Invasive Species Program—*Snakeheads, Aquatic Invaders*

Northern snakehead *(Channa argus)* Illustration by Susan Trammell

What are snakeheads?

Snakeheads are airbreathing freshwater fishes that are not native to North America. In scientific terms, snakeheads are divided into two distinct genera:

- *Channa* (snakeheads of Asia, Malaysia, and Indonesia); and
- *Parachanna* (African snakeheads).

In the summer of 2002 and again in late spring 2004, one of the Asian species, the northern snakehead, generated national media attention when anglers caught this fish in a pond in Maryland and, more recently, in the Potomac River in Maryland and Virginia. Fisheries scientists consider snakeheads to be invasive species because they have the potential to threaten native fishes, the recreational fishing industry, and aquatic ecosystems.

What do they look like?

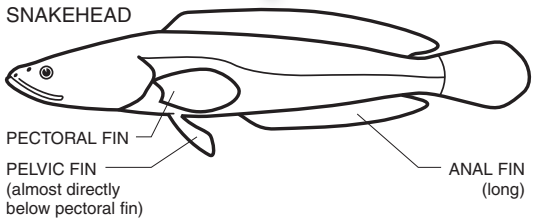
Snakeheads have a long, cylindrical body with a large mouth and sharp teeth. They have enlarged scales on top of their heads and their eyes are located far forward on their head, similar to the scale patterns and eye positions of snakes. Because their heads are similar to the heads of snakes, they have long been known by the common name "snakeheads." Size and color patterns vary among 29 recognized species. The largest recorded snakehead was almost 6 feet in length. Additionally, the young (juveniles) of many species often have color patterns dramatically different from the coloration of adults. Adult snakeheads superficially resemble the bowfin, a native North American fish.

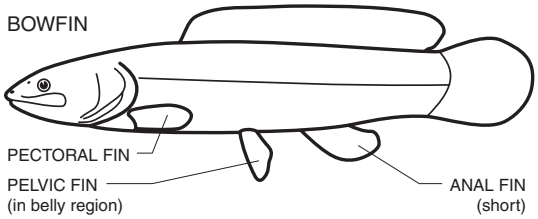
Where are they from?

Snakeheads are native to parts of Asia and Africa. Fishery scientists have found individuals of four species in waters of California, Florida, Hawaii, Maine, Maryland, Massachusetts, Rhode Island, Virginia, and Wisconsin. Reproducing populations, however, have been documented only in Florida, Hawaii, and Maryland. The blotched snakehead *(Channa maculata)* has thrived in Oahu, Hawaii, for more than a century; the bullseye snakehead *(C. marulius)* was discovered thriving in Florida in 2000. An isolated reproducing population of northern snakeheads was eradicated in Maryland in 2002. Captures of northern snakeheads of several different sizes in the Potomac River, Maryland and Virginia, in late spring and during summer 2004 indicates that this species is likely reproducing there.

How did they get here?

Prior to being added to the list of injurious wildlife under the Lacey Act in October 2002, which banned import and interstate transport without a permit from the U.S. Fish and Wildlife Service, snakeheads were sold in pet stores and in live food fish markets and some restaurants in several major U.S. cities, including Boston, New York, and St. Louis. Live specimens have been confiscated by authorities in Alabama, California, Florida, Texas, Virginia, and Washington where possession of live snakeheads is illegal. Some snakeheads living in





natural waters of the U.S. may have been released by aquarium hobbyists or those hoping to establish a local food resource. Also, some cultures practice "prayer animal release," a faith-based activity in which individuals purchase, then release, an animal (fish, amphibian, reptile, or bird) to earn merits with a deity.

What are the potential effects to our waters?

During all life stages, snakeheads compete with native species for food and habitat. As juveniles, they eat zooplankton, insect larvae, small crustaceans, and the young of other fishes. As adults, they become voracious predators, feeding on other fishes, crustaceans, frogs, small reptiles, and sometimes birds and small mammals. Should snakeheads become established in North American ecosystems, their predatory behavior could drastically disrupt food webs and ecological conditions, thus forever changing native aquatic systems by modifying the array of native species.

An additional concern is the snakehead's potential to transfer pathogens to native fishes, because snakeheads can carry diseases and parasites that have the potential to be harmful. Fishery scientists need to study this potential to determine if diseases and parasites can be transferred to North American species.

Have snakeheads been introduced to places other than the United States?

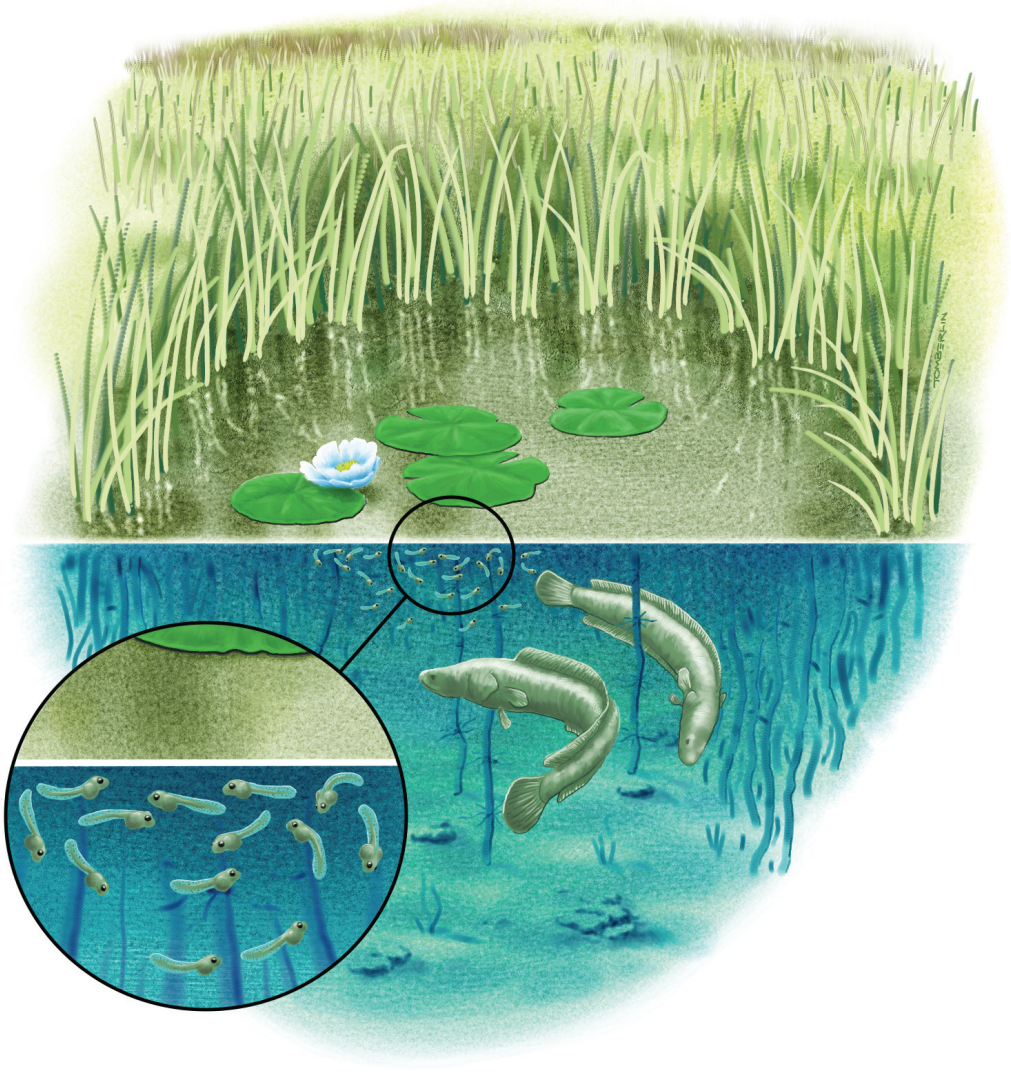
Northern snakeheads were purposefully introduced and established into Japan in the early 1900s. They were introduced into parts of the former Soviet Union (Kazakhstan, Uzbekistan, Turkmenistan) when accidentally mixed with shipments of imported Asian carps. This fish also became established in Russia for a short time in the 1950s and was successfully introduced into Czechoslovakia. The blotched snakehead was successfully introduced into the Philippines and into Madagascar where it is now a major threat to many of the endemic cichlid fishes of that island nation. The chevron snakehead *(Channa striata)* was successfully introduced into the Philippines, is reported to be established in other Pacific islands, and is being cultured in Hawaii.

Do snakeheads "walk?"

Although claims of their mobility have been greatly exaggerated, several species of snakeheads are able to wriggle overland from one body of water to another, particularly if the ground is wet. They do this by flexing their body and pushing with their tail, while using their broad pectoral fins to stabilize their head. It is unknown how far they can travel on land. This crawling ability is reduced in larger species of snakeheads as they reach adulthood. The introduced blotched snakehead in Madagascar is known to crawl onshore, allow its body to be covered with ants, then return to the water where the ants are dislodged and subsequently eaten by the fish.

How many eggs do snakeheads lay?

A mature northern snakehead female can carry as many as 50,000 eggs, although some will not develop and others will be eaten by insects and small fishes following fertilization. Depending on water temperature, eggs can hatch in about 24-48 hours. When the fry hatch, they remain clustered at the surface of the nest until their fins develop. At that time, the young (early juveniles) begin swimming by diving down into the center of the nest, then rising back to the surface. Early juveniles remain in the nest for 3-4 weeks, schooling, and being guarded by one or both parents. All species of snakeheads guard their eggs and young, a behavior that is rare in our native fishes.



Juvenile snakeheads (fry) cluster at the surface of their "nest," a column of water cleared from vegetation in 2-3 feet of water. Their parents will aggressively guard their nest for 3-4 weeks while the fry develop their fins, learn to school, and are ready to fend for themselves.

What are the major concerns about snakeheads?

- They are very predatory and could alter conditions in our aquatic ecosystems.
- They are airbreathers and several species are capable of overland migration during some part of their life history.
- They are very aggressive in their efforts to protect their young.
- Some snakehead species have a very large potential range in the U.S.

A recent comprehensive assessment concluded that when these factors are combined, snakeheads pose a significant threat to fish and wildlife resources of the United States.

The reproductive behavior of snakeheads is quite interesting. Most, perhaps all, are nest builders. The northern snakehead, for example, builds its nest in shallow water by clearing an area of vegetation. This results in a cylindrical column of water devoid of most vegetation. Nests are about 2-3 feet deep and about 3 feet in diameter.

A few species of snakeheads are mouthbrooders; that is, one of the parents will carry fertilized eggs in its mouth cavity. When the fry hatch, they are retained in the mouth until their fins develop to the point the young can swim. Even after the young leave the mouth of the adult, the parents continue to guard the young fish until they are able to fend for themselves.

What eats snakeheads?

Although little information exists in the scientific literature regarding predation on snakeheads, juveniles would be the most vulnerable to predation by other predatory fishes and some wading birds once they leave the nest and their guarding parents. In U.S. waters where snakeheads have become established, the most likely predatory fishes on juveniles would be gars, larger sunfishes, bass, perch, and pike. Because most native fishes could not eat the larger species of adult snakeheads, these snakeheads could become the top predators within the freshwater fish community.

Humans also eat snakeheads. Within their native ranges and places where they have been introduced, some species are considered a delicacy. Several species are caught in the wild for food, whereas others are cultured.

Where do snakeheads live?

Snakeheads are freshwater fishes with little, if any, tolerance for saltwater. Within their native and introduced ranges, they live in small and large streams, canals, rivers, ponds, reservoirs, and lakes. Many species can tolerate a wide range of pH, and one species living in Malaysia and parts of Indonesia prefers highly acid waters (pH 2.8-3.8). The northern snakehead and several other species prefer to live in somewhat dense aquatic vegetation where they feed and reproduce.

Can snakeheads harm humans?

Most snakeheads will avoid contact with humans. However, when guarding their eggs or young, they can become aggressive if approached. One species, the giant snakehead *(Channa micropeltes)* native to southeastern Asia, has been reported to be aggressive toward humans who got too close to their nest. Other snakeheads are not as aggressive toward humans.

What is the Federal Government doing about snakeheads?

Two agencies within the Department of the Interior (DOI) are responsible for researching and regulating snakeheads. The U.S. Geological Survey (USGS; http://www.usgs.gov) is a research arm of DOI, and USGS scientists conducted extensive, worldwide research on snakeheads that provided a basis for regulating their importation and interstate transport in the U.S. Funding for that research was sponsored through a grant from another DOI agency, the U.S. Fish and Wildlife Service (FWS; http://www.fws.gov), which is responsible for fisheries management, regulations, law enforcement, and education. The mission of the FWS is to work with others to conserve, protect, and enhance fish, wildlife, and plants for the continued benefit of the American people.

On October 4, 2002, the FWS added the snakehead family of fishes (Channidae) to the list of injurious wildlife under the Lacey Act. This includes all currently recognized species, and any new species that may be described within that family in the future. By taking this action, snakehead fishes can no longer be imported into the U.S. or transported across state lines without a permit. Permits for interstate transportation and importation into the U.S. can be obtained by calling the U.S. Fish and Wildlife Service Division

What should be done with a captured snakehead?

- Do not release the fish or throw it up on the bank (it could wriggle back into the water). Remember, this fish is an airbreather and can live a long time out of water.
- Kill the fish by freezing it or putting it on ice for an extended length of time.
- Photograph the fish if you have access to a camera so the species of snakehead fish can be positively identified.
- Contact your nearest fish and game agency or the U.S. Fish and Wildlife Service (703-358-2148) as soon as possible. Keeping data on the size, number, and location of where snakeheads are caught or seen is vital to controlling this invasive fish.

of Management Authority at 1-800-358-2104. Such permits, however, will only be issued for specific uses, such as medical or scientific research and education.

This injurious wildlife listing is based upon a thorough review of the scientific data on snakehead fishes and a risk assessment that was prepared for the FWS by the USGS. The FWS determined that regulation of all snakehead species is necessary to protect wildlife from the purposeful or accidental introduction of snakeheads into the ecosystems of the United States.

Can aquarium hobbyists still possess snakeheads as pets?

As mentioned previously, importation of live snakeheads and their interstate transport is prohibited. Many states prohibit possession of snakeheads, and several of those states have done so for decades. Aquarists can obtain information about regulations concerning possession of live snakeheads and other prohibited fishes by contacting their state fish and game agency. Transporting live snakeheads across a state line for any purpose, however, is a Federal offense under the Lacey Act, even between two states that allow possession of live snakeheads.

Can snakeheads still be purchased for food purposes?

Dead snakeheads—on ice or frozen—can be imported for food purposes to any state except those where importation or possession of dead snakeheads is illegal. Live snakeheads of one species being cultured in Hawaii, but not exported to the mainland of the U.S., are available in one market in Honolulu. Hawaii regulations require that all fish must be killed and their gills removed before the purchaser leaves the store.

What is an invasive species and why should the American public be concerned?

An invasive species is an introduced, nonnative organism (disease, parasite, plant, or animal) that begins to spread or expand its range from the site of its original introduction and has the potential to cause harm to the environment, the economy, or to human health. A few well-known examples include the unintentional introduction of the West Nile virus, chestnut blight, the South American fireant in the southeastern states, zebra mussels, and lamprey eels in the Great Lakes, in addition to the intentional introductions of salt cedar (Tamarisk) in the southwest, kudzu vine in the southeast, house sparrows, starlings, and nutria in Louisiana and Maryland.

Although the U.S. depends on many intentionally introduced nonnative plants and animals for our food supply, most are "domesticated" to be noninvasive (the introduction of potatoes and cattle, for example). In the past century, however, an increasing number of exotic plants and animals have been brought to the U.S. for other reasons. Many invasives have been unintentionally introduced as "hitchhikers" with imported species of plants, some animals have escaped or have been purposefully released, and many are now environmental and economic threats. A study conducted at Cornell University estimated the annual environmental and economic costs due to invasive species of plants and animals at $137 billion.*

*Source: Pimentel, D., Lach, L., Zuninga, R., and Morrison, D., 2000, Environmental and economic costs of nonindigenous species in the United States: Bioscience: v. 50, p. 53-65.

For More Information, Contact:

U.S. Fish and Wildlife Service
Division of Environmental Quality
Branch of Invasive Species
4401 N. Fairfax Drive,
Suite 840
Arlington, VA 22203
(703) 358-2148
http://contaminants.fws.gov/Issues/InvasiveSpecies.cfm

U.S. Geological Survey
Florida Integrated Science Center
7920 N.W. 71st Street
Gainesville, FL 32653
(352) 378-8181

U.S. Fish and Wildlife Service
(800) 344-WILD (800-344-9453)
http://www.fws.gov

The following report provides additional information on snakeheads and is available in HTML and downloadable pdf:

Courtenay, W.R., Jr., and Williams, J.D. 2004. Snakeheads *(Pisces, Channidae)*—A Biological Synopsis and Risk Assessment: USGS Circular 1251, 143 p.

http://fisc.er.usgs.gov/Snakehead_circ_1251/index.html

An informative and continually updated website database on nonindigenous plants and animals in the U.S. can be found at: *http://fl.biology.usgs.gov* and a site that provides information on invasive species is: *http://www.protectyourwaters.net*

Internet addresses updated Aug-08