

THERE'S A WAR GOING ON in Delaware that you probably haven't heard much about. But a lot is at stake. The war is between DNREC's Division of Fish and Wildlife and invasive species. Invasive species are a true menace. They're destructive, aggressive pests – alien species that cause economic and environmental harm. DNREC is working hard to eradicate them from our borders, to protect Delaware's precious natural resources from these hazardous invaders. Delaware faces invasives of all types, flora, fauna, and diseases, like white nose syndrome which is decimating our bat populations.

Invasives, as they are called, are introduced via a number of pathways. This type of “biological pollution” is much more difficult to deal within the natural environment because invasive species increase in number over time. Chemical pollutants, like DDT, were outlawed in the 1970s and, the quantity of chemicals in the environment gradually decreased over time. But unlike those chemical pollutants, once invasives get a foothold, they become more abundant as time passes, increasing their impact on our natural environment.

Technically, an invasive is an alien, non-native species whose introduction causes – or is likely to cause – economic or environmental harm or harm to human health. Not all non-native species are invasive, so what characteristics do invasives have? They are aggressive growers or colonizers, they produce many young, and have adaptable habitat needs. They also have few natural predators or diseases.

Here are the reasons why invasives are so harmful. They:

- reduce native diversity by competing for resources, such as space, sunlight, water and minerals.
- disrupt natural communities and change habitat structure for other organisms such as birds, mammals, turtles, fish and frogs.
- alter soil conditions by secreting chemicals that inhibit the germination or growth of other species.
- alter nutrient cycling by changing the amount, composition, or rate of decay of leaf litter.
- may hybridize with native species.

ALIENS IN OUR MIDST

**DNREC's Division of
Fish and Wildlife is
waging a little-known
war against invasive
species, and a lot is at
stake.**

Asian tiger mosquito

- may bring new diseases and parasites with them as hitchhikers.

The invasive species discussed in the pages ahead represent several animal and plant groups, which have been fairly recently introduced into Delaware. They were selected to depict the range of invasive species issues faced by DNREC's Division of Fish and Wildlife in natural areas.



Northern Snakehead (Channa argus)

by Cathy Martin

SNAKEHEAD FISH became big news when they were discovered reproducing in a small pond in Crofton, Maryland in 2002. Although that population was eradicated, the species – dubbed “frankenfish” by the news media – soon was



discovered in the tidal Potomac and has since increased rapidly in abundance and range. It was initially felt that the salty waters of the Chesapeake Bay would prevent the fish from moving to the Delmarva Peninsula. However, the fish have shown a tolerance to salinity. Heavy precipitation in spring 2010 dropped salinities throughout the Chesapeake Bay low enough so that the snakeheads could have traveled across.



Northern snakehead, also known as “frankenfish” should be killed if they are caught.

A northern snakehead (26 inches long) was collected from Broad Creek, a tributary of the Nanticoke River,

during electrofishing efforts for large-mouth bass in October, 2010. Although additional sampling in the area turned



Northern snakehead have been found in Delaware waters recently. They are aggressive top-level predators that feed on a variety of fish and other species, so can alter food webs and compete with gamefish such as largemouth bass for food resources.

up no more snakeheads, in July 2011, an angler caught another snakehead in the Marshyhope Creek near Woodenhawk. Less than a month later, the report of a young kayaker “bitten” by a fish guarding young in Becks Pond near Newark led fisheries staff to do some electrofishing there. Unfortunately, both adults and schools of fry were documented. Since then, several more snakeheads have been caught by anglers in the Nanticoke system and in Becks Pond.

Division of Fish and Wildlife biologists have retrieved most of the adults and obtained biological information from them: size, weight, age, sex and stomach contents. Subsequent sampling via electrofishing has occurred in both the Nanticoke and Broad system, and in Becks Pond.

Fish and Wildlife staff have posted identification signs at all snakehead discovery locations, requesting that anglers



Sam Johnson, seasonal biological aide from the Division of Fish and Wildlife, with a northern snakehead.

kill the fish and contact the Division. The most humane method to kill one of these fish is to cut off its head. A regulation is being developed to cover bow angling of the species, as this is a popular and successful method of take for northern snakeheads. Contacts with Maryland’s Department of Natural Resources and the U.S. Fish and Wildlife Service led to working relationships with the agencies,

especially on the Nanticoke, which lies within both states.

Meanwhile, Delaware fisheries personnel continue to monitor bass populations in these areas and to search for northern snakeheads. The northern snakehead and largemouth bass are similar in habitat needs and food habits, so the concern is that the invasive snakehead could adversely impact largemouth bass populations.

What you can do:

If you see a snakehead, contact the Division of Fish and Wildlife’s Fisheries Section at 302-739-9914. You can also email a photo to: catherine.martin@state.de.us. Kill the fish, keep it, and put it on ice or freeze. Also, dispose of unused bait responsibly, i.e. in the trash. Do not dump in the water or leave it on the ground. Do not transport live bait from one water body to another.

CATHY MARTIN IS A FISHERIES BIOLOGIST WITH THE DIVISION OF FISH AND WILDLIFE.



Nutria (Myocaster coypus)

by Joe Rogerson

NUTRIA ARE INVASIVE, non-native, semi-aquatic, South American rodents that to the casual observer look like a cross between a muskrat and a beaver. That’s because they are generally brown in color, have a round, mostly hairless



Nutria have been confirmed in marshy areas in Delaware – not good news.



Nutria feeding damages or destroys the root mat that binds marsh together, which reduces the marsh to mudflats.

tail like a muskrat, but are similar in size to a beaver. Nutria have short legs and a robust, highly arched body that is approximately 24 inches long. Their round tail is from 13 to 16 inches long. Males are slightly larger than females; the average weight for each is about 12 pounds.

Nutria have been present on Maryland's Eastern Shore for decades, but most recently their presence has been confirmed within Delaware on Mudmill Pond in Marydel. Feeding by nutria – done mostly in marshy areas – damages or destroys the root mat that binds a marsh together. When this fibrous root network is lost, marshlands are quickly reduced to unconsolidated mudflats. These areas, in turn, are highly susceptible to erosion and are eventually converted to open water. This downward spiraling not only harms the marsh but the wildlife that depends on it.

Earlier this year, DNREC's Division of Fish and Wildlife partnered with a federal agency, USDA APHIS Wildlife Services, to complete most of the surveillance, monitoring, and subsequent removal of nutria in Delaware. These activities will take place over the next several years.

What you can do:

If you've seen nutria in Delaware, DNREC's Division of Fish and Wildlife is asking you to let them know so that the nutria distribution can be determined. If you see nutria or want additional information about the eradication effort, please contact Joe Rogerson, Deer and Furbearer Biologist, at 302-735-3600 or the Wildlife Services Chesapeake Bay Nutria Project, at 1-877-463-6497. For more information about nutria and the

Invasive Species: *Updating Delaware's Fish and Wildlife Laws*

BY DAVID E. SAVEIKIS

DELAWARE'S FISH AND WILDLIFE laws often prevented timely and scientifically-based management of current and future invasive fish and wildlife species. To provide the needed legal ability for DNREC to respond to these invasive species in a timely and scientific manner, DNREC advocated, the 146th General Assembly passed and Governor Markell signed into law two landmark bills that provide the needed flexibility to manage invasive fish and wildlife species. These bills are Senate Bill No. 255 and House Substitute No. 1 to House Bill No. 402.

Senate Bill No. 255 provides DNREC the ability through regulation to designate invasive finfish species in tidal waters and establish and implement needed management measures to control or eradicate these invasive finfish species. (Such legal ability already existed for invasive finfish in non-tidal waters.)

House Substitute No. 1 to House Bill No. 402 provides DNREC the ability through regulation to designate non-native wildlife species, including invasive species, and to implement needed measures to control, eradicate or otherwise manage non-native and invasive wildlife species.

The Division of Fish and Wildlife is currently developing regulations involving public input that will soon enable timely, scientific, socially-responsible and effective management of invasive fish and wildlife species. **OD**

DAVID E. SAVEIKIS IS DIRECTOR OF DNREC'S DIVISION OF FISH AND WILDLIFE.





DIVISION OF FISH AND WILDLIFE

Lesser celandine can cause severe damage to natural areas because it forms large, dense, carpet-like patches preventing anything else from growing around it.

eradication effort please visit: www.fws.gov/chesapeakeinutriaproject/Index.html

JOE ROGERSON IS DEER AND FURBEARER BIOLOGIST WITH DNREC'S FISH AND WILDLIFE



Lesser celandine (*Ficaria verna*)

by Bill McAvoy

LESSER CELANDINE is one of the most invasive of all the non-native plants found growing in Delaware. It is a low-growing, perennial herb in the buttercup family that blooms in April and has bright yellow flowers and heart-shaped leaves. Currently, it is only known to occur in the Piedmont province of New Castle County, where it typically grows on the floodplains of creeks and streams.

Lesser celandine is native to Europe and was introduced to the U.S. as an ornamental plant for gardens. It may have escaped from gardens with help from squirrels, who have been known to dig up their finger-like tubers and carry them away. The ecological damage that lesser celandine can cause to natural areas is severe. It is a vigorous growing plant that can form large, dense, carpet-like patches. These patches are so dense, that literally nothing else grows.

On the floodplains where lesser celandine is most often found, a characteristic suite of native plants occur, such as Brandywine bluebells, lowland fragile fern, river wild rye, false mermaid weed, Eastern waterleaf, Greek valerian, and green-headed coneflower. Due to the

widespread establishment and aggressive nature of lesser celandine, these species are being displaced and may one day disappear from the state's flora. Insects that depend on many of these native species for nectar and pollen in the spring could also be affected if populations decline or disappear.

What you can do:

Lesser celandine is still available commercially, so do not purchase this plant for your garden. If you are gardening with native plants, plant only species that are indigenous to Delaware. For small infestations, lesser celandine can be pulled by hand or dug up using a hand trowel or shovel. It is very important to remove all tubers. A consideration when manually removing invasive plants like lesser celandine, is disturbance to the soil, which can encourage the invasion of other non-native invasive species. For large infestations, chemical herbicides can be used, but in order to have the greatest success in controlling lesser celandine and the least amount of impact to native species, herbicide should be applied in late winter-early spring, generally February through March.

BILL MCAVOY IS BOTANIST WITH THE DELAWARE NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM



Asian Tiger Mosquito (*Aedes albopictus*)

by William H. Meredith

INSECTS ARE OFTEN OVERLOOKED by the public as a category of invasive species, although farmers are certainly aware of major adverse impacts to their crops caused by foreign insects. With regard to public health and quality of life, non-native mosquitoes are introduced insects that can also wreak havoc. Among the worst offenders is the Asian tiger mosquito, native to Japan, China, southeastern Asia, and Pacific and Indian Ocean islands.

In recent years it has been found in many locations around the globe, aided in its spread by the worldwide trade in used tires. It was first found in the U.S. in Houston in 1985, arriving with scrap tires imported for recapping. Its appearance in Delaware dates back to 1987 in the Milford area, possibly from a shipment of scrap tires from North Carolina. It has since become established throughout Delaware, now joining with our native common house mosquito to form a "one-two punch" in cities, towns and suburbs. Around the country, Asian tigers have become a severe problem in urban areas from New Orleans north to Chicago. Along the east coast they now range to northern New Jersey.

Asian tiger mosquitoes are named for their striking coloration of jet black bodies with bold silvery-white bands, and for their aggressive biting habits, often causing "hot" bites more irritating than other



Asian tiger mosquitoes are named for their aggressive biting habits, which produce bites often more irritating than those of other mosquitoes.

types of mosquitoes. Asian tigers are daytime biters favoring early morning or late afternoon, typically attacking down low around calves or ankles. They are container-inhabiting species laying their eggs in a variety of artificial water receptacles, including discarded tires, clogged rain gutters, corrugated downspout extenders, upright wheelbarrows, tin can litter, upturned trash can lids, uncovered buckets, drums and cisterns, depressions in boat tarps, flower pot liners, cemetery urns/vases, abandoned in-ground swimming pools, unused kiddie wading pools, unchanged bird bath water, as well as using natural containers such as treeholes or leaf axils. Fortunately in comparison to other mosquitoes, their flight range is relatively limited, only a few hundred yards from their natal waters. However, due to their obscure habitats as larvae and their daytime activity patterns as adults, they are among the most challenging mosquito species to control with insecticides. The best control approach involves property owners practicing good water sanitation.

Asian tiger mosquitoes also present serious public health threats, due to their close proximity to people and their preference for mammalian blood meals. This species is a significant vector for dengue (“breakbone”) fever in southeast Asia, and recent outbreaks of dengue in southern Texas and south Florida are cause for concern in the U.S. Asian tigers have also been found to be vector competent in the laboratory for West Nile virus and eastern equine encephalitis, presenting human health concerns in Delaware and for other more northern locations. Bottom line? Beware of the tiger!

What you can do:

Land owners should either prevent or eliminate any unneeded standing water on their properties that persists for four or more consecutive days. When intolerable numbers of Asian tigers or other biting mosquitoes hit home, call the Delaware Mosquito Control Section in Glasgow at 302-836-2555 for all upstate areas from Dover north, or call 302-422-1512 in Milford for all downstate locations south of Dover. **DD**

WILLIAM H. MEREDITH IS ENVIRONMENTAL PROGRAM ADMINISTRATOR OF DNREC’S MOSQUITO CONTROL SECTION.

The Mute Swan

A Graceful Intruder

BY ROB HOSSLER

WHEN ONE HEARS the term “swan” they typically think of large, white conspicuous birds that symbolize purity and elegance, and are the subject of many a nursery rhyme.

We all remember the story of the “ugly duckling” that turned into the beautiful and graceful swan. So it understandably amazes many of us that these same storybook swans can become a wildlife management storybook nightmare. The problem is that not all swans are created

equally, at least between the two species that are seen in Delaware. The tundra swan (*Cygnus columbianus*), Delaware’s only current native swan, migrates here each fall from Alaska and Arctic Canada and is commonly seen feeding in large fields in flocks from November to March. Our other swan is the mute swan (*Cygnus olor*), a non-migratory, non-native species in-

troduced into the U.S. from Europe for ornamental purposes in the late 1800s. By the 1920s, small numbers of mute swans had escaped or were released into the wild. However,

the earliest known sighting of mute swans in Delaware was not until 1954 in Rehoboth Beach. Mute swans are the species commonly seen in park and large garden display ponds throughout the Mid-Atlantic and New England. In Delaware they can

be seen throughout the year, especially in large wetland complexes along the C&D Canal and within the Inland Bays.

So why are these beautiful birds problematic to wildlife and their habitats? Not unlike many other species introduced into Delaware, the mute swan is classified as an invasive species, meaning an ani-



Mute swans were introduced into the U.S. from Europe for ornamental purposes in the late 1800s.



Mute swans can consume eight pounds of key aquatic vegetation a day, feeding year round on it and destroying large amounts for nesting. The vegetation is critical habitat for crabs and fish, as well as for other native water bird species.

rable in relative size and distribution to Delaware's numbers. In both cases without proper management controls, the populations of mute swans in each state increased dramatically by three to 13 times their original size, respectively. As a result of this unchecked growth, these states were then later forced to implement large-scale removal programs where thousands of mute swans were euthanized and removed from the population. This was not only controversial but extremely expensive and time consuming for the respective natural resource agencies.

So what should be done about mute swans in Delaware? Herein lies the challenge. On one hand the mute swan is a classic invasive species capable of causing environmental harm, while on the other it is a majestic species that provides enjoyment for many people, who photograph, paint, or just watch the birds. Additionally, because mute swans have little or no fear of humans, likely due to their domestic origin, people derive enjoyment from feeding them and can become emotionally attached to individual swans, especially those obtained through the prolific, domestic live bird trade of mute swans. Furthermore, because mute swans are long-lived, have few natural predators and possess a high reproductive potential, their populations can easily grow exponentially.

As DNREC's wildlife management agency, the Division of Fish and Wildlife's mission is to ensure that invasive wildlife species, such as the mute swan,

mal alien to our ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Mute swans are invasive because they are introduced from Europe and have been shown to harm wetland habitats, impact native species of fish and wildlife, and pose a threat to human health and safety.

How intrusive can this beautiful bird be? Mute swans can consume eight pounds of submerged aquatic vegetation (SAV) per day, thereby reducing the amount of this important wetland vegetation available to native water bird species. Although some of these native water bird species also consume this vegetation, most of these species are migratory and only consume SAV during a portion of the year when plants are dormant and after seeds have been released. Mute swans feed on SAV year round and destroy large amounts of it for nest building or by raking and dislodging more of it than they can consume. SAV is critical habitat for crabs and fish and overgrazing of it by mute swans can also impact these important recreational and commercial species.

Although valued for their aesthetic beauty, mute swans are one of the most aggressive species of water birds. Mute swan pairs can be very territorial and some will vigorously defend their nest or display aggressive behavior that deters native species from nesting, sometimes even killing native water birds or their young. This aggressive behavior isn't just directed toward ducks and other water

birds. Mute swans can also cause serious nuisance problems and have attacked children and boaters and caused property damage. There are numerous reports around the country of mute swans turning over canoes, kayaks and even small boats. Several states have documented mute swan attacks on humans, some serious enough that individuals have required medical treatment and in a recent case in suburban Chicago, a kayaker drowned after being attacked by an aggressive mute swan.

How many mute swans are in Delaware? Based on summer aerial surveys, the mute swan population in Delaware is approximately 50 birds as a result of past population control efforts. While this might not seem like much of a population problem, 10 to 15 years ago the states of Maryland and Michigan had small populations of mute swans compa-



Mute swans are among the most aggressive species of water birds, deterring native species from nesting, even sometimes killing native water birds or their young.

DIVISION OF FISH AND WILDLIFE



are not be allowed to adversely impact important habitat types and native wildlife species. As such it is the Division's intent to continue to implement proactive management options while our mute swan population is still relatively small and to use proper population management that is sensible, attainable, effective and economical, thus avoiding the negatives associated with an eventual large-scale population reduction. The Division's solution is an integrated mute swan management plan whereby: 1) DNREC makes it unlawful to possess, buy, sell, barter, trade, or transfer any live mute swan or their eggs to or from another person unless permitted by DNREC; 2) the mute swan population in Delaware will be controlled and even reduced in most areas consistent with the Division's overall, scientifically-based, broader wildlife management responsibilities; and 3) because mute swans have aesthetic value and provide public enjoyment, isolated pairs of mute swans will be permitted in developed areas with relatively high human populations if it is determined that this action is environmentally responsible and assurances are made that population expansion will not occur as the result of successful reproduction or release of swans into the wild.

Mute swan population management will be undertaken by two means, non-lethal and direct lethal control. While sometimes controversial, direct removal of birds from the population either from euthanization or hunting is the most effective and a humane method to reduce the number of mute swans in Delaware. Prior to implementation of lethal control measures, non-lethal management options will be considered and discretion will be used whenever lethal control measures are implemented, especially in developed areas with relatively high human population (i.e., locations that are not environmentally important or sensitive natural areas). Non-lethal control methods such as egg treatment programs (addling and oiling) are techniques that render the eggs unviable, thereby preventing successful reproduction and recruitment into the swan population. DNREC recognizes the value and contribution these non-lethal techniques

can have in controlling the expansion of swan population levels in localized areas and, where practicable, will engage in egg treatment actions. DNREC will also encourage independent mute swan cooperators to locate swan nests and engage in egg treatment. Egg treatment, however, cannot be considered the primary method to reduce or otherwise properly manage and limit the population of free-ranging mute swans in natural areas due to the mute swan's long lifespan (up to 25 years) and the limitations of



egg treatment programs. For example, Rhode Island implemented a 16-year mute swan egg treatment program and added over 11,000 eggs yet the number of nesting mute swan pairs continued to increase from approximately 400 birds to over 1200. Such egg treatment programs will therefore not be the primary management option in those areas with important natural resources, but will primarily be utilized in those areas associated with swan possession permits or developed areas with relatively high human population.

DNREC will, in certain circumstances, issue possession permits to mute swan management cooperators granting them stewardship over a limited number of captive or free-ranging mute swans in developed areas with relatively high human populations. Such independent mute swan management cooperators would enlist the assistance of a qualified professional organization to help implement egg treatment programs to avoid population increases or redistribution of swans. Permit requests will be evaluated by DNREC using criteria to include the number of mute swans present in and

near the area, location relative to sensitive habitats and other wildlife species and the capability of the requesting mute swan management cooperator to implement appropriate mute swan management activities. It will be the responsibility of permit holders to ensure that all swans are marked and to implement egg treatment methods or other management actions to prevent successful reproduction. Permit holders that allow successful mute swan reproduction will be subject to permit revocation and appropriate remedies to control the population, including removal of all swans.

While some might view it unnecessary for DNREC to control the mute swan population, it would be irresponsible for the agency to allow unchecked population growth of an invasive species that can harm native wildlife and habitats. Even with this concern for population growth, exceptions are being made to consider the aesthetic qualities and public enjoyment swans can provide by allowing limited and managed possession. DNREC's integrated mute swan management plan and cooperation from our constituents provides a workable solution that is environmentally responsible and provides opportunities for stewardship and enjoyment of mute swans.

So is the mute swan really a wicked "ugly duckling"? Not really, it is more of a misplaced species whose population needs to be carefully controlled so that its invasive tendencies do not outweigh its beautiful aesthetic qualities.

Remember: It is unlawful to possess, buy, sell, barter, trade, or transfer any live mute swan or their eggs to or from another person unless permitted by the director of the Division of Fish and Wildlife. It is also unlawful to release any mute swan into the wild. **OD**

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