Longfin Tilapia (*Oreochromis macrochir*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2011
Revised, January 2018 and August 2019
Web Version, 8/5/2019

Photo: South African Institute for Aquatic Biodiversity. Licensed under Creative Commons BY 4.0. Available: https://www.gbif.org/occurrence/1230431634. (August 2019).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2019):

"Africa: Kafue, upper Zambezi, and Congo River systems; […] Also in the Okavango and Ngami region, Cunene basin, Chambezi and Bangweulu region [Trewavas and Teugels 1991]."

From Marshall and Tweddle (2007):

"Angola; Botswana; Namibia; South Africa; Swaziland; Zambia; Zimbabwe"

Status in the United States

From Nico (2018):

"The species is established in reservoir or pond habitats on Oahu, Maui, and Hawaii, Hawaii; it was first released ca. 1957 or 1958 (Morita 1981; Maciolek 1984; Devick 1991a). This species was reported as common or abundant in Wahiawa Reservoir (= Lake Wilson) on Oahu (Hida and Thomson 1962; Devick 1972). This species has also been collected in the Puukohola Heiau National Historic Site (Tilmant 1999)."

According to FAO (2019), this species is not present in aquaculture in the United States. No other evidence of trade in the United States was found.

The Florida Fish and Wildlife Conservation Commission has listed *Oreochromis macrochir* (longfin tilapia) as a prohibited species (FFWCC 2019).

From Minnesota DNR (2019):

"Minnesota has several state laws intended to minimize the introduction and spread of invasive species of wild animal and aquatic plants in the state. Using a four-tiered system, invasive species are classified as **prohibited**, **regulated**, **unregulated nonnative species**, or are unclassified and remain as **unlisted nonnative species**."

"It is legal to possess, sell, buy, and transport regulated invasive species [in Minnesota], but they may not be introduced into a free-living state, such as being released or planted in public waters. The regulated invasive species are: […]
tilapia (*Oreochromis*, *Sarotherodon*, and *Tilapia* spp.)"

From Montana Fish, Wildlife & Parks (2019):

"Prohibited species are live, exotic wildlife species, subspecies, or hybrid of that species, including viable embryos or gametes, that may not be possessed, sold, purchased, exchanged, or transported in Montana, except as provided in MCA 87-5-709 or ARM 12.6.2220 […]
Tilapia (*Oreochromis* spp.)"

From Texas Parks and Wildlife Department (2019):

"The organisms listed here are legally classified as exotic, harmful, or potentially harmful. No person may possess or place them into water of this state except as authorized by the [Texas Parks and Wildlife] department. Permits are required for any individual to possess, sell, import, export, transport or propagate listed species for zoological or research purposes; for aquaculture (allowed only for Blue, Nile, or Mozambique tilapia, Triploid Grass Carp, or Pacific White Shrimp); or for aquatic weed control (for example, Triploid Grass Carp in private ponds). […]
Tilapia, Family Cichlidae
All species of genera *Tilapia*, *Oreochromis* and *Sarotherodon*"

Oreochromis spp. are listed as "restricted" species in the State of Vermont (Vermont Fish and Wildlife Regulations 2009).

From Virginia DGIF (2019):

"A special permit is required, and may be issued by the Department, if consistent with the Department's fish and wildlife management program, to import, possess, or sell the following non-native (exotic) amphibians, fish, mollusks, aquatic invertebrates, and reptiles: […] tilapia […]."

Means of Introductions in the United States

From Nico (2018):

"Fish apparently were bred in captivity before being released into the wild, ca. 1958 (Maciolek 1984); this was considered a deliberate introduction (Devick 1991a)."

Remarks

From Nico (2018):

"Synonyms and Other Names: greenhead bream, greenhead tilapia."

"A commonly used name is *Tilapia macrochir*."

"In Hawaii, *O. macrochir* is reported as possibly hybridizing with *O. mossambicus* (Devick 1972)."

Both the valid scientific name, *Oreochromis macrochir*, and the common synonym, *Tilapia macrochir*, were used to search for information for this report.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Labroidei

Family Cichlidae
Genus *Oreochromis*
Species *Oreochromis macrochir* (Boulenger, 1912)"

From Eschmeyer et al. (2018):

"Current status: Valid as *Oreochromis macrochir* (Boulenger 1912). Cichlidae: Pseudocrenilabrinae."

Size, Weight, and Age Range

From Froese and Pauly (2019):

"Maturity: L_m 15.6, range 18 - 18 cm
Max length : 43.0 cm TL male/unsexed; [Kelley 1968]"

Environment

From Froese and Pauly (2019):

"Freshwater; benthopelagic; depth range 5 - 14 m [Mundy 2005]. […] 18°C - 35°C [Kleyhans and Hoffman 1992]"

Climate/Range

From Froese and Pauly (2019):

"Tropical; […] 5°N - 25°S"

Distribution Outside the United States

Native

From Froese and Pauly (2019):

"Africa: Kafue, upper Zambezi, and Congo River systems; […] Also in the Okavango and Ngami region, Cunene basin, Chambezi and Bangweulu region [Trewavas and Teugels 1991]."

From Marshall and Tweddle (2007):

"Angola; Botswana; Namibia; South Africa; Swaziland; Zambia; Zimbabwe"

Introduced

According to Froese and Pauly (2019), *O. macrochir* is established outside its native range in Burkina Faso, Democratic Republic of the Congo, Egypt, Israel, the Ivory Coast, Lake Kariba (on the Zambian-Zimbabwean border), Lake Kikila (Wallis and Futuna), Lake McIlwaine (Zimbabwe), Madagascar, Mauritius, Rwanda, and Sudan.

According to Froese and Pauly (2019), *O. macrochir* has also been introduced to the following locations, without confirmed establishment: Algeria, Benin, Burundi, Cameroon, Central African Republic, Gabon, Ghana, Japan, Kenya, Liberia, Republic of the Congo, Shashi Dam (Botswana), and Togo.

From Marshall and Tweddle (2007):

"Its introduction into Lake Kariba [Zambian-Zimbabwean border] in 1959 was not particularly successful (Jackson 2000) but it survives in small numbers. It may have colonised the Limpopo River after escaping from the Shashe Dam in Botswana and they have been collected from the Shashe River at Tuli (Minshull) [Zimbabwe] and from a pool downstream of the Shashe/Limpopo confluence [at the intersection of the Botswanan, Zimbabwean, and South African borders] (Kleynhans and Hoffman 1992). Also introduced to Komati system in Swaziland (Bills et al. 2004) and spreading to South Africa."

From Moralee et al. (2000):

"[…] in Lake Itasy, in Madagascar, *O. macrochir* was introduced in 1958 […]"

"[…] in Lake Ihema, Rwanda, *O. macrochir* was introduced near the end of the 1960s, […]"

Means of Introduction Outside the United States

From Gregg et al. (1998):

"Several tilapia species are native to Zimbabwe (Skelton, 1993). The Kariba tilapia *Oreochromis mortimeri* Trewavas is found historically in Zimbabwe only in the Middle Zambezi system, between Victoria Falls and Cahora Bassa rapids. The Nata system and Upper Save/Runde system contain the Mozambique tilapia *O. mossambicus* Peters. The greenhead tilapia *O. macrochir* (Boulenger) is native to the Upper Zambezi system. Historically these species were isolated from each other but the creation of artificial lakes and subsequent stocking of these lakes has created sympatry among these species."

"*Oreochromis macrochir* has been stocked extensively in impoundments. It was slow to establish in Lake Kariba (an impoundment on the Zambezi River), perhaps due to competition with the native *O. mortimeri* (Van der Lingen, 1973). Hybridization of *O. macrochir* with *O. mortimeri* was suspected although not substantiated (Jubb, 1967 in Trewavas, 1983). Jubb (1967) and Marshall (1979) report successful stocking of *O. macrochir* in Lake Kyle in the Lundi river system (Upper Save drainage), where *O. mossambicus* is native, and Lake Chivero in the Hunyani river system (Middle Zambezi drainage)."

Short Description

From Froese and Pauly (2019):

"Dorsal spines (total): 15 - 17; Dorsal soft rays (total): 11-14; Anal spines: 3; Anal soft rays: 9 - 12; Vertebrae: 29 - 32. Diagnosis: head profile steep [Gilchrist and Thompson 1917; Bell-Cross 1976; Trewavas 1983; Bell-Cross and Minshull 1988; Skelton 1993; Schwanck 1994; Skelton

2001] and rounded [Maar et al. 1966; Bell-Cross 1976]. Toothed area of lower pharyngeal bone with broadly rounded lobes; scales on cheek in 2-3 rows; caudal scales variable, not on the inter-radial membranes except at the base, and never stiffening the fin [Trewavas 1983]. Adults with black [Bell-Cross 1976; Trewavas 1983] or dark brown flecks in the temporal region, on the gill-cover [Poll 1967; Trewavvas 1983] and below the eye, mostly associated with openings of the lateral line system [Trewavas 1983]. Adults without conspicuous mid-lateral blotches [Trewavas 1983]."

Biology

From Marshall and Tweddle (2007):

"Found in quiet waters along river margins and backwaters, in floodplain habitats and impoundments (Skelton 2001, Tweddle et al. 2004). Feeds mainly on microscopic foods such as algae, especially diatoms, and detritus. Females mouth brood eggs and fry. Breeds in summer, nests grouped into arenas."

Human Uses

From Froese and Pauly (2019):

"Fisheries: commercial; aquaculture: commercial; gamefish: yes"

From Nico (2018):

"This tilapia species has been widely introduced into Africa and other parts of the world for use in aquaculture (Trewavas 1983; Axelrod 1993; Skelton 1993)."

Diseases

No OIE-listed diseases (OIE 2019) have been documented for this species.

Poelen et al. (2014) lists *Paradilepis delachauxi*, *Acanthogyrus tilapiae*, *Gyrodactylus niloticus*, and *Gyrodactylus shariffi* as parasites of *Oreochromis macrochir* (Strona et al. 2013).

From Moyo et al. (2009):

"In this study, a total of 329 worms of nine helminth species including 4 nematodes (*Paracamallanus cyathopharynx*, *Capillaria*, *Eustrongylides* sp. larvae and *Contracaecum* sp. larvae), 3 cestodes (*Bothriocephalus acheilognathi*, *Polyonchobothrium clarias* and *Proteocephalus glanduliger*), 1 digenean trematode (*Glossidium pedalum*), and 1 acanthocephala (*Acanthogyrus*) were found in *C. gariepinus*, *O. macrochir*, *O. mossambicus* and *S. robustus*."

Threat to Humans

From Froese and Pauly (2019):

"Harmless"

3 Impacts of Introductions

Welcomme (1992) lists *Oreochromis macrochir* as introduced for aquaculture in 13 countries and as a "Species generally viewed as beneficial where introduced."

From Canonico et al. (2005):

"The main threats to Madagascar's endemic fish are deforestation and exotic species introductions. While many species have been introduced in Madagascar for aquaculture or to enhance production in natural waters, their potential impact on endemics has largely been ignored. Introduced tilapiine fishes include *O. mossambicus*, *O. niloticus*, *O. macrochir*, *Tilapia melanopleura*, *T. rendalli*, and *T. zillii*. These species were introduced to support a commercial fishing industry starting in the late 1950s. All of these species are now established and most are widespread in Madagascar (Reinthal and Stiassny, 1991; Benstead et al., 2003)."

"There is a strong correlation between the introduction of exotic fish and the decline of native fish in Madagascar (Reinthal and Stiassny, 1991; Lévêque, 1997; Benstead et al., 2003; Sparks and Stiassny, 2003). Interviews with Lake Itasy fishermen indicated that the decline of native species in the lake was correlated with the introduction of exotic species (Reinthal and Stiassny, 1991). According to Lévêque (1997), 'the decline of the native *Ptychochromoides betsileanus* in Lake Itasy is attributed to the progressive introduction of different species, among which tilapiines are powerful competitors'. In Lake Alaotra, the progressive introductions of different species — carp first, followed by several species of tilapias in 1954 (*T. rendalli*), 1958 (*O. macrochir*), and 1961 (*O. niloticus* and *O. mossambicus*) — have also induced a drastic decline of native fish (Lévêque, 1997). Lévêque noted the quick proliferation of each of the tilapias since the first introduction in 1954, attributed to their high fecundity and ability to occupy empty niches."

From Nico (2018):

"*Oreochromis macrochir* has been replaced by Sarotherodon melanotheron [*sic*] as the second most abundant tilapia (after *O. mossambicus*?) in many Oahu reservoirs (Devick 1991b)."

"The overabundance of tilapias in at least one Hawaiian reservoir has possibly had the effect of suppressing production of desirable sport fishes (Devick 1972)."

The Florida Fish and Wildlife Conservation Commission has listed *Oreochromis macrochir* (longfin tilapia) as a prohibited species (FFWCC 2019).

From Minnesota DNR (2019):

"Minnesota has several state laws intended to minimize the introduction and spread of invasive species of wild animal and aquatic plants in the state. Using a four-tiered system, invasive species are classified as **prohibited**, **regulated**, **unregulated nonnative species**, or are unclassified and remain as **unlisted nonnative species**."

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Oreochromis spp. are listed as "restricted" species in the State of Vermont (Vermont Fish and Wildlife Regulations 2009).

From Virginia DGIF (2019):

"A special permit is required, and may be issued by the Department, if consistent with the Department's fish and wildlife management program, to import, possess, or sell the following non-native (exotic) amphibians, fish, mollusks, aquatic invertebrates, and reptiles: […] tilapia […]."

4 Global Distribution

Figure 1. Known global distribution of *Oreochromis macrochir*; reported from Africa and Hawaii. Map from GBIF Secretariat (2019). No georeferenced occurrences were available for parts of the species established range in Swaziland, Burkina Faso, Egypt, Israel, Wallis and Futuna, Madagascar, Mauritius, or Sudan. Occurrences in Burundi, Cameroon, Central African Republic, Gabon, Ghana, Liberia, Mozambique, and Togo do not represent established populations and were not included in the climate matching analysis.

5 Distribution Within the United States

Figure 2. Known distribution of *Oreochromis macrochir* in the United States. Map from Nico (2018). All occurrences except the northernmost occurrence on the island of Hawai'i represent established populations and were included in the climate matching analysis.

6 Climate Matching

Summary of Climate Matching Analysis

The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.016, which indicates a medium overall climate match. (Scores between 0.005 and 0.103 are classified as medium.) By State, the climate score was high in Texas; medium in Arizona, California, Florida, and New Mexico; and low elsewhere in the contiguous United States. Locally, the climate match was high in far southern Florida and along the border between the United States and Mexico. Medium matches occurred in central peninsular Florida, coastal Louisiana, the southern Southwest region, coastal California as far north as San Francisco, and east of Puget Sound. The climate match was low across the remainder of the contiguous United States.

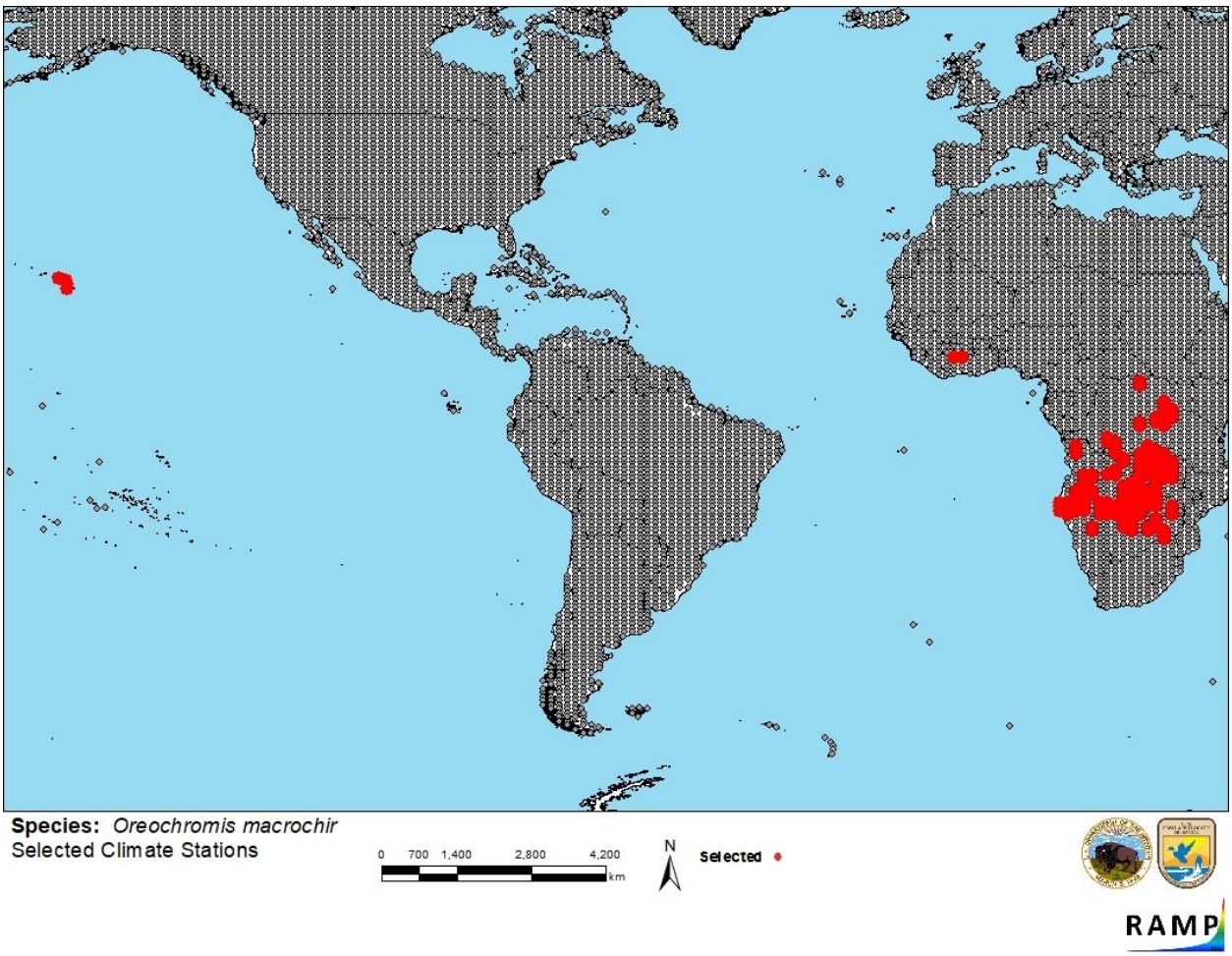

Figure 3. RAMP (Sanders et al. 2018) source map showing weather stations selected as source locations (red; Hawaii – U.S., Ivory Coast, Democratic Republic of the Congo, Rwanda, Burundi, Tanzania, Uganda, Angola, Namibia, Zambia, Zimbabwe, Botswana, South Africa) and non-source locations (gray) for *Oreochromis macrochir* climate matching. Source locations from GBIF Secretariat (2019).

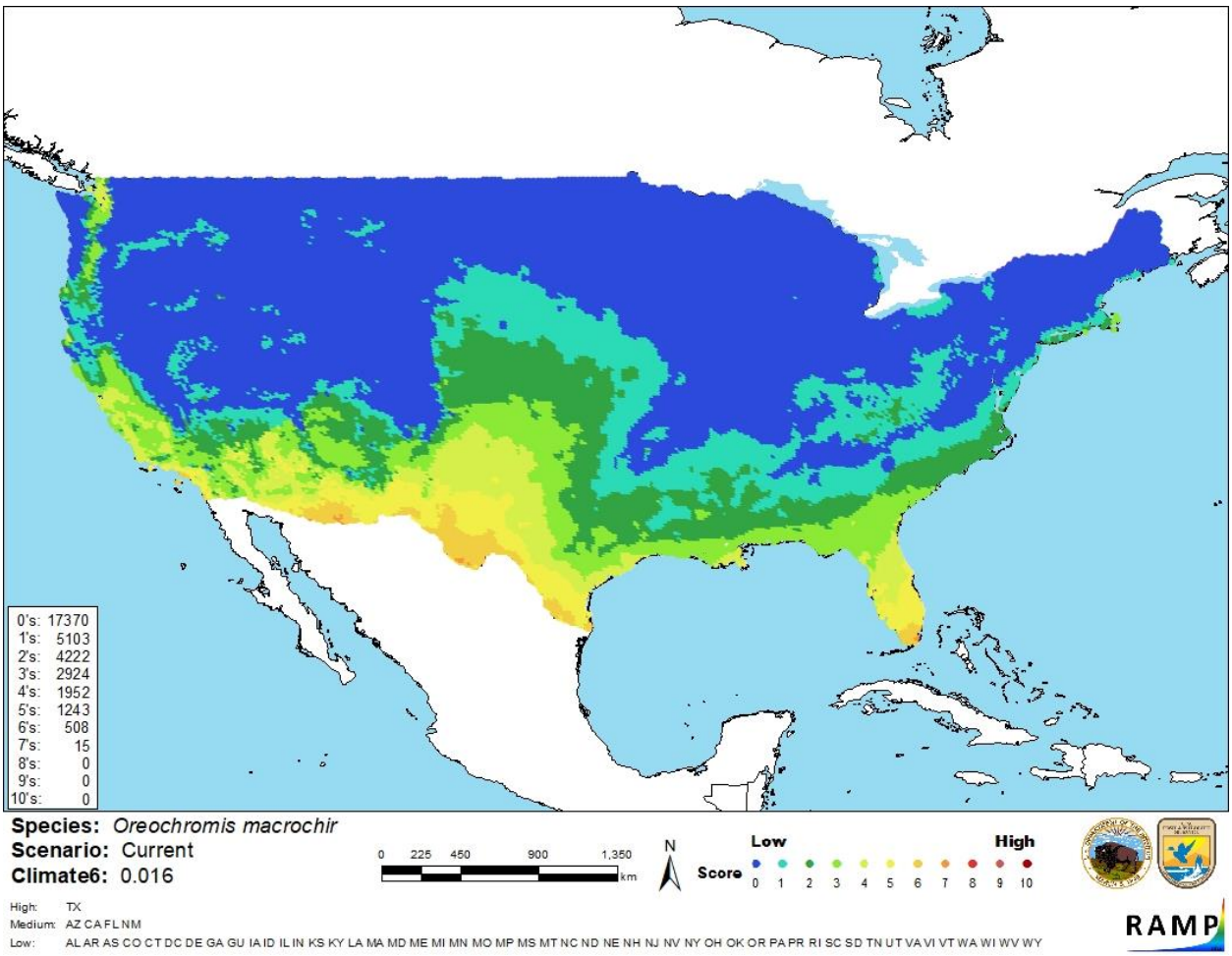

Figure 4. Map of RAMP (Sanders et al. 2018) climate matches for *Oreochromis macrochir* in the contiguous United States based on source locations reported by GBIF Secretariat (2019). 0 = Lowest match, 10 = Highest match.

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

There is adequate information available on the biology and distribution of *Oreochromis macrochir*. Numerous introductions of this species outside of its native range have been documented. Impacts of these introductions are unclear. Introduction of *O. macrochir* has been implicated in the decline of native fish species, but further information is needed to determine what impacts are attributable to *O. macrochir* in particular. Certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Oreochromis macrochir, Longfin Tilapia, is a fish species native to Africa. It has been introduced extensively into reservoirs and rivers in Africa outside of its native range, and it has also become established in Israel and Hawaii. It is utilized in aquaculture and as a sportfish. Numerous U.S. States prohibit or restrict the trade, possession, or use of *O. macrochir*. This species been implicated in the decline of native fish species in Lake Alaotra, Madagascar, but it was introduced along with carp and several other tilapia species, so this decline cannot be attributed specifically to *O. macrochir*. Decline of sport fisheries in Hawaii has been attributed to the introduction and proliferation of multiple species of exotic tilapia in reservoirs. History of invasiveness is "none documented." *O. macrochir* has a medium climate match with the contiguous United States, with the areas of high match located in Florida and along much of the border with Mexico. Further research is needed to determine what impacts, if any, can be definitively attributed to introductions of *O. macrochir.* Certainty of this assessment is low, and the overall risk assessment category is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Low**
- **Overall Risk Assessment Category: Uncertain**

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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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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