Midas Cichlid (*Amphilophus citrinellus*)

Ecological Risk Screening Summary

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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2014):

"Central America: Atlantic slope of Nicaragua and Costa Rica (San Juan River drainage, including Lakes Nicaragua, Managua, Masaya and Apoyo)."

Status in the United States

From Nico and Neilson (2011):

"First collected in July 1980, the species is now established in the Black Creek Canal system, Dade County, Florida (Anderson et al. 1984; Loftus and Kushlan 1987). It was taken from the Mowry (C-103) Canal, Miami-Dade County, in July 1992 (W. Smith-Vaniz, pers. comm.). It is relatively common there as well as in other connected canals such as C-103N and C-102 (W.F. Loftus, pers. comm.). There is an unconfirmed report from Bivens Arm Lake in Gainesville, Alachua County, March 1985 (J. Miller, pers. comm.); this record is not supported by a voucher specimen and the report is considered somewhat suspect. A voucher specimen exissts [sic] for Hillsborough County from 1976 in Six-mile Creek. Collections of specimens from other south Florida canals. The species has been collected from the University of Florida campus (Hill and Cichra 2005). The first report from Hawaii was of six specimens found dead, possibly from fungal infections, in Wahiawa Reservoir on Oahu, in February 1991 (Devick 1991); the species is now documented as being firmly established in Wahiawa Reservoir, and it also may be in other localities on Oahu (M. Yamamoto, pers. comm.). One fish was taken from Dodgeville Pond in Attleboro, Bristol County, Massachusetts, in July 1990 (Hartel 1992; Cardoza et al. 1993). One fish was found dead in Silver Lake in North St. Paul, Ramsey County, Minnesota (K. Schmidt, pers. comm.). In Puerto Rico, the fish has become established in the Canaboncito River, Canabon River, and La Plata River, and the Guajataca, Loiza, Dos Bocas, and La Plata Reservoirs (F. Grana, pers. comm.), but no voucher specimens exist for these locations."

"Established in Florida, Hawaii, and Puerto Rico. Failed in Massachusetts and Minnesota."

Means of Introductions in the United States

From Nico and Neilson (2011):

"Introductions into Florida were via aquarium or fish farm releases. In other states, introductions most likely represent aquarium releases."

Remarks

No additional remarks.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2014):

"Synonym(s): *Cichlasoma citrinellum* (Günther, 1864)

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata

Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Labroidei
Family Cichlidae
Genus *Amphilophus* Agassiz, 1859
Species *Amphilophus citrinellus* (Günther, 1864)"

From Eschmeyer et al. (2017):

"***citrinellus, Heros*** Günther [A.] 1864:153 [Proceedings of the Zoological Society of London 1864 (pt 1) (art. 3) (for 22 Mar. 1864) […]] Lake Nicaragua, Nicaragua. Syntypes: BMNH 1864.1.26.201-203 (3). •Valid as *Cichlosoma citrinellum* (Günther 1864) -- (Bussing 1987:195 […]). •Valid as *Cichlasoma citrinellum* (Günther 1864) -- (Page & Burr 1991:332 […], Conkel 1993:83 […], Fuller et al. 1999:420 […], Nelson et al. 2004:151 […]). •Valid as *Amphilophus citrinellus* (Günther 1864) -- (Kullander & Hartel 1997:195 […], Bussing 1998:312 […], Burgess 2000:54 […], Kullander in Reis et al. 2003:610 […], Stauffer & McKaye 2002:8 […], Mundy 2005:418 […], Stauffer et al. 2008:117 […], Scharpf 2009:3 […] as *citrinellum*, Oldfield 2009:1 […], Page & Burr 2011:610 […], Page et al. 2013:156 […], Kottelat 2013:373 […], Angulo et al. 2013:1004 […], Říčan et al. 2016:37 […]). **Current status:** Valid as *Amphilophus citrinellus* (Günther 1864). Cichlidae: Cichlinae."

Size, Weight, and Age Range

From Froese and Pauly (2014):

"Max length: 24.4 cm SL male/unsexed; [Kullander 2003]"

Environment

From Froese and Pauly (2014):

"Freshwater; benthopelagic. […]; 23°C - 33°C [assumed to be recommended aquarium temperature range] [Conkel 1993]; […]"

Climate/Range

From Froese and Pauly (2014):

"Tropical; […]; 15°N - 8°N"

Distribution Outside the United States

Native

From Froese and Pauly (2014):

"Central America: Atlantic slope of Nicaragua and Costa Rica (San Juan River drainage, including Lakes Nicaragua, Managua, Masaya and Apoyo)."

Introduced

From Froese and Pauly (2014):

"Introduced to Taiwan, Puerto Rico, Singapore, Philippines"

From Nico and Neilson (2011):

"Midas cichlid, along with red devil cichlid (*A. labiatus*) were introduced to, and are established in, Queensland, Australia in 1992 (Lintermans 2004)."

From FAO (2014):

"Introduced to Philippines from unknown.
Introduced to Singapore from unknown."

From Kwik et al. (2013):

"*A. citrinellus*, the dominant species in the surveyed urban ponds, has also established itself in Thailand and Australia (Wilson 2005; Nico et al. 2007) […]"

Means of Introduction Outside the United States

From FAO (2014):

"Reasons of Introduction: ornamental"

From Corfield et al. (2008:82):

"No explicit risk beyond concerns about releases by aquarists and escapes from garden ponds during flood events. The number of fish sold in Australia is relatively small and this species is of medium importance to the industry (Table 7.1 [in original source]). The risk of spread by humans is low."

Short Description

From Froese and Pauly (2014):

"This species coloration is mostly bright orange to orange-red in adults; mature males are of larger size, longer fins and with a distinct hump on their heads; aquarists usually refer to the lighter-colored, thin-lipped form as this species."

Biology

From Froese and Pauly (2014):

"Lives in box-cut canals with rocky vertical sides, crevices used for spawning and protection of the young [Page and Burr 1991]. Found in lakes; uncommon in the rivers but will penetrate the lower river valleys where the water is slow flowing or tranquil [Conkel 1993]. Omnivorous, eating mostly aufwuchs, snails and small fishes [Conkel 1993]; also feeds on insect larvae, worms and other bottom-dwelling organisms [Yamamoto and Tagawa 2000]. Majority of this fish has normal cryptic coloration (black, gray or brown), matching the substrate for camouflage and survival purposes. About 10 % of this species is xanthomorphic, undergoing a color metamorphosis at varying stages of growth [Conkel 1993]."

"Spawn preferentially on the ceiling of natural caves [Lavery 1991]. Deposit eggs on hard substrates, such as rocks or logs; both parents guarding the eggs and the fry for several weeks [Yamamoto and Tagawa 2000]. 300-1000 eggs [Baensch and Riehl 1985]."

From Nico and Neilson (2011):

"Primarily omnivorous, opportunistically consuming algae, insect larvae, benthic invertebrates, and fishes (Barlow 1976). Midas cichlids are substrate spawners, with reproduction generally occurring during the rainy season with breeding pairs defending a small territory around some form of cover (Noakes and Barlow 1973; Barlow 1976). Parental care is provided through protection of eggs and schooling fry from predators and through 'contacting' behavior, where fry will consume dermal mucus of the parents as part of their diet (Noakes and Barlow 1973; Barlow 1976)."

"Generally found in lakes and estuaries over a variety of substrate types; uncommon to rare in rivers and streams. Usually associated with some sort of structure or cover (e.g., rocky outcrops, logs)."

Human Uses

From Froese and Pauly (2014):

"An experimental fish being used for behavioral studies [Robins et al. 1991]."

"Fisheries: of no interest; aquarium: commercial"

Diseases

No records of OIE reportable diseases found.

From Froese and Pauly (2014):

"*Procamallanus* Infection 13, Parasitic infestations (protozoa, worms, etc.)
Sciadicleithrum Infection, Parasitic infestations (protozoa, worms, etc.)"

Threat to Humans

From Froese and Pauly (2014):

"Harmless"

3 Impacts of Introductions

No records of documented impacts from introductions were found. The following outlines potential impacts.

From Nico and Neilson (2011):

"Impact of Introduction: Unknown."

From Kwik et al. (2013):

"The results also appear to show that the fish community consisted of introduced species with the dominant species including two feral species (*Amphilophus citrinellus* and O*reochromis mossambicus*) with established breeding populations (i.e. presence of breeding pits and size classes ranging from juveniles to egg brooding adults)."

"*A. citrinellus*, the dominant species in the surveyed urban ponds, has also established itself in Thailand and Australia (Wilson 2005; Nico et al. 2007), but it is uncertain what impacts this species might have on the native fishes of Singapore if it spreads into reservoirs or natural stream or swamp systems."

From Corfield et al. (2008:82):

"The red devil [*Amphilophus citrinellus*] is included in the proposed grey list for ornamental fish indicating that it is of some concern but that more information is required (NRMMC 2006). Currently known to be present in only one location (Ross River, northern Queensland)."

4 Global Distribution

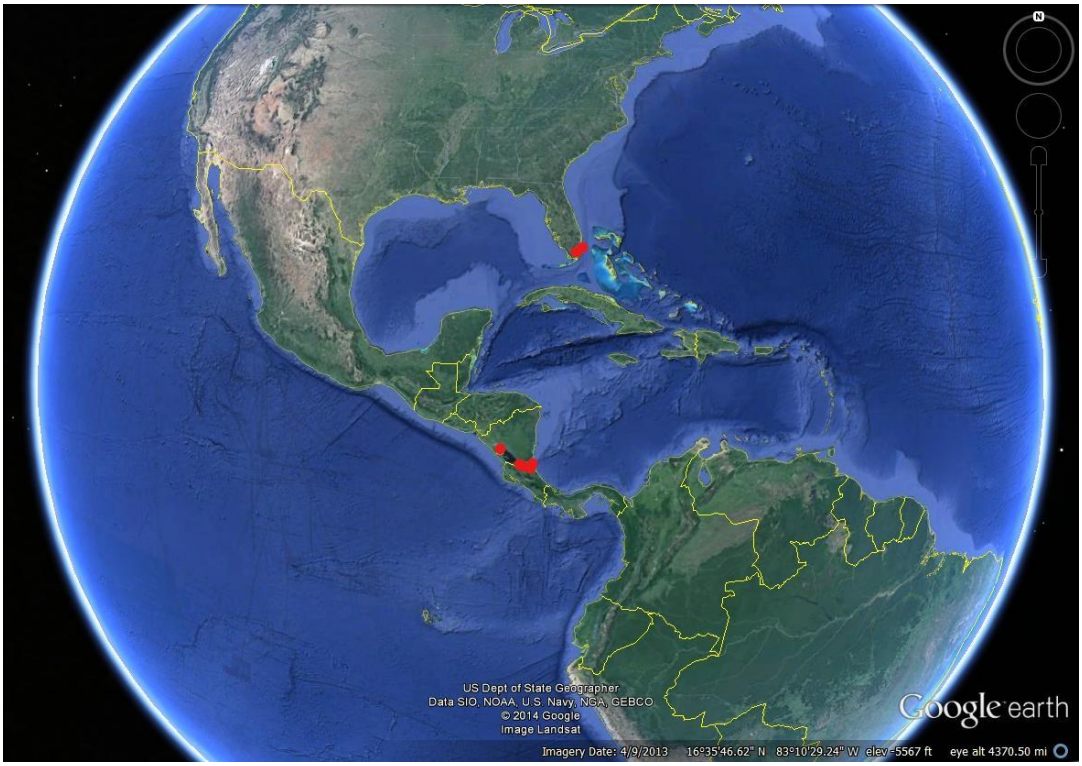

Figure 1. Known global distribution of *Amphilophus citrinellus*. Map from Froese and Pauly (2014).

Figure 2. Known global distribution of *Amphilophus citrinellus*. Map from GBIF Secretariat (2014).

Locations in Massachusetts and Minnesota are from failed introductions (Nico and Neilson 2011). The location in India could not be verified as from an established population. None of these locations were used as source points in the climate match.

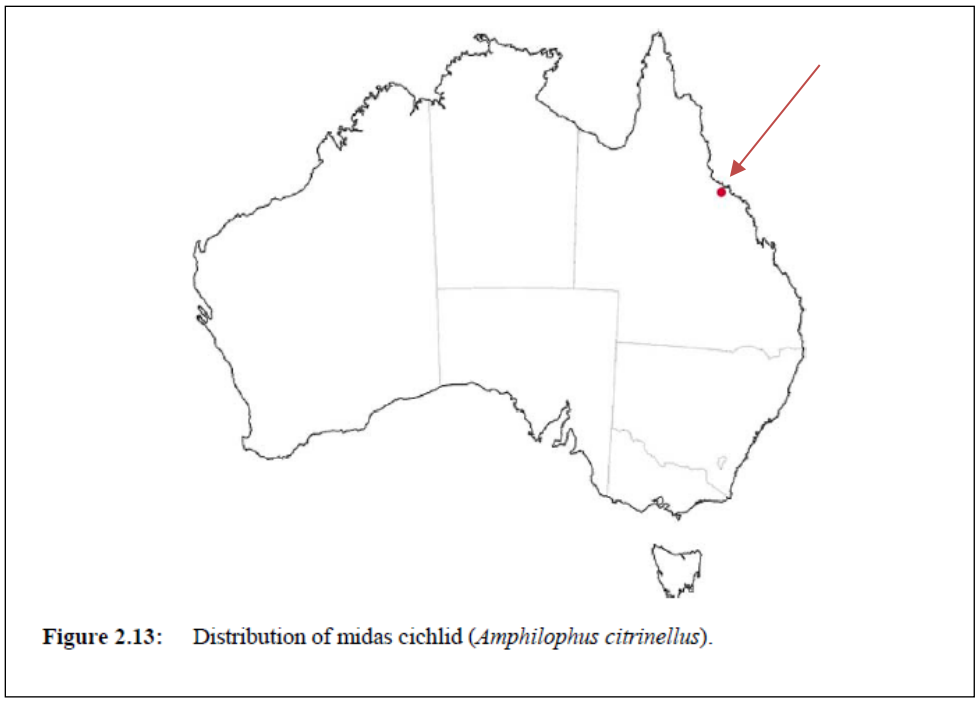

Figure 2.13: Distribution of midas cichlid (*Amphilophus citrinellus*).

Figure 3. *Amphilophus citrinellus* population in Australia (Corfield et al. 2008).

5 Distribution Within the United States

Figure 4. Known distribution of *Amphilophus citrinellus* in the United States. Map from USGS NAS Database (Nico and Neilson 2011).

Locations in Massachusetts and Minnesota are from failed introductions and were not used as source points in the climate match.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Amphilophus citrinellus* was very high for Florida and a portion of Texas' Gulf Coast. There was medium match to areas along the southern Atlantic Coast, Gulf Coast, and parts of southern Arizona and California. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.044, medium, and Florida, Georgia, North Carolina, and South Carolina had individually high climate matches.

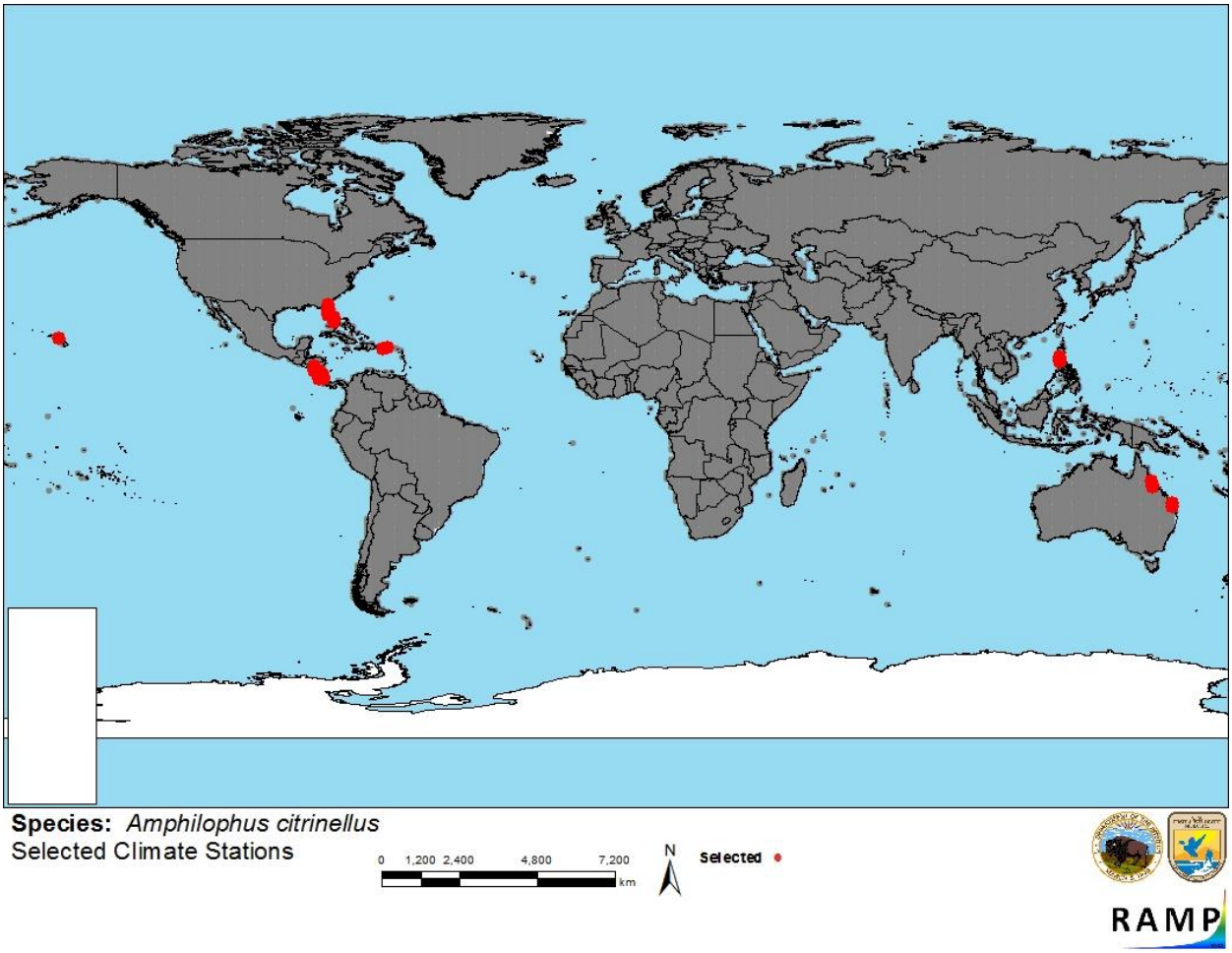

Figure 5. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (grey) for *Amphilophus citrinellus* climate matching. Source locations from Nico and Neilson (2011), Froese and Pauly (2014), and GBIF Secretariat (2014).

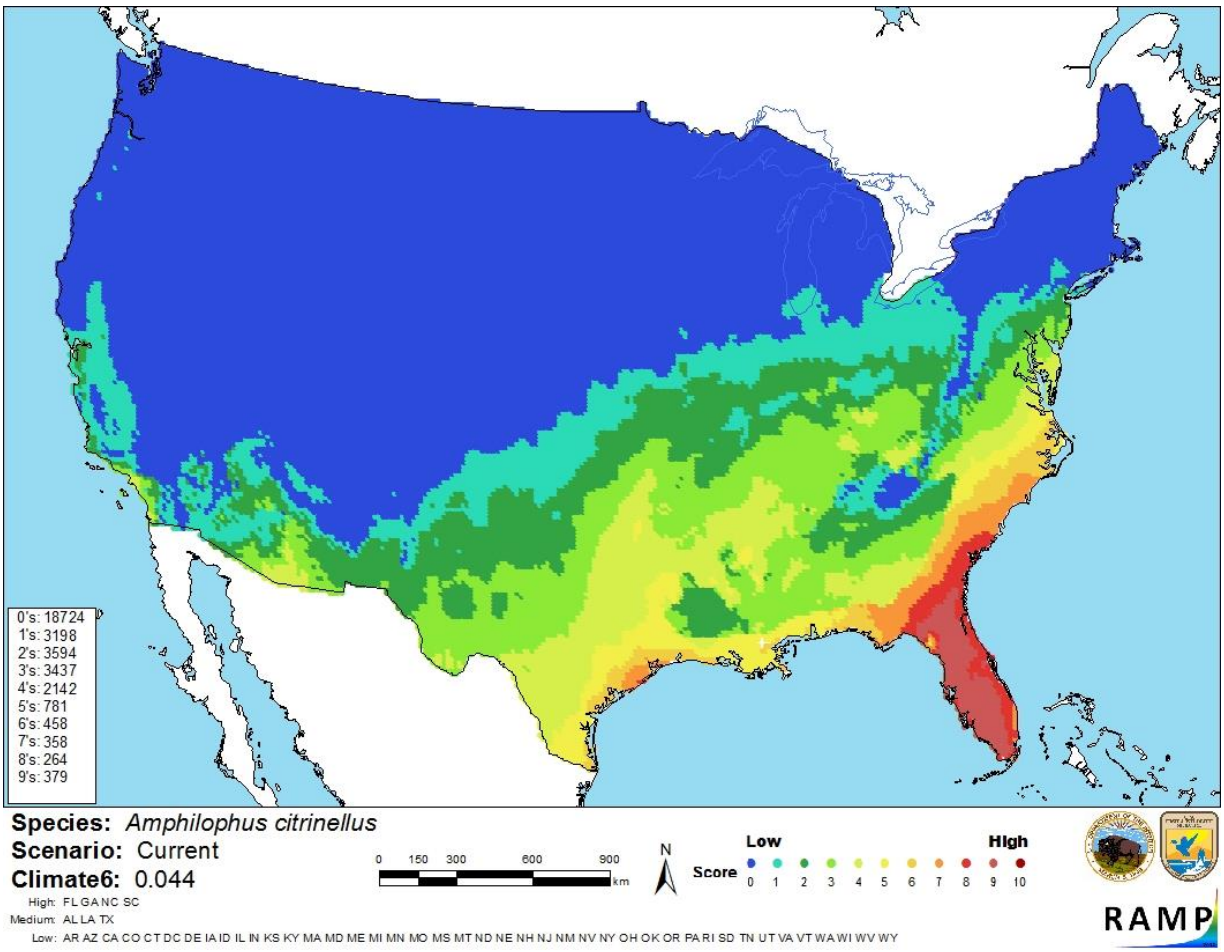

Figure 6. Map of RAMP (Sanders et al. 2014) climate matches for *Amphilophus citrinellus* in the contiguous United States based on source locations reported by Nico and Neilson (2011), Froese and Pauly (2014), and GBIF Secretariat (2014). 0 = Lowest match, 10 = Highest match.

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

The certainty of this assessment is medium. There was adequate information available for *Amphilophus citrinellus*. Records of introductions were found. The information found for impacts of introductions did not document actual impacts.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Amphilophus citrinellus is a freshwater fish native to Central America. The history of invasiveness is not documented. There are records of introductions, with some establishing populations, going as far back as the 1970s. No information on documented impacts was found, just potential impacts. *A. citrinellus* is present in the pet trade but at a low volume. There is already an established population in Florida and the climate match indicates that there is suitable climate to support the spread of this species. The climate match is medium. The certainty of assessment is medium. 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): Medium**
- **Remarks/Important additional information** No additional remarks.
- **Overall Risk Assessment Category: Uncertain**

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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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