

Freshwater crabs of Vietnam: diversity and conservation

Cua nước ngọt ở Việt Nam: đa dạng và bảo tồn

Review paper

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The freshwater crab fauna of Vietnam has a high diversity and endemism, 49 species have been recorded and 42 of them are only known from this country. In addition, many species are undescribed or undiscovered while at least 10% of known species are facing extinction. Water pollution, urban, industrial and agricultural development, habitat loss and fragmentation, deforestation and overexploitation are the main threats to this fauna. The first conservation recommendation is keeping rain forest tracts large enough to maintain habitat and water quality for long-term survival of these crabs. More research on taxonomy, distribution, population dynamics, main pressures, conservation status are needed in order to assess conservation status and create efficient conservation actions for freshwater crabs in Vietnam.

Khu hệ cua nước ngọt ở Việt Nam có mức độ đa dạng và đặc hữu cao với 49 loài đã được ghi nhận, trong đó có tới 42 loài chỉ được biết đến ở Việt Nam. Ngoài ra, nhiều loài cua nước ngọt còn chưa được mô tả hay chưa được khám phá, trong khi có tới 10% trong tổng số loài đã biết đang phải đối mặt với nguy cơ tuyệt chủng. Ô nhiễm môi trường nước, đô thị hóa, phát triển công nghiệp và nông nghiệp, nơi sống bị phân mảnh và mất, phá rừng cùng với khai thác quá mức là những mối đe dọa chính đối với khu hệ này. Công tác bảo tồn trước hết phải giữ cho diện tích rừng đủ lớn để duy trì chất lượng môi trường sống cho sự tồn tại lâu dài của các loài của này. Các nghiên cứu về phân loại học, phân bố, động lực quần thể là rất cần thiết để đánh giá tình trạng bảo tồn và đưa ra những hành động bảo tồn hiệu quả cho các loài cua nước ngọt ở Việt Nam.

Keywords: freshwater crab, Vietnam, diversity, conservation

1. Introduction

Freshwater crabs are among the most important invertebrates inhabiting Asian inland waters. These large and conspicuous crustaceans are present in almost all freshwater habitats from mountain streams to large lowland rivers and smaller water bodies (Yeo et al. 2008).

The first study of freshwater crabs in Vietnam began in the nineteenth century. In 1869, A. M. Edwards described a new species *Thelphusa longipes* in Con Dao Island. In 1904, De Man published the survey results of the Pavie team on freshwater shrimp and crabs in Indochina, Thailand, Myanmar, and Malaysia (Mission Pavie - III, 1904), with 28 species freshwater crustaceans, including 3 crab species (*Parathelphusa sinensis*, *Potamon longipes*, *P. cochinchinensis*). The results are considered the first data on freshwater crabs in this region. The number of species

of freshwater crabs found in Vietnam has grown steadily and was revised by studies of both Vietnamese and foreign scientists (Milne-Edwards (1869), De Man (1898, 1904), Rathbun (1902, 1904, 1905), Balss (1914), Kemp (1923), Dang (1967, 1975, 1995), Bott (1966, 1967, 1968a,b, 1970), Tuerkay and Naiyanetr (1987), Dang and Tran (1992), Dai (1995), Ng and Kosuge (1995), Ng (1996), Yeo and Ng (1998), Yeo & Quynh (1999), Yeo and Ng (1998a,b, 2003, 2005, 2007), Dang and Ho (2001, 2002, 2003, 2005, 2007, 2008), Ng and Yeo (2001, 2005), Yeo and Naruse (2007), Yeo (2010), Naruse et al. (2011), Shih and Do (2014)).

Most recently, in the monograph 'Freshwater shrimps and crabs in Vietnam (Palaemonidae, Atyidae, Parathelphusidae, Potamidae)', Dang and Ho (2012) published a list of 34 freshwater crab species from Vietnam. The authors included freshwater crab species that have been recorded in Vietnam to the present time, as well as discussing the

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taxonomy of this group in Vietnam. However, due to lack of specimens and data, these authors did not include many species that were described from Vietnam.

In general, the studies of freshwater crabs in Vietnam are limited, the available data does not fully reflect the diversity of freshwater crabs in this country, the information about the species is deficient and their taxonomy is out of date. In the past few decades, the degradation and pollution of the environment has placed many species of Vietnamese freshwater crabs in threatened status.

The main objectives of this project are to give an updated list of freshwater crabs which have been recorded in Vietnam, their conservation status and threats. Finally, to provide suggestions for the needed research and conservation methods for this group.

2. Diversity of freshwater crabs in Vietnam

Considering carefully all previous studies on freshwater crab of Vietnam, we have recorded 49 species of freshwater crab in Vietnam. They belong to 21 genera and two families: Gecarcinucidae (13 species) and Potamidae (36 species) (Table 1). The genera *Indochinamon* (9 species) and *Somanniathelphusa* (7 species) have a large number of species and need to be revised.

Compared with other countries in the Indo-Burma region (Vietnam, Thailand, Lao Peoples Democratic Republic, Cambodia and eastern part of Myanmar), the diversity of freshwater crab of Vietnam can be considered quite high and ranked only after Thailand with 107 species (Cumberlidge et al. 2012). Biodiversity of freshwater crabs and other organism is in relation to diversity of landscapes. Vietnam has floodplains, swamps, lakes, large lakes, moist forests, rivers, highlands and mountain (including limestone mountain) systems, etc. provide good habitats for many freshwater crab species.

Yeo and Ng (1999) used Thailand as a reference for estimating the number of freshwater crab species of Indochi-

na by a formula (1.8×10^{-4} species/km²). Based on this formula, we estimated that Vietnam (with an area of 331698 km²) should have about 60 species of freshwater crab. Thereby, the number of undiscovered species of Vietnam is still high. Indeed, at least 6 undescribed freshwater crab species are in our collection, deposited at Institute of Ecology and Biological Resources (IEBR).

The freshwater crabs of the Indo-Burma hotspot are highly endemic at the country level –92% of the potamid species, and 76% of the gecarcinucid species endemic (Yeo et al. 2008, Cumberlidge et al. 2009). The number of endemic species of Vietnam is 42 species (86%), and the remaining species (7 species) are only distributed in a few neighbouring countries (China, Thailand, Laos and Cambodia) (Table 1). This calculation showed the level of endemic freshwater crabs of Vietnam is expected to be very high. Freshwater crabs have high levels of endemism because of their life history characteristics of low fecundity, direct development and low vagility. They are endemic to their respective zoogeographical regions and are considered restricted in their distribution (Cox, 2001). Many freshwater crab species are found in only a few mountain areas of Vietnam and the distribution range estimated less than 20000 km² such as *Kukrimon cucphuongense*, *Nemoron nomas*, *Tiwaripotamon edostilus* (Figure 1) and other species in this genus.



Figure 1. *Tiwaripotamon edostilus* from Cat Ba island, Vietnam

Table 1. The list of freshwater crabs of Vietnam and their conservation status and distribution (VU: Vulnerable; LR: Lower Risk; DD: Data Deficient; -: have not yet evaluation in IUCN Red List or Vietnam Red Data Book)

N ^o	Taxon	Red	IUCN Red	Distribution
		Data Book of Vietnam (2007)		
1. GECARCINUCIDAE				
1	<i>Esanthelphusa dugasti</i> (Rathbun, 1902)		LC	Vietnam, Laos, Thailand
2	<i>Esanthelphusa prolatus</i> (Rathbun, 1902)		DD	Vietnam
3	<i>Guinothusa beauvoisi</i> (Rathbun, 1902)		DD	Vietnam
4	<i>Guinothusa harmandi</i> (Rathbun, 1902)		DD	Vietnam
5	<i>Mekhongthelphusa brandti</i> (Bott, 1968)		LC	Vietnam, Thailand
6	<i>Mekhongthelphusa neisi</i> (Rathbun, 1902)		DD	Vietnam

N ^o	Taxon	Red Data Book of Vietnam (2007)	IUCN Red List 2011	Distribution
7	<i>Sayamia germaini</i> (Rathbun, 1902)		LC	Vietnam, Thailand, Cambodia
8	<i>Somanniathelphusa dangi</i> Yeo & Quynh, 1999		LC	Vietnam
9	<i>Somanniathelphusa kyphuensis</i> Dang, 1995		DD	Vietnam
10	<i>Somanniathelphusa pax</i> Ng & Kosuge, 1995		LC	Vietnam
11	<i>Somanniathelphusa plicatus</i> (Fabricus, 1798)		DD	Vietnam
12	<i>Somanniathelphusa sinensis</i> (H. Milne-Edwards, 1853)		DD	Vietnam, China
13	<i>Somanniathelphusa triangularis</i> Dang & Hai, 2005		DD	Vietnam
2. POTAMIDAE				
14	<i>Balssipotamon fruhstorferi</i> (Balss, 1914)	VU	DD	Vietnam
15	<i>Balssipotamon ungulatum</i> (Dang & Ho, 2003)		DD	Vietnam
16	<i>Dalatomon laevior</i> (Kemp, 1923)		DD	Vietnam
17	<i>Dalatomon loxophrys</i> (Kemp, 1923)		DD	Vietnam
18	<i>Donopotamon haii</i> Dang & Hai, 2005		LC	Vietnam, Laos
19	<i>Dromothelphusa longipes</i> (A. Milne-Edwards, 1869)		DD	Vietnam
20	<i>Eosamon brousmichei</i> (Rathbun, 1904)		DD	Vietnam
21	<i>Hainanpotamon auriculatum</i> Yeo & Naruse, 2007		DD	Vietnam
22	<i>Hainanpotamon glabrum</i> (Dang, 1967)		LC	Vietnam
23	<i>Hainanpotamon rubrum</i> Dang & Tran, 1992		LC	Vietnam
24	<i>Indochinamon bavi</i> Naruse, Nguyen & Yeo, 2011		-	Vietnam
25	<i>Indochinamon cua</i> (Yeo & Ng, 1998)		VU	Vietnam
26	<i>Indochinamon dangi</i> Naruse, Nguyen & Yeo, 2011		-	Vietnam
27	<i>Indochinamon jinpingense</i> (Dai, 1995)		DD	Vietnam, China
28	<i>Indochinamon kimboiense</i> (Dang, 1975)	VU	DD	Vietnam
29	<i>Indochinamon mieni</i> (Dang, 1967)		VU	Vietnam
30	<i>Indochinamon orleansi</i> (Rathbun, 1904)		DD	Vietnam
31	<i>Indochinamon phongnha</i> Naruse, Nguyen & Yeo, 2011		-	Vietnam
32	<i>Indochinamon tannanti</i> (Rathbun, 1904)	VU	DD	Vietnam, China
33	<i>Kukrimon cucphuongense</i> (Dang, 1975)	LR	DD	Vietnam
34	<i>Laevimon kottelati</i> Yeo and Ng, 2005		DD	Vietnam
35	<i>Laevimon tankiense</i> (Dang & Tran, 1992)		DD	Vietnam
36	<i>Larnaudia larnaudii</i> (A. Milne-Edwards, 1869)		DD	Vietnam
37	<i>Nemoron nomas</i> Ng, 1996		VU	Vietnam
38	<i>Neolarnaudia botti</i> Tuerkay & Naiyanetr, 1987		DD	Vietnam
39	<i>Neolarnaudia phymatodes</i> (Kemp, 1923)		DD	Vietnam
40	<i>Planumon cochinchinense</i> (De Man, 1898)		DD	Vietnam
41	<i>Tiwaripotamon annamense</i> (Balss, 1914)	VU	LC	Vietnam
42	<i>Tiwaripotamon araneum</i> (Rathbun, 1904)		DD	Vietnam
43	<i>Tiwaripotamon edostilus</i> Ng & Yeo, 2001		VU	Vietnam
44	<i>Tiwaripotamon vietnamicum</i> Dang & Ho, 2002		DD	Vietnam
45	<i>Tiwaripotamon vixuyenense</i> Shih & Do, 2014		-	Vietnam
46	<i>Vietopotamon aluoiense</i> Dang & Ho, 2002		DD	Vietnam
47	<i>Vilopotamon klossianum</i> (Kemp, 1923)		DD	Vietnam
48	<i>Vilopotamon sphaeridium</i> (Kemp, 1923)		DD	Vietnam
49	<i>Vilopotamon thaii</i> Dang & Ho, 2003		-	Vietnam

3. Conservation status

In the Vietnam Red Book (2007), 5 species of freshwater crab, account for 10% of all known freshwater crab species in Vietnam, 4 species were assessed as Vulnerable (VU), 1 species assessed as Lower Risk (LR). According to the IUCN Red List 2011, the numbers of threatened freshwater crab species in Vietnam were 4 species (10%), all of them were assessed as VU, 9 species (20%) were assessed as Least Concern (LC) and 31 species (70%) were assessed as Data Deficient (DD). No species of freshwater crabs from Indo-Burma region including Vietnam have been confirmed Extinct (EX) or Extinct in the Wild (EW). However, it should be noted that a species cannot be formally assessed as Extinct until exhaustive surveys have been carried out (Cumberlidge et al. 2012).

In the Indo-Burma region, the results of IUCN's freshwater crab assessment reveal current high levels of threat, with 36% of the assessed extant species for which sufficient data are available considered Threatened. There was insufficient information to assess the status of many species, which were categorized as Data Deficient (DD) due to a lack of specimens, and locality and population data, as the result of insufficient field surveys (Cumberlidge et al. 2009). It is of great concern that in many cases these DD species have not been found in recent years. If all Data Deficient (DD) species also prove to be threatened, the level of threat could be as high as 72% (Cumberlidge et al., 2012).

Recently, our surveys on aquatic fauna throughout the country displayed a strongly decline of distribution range and population size of almost all freshwater crab species. It means that the levels of threat for this group should be much higher than as we know. Hence, it is necessary to have more research to assess exactly the freshwater crab conservation status in the diversity hotspots of Vietnam.

4. Major threats

The present study was prompted by a growing awareness of the true extent of freshwater crab diversity and of the possible threatened status of many narrowly distributed species given the current widespread destruction of tropical forests and aquatic ecosystems (see review in Cumberlidge et al., 2009). Freshwater crab life history characterized by low fecundity, direct development, and low vagility, and niche specialization makes freshwater crabs highly susceptible to anthropogenic activities. While there is no clear evidence that any one species has been driven to extinction as a result, the threats facing many known species are critical. The main threats to freshwater crabs are deforestation, urban, industrial, agricultural development, aquatic habitat loss and water quality degradation and pollution (Cumberlidge et al. 2012). Besides, overexploitation should be also considered as most impacted factor for the decline of species of Gecarcinucid crabs because they are one of main protein sources for Vietnamese daily living. Moreover, when Gecarcinucid crabs become fewer, people start to catch other freshwater crab

species for human consumption such as *Indochinamon* species.

5. Research actions required

Although Vietnam has a high aquatic biodiversity and high level of endemism of the freshwater fauna, the study of them is quite limited. There are still many new species yet to be described and many taxonomic issues are still unresolved. Moreover, data on the distribution, status, biology and ecology of freshwater crab species recorded in Vietnam is very limited. Several species are known only through the original description from the 19th century, and some species are known from only a few specimens obtained in a few random sampling locations. Additionally, specimen collections of freshwater crabs currently lack adequate specimens of many species.

There is a need for further surveys to discover new species, refine species distributions, define specific habitat requirements, describe population levels and trends, assess status, identify specific threats to Vietnam's freshwater crab fauna and suggest conservation methods and conservation areas (Cumberlidge et al., 2012).

6. Conservation recommendations

The rapid development of socio-economic pollution and destruction of the aquatic environment along with the overexploitation of fisheries resources has affected aquatic diversity in general as well as freshwater crabs in Vietnam. The population size of freshwater crabs living in the plains (like *Esanthelphusa*, *Somanniathelphusa*) fell significantly, some species are being bred in ponds to meet the needs of the people. Although no species of freshwater crab of Vietnam were ranked as Endangered in IUCN Red List and also in Vietnam Red Book, but the conservation measures for this species group are actually needed by high levels of endemism and restricted range of them. Restricted ranges of most species of freshwater crab will be the major issue for conservation. While a handful of freshwater crab species (belonging to Gecarcinucidae) living in the plains, in the rice fields and rivers have the ability to adapt and are more resistant to the changing environment, the majority of crabs in other freshwater habitats requires relatively clean and less disturbed waters. Thus, the conservation of freshwater crabs is to keep the natural forest area large enough to maintain good water quality for rivers and headwater streams.

The restricted range of many species, together with the on-going human-induced loss of habitat in many parts of the region, are primary causes of concern for the long-term survival of this fauna. Asia's freshwater crabs have a high degree of endemism with many species living in specialised habitats such as river rapids, lowland marshes, forested highlands, and islands. Additional research is recommended to determine the minimum effective size and design of protected areas for freshwater species such as crabs (Cumberlidge et al., 2012).

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