Flathead Catfish (*Pylodictis olivaris*)
Ecological Risk Screening Summary

Web Version—09/03/2014


Photo: E. Engbretson, USFWS from EOL (2014).

1 Native Range, and Status in the United States

Native Range
From Page and Burr (1991):

"North America: lower Great Lakes and Mississippi River basins from western Pennsylvania to White-Little Missouri River system in North Dakota, and south to Louisiana in the USA; Gulf Slope from Mobile Bay drainage in Georgia and Alabama, USA to Mexico. Transplanted elsewhere in USA."

Status in the United States
From Fuller and Neilson (2014):

"The flathead catfish has become established in most waters where introduced. For instance, it is widespread and reproducing in the lower Colorado River basin (Dill and Cordone 1997). As of about 1980, the Cape Fear River population had expanded from the site of its initial release near Fayetteville, North Carolina, and was found to inhabit a 201-kilometer stretch of the river (Guire et al. 1984). In samples taken by Guire et al. (1984) from the Cape Fear River, flathead accounted for 10.52% of total fish numbers and 64.7% of total fish weight. Establishment in

Oregon is uncertain (Bond 1994). The species does not appear to have survived to reproduce in Wyoming (Hubert 1994). It has been reported from the San Pedro River, Arizona, and from the Suwannee River, Florida. Established in Blue Marsh Reservoir and the Schuylkill River in Pennsylvania; reported in Springton Reservoir, Pennsylvania."

"Flathead catfish have been introduced to the Gila basin in the Salt, Verde, and San Pedro rivers and established in Bill Williams River National Wildlife Refuge in Arizona (Miller and Lowe 1967, Bottroff et al. 1969, Minckley 1973, S. Stefferud, personal communication, USFWS 2005); the Colorado River and Salton Sea basins in California (Bottroff et al. 1968, 1969, Minckley 1973, Moyle 1976, Dill and Cordone 1997); the Arkansas and Platte river drainages in Colorado (Ellis 1974, Walker 1993, Rasmussen 1998, Beckman 1952); the Apalachicola, Ochlockonee (Ober, personal communication), Escambia, and Perdido rivers in western Florida (Baker 1993), and the Suwannee River in central Florida (museum specimen); the Altamaha River drainage (Bart et al. 1994, C. Jennings, personal communication), the Flint River (Dahlberg and Scott 1971a, 1971b, Yerger 1977), and Lake Hartwell (1968) on the Savannah River (Dahlberg and Scott 1971a, 1971b) and Ochlockonee River (Ober, personal communication) in Georgia; the Snake River, between Lewiston and Swan Falls and the Brownlee Reservoir in Idaho (Linder 1963, Simpson and Wallace 1978, Idaho Fish and Game 1990, Anonymous 2004); the tidal portion of the Potomac River, Maryland, near the mouth of the Occoquan River (Starnes et al. 2011); Lake Maloney in the lower South Platte drainage in Nebraska (Jones 1963); the Gila River drainage in New Mexico (Koster 1957, Minckley 1973, Sublette et al. 1990); the Delaware and Raritan Canal in New Jersey (Bauers 2004); the Cape Fear, Tennessee, Yadkin, and Catawba river drainages in North Carolina (Hocutt et al. 1986, Menhinick 1991, Moser and Ross 1993, Jenkins and Burkhead 1994, Center for Marine Science, University of North Carolina, Wilmington 2004); Snake River, Hells Canyon Reservoir, Oxbow Reservoir, and the Brownlee Reservoir, Oregon (Bond 1973, 1994, Wydoski and Whitney 1979, State of Oregon 2000, Anonymous 2001); Blue Marsh Reservoir, the Schuylkill River in Philadelphia, the Susquehanna River, and Springton Reservoir in Media, Pennsylvania (M. Kaufman, personal communication); Lake Hartwell, Savannah River, Saluda River, Edisto River, Lake Moultrie, Lake Marion, Congaree River, Broad River, Wateree River, Santee River, Lynches River, and Great Pee Dee River in South Carolina (Dahlberg and Scott 1971b, Rohde et al. 2009); Occoquan Reservoir and tidal portion of Occoquan River, Smith Mountain Reservoir, the lower James, middle Roanoke, and upper James (Botetourt County) drainages in Virginia (Hocutt et al. 1986, Jenkins and Burkhead 1994, Starnes et al. 2011); Washington (Fletcher, personal communication); Oconomowoc and Nagawicka lakes, and the Wolf and Fox drainages, Wisconsin (Becker 1983); and in the lower North Platte drainage in Wyoming (Hubert 1994)."

Means of Introductions in the United States

From Fuller and Neilson (2014):

"The flathead catfish has been intentionally stocked in most cases. In Idaho, however, flatheads were accidentally stocked instead of blue catfish (Simpson and Wallace 1978). Populations in the Apalachicola River, Florida, probably spread from introductions upstream in the Flint River, Georgia. It is believed that flatheads were stocked by anglers circa 1950 in the vicinity of Potato Creek in Upson County, Georgia, with stock from the Tennessee drainage (Quinn 1988). They were recorded in the Flint River below the Warwick Dam at Lake Blackshear in the early 1960s, and at Albany in the early 1970s (Quinn 1988). Although there have been rumors that flatheads were stocked in the Suwannee River by the Florida Game and Freshwater Fish Commission in the 1960s (G. Burgess, personal communication), the rumors are not true (J. Krummrich, personal communication). The species was apparently first stocked in the Cape Fear River in 1966 when 11 sexually mature fish were released near Fayetteville, North Carolina, by North Carolina Wildlife Resources Commission biologists (Guire et al. 1984, Ashley and Buff 1986). Flatheads were stocked in Atlantic drainages (Savannah and Altamaha) in Georgia in the 1970s (Bart et al. 1994, C. Jennings, personal communication). According to Bart et al. (1994), at least some of these were the result of stocking by Georgia Department of Natural Resource personnel. The first known reports of this fish in California were recorded catches made in the lower Colorado River near Yuma in 1966 (Dill and Cordone 1997). The Colorado River populations in California and Arizona resulted, at least in part, from a stocking of about 600 flathead catfish above Imperial Dam made by the Arizona Game and Fish Department in 1962 (Dill and Cordone 1997). According to Dill and Cordone (1997), the believed route of the flathead catfish was downstream to Imperial Dam and subsequently into the All American Canal system to the Imperial Valley. Minckley (1973) reported that the species was introduced prior to 1950 into the Gila River system, a tributary of the Colorado River; however, Dill and Cordone (1997) indicated that, as far as is known, the flathead catfish was not taken in the lower Colorado River basin until after 1962. A single fish was taken 20 November 1995 in Arizona from the upper San Pedro River, about 32 kilometers from the Mexican border (Stefferud, personal communication). It is not known how the species gained access to the upper reach of this river. In Wisconsin, flatheads probably entered the Wolf and Fox drainages via the canal at Portage (Becker 1983). The Ochlockonee River introduction in Florida and Georgia was probably due to illegal stocking by anglers with fish from the nearby Apalachicola River, where the fish had also been introduced. The flathead's presence in eastern Pennsylvania is most likely due to stock contamination of channel catfish shipments (M. Kaufman, personal communication)."

Remarks

From Fuller and Neilson (2014):

"The flathead catfish became the dominant predator in the Cape Fear drainage, North Carolina, within 15 years of the introduction (Guire et al. 1984). The species may actually be native to the upper Tennessee drainage in North Carolina (Jenkins and Starnes, personal communication). In their book on Alabama fishes, Mettee et al. (1996) presented conflicting information regarding native versus introduced ranges. These researchers stated, in the species account, that *Pylodictis olivaris* is introduced to the Conecuh and Escatawpa river systems, but they listed the species as "native" in their summary table. Starnes et al. (2011) suggest that although the Potomac River population is highly localized, favorable habitat in the Plummers Island area could allow it to expand further upstream."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2011):

"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 Ictaluridae
Genus Pylodictis
Species Pylodictis olivaris (Rafinesque, 1818)

Taxonomic Status: Valid."

Size, Weight, and Age Range

From Page and Burr (1991):

"Maturity: Lm ?, range 18 - 20 cm; Max length : 155 cm TL male/unsexed; max. published weight: 55.8 kg (IGFA 2001); max. reported age: 20 years (Hugg 1996)."

Environment

From Page and Burr (1991):

"Freshwater; demersal."

Climate/Range

From Page and Burr (1991):

"Temperate; ? - 33°C (Eaton et al. 1995); 47°N - 26°N."

Distribution Outside the United States

Native

From Page and Burr (1991):

"North America: lower Great Lakes and Mississippi River basins from western Pennsylvania to White-Little Missouri River system in North Dakota, and south to Louisiana in the USA; Gulf Slope from Mobile Bay drainage in Georgia and Alabama, USA to Mexico. Transplanted elsewhere in USA."

Introduced

From Page and Burr (1991):

"This species is reported as introduced to Ontario from an unknown location."

Means of Introduction Outside the United States

From Page and Burr (1991):

Reason for introduction is listed as unknown. Species is reported to probably be established.

Short description

From Siriwardena (2008):

"*P. olivaris* has a slender, elongated body becoming moderately robust in adults (Ross 2001). It has a depressed or flattened head with small eyes (Hubbs et al. 1991) and a terminal mouth (Goldstein and Simon 1999) whose lower jaw projects forward beyond the upper jaw (Ross 2001) except in juveniles (ISSG 2005). This protruding lower jaw is an important characteristic when identifying the species as it distinguishes *P. olivaris* from other catfish and contributes to it being placed in a genus of its own (ISSG 2005). In all individuals except large adults, the caudal fin of *P. olivaris* has a white tip on the upper lobe (Page and Sheehy 2007).The body is yellow to dark purple-brown with black or brown mottling above and white to yellow below with white to yellow chin barbels and mottled fins (Page and Sheehy 2007)."

"*P. olivaris* has 8-10 gill rakers, 6-7 dorsal rays, a short and rounded anal fin with 16-17 or 14-17 anal rays, 8-11 pectoral rays, and 9 pelvic rays (Ross 2001). It has a premaxillary band of teeth on the upper jaw with a lateral backward extension on each side (Hubbs et al. 1991). "

Biology

From Page and Burr (1991):

"Inhabit pools with logs and other debris in low-gradient to moderate-gradient, small to large rivers. Also found in lakes and impoundments. Young occur in rocky and sandy runs and riffles. Juveniles feed on aquatic insect immatures in riffle areas (Etnier and Starnes 1993)."

From GISD (2014):

"FWC (UNDATED) states that *P. olivaris* is a predatory fish and will consume bass, bream, shad, crayfish and often feed on other catfish. The young rely more extensively on aquatic insects and crayfish than do the adults. They rarely eat dead or decaying matter."

"According to FWC (UNDATED), spawning occurs in late spring when water temperatures reach 21 to 27 degrees Celsius. One or both parents excavate a nest that is usually made in a natural cavity or near a large submerged object. Females lay a golden-yellow mass of up to 100,000 eggs. Males guard the nest and agitate the eggs to keep them clean and aerated. The young remain in a school near the nest for several days after hatching, but soon disperse."

From Siriwardena (2008):

"*P. olivaris* is reported to hybridize with the channel catfish (*Ictalurus punctatus*, Trautman 1957)."

Human uses

From Page and Burr (1991):

"Gamefish: yes; aquarium: public aquariums."

Diseases

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

Threat to humans

Harmless.

3 Impacts of Introductions

From Fuller and Neilson (2014):

"Many feeding studies have found that flathead catfish prey heavily on sunfish *Lepomis spp*. (Quinn 1988). One study found that they reduced the number of common carp *Cyprinus carpio* and bullheads *Ameiurus spp*. (Quinn 1988). However, the introduced population in the Flint River system was found to prey largely on crayfish, and that young-of-the-year flatheads fed on darters *Etheostoma spp*. clupeids, catostomids, ictalurids (including other flatheads), and centrarchids were also consumed (Quinn 1988). According to Quinn (1988), introduced flatheads in the Flint River rely more on crayfish than any other catfish population yet described. A severe decline in native fish species, particularly native bullhead species, was observed in the Cape Fear River within 15 years of the first flathead catfish introduction (Guire et al. 1984, Jenkins and Burkhead 1994). Feeding studies conducted in the Cape Fear River showed that flatheads consume mainly bullheads, catfishes, shad, and sunfishes (Guire et al. 1984, Ashley and Buff 1986). In 1979, flatheads in the Cape Fear River fed primarily on bullheads. However, by 1986, bullhead populations had declined and flathead catfish had switched to preying on shad (Ashley and Buff 1986). Diet studies also have been conducted in the Oconee River in Georgia, where this catfish had been implicated in causing declines of native bullheads and sunfishes (especially redbreast sunfish *Lepomis auritus*). However, findings of that initial study were inconclusive since most of the flathead catfish examined had empty stomachs (C. Jennings, personal communication). Flathead catfish also may be responsible for declines in other native species in the Altamaha drainage (C. Jennings, personal communication). In the Ocmulgee River, Georgia, abundances of silver redhorse *Moxostoma anisurum*, robust redhorse *M. robustum*, snail bullhead *Ameiurus brunneus*, flat bullhead *A. platycephalus*, and redbreast sunfish *Lepomis auritus*, were negatively correlated with flathead catfish occurrence and abundance (Bart et al. 1994). This correlation may be due to direct predation. Several authors have reported suckers and catfish as common prey items of flatheads (Bart et al. 1994). The snail bullhead and flat bullhead appear to be most affected by the presence of flathead catfish in the Ocmulgee drainage (Bart et al. 1994). It is suspected flatheads may be contributing to the decline of the federally threatened Gulf sturgeon *Acipenser oxyrinchus desotoi* by consuming the young benthic fish in the Apalachicola River (J. Williams, personal communication). The flathead catfish is thought to be contributing to the decline of the razorback sucker *Xyrauchen texanus*. For instance, Marsh and Brooks (1989) found that intensive predation by flathead catfish and channel catfish on juvenile razorback suckers is likely to prevent hatchery transplants of this southwestern endangered sucker from becoming re-established in portions of its natural range. If the flathead catfish becomes established in the San Pedro River, it could mean a major loss for recovery of several species (Stefferud, personal communication). Gilbert (personal communication) considers that introductions of flathead catfish are probably the most biologically harmful of all fish introductions in North America. Flathead catfish, along with other nonnative piscivorous fishes, have been shown to reduce the abundance and diversity of native prey species in several Pacific Northwest rivers (Hughes and Herlihy 2012)."

From Thomas (1993):

"A standardized stream monitoring program conducted on the Altamaha River, Georgia, from 1988 to 1992 was successful in detecting substantial changes in sport fish populations. Flathead catfish (*Pylodictus olivaris*) electrofishing catch rates generally increased from 1988 to 1992 reaching a peak CPUE of 90 fish per hour in 1990. CPUE of flathead catfish was significantly different ($P < 0.05$) between years and sites. Percent composition of flathead catfish in ictalurid samples doubled over the 5-year study period. A concurrent decrease in native bullhead populations was observed in annual creel and electrofishing surveys. Redbreast sunfish catch rates precipitously declined in both electrofishing samples and creel surveys taken from 1988 to 1992. Differences in mean CPUE of redbreast sunfish were significant ($P < 0.05$). Annual monitoring results suggest that the invasion and subsequent rapid expansion of flathead catfish in the Altamaha River has affected native sport fish populations."

From Bonvechio et al. (2009):

"Our results suggest that the introduction of the non-native flathead catfish may have negatively affected sportfish populations in the Satilla River. Similar to an earlier study (Thomas 1993), we observed significant declines in the abundance and/or size structure of redbreast sunfish and largemouth bass populations between the time periods evaluated (pre- and post-flathead introduction). Other studies have also documented declines in native riverine fish populations following flathead introduction including the abundance of ictalurids and redbreast sunfish (Guire et al. 1984, Bart et al. 1994, Ashley and Rachels 2000). Although we are unable to identify the mechanisms underlying observed changes in the sportfish populations in the Satilla River, we hypothesize that these differences were due in part to direct predation by flathead catfish and competition with flathead catfish for available prey resources."

From Pine et al. (2007):

"To evaluate the potential impact of this invasive species on the native fish community we developed an ecosystem simulation model (including flathead catfish) based on empirical data collected from a North Carolina coastal river. The model results suggest that flathead catfish suppress native fish community biomass by 5–50% through both predatory and competitive interactions."

From Siriwardena (2008):

"According to Fuller (2000), introductions of *P. olivaris* are probably the most biologically harmful of all fish introductions in North America. Many feeding studies have found that *P. olivaris* prey heavily on bullheads (*Ameiurus spp*.) (Fuller 2000) and sunfish (*Lepomis spp*.) (Quinn 1988, Fuller 2000). According to Quinn (1988), introduced flatheads in the Flint River rely more on crayfish than any other catfish population described. One study also found that they reduced the number of common carp (*Cyprinus carpio*) in addition to bullheads (*Ameiurus spp*.), (Quinn 1988). However, the introduced population in the Flint River system was also found that young-of-the-year *P. olivaris* fed on darters (*Etheostoma spp*.) clupeids, catostomids, ictalurids, and centrarchids (Quinn 1988). A severe decline in native fish species, particularly native bullhead species, was observed in the Cape Fear River within 15 years of the first *P. olivaris* introduction (Guire et al. 1984, Jenkins and Burkhead 1994)."

"Risk and Impact Factors
Invasiveness

Abundant in its native range
Capable of securing and ingesting a wide range of food
Fast growing
Has a broad native range
Has high genetic variability
Has high reproductive potential
Highly mobile locally
Invasive in its native range
Is a habitat generalist
Long lived
Proved invasive outside its native range"

"Impact outcomes

Altered trophic level
Reduced native biodiversity
Threat to/ loss of native species"

"Impact mechanisms

Competition - other
Hybridization
Predation
Rapid growth"

4 Global Distribution

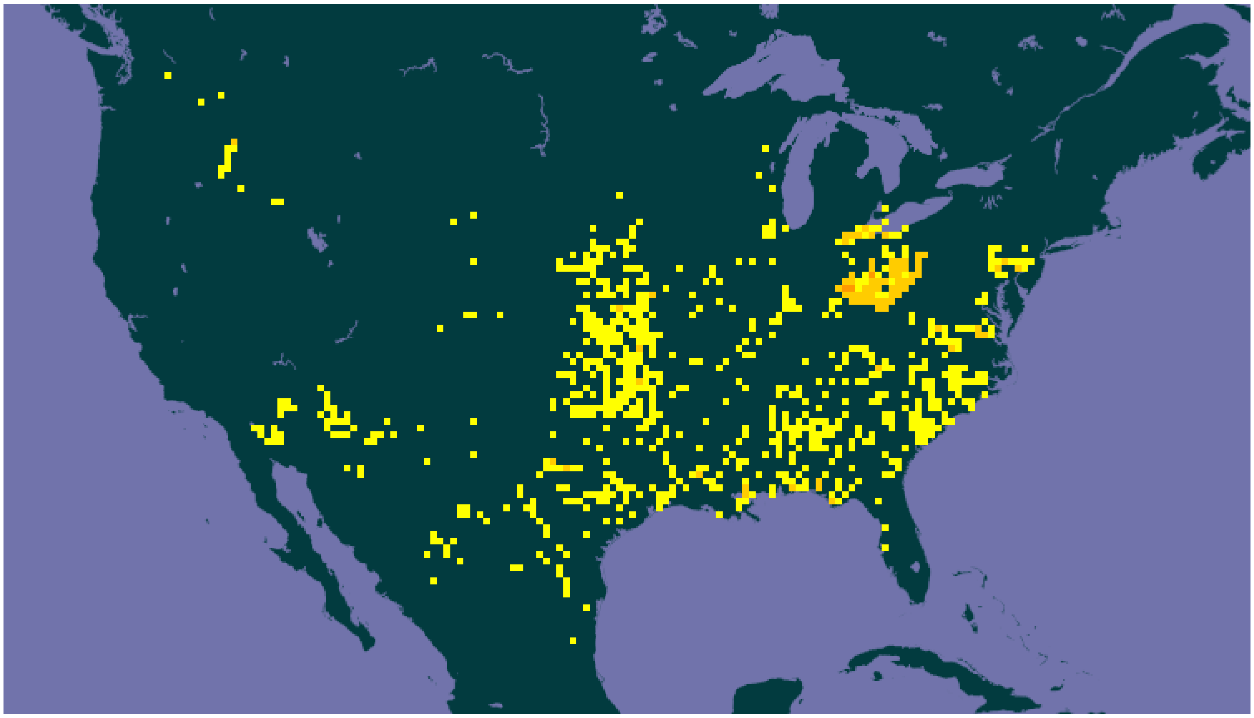

Figure 1. Map of known global distribution of *Pylodictis olivaris*. Map from GBIF (2014).

5 Distribution within the United States

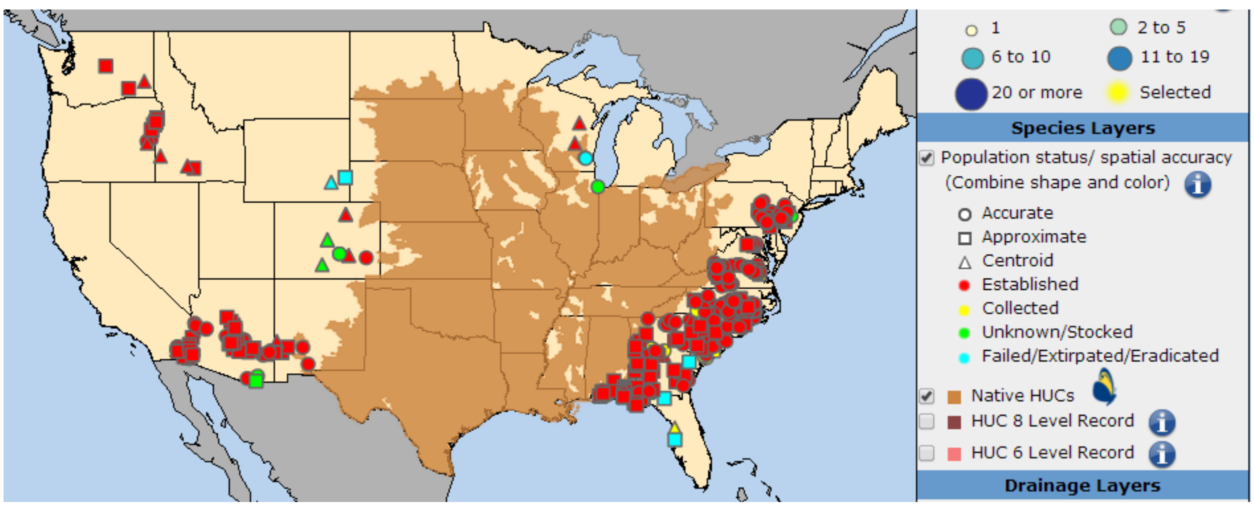

Figure 2. U.S. distribution of *Pylodictis olivaris*. Map from Fuller and Neilson (2014).

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2008; 16 climate variables; Euclidean Distance) was high across the entire contiguous United States except the Florida peninsula and the west coast. 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 *Pylodictis olivaris* is 0.884.

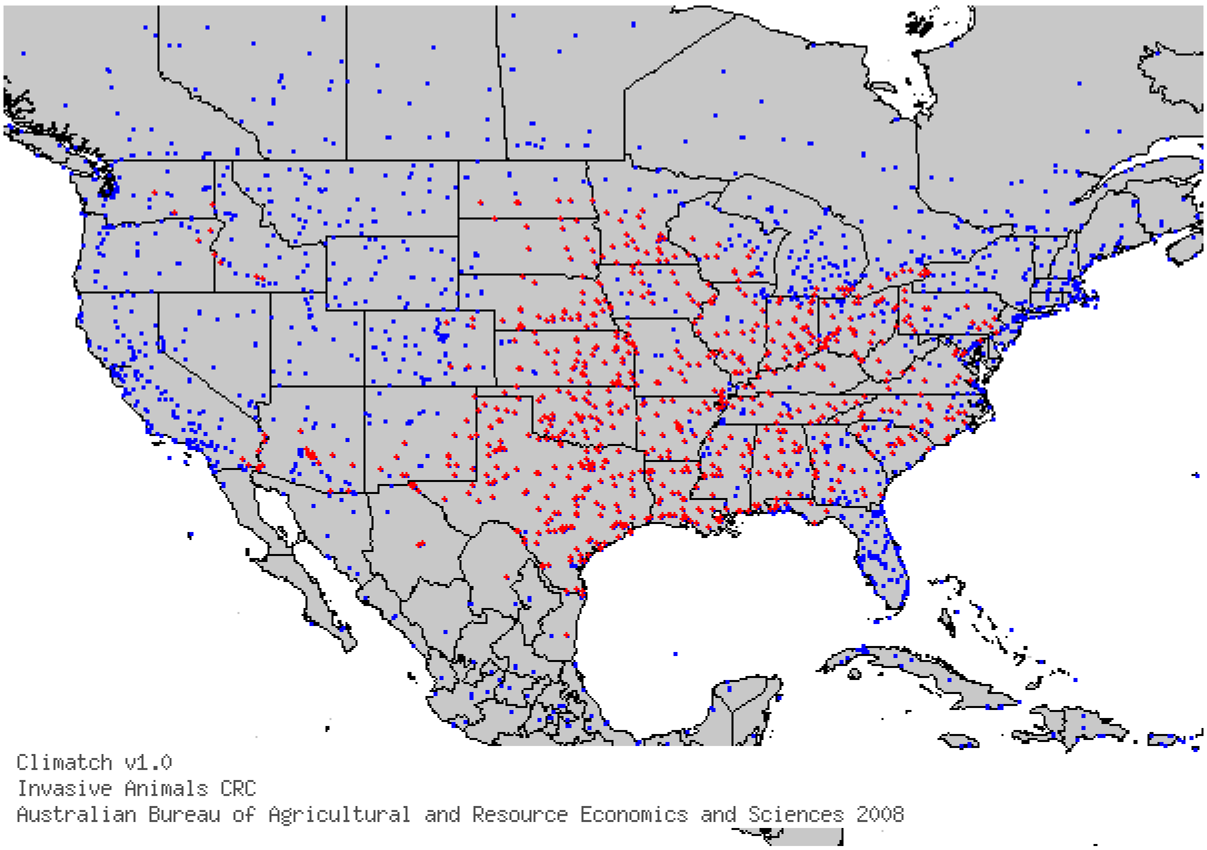

Figure 3. CLIMATCH (Australian Bureau of Rural Sciences 2008) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *Pylodictis olivaris* climate matching. Source locations from GBIF (2011) and Fuller and Neilson (2014). Only established population locations were used.

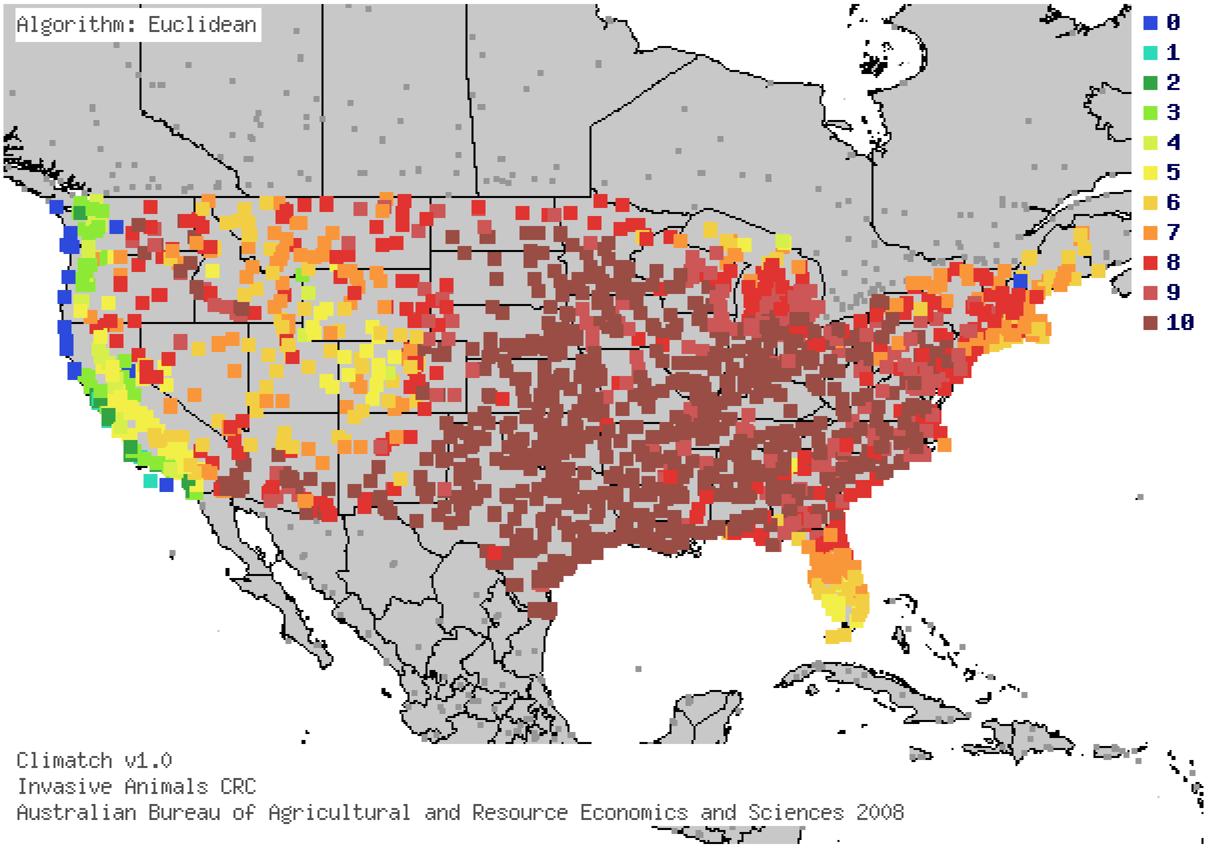

Figure 4. Map of CLIMATCH (Australian Bureau of Rural Sciences 2008) climate matches for *Pylodictis olivaris* in the continental United States based on source locations reported by GBIF (2011) and Fuller and Neilson (2014). 0= Lowest match, 10=Highest match.

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	19	7	22	49	46	86	139	190	310	232	874
Climate 6 Proportion =		0.884									

7 Certainty of Assessment

The biology, distribution, and impacts of *Pylodictis olivaris* are well-documented in the scientific literature. No further information is needed to evaluate the negative impacts the species is having where introduced. Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Pylodictis olivaris is a freshwater fish native to the lower Great Lakes and the Mississippi River basin. This species has been introduced throughout much of the U.S. for sportfishing. Climate match with the contiguous U.S. is high. There is a good deal of evidence that this species reduces native fish abundance where introduced, and this species is widely considered to be invasive. The 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):** High
- **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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10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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