Ocellate River Stingray (*Potamotrygon motoro*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, August 2015
Revised, March 2018
Web Version, 3/2/2021

Organism Type: Fish
Overall Risk Assessment Category: High

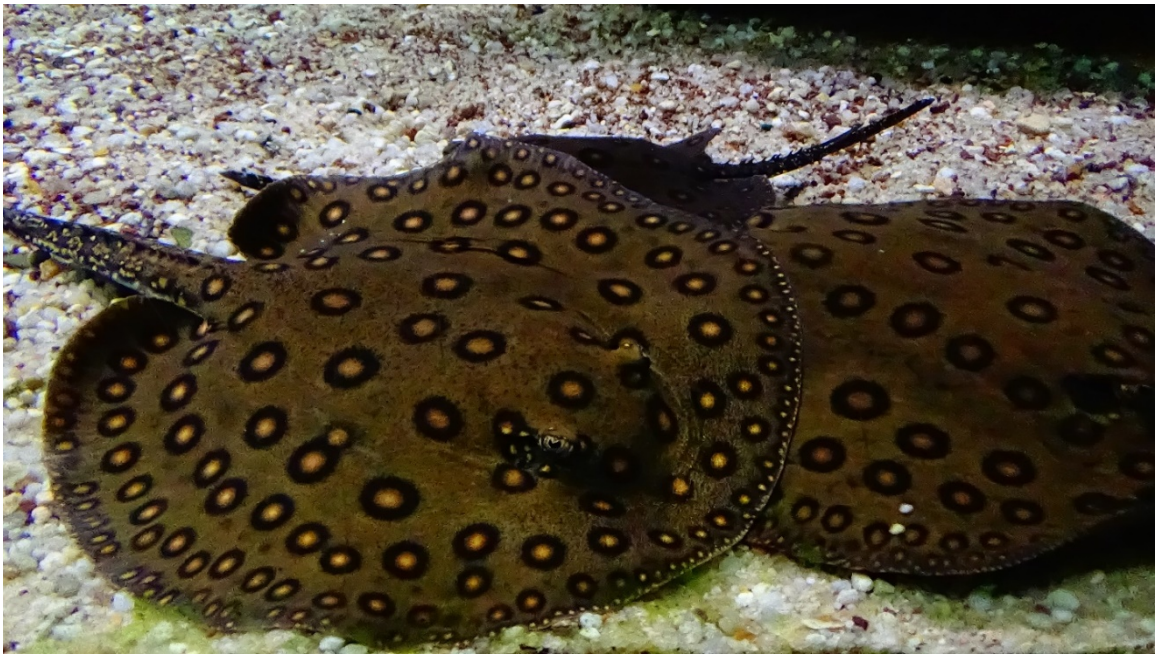

Photo: Loury Cédric. Licensed under CC BY-SA 4.0 International. Available: https://commons.wikimedia.org/wiki/File:Potamotrygon_motoro_-_raye_d%27eau_douce_-_Aqua_Porte_Dor%C3%A9e_01.JPG. (February 2018).

1 Native Range and Status in the United States

Native Range

From Araújo et al. (2004):

"Amazon, Orinoco and de La Plata Basins" in the countries of "Argentina, Brazil, Bolivia, Columbia, French Guyana, Guyana, Paraguay, Peru, Surinam and Uruguay"

From Froese and Pauly (2018):

"South America: Uruguay, Paraná-Paraguay, Orinoco, and Amazon River basins."

Status in the United States

Potamotrygon motoro has not been reported in the wild in the United States.

P. motoro is in trade in the United States (e.g. AquaImports 2021).

The Florida Fish and Wildlife Conservation Commission has listed the freshwater stingray *Potamotrygon motoro* as a conditional species. Conditional nonnative species (FFWCC 2020), "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, although exceptions are made by permit from the Executive Director for research, commercial use (with security measures to prevent escape or release) or public exhibition purposes."

From Arizona Office of the Secretary of State (2013):

"I. Fish listed below are considered restricted live wildlife:
[…]
32. All species of the family Potamotrygonidae. Common name: stingray."

From California Department of Fish and Wildlife (2019):

"It shall be unlawful to import, transport, or possess live animals restricted in subsection (c) below except under permit issued by the department. […]
Restricted species include:
[…]
Family Potamotrygonidae-River stingrays: All species (D)."

From Georgia DNR (2020):

"The exotic species listed below, except where otherwise noted, may not be held as pets in Georgia. This list is not all inclusive. […]
Fresh-water stingray; all species"

From Mississippi Secretary of State (2019):

"All species of the following animals and plants have been determined to be detrimental to the State's native resources and further sales or distribution are prohibited in Mississippi. No person shall import, sell, possess, transport, release or cause to be released into the waters of the state any of the following aquatic species or hybrids thereof. However, species listed as prohibited may be allowed under a permitting process where environmental impact has been assessed.
[…]
Freshwater stingrays Family Potamotrygonidae **** [indicating all species within the family are included in the regulation]"

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:
[…]
Freshwater stingray.....All species in the family Potamotrygonidae"

From Oklahoma Secretary of State (2019):

"Until such time as is necessary for the Department of Wildlife Conservation to obtain adequate information for the determination of other harmful or potentially harmful exotic species, the importation into the State and/or the possession of the following exotic fish or their eggs is prohibited:
[…]
Freshwater Stingray group: *Paratrygon* spp., *Potomotrygon* spp., and *Disceus* spp."

From Texas Parks and Wildlife (2020):

"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 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).
[…]
Freshwater Stingrays, Family Potamotrygonidae All species"

Means of Introductions in the United States

This species has not been reported in the United States.

Remarks

From Cruz et al. (2015):

"Four individuals morphologically characterized as *P. motoro* but showing *P. falkneri* mtDNA haplotypes were suspected to be the result of hybridization and were further analyzed with microsatellites. These individuals showed the combination of diagnostic alleles for both species, thus demonstrating for the first time the occurrence of hybrids between species of stingrays."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Eschmeyer et al. (2017):

"**Current status:** Valid as *Potamotrygon motoro* (Müller & Henle 1841)."

From ITIS (2018):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Chondrichthyes
Class Chondrichthyes
Subclass Elasmobranchii
Superorder Euselachii
Order Myliobatiformes
Family Potamotrygonidae
Genus *Potamotrygon*
Species *Potamotrygon motoro* (Müller and Henle, 1841)

Size, Weight, and Age Range

From Froese and Pauly (2018):

"Max length : 50.0 cm WD male/unsexed; [de Carvalho et al. 2003] ; max. published weight: 34.2 kg [Machacek 2010]"

"Maximum length reported in Axelrod et al., 1991 […] is 100 cm TL."

Environment

From Froese and Pauly (2018):

"Freshwater; benthopelagic; pH range: 5.0 - 6.0; dH range: 10 - ?; potamodromous [Riede 2004]"

Climate

From Froese and Pauly (2018):

"Tropical; 24°C - 26°C [assumed to be recommended aquarium temperature range] [Baensch and Riehl 1985]"

Distribution Outside the United States

Native

From Araújo et al. (2004):

"Amazon, Orinoco and de La Plata Basins" in the countries of "Argentina, Brazil, Bolivia, Columbia, French Guyana, Guyana, Paraguay, Peru, Surinam and Uruguay"

From Froese and Pauly (2018):

"South America: Uruguay, Paraná-Paraguay, Orinoco, and Amazon River basins."

Introduced

From Garrone Neto et al. (2014):

"The record of elasmobranchs as alien species is not common in the literature. Ng et al. (2009) confirmed the presence of an established population of the South American ocellate river stingray*, P. motoro*, in the Upper Seletar Reservoir, Singapore. Although the authors confirmed the first introduction and establishment of potamotrygonid stingrays outside the Neotropics, this report was not the first record of this group as alien species, since Agostinho et al. (1997), Garrone Neto et al. (2007) and Júlio-Júnior et al. (2009) had already reported the occurrence and the establishment of potamotrygonids outside of their natural range in Southeastern Brazil."

"In the Paraná River, Southeastern Brazil, the Sete-Quedas Falls played an important role in the division of the ichthyofauna, […]. However, in 1982 this natural barrier was submerged after the filling of the reservoir formed by the Itaipu Dam, enabling the connection of fish faunas that were previously isolated (Bonetto 1986; Agostinho et al. 1992, 1997; Luiz et al. 2004). Therefore, several species of fishes restricted to the downstream of the Sete-Quedas Falls successfully colonized and spread over the upper course of the Paraná River (see Júlio-Júnior et al. 2009 and references therein for reviews). Among these, at least two species of potamotrygonid stingrays belonging to the genus *Potamotrygon* Garman, 1877 were recognized in the Upper Paraná River basin: *P. falkneri* Castex and Maciel (1963) and *P. motoro* (Müller and henle [sic], 1841) (Agostinho et al.1997; Garrone Neto et al. 2007; Júlio-Júnior et al. 2009). Today, both species are found more than 400 km upstream from the Sete-Quedas Falls, where their populations are apparently established and exhibit signs of expansion (Garrone Neto et al. 2007; Garrone Neto and Haddad Jr. 2010; Haddad Jr. et al. 2013)."

Means of Introduction Outside the United States

From Ng et al. (2010):

"Given the strong presence of *P. motoro* in the aquarium trade in Singapore, and the trade's likely role in introducing many exotic freshwater species into Singapore (Ng et al. 1993), we are certain that this population in Upper Seletar Reservoir was established from unwanted pets discarded or had been intentionally released into the reservoir."

From Garrone-Neto et al. (2014):

“However, in 1982 this natural barrier was submerged after the filling of the reservoir formed by the Itaipu Dam, enabling the connection of fish faunas that were previously isolated (Bonetto 1986; Agostinho et al. 1992, 1997; Luiz et al. 2004). Therefore, several species of fishes restricted to the downstream of the Sete-Quedas Falls successfully colonized and spread over the upper course of the Paraná River (see Júlio-Júnior et al. 2009 and references therein for reviews).”

“Furthermore, reports on the use of navigation locks by the stingrays [*Potamotrygon motoro* and *P. falkneri*] to expand their distributions in the Upper Paraná basin are known and demonstrate the high potential of dispersal of these animals (Garrone Neto et al. 2007). However, details about this fact remains unknown and very few mitigating measures or monitoring programs were adopted from government agencies and private institutions in the areas recently colonized by the stingrays.”

Short Description

From Encyclopedia of Life (2018):

“The body of the [South American Freshwater] stingray is an oval disc, with a greyish-brown upper surface patterned with distinct yellow-orange spots, and a white underside (Fowler et al. 2005). While the [South American Freshwater] stingray is a beautiful species, it is much feared for the single spine borne at the tip of the robust tail, which is capable of delivering a painful sting (Fowler et al. 2005) (Campbell and Dawes 2004).”

“These stingrays can be distinguished from closely related species (such as large spot stingrays (*Potamotrygon falkneri*)) by the presence of orange to yellow dorsal eyespots, each surrounded by a black ring, with diameters larger than the eyes. Body color is otherwise greyish-brown. They are oval in shape with a robust tail, bearing a venemous [sic] spine. Maximum total length has been reported at 100 centimeters and maximum weight at 15 kg, though individuals tend to be much smaller (50-60 cm and under 10 kg). Females tend to be slightly larger than males.”

Biology

From Encyclopedia of Life (2018):

“The stingray [*Potamotrygon motoro*] is often found lying still, buried in the sandy sediment at the bottom of a stream, particularly during the warmest part of the day (Fowler et al. 2005) (Campbell and Dawes 2004). Like all stingrays, the females of this species produce eggs, but these develop inside the female. The young hatch inside the female and are then 'born' live after a gestation period of no more than three months (Campbell and Dawes 2004) (Thorson et al. 1983). The litter size of the stingray [*P. motoro*] varies massively, from 3 to 21 young (Fowler et al. 2005). Sexual maturity is reached at around three years of age, when the stingray measures between 30 and 35 centimetres across (Fowler et al. 2005). […] Stingray [*P. motoro*] has relatively few predators, except for some larger fish and caiman (Burnie 2001).”

"Food types consumed depend on age and environment. Shortly after birth, young eat plankton and juveniles add small mollusks, crustaceans, and aquatic insect larvae to their diets. Adults are primarily consumers of fish, including loricariids, *Astyanax* species, and graceful pimelodellas (*Pimelodella gracilis*), as well as crustaceans (Palaemonidae sp.). They are also known to eat gastropods (Ampullariidae and Hydrobiidae sp.), aquatic insects (Baetidae, Chironomidae, Elmidae, and Naucoridae sp.), and flying insects (Pyralidae, Corduliidae, Gomphidae, Hydropsychidae, Leptoceridae, and Odontoceridae sp.)."

Human Uses

From Araújo et al. (2004):

"Data on fishing practices and conservation efforts of Potamotrygonidae for ornamental trade have only recently begun to be collected."

From Ng et al. (2010):

"Given the strong presence of *P. motoro* in the aquarium trade in Singapore, […]"

"Freshwater stingrays of the family Potamotrygonidae are native to the Atlantic drainages of South America (Berra 2001), and are frequently encountered in the aquarium trade, where they are popular as pets (Ross 1999; de Araújo et al. 2004). More than 60,000 specimens are sold worldwide, with Brazil alone accounting for up to 47,000 specimens exported annually (including both legally and illegally traded specimens) (Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 2006) and Peru accounting for another 15,000 (Moreau and Coomes 2007). In addition, large-scale captive breeding in Asia has added more specimens to the trade, and contributed to their popularity through lowered shipping costs and enhanced ''attractiveness'' of the stingrays with the production of hybrids with various color patterns (CITES 2009)."

P. motoro is in trade in the United States (e.g. AquaImports 2021).

Diseases

No records of OIE-reportable (OIE 2021) diseases were found for *Potamotrgyon motoro*.

From Froese and Pauly (2018):

" Procamallanus Infection 10, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 10, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 10, Parasitic infestations (protozoa, worms, etc.)
Brevimulticaecum Infestation, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 17, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 17, Parasitic infestations (protozoa, worms, etc.)"

From Brooks and Amato (1992):

"Specimens of 5 species of cestodes were collected from 6 specimens of the freshwater stingray *P. motoro,* collected in the vicinity of Corumba, Mato Grosso do Sul, Brazil. *Acanthobothrium regoi, Potamotrygonocestus orinocoensis, Rhinebothroides venezuelensis* and *Rhinebothrium paratrygoni* are reported from *Potamotrygon motoro* and from southwestern Brazil for the first time"

Poelen et al. (2014) list *Potamotrygonocotyle rionegrense, Paroncomegas araya, Procamallanus inopinatus, Potamotrygonocotyle rionegrense, Paroncomegas araya, Acanthobothrium regoi, Acanthobothrium terezae, Potamotrygonocestus amazonensis, Potamotrygonocestus fitzgeraldae, Potamotrygonocestus orinocoensis, Potamotrygonocestus travassosi, Rhinebothrium paratrygoni, Rhinebothroides freitasi, Rhinebothroides glandularis, Rhinebothroides scorazai, Rhinebothroides venezuelensis, Eutetrarhynchus araya, Acanthobothrium peruviense, Acanthobothrium ramiroi, Rhinebothroides campbelli, Rhinebothroides mclennanae, Potamotrygonocotyle chisholmae, Potamotrygonocotyle dromedaries, Potamotrygonocotyle eurypotamoxenus, Potamotrygonocotyle tsalickisi, Brevimulticaecum regoi, Procamallanus peraccuratus* as parasites of *Potamotrygon motoro*."

From Yun et al (2017):

"*Aeromonas (A.) hydrophila* was isolated from a captive-bred adult freshwater stingray (*Potamotrygon motoro*) reared at a commercial aquarium in Korea"

From Encyclopedia of Life (2018):

"*Leiperia gracile* (Order Porocephalida, Subclass Crustacea)"

Threat to Humans

From Froese and Pauly (2018):

"Traumatogenic [Halstead 1980]"

"It is an extremely dangerous species."

From Garrone Neto et al. (2014):

"[…] negative interactions between humans and stingrays have been identified as the main impact of this colonization, with injuries to bathers and fishermen reported and with the practice of 'negative fishing' (i.e. the capture and mutilation and/or death of stingrays for amateur and professional anglers) over several riverside communities of the Upper Paraná River basin (Haddad Jr. et al. 2004, 2013; Garrone Neto and Haddad Jr. 2010)."

"Unlike the situation in Singapore, where the Upper Seletar Reservoir is not inserted into a large waterway system as the Tietê-Paraná Hydroway, and impacts such as interactions between potamotrygonid stingrays and humans have not been detected in the newly colonized areas (Ng

et al. 2009), *P. falkneri* and *P. motoro* have been present for at least ten years in the Upper Paraná River basin and are frequently involved in accidents with humans. Fatal incidents are not known in Brazil, but injuries provoked by stingrays usually have high morbidity rates and great potential to generate severe cases of infection and temporary or permanent incapacity (Haddad Jr. et al. 2004, 2012, 2013; Garrone Neto and Haddad Jr. 2010)."

3 Impacts of Introductions

From Garrone-Neto et al. (2014):

"Impacts of this colonization on aquatic fauna have not been evaluated, but the predominantly benthic habit associated with the wide feeding spectrum of the stingrays suggests a possible overlap of niche with other species of similar habits (Garrone Neto 2009; Garrone Neto and Sazima 2009). In contrast [to a lack of information regarding ecological impacts], negative interactions between humans and stingrays [*Potamotrygon falkneri* and *P. motoro*] have been identified as the main impact of this colonization, with injuries to bathers and fishermen reported and with the practice of 'negative fishing' (i.e. the capture and mutilation and/or death of stingrays for amateur and professional anglers) over several riverside communities of the Upper Paraná River basin (Haddad Jr. et al. 2004, 2013; Garrone Neto and Haddad Jr. 2010)."

"*P. falkneri* and *P. motoro* have been present for at least ten years in the Upper Paraná River basin and are frequently involved in accidents with humans. Fatal incidents are not known in Brazil, but injuries provoked by stingrays usually have high morbidity rates and great potential to generate severe cases of infection and temporary or permanent incapacity (Haddad Jr. et al. 2004, 2012, 2013; Garrone Neto and Haddad Jr. 2010)."

From Ng et al. (2010):

"To date, there have not been any reports of negative impacts of the alien stingray in Singapore. However, *P. motoro* is the most fecund potamotrygonid species and is widely distributed in its native continent (de Araújo et al. 2004), indicating a potential for becoming invasive. In addition, as an apex predator (de Araújo et al. 2004; Martin 2005) feeding on a wide range of animals including mollusks, crustaceans, and fishes (Achenbach and Achenbach 1976; Silva and Uieda 2007), *P. motoro* also poses a threat to biodiversity in Singapore through direct predation."

"*Potamotrygon motoro* is also a threat to human health because of its potential for causing serious harm to humans. Although public use of the Upper Seletar Reservoir for recreational activities is currently restricted (and therefore contact with humans reduced), there remains a distinct concern over the safety hazard that the stingrays may pose (coupled with the possibility that the species could spread or be introduced into other, more publicly accessible reservoirs in Singapore)."

Potamotrygon motoro is regulated in multiple States.

4 History of Invasiveness

Potamotrygon motoro has been found introduced in the Upper Seletar Reservoir, Singapore and outside their natural range in southeastern Brazil. *P. motoro* was introduced to the Upper Paraná River basin in southeastern Brazil after a dam and lock system created a bypass around a naturally occurring waterfall which had served as a barrier. *P. motoro* is now established in that region. There are now reports of injuries to humans from stingrays in the invaded region. Due to this impact on human health the history of invasiveness is High.

5 Global Distribution

Figure 1. Known distribution of *Potamotrygon motoro* in South America. Map from GBIF Secretariat (2021). While Ecuador is not specifically mentioned in the species' range description, the locations in that country fall within the Amazon River basin. Those locations were therefore determined to be valid and were used to select source points for the climate match.

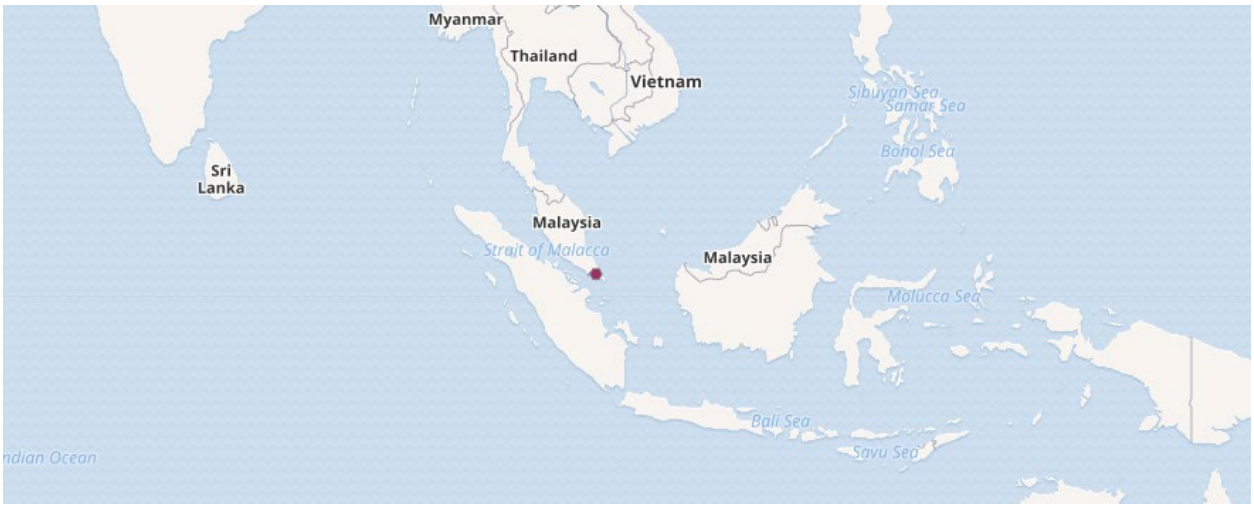

Figure 2. Distribution of *Potamotrygon motoro* in southeastern Asia. Map from GBIF Secretariat (2021).

6 Distribution Within the United States

This species has not been reported in the United States.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Potamotrygon motoro* was high along the Gulf Coast, most of Florida, and an area of coastal Virginia. Most of the remainder of the southeast, the mid-Atlantic and part of the southwest had medium matches. Areas of low match were in the Northeast, with a small path along the Appalachian Mountains. Most of the upper Midwest, Great Plains, Rocky Mountains, and West coast had low matches. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.092, medium (scores greater than 0.005, but less than 0.103, are classified as medium). The following States had high individual climate 6 scores: Alabama, Delaware, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, and Virginia. The following States had medium individual scores: Arkansas, New Jersey, and Tennessee. The remainder of the States had low individual scores.

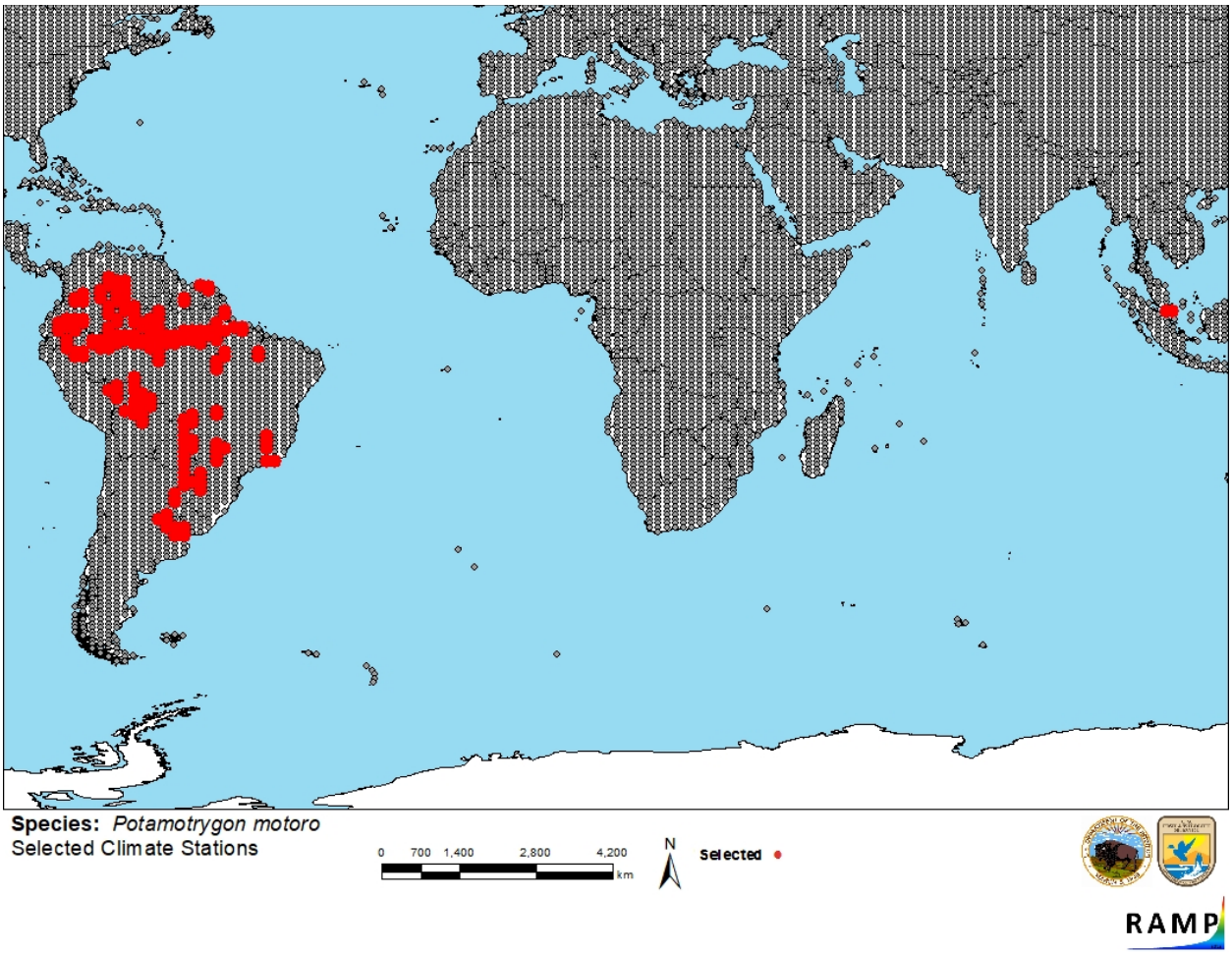

Figure 3. RAMP (Sanders et al. 2018) source map showing weather stations selected as source locations (red; Argentina, Colombia, Bolivia, Brazil, Ecuador, French Guiana, Malaysia, Paraguay, Peru, Suriname, Uruguay, Venezuela) and non-source locations (gray) for *Potamotrygon motoro* climate matching. Source locations from GBIF Secretariat (2021). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

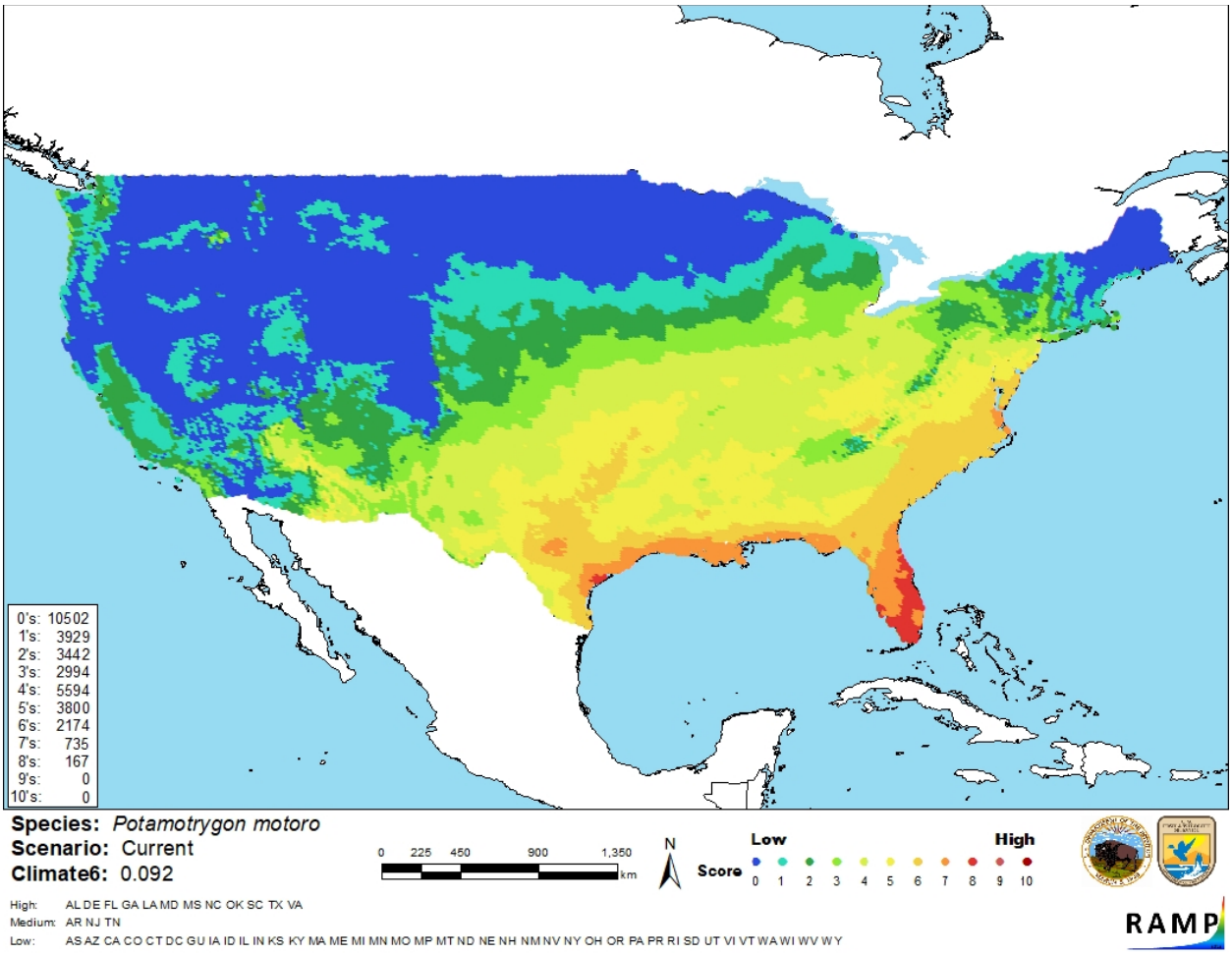

Figure 4. Map of RAMP (Sanders et al. 2018) climate matches for *Potamotrygon motoro* in the contiguous United States based on source locations reported by GBIF Secretariat (2021). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

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≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

Potamotrygon motoro appears to be the most well-known freshwater ray of the *Potamotrygon* genus. There are a few documented introductions of *P. motoro* outside its native range, with some information regarding impacts of those introductions. Impact information was available from peer-reviewed sources. The certainty of assessment for *Potamotrygon motoro* is High.

9 Risk Assessment

Summary of Risk to the Contiguous United States

The Ocellate River Stingray (*Potamotrygon motoro*) is one of the most well-known and widely distributed species of the freshwater rays in the Potamotrygonidae family. This species is popular in the aquarium trade, which is believed to be the vector of its introduction in Singapore. *P. motoro* has also been introduced outside of its native range in Brazil where the main impact has been injuries to humans from this species in an area that did not previously have any species of freshwater stingray. Due to risk of injury to humans, this species is the subject of 'negative fishing' in which the species has the barb removed or is killed after a recreational capture. *P. motoro* is in trade in the United States and is regulated by multiple States. The history of invasiveness for this species is High. The certainty of assessment is high. The overall climate match to the contiguous United States was medium. The areas of highest match were in the southeast, along the Gulf Coast, and mid-Atlantic. The overall risk assessment category for this species is High.

Assessment Elements

- **History of Invasiveness (Sec. 4): High**
- **Overall Climate Match Category (Sec. 7): Medium**
- **Certainty of Assessment (Sec. 8): High**
- **Remarks/Important additional information:** May cause injury to humans.
- **Overall Risk Assessment Category: High**

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.

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11 Literature Cited in Quoted Material

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