

Common Water Monitor (*Varanus salvator*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, February 2022

Revised, April 2022, June 2022

Web Version, 1/3/2023

Organism Type: Reptile

Overall Risk Assessment Category: Uncertain



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1 Native Range and Status in the United States

Native Range

From Quah et al. (2021):

“This species is extremely widespread throughout southern and Southeast Asia (Gaulke and Horn 2004, Auliya 2006, Bennett *et al.* 2010), including eastern India, Sri Lanka, Bangladesh, southern China (it is thought to have become extinct in Hong Kong [M. Cota pers. comm. 2017]), Myanmar, Lao PDR, Viet Nam, Thailand, Cambodia, Peninsular and Eastern Malaysia (both Sarawak - Das and Yaakob 2007 - and Sabah - Zakaria and Raipar 2015) except for high elevations, Singapore, Indonesia (Simeulue to Enggano in the Mentawai Islands, Sumatra, Java, Borneo, Bali, Lombok, Sulawesi, Sumba, Flores, Wetar and some smaller islands - D.T. Iskandar pers. comm. 2017) and the Philippines (Laurenti 1768, Zhao and Alder 1993, Nguyen *et al.* 2009, Das 2010, Chan-ard *et al.* 2015). Early records of this species from some islands in Maluku [Indonesia] east as far as Halmahera require verification, as the species has not been confirmed from these islands following recent taxonomic work and recent literature does not include these within the species' range (D.T. Iskandar pers. comm. 2017), but it is known at least as far east as Obi (the subspecies *Varanus salvator ziegleri*) (Koch and Böhme 2010, Weijola 2010, Weijola and Sweet 2010). The species' distribution in Myanmar, where its occurrence was recently confirmed by Sai Sein Lin and Bates (2016), is poorly-understood; recent records from the Ayeyarwady, Sagaing and Tanintharyi Regions and Rakhine State suggest that it may be relatively widespread (Platt *et al.* 2018a,b).”

“In China, this species is known from Hong Kong (from which it has not been recorded for more than 20 years - M. Cota pers. comm. 2017), Guangdong, Hainan, Guangxi and southern Yunnan (Zhao and Adler 1993); Zhao *et al.* (1999) reports records also from Xianggang, [...]. It is absent from much of Yunnan, and all but the immediate coastal strip of south China adjacent to Hainan.”

“In Indonesia, it has been found in Kalimantan, Sumatra (Pulau Nias, Pulau Bangka, Pulau Belitung, Pulau Weh, the Mentawai Archipelago), Borneo, Java, Sulawesi, Anambas Islands, Natuna Archipelago and the Lesser Sundas (Das 2010, Chan-ard *et al.* 2015). In India, it is also known from the Nicobar Islands (Das 2010), with records from Car Nicobar, Tarasa, Bompoka, Tillanchong, Katchall, Camorta, Nancowry, Trinkat, Great Nicobar, Little Nicobar, Kondul, Pilo Milo, Menchal.”

Quah et al. (2021) list *Varanus salvator* as native to Bangladesh, Cambodia, China, India (including the Andaman and Nicobar islands), Indonesia, Laos, Malaysia, Myanmar, Singapore, Sri Lanka, Thailand, and Vietnam.

Status in the United States

From Somma (2019):

“Not established anywhere in the U.S. (Kraus, 2009; Krysko et al., 2011).”

According to Somma (2019), nonindigenous occurrences of *Varanus salvator* have been reported in the following States (years of reports and hydrologic unit code names given after State name):

- Arizona (1993; Lower Salt)
- California (2006; California)
- Florida (1994-2007; Florida Southeast Coast; Lower St. Johns)
- Texas (2019; San Gabriel)

From Quah et al. (2021):

“The species is common in the pet trade; most animals sold in the US are caught as juveniles and the number of captive-born specimens is low (B. Stuart and M. Cota pers. comm. 2017).”

Varanus salvator is listed on Hawaii’s Restricted Animal List (Part A). Animals on this list are allowed to be imported into Hawaii “for research, medical or scientific purposes as determined by the board, by universities, government agencies, or other institutions approved by the board, for exhibition in government zoos or government-affiliated aquariums, or for other purposes as specified in [Chapter 4-71, Hawaii Administrative Rules]” (Hawaii Department of Agriculture 2019).

Captive-bred *V. salvator* are listed on Maine’s Category 2 Restricted Species list. Individuals who import or possess Category 2 Restricted Species must have a permit, established safety measures, a maintenance plan, and credentials (Maine Department of Inland Fisheries and Wildlife 2019).

Means of Introductions in the United States

From Somma (2019):

“Unknown for **Arizona**. Probable pet escapees. Individuals from **California** are probably released or escaped pets (Kraus, 2009). *Varanus salvator* found in **Florida** are escaped or released pets (Krysko et al., 2011).”

“Unfortunately, monitor lizards as pet releases/escapees probably represent an increasingly common problem in **Florida** (Frank and McCoy, 1995; Simberloff, 1997; Krysko et al., 2011).”

Remarks

According to Quah et al. (2021), synonyms for *Varanus salvator* include *Hydrosaurus salvator* (Laurenti, 1768), *Monitor bivittatus* var. *celebensis* (Schlegel 1844), *Monitor nigricans* (Cuvier 1829), *Monitor salvator* (Laurenti, 1768), *Stellio salvator* (Laurenti, 1768). Information for this assessment was searched for using the valid name *Varanus salvator* and these synonyms.

From Quah et al. (2021):

“Significant taxonomic uncertainty still surrounds this species, and although this may not affect the extinction risk of *Varanus salvator sensu stricto* (which has a type locality on Sri Lanka, an area where subpopulations are at limited risk), this is of the utmost importance for identifying cryptic species which may be of more significant conservation concern.”

“The former subspecies *Varanus salvator togianus* (Peters, 1872), *V. s. nuchalis*, *V. s. cumingi*, and *Varanus salvator marmoratus* (Wiegmann, 1834) have been elevated to full species status (Koch et al. 2007), but *Varanus salvator* remains polytypic (Koch et al. 2013).”

“*Varanus salvator* is included in Appendix II of CITES.”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

Varanus salvator (Laurenti, 1768) is the accepted name for this species (WoRMS 2022).

From ITIS (2022):

Kingdom Animalia

Subkingdom Bilateria

Infrakingdom Deuterostomia

Phylum Chordata

Subphylum Vertebrata

Infraphylum Gnathostomata

Superclass Tetrapoda

Class Reptilia

Order Squamata

Suborder Autarchoglossa

Family Varanidae

Genus *Varanus*

Species *Varanus salvator* (Laurenti, 1768)

Size, Weight, and Age Range

From Somma (2019):

“A very large lizard that may reach a total length of 2.5 m (exceeding 8 ft) (Minton and Minton, 1973; [Whitaker], 1986; De Lisle, 1996).”

From EDDMapS (2022):

“Males are typically larger than females. [...] Typically long-lived, in captivity *V. salvator* have an average lifespan of 10.6 years.”

Environment

From Quah et al. (2021):

“This species is semi-aquatic and opportunistic and inhabits a variety of natural habitats, such as primary forests and mangrove swamps (Gaulke and Horn 2004, Weijola 2010, Bennett *et al.* 2010). In China it is found in tropical and subtropical forests in montane regions, commonly near streams (Zhao *et al.* 1999). This diurnal species prefers habitats in the vicinity of water which include beaches, mangrove swamps, peat swamps, lakes, streams and rivers (Boulenger 1903, Cantor 1847, Diong *et al.* 1995, Sukumaran *et al.* 2006, Lim *et al.* 2008, Traeholt 1995a, Grismer 2011). Water monitor lizards are occasionally seen away from the water in lowland and hill dipterocarp forest and are reasonably good climbers, especially the juveniles (Leong [and] Lim 2003, Laidlaw 1901, Grismer 2011). The animals have been reported to thrive in agricultural areas (e.g., rice, oil palm) and even cities with canal systems (e.g., in Sri Lanka, where they are not or are hardly disturbed, hunted or persecuted - M. Gaulke pers. comm.) and second growth forest (S. Sweet pers. comm., Bennett *et al.* 2010)”

“Although the species has an upper elevational limit of 1,800 m above sea level [asl], it is typically a lowland species which is common only in areas up to 600 m and rare at higher altitudes, particularly above 850 m (M. Cota pers. comm. 2017, Bennett *et al.* 2010). In China records have been taken from 225 to 1,040 m asl (Zhao *et al.* 1999).”

“Although the species occurs widely in the above-mentioned habitats across or in much of its range, it exhibits a preference for mangrove vegetation, swamps, open large river systems, and wetlands at elevations below 1,000 m, and these are consequently considered the natural habitats of greatest significance to the species (Gaulke and Horn 2004, Auliya 2006; Bennett *et al.* 2010).”

Climate

From Shine *et al.* (1998):

“The species [*Varanus salvator*] occurs in a diverse array of habitats and climates [...].”

Distribution Outside the United States

Native

From Quah *et al.* (2021):

“This species is extremely widespread throughout southern and Southeast Asia (Gaulke and Horn 2004, Auliya 2006, Bennett *et al.* 2010), including eastern India, Sri Lanka, Bangladesh, southern China (it is

thought to have become extinct in Hong Kong [M. Cota pers. comm. 2017]), Myanmar, Lao PDR, Viet Nam, Thailand, Cambodia, Peninsular and Eastern Malaysia (both Sarawak - Das and Yaakob 2007 - and Sabah - Zakaria and Raipar 2015) except for high elevations, Singapore, Indonesia (Simeulue to Enggano in the Mentawai Islands, Sumatra, Java, Borneo, Bali, Lombok, Sulawesi, Sumba, Flores, Wetar and some smaller islands - D.T. Iskandar pers. comm. 2017) and the Philippines (Laurenti 1768, Zhao and Alder 1993, Nguyen *et al.* 2009, Das 2010, Chan-ard *et al.* 2015). Early records of this species from some islands in Maluku [Indonesia] east as far as Halmahera require verification, as the species has not been confirmed from these islands following recent taxonomic work and recent literature does not include these within the species' range (D.T. Iskandar pers. comm. 2017), but it is known at least as far east as Obi (the subspecies *Varanus salvator ziegleri*) (Koch and Böhme 2010, Weijola 2010, Weijola and Sweet 2010). The species' distribution in Myanmar, where its occurrence was recently confirmed by Sai Sein Lin and Bates (2016), is poorly-understood; recent records from the Ayeyarwady, Sagaing and Tanintharyi Regions and Rakhine State suggest that it may be relatively widespread (Platt *et al.* 2018a,b)."

"In China, this species is known from Hong Kong (from which it has not been recorded for more than 20 years - M. Cota pers. comm. 2017), Guangdong, Hainan, Guangxi and southern Yunnan (Zhao and Adler 1993); Zhao *et al.* (1999) reports records also from Xianggang, [...]. It is absent from much of Yunnan, and all but the immediate coastal strip of south China adjacent to Hainan."

"In Indonesia, it has been found in Kalimantan, Sumatra (Pulau Nias, Pulau Bangka, Pulau Belitung, Pulau Weh, the Mentawai Archipelago), Borneo, Java, Sulawesi, Anambas Islands, Natuna Archipelago and the Lesser Sundas (Das 2010, Chan-ard *et al.* 2015). In India, it is also known from the Nicobar Islands (Das 2010), with records from Car Nicobar, Tarasa, Bompoka, Tillanchong, Katchall, Camorta, Nancowry, Trinkat, Great Nicobar, Little Nicobar, Kondul, Pilo Milo, Menchal."

Quah *et al.* (2021) list *Varanus salvator* as native to Bangladesh, Cambodia, China, India (including the Andaman and Nicobar islands), Indonesia, Laos, Malaysia, Myanmar, Singapore, Sri Lanka, Thailand, and Vietnam.

Introduced

From Quah *et al.* (2021):

"[...] and it has been introduced to Taiwan (from which it is naturally absent - M. Cota pers. comm. 2017)."

From Somma (2019):

“*Varanus salvator* is not established in Taiwan (Kraus, 2009).”

According to Robinson et al. (2020), *Varanus salvator* is “present” in South Africa, and according to González Martínez et al. (2020), *Varanus salvator* is “present” in Mexico. No documentation of establishment of *V. salvator* was found for either country.

Means of Introduction Outside the United States

From Somma (2019):

“Specimens from Taiwan are thought to be escapees from cargo ships (Zhao and Adler, 1993).”

Short Description

From Somma (2019):

“Adult dorsal coloration is a dark olive with irregular pale, or yellow, spots that may be in transverse rows; often becoming indistinct as the animal ages (De Lisle, 1996; Steel, 1996; Rogner, 1997; Cox et al., 1998). Laterally compressed tail may be banded (De Lisle, 1996). The neck is typically longer than the tapered head. No other lizard indigenous to the U.S. reaches this large size or has this combination of anatomical features.”

Biology

From Somma (2019):

“The water monitor is a tropical, semiaquatic, omnivorous predator that forages on land and in the water, preying upon invertebrates, carrion, human corpses and feces, and any vertebrate (including fish) it can overpower (Smith, 1935; Daniel, 1983, 2002; De Lisle, 1996; Shine et al., 1996; Steel, 1996; Manthey and Grossmann, 1997; Bennett, 1998; Cox et al., 1998).”

“They typically shelter in large burrows (Bennett, 1998). The female lays her eggs and buries them in a sheltered locality, such as termitaria (termite mounds), hollow logs, or riverbanks (van der Meer Mohr,

1930; Smith, 1935; [Whitaker], 1986; De Lisle, 1996; Manthey and Grossmann, 1997; Wicker et al., 1999; Gaulke and Horn, 2004; Horn and Gaulke, 2004). Several authors have observed maternal parental care, including nest guarding, in various subspecies and populations of *V. salvator* (Anonymous, 1978; Biswas and Kar, 1981; Wicker et al., 1999; Somma, 2003; Horn and Gaulke, 2004).”

From Shine et al. (1998):

“Reproduction occurs year-round, but at a lower intensity in drier months (March and June). Females produce multiple clutches of 6–17 eggs each year.”

From Quah et al. (2021):

“The diet includes invertebrates (e.g. insects), fish, crabs, freshwater turtles, birds and their eggs, crocodiles, sea turtles, lizards, rats, as well as carrion (Das 2010). According to Traeholt (1995b) and Laidlaw (1901), it overnights in self-constructed burrows and Traeholt (1995a) noted that it uses water and burrows to lower body temperatures during the hottest periods of the day.”

“Clutches comprise 5 to 30 eggs, and incubation lasts 171 to 327 days (Das 2010). Hatchlings are 250–390 mm long (Das 2010, Auliya and Koch 2020).”

From Traeholt (1994):

“Individuals are able to follow a scent trail and scent a rotten carcass up to 100 m away.”

From Uyeda (2009):

“Previous research has indicated that *V. salvator* has an extremely broad diet and will scavenge food leftovers from residents and tourists in addition to seeking out live prey.”

From Platt et al. (2018a):

“According to fishermen, *V. salvator* is a major predator of marine turtle eggs on islands in Lampi Marine National Park.”

Human Uses

From Somma (2019):

“[...] this could be the easiest varanid (monitor) to obtain through the pet trade (Sprackland, 1992; Bennett, 1998), Rogner (1997) recommends that these huge, aggressive lizards only be kept in zoos.”

“Under C.I.T.E.S., *V. salvator* is listed under Appendix II; international trade is regulated through mandatory permits (Level, 1997).”

From Quah et al. (2021):

“This species is one of the most heavily-exploited varanid lizards globally (King and Green 1999, Auliya 2006, Pernetta 2009, Bennett *et al.* 2010). It is mainly hunted because its skin is used in the leather trade, its meat is eaten, and its fat is used in traditional medicine. An estimated 1.5 million skins are traded annually (Herrmann 1999), although the skin trade has decreased slightly since the 1990s (Bennett *et al.* 2010). In 1998, the annual allowable catch was set at 454,000 (Auliya *et al.* 1999), but extensive hunting still occurs in many areas, with national and international protective legislation being ignored (Bennett *et al.* 2010). Recorded imports have varied widely over time; between 2010-2018, major source countries Malaysia and Indonesia exported >2.3 million skins of wild-caught specimens (Auliya and Koch 2020) (CITES Trade database; <https://trade.cites.org>). Large numbers of juveniles are exported alive from Indonesia (primarily Java and Sumatra) (S. Sweet pers. comm., Bennett *et al.* 2010). The origin of traded animals for the skin industry remains almost exclusively wild-caught (Auliya 2006, Pernetta 2009, Bennett *et al.* 2010). According to Duckworth *et al.* (1999) the species is hunted for food in Lao PDR and sold to Lao and Thai traders (Baird 1993, Stuart 1998c, Stuart 1998d, 1998e). It is heavily hunted for domestic consumption in Laos, for both meat and blood, and despite its rarity in this country is still regularly found in markets (S. Phimmachak pers. comm. 2017). It is widely hunted for domestic consumption in Myanmar (Platt *et al.* 2018). The species is also popular in the pet trade.”

“The main threat to this species is the offtake for the commercial skin/fashion industry (e.g., Luxmoore *et al.* 1990, Auliya 2006, Pernetta 2009, Bennett *et al.* 2010). In addition, the species is regionally hunted for its meat and its fat is used in traditional medicine; these are common by-products in skinneries (Auliya 2006).”

“In Sri Lanka, the species is not hunted for meat due to the belief that its meat is toxic, but the oil extracted from it is used for traditional medicine and witchcraft.”

“The species is common in the pet trade; most animals sold in the US are caught as juveniles and the number of captive-born specimens is low (B. Stuart and M. Cota pers. comm. 2017).”

From Nowak (2010):

“Owing to its large size, it is rarely seen in private collections.”

From Platt et al. (2018a):

“*Varanus salvator* is widely harvested for domestic consumption by rural villagers.”

From Uyeda (2009):

“[...] with a reported 2,300-6,600 live specimens exported annually [from Indonesia] during [1993–2001] (TRAFFIC and the IUCN/SSC Wildlife Trade Programme, 2004), live capture of *V. salvator* for food and pet trade is also considered a factor when reviewing overall species activity.”

Diseases

No records of OIE-reportable diseases (OIE 2022) were found for *Varanus salvator*.

From Tang et al. (1992):

“The diphyllbothriid cestode *Duthiersia fambriata* is reported from the monitor lizard *Varanus salvator* in China.”

Acanthotaenia shipleyi, *Duthiersia expansa* and *Scyphocephalus bisulcatus* have been identified as helminth parasites of *Varanus salvator* (Pinnell and Schmidt 1977).

From Nowak (2010):

“[...] on *Varanus salvator* brought from Indonesia to Poland: *Amblyomma varanensis*.”

According to WoRMS (2022), the following are parasites or pathogens of *Varanus salvator*: *Acanthotaenia daileyi*, *Kapsulotaenia frezei*, *Meristocotyle provitellaria*, and *Meristocotyle varani*.

Poelen et al. (2014) lists the following as additional pathogens and parasites of *Varanus salvator*: *Amblyomma gervaisi*, *Haplorchis pumilio*, *Hastospiculum macrophallos*, *Herpetostrongylus pythonis*, *Morganella morganii*, *Neolinguatula nuttalli*, *Raillietascaris varani*, *Sphaerechinorhynchus macropisthospinus*, and *Tanqua tiara*.

Threat to Humans

From Yudhana et al. (2021):

“To the best of our knowledge, this study not only recorded as the first evidence but also confirms the role of monitor lizards [*Varanus salvator*] as sparganosis [tapeworm infection] transmitters in Asia and reveals additional routes of sparganosis transmission in Indonesian reptiles.”

“Moreover, based on the complexity of the parasite life cycle, sparganosis also categorized as food- and water-borne zoonotic disease [Tanaka et al. 1997; Song et al. 2007].”

From Somma (2019):

“Moreover, their size and aggressive behavior makes them potentially dangerous to humans.”

3 Impacts of Introductions

From Somma (2019):

“None in the U.S. Unknown in Taiwan. The potential impact of these huge, aggressive predators on indigenous wildlife almost certainly would be negative should they establish themselves.”

Hawaii and Maine regulate the importation and possession of *Varanus salvator*.

4 History of Invasiveness

Varanus salvator has been reported as introduced to Taiwan, Mexico, and South Africa. No records of established populations were found. *V. salvator* has also been observed in the wild in the United States, however, the observations are all thought to be escaped or released pets. There are no established populations in the United States. *V. salvator* is in live trade inside and outside the United States but available information indicates a low volume of live trade. While one source states that the potential impact of introduction of this species could be negative, no information was available regarding documented impacts from introductions. Due to the lack of established populations, the history of invasiveness is classified as No Known Nonnative Population.

5 Global Distribution

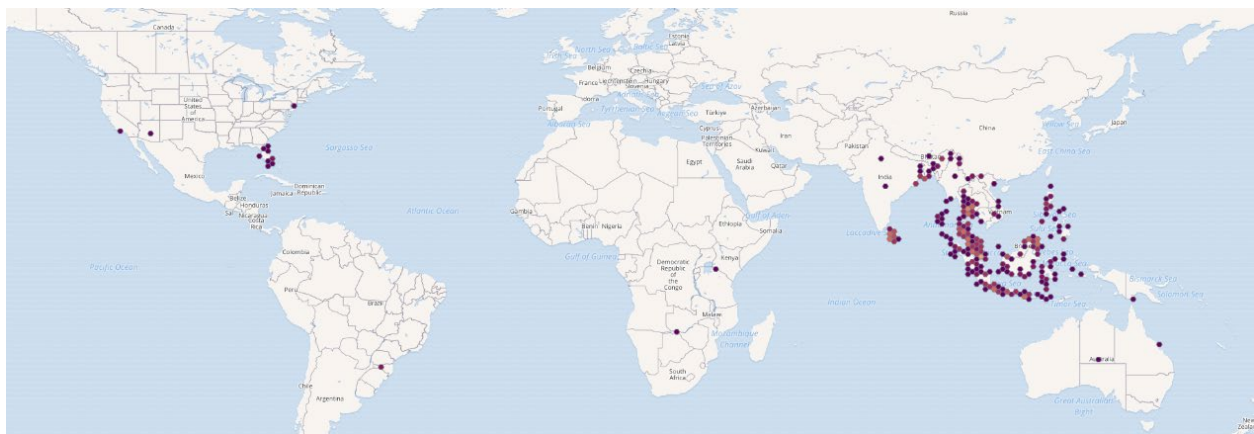


Figure 1. Known global distribution of *Varanus salvator*. Map from GBIF Secretariat (2022). Source points within North America, South America, Africa, central India, Papua New Guinea, and Australia were not used in the climate match as no proof of establishment could be found for these areas.

Additional observations in Myanmar given in Platt et al. (2018a,b) were used in the climate matching analysis.

6 Distribution Within the United States



Figure 2. Known observations of *Varanus salvator* in the United States. Map from Somma (2019). The points within the United States were not representative of a wild established population and therefore were not included in the climate matching analysis.

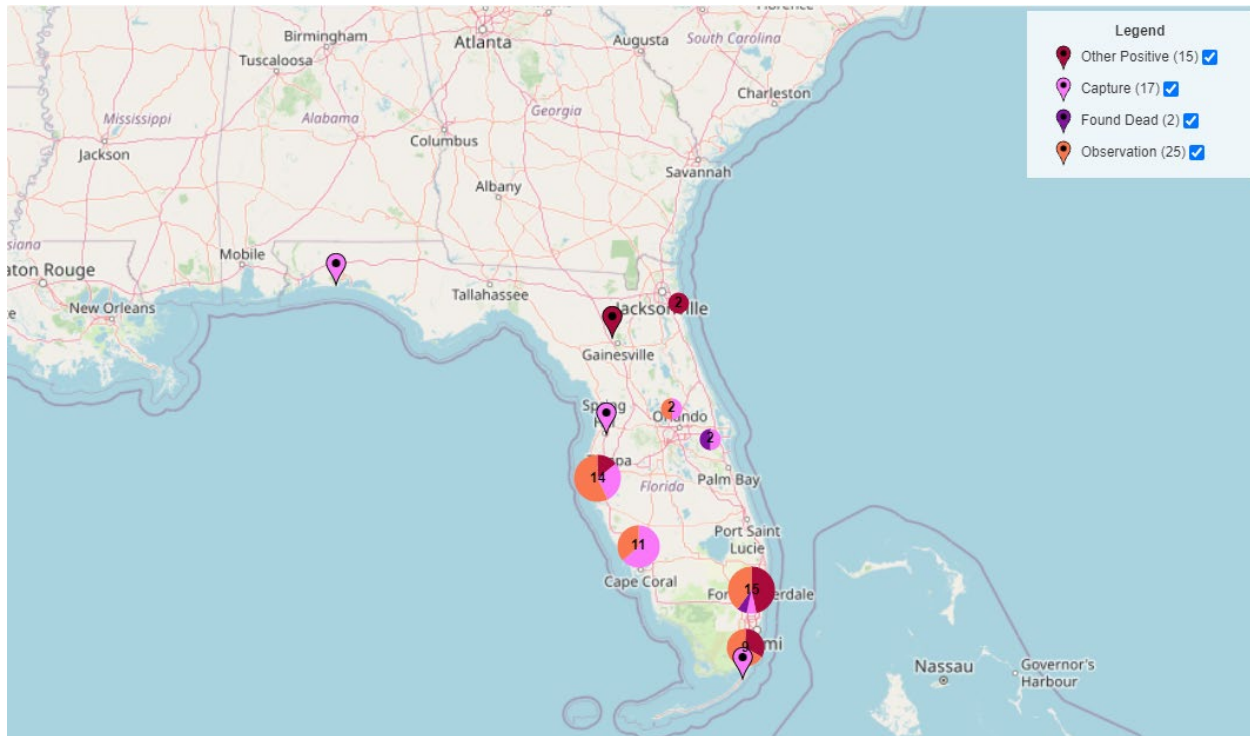


Figure 3. Known observations of *Varanus salvator* in the United States. Points are aggregated by location, total given by the number in the point, with the colors indicating the source of the record. Map from EDDMapS (2022). None of these observations represent an established population and were not used in the climate match.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Varanus salvator* was generally low for much of the contiguous United States. Areas of medium match were found along the Gulf and South Atlantic coasts, extending slightly inland. Small areas of medium match were found in the eastern Rocky Mountains and southern Arizona. Southern peninsular Florida and a thin strip of coastal Louisiana had a high climate match. Everywhere else had a low climate match. The overall Climate 6 score was 0.018, medium (scores between 0.005 and 0.103, exclusive, are classified as medium). Florida and Louisiana had high individual Climate 6 scores. Alabama, Mississippi, North Carolina, South Carolina, and Texas had medium individual Climate 6 scores. The remainder of the States within the contiguous United States had low individual Climate 6 scores.

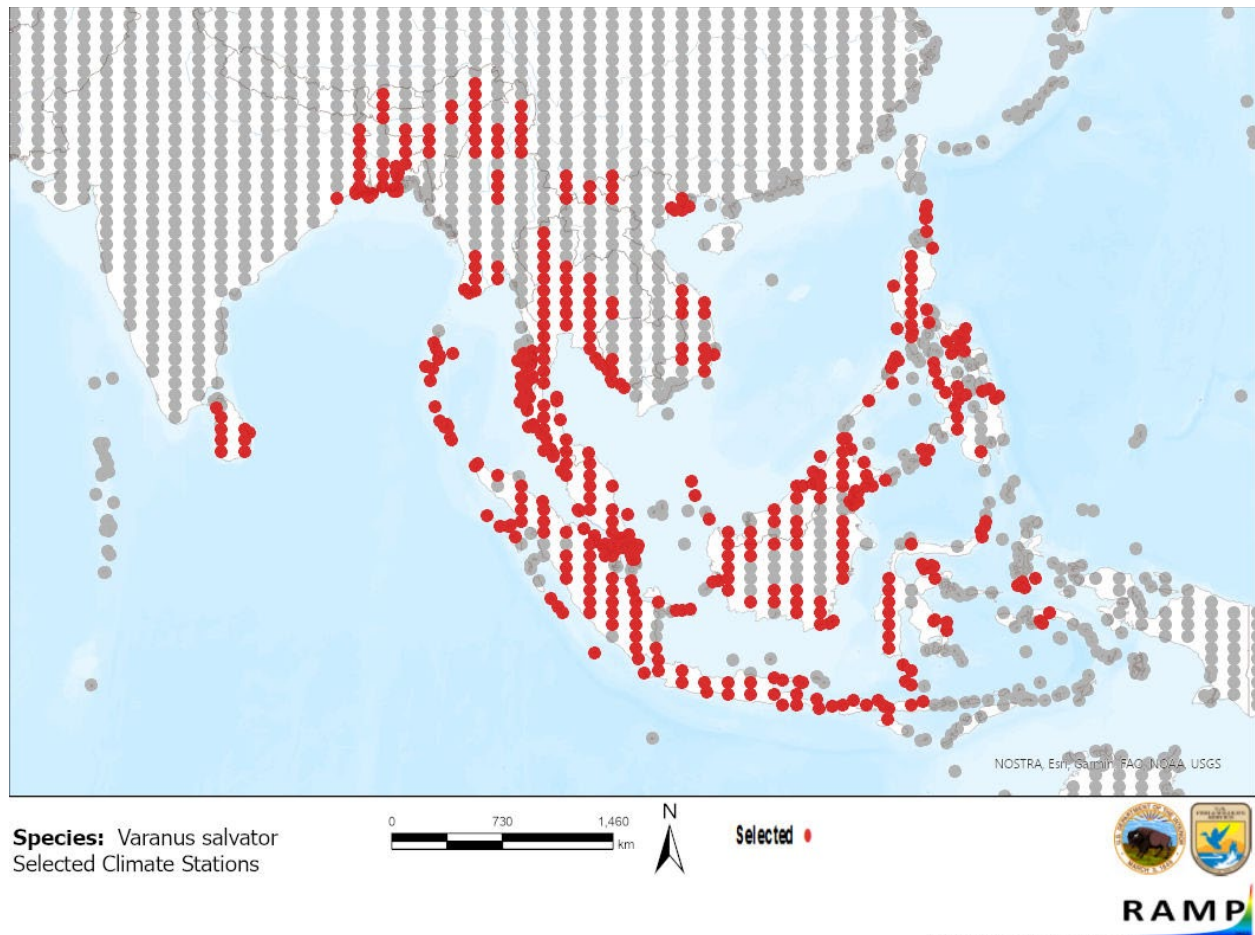


Figure 4. RAMP (Sanders et al. 2021) source map showing weather stations in southern Asia selected as source locations (red; Bangladesh, Bhutan, Brunei, Cambodia, China, Laos, India, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Thailand, Vietnam) and non-source locations (gray) for *Varanus salvator* climate matching. Source locations from GBIF Secretariat (2022). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

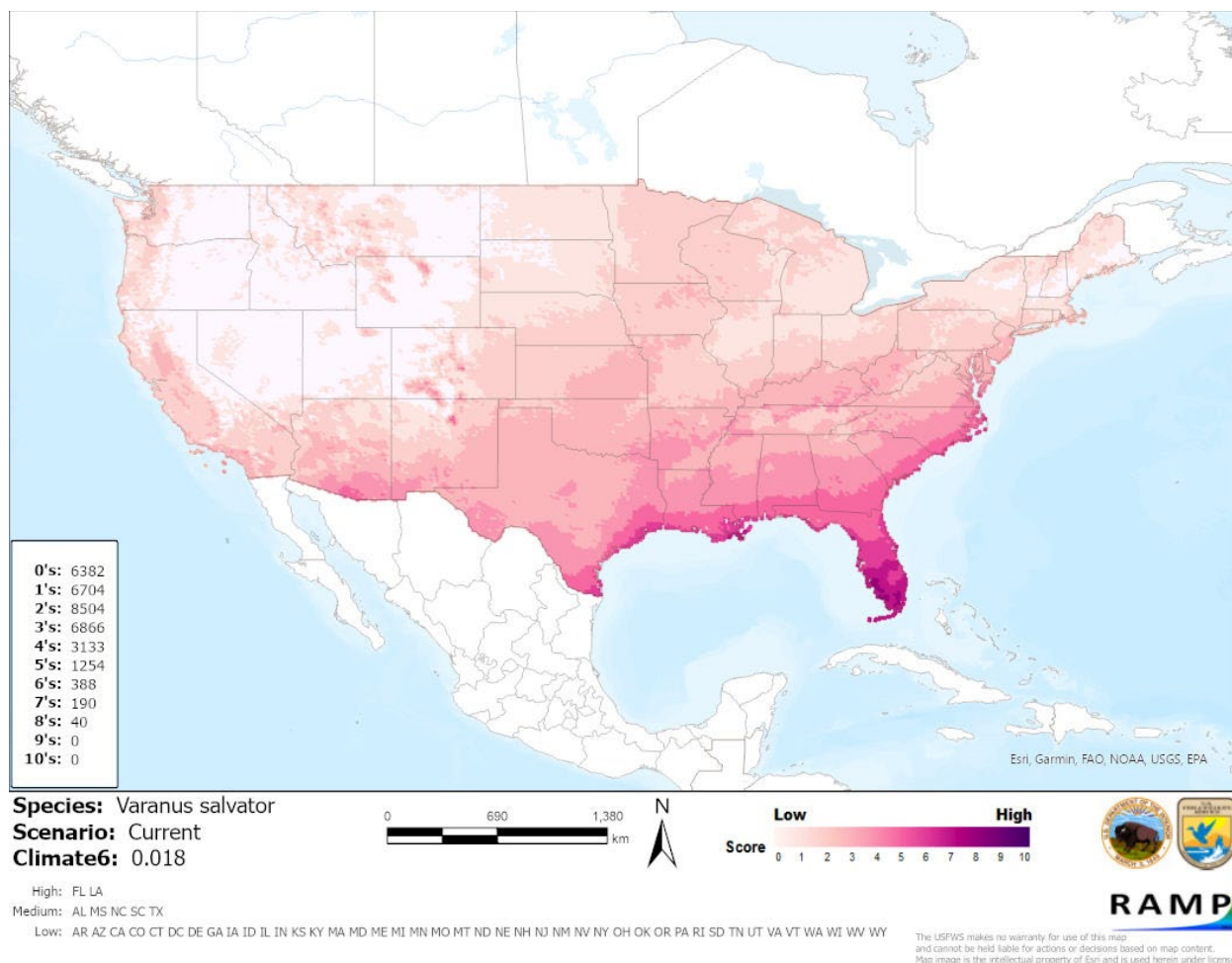


Figure 5. Map of RAMP (Sanders et al. 2021) climate matches for *Varanus salvator* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Light Pink = Lowest match, 10/Dark Purple = Highest match.

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 is Low. There is quality information available about the biology and ecology of *Varanus salvator*. Records of introduction were found but establishment outside the native range could not be confirmed, and no information was available regarding impacts of introduction. The certainty is classified as Low due to the lack of information on introduction outcomes to inform history of invasiveness.

9 Risk Assessment

Summary of Risk to the Contiguous United States

The common water monitor (*Varanus salvator*) is a semiaquatic, omniscarnivorous reptile native to southern and southeastern Asia. This species is in trade within its native range, internationally, and in the United States, although there is limited information about the volume of live trade. Hawaii and Maine regulate import and possession of *V. salvator*. *V. salvator* has been reported as introduced outside its native range, however, none of the introductions have resulted in an established population. No information was available regarding impacts from those introductions. The history of invasiveness is classified as No Known Nonnative Population. The overall climate match for the contiguous United States was Medium; the Gulf and South Atlantic coasts had a medium match and southern Florida had a high match. The certainty of assessment was Low due to uncertainty about nonnative establishment and lack of information on impacts of introduction. The overall risk assessment category is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): No Known Nonnative Population**
- **Overall Climate Match Category (Sec. 7): Medium**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks, Important additional information: None**
- **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.

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