

# Peregrine Crab (*Varuna litterata*)

## Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, July 2020  
Revised, December 2020  
Web Version, 4/13/2021

Organism Type: Crustacean  
Overall Risk Assessment Category: Uncertain



Photo: Wibowo Djtmilo. Licensed under Creative Commons Attribution-Share Alike 4.0 International, 3.0 Unported, 2.5 Generic, 2.0 Generic, and 1.0 Generic license. Available: [https://en.wikipedia.org/wiki/Varuna\\_litterata#/media/File:Varun\\_litterat\\_160312-0348\\_rwg.JPG](https://en.wikipedia.org/wiki/Varuna_litterata#/media/File:Varun_litterat_160312-0348_rwg.JPG) (July 2020).

## 1 Native Range and Status in the United States

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### Native Range

From Palomares and Pauly (2020):

“Indo-Pacific.”

According to Palomares and Pauly (2020), *Varuna litterata* is native to the following countries: Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa, Tanzania, China, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Taiwan, Timor-Leste, Vietnam, Australia, Fiji, French Polynesia, New Caledonia, Papua New Guinea, Vanuatu, and Wallis Futuna.

From Ng (2006):

“Indo-west Pacific Oceans (East Africa to Japan).”

“[...] *Varuna litterata* is the most naturally widespread species of varunid, ranging from Africa to across the West Pacific.”

The following information pertains to the natural expansion of this species within countries of its native range.

From Mos et al. (2017):

“The river swimming crab, *Varuna litterata* is here recorded for the first time from New South Wales (NSW), Australia, representing a southerly range extension of approximately 290 km.”

“It is noteworthy that *V. litterata* and other euryhaline crabs are also undergoing a poleward range extension along the east coast of South Africa, another climate change hot-spot with a strengthening ocean current (Whitfield et al., 2016).”

“We hypothesise two reasons why these crabs may prefer to occupy these habitats [in New South Wales, Australia]. Firstly, the crabs may be avoiding predators. Avoidance of predatory eels, such as the long-finned eel *Anguilla reinhardtii* Steindachner, 1867, drives the distribution of other freshwater macroinvertebrates (e.g. McCormack, 2005), and this may also be the case for *V. litterata*. Large individuals of *A. reinhardtii* capable of preying on adult *V. litterata* were only observed in deep-water habitats. Secondly, the tropical *V. litterata* may be responding to thermal gradients. Shallow habitats were often warmer by up to 4.5 °C and could be acting as thermal refuges, enabling the tropical *V. litterata* to over-winter in the subtropics. If so, *V. litterata* from these southern localities may be living at the present limits of their thermal tolerance. Our results should be interpreted with caution, however, as they were taken from a small number of sites over short periods of time, and further studies testing our hypotheses are required. The planktonic larval phase of *V. litterata* is one mechanism by which this species could have extended its range from southern Queensland into northern NSW [...] Alternatively, it is possible juvenile or adult *V. litterata* dispersed southwards by rafting on floating debris associated with flood events.”

From Susilo et al. (2020):

“*V. litterata* is a widely distributed species [...] however, this species had never been reported from the eastern part of Java [Indonesia] before. Our finding of *V. litterata* from the southern

coast of East Java which is directly facing the Indian Ocean [...] is a new record for Meru Betiri National Park.”

*Varuna litterata* is native to Guam, a Territory of the United States (Paulay et al. 2003; BISON 2020; GBIF Secretariat 2020).

## Status in the United States

*Varuna litterata* is native to Guam, a Territory of the United States (Paulay et al. 2003; BISON 2020; GBIF Secretariat 2020). *V. litterata* has not been reported anywhere outside of its native range in the United States.

## Means of Introductions in the United States

*Varuna litterata* is not found outside its native range in the United States.

## Remarks

Information for this assessment was searched for using the valid name *Varuna litterata* and the common name Peregrine Crab.

# 2 Biology and Ecology

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## Taxonomic Hierarchy and Taxonomic Standing

From WoRMS (2020):

“Biota > Animalia (Kingdom) > Arthropoda (Phylum) > Crustacea (Subphylum) > Multicrustacea (Superclass) > Malacostraca (Class) > Eumalacostraca (Subclass) > [...] Decapoda (Order) > Pleocyemata (Suborder) > Brachyura (Infraorder) > Eubrachyura (Section) > Thoracotremata (Subsection) > Grapsoidea (Superfamily) > Varunidae (Family) > Varuninae (Subfamily) > *Varuna* (Genus) > *Varuna litterata* (Species)”

According to WoRMS (2020), *Varuna litterata* (Fabricius, 1798) is the accepted scientific name. The original name of this species was *Cancer litterata*. *Cancer simmonsii* and *Varuna tomentosa* are synonyms of this species.

## Size, Weight, and Age Range

From EOL (2020):

“Body width: 5cm”

From Ng (2006):

“This species can grow to relatively large size, the largest male specimen examined is 58.4mm x 51.4mm [...], while the largest female specimen examined is 42.8mm x 40.2mm [...].”

## Environment

From Palomares and Pauly (2020):

“Benthic; freshwater; brackish; depth range 0 - 757 m [CRUSTA 2012].”

From Devi et al. (2013):

“They usually inhabit the mangroves, estuarine and freshwater environments, in shallow sub tidal regions and usually found under rocks, logs and dead leaves and lives in burrows along the embankments or sides of pools, creeks and shallow banks. *V. litterata* is euryhaline and can be found in rivers, brackish waters or at sea.”

From Susiol et al. (2020):

“This species can be found as far as 31 km from the sea in completely freshwater and it can reach up to 223 meters above sea level.”

## Climate

From Palomares and Pauly (2020):

“Tropical”

## Distribution Outside the United States

Native

From Palomares and Pauly (2020):

“Indo-Pacific.”

According to Palomares and Pauly (2020), *Varuna litterata* is native to the following countries: Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa, Tanzania, China, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Taiwan, Timor-Leste, Vietnam, Australia, Fiji, French Polynesia, New Caledonia, Papua New Guinea, Vanuatu, and Wallis Futuna.

From Ng (2006):

“Indo-west Pacific Oceans (East Africa to Japan).”

“[...] *Varuna litterata* is the most naturally widespread species of varunid, ranging from Africa to across the West Pacific.”

The following information pertains to the natural expansion of this species within countries of its native range.

From Mos et al. (2017):

“The river swimming crab, *Varuna litterata* is here recorded for the first time from New South Wales (NSW), Australia, representing a southerly range extension of approximately 290 km.”

“It is noteworthy that *V. litterata* and other euryhaline crabs are also undergoing a poleward range extension along the east coast of South Africa, another climate change hot-spot with a strengthening ocean current (Whitfield et al., 2016).”

“We hypothesise two reasons why these crabs may prefer to occupy these habitats [in New South Wales, Australia]. Firstly, the crabs may be avoiding predators. Avoidance of predatory eels, such as the long-finned eel *Anguilla reinhardtii* Steindachner, 1867, drives the distribution of other freshwater macroinvertebrates (e.g. McCormack, 2005), and this may also be the case for *V. litterata*. Large individuals of *A. reinhardtii* capable of preying on adult *V. litterata* were only observed in deep-water habitats. Secondly, the tropical *V. litterata* may be responding to thermal gradients. Shallow habitats were often warmer by up to 4.5 °C and could be acting as thermal refuges, enabling the tropical *V. litterata* to over-winter in the subtropics. If so, *V. litterata* from these southern localities may be living at the present limits of their thermal tolerance. Our results should be interpreted with caution, however, as they were taken from a small number of sites over short periods of time, and further studies testing our hypotheses are required. The planktonic larval phase of *V. litterata* is one mechanism by which this species could have extended its range from southern Queensland into northern NSW[...] Alternatively, it is possible juvenile or adult *V. litterata* dispersed southwards by rafting on floating debris associated with flood events.”

From Susilo et al. (2020):

“*V. litterata* is a widely distributed species [...] however, this species had never been reported from the eastern part of Java [Indonesia] before. Our finding of *V. litterata* from the southern coast of East Java which is directly facing the Indian Ocean [...] is a new record for Meru Betiri National Park.”

## Introduced

*Varuna litterata* has naturally expanded within its native range, however, this species has not been introduced or become established anywhere outside of its native range.

## Means of Introduction Outside the United States

*V. litterata* has not been introduced anywhere outside of its native range.

## Short Description

From Palomares and Pauly (2020):

“Carapace squarish, surface smooth; front straight; anterolateral margins each with 3 very broad, low nut sharp teeth. Dactylus, propodus, and carpus of legs literally flattened, fringed with long, closely packed setae. Color: light brown to brownish grey on dorsal surfaces.”

From Susilo et al. (2020):

“The chelipeds are symmetrical. Male crabs have larger chelipeds than the females. Ambulatory legs are long and slender. The last ambulatory leg is very flattened in form of a peddle.”

From Ng (2006):

“Carapace quadrangular. Dorsal surface punctate, regions well defined. Front broad, anterior margin almost straight, slightly produced, sloping downwards. Anterolateral margins arched upwards, with three teeth including orbital tooth. Third maxillipeds closed with a narrow gap. Chelipeds symmetrical, larger in males. Fingers closed without any gap. Ambulatory legs long, slender, merus with a small sub-distal spine on anterior margin, densely setose on anterior, posterior margins, last ambulatory very flattened. G1 long, stout, distal end with a single lobe, length to width ratio 6.9. Female gonopore operculate, with an oval protruding button.”

## **Biology**

From Palomares and Pauly (2020):

“Generally estuarine; prefers areas faced by more oceanic waters. They prefer slow-moving or almost stagnant bodies of water. Species can be found up to 20 km from the sea in completely fresh water. Large or ovigerous specimens can be found in intertidal areas, frequently associated with floating clumps of brown algae, *Sargassum* spp. [Ng 1998]. Members of the order Decapoda are mostly gonochoric. Mating behavior: Precopulatory courtship ritual is common (through olfactory and tactile cues); usually indirect sperm transfer [Ruppert et al. 2004].”

From Mos et al. (2017):

“*Varuna litterata* is omnivorous and highly fecund (Devi et al., 2013; Tu, 1992) [...]”

From Susilo et al. (2020):

“In India, *V. litterata* is commonly found at the sea on drift logs [Alcock 1900] and the females need go to the deep sea for spawning [Ng 2006]. Gravid females of this species can be found also in intertidal areas, [...] The phenomenon of the migration of *V. litterata* from marine environment through estuarine is strongly related to the physiological mechanisms. The zoea and the crab stages of this species are stenohaline, they can only survive within a narrow range of salinities. The zoeae need high salinity, while the crabs need zero salinity although during the mating season adult crabs will migrate to the sea. During megalopa and young crab stages they become euryhaline because they are in the estuarine area where the level of salinity is quite variable. The salinity can be low due to rainwater or freshwater input from the river. However, *V. litterata* is still not successfully in invading freshwater since the larvae still need marine environment with high salinity for their development. Due to this life style, *V. litterata* can be considered as a euryhaline and a catadromous species.”

## Human Uses

From Devi et al. (2013):

“It has been recorded as commercially important species in Bengal, India, where it is eaten by poor people, and its numbers compensate for its small size (Hora, 1933). Rao et al. (1973) also reported it as an edible species and a fishery resource of India.”

From Ng (2006):

“Varunid crabs are important commercially, scientifically and medically [...] *Varuna litterata*, [...] are considered by Asians as delicacies.”

“*Varuna litterata* [...] is still sold in many East and South East Asian markets at a relatively high price when they are available (Ng, 1998; pers. observ.). Interestingly, the supply of *Varuna* is somewhat sporadic as nobody has been able to culture the crab commercially.”

## Diseases

**No OIE-reportable diseases (OIE 2020) were reported for *Varuna litterata*.**

According to WoRMS (2020), *V. litterata* is a host to the parasite *Megacepon pleopodatopus*.

## Threat to Humans

From Palomares and Pauly (2020):

“Harmless”

## 3 Impacts of Introductions

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*Varuna litterata* has not been introduced outside of its native range. This species has naturally dispersed and expanded within its native range. The following information pertains to potential impacts of introduction within its expanded native range.

From Mos et al. (2017):

“The ecological consequences of the advance of *V. litterata* into freshwater habitats in subtropical eastern Australia are unknown. *Varuna litterata* is omnivorous and highly fecund (Devi et al., 2013; Tu, 1992), and crabs with these characteristics are often problematic when invading new areas due to their ability to outcompete native organisms for food and living space (e.g. Dittel & Epifanio, 2009; Falk-Petersen et al., 2011). This is concerning given that the range extension of *V. litterata* reported here overlaps with an area supporting a high diversity of freshwater organisms, such as freshwater crayfishes (*Euastacus* spp.). Most of these endemic crayfishes have small distributions and are already threatened by habitat modification, climate change and competition with introduced tropical crayfish (Coughran et al., 2009; Richman et al., 2015). It is also possible that *V. litterata* could carry tropical parasites and pathogens into temperate waters.”

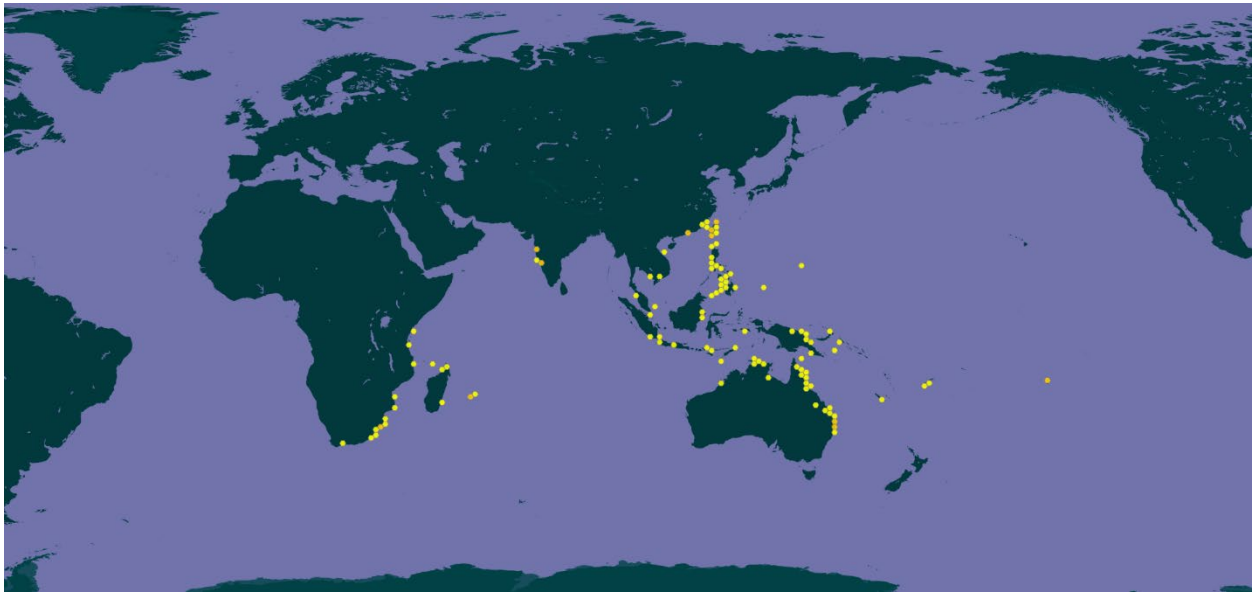
## 4 History of Invasiveness

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The history of invasiveness for *Varuna litterata* is classified as No Known Nonnative Population. The species has not been introduced beyond its native range but has naturally expanded its range in some native countries. Potential impacts of introduction have been hypothesized by peer-review sources in regards to the natural range expansion, however no actual impacts have been documented. Information regarding the duration this species had been in trade or the volume of trade was not available.

## 5 Global Distribution

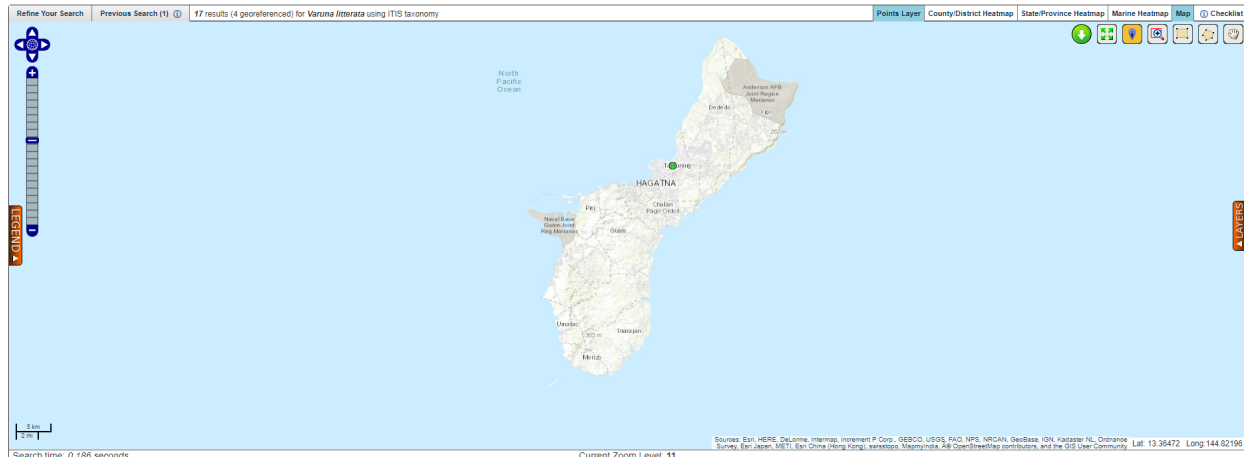
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**Figure 1.** Known global distribution of *Varuna litterata*. Observations are reported from eastern Africa, India, East Asia, Southeast Asia, and Australia. Map from GBIF Secretariat (2020). Because the climate matching analysis is not valid for marine waters, no marine occurrences were used in the climate matching analysis.



## 6 Distribution Within the United States

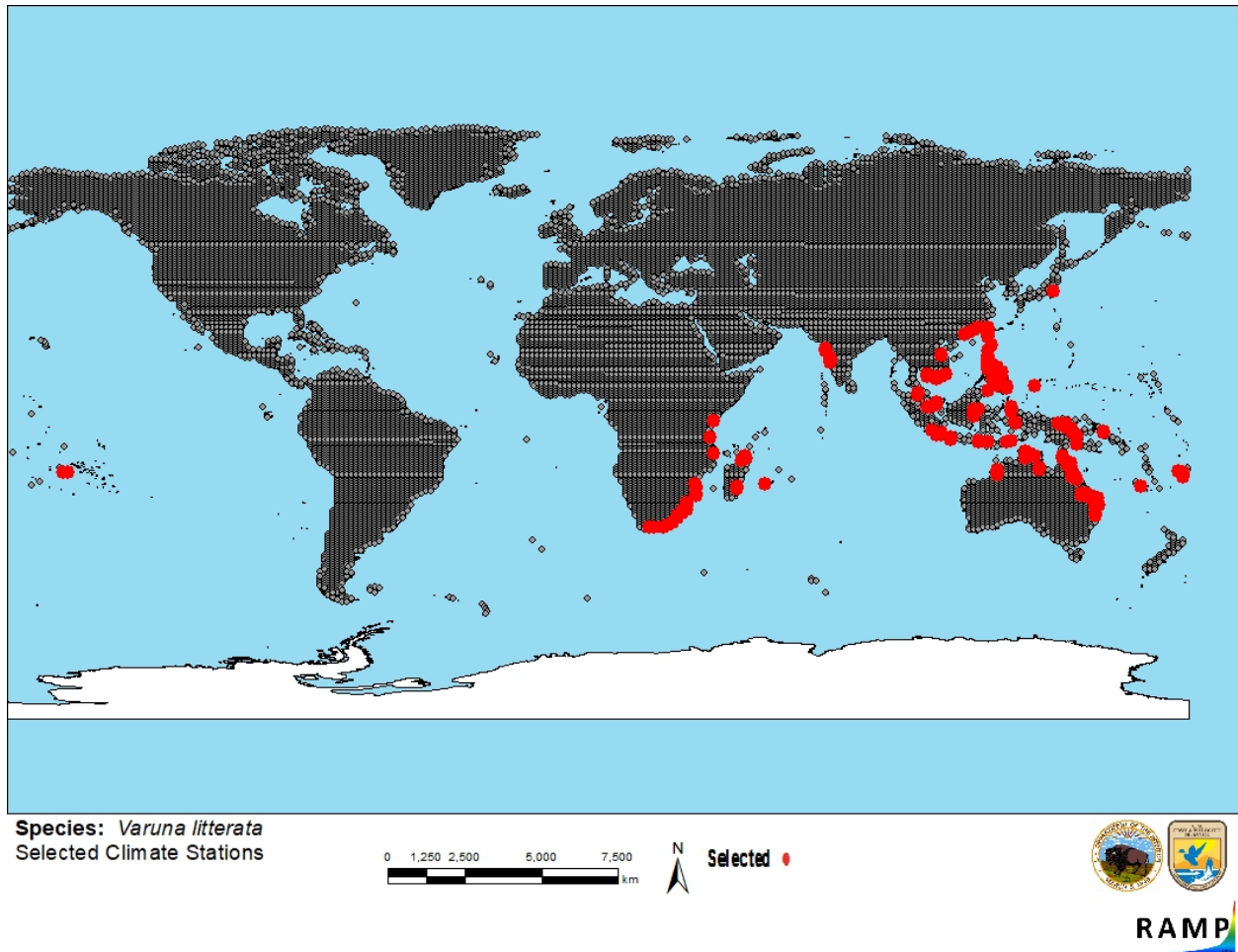


**Figure 2.** Known distribution of *Varuna litterata* in the United States. Location is in Guam. Map from BISON (2020).

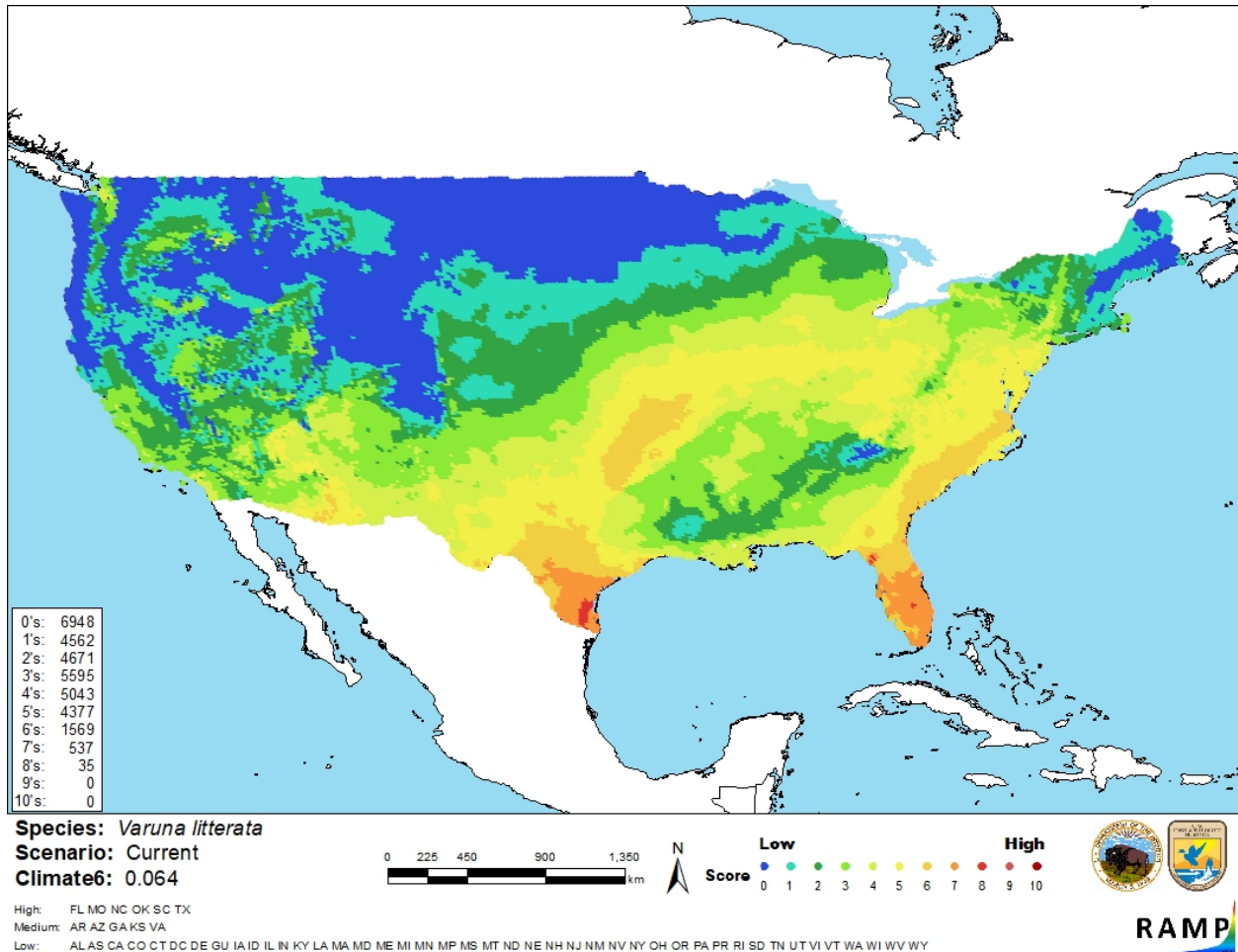
## 7 Climate Matching

### Summary of Climate Matching Analysis

The climate match for *Varuna litterata* was generally medium for the contiguous United States. A high match was found along the Atlantic Coast from southern coastal Virginia to Florida, as well as in South Texas, and parts of Oklahoma, and Missouri. Low match was primarily found in the West, upper Midwest and Northeast, with a patch in the Southeast. Medium match was found throughout the remaining areas of the contiguous United States. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.064, medium (scores greater than 0.005 and less than 0.103, exclusive, are classified as medium). The following States had high individual Climate 6 scores: Florida, Missouri, Oklahoma, North Carolina, South Carolina, and Texas. The following States had medium individual Climate 6 scores: Arkansas, Arizona, Georgia, Kansas, and Virginia. All remaining States received low individual scores. The climate match presented here refers only to where the species can survive in freshwater and brackish environments and not in marine environments where larvae develop.



**Figure 3.** RAMP (Sanders et al. 2018) source map showing weather stations in West-Indo Pacific selected as source locations (red; South Africa, Mozambique, Madagascar, Tanzania, Kenya, Reunion, India, Taiwan, China, Hong Kong, Japan, Cambodia, Vietnam, Malaysia, the Philippines, Indonesia, Papua New Guinea, Palau, Timor-Leste, the Solomon Islands, New Caledonia, Australia, Fiji, and French Polynesia) and non-source locations (gray) for *Varuna litterata* climate matching. Source locations from GBIF Secretariat (2020). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.



**Figure 4.** Map of RAMP (Sanders et al. 2018) climate matches for *Varuna litterata* in the contiguous United States based on source locations reported by GBIF Secretariat (2020). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
$\geq 0.103$	High

## 8 Certainty of Assessment

The certainty of this assessment is Low. There is ecological and biological information available about *Varuna litterata*. There are records of natural range expansion for *Varuna litterata* within the native range with some information on potential impacts in those areas. However no actual nonnative introductions have been reported, therefore there is no actual information on the

impacts of introduction. There was no detailed trade history available for *V. litterata*. However, according to Devi et al. (2013) and Ng (2006) *V. litterata* is important commercially in its native range. This species migrates between marine and non-marine environments. Because not all locations in the United States are conducive to such migration, inland establishment of this species may be limited according to the existing connectivity between marine and non-marine environments.

## 9 Risk Assessment

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### Summary of Risk to the Contiguous United States

Peregrine Crab (*Varuna litterata*) is a euryhaline grapsid crab that inhabits rivers, brackish waters and seas throughout the Indo-Pacific region. This species is important commercially throughout its native range for human consumption, however no substantial trade information was found. There are records of natural range expansion for *Varuna litterata* within the native range with some information on potential impacts in those areas. However no actual nonnative introductions have been reported, therefore there is no information on the impacts of introduction. The history of invasiveness is No Known Nonnative Population. The overall climate match for the contiguous United States was Medium. A high match was found along the Atlantic Coast from southern coastal Virginia to Florida, as well as in South Texas, and parts of Oklahoma, and Missouri. This species migrates between marine and non-marine environments. Because not all locations in the United States are conducive to such migration, inland establishment of this species may be limited according to the existing connectivity between marine and non-marine environments. The certainty of assessment is Low due to limited information on the impacts of introduction. The overall risk assessment category for *Varuna litterata* 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:**
- **Overall Risk Assessment Category: Uncertain**

## 10 Literature Cited

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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 11.**

BISON. 2020. Biodiversity Information Serving Our Nation. U.S. Geological Survey. Available: <https://bison.usgs.gov> (July 2020).

Devi PL, Nair DG, Joseph A. 2013. Habitat ecology and food and feeding of the herring bow crab *Varuna litterata* (Fabricius, 1798) of Cochin backwaters, Kerala, India. *Arthropods* 2(4):172–188.

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## 11 Literature Cited in Quoted Material

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**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.**

- Alcock A. 1900. *Journal of the Asiatic Society of Bengal* 69(2):279–456. [Source material did not provide full citation for this reference.]
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