



## Aquatic Invasive Species (AIS) Control Plan: Northern Snakehead

This control plan is a living document and will be updated, as needed, to reflect the status of the species within Pennsylvania.

### Natural History

**Description:** Northern Snakehead (*Channa argus*) is a large predatory fish which can attain sizes of over 85 cm (33 inches) in length.

### Taxonomy

Common name: **Northern Snakehead**  
Family: **Channidae**  
Species: *Channa argus*  
Integrated Taxonomic Information System (ITIS) Serial Number **166680**

**Morphology:** Northern Snakehead are elongate fish with anal and dorsal fins that extend nearly to the origin of the caudal fin (Stauffer et al. 2016; Fuller et al. 2020). The head is moderately compressed. Eyes are situated in a dorsolateral position on the anterior part of the head, and anterior nostrils are present. Coloration is typified by shades of brown with dark blotches. Adults are sexually dimorphic, with males appearing darker in coloration and typically having larger heads (Fuller et al. 2020). Juveniles are similar in appearance to adults (Figure 1).

Northern Snakehead are similar in appearance to and may be confused with two native Pennsylvania fish species, the

Bowfin *Amia calva* and the Pennsylvania endangered Burbot *Lota lota*. Northern Snakehead can be distinguished from Bowfin by the position of the pelvic fin, which is almost directly below the pectoral fins in the Northern Snakehead but positioned further back in the Bowfin. Northern Snakehead also have a much longer anal fin than the Bowfin and possess scales on the top of the head which Bowfin lack. Burbot possess a chin barbel and two dorsal fins which are not present in the Northern Snakehead. More information, including photos of Burbot and Bowfin in comparison to Northern Snakehead, can be found on the Pennsylvania Fish and Boat Commission (PFBC)'s Northern Snakehead webpage:

<https://www.fishandboat.com/Fish/PennsylvaniaFishes/Pages/Snakehead.aspx>



**Figure 1.** (Top) adult Northern Snakehead caught by PFBC staff in the lower Susquehanna River. (Bottom) juvenile Northern Snakehead. Source: USGS.

Additionally, anglers have confused Chain Pickerel *Esox niger* and Northern Hogsucker *Hypentelium nigricans* for adult Northern Snakehead, and have confused Tessellated



Darters *Etheostoma olmstedi*, Sculpins *Cottus spp.*, and Eastern Mudminnows *Umbra pygmaea* for juvenile Northern Snakehead. More information on the identification of all of these species can be found in Stauffer et al. (2016).

Origin: Northern Snakeheads are part of a broader family of fishes (consisting of approximately 26 species in the family Chanidae) indigenous to parts of Asia and Africa. Northern Snakehead are native to portions of China, Korea, and Russia (Fuller et al. 2020). Most populations in the eastern United States are genetically distinct and likely resulted from independent introductions (Orrell and Weigt 2005).

Food Preferences: Northern Snakeheads are dietary generalists consuming a broad variety of prey items, including fish, amphibians, and aquatic invertebrates (Fuller et al. 2020). Gut content studies of established populations in the eastern United States report most prey items included sunfishes *Lepomis spp.*, topminnows (family Fundulidae), and aquatic invertebrates (Saylor et al. 2012; Cohen and MacDonald 2016; Lapointe et al. 2019). Northern Snakehead have significant dietary overlap with Largemouth Bass *Micropterus salmoides* (Saylor et al. 2012).

Reproduction: Northern Snakeheads typically take 2-3 years to reach sexual maturity; however, individuals in invasive populations may reach sexual maturity within approximately one year (Fuller et al. 2020). Breeding begins in late April and extends through August, and both sexes guard the nest (Stauffer et al. 2016; Fuller et al. 2020). Up to five spawns may occur in one year, with up to ~50,000 eggs per clutch (Fuller et al. 2020).

Notable Characteristics: This species can survive for up to four days outside of water (Fuller et al. 2020). Although other species of snakeheads are known to make short overland movements, this is unlikely to occur in Northern Snakeheads due to their robust morphology (Fuller et al. 2020).

Historic Vectors: Northern Snakeheads are thought to have arrived in the United States via importation for the live fish market (Fuller et al. 2020).

Current Pathways/Vectors: Northern Snakehead populations within the Chesapeake Bay drainage are genetically similar to those within the Potomac drainage, suggesting populations within the Chesapeake Bay drainages originated from Potomac populations (Wegleitner et al. 2016). Northern Snakehead importation and cross-border transport was prohibited in 2002 by the Lacey Act and this species has been banned from possession in several States and Ontario (Fuller et al. 2020). Despite these restrictions, it is thought that the primary vector of new Northern Snakehead introductions is from illicit, intentional releases, such as from prayer-release religious ceremonies (Fuller et al. 2020) or by anglers wishing to develop fishing opportunities for this species (Stauffer et al. 2016). Incidental release through bait collection may also occur but is not thought to be a significant vector or method of spread (Fuller et al. 2020).

Northern Snakehead may disperse via long (up to 39 km) upstream movements (Lapointe et al. 2013) and thus have the potential to disperse significantly in lotic ecosystems unaided by human influence. However, these movements may be blocked or slowed by impoundments (Stauffer et al. 2016) or facilitated through migratory fish



passage operations at dams. Estimates predict a high rate of range expansion for introduced populations of this species within watersheds (Love and Newhard 2018).

**Preferred Habitat:** Northern Snakeheads are obligate air breathers and can survive in oxygen-poor waters (Fuller et al. 2020). Northern Snakehead typically prefer lentic or slow-moving waters typified by silty sediments and aquatic vegetation (Stauffer et al. 2016). This species can tolerate a wide range of water temperatures (Stauffer et al. 2016). Northern Snakehead may also tolerate slightly brackish water (Bunch et al. 2019).

## Distribution and Status

**Distribution:** Northern Snakeheads have been reported from at least 16 States (Figure 2), with established populations concentrated primarily in the mid-Atlantic states, and scattered populations in the southeastern United States, California, and in the vicinity of Lake Michigan (Fuller et al. 2020). Northern Snakeheads are presently the only species in the family Channidae known to occur in Pennsylvania, although other species in the genus *Channa* such as Giant Snakehead *Channa micropeltes* and Blotched Snakehead *Channa maculata* have been introduced elsewhere in the United States.

In Pennsylvania, Northern Snakehead were first reported from a lake in Philadelphia in 2004 (Stauffer et al. 2016). This lake is part of a maze of embayments and tidal sloughs that form a large, interconnected aquatic complex connected to the Delaware and Schuylkill Rivers and eradication was determined to be unfeasible due to this fact. Northern Snakehead have subsequently been reported from waters within the lower

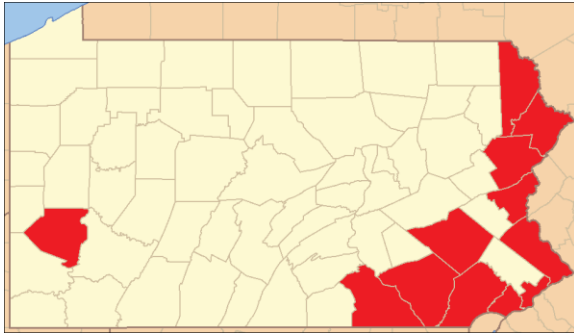
Delaware basin and populations have established in parts of this this region. Scattered records are known from the middle and upper Delaware River and likely represent migrants from the lower Delaware basin or illicit introductions.



**Figure 2.** Distribution of Northern Snakehead within the continental United States. Source: USGS.

Northern Snakehead are known to occur in impoundments in Berks, York and Lancaster counties (Schuylkill River and lower Susquehanna basins, respectively) resulting from unlawful introductions. This species also occurs in portions of the Octoraro watershed in Lancaster County via connectivity to Susquehanna River downstream of Conowingo Dam.

Two recent captures of adult Northern Snakehead by anglers in the Allegheny and Monongahela River (both in the vicinity of Pittsburgh, Allegheny County) were likely recently released captive fish that were possessed and released unlawfully, and Northern Snakehead are not known to be established in this area.



**Figure 3.** County-level map depicting the distribution of Northern Snakehead records in Pennsylvania (December 2022).

Pennsylvania Legal Status: All species of Snakehead Fish (family Channidae), including the Northern Snakehead, are regulated in 58 Pa. Code §71.6 and §73.1. Live Northern Snakehead, as well as all other live Snakehead species, may not be possessed, transported, sold, or bartered within the Commonwealth. Northern Snakehead, as well as all members of the family Channidae, are listed as injurious wildlife under the federal (18 U.S.C. 42) Lacey Act.

## Threats

Ecological: Northern Snakehead have the potential to significantly impact fish communities due to their ecological role as a large, predatory generalist (Cudmore and Mandrak 2006). Northern Snakehead can significantly reduce biomass of prey fish species such as sunfishes or minnows (Love and Newhard 2020). Northern Snakehead have considerable dietary overlap with Largemouth Bass and likely other predatory game fish (Love and Newhard 2012; Saylor et al. 2012). Models predict a minor impact to Largemouth Bass fisheries when Northern Snakehead populations are low, but denser populations are predicted to have a greater impact to fisheries (Love and Newhard

2012). An analysis of a fish community prior to and after Northern Snakehead establishment demonstrated that 17 of 21 fish species declined in abundance from estimates of 30% to 97%, suggesting Northern Snakehead can have major impacts on fish communities (Love and Newhard 2019). Few data appear to be available on their potential risks of Northern Snakehead towards coldwater fish communities; however, given the habitat preferences of this species, it is likely warmwater communities are at much greater risk.

Northern Snakehead are proposed to have a high risk of impacting imperiled (e.g., threatened or endangered) fish, crustaceans, and amphibians (Courtenay and Williams 2004). However, this has received little direct study due to the relatively recent establishment of Northern Snakehead populations in the United States. Northern Snakehead may also carry diseases which impact fish populations (Iwanowicz et al. 2013).

Economic: No studies appear to have estimated the quantitative economic impacts of Northern Snakehead establishment in the United States. However, due to their potential to substantially impact fish communities through predation, ecological competition, and disease transmission (Love and Newhard 2012; 2019; 2020; Saylor et al. 2012; Iwanowicz et al. 2013) it is possible that Northern Snakehead establishment may have economic and ecosystem implications for fisheries. Northern Snakehead are not predicted to have any significant economic impacts unassociated with fisheries (Courtenay and Williams 2004).



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## Management

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Management Goals: Northern Snakehead presently have a limited, but expanding, distribution in Pennsylvania. Therefore, the primary management goal should be to contain infestations and study colonized waters to determine what impacts are occurring to aquatic communities because of their presence.

Containment and Prevention Actions:

- As capacities allow, monitor select known Northern Snakehead sites in Pennsylvania for population increases and/or expansion, and survey areas at-risk for Northern Snakehead spread in collaboration with Federal and/or other Pennsylvania (or adjacent state) agencies when applicable. For example, as bowfishing was recently approved for Northern Snakehead in Pennsylvania, monitoring could evaluate the effectiveness of this measure on reducing biomass.
- Work with applicable partners to evaluate the control of Northern Snakehead passage through fish lifts associated with impoundments on the lower Susquehanna River.
- As staff capacities allow, initiate research initiatives or support partner research initiatives evaluating the ecological and/or economic impacts of Northern Snakehead within Pennsylvania.
- Continue and enhance the public education effort to acquaint anglers with the threat of Northern Snakehead, emphasizing reporting/destroying

captures, the possible risk this species poses towards Pennsylvania fisheries, and the illegality of live possession, propagation, release, and transport.

- Enhance/update the PFBC's website on Northern Snakeheads, including information on recommended ways to dispatch captures and promoting harvest as conservation-based table fare.
- Continue installing Northern Snakehead-specific signage developed by the PFBC and Pennsylvania Sea Grant at locations infested by Northern Snakehead.
- Continue to strictly enforce Northern Snakehead as a banned species in 58 Pa. Code §71.6 and §73.1, particularly because this species is often illicitly spread despite prohibitions in state and federal regulations (Fuller et al. 2020).
- Encourage the incident reporting of aquatic invasive/nuisance species such as Northern Snakehead within Pennsylvania. Online reporting can now be conducted at the following PFBC web site: <https://pfbc.pa.gov/forms/reportAIS.htm> as well as PA iMapInvasives at: <https://www.paimapinvasives.org/> and at the national level, USGS Nonindigenous Aquatic Species website: <https://nas.er.usgs.gov/SightingReport.aspx>

Rapid Response Options:

- Northern Snakehead have been successfully eliminated from smaller water bodies utilizing rotenone treatments and/or manual removal (e.g., intensive trapping); however,



this appears to be largely ineffective for larger waterbodies or lotic environments (Fuller et al. 2020). Thus, a practical approach for newly discovered Northern Snakehead introductions would be to target angler education to support removal/harvest to reduce biomass (Newhard et al. 2019).

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