Southeast Asian Toad (*Duttaphrynus melanostictus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, Web Version - 1/9/2018

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1 Native Range and Status in the United States

Native Range

From van Dijk et al. (2004):

"This species occurs widely from northern Pakistan through Nepal, Bangladesh, India (including the Andaman and Nicobar Islands), Sri Lanka, southern China (including Taiwan, Hong Kong and Macau), Myanmar, Lao People's Democratic Republic, Viet Nam, Thailand and Cambodia to Malaysia, Singapore, and Indonesia (Sumatra, Java, Borneo, Anambas Islands and Natuna Islands)"

From Fuller (2016):

"Widely distributed in South Asia. Asian common toads occur from northern Pakistan through Nepal, Bangladesh, India including the Andaman and Nicobar Islands, Sri Lanka, Myanmar, Thailand, Laos, Vietnam, Cambodia and southern China, Taiwan, Hong Kong and Macau to Malaysia, Singapore, and the Indonesian islands of Sumatra, Java, Borneo, Anambas and Natuna Islands."

Status in the United States

From Fuller (2016):

"A single individual was captured in Miami-Dade County, Florida, in August of 2012, in a shipment of cargo from China (Krysko et al., 2011) [The source material attributed the capture in 2012 to the 2011 publication without further comment]."

Means of Introductions in the United States

From Fuller (2016):

"Hitchhiker in cargo (Krysko et al., 2011)."

Remarks

From CABI (2017):

"Phylogenetic and population genetic analyses by Wogan et al. (2016) indicate three distinct evolutionary lineages corresponding to the Asian mainland, coastal Myanmar and the Sundaic islands (Indonesia) which suggests that *D. melanostictus* actually consists of multiple species, each having narrower geographical ranges and ecological niches than is currently recognized."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2016):

"Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata
        Subphylum Vertebrata
          Infraphylum Gnathostomata
            Superclass Tetrapoda
              Class Amphibia
                Order Anura
                  Family Bufonidae
                    Genus *Duttaphrynus*

Species *Duttaphrynus melanostictus* (Schneider, 1799)"

"Taxonomic Status:
Current Standing: valid"

Size, Weight, and Age Range

From AmphibiaWeb (2016):

"It is the largest toad in Pakistan, female exceeds 150 mm in snout-vent length."

"Total length of tadpole 26-27 mm, tail 19-20 mm."

From EOL (2016):

"Asian toads are a large species; females can grow to 20 cm (8 in) snout-vent length. Males are considerably smaller in size."

From Gelb (2013):

"Asian common toads live an average of 4 years in the wild and up to 10 years in captivity. ("Pest Risk Assessment: Asian spined toad (*Bufo melanostictus*)" [The State of Queensland], 2010; Khan, 2000; Mercy, 1999; Saidapur and Girish, 2001)"

Environment

No information on the environmental condition required by *Duttaphrynus melanostictus* was found.

Climate/Range

From van Dijk et al. (2004):

"It has been recorded from sea level up to 1,800m asl."

Distribution Outside the United States

Native

From van Dijk et al. (2004):

"This species occurs widely from northern Pakistan through Nepal, Bangladesh, India (including the Andaman and Nicobar Islands), Sri Lanka, southern China (including Taiwan, Hong Kong and Macau), Myanmar, Lao People's Democratic Republic, Viet Nam, Thailand and Cambodia to Malaysia, Singapore, and Indonesia (Sumatra, Java, Borneo, Anambas Islands and Natuna Islands)"

From Fuller (2016):

"Widely distributed in South Asia. Asian common toads occur from northern Pakistan through Nepal, Bangladesh, India including the Andaman and Nicobar Islands, Sri Lanka, Myanmar, Thailand, Laos, Vietnam, Cambodia and southern China, Taiwan, Hong Kong and Macau to Malaysia, Singapore, and the Indonesian islands of Sumatra, Java, Borneo, Anambas and Natuna Islands."

Introduced

From van Dijk et al. (2004):

"Introduced: Papua New Guinea"

"introduced to Bali, Sulawesi, Ambon and Manokwari, New Guinea (northeastern portion of the Vogelkop Peninsula, centred on Manokwari)"

From Fuller (2016):

"They were introduced to the islands of Bali, Sulawesi, Ambon and Manokwari, and the northeastern portion of the Vogelkop Peninsula in New Guinea (Krysko et al., 2011; EOL, 2012)."

From Moore (2015):

"In March 2014, the scientific and conservation communities were alerted to the presence of the toad around Madagascar's main port and second largest city, Toamasina"

From Kaiser et al. (2011):

"For a first glance at key species for conservation concern in Timor-Leste we wish to single out the only confirmed single-island endemic, *Limnonectes timorensis*, and the recently introduced toad *Duttaphrynus melanostictus*."

Means of Introduction Outside the United States

From Kaiser et al. (2011):

"The common Asian toad (Fig. 2 [in source material]) was introduced into Timor-Leste fairly recently, probably during the staging of the international peacekeeping force in the transition period from Indonesian occupation to independence (1999–2002)."

From Price-Rees et al. (2012):

"For example, the black-spined toad (*Duttaphrynus melanostictus*) is spreading rapidly through Indonesia, and several specimens have been intercepted at Australian ports (Australian Quarantine and Inspection Service 2010)."

From The State of Victoria (2016):

"An increasing number are being intercepted at Australian airports and sea ports from flights and ships arriving from Asia, where the toad is widespread. They are usually found in shipping containers, machinery and personal effects such as bags and shoes."

From EOL (2016):

"These toads easily disperse as a result of human activities, leading Wogan et al. (2016) to describe them as tropical Asia's "weediest" amphibian."

From Gelb (2013):

"The ways in which these toads have been introduced is not fully known in most areas, although in some areas it is assumed that Asian common toads first occurred on these islands when they were fist settled. In other cases, such as in Papua New Guinea, it is rumored that the Department of Health released these toads as means to control mosquito populations."

Short Description

From AmphibiaWeb (2016):

"Head with distinct rostral, preorbital, supraorbital, postorbital and a short orbito-tympanic, cranial crests; no temporal ridge; interorbital space much broader than upper eyelid; tympanum very distinct, at least two third the diameter of the eye; first finger generally but not always extends beyond second; double subarticular tubercles only under third finger. Toes with single subarticular tubercle; parotid elipticle, with dark brown scattered branching concretions; skin heavily tuberculated on flanks, tubercles usually tipped with dark brown spines; a lateral dorsal staggered row of 8-9 enlarged tubercles; cranial crests, lips, digit tips, metacarpal and metatarsal tubercles are cornified with dark brown, which tend to peal [sic] off in preserved specimens; head is almost smooth."

"Color: Dorsum uniform gray of various shades, brown or reddish with dark spots, ventrum uniform dirty white, speckled with light brown on chin and throat."

"The throat of breeding male is light orange or yellow. It develops cornified pads on inner side of first and second fingers."

"Tadpole: The tadpoles are uniform dark, inhabits side pools along hilly torrents, schools of them swarm along the marginal waters of ponds and puddles feeding on any type of algal material. The body is typically bufonid, globular with weak tail, dorsal fin is broad while ventral is narrow. The oral disc is typically bufonid, with 2(2)/3 labial tooth row formula, the oral papillae are lateral. The beak is finely serrated and sharp (Khan, 1991)."

Biology

From AmphibiaWeb (2016):

“Nocturnal, appears soon after sunset; during day hides under stones, logs, piles of vegetation, holes and crevices among stones and in ground. Once a suitable place is selected, it is permanently shared with several toads.”

“The toad is lethargic timid animal. It moves about with deliberate hops from place to place in search of insects on which it feeds. In tropical southeast Asia it is most common amphibian, comes out after sunset in large numbers and frequents mostly the human habitations, where it congregate under street lamps to feed on photophilic insects (Church, 1960).”

“In temperate environs of western Himalayas, the breeding is initiated by the monsoon rains, from July to August. Males, gather in shallow side-pools along torrents and ponds. The call in low melodious "curr, curr, curr" repeated several times ending in a whistling note. The calling males become quite aggressive, tugging and jumping over each other, males for exceed female in numbers. It breeds in every available space containing some water from first showers of monsoon rains in the southern India (McCann, 1938). Males are much smaller than females. However, in tropical southeast Asia, the toad is known to breed throughout the year (Church, 1960).”

“Calling males occasionally jump over each other and try to secure a nuptial hold on each other, however, kicks and zestful wriggling dislodge them from each other and soon they resume calling. The females lurch round, as soon one comes close, a male jumps over it and quickly tightens it nuptial clasp, the other suitors are shaken off as the nuptial pair moves to a quitter place away from the site.”

“The eggs are laid in a double jelly string, generally in deep quieter water, where the egg-string is entangled in the vegetation or female moves round the submerged vegetation to wound the egg string round it. An egg is enclosed in a double gelatinous capsule (Khan, 1982).”

“The swarms of recently metamorphosed toadlets from synchronised pairings leave water, many fall prey to several kind of predators, while several are crushed under feet and passing traffic.”

From van Dijk et al. (2004):

“It is mainly a species of disturbed lowland habitats, from upper beaches and riverbanks to human-dominated agricultural and urban areas. It is uncommon in closed forests. It breeds in still and slow-flowing rivers and temporary and permanent ponds and pools. Adults are terrestrial and may be found under ground cover (eg. rocks, leaf-litter, logs), and are also associated with human habitations. The larvae are found in still and slow-moving waterbodies.”

From Gelb (2013):

“Asian common toads have typical anuran development which is indirect with an aquatic tadpole stage. Eggs become larva within 24 and 28 hours. Saidapur and Girish (2001) showed that Asian

common toad tadpoles reared with sibling groups grow at a higher rate and develop faster compared to larvae reared in mixed groups. Because females produce so many eggs, intraspecific competition among tadpoles is likely intense in the ephemeral pools in which this species breeds. Therefore, Saidapur and Girish (2001) suggested that the rapid growth and development of tadpoles in the presence of siblings helps increase reproductive success. A study done by Mogali et al (2011) illustrates that tadpoles of Asian common toads will emerge at different times and sizes with the presents of predators. When predators are present tadpoles will decrease in body mass up to 46% and metamorphosis will also occur earlier (Mogali et al 2011,The State of Queensland 2010, Saidapur and Girish 2001). ("Pest Risk Assessment: Asian spined toad (*Bufo melanostictus*)", 2010; Mogali, et al., 2011; Saidapur and Girish, 2001)"

"Asian common toads are insectivorous although these toads are also know [*sic*] to be an opportunist and will feed on a variety of arthropods and even mollusks. An analysis of the stomach contents of multiple specimens of Asian common toads yielded arthropod orders such as earwigs, grasshoppers, crickets, weta, and locusts, true bugs, moths and butterflies, beetles, typical bugs, sawflies, wasps, bees and ants, termites, cockroaches, and mantids, true flies, centipedes, and millipedes. Though these toads are opportunistic feeders the insects that showed the greatest abundance in the stomach were sawflies, wasps, bees and ants, beetles and termites. This toad is feeds on insects that are known pests to human such mosquitoes and various crop pests (Mercy 1999, The State of Queensland 2010). ("Pest Risk Assessment: Asian spined toad (*Bufo melanostictus*)", 2010; Mercy, 1999)"

Human Uses

From van Dijk et al. (2004):

"It is sometimes found in the international pet trade but at levels that do not currently constitute a major threat. It is eaten locally in northern Thailand."

Diseases

No records of OIE reportable diseases were found.

From Nakano and Sung (2014):

"*Tritetrabdella taiwana*
[…] Other reported anuran hosts: […] Asian common toad, *Duttaphrynus melanostictus* (Yuen and Nakano, 2012) […]."

From McAllister et al. (2010):

"*Aplectana macintoshii* (Stewart, 1914) Travassos, 1931 […] Other reported hosts: Amphibia: […] Asian black-spotted toad, *Duttaphrynus melanostictus* (=*Bufo melanostictus*, Stewart, 1914; […]"

From Labisko et al. (2015):

"Similarly, and despite no currently recorded infection or capacity as a host for Bd [*Batrachochytrium dendrobatidis*, chytrid fungus] (www.bd-maps.net/surveillance/s_species.asp; accessed 21 September 2014), the recent discovery of Asian Common Toads (*Duttaphrynus melanostictus*)"

From Junker et al. (2015):

"The heterakid genus *Meteterakis* Karve, 1930 was originally erected to accommodate *M. govindi* Karve, 1930, a parasite described from a bufonid toad *Duttaphrynus melanostictus* (Schneider) (syn. *Bufo melanostictus* Schneider) (Bufonidae) in Burma (Karve, 1930)."

"*M*[*eteterakis*]. *bufonis* (Biswas & Chakravarty, 1963) Baker, 1984 (syn. *Heterakis bufonis* Biswas & Chakravarty, 1963) from *D. melanostictus* in India […]
M. aurangabadensis Deshmukh & Choudhari, 1980 (spicules 620–720 lm long) from *D. melanostictus* in India (Deshmukh & Choudhari, 1980);
M. karvei Naidu & Thakare, 1981 (spicules 660–840 lm long) from *D. melanostictus* in India (Naidu & Thakare, 1981); […].
M. singaporensis (Sandosham, 1954) Inglis, 1958 (syn. *Africana singaporensis* Sandosham, 1954) (spicules 740–960 lm long) from *D. melanostictus* in Singapore (Sandosham, 1954); […]
M. gambhiri Zhang & Zhang, 2011 (spicules 220–270 lm long) from *D. melanostictus* in Manipur, India, […]"

Threat to Humans

From Moore (2015):

"Because *D. melanostictus* is poisonous, these concerns also extend to human health risks. *D. melanostictus* is implicated as the cause of poisoning in humans through consumption in Laos and has also been documented as the cause of death and cardiac arrest in children who have consumed toad tissue (Keomany et al. 2007). This health risk is elevated in the case of Madagascar, as its extensive rural populations to some extent rely on hunting and gathering for their sources of protein, their diet can include Anurans, and many people are unaware of the poisonous nature of the Asian toad."

From The State of Victoria (2016):

"The milky toxin has a pungent odour and may cause itching in the nose and eyes when handled by humans. It does not pose a direct threat to human safety unless directly consumed. The consumption of Asian black-spined toad skin or eggs can cause serious illness or even death."

3 Impacts of Introductions

From Kaiser et al. (2014):

"A greater threat, however, emanates from the introduced *Duttaphrynus melanostictus* (see Trainor 2009). This species is capable of occupying niches in which other species (both frogs and smaller reptiles) exist, is a formidable predator of small frogs and small reptiles (e.g., geckos, skinks), and it can become a nuisance and an object of pursuit in human habitations, to the extent that frogs may be considered equally offensive as toads merely by having a similar appearance."

From Labisko et al. (2015):

"Similarly, and despite no currently recorded infection or capacity as a host for Bd [*Batrachochytrium dendrobatidis*, chytrid fungus] (www.bd-maps.net/surveillance/s_species.asp; accessed 21 September 2014), the recent discovery of Asian Common Toads (*Duttaphrynus melanostictus*) on the east coast of Madagascar, having likely arrived in shipping containers from Asia (Kolby 2014a), highlights a further risk to Seychelles endemic fauna as a potential disease vector."

From Piludu et al. (2015):

"Another cause of concern is the spread of the invasive Asian common toad *Duttaphrynus melanostictus* that was recorded for the first time in Toamasina in March 2014 (Kolby, 2014b). A species distribution model performed by Pearson (2015), showed a high probability of occurrence in the distribution of [*Mantella*] *aurantiaca*, which suggest an increased risk of disease transmission and food-web disruption."

From Gelb (2013):

"[…] there is a possibility that Asian common toads are displacing a smaller species of toads such as crested toads. Asian common toads are suspected to cause intense ecological damage. On the islands where Asian common toads have become naturalized it is competing heavily for similar resources of native anurans. These toads are also known to feed on the eggs, larva and juveniles of other native amphibians, which further exasperates the added competition. This competition may in the future resemble the ecological crisis of cane toads in Australia (Church 1960, Lever 2003, The State of Queensland 2010). (Church, 1960; Lever, 2003)"

4 Global Distribution

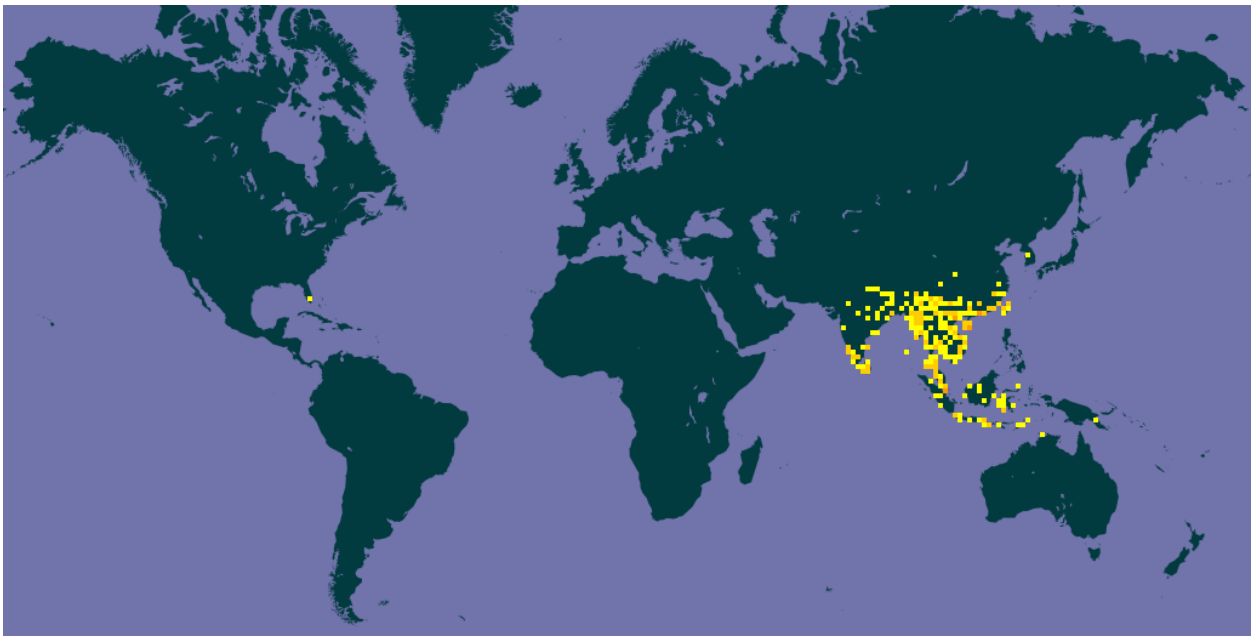

Figure 1. Known global distribution of *Duttaphyrnus melanostictus*. Map from GBIF Secretariat (2016).

The location in Florida (Fig. 1) is a result of one specimen that hitchhiked in shipping materials and not an established population. The point in Korea is similarly from a single individual, reported as a possible escaped pet. The point in northern Australia was from a single specimen collected in 1974 and not thought to be representative of an established population. None of those locations were used as source points in the climate match.

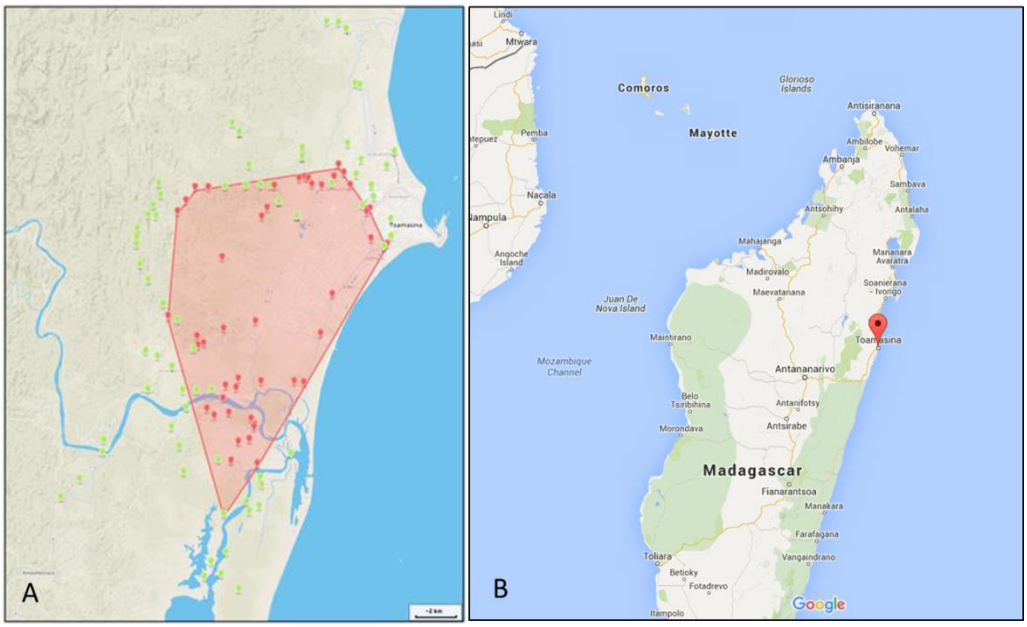

Figure 2. Map A, from Moore et al. (2015), survey results for *D. melanostictus* around the city of Toamasina, Madagascar. Red locations were positive for the species, green were negative. Map B shows the location of Toamasina within Madagascar (Google 2016).

5 Distribution Within the United States

Figure 3. Known distribution of *D. melanostictus* in the United States. Map from Fuller (2016).

The single location in Florida (Fig. 3) was the result of an individual found in shipping and is not indicative of an established population. This location was not used as a source point for the climate match.

Figure 4. Known distribution of *D. melanostictus* in the United States. Map from BISON (2017).

No records indicating and established population in California were found. No other sources recorded any observations in California. This location was not used as a source point in the climate match.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Duttaphrynus melanostictus* was high for Florida and the Atlantic coast of Georgia. It was medium across much of the Midwest, Atlantic Coast, and down to Texas. It was low everywhere else. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.048, medium, and high in Florida, Georgia, North Carolina, Oklahoma, and South Carolina.

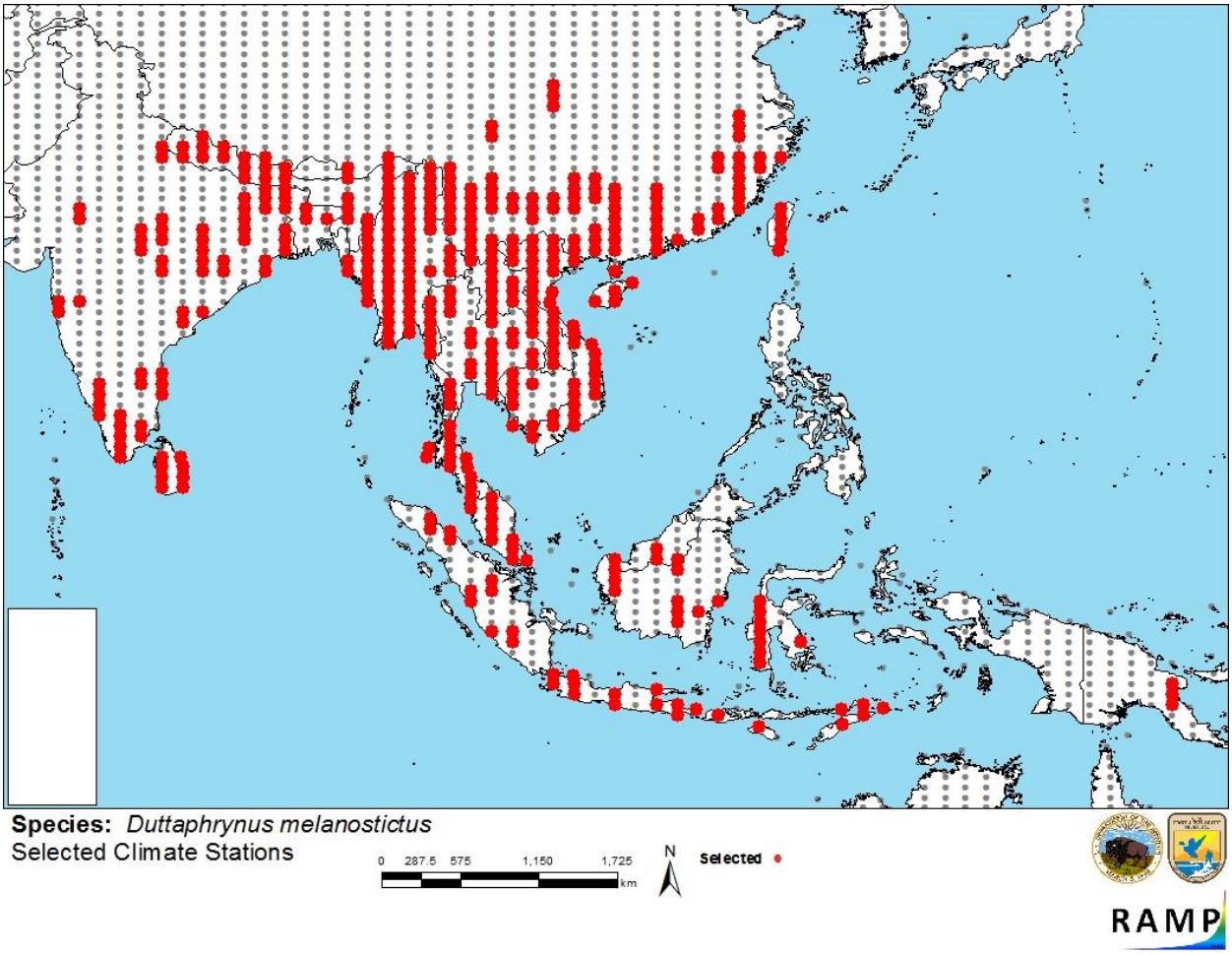

Figure 5. RAMP (Sanders et al. 2014) source map of Southeast Asia showing weather stations selected as source locations (red) and non-source locations (grey) for *Duttaphrynus melanostictus* climate matching. Source locations from Moore et al. (2015), Fuller (2016), and GBIF Secretariat (2016).

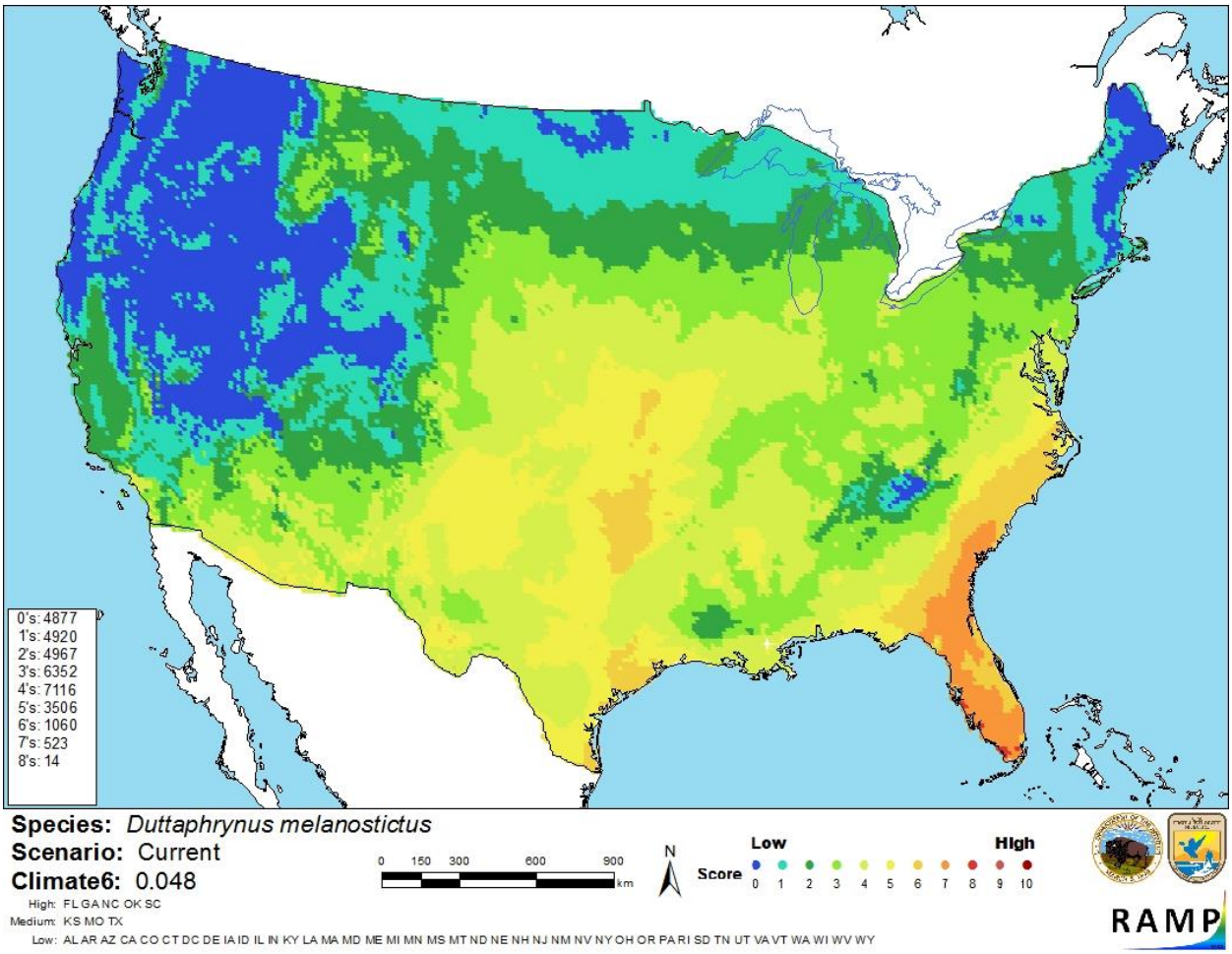

Figure 6. Map of RAMP (Sanders et al. 2014) climate matches for *Duttaphrynus melanostictus* in the contiguous United States based on source locations reported by Moore et al. (2015), Fuller (2016), and GBIF Secretariat (2016). 0 = Lowest match, 10 = Highest match.

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
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

The certainty of assessment is medium. There have been many introductions of *Duttaphrynus melanostictus* that resulted in established populations but there few documented impacts. Many sources detail dire potential impacts. This species is easily transferable in international trade, as evidenced by individual specimens arriving in Florida and Australia. The climate match is medium, but with an area of high match for Florida and surrounding areas. To increase the

certainty of this assessment, impacts of *Duttaphrynus melanostictus* on invaded ecosystems would need to be better documented.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness for *Duttaphrynus melanostictus* is high. There have been multiple introductions that established populations. This species directly competes with native toads to the detriment of those toads. In addition, it is potentially a carrier for chytrid fungus, an OIE reportable disease. This species is harmful to humans that ingest the tissues, causing illness and death. Recent papers, 2014 and 2015, have all called for more research to be done on more specific impacts of this species. The climate match is overall medium, but shows that the climate conditions are present for this species to thrive in Florida. That is cause for concern since at least one individual has already been intercepted as a shipping stowaway there (Fuller 2016). The overall risk assessment is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** Species is poisonous, can cause serious illness or death if ingested. A single individual has been intercepted in shipping materials in Florida.
- **Overall Risk Assessment Category: High**

9 References

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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10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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