

Mango Tilapia (*Sarotherodon galilaeus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, May 2011

Revised, September 2018

Web Version, 2/17/2021

Organism Type: Fish

Overall Risk Assessment Category: Uncertain

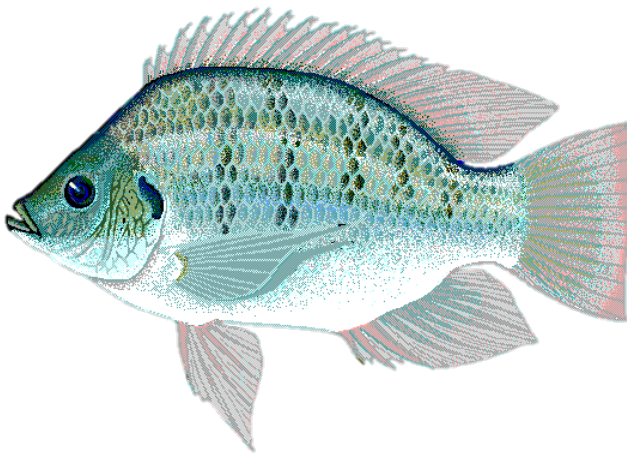


Image: Robbie Cada. Licensed under Creative Commons By 3.0 Unported. Available: <http://www.fishbase.org/photos/PicturesSummary.php?StartRow=4&ID=1389&what=species&TotalRec=9>. (September 2018).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2018a):

“Africa and Eurasia: Jordan system, especially in lakes; coastal rivers of Israel; Nile system, including the delta lakes and Lake Albert and Turkana [Kenya]; in West Africa in the Senegal [Senegal, Mali], Gambia [Gambia, Senegal], Casamance [Senegal], Géba [Guinea-Bissau], Konkouré [Guinea], Sassandra, Bandama, Comoé, Niger [Mali, Niger, Nigeria], Volta [Ghana], Tano [Ghana], Lake Bosumtwi [Ghana], Mono [Togo], Ouémé [Benin], Ogun [Nigeria], Cross [Cameroon, Nigeria], Benue [Cameroon, Nigeria], Logone [Chad], Shari [Central African Republic] and Lake Chad [Cameroon, Chad]; Draa (Morocco), Adrar (Mauritania); Saharian oases Borku, Ennedi and Tibesti in northern Chad; Sanaga and Nyong basins in Cameroon [Trewavas and Teugels 1991]. In the Congo basin, *Sarotherodon galilaeus boulengeri* is known

from the lower and middle Congo River from Matadi to Pool Malebo (=Stanley Pool) and the lower Kasai [Trewavas 1983] and Lukenie [Thys van den Audenaerde 1964] while *Sarotherodon galilaeus galilaeus* is present in the middle Congo River basin, in the middle Congo River and drainages of the Ubangi, Uele [Thys van den Audenaerde 1964; Trewavas 1983], Itimbiri [Thys van den Audenaerde 1964; Trewavas 1983; Decru 2015], Aruwimi [Decru 2015] and Lomami [Moelants 2015]. *Sarotherodon galilaeus* is also reported from the Luilaka River (Ruki drainage, middle Congo River basin) [Monsembula Iyaba and Stiassny 2013].”

“[In Cameroon:] Found in rivers Cross [Teugels and Thys van den Audenaerde 1990; Stiassny et al. 2008] and Meme, and Lake Barombi-Kotto [Stiassny et al. 2008]. Also occurs in Benue system [Vivien 1991; Teugels and Thys van den Audenaerde 2003], Lake Chad [Vivien 1991], Nyong and Sanaga basins [Stiassny et al. 2008]. Populations in Lake Ejagham are vulnerable [Baillie and Groombridge 1996].”

“[In Central African Republic:] Present in the Gribingui, upper Shari tributary [Teugels and Thys van den Audenaerde 2003].”

“[In Republic of the Congo:] Known from the middle Congo River [Trewavas 1983].”

“[In Ethiopia:] Known from the Baro basin [Getahun 2007].”

“[In Ghana:] Known from Pra and Tano basins [Paugy et al. 1994], Ankobra, Bia river, Volta [Dankwa et al. 1999], Tano and Lake Bosumtwi [Teugels and Thys van den Audenaerde 2003], Densu River at Weija and the Black Volta at Busunu [Falk et al. 1998].”

“[In Guinea:] Occurs in the Great Scarcies River [Paugy et al. 1994] and the Konkouré [Teugels and Thys van den Audenaerde 2003].”

“[In Guinea-Bissau:] Occurs in the Géba [Paugy et al. 1994; Teugels and Thys van den Audenaerde 2003] and Corubal rivers [Paugy et al. 1994].”

“[In Mauritania:] Known from Molomhar guelta in Adrar Mountains [Trape 2016].”

“[In Nigeria:] Widely distributed [Olaosebikan and Raji 1998]. Occurs in the Ogun River [Paugy et al. 1994; Teugels and Thys van den Audenaerde 2003], Kainji Lake [Anonymous 1998; Teugels and Thys van den Audenaerde 2003], lower Niger including the delta, Cross, Benue [Teugels and Thys van den Audenaerde 2003] and Ehoma Floodplain, Afikpo [Oti 2003].”

“[In Sudan:] Occurs in the Ghazal and Jebel systems, White and Blue Niles, Nile to Lake Nubia. Has a rather patchy occurrence [Bailey 1994].”

“[In Togo:] Occurs in Lake Togo [Paugy et al. 1994] and Mono River [Paugy et al. 1994; Teugels and Thys van den Audenaerde 2003].”

“[In Israel:] Yarqon, Hula and Lake Kinneret. Not threatened in Israel (but elsewhere).”

“[In Chad:] The subspecies *Sarotherodon galilaeus galilaeus* is known from Lake Chad basin [Trewavas and Teugels 1991; Teugels and Thys van den Audenaerde 2003], including Lake Chad, Chari River and Logone River [Trewavas 1983; Teugels and Thys van den Audenaerde 2003]. The subspecies *Sarotherodon galilaeus borkuanus* is known from Tibesti [Trewavas 1983; Trewavas and Teugels 1991], Borkou [Johnson 1974; Trewavas 1983; Trewavas and Teugels 1991; Trape 2016] and Ennedi [Trewavas 1983; Trewavas and Teugels 1991].”

“[In Democratic Republic of the Congo:] *Sarotherodon galilaeus boulengeri*: known from the lower and middle Congo River from Matadi to Pool Malebo (=Stanley Pool) and the lower Kasai [Trewavas 1983] and Lukenie [Thys van den Audenaerde 1964]. *Sarotherodon galilaeus galilaeus*: middle Congo River basin, in the middle Congo River and drainages of the Ubangi, Uele, Itimbiri [Thys van den Audenaerde 1964; Trewavas 1983], Lomami [Moelants 2015] and Aruwimi [Decru 2015]. *Sarotherodon galilaeus* also reported from the Luilaka River (Ruki drainage) [Monsembula Iyaba and Stiassny 2013], but subspecies not given.”

Additionally, Froese and Pauly (2018a) report *Sarotherodon galilaeus* as native and present in Cote d’Ivoire, Egypt, Morocco, Uganda, and Syria.

Status in the United States

There are no records of *Sarotherodon galilaeus* in the wild or in trade in the United States.

FAO (2018) lists *Sarotherodon galilaeus galilaeus* as introduced to Japan from the United States. No further information on the status of the subspecies in the United States was given.

The Florida Fish and Wildlife Conservation Commission has listed the tilapia *S. galilaeus* as a prohibited species. Prohibited nonnative species (FFWCC 2018), “are considered to be dangerous to the ecology and/or the health and welfare of the people of Florida. These species are not allowed to be personally possessed or used for commercial activities.”

From Louisiana State Legislature (2019):

“No person, firm, or corporation shall at any time possess, sell, or cause to be transported into this state by any other person, firm, or corporation, without first obtaining the written permission of the secretary of the Department of Wildlife and Fisheries, any of the following species of fish: freshwater electric eel (*Electrophorus* sp.); rudd (*Scardinius erythrophthalmus*); all members of the families *Synbranchidae* (Asian swamp eels); *Channidae* (snakeheads); *Clariidae* (walking catfishes); *Trichomycteridae* (pencil catfishes); all species of tilapia [*Sarotherodon galilaeus* is a species of tilapia], [...]”

Sarotherodon galilaeus falls within Group IV of New Mexico’s Department of Game and Fish Director’s Species Importation List (New Mexico Department of Game and Fish 2010). “The importation of these species [Group IV] are prohibited for the general public but may be allowed for, scientific study, department approved restoration and recovery plans, zoological display, temporary events/entertainment, use as service animal or by a qualified expert.”

From State of Nevada (2018):

“Except as otherwise provided in this section and NAC 504.486, the importation, transportation or possession of the following species of live wildlife or hybrids thereof, including viable embryos or gametes, is prohibited: [...] All species in the genera *Tilapia* and *Sarotherodon*”

Tilapia species are prohibited to be sold and used as bait or stocked in heated-water reservoirs in the State of Oklahoma (Oklahoma Secretary of State 2019).

All species in the genus *Sarotherodon* are listed as prohibited in Texas (Texas Parks and Wildlife 2020).

From Utah Office of Administrative Rules (2019):

“All species of fish listed in Subsections (2) through (30) are classified as prohibited for collection, importation and possession, [...] (30) Tilapia, (*Tilapia* and *Sarotherodon*) (All species) family Cichlidae.”

A permit is required to import, possess, or sell any species of tilapia in Virginia (Virginia Department of Game and Inland Fisheries 2020).

All species in the genus *Sarotherodon* are considered regulated Type A species in Washington. Regulated Type A species (Washington State Senate 2019) are “nonnative aquatic animal species that pose a low to moderate invasive risk that can be managed based on intended use or geographic scope of introduction, have a beneficial use, and are a priority for department-led or department-approved management of the species' beneficial use and invasive risks.”

Means of Introductions in the United States

There are no records of *Sarotherodon galilaeus* in the wild in the United States

Remarks

From Froese and Pauly (2018a):

“Five subspecies are recognized: *Sarotherodon galilaeus borkuanus*, *Sarotherodon galilaeus boulengeri*, *Sarotherodon galilaeus galilaeus*, *Sarotherodon galilaeus multifasciatus*, *Sarotherodon galilaeus sanagaensis*.”

Information on the different subspecies was included in the ERSS when found. This information is clearly marked as pertaining to a subspecies.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Fricke et al. (2018), *Sarotherodon galilaeus* (Linnaeus 1758) is the current valid name for this species. *Sarotherodon galilaeus* was originally described as *Sparus galilaeus* Linnaeus 1758 and has been known previously as *Tilapia galilaea* (Goren 1974).

From ITIS (2018):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Subclass Actinopterygii
Class Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Labroidei
Family Cichlidae
Genus *Sarotherodon*
Species *Sarotherodon galilaeus* (Linnaeus 1758)

Size, Weight, and Age Range

From Froese and Pauly (2018a):

“Max length : 39.5 cm TL male/unsexed; [Lalèyè 2006]; max. published weight: 1.6 kg [Daget 1954]”

“Maximum size recorded at 41.0 cm TL [Daget 1954].”

Environment

From Froese and Pauly (2018a):

“Freshwater; brackish; demersal; potamodromous [Riede 2004] [...] 22°C - 28°C [assumed to be recommended aquarium temperature range] [Baensch and Riehl 1991]; [...]”

“Has been known to occur at 9°C [water temperature]”

Climate

From Froese and Pauly (2018a):

“Subtropical; [...]; 35°N - 15°S”

Distribution Outside the United States

Native

From Froese and Pauly (2018a):

“Africa and Eurasia: Jordan system, especially in lakes; coastal rivers of Israel; Nile system, including the delta lakes and Lake Albert and Turkana [Kenya]; in West Africa in the Senegal [Senegal, Mali], Gambia [Gambia, Senegal], Casamance [Senegal], Géba [Guinea-Bissau], Konkouré [Guinea], Sassandra, Bandama, Comoé, Niger [Mali, Niger, Nigeria], Volta [Ghana], Tano [Ghana], Lake Bosumtwi [Ghana], Mono [Togo], Ouémé [Benin], Ogun [Nigeria], Cross [Cameroon, Nigeria], Benue [Cameroon, Nigeria], Logone [Chad], Shari [Central African Republic] and Lake Chad [Cameroon, Chad]; Draa (Morocco), Adrar (Mauritania); Saharian oases Borku, Ennedi and Tibesti in northern Chad; Sanaga and Nyong basins in Cameroon [Trewavas and Teugels 1991]. In the Congo basin, *Sarotherodon galilaeus boulengeri* is known from the lower and middle Congo River from Matadi to Pool Malebo (=Stanley Pool) and the lower Kasai [Trewavas 1983] and Lukenie [Thys van den Audenaerde 1964] while *Sarotherodon galilaeus galilaeus* is present in the middle Congo River basin, in the middle Congo River and drainages of the Ubangi, Uele [Thys van den Audenaerde 1964; Trewavas 1983], Itimbiri [Thys van den Audenaerde 1964; Trewavas 1983; Decru 2015], Aruwimi [Decru 2015] and Lomami [Moelants 2015]. *Sarotherodon galilaeus* is also reported from the Luilaka River (Ruki drainage, middle Congo River basin) [Monsembula Iyaba and Stiassny 2013].”

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Introduced

From Krupp and Schneider (1989):

“Twenty-four species of fishes are native to the Jordan-Dead Sea catchment basin; 28 species from outside have so far been introduced intentionally or accidentally. Among the latter are two species which also occur naturally in the Jordan River basin, *Sarotherodon galilaeus* and *Oreochromis aureus*.”

From Froese and Pauly (2018a):

“[In Gabon: Introduced and] Present in the lower Ogooué [Trewavas 1983; Vreven et al. 2007].”

“May have been introduced [to Israel and Syria] [Bartley 2006].”

“[In China:] Has established in aquaculture through assisted/artificial [*sic*] reproduction. Has not established in the wild [Welcomme 1988].”

FAO (2018) lists *Sarotherodon galilaeus galilaeus* as introduced to and established in the wild through natural reproduction in Oman.

FAO (2018) lists *Sarotherodon galilaeus* as introduced to and established in the wild through continuous restocking in Iraq.

FAO (2018) lists *Sarotherodon galilaeus* as introduced to and probably not established in the wild in Turkey.

From Innal (2012):

“Overall alien fish species in Turkey are reported as 30. with [*sic*] 15 species specifically introduced into reservoirs namely, [...], *Sarotherodon galilaeus galilaeus* (Linnaeus, 1758), [...].”

FAO (2018) lists *Sarotherodon galilaeus galilaeus* as introduced to South Africa and Japan but not established in the wild in either country.

Means of Introduction Outside the United States

CABI (2018) lists *Sarotherodon galilaeus* as introduced for aquaculture.

FAO (2018) lists aquaculture, weed control, mosquito control, research, and accidental introduction as reasons of introduction for *Sarotherodon galilaeus*.

Short Description

From Froese and Pauly (2018a):

“Dorsal spines (total): 15 - 17; Dorsal soft rays (total): 12-13; Anal spines: 3; Anal soft rays: 9 - 11; Vertebrae: 28 - 30. Diagnosis: 21-25 rakers on lower limb of first arch; length of lower pharyngeal jaw < 43.5% of head length; 29-32 scales in lateral line series; head length 32.5-39% of standard length; toothed area of lower pharyngeal jaw broad > 2-3 times in keel length [Stiassny et al., 2008].”

From CABI (2018):

“Melanin patches are found only in occasional individuals, and the caudal is naked except at the base. Reproductive individuals are greyish dorsally and silvery ventrally. Dorsal and caudal fins are with pinkish margins. Pectoral fins usually extend to above the vent or spinous anal fin. Males have longer soft dorsal and anal fin rays.”

Biology

From Froese and Pauly (2018a):

“[...]; occasionally form schools; territorial [Trewavas 1983]. Adults prefer open waters but juveniles and breeding adults are found inshore [Trewavas 1991]. Often associated with beds of submerged vegetation in Sudd lakes; feed on algae and fine organic debris; bi-parental mouthbrooder [Bailey 1994]. Lacks marked sexual dichromatism when sexually active; forms temporary pair bonds [Stiassny et al. 2008].”

“The initiative throughout courting and mating is taken predominantly by the female; female mainly responsible for the excavation of nest and defending mating territory. Pair-formation exists and is dissolved as soon as the eggs are in the parental mouth. Mouth brooding is reportedly biparental.”

“Is an obligate particulate feeder during the larval and juvenile stage, and is mainly an obligate filter feeder when adult. A transition period exists during which both feeding modes can be used according to environmental conditions [Drenner et al. 1982; Lazzaro 1987].”

Human Uses

From Froese and Pauly (2018a):

“Fisheries: commercial; aquaculture: commercial; aquarium: commercial”

FAO (2018) listed aquaculture, weed control, mosquito control, and research as some of the reasons for introduction of *Sarotherodon galilaeus*.

Diseases

No records of OIE-reportable diseases (OIE 2021) were found for *Sarotherodon galilaeus*.

Pariselle and Euzet (2009) list *S. galilaeus* as a host for *Enterogyrus cichlidarum*, *Enterogyrus amieti*, *Scutogyrus longicornis*, *Scutogyrus bailloni*, *Cichlidogyrus bychowskii*, *Cichlidogyrus cirratus*, *Cichlidogyrus dionchus*, *Cichlidogyrus douellouae*, *Cichlidogyrus halli*, *Cichlidogyrus njinei*, *Cichlidogyrus thurstonae*, and *Cichlidogyrus tilapiae*.

Kuchta et al. (2012) list *S. galilaeus* as a host for *Polyonchobothrium polypteri*.

From Froese and Pauly (2018a):

“Isopoda infestation with *Nerocila* Parasitic infestations (protozoa, worms, etc.)
Amplicaecum Infection (Larvae) Parasitic infestations (protozoa, worms, etc.)
Pentastoma Infection (Larvae) Parasitic infestations (protozoa, worms, etc.)
Whirling Viral Disease of Tilapia Larvae Viral diseases”

Froese and Pauly (2018b) list *Chilodonella cyprini*, *Ergasilus latus*, *Ergasilus lizae*, *Gendria tilapiae*, *Gyrodactylus ergensi*, *Lamproglana monodi*, *Lernaea hardingi*, as additional parasites of *S. galilaeus*.

According to Poelen et al. (2014), *S. galilaeus* is a host for the following additional parasites: *Anacanthorus colombianus*, *Cichlidogyrus acerbus*, *Cichlidogyrus sclerosus*, *Euclinostomum heterostomum*, *Gyrodactylus ergensi*, *Gyrodactylus cichlidarum*, *Ophiovalipora minuta*.

Threat to Humans

From Akoto et al. (2016):

“On the other hand, *S. galilaeus*, *C. anguillaris* [sic] and *S. intermedius* showed no health hazard associated with their consumption as their hazard indices for all the detected residues (aldrin, p,p'-DDE and p,p'-DDD) were <1 in spite of the presence of OCP and OPP residue in the fish.”

3 Impacts of Introductions

Records of introductions resulting in established wild populations were found but no information on impacts of introductions was found.

4 History of Invasiveness

Sarotherodon galilaeus is a tilapia native to Africa and Eurasia. They have been introduced for aquaculture, weed control, mosquito control, and research in Oman, Turkey, Israel, Syria, Uganda, Morocco, Egypt, and China. The species is not present in the United States, and is prohibited in Florida. The history of invasiveness is data deficient.

5 Global Distribution

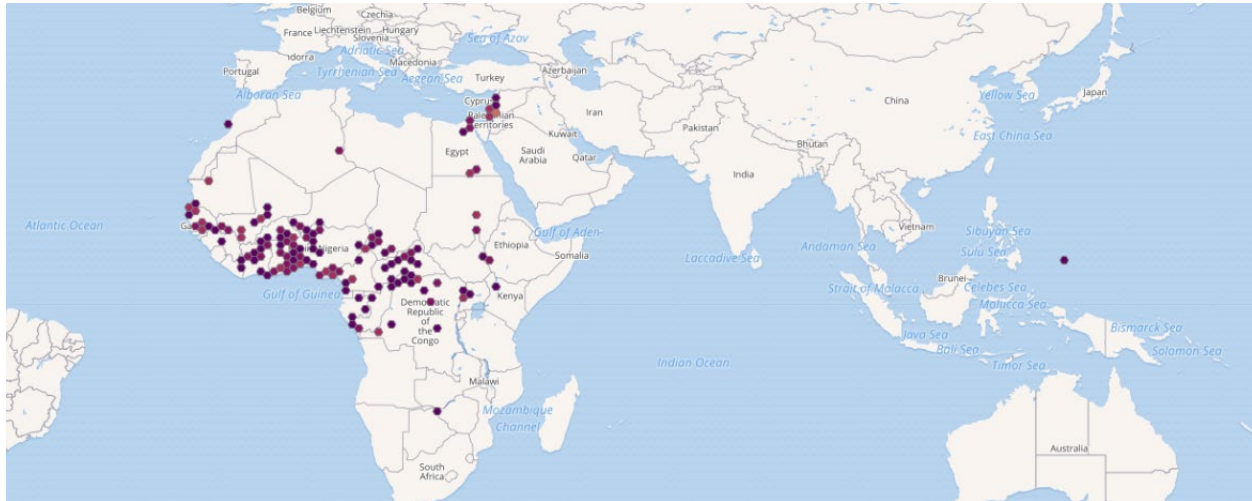


Figure 1. Known global distribution of *Sarotherodon galilaeus*. Locations are in Africa, the Middle East, and Palau. Map from GBIF Secretariat (2018). The point farthest east in Palau and the point farthest south in Zimbabwe were not considered as established populations. There was no documentation of populations in those locations. The record information for the observation in Palau states that the specimen was collected in the ocean (GBIF Secretariat 2018); *Sarotherodon galilaeus* is not a saltwater species. The location in Algeria was not used to select source points. Froese and Pauly (2018) report this identification as questionable, and it is not near any other known populations.

6 Distribution Within the United States

No records of *Sarotherodon galilaeus* in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Sarotherodon galilaeus* was high in the Southwest and most of California and small areas in eastern Washington and southern Florida. The climate match was medium in the rest of Florida, along the Gulf Coast and Mexican border, and in pockets in the west. Everywhere else had a low climate match. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for contiguous United States was 0.048, medium (scores greater than 0.005, but less than 0.103, are classified as medium). The following States had high individual climate scores: Arizona, California, Florida, and Washington. Nevada and Oregon had medium scores, while the remaining States had low individual climate scores.

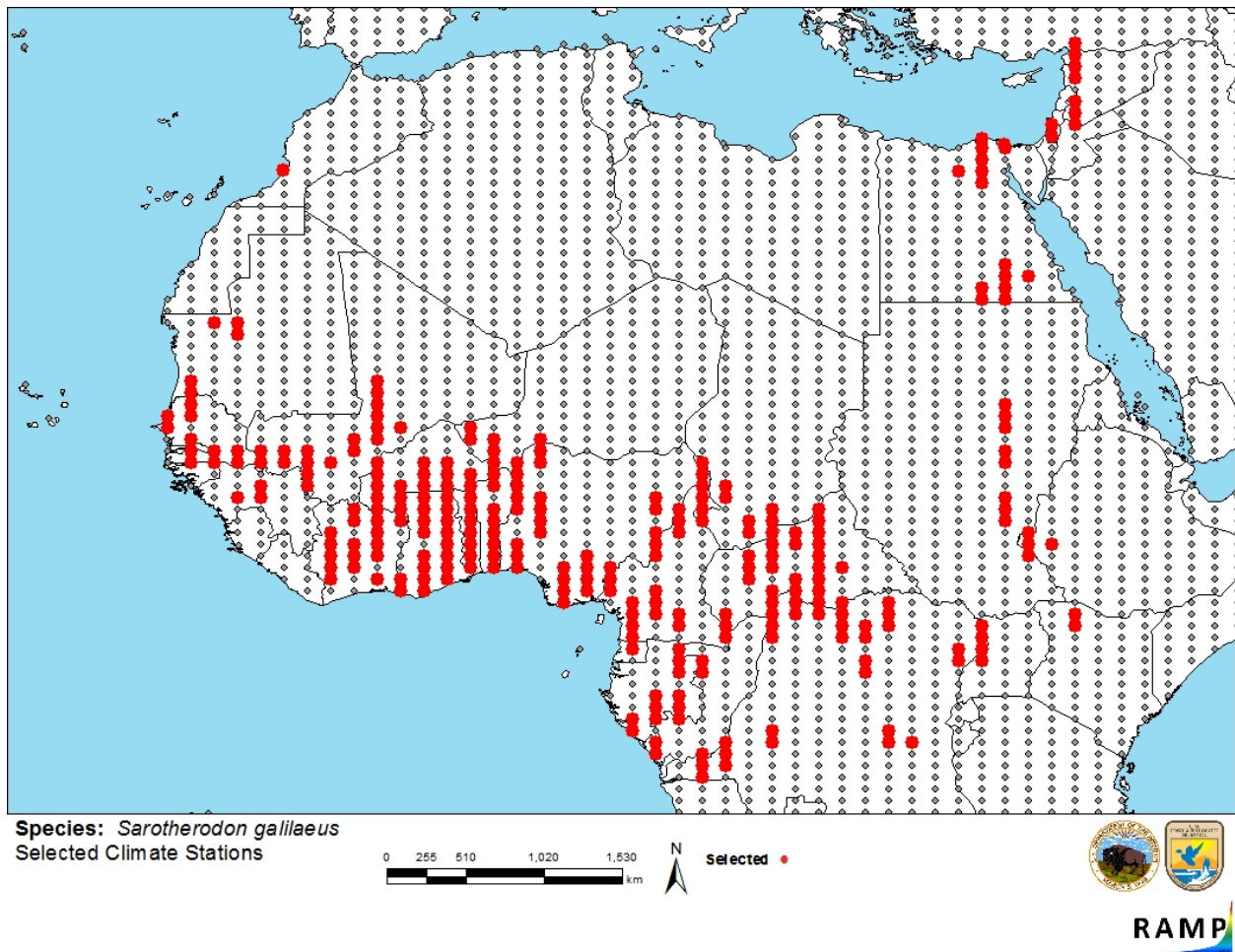


Figure 2. RAMP (Sanders et al. 2018) source map showing weather stations across Africa and western Asia selected as source locations (red; Morocco, Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, Cote d'Ivoire, Burkina Faso, Ghana, Togo, Benin, Niger, Nigeria, Cameroon, Chad, Central African Republic, Equatorial Guinea, Gabon, Republic of the Congo, Democratic Republic of the Congo, Uganda, Kenya, Ethiopia, Sudan, Egypt, Israel, Jordan, Syria, Turkey) and non-source locations (gray) for *Sarotherodon galilaeus* climate matching. Source locations from GBIF Secretariat (2018). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

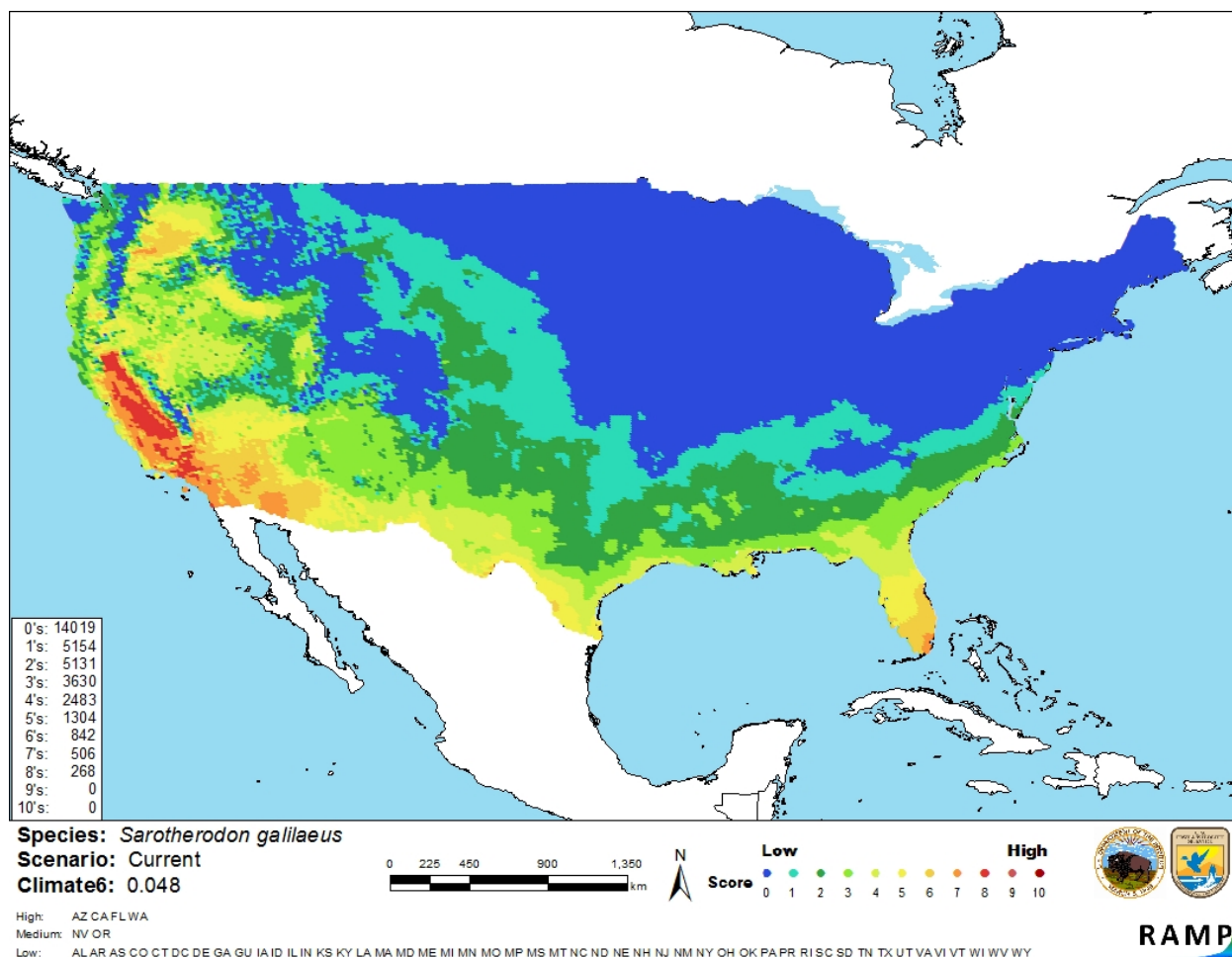


Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *Sarotherodon galilaeus* in the contiguous United States based on source locations reported by GBIF Secretariat (2018). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

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

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

8 Certainty of Assessment

The certainty of assessment for *Sarotherodon galilaeus* is low. There is some biological and ecological information available. There are few records of established populations outside of their native range. Most nonnative populations were purposely established for aquaculture, and there are no records of impacts by *Sarotherodon galilaeus* in the introduced areas.

9 Risk Assessment

Summary of Risk to the Contiguous United States

The Mango Tilapia (*Sarotherodon galilaeus*) is a fish native from the Western Coast of Africa to Eurasia. *S. galilaeus* is used for human consumption, in weed and mosquito control, and for research. The history of invasiveness is data deficient for *Sarotherodon galilaeus*. There is history of introduction for this species that have resulted in established populations. However, there is no information on impacts of introduction available. *S. galilaeus* was introduced for aquaculture and commercial uses but there is no information available on the volume and duration of this trade. The climate match was medium. The areas of highest match were in the southwest and California. The certainty of assessment is low. Overall risk assessment for *Sarotherodon galilaeus* is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): Medium**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks/Important additional information:** *Sarotherodon galilaeus* is regulated in multiple States.
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 11.

Akoto O, Azuure AA, Adotey KD. 2016. Pesticide residues in water, sediment and fish from Tono Reservoir and their health risk implications. SpringerPlus 5:1849.

[CABI] CAB International. 2018. *Sarotherodon galilaeus* (mango tilapia) [original text by S. Siriwardena]. CABI Invasive Species Compendium. Wallingford, United Kingdom: CAB International. Available: <https://www.cabi.org/ISC/datasheet/65484> (September 2018).

[FAO] Fisheries and Agriculture Organization of the United Nations. 2018. Database on introductions of aquatic species. Rome: FAO. Available: <http://www.fao.org/fishery/introsp/search/en> (September 2018).

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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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