

Rapid Communication

Redclaw crayfish, *Cherax quadricarinatus* (von Martens, 1868), widespread throughout Indonesia

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Abstract

The redclaw crayfish, *Cherax quadricarinatus*, is a freshwater crayfish native to north-eastern Australia and southern New Guinea. In 2016, the species was found for the first time west of the Wallace Line in Java, Indonesia and, based on climate matching, its further spread within Indonesian territory was predicted. In this study, surveys of selected localities within Indonesia were performed to examine the species occurrence. Redclaw crayfish were found throughout Indonesia, in numerous rivers, lakes, ponds and reservoirs in Batam and Bintan Islands (Riau Archipelago), Java, Kalimantan (Borneo), Sulawesi and Sumatra. Some stocks were apparently well established, providing a food source for local people and sustaining capture for pet trade purposes. Because there are no effective regulations of introductions and exploitation of this crayfish in Indonesia, its further spread to new localities is expected. Increased attention to this issue, especially regarding crayfish management and policy implementation, is urgently needed.

Key words: biological invasion, non-indigenous species, Parastacidae, aquaculture, pet trade, Java

Introduction

The redclaw crayfish, *Cherax quadricarinatus* (von Martens, 1868) (Decapoda: Parastacidae), is globally one of the most widely exploited freshwater crayfish species, cultivated mostly in extensive aquaculture systems (Saoud et al. 2013). It belongs to the northern group of *Cherax* crayfish, with a native range that includes northern parts of the Northern Territory and

far north Queensland in Australia and the southern part of New Guinea (Munasinghe et al. 2004; Bláha et al. 2016). It has been previously introduced for aquaculture into numerous countries, especially in tropical or subtropical regions (Ahyong and Yeo 2007; Lodge et al. 2012; Kouba et al. 2015). In Indonesia, *C. quadricarinatus* is native only to the Papua province but, in 2016, it was recorded as non-indigenous and established at two localities west of the Wallace Line in Java, Indonesia (Patoka et al. 2016).

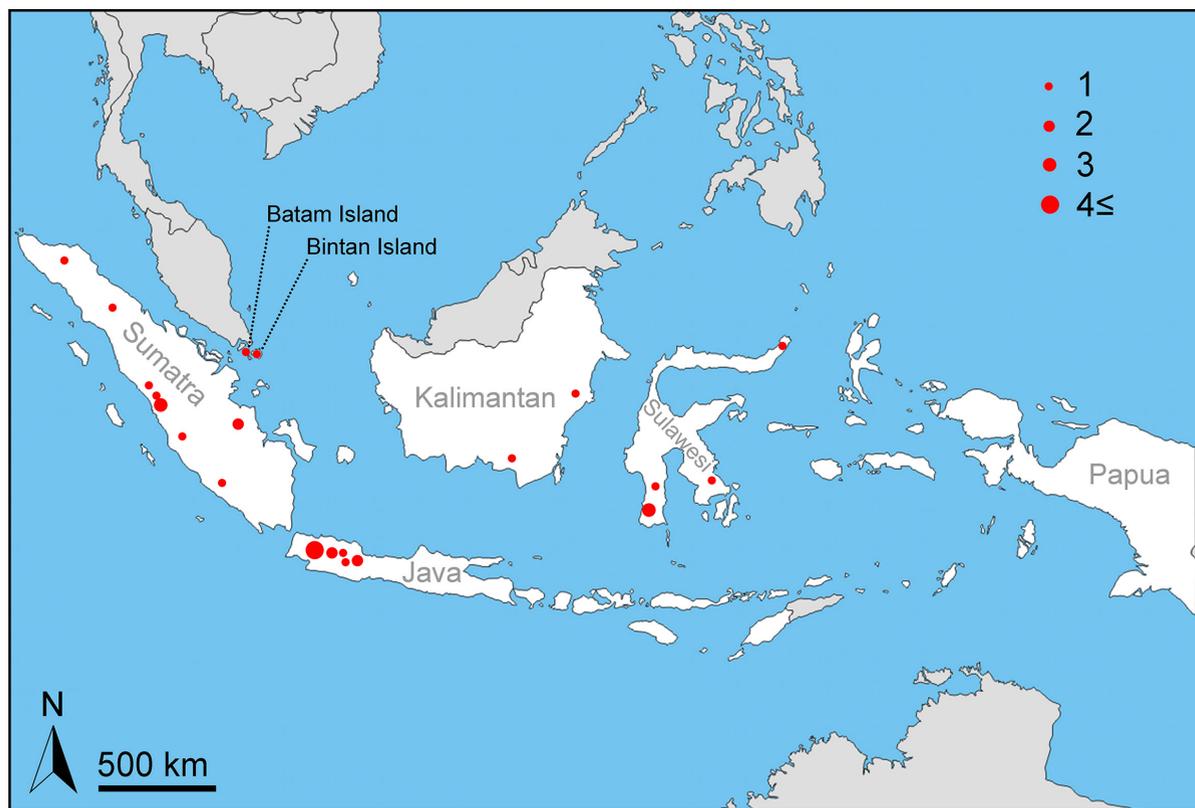


Figure 1. Map of Indonesia showing localities where *Cherax quadricarinatus* was recorded. Circles of different sizes represent different number of sites sampled at each locality.

The introduction history of *C. quadricarinatus* in Indonesia is not well known. Edgerton (2005) noted that *C. quadricarinatus* was imported into Indonesia for the establishment of aquaculture industries in 2003. The species performed well and has increased in popularity for human consumption in the country (Patoka et al. 2016). Moreover, Indonesia has been identified as one of the leading exporters of ornamental crayfish, especially of the genus *Cherax* (Patoka et al. 2015). The production of *C. quadricarinatus* for ornamental purposes has also been recorded there (Patoka et al. 2016). Nevertheless, information about the methods of farming and harvesting in this region remains anecdotal and detailed monitoring is lacking.

Based on climate matching between its native range and the entire Indonesian territory, this species has been predicted to have a high potential to become established when introduced to different parts of Indonesia (Patoka et al. 2016). *Cherax quadricarinatus* is a relatively large and highly fecund species (Jones et al. 2000), known to be a successful invader in warm climatic conditions. Its spread and associated potential negative consequences

to native Indonesian crustaceans including shrimps, crabs and other freshwater biota can be expected. A possible reflection of such negative impact may already be observed at Lido Lake, Java, where the occurrence of *C. quadricarinatus*, together with the invasive shrimp *Macrobrachium lanchesteri* (de Man, 1911), has resulted in the decline and eventual extirpation of the native shrimp *M. sintangense* (de Man, 1898) (Aprila, Wowor and Farajallah, unpubl. data).

Because there are no effective legislative measures against non-native crayfish introductions in Indonesia (Jerikho R., unpubl. data), *C. quadricarinatus* is probably already found in different areas of the country and further spread to new localities is likely. This is a highly alarming scenario, given the region contains prominent global biodiversity hotspots, such as Sundaland and Wallacea (Myers et al. 2000). This study aimed to investigate the current distribution of *C. quadricarinatus* in several Indonesian islands, with the associated goal of providing a starting point for future management actions to be implemented.



Figure 2. Net cages used for culture of ornamental fish and crayfish in Kemang Lake, Java. Photo by Martin Bláha

Methods

From June 2016 to August 2017, selected localities within Indonesia were surveyed to ascertain the presence of *C. quadricarinatus*. Sampling localities were selected based on information provided by local people about crayfish occurrence and cultivation: sampling was only performed at localities where crayfish presence was suspected (Supplementary material Table S1). Crayfish were collected at each locality during one night sampling events, with use of bamboo and/or foldable net traps, baited with fish and gastropod meat. The number of traps varied between collecting events, but up to ten traps were used per locality within one night captures. Identification of captured crayfish was based on morphological characteristics according to Holthuis (1949) and Souty-Grosset et al. (2006).

Results

Populations of *C. quadricarinatus* were found in all surveyed waterbodies in Batam and Bintan Islands (Riau Archipelago), Java, Kalimantan (Borneo),



Figure 3. Ovigerous female of *Cherax quadricarinatus* captured in Cirata Reservoir, Java. Photo by Yusli Wardiatno.

Sulawesi, and Sumatra (Figure 1). *Cherax quadricarinatus* was recorded from one locality in Batam Island, one locality in Bintan Island, 13 localities in Java, two localities in Kalimantan, six localities in Sulawesi and 12 localities in Sumatra. Crayfish were captured in many different habitat types, including natural lakes and rivers, and also artificial ponds and reservoirs (Table S1, Figure 2). Crayfish were found in very high abundances at all sampling localities, usually in numbers well above hundreds of adults. Subadult individuals, as well as ovigerous females (Figure 3), the latter often caught by locals using submerged bamboo traps, were found in all populations.

Discussion

In addition to previous records from Cilala and Lido Lakes, Java (Patoka et al. 2016), we here report the presence of 35 populations of *C. quadricarinatus* widespread within the Indonesian territory, outside its native range. These populations are assumed to be established in the area given the presence of subadults, ovigerous females and the long-term cultivation history of redclaws in the surveyed localities. This validates the prediction (Patoka et al. 2016), of high potential for this crayfish to establish and spread in Indonesian territory.

Edgerton (2005) noted that *C. quadricarinatus* was imported into Indonesia in 2003 for the establishment of aquaculture industries. However, based on information obtained from local people, the crayfish in Kemang Lake, Java, were already cultivated for the pet trade in net cages in 2002 (Figure 2), having escaped from the facility the same year.

Cherax quadricarinatus is also commonly advertised for trade as an ornamental animal in local pet shops in Jakarta and Bogor, Java, being offered under the general local name “lobster air tawar” (freshwater crayfish) and, in one case, under the misnomer *C. albertisii*. Based on information from pet shop owners, the traded crayfish originates from Kemang Lake.

The only national regulation on aquatic non-native species in Indonesia is Regulation No. 41/PERMEN-KP/2014, which bans the import of 152 selected non-native fish. In this law, fishes are defined as “all types of organisms in which all or part of their life cycle is in an aquatic environment”. Only four species of crayfish are listed and banned: *Faxonius rusticus* (Girard, 1852) [previously known as *Orconectes rusticus*], *F. virilis* (Hagen, 1870) [previously known as *Orconectes virilis*], *Pacifastacus leniusculus* (Dana, 1852) and *Procambarus clarkii* (Girard, 1852).

It is clear that *C. quadricarinatus* is popular for exploitation in Indonesia and, because release of this crayfish species into the wild is not illegal in the country, more and more waterbodies will probably be used for its culture. As a consequence, more unintentional escapes can be expected. Local people have very poor knowledge of the risks of invasive species (Patoka J., pers. obs. 2017). As eradication of established crayfish populations is practically impossible, further education of the general public seems crucial for prevention of new introductions of redclaws and other exotic crayfish species in the area. Therefore, active measures implemented by wildlife managers and national policymakers are urgently and strongly recommended to address this crayfish invasion.

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Supplementary material

The following supplementary material is available for this article:

Table S1. Populations of *Cherax quadricarinatus* sampled in Indonesia.

This material is available as part of online article from:

http://www.reabic.net/journals/bir/2018/Supplements/BIR_2018_Patoka_et_al_Table_S1.xlsx