies. The first studies to be conducted in this new suite include experimental infections of small peridomestic mammals (such as mice, squirrels and rabbits) and wild birds with West Nile virus.

  Anticipated future animal and laboratory studies will be conducted using BSL-3 agents such as histoplasma, Saint Louis encephalitis virus, highly pathogenic avian influenza, Rift Valley fever, and bovine tuberculosis.

- **Wildlife Disease Research Building** – WS is working to construct a new BSL-3 Ag research facility called the Wildlife Disease Research Building (WDRB) at NWRC's headquarters campus. The new facility will greatly expand WS' capabilities to respond to wildlife disease emergencies and resolve important disease issues that involve livestock-wildlife and human-wildlife interactions.

To support both experimental and field investigations, a complete laboratory infrastructure and animal testing capability will be included in the new BSL-3 Ag research facility to provide support for diagnostics methods development, vaccine development, risk assessments, and wildlife disease surveillance and monitoring activities. Diagnostic methods development will include rapid diagnostics for diseases in wildlife, such as avian influenza, rabies, tuberculosis, West Nile virus.

In addition, activities will focus on development of diagnostic and screening assays for multiple diseases from single samples. The ability to process large numbers of samples for multiple diseases in any surveillance effort will require expanded

capabilities for high throughput testing (robotic processing) of samples and controlled biosafety environments for development and validation of multiplex diagnostic methods for zoonotic and animal pathogens. The infrastructure of the new WDRB would include diagnostic capabilities in the areas of mycology, virology and bacteriology.

The new BSL-3 Ag WDRB will expand NWRC's existing BSL-3 wildlife disease research capabilities, as well as increase opportunities for collaborative research with Colorado State University. The "Ag" designation in the BSL-3 description of the WDRB indicates that each animal room is being designed as primary containment for diseased animals, meaning the animals can roam free in the rooms and do not have to be caged. As of September 2007, a lease document has been signed between APHIS and GSA and the written program of requirements, environmental assessment, and Phase I of the Procurement with GSA has been completed. The final design and construction period, after award, will take approximately two years, with completion anticipated December 2009/January 2010. The WDRB will provide 28,500-sq-ft of office, BSL-3 laboratory, BSL-3 Ag animal holding and testing, and other ancillary support spaces for wildlife disease research purposes.

Partnerships

WS Partners with Chinese Scientists to Study Role of Wildlife as Carriers of Avian Influenza

In April 2005, scientists first saw the potential effects of the highly pathogenic H5N1 avian influenza on wild birds. More than 6,000 wild migratory birds died from the virus at Qinghai Lake nature reserve in central China. This event was highly unusual and likely unprecedented. Prior to the event, wild bird deaths from highly pathogenic avian influenza (HPAI) virus were extremely rare.

To obtain a better understanding of how the virus entered the Qinghai Lake ecosystem and resulted in the death of so many birds, scientists from the Institute of Zoology, Chinese Academy of Sciences and the WS program are studying wild and domestic animals in the vicinity of Qinghai Lake. Their objectives include the following:

- Identifying reservoirs of avian influenza through surveillance of wild and domestic species,
- Developing a risk assessment of avian influenza to people, poultry and wild animals in Qinghai and Xinjiang Providences, and
- Making recommendations for bio-security and conservation on farms in northwestern China.

The two-year study is part of a cooperative agreement funded through USDA APHIS and implemented collaboratively through the USDA Foreign Agricultural Service/International Cooperation and Development.

"It's important that we develop a better understanding of the role wildlife species may serve as vectors or reservoirs for highly pathogenic H5N1 and the risk these species pose to domestic or farm animals. Collaborating with the Chinese near Qinghai Lake is an excellent opportunity to further our current understanding," noted Dr. Dale Nolte, International Liaison for the WS Disease Program and lead for this collaborative avian influenza work in China.

Initial trips to China by WS representatives in December 2005 and June 2006 helped determine the study's objectives and finalize an official cooperative agreement between the USDA and Chinese Academy of Sciences/Institute of Zoology. During August 2006, three wildlife biologists from WS spent three weeks surveying the wildlife and habitats in and around Qinghai Lake. Together with their Chinese counterparts, they captured and sampled approximately 200 birds and 150 mammals for avian influenza research. The team also collected more than 1,000 environmental samples from water, soil and feces. The samples will be analyzed in China, then the international team will cooperatively analyze the data to develop risk assessments and make recommendations. Qinghai Lake is the largest inland saltwater lake in China. It sits at 3,200 m (10,500 ft) above sea level and spans 4,635 sq km (1,789 sq miles). It attracts large flocks of migratory birds, including geese, gulls, sandpipers and cormorants.

"In addition to waterfowl, the Chinese government is interested in the potential impact avian influenza may have on other wildlife species, such as mammals and passerines," said Dr. Jeff Root, research wildlife biologist at WS/NWRC. "While in China, we collected blood and tissue samples from several species in order to determine whether they were exposed to the virus and to begin to assess if they might serve as possible vectors or reservoirs of the virus."

"This project is one part of the United States' commitment to assist countries to control and

eradicate highly pathogenic H5N1," stated Dr. Thomas DeLiberto, APHIS' National Wildlife Disease Coordinator responsible for managing APHIS' national and international avian influenza surveillance efforts in wild birds. APHIS is also assisting countries in Asia, Europe and South America, as well as Mexico, to monitor and control avian influenza in wild birds.

Michael Marlow and Carl Betsill, two WS wildlife disease biologists who traveled to China, summed up their experiences this way, "Working with scientists in China provided us with new perspectives on wildlife management and disease issues in other countries. We value the new relationships and partnerships we made while working overseas."

WS hosted Mr. Yubang He, the Deputy Director of Qinghai Lake nature reserve on February 4-6, 2007. He received an overview of NWRC research, and later met with bird research scientists and wildlife disease research scientists, who discussed bird research activities and NWRC's avian influenza surveillance program. NWRC scientists also arranged for Mr. He to visit Rocky Mountain National Park, the Rocky Mountain Bird Observatory, and the Rocky Mountain Raptor Program.

Rodent Control Collaboration at Army Training Area

Biologists from the NWRC Hilo, Hawaii, field station and Hawaii WS operational staff met with the Hawaii Department of Public Works Environmental Division personnel from the U.S. Army's Pohakuloa Training Area (PTA) to discuss reports of rodent outbreaks on the base. WS operational staff monitor mouse populations on a monthly basis. After surveying the current situation, it was determined that the increased mouse activity was the result of poor sanitation practices and not an overall increase in mouse populations. NWRC

recommended that sanitation be improved before any mouse control efforts can be implemented. The poor sanitation conditions could lead to problems with other wildlife including pigs, feral dogs, and feral cats.

NWRC Field Station Assists University of Hawaii Anthropology Department

Personnel from NWRC's Hilo, Hawaii, field station provided specimens of wild-captured Polynesian rats in January to the Anthropology Department of the University of Hawaii in Honolulu. Zooarchaeology specialty researchers plan to prepare voucher reference skeletons to be used in documenting samples collected during archaeological surveys at various historical Hawaiian settlement and burial sites. Additionally, NWRC continues to assist a Ph.D. student in the Department of Cell and Molecular Biology, Center for Infectious Disease Ecology, Asia-Pacific Institute for Tropical Medicine and Infectious Diseases at the University of Hawaii in Honolulu. The student is quantifying the prevalence and seasonality of various human disease-causing pathogens commonly hosted in rodents and mongooses in Hawaii. NWRC staff assists with animal trapping/marking techniques, species identification, and gender determination.

Developing Methods & Providing Wildlife Services

NWRC applies scientific expertise to the development of practical tools and methods for use in wildlife damage management that protect agriculture, wildlife and other natural resources, property, and human health and safety.

How High Can a Deer Jump?

It's a simple question, but one with few scientific studies documenting an answer. Instead, most evidence is anecdotal. As in fishing stories where the catch increases in size with each re-telling, deer seem to become more acrobatic and able to jump higher fences each time a tale is recounted.

Deer can breach fences by going over, through or under. Knowledge of effective fence heights and configurations for preventing deer movement is important to individuals and government agencies, especially those responsible for controlling disease transmission by preventing intermingling of captive cervids (e.g., deer and elk) or livestock with wild animals. For example, in Michigan, state agencies are developing fencing guidelines and recommendations to help manage bovine tuberculosis.

Earlier this year, NWRC partnered with the University of Wisconsin-Madison, the Wisconsin Department of Natural Resources, WS Wisconsin State Office, and USDA Veterinary Services to investigate the minimum fence height that will prevent deer movement. Researchers also looked at the effectiveness of shorter fences relative to a deer's level of motivation. To carry out the study, 22 wild, white-tailed deer were captured and placed in a 6-acre pen surrounded by a 14-foot tall perimeter fence. One interior cross fence was constructed in the pen and raised during consecutive trials.

For each height trail, deer were motivated to jump the fence by using three people to drive them towards the fence. If this did not sufficiently motivate the deer to jump the fence, the trial was repeated the next day using leashed dogs and people. Motivation ceased once it became clear that all the deer that were going to cross the fence had done so. Those that did not jump the fence were released back into the wild. If deer successfully jumped a fence, its height was raised one foot.

After 7-14 days, a new trial was conducted at the new height. Cameras stationed at the ends of the cross fence recorded all activities. All deer successfully jumped the fence at 3-, 4-, and 5-foot high levels. At 6-feet, ninety-one percent of the deer jumped the fence. At 7-feet, only one deer jumped the fence. None of the deer were able to jump the 8-foot fence.

"Though it may be possible for deer to jump higher fences, we found it isn't the norm," noted Dr. Kurt VerCauteren, research wildlife biologist. "There may always be stories of deer jumping higher fences, but at least now managers and decision-makers have scientifically documented information to aid in the development of policy and management guidelines."

New Research on Scare Devices for Wolves Shows Promise

NWRC scientists and partners continually work to develop new aversive conditioning devices to keep predators away from livestock. Currently, one study is examining the use of electrified fladry that combines an animal's fear of a novel stimulus with conditioning from an unpleasant electric shock.

Fladry is simply a line of flags hung along the perimeter of a pasture. It has a long history of use in Europe to deter wolves. Recently, it has become commercially available and can be purchased by the kilometer. Because wolves are often wary of new or novel items in their environment, they are cautious of crossing the fladry. Studies have shown normal fladry effectively keeps wolves from pastures for up to 60 days. This is useful during the calving season, but NWRC researchers want to go one step further and increase the tool's long-term effectiveness. Research has shown that wolves often bite at fladry when they first investigate it. If the fladry were electrified, wolves could potentially receive a very negative first impression and, therefore, be less likely to cross the barrier. In an initial study, NWRC scientists tested electrified fladry on 36 wolves in 10 groups. Eight of the groups crossed the normal fladry barrier, but only two crossed the electrified fladry. Additional field studies are planned in Montana later this year and will be conducted with the help of the Montana WS state office and Montana Fish, Wildlife and Parks.

"The more tools we have in our tool box the better," said Montana WS State Director John Steuber. "Working with wolves, in particular, can be very challenging. By working closely with NWRC scientists, WS operations can help develop more innovative management options, like electrified fladry, for use by our field specialists and partners."

Scientists Use Infrared Thermography to Detect Wildlife Disease in Israel

During April 2-7, 2007, NWRC scientists conducted field experiments in Israel to further the development of infrared thermography to detect signs of disease in animals. Because an epizootic of foot and mouth disease (FMD) was occurring in Israel, the scientists used the equipment to try to remotely detect FMD in domestic livestock and mountain gazelles. This tool was successfully used in earlier laboratory experiments in the United States to detect signs of rabies and FMD in wildlife. In Israeli ground observations, the technology detected heat associated with infection of FMD in the feet and oral area of cattle from up to 45 yards away. When used in helicopters, infrared thermography also detected signs of the disease in cattle, even in less-than-optimal flying conditions (afternoon heat and wind). Use of thermography to aerially detect disease was more problematic in mountain gazelles, due to their small size, wariness, swiftness, and the continuing poor flying conditions. Though results of the FMD field studies in Israel varied, it appears that infrared thermography warrants further attention for development as a tool that may one day assist in the eradication of this devastating disease if ever again found in the United States.

Chromaflare Device Evaluated

On February 12, 2007, Max Yoshida, CBC (America) Corporation, New York and Nobuyasu Yoshizawa, CBC Corporation, Tokyo, Japan visited scientists at the NWRC in Fort Collins, CO, to discuss NWRC's evaluation of their chromaflare device as a potential frightening device for American crows. The devices are being evaluated in NWRC's outdoor bird flight pen. The chromaflare device has been successfully used in Japan to keep crows away from structures, garbage dumpsters and utility towers. It consists of a strip (1.5-3.5 cm wide) of stiff, shiny plastic-like material cut into a spiral shape so that when suspended it extends down approximately 75 cm, becoming progressively broader from approximately 3 cm diameter at the top to 20 cm at the bottom. The uniqueness of the device is that the color varies from green to purple depending on the viewing angle.

New Methods and Tools

EPA Registers Oral Contraceptive for Pigeons

In May 2007, Innolytics, LLC, announced that the U.S. Environmental Protection Agency (EPA) has granted registration for OvoControl™ P for pigeons. The product is similar to OvoControl™ G which was developed for resident Canada geese and registered in 2005. Both oral contraceptive baits effectively control egg hatchability by causing disruption of the yolk membrane and creating conditions under which the embryo cannot develop. NWRC scientists worked with Innolytics to evaluate both products and gather the appropriate data for registration.

Pigeons, the ubiquitous bird found in urban and industrial areas, can cause serious economic damage. The costs of removing waste, increased maintenance and the potential for transmission of disease are all serious pigeon-related issues.

Oregon and Washington Register a New Forest Pest Management Tool

On September 20, 2006, and October 20, 2006, state agriculture departments in Washington and Oregon, respectively, approved a Special Local Need (SLN) legislation for use of Rozol™ Pellets (active ingredient chlorophacinone rodenticide) to control mountain beavers in forested lands west of the Cascade Crest. For the past four years, the National Wildlife Research Center (NWRC) Olympia, WA, field station has researched baiting as an alternative to trapping for reducing seedling damage by mountain beavers in reforested areas. While trapping is currently the most common and effective method for controlling mountain beaver damage, NWRC's research demonstrated that the effects are short-term. Mountain beavers quickly reinvade newly harvested units and are, therefore, present when new seedlings are most vulnerable to damage. NWRC research also demonstrated that using integrated pest management (trapping and baiting) may allow for additional seedling protection between the time of trapping and the emergence of herbaceous vegetation, thus decreasing long-term costs of re-trapping and re-planting.

New DRC-1339 "Take" Models Available for Use

WS biologists currently use a number of techniques to estimate "take" of target birds during DRC-1339 baiting operations and these techniques vary widely in their assumptions and scientific validity. DRC-1339 is the only registered avicide for use on starlings and blackbirds. Its continued use depends upon WS' ability to document its effectiveness and impact on target species.

In 2006, NWRC developed and tested DRC-1339 "take" models to estimate the mortality of target birds at feedlots and dairies and on staging areas for DRC-1339 baiting operations. Initial models were distributed to all WS state offices that reported using either the staging area and/or dairy/feedlot registration labels. NWRC scientists then asked for feedback from all WS biologists who reported using the models and modified the models' user interface accordingly to make them easier and more practical.

"I am excited about the positive impacts this new tool will have on the way Wildlife Services does business," stated Jeff Green, WS Western Region Director. "NWRC has worked hard to develop a tool that addresses our needs and is easy to use."

Future NWRC research will focus on a method for estimating take under the corvid egg bait label, and if necessary, to modify the labels for other baits, concentrations, and/or dilution rates.

Researchers Present Method for Permitted Take of Migratory Birds

On January 9, 2007, two NWRC research biologists from the Gainesville, FL, and Sandusky, OH, field stations met with researchers from U. S. Geological Survey and U. S. Fish and Wildlife Service (FWS) in an ongoing effort to develop a scientifically sound method for setting limits on the permitted take of migratory birds. The NWRC scientists presented a demographic matrix model and behavioral data derived from satellite telemetry on black vultures. These findings were incorporated into a model of potential biological removal (PBR), which was then presented at the annual coordination meeting between FWS Region 5 and WS Eastern Regional staff on January 17-18, 2007. The method developed to set limits on allowable take of vultures will later be applied to numerous other bird species of concern to WS and FWS.

New HPCL Analytical Method Developed for Warfarin

A new analytical-scale, high-performance-liquid-chromatography (HPLC) method for the separation of the two enantiomers of warfarin has been developed by NWRC scientists. Enantiomers are two or more forms of a compound that differ in the spatial arrangement of different parts of the molecule. Enantiomers have the same chemical formula but often have very different physiological responses in organisms due to these structural differences. This method will be used to collect quantities of the two forms of warfarin. These will then be used in studies to develop a toxicology model to evaluate differences in uptake and metabolism for rodenticides being developed at the NWRC.

Invasive Species

WS Begins Efforts to Remove the Invasive Gambian Giant Pouched Rat in Florida

In 1999, eight Gambian giant pouched rats escaped from an exotic pet breeder on Grassy Key, Florida. Wildlife management agencies were not aware of this release or of the subsequent sightings by local residents. Years passed and the presence of a breeding population of Gambian giant pouched rats on Grassy Key was finally confirmed in August 2004.

Amazingly, it can be that simple for an invasive species to take up residence. You may wonder, why should we care if another rat is loose in Florida? What harm can come of it?

"A lot," noted Dr. Gary Witmer, one of the participants in an invasive species project to remove the rats from Grassy Key. "Because of its large size (males can weigh as much as 2.8 kg/ 6.2 lbs.), high reproductive rate and omnivorous diet, the Gambian giant pouched rat has the potential to become a highly destructive invasive species, particularly to agriculture. It is also known to carry wildlife diseases, such as monkeypox, leptospirosis and murine typhus, which can be harmful to humans."

In an effort to "fight back" and remove the Gambian giant pouched rat from Florida, scientists and field specialists from WS, in cooperation with the Florida Fish and Wildlife Conservation Commission, the South Florida Water Management District and the U.S. Fish and Wildlife Service, have designed an eradication program to remove the Gambian rats from the Florida Keys before they reach the mainland. The eradication design phase was completed in 2006. Monitoring and indexing methods were developed to define the animal's range. Additionally, baits, toxicants, and bait-delivery devices that exclude native animals were developed and tested.

"WS research and operations have been working side-by-side to proactively address this invasive species problem," stated Bernice Constantine, WS State Director in Florida. "I'm confident our efforts will be successful at reducing the Gambian giant pouched rat population and serve as a model for future invasive species eradication efforts."

An eradication program conducted in early 2007 began with WS field specialists establishing a grid of over 1,000 bait stations on the relatively small (1,500 acres) island of Grassy Key. Each station included bait containing zinc phosphide, peanut butter, and a horse feed mixture. The stations were maintained for about a month. Following the baiting operation, motion-activated cameras were placed across the island near trees baited with peanut butter to see if any Gambian giant

pouched rats remained. Gambian rats have been detected at several locations so intensive trapping and re-baiting of nearby bait stations has been on-going in those areas in an effort to finish the eradication. NWRC also collected a few dozen of the rats for study in the new Invasive Species Research Building in Fort Collins, CO. Scientists are particularly interested in learning more about lures to better attract the rats and alternative rodenticides that would be more effective against the rats. The information will be key toward future detection, control, and eradication efforts should those be needed. Unfortunately, diphacinone, a first-generation anticoagulant rodenticide, was not found to be effective on the Gambian rats in captivity trials.

Multiple Capture Nutria Trap Successful in Louisiana

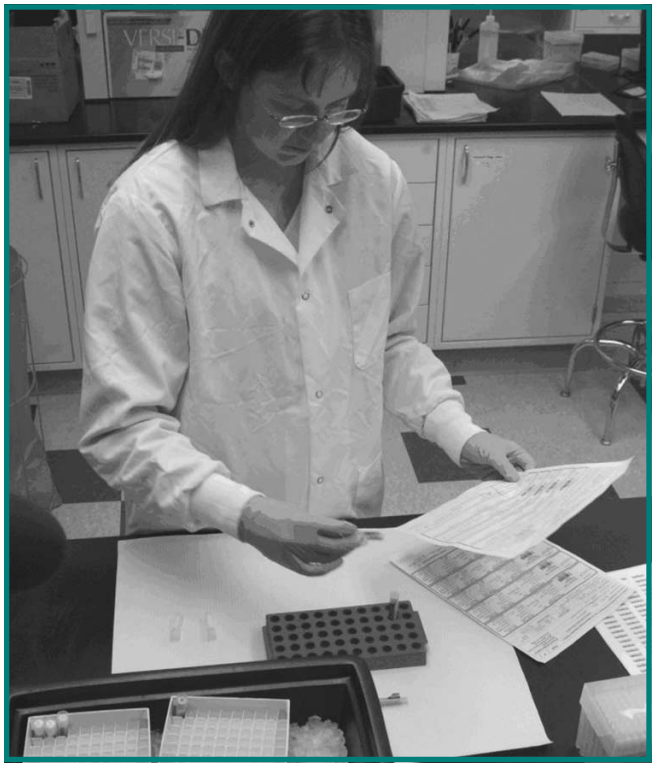
NWRC researchers tested a multiple-capture trap (MCT) in January at the Mandalay National Wildlife Refuge in coastal Louisiana. The researchers were trapping nutria, an invasive aquatic rodent from South America that causes substantial damage to marsh vegetation in many areas of the United States. Six MCTs were baited with foods (carrots, corn and sweet potatoes) and six MCTs used trays of fertilized marsh plants as lures. Nutria were caught in both types of MCT sets: 10 in the food traps and 12 in plant-lure traps during the 10-day trial. As many as three nutria were captured overnight in one trap. On two occasions, nutria escaped the traps. No nontarget animals were captured, however, it was suspected that swamp rabbits were entering the MCTs to feed and then escaping through the “one-way door.” Using a FLIR (forward-looking infra-red) unit at night, several nutria were observed around some of the traps but never caught; hence, a more effective lure/attractant would be useful.

Wildlife Disease

NWRC's Avian Influenza Diagnostic Lab Analyzes Over 50,000 Samples

NWRC's wildlife disease diagnostics laboratory is heavily involved in the national surveillance effort for the early detection of highly pathogenic avian influenza virus. In the fall of 2006, NWRC laboratory staff analyzed over 50,000 environmental (fecal) samples collected by WS and its partners in all 50 states and Guam. The 2007 target goal is 25,000 more strategically selected samples.

To help reach this monumental goal, NWRC has hired eight additional laboratory staff and purchased new equipment, such as a robotic RNA extraction system, a genetic analyzer, additional RT-PCR systems, laboratory data systems, and ultracold freezers. When samples arrive at the lab, they are pooled into groups of five or less, depending upon species, date, and location. The pooled samples are then analyzed for avian influenza virus.



So far, NWRC has detected more than 300 positive pooled samples for avian influenza. All of these positive samples were determined to be low pathogenic avian influenzas that naturally occur in wild birds. Approximately fifteen of the samples were identified as the H5 or H7 subtype which has the potential to be highly pathogenic. These samples were sent to the National Veterinary Services Laboratory in Ames, Iowa, for further testing and confirmation. They too were found to be of low pathogenicity.

NWRC is the only laboratory responsible for analyzing the environmental samples collected as part of the national effort. Information gathered from these samples will provide valuable insights into the distribution and movement of avian influenza viruses in the United States, thus helping managers to quickly identify and respond to potential disease outbreaks.

In addition to diagnostics, the NWRC wildlife disease program has developed field collection guidelines, worked with scientists at Colorado State University (CSU) to develop recommendations for strategic collection of environmental samples across the United States, and is currently working with scientists from CSU, APHIS Centers for Epidemiology and Animal Health, U.S. Geological Survey, and other institutions to develop a nationwide risk assessment model for introduction and spread of highly pathogenic avian influenza.

Bird Banding Data Used to Develop Prioritized Avian Influenza Sampling Protocols

The avian influenza surveillance effort of 2006 was unprecedented. Never before have so many wildlife samples for disease surveillance been collected from so many locations in such a short amount of time. Wildlife disease biologists and field specialists used a "blanketed" approach whereby they collected samples at numerous sites throughout each state across the entire United States.

In the 2007 surveillance season, WS personnel have a new tool to help them prioritize sampling sites based upon concentrations and seasonal movement patterns of migratory waterfowl in the United States. A panel of sampling and experimental design experts from NWRC, Colorado State University, the Centers for Epidemiology and Animal Health, and the U.S. Geological Survey have developed a comprehensive spatial dataset that overlays banding and recovery data with the location of federal and state wildlife refuges. The dataset not only pinpoints areas with high levels of waterfowl, but more importantly, areas that contain high concentrations of birds that were originally banded in Alaska and Canada. Alaskan birds are the ones most likely to intermingle with potentially infected waterfowl from Asia. From this data, the panel was able to identify and prioritize collection sites for each state. Areas that were given the highest priority contained five or more banded birds from Alaska, Asia or Canada.

Further adjustments to these recommended sampling locations will likely occur as addition information, such as the location of poultry farms, is added to the dataset.

NWRC Scientists Participate in Avian Influenza Training in Cambodia

On January 22-26, 2007, the U.S. Department of Agriculture conducted a cooperative workshop with the Cambodian Wildlife Protection Office (WPO) in Sihanoukville, Cambodia. The primary objective of the course was to train 24 WPO biologists to respond to wild bird morbidity/mortality events. Five WS personnel from the NWRC and the National Wildlife Disease Program instructed participants on wild bird capture, necropsy, and avian influenza sampling techniques using classroom and field exercises. The success of the training was well demonstrated during the last field exercise that required the newly trained staff to respond to a mock morbidity/mortality event. Staff accurately assessed the status of the event then made an appropriate response, wearing protective equipment to gather birds and collect samples to test for potential avian influenza.

Avian Influenza Samples to be Stored at NWRC

During 2006, many WS employees were involved in the national effort to monitor wild birds for the early detection of highly pathogenic avian influenza (HPAI) in the United States. The results of the effort were impressive – nearly 80,000 bird samples and 50,000 fecal samples were collected from across the country, Hawaii and Guam. Luckily, no HPAI was found in the United States, however, scientists can still learn a lot about avian influenza and other diseases from the samples.

Oral Rabies Vaccination Program

Rabies is an acute, fatal viral disease most often transmitted through the bite of a mammal. It can be found in many wild animals, including raccoons, skunks, gray fox, arctic fox, and coyotes and can infect people as well as animals. NWRC is participating in the Wildlife Services Oral Rabies Vaccination (ORV) program – looking at a new, less invasive marker, such as rhodamine B, to use in baits and evaluating the possibility of rabies spreading to new areas.

Rhodamine B is a chemical dye that when ingested, stains the oral cavity and is absorbed in growing tissues such as hair and whiskers, producing fluorescent orange bands under ultraviolet (UV) light. It appears to be a safe and effective biomarker that may reduce the need for invasive sampling techniques to assess the success of the ORV program. Researchers fed 18 raccoons rhodamine B and monitored their whiskers and fur for fluorescence for 15 weeks. All raccoons exhibited fluorescence in their whiskers. An average of 55 percent of whiskers sampled from each individual on each sampling day exhibited fluorescence. Evaluation of whiskers using a UV-equipped microscope and hand held UV lights will be compared to determine if evaluation of whiskers can reliably be done in the field. Scientists next step will be to assess whether raccoons readily consume fishmeal polymer baits containing rhodamine B.

Additionally, as part of the ORV Program conducted by WS Operations, NWRC researchers are looking at an epizootic of genetically distinct raccoon rabies that has spread in the eastern states as a result of animals transported to the Virginia/West Virginia border from Florida and Georgia. Currently, eastern Ohio serves as one boundary to its westward spread, and vaccine-laden baits have been distributed on the Ohio-Pennsylvania border since 1997. The goal of the ORV Program in Ohio has been to contain raccoon rabies in the natural corridor consisting of the Allegheny Mountains in the north and the Ohio River in the southeast. However, with the spread of rabies into Lake, Geagua and Cuyahoga counties of northeastern Ohio, movements of raccoons in northeastern Ohio need to be examined.

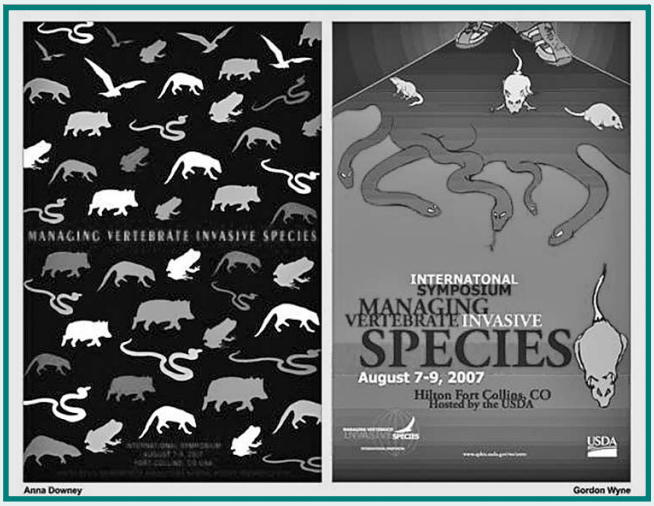
An NWRC researcher has captured and radio-collared 18 raccoons for the first part of a raccoon-movement study, with a final target of 50 radio-collared animals. Raccoons are being located weekly using VHF telemetry. Genetic sampling, which will be used to evaluate historic movements in northern Ohio, has also begun with approximately 20 of the 180 desired samples collected. The majority of genetics sampling will occur simultaneously during a raccoon density study to begin in late summer/early fall of 2007. The raccoon location information is being entered into a geographic information system program in Fort Collins in an effort to follow raccoon movements and evaluate any barriers/corridors (i.e., rivers, roads, greenbelts, etc.) to movement.

Information and Communication

NWRC is committed to providing valid, objective, and biologically sound information of the highest quality to its partners, stakeholders, and the public.

Managing Vertebrate Invasive Species Symposium a Great Success

On August 7-9, 2007, the NWRC hosted a three-day international symposium on managing invasive (or nonnative) wildlife species at the Fort Collins Hilton in Fort Collins, CO. The goal of the symposium was to highlight research, management and public education associated with invasive birds, mammals, reptiles and amphibians. More than 50 speakers from eight countries presented talks on topics ranging from early detection and rapid response to prevention, management, eradication, impacts, economics, resource recovery, public education and support, research needs, and global initiatives. Thirty technical posters were also displayed during the conference.



Dr. David Pimentel, Professor Emeritus, from Cornell University and author of "Biological Invasions: Economic and Environmental Costs of Alien Plant, Animal and Microbe Species" was the keynote speaker and began the symposium on Tuesday with an overview of vertebrate invasive species in the United States.

The 165 attendees were also given the opportunity to tour NWRC's new 25,000-sq-ft Invasive Species Research Building located at the NWRC's headquarters site on the Colorado State University Foothills Research Campus.

In addition to the technical poster session, the symposium sponsored a special art competition for students of Colorado State University's (CSU) Graphic Arts Department. Poster designs highlighting invasive species were submitted from approximately forty CSU students and were displayed during the symposium. Attendees voted for their favorite. CSU student Anna Downey won the contest and was awarded a $200 prize, plus the opportunity to have her poster featured on the cover of the symposium's published proceedings. The proceedings will be available from the NWRC Library in early 2008.

WS Records Trapping History

"You know, a lot of people, they don't like Monday mornings, but Monday morning was one of my favorite times to get back to work."

This descriptive quote is from retired WS Operations employee Odon Corr, who worked 34 years in South and North Dakota and Minnesota. Clearly Odon loved his job, a common sentiment voiced by the 24 retired and current WS employees interviewed for the Trapping Oral History Initiative.

This initiative, the brainchild of NWRC's Dr. John Shivik, began in 2005 as a WS collaborative effort between Operations and the NWRC. With its focus on interviewing retired and current WS employees, the initiative emphasizes the trapping and hunting aspects of the program. The idea of the interviews grew out of conversations between Dr. Shivik and field personnel, who noted the loss of knowledge as people retired or passed on. The finished interviews may be used for a book, the WS website, or any number of purposes.

In early 2005, John Shivik and Nancy Freeman, NWRC Archivist, began planning for the initiative. WS state directors and several retired NWRC employees were asked to solicit potential interviewees. General questions were developed and recording equipment was purchased. A list of interviewees was drawn up, and the interviews began in the summer of 2005. Nancy Freeman and Diana Dwyer, both members of NWRC's Information Services unit, conducted the 24 interviews, mainly in the West. Additional interviews are planned for covering the eastern part of the United States. The transcribed interviews will eventually become part of the NWRC Archives.

Oral history is, at a basic level, an easy process. The general idea is to interview a person or a group of people to gather information and history that usually is not written down. The oral tradition is a long and varied one, with the gathering of oral history particularly prevalent since the 1960s. Oral history becomes more complicated in the nitty gritty of a project: deciding on interviewees, choosing general questions, covering legalities, using recording equipment, and dealing with travel logistics. In the case of the Trapping Oral History Initiative, the imperative is to gather information from current and retired employees before it is lost. Oral history is a bit like the Paul Harvey radio features of "The Rest of the Story." The Initiative's purpose is to document aspects of WS work that often are not written down, but either shared orally or not at all. With some exceptions, the Initiative's interviewees have not previously talked about their work experiences in this manner. The stories and memories from the participants are interesting, poignant, and often quite humorous.

The overriding similarity in the interviews is that the current and retired employees loved their work. They may not have liked everything about it, but overwhelmingly, they'd have worked for no one else or done any other type of work.

In the words of Dale Booth, current Utah WS employee, "...it's been a good job. It's been my life, you know, I mean, that's what I've enjoyed. After working 38 and a half years, if I could be young again, I'd do the very same thing."

Valuing and Investing in People

NWRC values and invests in its people to support their professionalism, competency, and innovation as Federal leaders of wildlife damage management.

Dr. Dale Nolte Accepts Position as WS International Liaison

In April 2007, Dr. Dale Nolte, NWRC's Mammal Research Program Manager, accepted a new position with the WS Wildlife Disease Coordinator's office to focus on WS' international training and outreach development. Dale will be detailed to APHIS/International Services in Bangkok, Thailand, to assist in avian influenza wildlife surveillance training and capacity building for APHIS and WS. Bangkok is the regional office for International Services avian influenza activities in Southeast Asia.

Dale's new role is part of WS' effort to increase its international capabilities. During the last few years, WS has received increasing requests from foreign countries regarding assistance for a number of wildlife damage management issues. These requests involve invasive species; wildlife hazards at airports; wildlife diseases issues; and others. Because WS possesses unique abilities in wildlife damage management, this increased interest presents the program with an opportunity to expand its expertise internationally.

Dale has been with NWRC for 15 years, both at the Olympia, WA field station and at NWRC headquarters in Fort Collins, Colorado.

Dr. Scott Barras Becomes Virginia WS State Director

In May 2007, Dr. Scott Barras became the new State Director for the Virginia WS program. Scott has served as the field station leader of the NWRC Starkville, MS field station since 2002. In this capacity, he developed research projects related to understanding and reducing the conflicts between fish-eating birds and aquaculture producers. From 1999 to 2002, Scott served as a research wildlife biologist at the Sandusky, OH field station where he developed and conducted research aimed at reducing the factors that contribute to wildlife-aircraft collisions.

NWRC Biologist Receives APHIS Administrator's Civil Rights Award

Susan Jojola, a biologist with NWRC's Invasive Species and Technology Development Research Program, was honored on October 26, 2006, with the USDA APHIS Civil Rights Award for her efforts as a Tribal Liaison for the APHIS Native American Working Group. As Tribal Liaison, Susan has facilitated potential efforts and information exchange between APHIS and Native Americans on topics such as avian influenza surveillance, emergency response and preparedness procedures, and surveillance for chronic wasting disease in deer and elk. Susan has also served as a mentor providing career guidance to a Native American high school student in Fort Collins, Colorado.

Other APHIS award recipients include Virginia Green (WS), Dr. Michael Firko (PPQ), Dr. Rick Hill (VS), Estela Diaz (MRPBS), Dr. Terry Clark (VS), VS-NCAHPP EEO/CR Advisory Committee, PPQ Civil Rights Strategic Plan Working Group,

VS-Pennsylvania Area EEO Committee, and VS-Live Bird Marketing System Low Pathogenicity Avian Influenza Program.

NWRC Researchers Submit Winning Posters

Dennis Kohler and Paul Oesterle, both researchers at NWRC who are pursuing graduate degrees at Colorado State University (CSU), received awards and recognition for their research at the 2006 Zoonotic Disease Colloquium at CSU. The two winning posters were:

DENNIS KOHLER, R.A. BOWEN, M.R. DUNBAR, R.G. MCLEAN: Duration of protective immunity in raccoons (*Procyon lotor*) immunized with oral rabies virus vaccine V-RG.

PAUL OESTERLE, J. HALL, R.G. MCLEAN, L. CLARK: Cliff swallows as a sentinel in West Nile virus surveillance.

Biologist Honored at Florida Wildlife Society Meeting

NWRC biologist John Humphrey was honored with an award in appreciation of his dedication, support, and promotion of the Florida Chapter of The Wildlife Society during the 9th Annual Spring Conference in St. Petersburg, FL.

2005 NWRC Outstanding Publication Award

NWRC is pleased to announce the winner of the 2005 outstanding NWRC publication award. The paper by Kitchen et al. titled "Genetic and spatial structure within a swift fox population" was selected from more than one hundred publications by the Center's Publication Award Committee. Although social structure in canids is well documented in the larger species, very little information is available on the smaller canid species. This study explores the world of swift foxes by combining both genetic and field observational data to understand kin selection and evolutionary strategies.

KITCHEN, A. M., E. M. GESE, L. P. WAITS, S. M. KARKI, AND E. R. SCHAUSTER. 2005. Genetic and spatial structure within a swift fox population. Journal of Animal Ecology 74: 1173-1181. (A copy of the complete article can be downloaded from the NWRC web site at http://www.aphis.usda.gov/ws/nwrc/is/annpubs2005.html)

Student Receives Award on Coyote Lure Operative Devices Research

CSU Hughs Undergraduate Research Scholars student and NWRC biological science technician, Julia Figueroa, was awarded honors for her poster presentation titled "Obtaining Genetic Data from Activated Coyote Lure Operative Devices" at the CSU College of Natural Sciences "Celebrate Undergraduate Research and Creativity Showcase." Julia's poster highlights her work contributing to the development of methods for extracting DNA from coyote lure operative devices (CLODs) to identify individual coyotes or non-target species.

CLODs are a new management tool being investigated by NWRC. They orally deliver active compounds to coyotes. Potential active ingredients include contraceptives, vaccines, marking agents and toxicants. Other uses include censusing and monitoring wild populations of coyotes from genetic data collected from activated (chewed) CLODs.

Publications

NWRC scientists publish their research findings in peer-reviewed journals and other literature. For downloadable copies of these and other NWRC publications, please visit the NWRC website at http://www.aphis.usda.gov/ws/nwrc/is/publications.html

Recent publications include:

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PEDERSEN, K., AND L. CLARK. 2007. A review of Shiga toxin *Escherichia coli* and *Salmonella enterica* in cattle and free-ranging birds: potential association and epidemiological links. Human-Wildlife Conflicts 1:68-77.

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