Walking Catfish (*Clarias batrachus*)
Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, April 2011
Revised, January 2017, July 2017
Web Version, 6/14/2018

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1 Native Range and Status in the United States

Native Range
From Nico et al. (2017):

"Southeastern Asia including eastern India, Sri Lanka, Bangladesh, Burma, Indonesia, Singapore, and Borneo (Lee et al. 1980 et seq.; Talwar and Jhingran 1992; Kottelat et al. 1993). Laos (Baird et al. 1999)."

Status in the United States
From Nico et al. (2017):

"This species has been collected in California from the All American Canal west of Yuma, Arizona (Minckley 1973; Courtenay et al. 1984); from the San Joaquin River, Sacramento County (Courtenay and Hensley 1979a; Courtenay et al. 1984, 1986); and from Legg Lake, Los Angeles County (Shapovalov et al. 1981). Specimens have been captured in widely separated water bodies in Connecticut (Whitworth 1996). It has been firmly established in southern peninsular Florida since the late 1960s, including Florida Panther National Wildlife Refuge, Charlotte Harbor, Myakka River, Pelican Island National Wildlife Refuge, Big Cypress National Preserve and Everglades National Park (Courtenay 1970, 1978, 1979a; Courtenay et al. 1974; Courtenay and Miley 1975; Courtenay and Hensley 1979a; Loftus and Kushlan 1987; Anonymous 1983a; Lorenz et al. 1997; Tilmant 1999; Charlotte Harbor NEP 2004; USFWS 2005; Lemon, personal communication; Galvez, personal communication). They have also become established in Kissimmee and Lake Okeechobee drainages (Nico 2005[b]), and individuals have been collected in the Tampa Bay region (e.g., Little Manatee River; Hillsbororugh, Pinellas, and Pasco counties) and from the Indian River system near Daytona Beach. A specimen has been taken from the Flint River in Georgia (Courtenay and Miley 1975; Courtenay and Hensley 1979a; Courtenay et al. 1984, 1991; Gennings, personal communication). A single fish was taken by an angler from Waldo Lake, Brockton in Plymouth County, Massachusetts, in August 1971; three or four additional fish were reportedly taken from ponds in the eastern part of the state in the mid-1970s, but the specimens were not retained (Hartel 1992; Cardoza et al. 1993; Hartel et al. 1996). Two specimens were taken from Rogers Spring, Clark County, Nevada (Courtenay and Deacon 1983; Deacon and Williams 1984). Populations have failed throughout Nevada (Vinyard 2001)."

"Established in Florida; failed in California, Connecticut, Georgia, Massachusetts, and Nevada."

"In 1968, this species was confined to three south Florida counties; by 1978, it had spread to 20 counties in the southern half of the peninsula (Courtenay 1979a; Courtenay et al. 1986). Dispersal apparently has occurred by way of the interconnected network of canals along the southeastern coastal region; however, spread was accelerated by overland migration, typically during rainy nights (Loftus and Kushlan 1987). Its ability to use atmospheric oxygen assists in survival in low-oxygen habitats (Loftus 1979). The walking catfish has been established in Everglades National Park and in Big Cypress National Preserve since the mid-1970s (Courtenay 1989). Populations suffer periodic die-offs from cold temperatures and subsequent bacterial infection (Loftus and Kushlan 1987); consequently, northward dispersal is limited (Courtenay 1978, Courtenay and Stauffer 1990). Although all Florida imports were originally albinos, albinos in the wild are now rare and descendants have reverted to the dominant, dark-color phase (dark brown to gray) probably a result of natural selection by predators (Courtenay et al. 1974; Courtenay and Stauffer 1990). Guarding of free-swimming young may enhance survivorship over that of native species with less advanced (or no) parental care (Taylor et al. 1984)."

From Masterson (2007):

"*C. batrachus*, a southeastern Asian native species, is now established throughout most of Florida (Courtenay et al. 1991), although Shafland and Pestrak (1982) suggest that cold intolerance puts the northernmost limit of potential range expansion at approximately Gainsville."

Means of Introductions in the United States

From Nico et al. (2017):

"The walking catfish was imported to Florida, reportedly from Thailand, in the early 1960s for the aquarium trade (Courtenay et al. 1986). The first introductions apparently occurred in the mid-1960s when adult fish imported as brood stock escaped, either from a fish farm in northeastern Broward County or from a truck transporting brood fish between Dade and Broward counties (Courtenay and Miley 1975; Courtenay 1979a; Courtenay and Hensley 1979a; Courtenay et al. 1986). Additional introductions in Florida, supposedly purposeful releases, were made by fish farmers in the Tampa Bay area, Hillsborough County in late 1967 or early 1968, after the state banned the importation and possession of walking catfish (Courtenay and Stauffer 1990). Aquarium releases likely are responsible for introductions in other states (Courtenay and Hensley 1979a; Courtenay and Stauffer 1990; Hartel 1992). Dill and Cordone (1997) reported that this species has been sold by tropical fish dealers in California for some time."

Remarks

From GISD (2011):

"*Clarias batrachus* can survive out of water for quite sometime using its auxiliary breathing organs and move short distances over land allowing it to migrate to new water bodies (Froese and Pauly, 2009)."

"This species has been nominated as among 100 of the "World's Worst" invaders"

From Masterson (2007):

"In Florida, novices may confuse this species [*Clarias batrachus*] with the native Ariid marine hardhead catfish (*Ariopsis felis*) and gafftopsail catfish (*Bagre marinus*). However, the forked tail, adipose fin set anterior to the caudal peduncle, and the presence of a dorsal spine on the native species are among the many features that easily differentiate them from *C. batrachus*. Similar distinguishing features can be used to distinguish *C. batrachus* from resident freshwater Ictalurid catfish such as the brown bullhead (*Ictalurus nebulosus*) and channel catfish (*I. punctatus*)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2014):

"Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata
        Subphylum Vertebrata

Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Siluriformes
Family Clariidae
Genus *Clarias* Scopoli, 1777
Species *Clarias batrachus* (Linnaeus, 1758)"

According to Eschmeyer et al. (2017), *Clarias batrachus* (Linnaeus 1758) is the valid name for this species. *Clarias batrachus* was originally described as *Silurus batrachus* Linnaeus 1758.

Size, Weight, and Age Range

From Nico et al. (2017):

"Size: 61 cm in native range; rarely"

From Froese and Pauly (2011):

"Maturity: Lm 28.0 range ? - ? cm
Max length: 47.0 cm TL male/unsexed; [IGFA 2001]; common length: 26.3 cm TL male/unsexed; [Hugg 1996]; max. published weight: 1.2 kg [IGFA 2001]"

From Masterson (2007):

"Walking catfish typically attain a standard length of 225-300 mm, although animals twice that size are encountered (Courtenay and Miley 1975; Hensley and Courtenay 1980)."

Environment

From Froese and Pauly (2011):

"[…] freshwater; brackish; depth range 1 - ? m [Herre 1924]. […]; 10°C - 28°C [assumed to be recommended aquarium temperature range] [Baensch and Riehl 1985]; […]"

From GISD (2011):

"[…] it is also reported to occur in intercoastal waterways of salinities up to 18 ppt."

Climate/Range

From Froese and Pauly (2011):

"Tropical; […]; 29°N - 7°S"

From GISD (2011):

"[…] moderate tolerance to colder waters with a reported a [sic] lower lethal temperature of 9.8°C."

Distribution Outside the United States

Native

From Nico et al. (2017):

"Southeastern Asia including eastern India, Sri Lanka, Bangladesh, Burma, Indonesia, Singapore, and Borneo (Lee et al. 1980 et seq.; Talwar and Jhingran 1992; Kottelat et al. 1993). Laos (Baird et al. 1999)."

Introduced

From GISD (2011):

"Known introduced range: Indonesia (Sulawesi), USA, Hong Kong, Taiwan, China, UK, Papua New Guinea, Guam, Taiwan, Thailand (FishBase, 2003). Probably introduced into the Philippines (Nico, 2005[b])."

From NIES (2017):

"Range in Japan: Okinawajima Island."

Means of Introduction Outside the United States

From GISD (2011):

"Introduction pathways to new locations
Aquaculture: Introduced into Hong Kong from Thailand for aquaculture, (FishBase, 2003).
Pet/aquarium trade: The walking catfish was imported to Florida, reportedly from Thailand, in the early 1960s for the aquarium trade (Courtenay et al. 1986).
Local dispersal methods
Aquaculture (local): Aquarium releases likely are responsible for introductions in other states of America. (Nico, 2005[b])
Escape from confinement: In Florida adult fish imported as brood stock escaped from confinement, either from a fish farm in northeastern Broward County or from a truck transporting brood fish between Dade and Broward counties. (Nico, 2005[b])
Other (local): Dill and Cordone (1997) reported that this species has been sold by tropical fish dealers in California for some time. (Nico, 2005[b])
Water currents: In America dispersal apparently has occurred by way of the interconnected network of canals along the southeastern coastal region. (Nico, 2005[b])"

From NIES (2017):

"Route: Deliberate: distributed as pet animal."

Short Description

From Froese and Pauly (2011):

"Dorsal spines (total): 0; Dorsal soft rays (total): 60-76; Anal spines: 0; Anal soft rays: 47 - 58. Body compressed posteriorly. Upper jaw a little projecting. Spine of pectoral fins rough on its outer edge and serrated on its inner edge [Taki 1974]. Occipital process more or less triangular, its length about 2 time in its width [Kottelat 1998]; distance between dorsal and occipital process 4-5.5 times in distance from tip of snout to end of occipital process [Kottelat 2001]. Genital papilla in males is elongated and pointed [Ros 2004]."

From GISD (2011):

"*Clarias batrachus* has a broad, flat head and an elongate body which tapers toward the tail. It is readily recognizable as a catfish with four pairs of barbels whiskers and fleshy, papillated lips. The teeth are villiform, occurring in patches on the jaw and palate. Its eyes are small. The dorsal fin is continuous and extends along the back two-thirds of the length of the body but there is no dorsal spine. The dorsal, caudal, and anal fins together form a near-continuous margin; the caudal fin is rounded and not eel-like though it is occasionally fused with the other fins. Its pectoral spines are large and robust and finely serrate along the margins with which it walks accompanied by a back and forth flexion. Their coloration is olive to dark brown or purple to black above, blue green on the sides and white below, with white specks on their rear side. *C. batrachus* may be easily distinguished from many of the North American Ictalurid catfishes in that the walking catfish lacks an adipose fin (Masterson, 2007; Robins, undated; GSMFC, 2006)."

From CABI (2017):

"*C. batrachus* has an elongated body, broad at the anterior and narrow at the posterior. *C. batrachus* is similar in size and appearance to *C. macrocephalus* but can be distinguished from the latter species by the shape of the occipital process in the head portion. The occipital process is round-shaped in *C. macrocephalus* but pointed in *C. batrachus*. Unlike *C. macrocephalus*, *C. batrachus* does not have large numbers of small white spots along the sides of its body (Teugels et al., 1999). *C. batrachus* lacks an adipose fin. Dorsal and anal fins are without spines, pectoral fins are strong with fine serrations on both edges, pelvic fins are small and the caudal fin is not confluent with dorsal or anal fin. The mouth is wide and has four pairs of well-developed barbels, with the maxillary barbels reaching to the middle or base of the pectoral fin (Talwar and Jhingran, 1991)."

"The body of the normal coloured variety is greyish to olive in colour with a whitish underside. Other varieties include albino with a white body and reddish eyes, and a pink variety with normal coloured eyes (Axelrod et al., 1971). Various multi-coloured varieties are becoming more common in the tropical fish aquarium trade."

Biology

From Froese and Pauly (2011):

“Can live out of water for quite sometime and move short distances over land [Talwar and Jhingran 1991]. Can walk and leave the water to migrate to other water bodies using its auxiliary breathing organs. […] Feed on insect larvae, earthworms, shells, shrimps, small fish, aquatic plants and debris [Ukkatawewat 2005]. […] Recently rare, being replaced by introduced African walking catfish [Vidthayanon 2002].”

“Inhabits lowland streams [Vidthayanon 2002], swamps, ponds, ditches, rice paddies, and pools left in low spots after rivers have been in flood [Herre 1924, Vidthayanon 2002]. Usually confined to stagnant, muddy water [Rahman 1989]. Found in medium to large-sized rivers, flooded fields and stagnant water bodies including sluggish flowing canals [Taki 1978]. Undertakes lateral migrations from the Mekong mainstream, or other permanent water bodies, to flooded areas during the flood season and returns to the permanent water bodies at the onset of the dry season [Sokheng et al. 1999].”

From GISD (2011):

“Nutrition
Clarias batrachus feeds on insect larvae, earthworms, shells, shrimps, small fish, aquatic plants and debris.
Reproduction
Clarias batrachus engages in mass spawning migrations in late spring and early summer. Inundated rice paddy fields have been reported as favored spawning grounds over its native range. The pair manifests the 'spawning embrace' which is widely observed in other catfish species. Mating occurs repeatedly for as long as 20 hours. The pair gently nudge each other in the genital region and flick their dorsal fins; male wraps his body around the female, then the female releases a stream of hundreds to thousands of adhesive eggs into the nest or on submerged vegetation. Males guard the nests and embryos hatch in about 30 hours. Both parents guard fry for about three days, when they develop barbles visible to the naked eye and swim freely (GSMFC, 2006; FishBase, 2009, Ros, 2004c).”

“Lifecycle stages
In southeast Asia, spawning period is during the rainy season, when rivers rise and fish are able to excavate nests in submerged mud banks and dikes of flooded rice fields (FishBase, 2003).”

From Masterson (2007):

“Individuals become sexually mature at approximately one year of age (Talwar and Jhingran 1991). Where populations are established, walking catfish exhibit rainy season mass migration and spawning events. Adhesive egg masses containing as many as 1,000 eggs are laid in nesting hollows prepared by the breeding pair. Egg masses are found on on [sic] aquatic vegetation or within other suitable nest sites. They are guarded by the males until they hatch (Courtenay et al. 1974, Hensley and Courtenay 1980). The female, leaving care of the eggs to the male, guards the area around the nest.”

"Embryonic development within the egg is rapid. Embryos hatch out in approximately 30 hours at 25°C. For the first two days after hatching, parents still remain by the nest to protect the fry. At this stage, the fry are egg-sac larvae that do not yet feed, but instead live off of energy reserves stored in the yolk sac for the first two to three days after hatching (Rao et al. 1995). When the free-swimming young have consumed the remaining yolk reserves, they begin to forage for themselves."

Human Uses

From Froese and Pauly (2011):

"Fisheries: commercial; aquaculture: commercial; aquarium: commercial"

"The Lao use this fish as lap pa or ponne pa [traditional fish dishes]. […] An important food fish [Talwar and Jhingran 1991] that is marketed live, fresh and frozen [Frimodt 1995]."

From GISD (2011):

"They have become a significant source of food and for inhabitants and income for local fisheries (Joshi, undated)."

Diseases

No records of OIE reportable diseases.

From Froese and Pauly (2011):

"Dactylogyrus Gill Flukes Disease, Parasitic infestations (protozoa, worms, etc.)
Skin Flukes, Parasitic infestations (protozoa, worms, etc.)
Gonad Nematodosis Disease, Parasitic infestations (protozoa, worms, etc.)
Sporozoa Infection (*Hennegya* sp.), Parasitic infestations (protozoa, worms, etc.)
Sporozoa-infection (*Myxobolus* sp.), Parasitic infestations (protozoa, worms, etc.)
Haplorchis Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Posthodiplostomum Infestation, Parasitic infestations (protozoa, worms, etc.)
Clinostomoides Infestation, Parasitic infestations (protozoa, worms, etc.)
Neodiplostomum Disease, Parasitic infestations (protozoa, worms, etc.)
Orientocreadium Infestation, Parasitic infestations (protozoa, worms, etc.)
Gauhatian Infestation, Parasitic infestations (protozoa, worms, etc.)
Opegaster Infestation, Parasitic infestations (protozoa, worms, etc.)
Phyllodistomum Infestation, Parasitic infestations (protozoa, worms, etc.)
Boviena Disease, Parasitic infestations (protozoa, worms, etc.)
Lytocestus Disease, Parasitic infestations (protozoa, worms, etc.)
Gnathostoma Infestation, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 1, Parasitic infestations (protozoa, worms, etc.)
Cristaria Infestation, Parasitic infestations (protozoa, worms, etc.)
Bacterial Infections (general), Bacterial diseases
Anchor worm Disease, Parasitic infestations (protozoa, worms, etc.)

Dactylogyrus Gill Flukes Disease, Parasitic infestations (protozoa, worms, etc.)
Trichodinosis, Parasitic infestations (protozoa, worms, etc.)
Yellow Grub, Parasitic infestations (protozoa, worms, etc.)
Camallanus Disease, Parasitic infestations (protozoa, worms, etc.)
Acanthogyrus Infestation, Parasitic infestations (protozoa, worms, etc.)
Clinostomum Infestation (metacercaria), Parasitic infestations (protozoa, worms, etc.)
Acanthogyrus Infestation, Parasitic infestations (protozoa, worms, etc.)
Sporozoa-infection (*Myxobolus* sp.), Parasitic infestations (protozoa, worms, etc.)
Orientocreadium Infestation, Parasitic infestations (protozoa, worms, etc.)
Boviena Disease, Parasitic infestations (protozoa, worms, etc.)
Lytocestus Disease, Parasitic infestations (protozoa, worms, etc.)
Gnathostoma Infestation, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 1, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Disease, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 5, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Disease 2, Parasitic infestations (protozoa, worms, etc.)
Pallisentis Disease, Parasitic infestations (protozoa, worms, etc.)
Hemiclepsis Infestation, Parasitic infestations (protozoa, worms, etc.)
Palaeorchis Disease, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 6, Parasitic infestations (protozoa, worms, etc.)
Masenia Infestation, Parasitic infestations (protozoa, worms, etc.)
Phyllodistomum Infestation 3, Parasitic infestations (protozoa, worms, etc.)
Posthodiplostomum Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Dactylogyrus Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Capingentoides Infestation, Parasitic infestations (protozoa, worms, etc.)
Djombangia Infestation, Parasitic infestations (protozoa, worms, etc.)
Gyrocotyle Disease, Parasitic infestations (protozoa, worms, etc.)
Lytocestus Disease (*Lytocestus* sp.), Parasitic infestations (protozoa, worms, etc.)
Lytocestus Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Lytocestus Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Lytocestus Infestation 3, Parasitic infestations (protozoa, worms, etc.)
Monobothrioides Disease, Parasitic infestations (protozoa, worms, etc.)
Pseudocaryophyllaeus Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Pseudolytocestus Infestation, Parasitic infestations (protozoa, worms, etc.)
Ascaridia Disease, Parasitic infestations (protozoa, worms, etc.)
Echinocephalus Disease, Parasitic infestations (protozoa, worms, etc.)
Pallisentis Infestation 3, Parasitic infestations (protozoa, worms, etc.)
Columnaris Disease (e.), Bacterial diseases
Fungal Infection (general), Fungal diseases
Aeromonosis, Bacterial diseases
Enteric Septicaemia of Catfish, Parasitic infestations (protozoa, worms, etc.)”

Threat to Humans

From Froese and Pauly (2011):

“Potential pest”

3 Impacts of Introductions

From Nico et al. (2017):

"Largely unknown. In Florida, walking catfish are known to have invaded aquaculture farms, entering ponds where these predators prey on fish stocks. In response, fish farmers have had to erect protective fences to protect ponds (Courtenay and Stauffer 1990). Loftus (1988) reported heavy predation on native fishes in remnant pools during seasonal drying of wetlands. Baber and Babbitt (2003) examined predation impacts on tadpole assemblages in temporary wetlands in south-central Florida, and found that native fishes (e.g., eastern mosquitofish *Gambusia holbrooki*, golden topminnow *Fundulus chrysotus*, flagfish *Jordanella floridae*) had larger impacts and higher predation rates on tadpoles than *C. batrachus*."

From GISD (2011):

"*Clarias batrachus* in South Florida are known to invade commercial aquaculture facilities, often consuming vast numbers of the stocks of fishes (Robins, undated). The impacts from this opportunist feeder are probably most pronounced in small, isolated wetland ponds where walking catfish quickly consume or outcompete other resident populations to become the dominant species in the pond. Resident centrarchids (freshwater sunfish) and native catfish species appear particularly susceptible to impacts from this invader (Masterson, 2007). *C. batrachus* can also negatively impact native amphibian populations by preying on tadpoles. The ability of walking catfish to exploit isolated, ephemeral water bodies allows them to access tadpole prey stocks that other fish cannot reach (Masterson, 2007)."

"The intensive dispersal of the species in Luzon [the Philippines] in the 1970s led to the displacement of the native catfish in irrigation systems, lakes and rivers. It has completely dominated natural populations in lakes and rivers and the indigenous *Clarias macrocephalus* can hardly be found in the markets today."

"*Clarias batrachu*s threatens endemic fresh water fishes in Sri Lanka (Kotagama & Bambaradeniya, 2006)."

"*Clarias batrachus* will outcompete or directly consume several co-occurring native species in Florida. Resident centrarchids, freshwater sunfish, and native catfish species appear particularly susceptible to impacts from this invader. *C. batrachus* can also negatively impact native amphibian populations by preying on tadpoles (Masterson, 2007)."

"*Clarias batrachus* in South Florida are known to invade commercial aquaculture facilities, often consuming vast numbers of the stocks of fishes (Robins, undated)."

From Masterson (2007):

"One specific example of an observed economic impacts is the cost associated with barrier fences. Florida fish farmers have had to install such fences to keep walking catfish out of their ponds (Courtenay and Stauffer 1990, Nico 2005[a])."

From NIES (2017):

"Impact [in Japan]: Predation and competition against native species."

4 Global Distribution

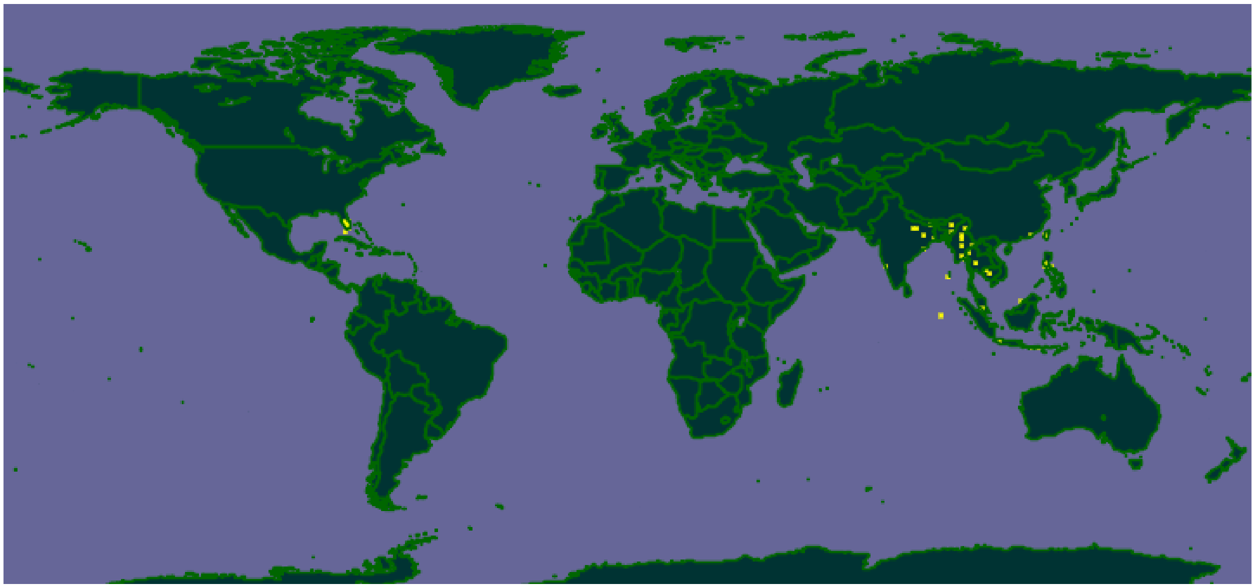

Figure 1. Known global distribution of *Clarias batrachus* as reported by GBIF Secretariat (2011). Locations are in southern Asia and Florida.

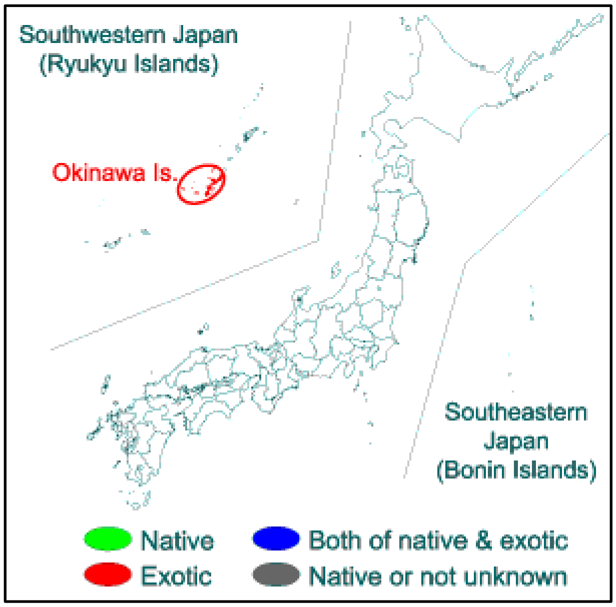

Figure 2. Known distribution of *Clarias batrachus* in Japan. Map from NIES (2017).

5 Distribution Within the United States

Figure 3. Known United States distribution of *Clarias batrachus* as reported by the USGS NAS Database (Nico et al. 2017).

The points in Arizona, California, Georgia, and Massachusetts are from failed introductions and subsequently were not used as source locations in the climate match.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Clarias batrachus* was high in southern Florida, the Southeast, and along the Gulf Coast, and was low across the rest of the United States. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous United States was 0.041, medium, and individually high in Florida, Georgia, North Carolina, and South Carolina.

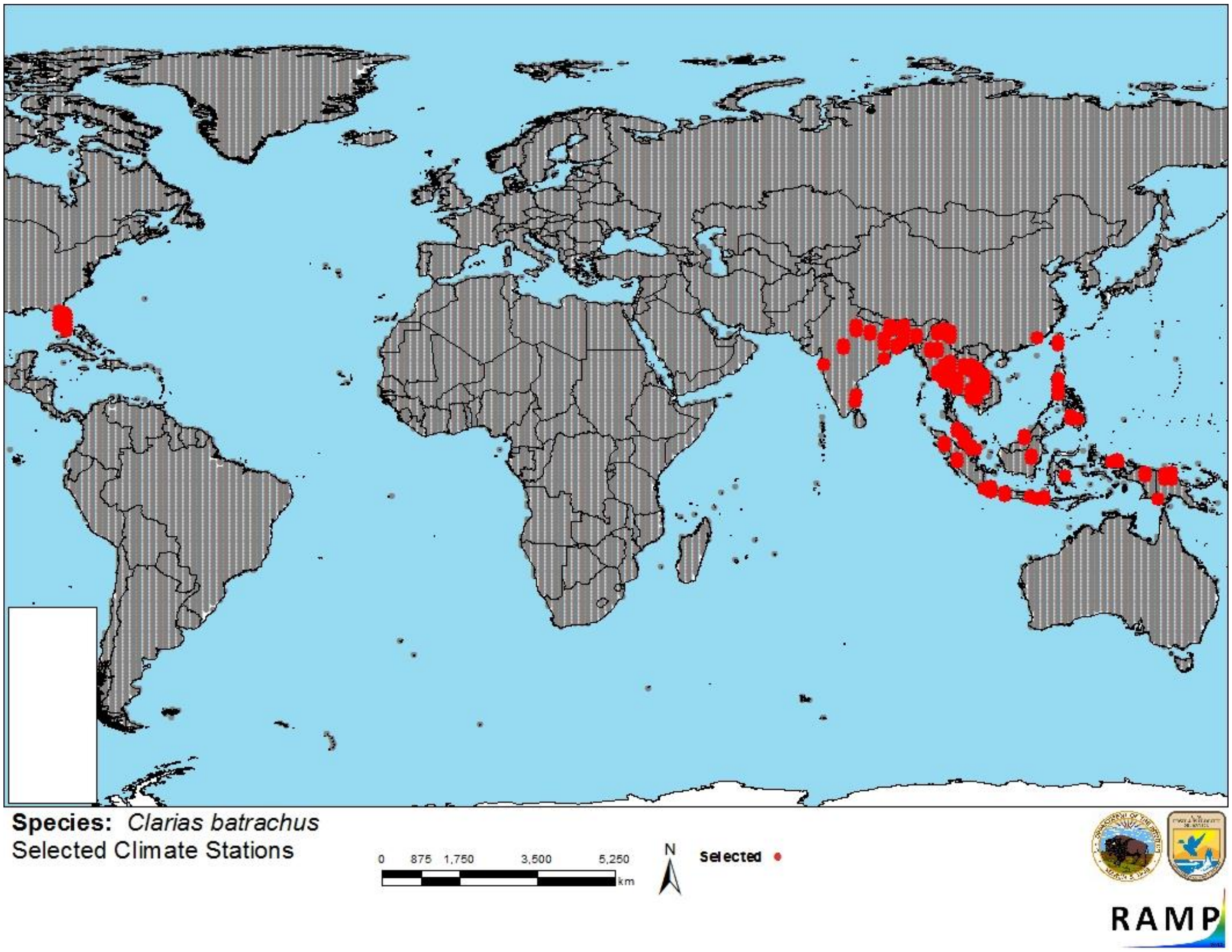

Figure 4. RAMP (Sanders et al. 2014) source map showing weather stations in the United States and South Asia selected as source locations (red) and non-source locations (grey) for *Clarias batrachus* climate matching. Source locations from GBIF Secretariat (2011) and USGS NAS Database (Nico et al. 2017).

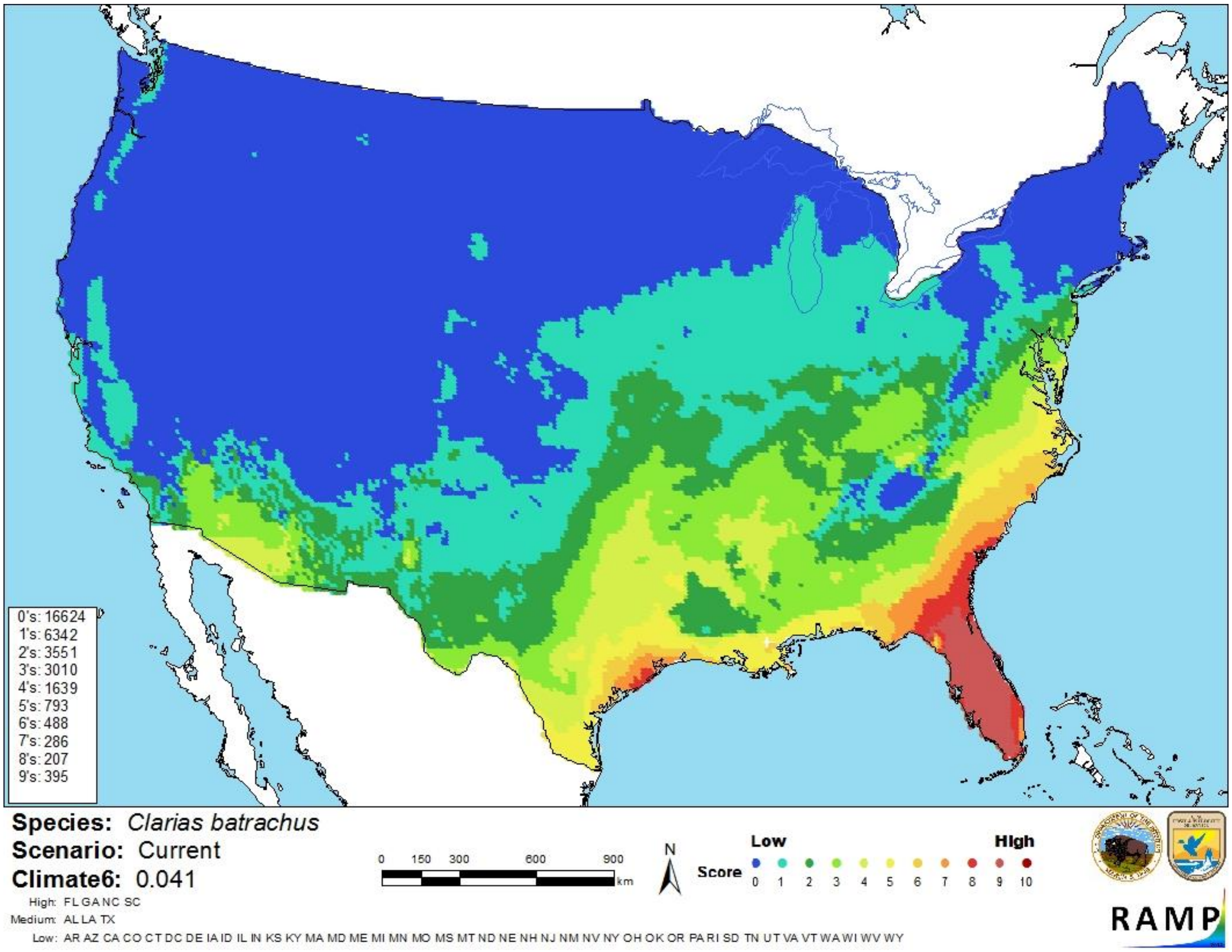

Figure 5. Map of RAMP (Sanders et al. 2014) climate matches for *Clarias batrachus* in the contiguous United States based on source locations reported by GBIF Secretariat (2011) and USGS NAS Database (Nico et al. 2017). 0 = Lowest match, 10 = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

The certainty of this assessment is medium. *Clarias batrachus* had adequate information available about its biology, ecology, and invasiveness for the assessment. The negative impacts of *C. batrachus* introductions have been demonstrated.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness is high. There are many documented introductions and adverse impacts reported from Florida. The climate match is medium, with the highest match in Florida and the extreme Southeast. The certainty of assessment is medium. The overall risk assessment category is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** No additional remarks.
- **Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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