U.S. Fish & Wildlife Service

Butterfly Peacock Bass (*Cichla ocellaris*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, December 2023
Revised, April 2024, May 2025
Web Version, 6/5/2025

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

Photo: Justin Procopio. Public Domain. Available: https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=437 (December 2023).

1 Native Range and Status in the United States

Native Range

From Fricke et al. (2025):

"Northern South America: Brazil, French Guiana, Guyana and Suriname."

From Kullander and Ferreira (2006):

"*Cichla ocellaris* is known from the Guianas, including the Marowijne, Suriname, Corantijn, Demerara, and Essequibo river drainages, and also the upper Rio Branco in Brazil."

Status in the United States

From Nico and Neilson (2023):

"Established in south Florida (Courtenay and Robins 1989; Shafland 1995), Guam (Welcomme 1988), Hawaii (Maciolek 1984), and Puerto Rico (Erdman 1984). Shafland (1996) indicated that fishable populations of peacock cichlid in Florida exist in more than 500 km of canals, plus numerous urban lakes in the metropolitan Miami-Ft. Lauderdale area. The range of this species in Florida is limited by cold winters that restrict it to the southernmost counties and exclude it from much of the Everglades. Extirpated in Texas: some *Cichla* populations in Texas survived and reproduced for a brief period, but by 1992 all fish had died. For the most part, *Cichla* species are unable to survive cold winters, although evidence indicated fish in one Texas reservoir succumbed to high summer temperatures (Garrett 1982; Courtenay and Robins 1989; Howells and Garrett 1992). Unknown, but likely failed, in Arizona."

Nico and Neilson (2023) also report nonindigenous occurrences of *Cichla ocellaris* from Louisiana (unknown status) and Maryland (failed).

Froese and Pauly (2025) report *Cichla ocellaris* as established in the U.S. Virgin Islands.

No information was found to clarify the taxonomic identity of fish reported as *Cichla ocellaris* in the United States (see Remarks).

There are records of *Cichla ocellaris* being sold online in the United States, for example:

From Aqua-imports (2023):

"Ocellaris Peacock Bass (*Cichla ocellaris*)
$19.99 – $149.99'

From Arizona Aquatic Gardens (2023):

"Peacock Bass Cichlid $21.99-$28.99 Max Size: 6 up to 12"

Regulations

Cichla ocellaris is regulated at the family level (Cichlidae) in Arkansas (AGFC 2022), California (CDFW 2021), Colorado (CPW 2023), New Mexico (NMDGF 2023), New Hampshire (NHFG 2022), Texas (TPWD 2022), Utah (Utah DWR 2020), Virginia (Virginia DWR 2022), and Washington (Revised Code Of Washington 2022). Please refer back to state agency regulatory documents for details on the regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Nico and Neilson (2023):

"Peacock cichlids have been stocked by state agencies as a sport fish. The Florida Game and Fresh Water Fish Commission obtained breeding stock from several regions of South America. The progeny were released into open waters primarily as a sport fish, but also with the hope that it would prey on and thus control other introduced cichlids (Courtenay and Robins 1989; Shafland 1995). About 10,000 juveniles were released in the Fort Lauderdale area of Dade County, Florida, in 1964 (Moe 1964), but apparently those fish did not survive the cold winter of 1964-1965 (Courtenay et al. 1974; Courtenay and Robins 1989). More recent introductions into canals in Broward and Miami-Dade counties, starting in late 1984, resulted in established populations (Larsen 1993; Shafland 1995). The Hawaiian Division of Fish and Game obtained their broodstock from an aquatic supply dealer in New York, ca. 1957 (Kanayama 1968). These fish reportedly came from Guyana (Larsen 1993). The first Texas populations were released by the Texas Parks and Wildlife Department in 1978. Texas stock came from Colombia and possibly Brazil, and from the Florida Game and Fresh Water Fish Commission. The single fish reported from Arizona was likely an aquarium release or illegal stocking, as no authorized stocking of this fish has occurred in that state."

Remarks

This ERSS was previously published in June 2018. Revisions were completed to incorporate new information and conform to updated standards.

There is considerable taxonomic confusion surrounding this species, leading to conflicting information regarding its distribution. The recent taxonomic history is described below. This report follows the species definition in Catalog of Fishes (Fricke et al. 2025), which is the chosen taxonomic authority for fishes for Ecological Risk Screening Summaries, according to the Standard Operating Procedure (USFWS 2024). Thus, *Cichla ocellaris* is treated as native to "Brazil, French Guiana, Guyana, and Suriname" (Fricke et al. 2025) and the following are recognized as valid species, distinct from *C. ocellaris*: *Cichla kelberi* Kullander & Ferreira 2006 (native to Araguaia River and lower Tocantins River drainages, Brazil), *Cichla monoculus* Spix & Agassiz 1831 (native to Amazon River basin in Brazil, Ecuador, Colombia, Peru, and possibly Venezuela; Oyapock River basin in northeastern Brazil and French Guiana), *Cichla nigromaculata* Jardine 1843 (native to upper Orinoco and Casiquiare tributaries and middle Negro River in Brazil and Venezuela), and *Cichla pleiozona* Kullander & Ferreira 2006 (native to Amazon basin and Guaporé river drainages in Bolivia and Brazil; Fricke et al. 2025). Significant effort was made to ensure that information in this report—particularly information related to distribution and impact of introduction—applies to *C. ocellaris* as defined by Fricke et al. (2025), but the species definitions used by different authors were not always clear.

From Maddern (2016):

"Kullander and Ferreira (2006) reviewed the genus and recognised 15 species, including nine new species, by morphology and meristics (principally colour pattern as the most important determinant). These authors split *C. ocellaris* into several species, including *C. kelberi*, a species they recognised within the Tocantins–Araguaia Basin."

"Willis et al. (2012) conducted genetic analysis of the *Cichla* genus based on multiple separate sources of molecular data, mtDNA, nuclear sequences and microsatellites and concluded that several of the species described by Kullander and Ferreira (2006) are actually *C. ocellaris*, a single species with extensive genetic introgression among geographic variants showing varying degrees of morphological differentiation. Willis et al. (2012) recommended that *C. ocellaris* remain a valid species and *C. monoculus*, *C. nigromaculata*, *C. kelberi* and *C. pleiozona* are all synonymised with *C. ocellaris*, although considered as subspecies or significant evolutionary units. The incorporation of these species into *C. ocellaris* has not yet been widely acknowledged and some sources still recognise the distinct species, e.g., Froese and Pauly (2015)."

From Nico and Neilson (2023):

"Many fish currently called *C. ocellaris* by state resource agencies may be members of another *Cichla* species or possibly hybrids."

From Khaleel et al. (2021):

"There is a high resemblance in peacock bass species which creates ambiguity in identifying them using the morphological classification method. […] molecular identification method is proven to be the best in identifying peacock bass species (Willis et al., 2012; Khaleel et al., [2020])."

Due to the different taxonomic definitions used for *Cichla ocellaris* and the difficulty in distinguishing morphologically among *Cichla* species, certain widely cited sources on introduced populations of "*Cichla ocellaris*" were not considered in this ERSS due to evidence that they actually refer to other species of *Cichla* as defined by Kullander and Ferreira (2006) and accepted by Fricke et al. (2025). In particular:

From de Carvalho et al. (2009):

"With the exception of a review by Kullander and Ferreira (2006), the introduced *Cichla* in Minas Gerais [Brazil] are still being misidentified as *C. temensis*, *C. ocellaris* and *C. monoculus* (*e.g.*, Alves et al., 2007)."

"Mitochondrial DNA haplotypes found in introduced fish from Minas Gerais state (southeastern Brazil) clustered only with those from native species of the Tocantins River (*Cichla piquiti* and *C. kelberi*) […]"

From Sharpe et al. (2017):

"In another classic example, Zaret and Paine (1973) demonstrated that the introduction of a novel apex predator (peacock bass, *Cichla monoculus*, previously *C. ocellaris*) into Lake Gatun, Panama in 1969 had strong community-level effects."

Cichla ocellaris has been intentionally stocked outside its native range within the United States by State fishery managers to achieve fishery management objectives. State fish and wildlife management agencies are responsible for balancing multiple fish and wildlife management objectives. The potential for a species to become invasive is now one important consideration when balancing multiple management objectives and advancing sound, science-based management of fish and wildlife and their habitat in the public interest.

According to ITIS (2023), another English common name for *Cichla ocellaris* is Peacock Cichlid.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

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 *Cichla*
                          Species *Cichla ocellaris*

According to Fricke et al. (2025), *Cichla ocellaris* Bloch & Schneider 1801 is the current valid name for this species.

Size, Weight, and Age Range

From Nico and Neilson (2023):

"Size: 70 cm TL."

From Froese and Pauly (2025):

"Max length: 74.0 cm TL male/unsexed; [IGFA 2001]; max. published weight: 6.8 kg [IGFA 2001]"

From Maddern (2016):

"*C. ocellaris* is a large cichlid that may reach 91 cm, though 50-60 cm is the typical adult size."

Environment

From Froese and Pauly (2025):

"Freshwater; brackish; benthopelagic; depth range 5 - ? m."

From Maddern (2016):

"As *C. ocellaris* is a diurnal visual predator, it exhibits a strong preference for aquatic environments with high water clarity (Winemiller, 2001). It is euryhaline though occurs primarily in freshwater (ISSG, 2015). An upper salinity tolerance of 18 ppt has been reported (Shafland, 1995). *C. ocellaris* is a tropical species and is less cold tolerant than other introduced cichlids in the USA. The range of *C. ocellaris* in Florida is limited by cold winters that restricts it to the southernmost counties and exclude it from much of the Everglades (USGS NAS, 2015). Swingle (1966) reported a lower lethal temperature of 16°C for 80 mm fingerlings and Guest et al. (1979) reported a similar lower lethal temperature of 15.6°C and a higher lethal temperature of 37.9°C for fingerlings between 85-140 mm TL. When salinity was raised to 10 ppt some fish exhibited a lower lethal temperature of 13.5 °C (Guest et al., 1979)."

Climate

From Froese and Pauly (2025):

"Tropical […]"

Distribution Outside the United States

Native

From Fricke et al. (2025):

"Northern South America: Brazil, French Guiana, Guyana and Suriname."

From Kullander and Ferreira (2006):

"*Cichla ocellaris* is known from the Guianas, including the Marowijne, Suriname, Corantijn, Demerara, and Essequibo river drainages, and also the upper Rio Branco in Brazil."

Introduced

According to Froese and Pauly (2025), *Cichla ocellaris* is established in the Dominican Republic, Panama, and Singapore; probably established in Malaysia; and probably not established in Kenya. The Panama population has been attributed to another species (Sharpe et al. 2017; see Remarks).

Huang et al. (2021) report 6 individual *Cichla ocellaris* in an urban pond in southern Taiwan.

From Khaleel et al. (2020):

"In this recent study, we found the population of peacock bass in Lake Telabak, a man-made lake in Besut, Terengganu [Malaysia]. Using mitochondrial DNA analysis approach, the origin and taxonomy of peacock bass in the lake were clarify [sic]. A total of forty fishes were sampled from Lake Telabak for the analysis. Haplotype was detected among all samples. The current study revealed that *Cichla* spp. in Lake Telabak are closer to *Cichla ocellaris* (Bloch and Schneider, 1801) […]"

From Andriyono et al. (2025):

"In the present study, we successfully performed identification using molecular approaches in a noteworthy case involving *Cichla* fish [from the Bedog River, Yogyakarta, Indonesia]. Specifically, we identified seven *Cichla* fish samples, and the molecular analysis results uniformly affirmed their classification as the species *C. ocelaris* [sic] […]"

"The identified species, *C. ocellaris*, has successfully adapted to the Bedog River in Yogyakarta […]"

From Menezes et al. (2012):

"By chance or by intention, tucunaré [*Cichla* cf. *ocellaris*] was first introduced in southern Lake Redonda [Rio Grande do Norte State, Brazil] between 1989 and 1990 (Molina et al. 1996) and subsequently spread to Lakes Boa Água, Ferreira Grande, Carcará and Urubu, either due to connectivity among the lakes or to introduction."

Means of Introduction Outside the United States

From Maddern (2016):

"*C. ocellaris* is a desirable sport and table fish and it is likely that the species is regularly released into new waterways."

According to Maddern (2016), *Cichla ocellaris* has also been introduced to "control stunted Tilapia populations."

From Khaleel et al. (2020):

"The species was deliberately introduced into Malaysia freshwater bodies by anglers in the early 1990's for sport fisheries."

Short Description

From GISD (2017):

"*Cichla ocellaris* have a sloping forehead and elongate bodies that typically reach 50-60cm in length (91cm is the current record) with a deeply notched dorsal fin. Males are larger than females. Their mouth is large, the lower jaw projects beyond the upper jaw. They have a characteristic large black spot encircled by a silver coloured halo on their caudal fin. Their colouration is olive-green dorsally fading to yellow-white ventrally, with three broad transverse stripes, between which are a series of dark spots. The first dorsal, upper caudal, and pectoral fins are gray or black, the anal, pelvic and the lower caudal fins are red. White spots are present on the second dorsal and the upper lobe of the caudal fin. Large adults have a yellow-orange stripe, which extends from their mouth to their caudal fin. Their iris is red (Environmental Institute of Houston, 2004; Gulf States Marine Fisheries Commission, 2005; and Mongabay Tropical Fish, 2006)."

From Froese and Pauly (2025):

"Distinguished from all other species of *Cichla* except *C. nigromaculata*, *C. intermedia*, *C. piquiti*, and *C. melaniae*, by presence of bars 1a and 2a. Lateral band abbreviated in juveniles. Distinguished from its congeners with abbreviated lateral band by lateral line usually continuous (vs. discontinuous or nearly always discontinuous in *orinocensis* and *nigromaculata*; scales in E1 row (67-) 70-80 (-82) (vs. 84-93 in *pleiozona*); occipital bar absent or indistinct (vs. emphasized in adults of *monoculus*, *kelberi*, and *pleiozona*); abdominal blotches present (vs. absent in *orinocensis*); vertical bars present at adult size (vs. three midlateral ocellated blotches in *orinocensis*), except that an ocellated blotch consistently formed in dorsal portion of bar 3; absence of small black blotches on dorsum (vs. present in *nigromaculata*); vertical bars about equally wide across side (vs. wide, occasionally confluent dorsally, and tapering ventrad in *nigromaculata*, *monoculus*, *kelberi*, and *pleiozona*. Distinguished from *C. intermedia*, *C. piquiti*, and *C. melaniae* by abbreviated vs. complete juvenile lateral band, less scales in E1 row (67-82 vs. (78) 83-108), and presence of ocellated blotch in dorsal portion of bar 3 vs. absence [Kullander and Ferreira 2006]."

Biology

From GISD (2017):

"*Cichla ocellaris* are piscivorus [sic] and feed during the day while remaining inactive at night. Prey is caught typically through high-speed pursuit. Fish consumed include atherinids, poecilids, characids, eleotrids and other cichlids. Spotted tilapia, *Tilapia mariae*, Mozambique tilapia, *Oreochromis mossambicus*, and bluegill, *Lepomis macrochirus* also constitute major prey items (Environmental Institute of Houston, 2004; and Gulf States Marine Fisheries Commission, 2005)."

"The *Cichla ocellaris* is a biparental substrate spawner, spawning approximately 2000-3000 eggs per brood. Spawning, with rare exceptions, takes place on a flat, horizontal surface which is either bare to begin with, or cleared of algae or other vegetation during the spawning activities. The female moves forward laying a single row of eggs and the male follows exuding sperm over each row. Once the eggs have hatched, the parents transport the larvae in their mouths to one of the depression nests. Breeding pairs guard their clutch for approximately nine weeks, at which time the fry move from open waters to areas rich vegetation along banks. As is the case with most cichlids, breeding pairs are highly territorial and aggressive (FishBase, 2006; and Gulf States Marine Fisheries Commission, 2005)."

From Maddern (2016):

"*C. ocellaris* is diurnal and non-migratory. Shafland (Shafland 1996; Shafland 1999a; Shafland, 1999b; Shafland, 1999c) conducted extensive research on the biology and ecology of *C. ocellaris* in six canal systems of south-eastern Florida in 1995. […] Under favourable conditions *C. ocellaris* can grow rapidly and become sexually mature and attain 250-300 mm in under 12 months (Shafland, 1996). Annual growth estimates for the species in the Tamiami Canal over the years 1-6 were calculated as 204 mm, 327 mm, 418 mm, 480 mm, 531 mm and 592 mm (Shafland, 1999c)."

Human Uses

From GISD (2017):

"In Miami, there is an estimated $15.5 million dollar market attributed to sportfishing, of which most is contributed by anglers fishing for *C. ocellaris* and largemouth bass (*Micropterus salmoides*). The *C. ocellaris* received 56% more fishing effort than largemouth bass, and their estimated annual asset value was $6.6 million (Shafland and Stanford, 1999)."

From Froese and Pauly (2025):

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

From Maddern (2016):

"*C. ocellaris* was extensively released not only to create a sport-fishery, but also to control introduced fishes such as *Tilapia mariae*, the spotted Tilapia (Shafland, 1999b; Robins, 2015). *C. ocellaris* may also be caught for their meat."

"*C. ocellaris* is not a popular ornamental species because it grows to a large size and is piscivorous and is therefore definitely not suitable for the standard "community" aquarium. It can be found for sale on various internet sites, however, for aquarium enthusiasts with larger tanks."

Diseases

No information was found associating *Cichla ocellaris* with any diseases listed by the World Organisation for Animal Health (2023).

According to Poelen et al. (2014), *Cichla ocellaris* is host to several parasites including: *Eustrongylides ignotus*, *Goezia intermedia*, *Gussevia arilla*, *Gussevia longihaptor*, *Gussevia tucunarensis*, *Gussevia undulata*, *Proteocephalus macrocephalus*, *Proteocephalus microscopicus*, *Sciadicleithrum ergensi*, *Sciadicleithrum umbilicum*, *Sciadicleithrum uncinatum*, and *Sciadocephalus megalodiscus*.

From Pereira et al. (2024):

"Peacock bass (syn.: tucunaré, *Cichla ocellaris*) […] are South American cichlids that are highly valued in both the ornamental and sport fish industries. Since 2017, a number of outbreaks of infectious spleen and kidney necrosis virus (ISKNV) have been reported on Brazilian food and ornamental fish farms. In this study, we detected ISKNV in farmed peacock bass […] by PCR and sequence analysis of the partial major capsid protein (MCP) gene."

Threat to Humans

From Froese and Pauly (2025):

"Potential pest"

3 Impacts of Introductions

From Nico and Neilson (2023):

"Largely unknown. Introduced *Cichla* in Florida include native fishes in their diets (Nico, unpublished data) although Shafland (1999[a]) claimed no evidence for adverse effects on native communities. There is some evidence that it may exclude largemouth bass from spawning aread [sic] in Florida canals."

From GISD (2017):

"Some studies have reported as much as a 25% decline of forage fish from canals in which *C. ocellaris* have been introduced. There is speculation that if *C. ocellaris* continues to expand its range throughout southern Florida, faunas of less altered waters, such as those of the Everglades, could be at risk (Gulf States Marine Fisheries Commission, 2005)."

"However, other studies report beneficial effects of this species introudction [sic] into Florida's waterways such as attributed increases to native fish because *C. ocellaris* feeds on non-indigenous fish that have previously caused other native fish declines. Also, this species attracts recreational fishermen (Gomiero and Braga, 2004), which has accounted for a very large boon to the sport fishing industry in Florida. And some analyses and estimates reveal no major deleterious effects attributable to *C. ocellaris*, and indicate native fishes continue to exist satisfactorily with them (Shafland, 1999[a]; and Shafland and Stanford, 1999)."

From Maddern (2016):

"The introduction of *C. ocellaris* to southern Florida is the only documented example of positive environmental impacts following introduction of the species. It is important to note that the success of the introduction and the limitation of deleterious environmental impacts are largely due to the confinement of *C. ocellaris* to artificial drainage canals and lakes in the southern extremity of Florida where temperatures restrict the spread of this species. Shafland (1999b) determined that *C. ocellaris* primarily consumed the introduced cichlid *Tilapia mariae* and there was little dietary overlap between *C. ocellaris* and the native predator *Micropterus salmoides*.

C. ocellaris also feeds on other non-native species present in the waters and the impact on native species is limited."

From Menezes et al. (2012):

"We compared the species richness and abundance of fish, zooplankton and phytoplankton in nine mesotrophic coastal shallow lakes (Northeastern Brazil) with and without the exotic predator cichlid tucunaré or 'peacock bass' (*Cichla* cf. *ocellaris*). […] Although fish richness and diversity were, in fact, drastically lower in the lakes hosting tucunaré, no significant differences were traced in total fish catch per unit of effort, zooplankton and phytoplankton biomass, plankton diversity or the zooplankton:phytoplankton biomass (TZOO:TPHYTO) ratio. However, zooplankton biomass and TZOO:TPHYTO tended to be higher and the phytoplankton biomass lower in lakes with tucunaré. Our analyses therefore suggest that the introduction of tucunaré had marked effect on the fish community structure and diversity in these shallow lakes, but only modest cascading effects on zooplankton and phytoplankton."

Cichla ocellaris is regulated in multiple states, including Arkansas (AGFC 2022), California (CDFW 2021), Colorado (CPW 2023), New Hampshire (NHFG 2022), New Mexico (NMDGF 2023), Texas (TPWD 2022), Utah (Utah DWR 2020), Virginia (Virginia DWR 2022), and Washington (Revised Code Of Washington 2022). See section 1.

4 History of Invasiveness

The History of Invasiveness for *Cichla ocellaris* is classified as Data Deficient. This species has been introduced and is established in multiple countries beyond its native range. However, taxonomic uncertainty presents considerable challenges in tracking both the introduction history and impacts attributable to *Cichla ocellaris*. Several sources suggest a lack of impact to native fish communities in Florida due to the establishment of the species within canals where few native species are found, as well as beneficial impacts related to sport fishing opportunities. There is evidence of impacts to fish community structure and diversity in lakes in northeastern Brazil but the authors of that study are not confident in the species identification, referring to the nonnative species as *Cichla* cf. *ocellaris*.

5 Global Distribution

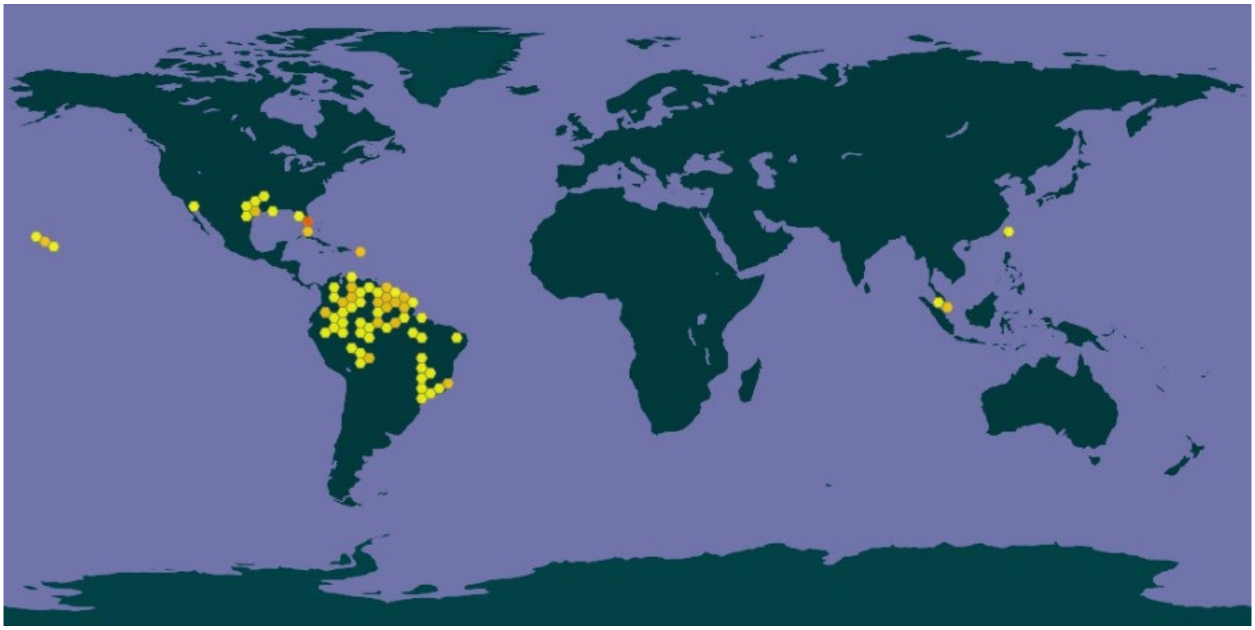

Figure 1. Reported global distribution of *Cichla ocellaris*. Map from GBIF Secretariat (2023). Observations are reported from the southern United States, Hawaii, Puerto Rico, northern South America, Malaysia, and Taiwan. Points in Arizona and Louisiana, United States, and in Taiwan were not included in the climate matching analysis due to a lack of documented established populations. Points from Texas were not included in the climate matching analysis because *C. ocellaris* failed to produce a self-sustaining population beyond a few years. In South America, only points in French Guiana, Suriname, Guyana, the Essequibo basin in Venezuela, the Branco basin in Brazil, and Rio Grande do Sul State in Brazil were used to select source points for climate matching; other reported occurrences in South America likely refer to other closely related species (see Remarks).

There were no georeferenced occurrences available representing an established population of *Cichla ocellaris* in the Dominican Republic.

Additional established populations in northeastern peninsular Malaysia (Khaleel et al. 2020) and Java, Indonesia (Andriyono et al. 2025), were used to select source points for the climate matching analysis.

6 Distribution Within the United States

Figure 2. Reported distribution of *Cichla ocellaris* in the contiguous United States. Map from Nico and Neilson (2025). Yellow points (southern Florida) represent established populations. Orange points (Arizona, Florida, Louisiana, Maryland, Texas) represent locations where population status is unknown, or where a population has failed or been eradicated. Only established populations were used to select source points for the climate matching analysis.

Figure 3. Reported distribution of *Cichla ocellaris* in Hawaii. Map from Nico and Neilson (2025). Yellow points represent established populations. Orange points represent locations where population status is unknown, where a population has failed or been eradicated, or where the geographic coordinates represent a centroid rather than an actual occurrence location. Only established populations were used to select source points for the climate matching analysis.

Figure 4. Reported distribution of *Cichla ocellaris* in Puerto Rico. Map from Nico and Neilson (2025). Yellow points represent established populations. Orange points represent locations where population status is unknown, where a population has failed or been eradicated, or where the geographic coordinates represent a centroid rather than an actual occurrence location. Only established populations were used to select source points for the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cichla ocellaris* was high in southern Florida and in a narrow band along the Gulf Coast. Most of the contiguous United States had a low or medium match with the lowest matches found throughout northern and western States. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.033, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024). Taxonomic issues (see Remarks) lend uncertainty to the distribution of *Cichla ocellaris* used to select source points for the climate matching analysis, which, in turn, adds uncertainty to the results.

Projected climate matches in the contiguous United States under future climate scenarios are available for *Cichla ocellaris* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

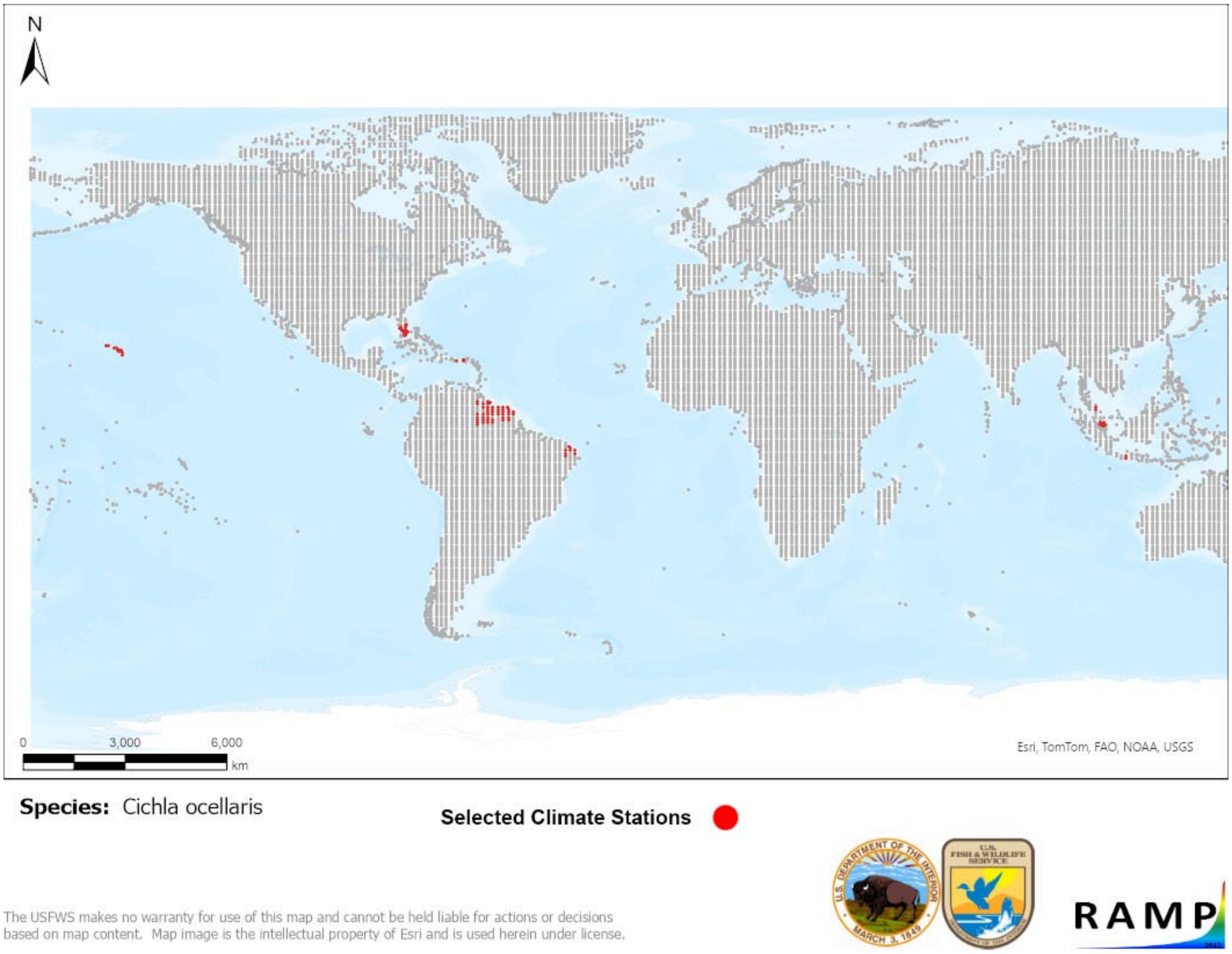

Figure 5. RAMP (Sanders et al. 2023) source map showing global weather stations selected as source locations (red; United States, French Guiana, Suriname, Guyana, Venezuela, Brazil, Malaysia, Singapore, Indonesia) and non-source locations (gray) for *Cichla ocellaris* climate matching. Source locations from GBIF Secretariat (2023), Khaleel et al. (2020, and Andriyono et al. (2025). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

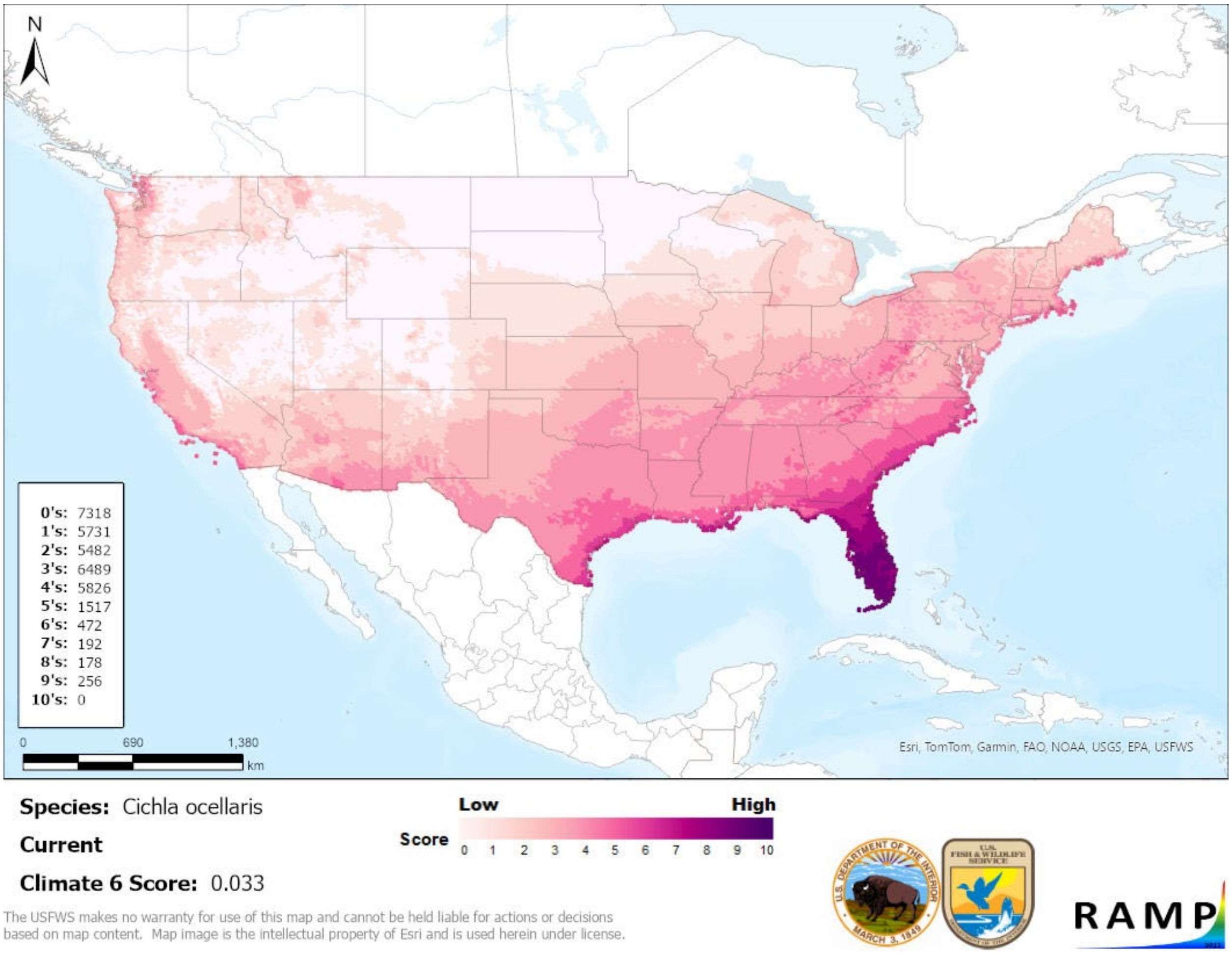

Figure 6. Map of RAMP (Sanders et al. 2023) climate matches for *Cichla ocellaris* in the contiguous United States based on source locations reported by GBIF Secretariat (2023), Khaleel et al. (2020), and Andriyono et al. (2025). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The certainty of this assessment is Low. There are multiple established populations of *Cichla ocellaris* reported outside its native range; most were the result of intentional stocking programs. However, a history of taxonomic changes and current disagreement over the definition of this species leads to uncertain interpretation of the reported distributional information. Without clarity on the identity of introduced populations of peacock bass, there is considerable uncertainty in both the impacts of introduction attributable to *Cichla ocellaris* and the climate match to the contiguous United States.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Cichla ocellaris, the Butterfly Peacock Bass, is a large piscivorous fish native to northern South America. This species has been intentionally introduced for sport fishing and to control other introduced species (e.g., tilapia). There are records of *C. ocellaris* for sale in the United States and at least ten States regulate its possession or trade. A 2006 study split *C. ocellaris* into several different species, retaining the name *Cichla ocellaris* for one of the species, but not all authors have accepted these taxonomic changes. As a result, it is difficult to verify whether some of the introduced populations are populations of *C. ocellaris* under the new taxonomy, or one of the related species that were included in *C. ocellaris* under the old taxonomy. Although there are some records of negative, neutral, and positive ecological and economic impacts, in most cases the species identity could not be confirmed so the History of Invasiveness for *C. ocellaris* is classified as Data Deficient. The climate matching analysis for the contiguous United States indicates establishment concern for this species with the highest matches occurring in Florida. However, taxonomic uncertainty contributes to uncertainty in the results of the climate matching analysis, too. As a result, the Certainty of Assessment for this ERSS is classified as Low. The Overall Risk Assessment Category of *C. ocellaris* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see Section 4): Data Deficient**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): Low**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023), Khaleel et al. (2020), and Andriyono et al. (2025).

Under the future climate scenarios (figure A1), on average, high climate match for *Cichla ocellaris* was projected to occur in the Southern Florida region of the contiguous United States. High match also extended in a thin band along the Gulf and Atlantic coasts under all scenarios. Areas of low climate match were projected to occur in the Colorado Plateau, Great Basin, Great Lakes, Northern Plains, Southern Plains, Southwest, and Western Mountains regions. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.021 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.049 (model: MRI-ESM2-0, SSP3, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.033, figure 6) falls within the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario. Primarily at the 2085 time step and especially under SSP5, areas within the Colorado Plateau, Great Lakes, Northeast, Northern Pacific Coast, Northern Plains, and Southern Plains saw a moderate increase in the climate match relative to current conditions. At the 2085 time step, areas within the Gulf Coast, Southern Atlantic Coast, and Southern Florida saw a moderate decrease in the climate match relative to current conditions. No large increases or decreases were observed regardless of time step and climate scenarios. Additional, very small areas of large or moderate change may be visible on the maps (figure A3).

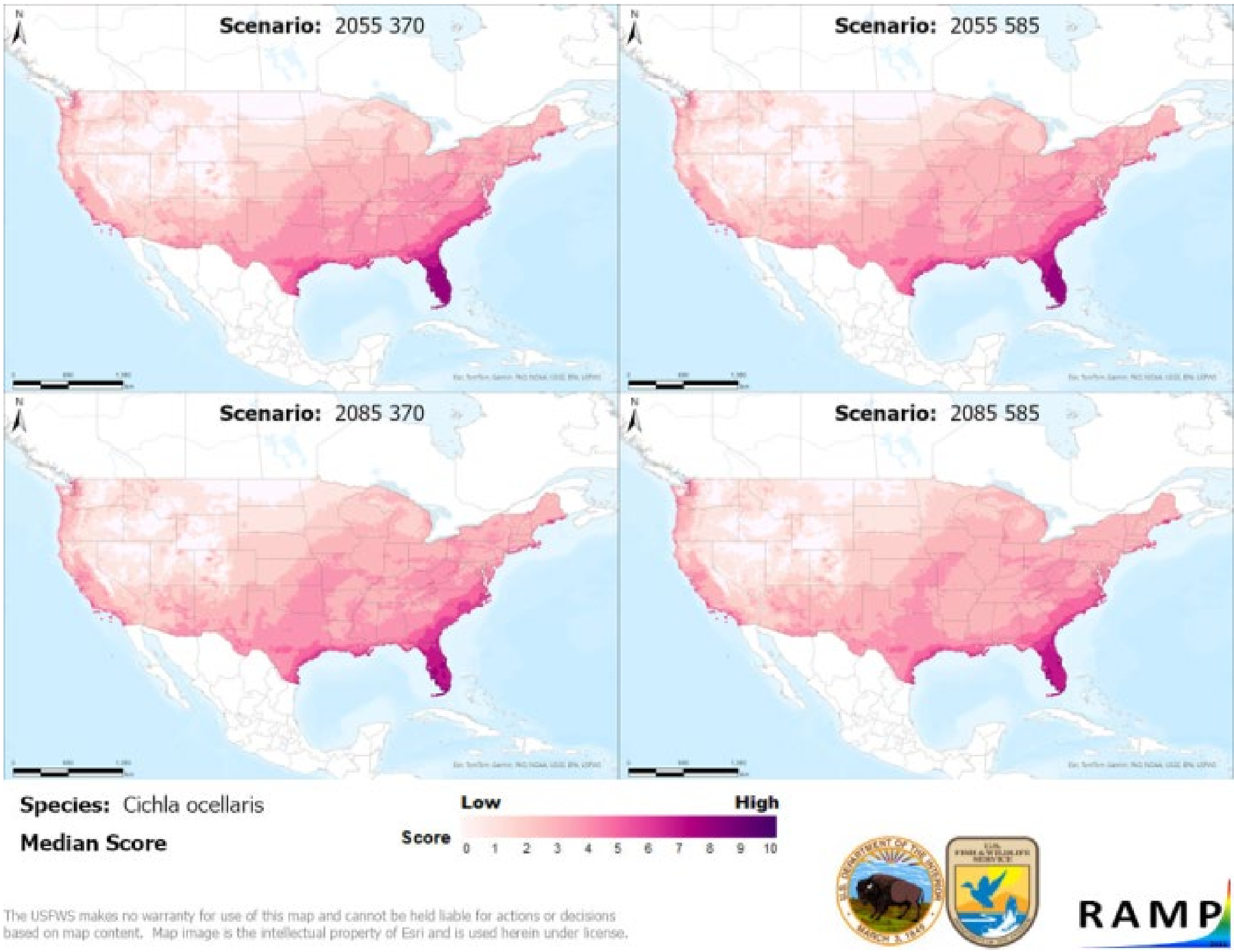

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Cichla ocellaris* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023), Khaleel et al. (2020), and Andriyono et al. (2025). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

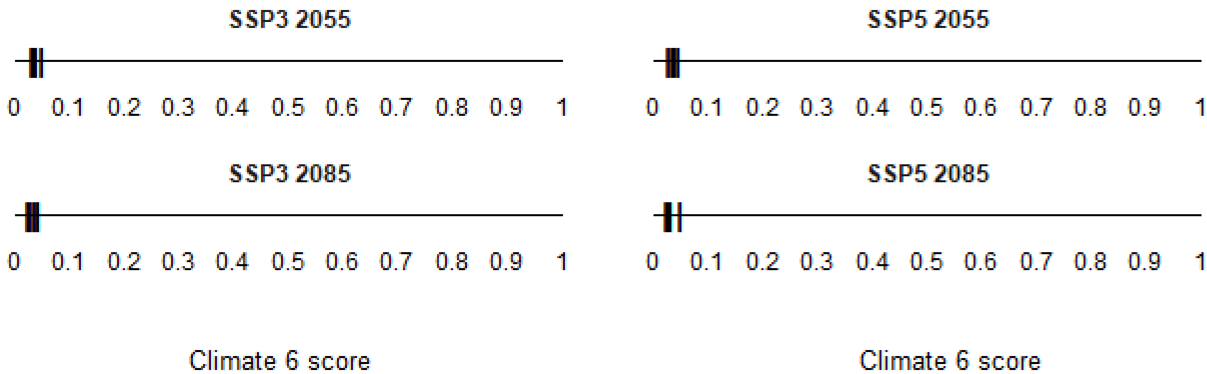

Figure A2. Comparison of projected future Climate 6 scores for *Cichla ocellaris* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

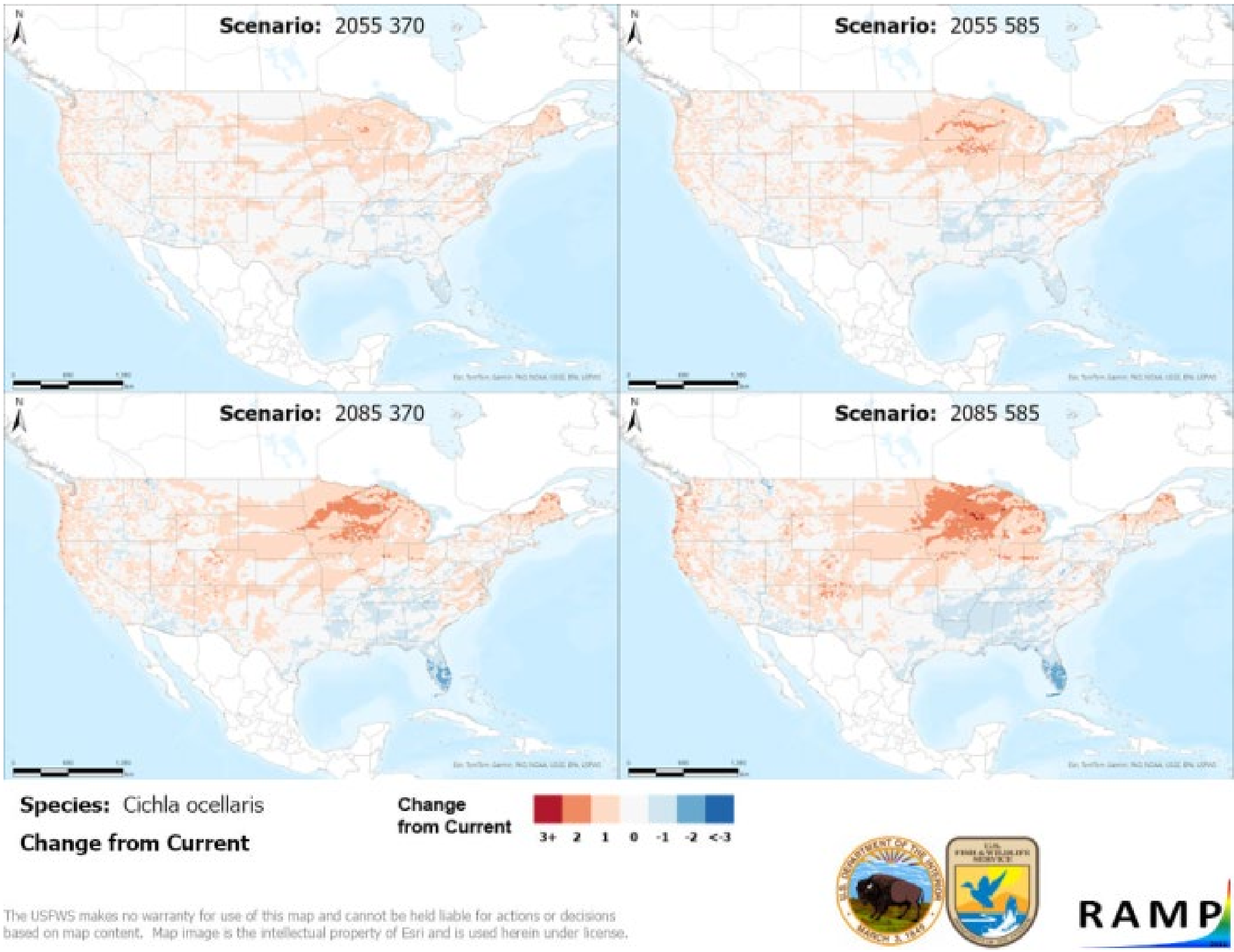

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 6) and the median target point score for future climate scenarios (figure A1) for *Cichla ocellaris* based on source locations reported by GBIF Secretariat (2023), Khaleel et al. (2020), and Andriyono et al. (2025). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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