CONSERVATION ASSESSMENT PRACTICE – A CASE STUDY OF THE BORNEAN GIANT FRESHWATER CRAB, ISOLAPOTAMON BAUNENSE NG, 1987 FROM SOUTHWESTERN SARAWAK

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Abstract

The conservation of freshwater crabs in Borneo is important as they have a significant role in the rainforest ecosystem and a key indicator for habitat health. Borneo island has a high diversity of freshwater crab species and to date, 85 species have been described. All are endemic to the island, with some species being rare and occurring only in very small ranges. While taxonomic studies of freshwater crabs in the region are ongoing, the threat to these animals is currently of great concern, especially due to accelerating habitat destruction, increased pollution and climate change impacts. The conservation assessment of global freshwater crabs shows the invertebrates are one of the most endangered aquatic animals. Biodiversity conservation efforts in the region, however, have not sufficiently focused on these invertebrates, and this is partly due to insufficient baseline data to support drafting an effective conservation policy. Several Bornean species are categorized in the IUCN Red List as endangered and vulnerable. The IUCN list does not accurately reflect the actual situation on the ground because there is a lack of key data. This paper shows a case study of the conservation assessment practice of the giant freshwater crab, Isolapotamon bauense, in Sarawak. The species was first recorded from limestone in Bau in 1903 but was only described more than 80 years later. Collections have indicated that the population of the crab is relatively small with a narrow geographical area of occurrence. Therefore, the first conservation assessment in 2008 categorized the species as vulnerable because its known habitats are not protected and are currently under threat by land-use activities. Ongoing population monitoring studies have indicated that the distribution of the crab includes protected areas, and in the process, we have data on some ecological characteristics of the crabs include sex ratio, growth pattern, population size, and density. Local people also consume the crab and occasionally harvest the resource without any management strategy. Thus, we conducted a nutrient contents analysis of the crab meat. The result of the study suggests that harvesting wild I. bauense as a source of protein supplement is not practical because of its relatively low population, and negative impacts for the forest ecology. Our recent experiments on the fecundity and breeding show that the success rate of captive breeding is low with the fecundity and hatching rate low, with
females only producing between 26 and 81 eggs. The gestation period is considered long for an invertebrate, ranging from 36 and 45 days. All the ecological and biological data suggest that the conservation status of *Isolapotamon bauense* in the IUCN Red List needs to be revised. We propose that the conservation of Sarawak’s biodiversity under the Wildlife Protection Ordinance 1998 may need to incorporate the IUCN Red List, especially for threatened freshwater crab species.

**Keywords:** Brachyura, limestone, IUCN, Borneo, conservation
Introduction

Conservation assessment is a systematic protocol to determine the probability of a species will go extinct in the natural habitats in the near future. The assessment is systematically managed by the International Union for Conservation of Nature of which it may implement at global or national scale (DWNP, 2010; IUCN Standards and Petitions Committee, 2022). Accordingly, the assessment defines nine distinct categories or conservation status of organisms on the basis of five quantitative criteria: (1) population size reduction (past, present and/or projected), (2) geographic range size, and fragmentation, decline or fluctuations, (3) small population size and fragmentation, decline, or fluctuations, (4) very small population or very restricted distribution, (5) quantitative analysis of extinction risk (population viability analysis). To date, 142,577 species of plants and animals have been assessed and categorised among nine conservation status, namely Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD) and Not Evaluated (NE) that published on website of IUCN Red List of Threatened Species (www.iucnredlist.org). The conservation status of a given species published by the IUCN serves as useful data for effective conservation strategies, where the reconciliation between conservation and sustainable development can be achieved (Hayward, 2011; Grinang et al., 2017). The data are crucial and widely used in environmental impact assessment as basis for assessing potential biodiversity threats from proposed development projects (Meynell, 2005; Susie, 2019). For example, an environmental impact assessment of a proposed project in Malaysia is required to identify conservation status of species based on the IUCN Red List along with potential mitigation measures to minimise impact of the project on the species concern (Department of Environment, 2017).

The conservation assessment of global freshwater crabs shows the invertebrates are one of the most endangered aquatic animals. Over 1,300 species of freshwater crabs had been described globally of which conservation status of 1,280 species have been assessed and published in the IUCN Red List (Cumberlidge et al., 2009). The assessment shows one-sixth of the total species have been predicted to be threatened with extinction, as a result of habitat loss and environmental pollution (Yeo et al., 2008; Cumberlidge et al., 2009). Several Bornean crab species are categorized in the IUCN
Red List as endangered and vulnerable. However, the IUCN list does not accurately reflect the actual situation on the ground because insufficient of key data.

Biodiversity conservation efforts in Borneo have not sufficiently focused on freshwater crabs, and this is partly due to insufficient baseline data to support drafting an effective conservation policy. Wildlife protection laws have been respectively made for each Kalimantan (i.e., Conservation Act Law 1990), Brunei (i.e., Wildlife Protection Act 1978), Sabah (i.e., Wildlife Conservation Enactment 1997) and Sarawak (i.e., Wildlife Protection Ordinance 1998) to conserve their biological diversity. However, the laws emphasize the protection of species without a statistical analysis of biological and ecological characteristics of the species. For instance, the category of species protection in Sarawak Wildlife Protection Ordinance 1998 is solely based on the pressure from hunting and wildlife trading (Wildlife Conservation Society & Forest Department Sarawak, 1996), whereas data of geographic range size and population size reduction of a species are not available. This implies less protection priority has been given to species that are no or less pressure from hunting and wildlife trading activities. In fact, the perception that protection of other species is depending on the establishment of totally protected areas. Therefore, more than two million hectares of primary forests had been gazetted across the State for in-situ conservation purpose, comprise 47 national parks, five wildlife sanctuaries and 15 nature reserves. More than 150 species of animals are categorized as Protected or Totally Protected in the Ordinance some of which are also listed in the IUCN Red List of Threatened Species. Of the total 51 known species of Sarawak freshwater crabs, six species are categorised as endangered or vulnerable, but none of the species is listed in Wildlife Protection Ordinance. Lack of coherent of conservation status between IUCN Red List, and Wildlife Protection Ordinance is a challenge in conserving those species effectively. This paper demonstrates a case study of conservation assessment practice of the giant freshwater crab, *Isolapotamon bauense* in Sarawak based on available data and following of the guideline of IUCN.

**Materials and Methods**

The IUCN conservation assessment of *Isolapotamon bauense* in 2008 had categorised the species as vulnerable (Esser & Cumberlidge, 2008). This present assessment used
metadata from IUCN website (NatureServe & IUCN, 2019) and incorporate with current information of the crab such as distribution, ecological and biological parameters (Figures 1 & 2). The quantitative criteria of IUCN conservation assessment such as extent of occurrence, area of occurrence, and population size reduction were applied to evaluate the status of the species. Historical records of distribution of Bornean freshwater crabs along with current sites surveyed were used to produce the geographical distribution of the species and the exercise was done using QGIS Version 3.20 (Grinang, 2016; QGIS Development Team, 2020). Since the species is not tolerate to salt water, the estimated highest tidal level of rivers was used as the limiting distribution range of the species towards the coastal habitats. Similarly, the known home range of the species was used to predict extent of occurrence of the species, whereby it is anticipated that the distribution is not extend beyond the river basin where its population was identified (Grinang, 2014; 2016; Grinang et al., 2016). Other information also incorporated in the assessment include captive breeding, and nutritional content of the species in relation to the resource harvesting by local people (Grinang et a., 2017; Abit et al., 2020; Abit et al., in press).

Results and Discussion

The freshwater crabs of Borneo are currently represented by 85 species, while more than 280 species have been statistically estimated for the island (Grinang, 2016; Ng et al., 2008). None of the species is listed in the protection laws in all four regions (i.e., Kalimantan, Brunei, Sabah and Sarawak). However, the conservation assessment of the IUCN categorised eight Bornean crab species as endangered or vulnerable. Others are categorised either least concerned or data deficient mainly due to lack of ecological data of the species. Of the total 51 species of Sarawak crabs, four species are categorised as endangered (i.e., *Ibanum pilimanus*, *Lepidothelphusa cognettii*, *Thelphusula cristicervix*, *Terrathelphusa kuchingensis*) and two species are listed as vulnerable (i.e., *Isolapotamon bauense*, *Stygothelphusa bidiensis*) (Esser & Cumberlidge, 2008).

The first IUCN conservation assessment of global freshwater crabs was made in 2008 some of which may require reassessment as more ecological data of few species are made available. In particular for this exercise, we focused on *Isolapotamon bauense* because of our close monitoring of the population of the crab since it was first assessed,
as well as some ecological and biological data are available. *Isolapotamon bauense* was first recorded from limestone in Bau, Sarawak in 1903 but was only described more than 80 years later (see Ng, 1987). *Isolapotamon bauense* has been regarded as the largest freshwater crab in Southeast Asia (Abit et al., 2022) and it is endemic to Sarawak. The earlier collections have indicated that the population of the crab is relatively small with a narrow geographical area of occurrence. Therefore, the earlier conservation assessment categorized the species as vulnerable because its known habitats are not protected and are currently under threat by land-use activities. A continuous monitoring of population of the species showed that the distribution of the crab includes protected areas that are gazetted lately (Figure 3). By incorporating all available data, the extent of occurrence of *I. bauense* should covers southwestern of Sarawak that confine to isolated sandstone and limestone habitats (Figure 3). Some ecological characteristics of the crabs such as sex ratio, growth pattern, population size, and density have implied the population crab was in good state (Grinang, 2014; Grinang et al., 2016; 2017). Local people consume the crab and occasionally harvest the resource without any management strategy (see Grinang, 2014). Therefore, nutrient contents analysis of the crab meat was done to evaluate the importance between conservation of the species and crab resource harvesting regarding protein requirement. The result of the study suggests that harvesting wild *I. bauense* as a source of protein supplement is not practical because of its relatively low population, and negative impacts for the forest ecology (Grinang et al., 2017). In addition, recent experiments on the fecundity and breeding show that the success rate of captive breeding is low with the fecundity and hatching rate low, with females only producing between 26 and 81 eggs (Abit et al., 2020). The gestation period is considered long for an invertebrate, ranging from 36 and 45 days (Abit et al., *in press*). These findings might have implied that the species is not a potential species for aquaculture industry. Nonetheless, the study shows that captive breeding of the species for conservation purpose is possible (Abit et al., 2020; Abit et al., *in press*). The current ecological and biological data suggest that the conservation status of *Isolapotamon bauense* in the IUCN Red List needs to be revised. It is also important to incorporate the conservation of Sarawak’s biodiversity under the Wildlife Protection Ordinance 1998 with the IUCN Red List, especially for threatened freshwater crab species.
Conclusion

Effective conservation of a freshwater crab in Borneo is very challenging because conservation assessment at international level (i.e., IUCN Red List of Threatened Species) and national wildlife conservation laws are less coherent. This case study of giant freshwater crab shows the conservation status of the species is much in concern at international level, but it is not protected at the national level. Should the national conservation laws follow the IUCN protocols or vice versa, this may be necessary to be discussed in the near future for a more uniform and effective conservation exercises.

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References


Figures and Tables

Figure 1. Exploration of Bornean freshwater crabs based on records extracted from literatures and present fieldwork.

Figure 2. Distribution range of *Isolapotamon bauense* estimated in 2008 (sensu Esser & Cumberlidge, 2008).
Figure 3. Present assessment of occurrence and distribution range of *Isolapotamon bauense*.