Vermiculated Sailfin Catfish (*Pterygoplichthys disjunctivus*)
Ecological Risk Screening Summary

Web Version—09/02/2014

Photo: U.S. Geological Survey from Nico et al. (2014).

1 Native Range, and Status in the United States

Native Range

From Nelson et al. (2004):

"South America: Madeira River basin. Introduced to countries outside its native range."

Status in the United States

From Nico et al. (2014):

"Established in Florida, the species has recently expanded its range into several new drainages within the state (Nico, unpublished data). Established in North Carolina. Collected in Mississippi and Washington."

"This species is known from streams, canals and other water bodies, in Florida. Published records document its presence in several sites in Hillsborough County, including the Hillsborough River drainage, Hillsborough County, Florida (Ludlow and Walsh 1991, referenced as *Pterygoplichthys cf. multiradiatus*, Page 1994) and Lake Thonotosassa and Baker Creek (Page 1994, museum specimens). More recent records include the Little Manatee, Alafia, Peace, Kissimmee, Myakka, Lake Okeechobee, and Withlacoochee river drainages, and several other streams and lakes in the central part of the state (Page 1994, Fuller et al. 1999, L.G. Nico, unpublished data, Charlotte Harbor NEP 2004, Nico 2005)."

"A single specimen was collected from the Pearl River in Mississippi in 1992 (MMNS 2862) (T. Slack and J. Hoover, personal communication). It has also been collected in Julian Reservoir, North Carolina (W. Starnes, personal communication), and Long Lake near Olympia, Washington (K. Aitkin, personal communication)."

Means of Introductions in the United States

From Nico et al. (2014):

"In Florida, probably originally introduced through fish farm escapes or releases, although aquarium releases cannot be ruled out. Aquarium releases in other areas."

Remarks

From Nico et al. (2014):

Prior to its description, specimens of this species taken in Florida (Tampa Bay area) were reported as *Pterygoplichthys multiradiatus* or, in some earlier cases, as *Hypostomus* species. *Pterygoplichthys disjunctivus* specimens from the Hillsborough River drainage of Florida were tentatively identified as *Pterygoplichthys cf. multiradiatus* by Ludlow and Walsh (1991). Page (1994) followed Weber (1992) in using the name *Liposarcus disjunctivus*. The distribution and impact of this species in Florida, and that of other introduced armored catfishes, is currently being investigated by U.S. Geological Survey researchers. Sailfin suckermouth catfishes (*Pterygoplichthys spp*.) are capable of surviving mesohaline conditions (up to 10 ppt) for extended periods of time, allowing for the use of estuarine and coastal areas for dispersal (Capps et al. 2011)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2011):

"Kingdom Animalia
Phylum Chordata
Subphylum Vertebrata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Siluriformes
Family Loricariidae
Subfamily Hypostominae
Genus Pterygoplichthys
Species Pterygoplichthys disjunctivus (Weber, 1991)

Taxonomic Status: Valid."

Size, Weight, and Age Range

From Nelson et al. (2004):

"Maturity: Lm ? range ? - ? cm; Max length : 70.0 cm TL male/unsexed; (Nico and Fuller 2006)."

Environment

From Nelson et al. (2004):

"Freshwater; demersal."

From GISD (2014):

"*Pterygoplichthys* spp. can be found in a wide variety of habitats, ranging from relatively cool, fast-flowing and oxygen-rich highland streams to slow-flowing, warm lowland rivers and stagnant pools poor in oxygen. [...] They can thrive in a range of acidic to alkaline waters in a range of about (pH 5.5.0 to 8.0) (Mendoza et al. 2009). They are often found in soft waters, but can adapt very quickly to hard waters. *Pterygoplichthys* spp. are also highly tolerant to poor water quality and are commonly found in polluted waters (Chavez et al. 2006). They are known to use outflow from sewage treatment plants as thermal refugia and can readily adapt to changing water quality (Nico & Martin 2001). *Pterygoplichthys* spp. may be found in from lowlands to elevations of up to 3,000 m (Wakida-Kusunki 2007). Some species are salt tolerant (Mendoza et al. 2009)."

Climate/Range

From Nelson et al. (2004):

"Tropical."

From GISD (2014):

"They are tropical fish and populations are typically limited only by their lower lethal temperature which has been found to be about 8.8-11°C in some species (Gestring 2006)."

Distribution Outside the United States

Native

From Nelson et al. (2004):

"South America: Madeira River basin. Introduced to countries outside its native range."

Introduced

From Nelson et al. (2004):

This species is reported as introduced in Taiwan, Java, Japan, Singapore, Philippines, Puerto Rico and the Asi River in Turkey.

Means of Introduction Outside the United States

From Nelson et al. (2004):

Reasons listed for the introduction of this species include ornamental and unknown. The species is listed as established in most locations where introduced and having negative impacts in some locations.

Short description

From Nelson et al. (2004):

"Dorsal soft rays (total): 10-14; Anal soft rays: 3 – 5."

From Nico et al. (2014):

"The dorsal pattern consists of light spots that become chevrons posteriorly. The abdominal pattern has dark and light vermiculations of equal width (Howells 2005)."

"*Pterygoplichthys* and other suckermouth armored catfishes (family Loricariidae) can be distinguished from native North American catfishes (Ictaluridae) by the presence of flexible bony plates (absent in ictalurids) and a ventral suctorial mouth (terminal in ictalurids). *Pterygoplichthys* is often confused with *Hypostomus*: these genera can be

distinguished by the number of dorsal fin rays (7-8 in *Hypostomus* vs. 9-14 in *Pterygoplichthys*)."

Biology

From Nelson et al. (2004):

"Typically from floodplain lakes, swamps and borrow pits, in poorly-oxygenated waters and must rely on air breathing for long periods of time. Has a specialized (enlarged) stomach which appear to function as accessory respiratory organs (Armbruster 1998)."

From Nico et al. (2014):

"*Pterygoplichthys disjunctivus* is a benthic forager, using its suctorial mouth to attach to surfaces and consuming detritus and algae. Nico et al. (2009b) and Nico (2010) describe a unique association between *P. disjunctivus* and wintering Florida manatees (*Trichechus manatus latirostris*) in artesian springs, where sailfin catfishes will attach to stationary manatees and graze on epibionts."

"Gibbs et al. (2008) examined the reproductive morphology and strategy of an introduced population of *P. disjunctivus* in Volusia Blue Spring, Florida. Females exhibited an increase in gonadosomatic index between May and September, indicating a summer breeding season. Multiple size classes of oocytes and a lack of completely spent ovaries suggest that this species is an asynchronous, multiple spawner (Gibbs et al. 2008)."

Human uses

From Nelson et al. (2004):

"Aquarium: commercial."

Diseases

There are no known OIE-reportable diseases listed for this species.

Threat to humans

Potential pest.

3 Impacts of Introductions

From Nico et al. (2014):

"Largely unknown. In several natural streams [...] this species is relatively abundant. Because it grazes and removes attached algae, and also feeds on benthic organisms and detritus, this introduced catfish may be having a significant impact on the aquatic food base and, therefore, negatively effecting native invertebrate and vertebrate species (Nico, personal observations)."

"Male members of the genus *Pterygoplichthys* dig out river banks to create burrows in which an attracted female will lay and guard her eggs. In large numbers, this burrowing behavior by *Pterygoplichthys* contributes to problems with siltation. In addition, the burrows potentially destabilize the banks, leading to an increased rate of erosion (Nico et al. 2009a)."

From GISD (2014):

"Potential effects of *Pterygoplichthys spp*. include alteration of bank structure and erosion, disruption of aquatic food chains, competition with native species, mortality of endangered shore birds, changes in aquatic plant communities, and damage to fishing gear and industry. Environmental impacts of *Pterygoplichthys spp*. are not fully understood, but in locations where they are introduced and abundant, their feeding behaviours and burrowing activities can cause considerable disturbance. Their burrows have been reported as contributing to siltation problems and bank erosion and instability (Hoover et al. 2004, Nico et al. 2009b). *Pterygoplichthys spp*. forage along the bottoms of streams and lakes, occasionally burying their heads in the substrate and lashing their tails. These behaviours can uproot or shear aquatic plants and reduce the abundance of beds of submersed aquatic vegetation, creating floating mats that shade the benthos from sunlight. By grazing on benthic algae and detritus, they may alter or reduce food availability and the physical cover available for aquatic insects eaten by other native and non-native fishes where they are introduced (Mendoza et al. 2009, Hossain et al. 2008). *Pterygoplichthys spp*. may also compete with native fish. They are believed to displace several species of minnow in Texas including the Federally threatened and 'Vulnerable (VU)' Devils River minnow (see *Dionda diaboli*) (Cohen 2008, Mendoza et al. 2009). *Pterygoplichthys spp*. have also been found to ingest eggs of *Etheostoma fonticola*, also listed as vulnerable (Cook-Hildreth 2009)."

"*Pterygoplichthys spp*. are thought to create large, novel nutrient sinks in invaded streams of southern Mexico. They sequester the majority of nitrogen and phosphorus of systems in their body armor. These impacts on nutrient systems may also exacerbate the nutrient limitation of primary productivity in invaded streams (Capps et al. 2009)."

"*P. disjunctivus* and *P. pardalis* are reportedly destroying cages and nets and causing a decline in native, more desirable fish in Laguna de Bay, Philippines (Chavez et al. 2006). *P. disjunctivus* attaches to the skin of the 'Endangered (EN)' native Florida manatee (see *Trichechus manatus ssp. latirostris*) and feeds on their epibiota. In some instances dozens of *P. disjunctivus* and manatees appeared agitated. This interaction may be detrimental to manatee but remains unclear (Nico et al. 2009a)."

"Competition: Gut content assessments of *Pterygoplichthys spp*. and of Guadeloupe roundnose minnow *Dionda nigrotaeniata* and two additional Dionda species suggest high dietary overlap between the *Dionda* complex and *Pterygoplichthys*."

From Simonovic et al. (2010):

"The sailfin catfish genus *Pterygoplichthys* already has the invasive history, since species *P. multiradiatus*, *P. pardalis* and *P. disjunctivus* have been so far recorded as exotic in Mesoamerica – Puerto Rico and Mexico (Bunkley-Williams et al. 1994, Guzman and Barragan 1997); in North America: southern United States – Florida, Texas, Washington and North Carolina, as well as at Hawaii islands (Edwards 2001, Fuller et al. 1999, Nico and Fuller 2010, Ludlow and Walsh 1991, Nico and Martin 2001); in Philippines and south-eastern Asia: peninsular Malaysia, Singapore, Taiwan, Java and Sumatra (Page and Robins 2006). In all those recipient areas recorded so far, the aquarists were assigned responsible for their releasing into natural ecosystems and subsequent establishment."

From Hubilla et al. (2007):

"Based on the findings of the study, the janitor fish in the Agusan March (Pilippines) are considered threat to freshwater biodiversity. Their wide distribution in the Marsh may lead to increase in numbers rapid enough to displace the native fish species, because they are voracious feeders and they have no natural predators in the Marsh. The larger the number of janitor fishes in Agusan Marsh, the higher their corresponding contribution to water turbidity and soil erosion. Socio-economic impacts, such as the destruction of fishing gears and livelihood should be addressed accordingly before it gets worse."

4 Global Distribution

Figure 1. Map of known global distribution of *Pterygoplichthys disjunctivus*. Map from GBIF (2014).

5 Distribution within the United States

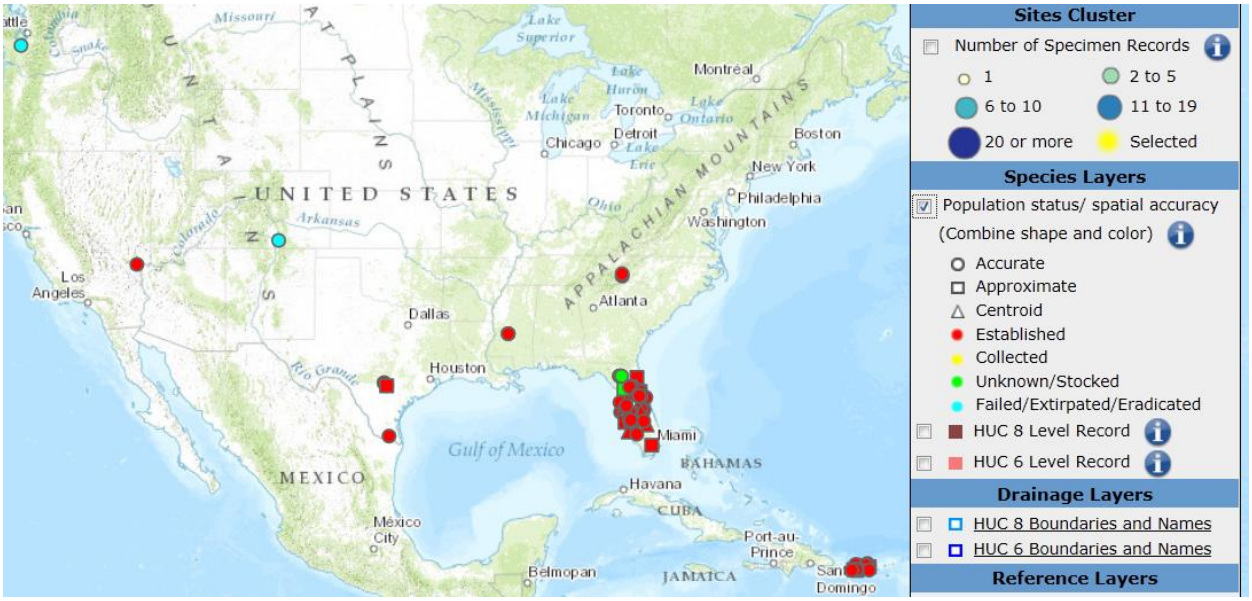

Figure 2. Distribution of *Pterygoplichthys disjunctivus* in the United States. Map from Nico et al. (2014).

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2008; 16 climate variables; Euclidean Distance) was high in the southeastern U.S., Texas, and the Mid-Atlantic. Medium matches occurred in the southern Midwest, southern Northeast, and California. Low matches occurred in the upper Midwest, Maine, and most of the West. Climate 6 proportion indicated that the contiguous U.S. has a high climate match. The range for a high climate match is 0.103 and greater; climate match of *Pterygoplichthys disjunctivus* is 0.366.

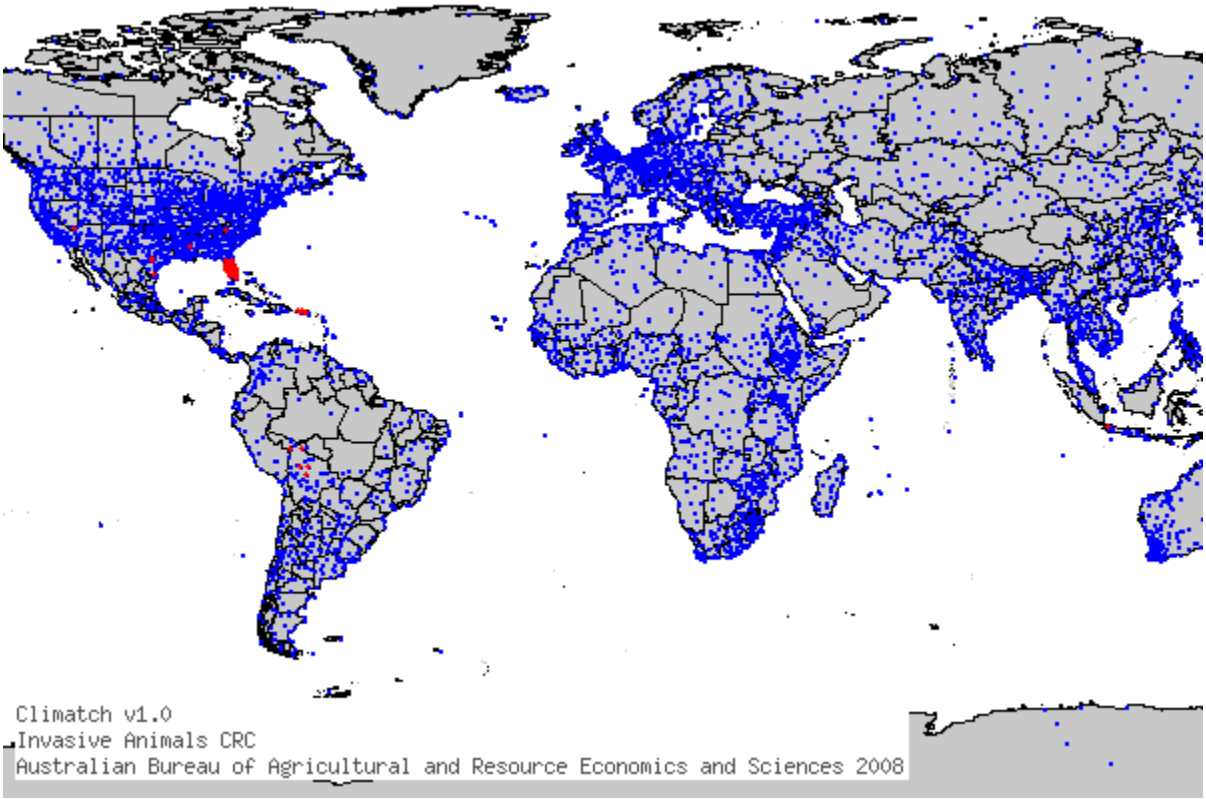

Figure 3. CLIMATCH (Australian Bureau of Rural Sciences 2008) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *Pterygoplichthys disjunctivus* climate matching. Source locations from GBIF (2014) and Nico et al. (2014).

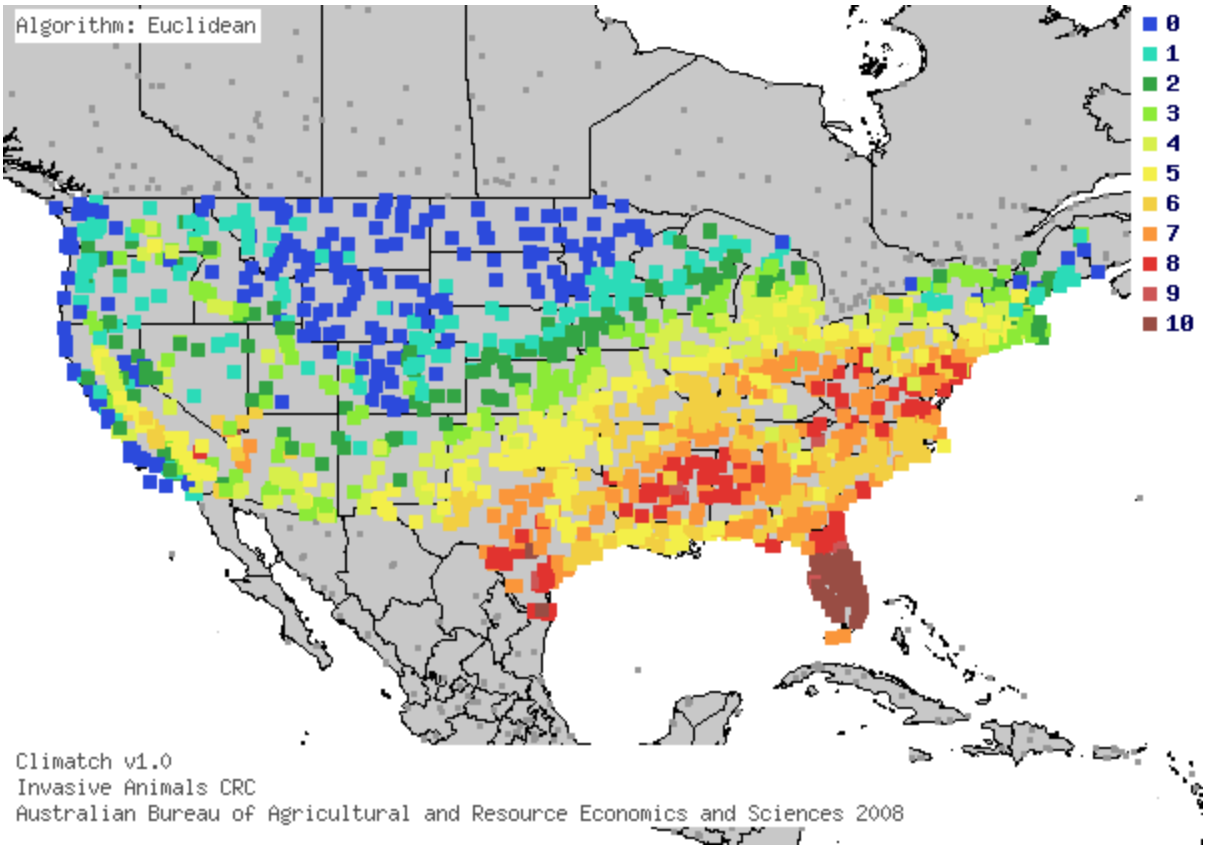

Figure 4. Map of CLIMATCH (Australian Bureau of Rural Sciences 2008) climate matches for *Pterygoplichthys disjunctivus* in the continental United States based on source locations reported by GBIF (2014) and Nico et al. (2014). 0= Lowest match, 10=Highest match.

Table 1. CLIMATCH (Australian Bureau of Rural Sciences 2008) climate match scores.

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Count	242	207	156	183	222	241	272	232	134	11	74
Climate 6 Proportion =		0.366									

7 Certainty of Assessment

Information on the biology of this species is readily available. The information on impacts, however, is often generalized to the entire genus and usually cites potential impacts instead of observed impacts for *Pterygoplichthys disjunctivus*. Further information on the impacts of this species would be helpful, but the available evidence is sufficient to warrant a high rating for history of invasiveness. The certainty of this assessment is medium.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Pterygoplichthys disjunctivus is a freshwater fish native to the Madeira River basin in South America. This species has spread to several non-native countries including the U.S., where it has established populations in Florida, Texas, Mississippi, North Carolina, and Nevada. It is popular in the aquarium trade and was likely released by aquarists. While ecological impacts are mostly unknown, several sources describe negative, or potentially negative impacts. These include increased siltation, bank erosion, competition with native species for food, destruction of fishing gear, and disruption of endangered species. *Pterygoplichthys disjunctivus* and other members of the genus *Pterygoplichthys* are described by many sources as highly invasive. This species has a high climate match with the contiguous U.S. Overall risk for this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3):** High
- **Climate Match (Sec.6):** High
- **Certainty of Assessment (Sec. 7):** Medium
- **Remarks/Important additional information** Potential pest
- **Overall Risk Assessment Category: High**

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