Oceanography & Fisheries
Open access Journal
ISSN: 2476-0536

Juniper Publishers
key to the Researchers

Review Article
Volume 12 Issue 3 - August 2020
DOI: 10.19080/OFOAJ.2020.12.555836

Oceanogr Fish Open Access J

An Overview of the Freshwater Crabs (Brachyura: Gecarcinucidae) of the Western Ghats, India

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Submission: July 07, 2020; **Published**: August 25, 2020

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Abstract

The Western Ghats has been well studied for freshwater crabs among the regions of the Indian subcontinent. Several studies on the Western Ghats crabs notwithstanding, their actual diversity is still incompletely known. The previous data on their diversity seems to be erroneous. The freshwater crabs of the Western Ghats are revisited to update the information on their diversity, distribution, endemism, and conservation, which include 888 locality records from 46 publications. The updated data comprises 62 crab species in 18 genera of the family Gecarcinucidae, including recognition of two new records from the Western Ghats: *Oziotelphusa biloba* and *Oziotelphusa ravi*. The Western Ghats crabs contribute nearly half the diversity of the Indian freshwater crabs and more than two-thirds the diversity of the Indian gecarcinucid crabs. Nearly two-thirds crab species of the Western Ghats have been reported during the last two decades. The Southern Western Ghats is relatively rich in crab diversity as compared to the Northern- and Central Western Ghats. Nearly one-third crab species of the Western Ghats are found above the average elevation and seven species above 2000 m altitude. Among the crab genera of the Western Ghats, *Sahyadriana* is the most species-rich followed by *Ghatiana*, *Vanni*, and *Travancoriana*. Although the Western Ghats crabs possess high-level endemism (67% endemic genera and 82% endemic species), only two species have been considered as 'Vulnerable' and seven species as 'Least Concern' by the International Union for Conservation of Nature; the remaining species are either 'Data Deficient' or not assessed yet.

Kewords: Review; Crustacea; Decapoda; Diversity; Distribution; Endemism; Conservation; New Record

Introduction

The Western Ghats is a long stretch (1600 km) of mountain ranges running parallel to the western coast of the Indian peninsula in the states of Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala (Figure 1). The peak of the Western Ghats is located at Anamudi of Kerala (2695 m above sea level). Some mountains are situated at lower elevations but fall within the limits of the Western Ghats. The Western Ghats is divided into three parts viz., 1) Northern Western Ghats (from Tapi valley to Goa); 2) Central Western Ghats (south of Goa-Nilgiris); and 3) Southern Western Ghats (south of Palghat gap) [1]. The Western Ghats along with Sri Lanka is one of the "hottest hotspots" and rich in faunal diversity [2,3]. The Western Ghats of India is home to many freshwater animals, including decapod crustaceans [4,5].

Freshwater crabs are the decapod crustaceans, which play a significant ecological role in tropical freshwater ecosystems besides having economic importance [6,7]. Some species also contribute to small-scale fisheries and aquarium trade [6,7]. These animals recently revealed their high conservation priority [7]. They have also been considered phylogenetically important and biogeographically informative [7,8].

Globally, 1564 species in five families of freshwater crabs are so far known [9]. Among these, 125 species in two families (Gecarcinucidae and Potamidae) are found in India [10-12]. The Western Ghats has gecarcinucid crabs only and previously reported to have 60 species [11]. They occupy a range of freshwater, semi-terrestrial, and terrestrial environments, including cryptic habitats like basalt rocks and phytotelmata [10,14-16]. The level of endemism is surprisingly high among the Western Ghats crabs [5]. This could be due to the isolated mountains that act as a geographical barrier in the form of 'sky islands' [10,14,17]. The freshwater crabs of the Western Ghats are revisited here with an aim to update the information on their diversity, distribution,

endemism, and conservation. Records of the Western Ghats crabs from 888 localities (Figure 1) appeared in 46 publications [10,11,14–57] were analyzed for this review.

Diversity

The previous figure for the crabs of the Western Ghats seems to be erroneous, which shows the presence of 60 species [10,11]. Two species of *Oziotelphusa* (*Oziotelphusa biloba* and *Oziotelphusa ravi*) are found within the limits of the Western Ghats. While *Oziotelphusa biloba* was reported from few localities of Palakkad and Thrissur districts of Kerala [50,53], *Oziotelphusa ravi* has been recently described from a locality in Kanyakumari district of Tamil Nadu [52]. All these localities are clearly situated in the Western Ghats. Although *Oziotelphusa biloba* and *Oziotelphusa ravi* have been reported on earlier occasions, both the species are recognized herein as the new records to the Western Ghats.

The updated data on the freshwater crabs of the Western Ghats revealed the presence of 62 species in 18 genera of the family Gecarcinucidae (Table 1). The Western Ghats crabs possess nearly half the number of Indian genera and species (18/35 genera and 62/125 species) and more than two-thirds the number of the Indian gecarcinucid genera and species (18/24 genera and 62/90 species) [10-12]. The Southern Western Ghats has the highest diversity of freshwater crabs (27 species in 12 genera) followed by the Northern Western Ghats (27 species in 6 genera) and the Central Western Ghats (21 species in 8 genera) (Table 1).

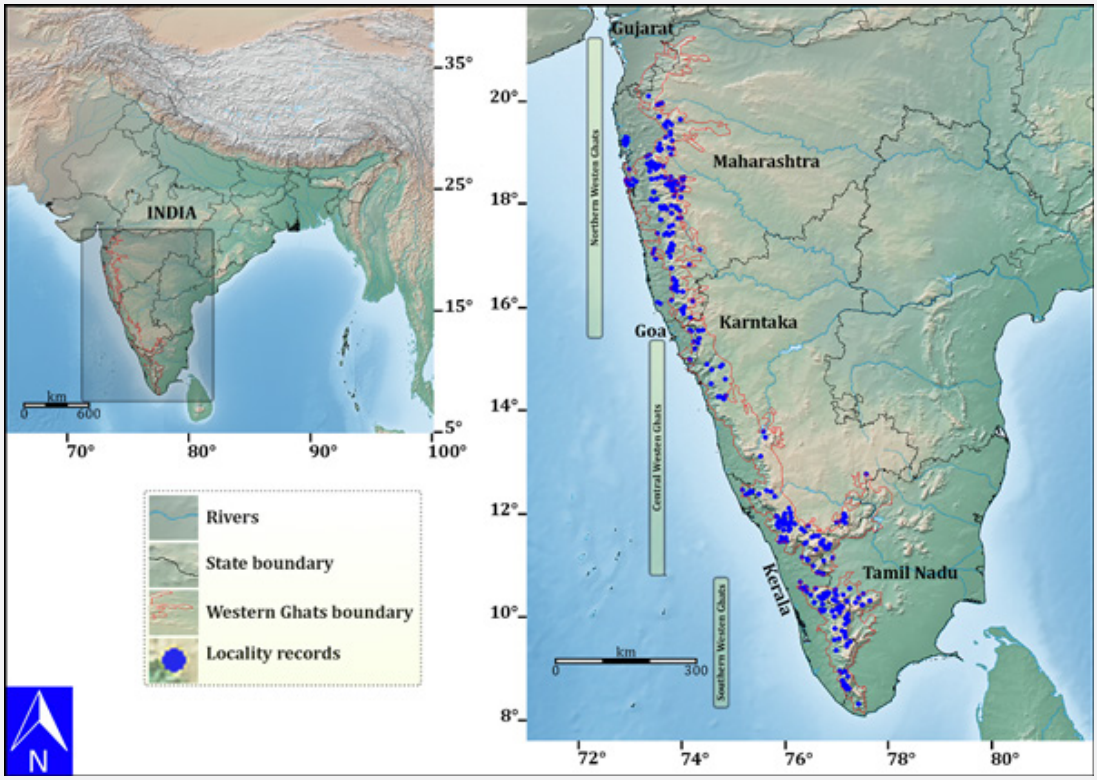

Figure 1: Map of the Western Ghats in India showing the locality records of the freshwater crabs.

The Northern Western Ghats seems to be relatively well studied for the freshwater crabs as far as the genus-species proportion and locality records are concerned (Figure 1). The Central Western Ghats is poorly explored, which is evident from the smaller number of locality records (Figure 1). *Sahyadriana* is the most species-rich genus (10 species) in the Western Ghats followed by *Ghatiana* (8 species), *Vanni* (7 species), and *Travancoriana* (6 species). The remaining genera possess less than five species, with *Inglethelphusa*, *Kani* and *Lamella* are monotypic. All the known species of each genus are found in the Western Ghats except for *Cylindrotelphusa* and *Oziotelphusa* (Figure 2).

The first-ever species recorded from the Western Ghats is currently known as *Barytelphusa cunicularis*, which was originally described as *Thelphusa cunicularis* by J O Westwood in the work of W H Sykes during 1836 [18]. Thereafter, many crab species were described or reported from the Western Ghats [10,11,14-17,19-57], especially during the last two decades that contribute nearly two-thirds of the currently known species (Figure 3).

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Table 1: List of freshwater crabs of the Western Ghats and their distribution.

Species	Distribution					IUCN Red List Status
	NWG	CWG	SWG	Altitudinal range (m ASL)	Endemic to WG	
Genus *Arcithelphusa* Pati & Sudha Devi, 2015	–	+	–	709–864	Yes	
1. *Arcithelphusa cochleariformis* Pati & Sudha Devi, 2015	–	+	–	709–864	Yes	NE
2. *Arcithelphusa tumpikkai* Pati, Sujila & Sudha Devi, 2019	–	+	–	729–860	Yes	NE
Genus *Baratha* Bahir & Yeo, 2007	–	–	+	1160–1290	Yes	
3. *Baratha peena* Bahir & Yeo, 2007	–	–	+	1160–1260	Yes	DD
4. *Baratha pushta* Bahir & Yeo, 2007	–	–	+	1290	Yes	DD
Genus *Barytelphusa* Alcock, 1909	+	+	+	3–2231	No	
5. *Barytelphusa cunicularis* (Westwood in Sykes, 1836)	+	+	+	3–2231	No	LC
6. *Barytelphusa guerini* (H. Milne-Edwards, 1853)	+	–	–	4–1277	No	LC
7. *Barytelphusa mccanni* (Chopra & Das, 1935)	+	+	–	74–1386	No	NE
Genus *Cylindrotelphusa* Alcock, 1909	–	+	+	46–980	No	
8. *Cylindrotelphusa breviphallus* Pati, Rajesh, Raj, Sheeja, Kumar & Sureshan, 2017	–	–	+	920–945	Yes	NE
9. *Cylindrotelphusa steniops* (Alcock, 1909)	–	+	+	46–980	No	LC
Genus *Gecarcinucus* H. Milne Edwards, 1844	+	–	–	82–991	No	
10. *Gecarcinucus edwardsi* Alcock, 1909	+	–	–	302–991	No	DD
11. *Gecarcinucus jacquemontii* H. Milne Edwards, 1844	+	–	–	82–933	No	LC
Genus *Ghatiana* Pati & Sharma, 2014	+	+	–	54–1104	No	
12. *Ghatiana atropurpurea* Pati, Thackeray & Khaire, 2016	+	+	–	54–736	No	NE
13. *Ghatiana aurantiaca* Pati & Sharma, 2014	+	–	–	215–277	Yes	NE
14. *Ghatiana basalticola* (Klaus, Fernandez & Yeo, 2014)	–	+	–	778–852	Yes	NE
15. *Ghatiana botti* Pati & Thackeray, 2018	+	–	–	66–145	Yes	NE
16. *Ghatiana hyacintha* Pati & Sharma, 2014	+	–	–	883–997	Yes	NE
17. *Ghatiana pulchra* Pati & Thackeray, 2018	+	–	–	1104	Yes	NE
18. *Ghatiana rathbunae* Pati & Thackeray, 2018	+	–	–	977	Yes	NE
19. *Ghatiana splendida* Pati, Thackeray & Khaire, 2016	+	–	–	839–853	Yes	NE
Genus *Gubernatoriana* Bott, 1970	+	–	–	306–1386	Yes	
20. *Gubernatoriana gubernatoris* (Alcock, 1909)	+	–	–	1055–1386	Yes	DD
21. *Gubernatoriana longipes* Pati & Thackeray, 2018	+	–	–	687–688	Yes	NE
22. *Gubernatoriana marleshwarensis* Pati & Thackeray, 2018	+	–	–	306	Yes	NE
23. *Gubernatoriana wallacei* Pati & Thackeray, 2018	+	–	–	1051–1075	Yes	NE
Genus *Inglethelphusa* Bott, 1970	+	–	–	800–1272	Yes	
24. *Inglethelphusa fronto* (Alcock, 1909)	+	–	–	800–1272	Yes	DD

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Genus *Kani* Raj & Ng, 2017	–	–	+	372	Yes	
25. *Kani maranjandu* Raj & Ng, 2017	–	–	+	372	Yes	NE
Genus *Karkata* Pati, Rajesh, Raj, Sheeja, Kumar & Sureshan, 2017	–	–	+	43–793	Yes	
26. *Karkata ghanarakta* Pati, Rajesh, Raj, Sheeja, Kumar & Sureshan, 2017	–	–	+	43–555	Yes	NE
27. *Karkata kusumbha* Pati, Rajesh, Raj, Sheeja, Kumar & Sureshan, 2017	–	–	+	793	Yes	NE
Genus *Lamella* Bahir & Yeo, 2007	–	–	+	43–889	No	
28. *Lamella lamellifrons* (Alcock, 1909)	–	–	+	43–889	No	LC
Genus *Oziotelphusa* Müller, 1887	–	+	+	46–839	No	
29. *Oziotelphusa biloba* Bahir & Yeo, 2005	–	+	+	89–145	No	VU
30. *Oziotelphusa* Raj, Kumar & Ng, 2017	–	–	+	46	Yes	NE
31. *Oziotelphusa wagrakarowensis* (Rathbun, 1904)	–	+	–	583–839	No	VU
Genus *Pilarta* Bahir & Yeo, 2007	–	–	+	40–1784	Yes	
32. *Pilarta anuka* Bahir & Yeo, 2007	–	–	+	920–975	Yes	DD
33. *Pilarta aroma* Pati, Rajesh, Raj, Sheeja, Kumar & Sureshan, 2017	–	–	+	1784	Yes	NE
34. *Pilarta punctatissima* Pati, Rajesh, Raj, Sheeja, Kumar & Sureshan, 2017	–	–	+	40–46	Yes	NE
Genus *Sahyadriana* Pati & Thackeray, 2018	+	–	–	12–1319	Yes	
35. *Sahyadriana alcocki* (Pati in Pati et al., 2016)	+	–	–	1082	Yes	NE
36. *Sahyadriana billyarjani* Pati & Thackeray, 2018	+	–	–	499–600	Yes	NE
37. *Sahyadriana pachyphallus* Pati & Thackeray, 2018	+	–	–	493	Yes	NE
38. *Sahyadriana pilosipes* (Alcock, 1909)	+	–	–	1096–1272	Yes	DD
39. *Sahyadriana sahyadriensis* Pati & Thackeray, 2018	+	–	–	12–808	Yes	NE
40. *Sahyadriana tenuiphallus* Pati & Thackeray, 2018	+	–	–	596	Yes	NE
41. *Sahyadriana thackerayi* (Pati in Pati et al., 2016)	+	–	–	499	Yes	NE
42. *Sahyadriana triangulus* (Pati & Sharma, 2014)	+	–	–	1055–1207	Yes	NE
43. *Sahyadriana waghi* (Pati in Pati, Thackeray & Khaire, 2016)	+	–	–	588–1319	Yes	NE
44. *Sahyadriana woodmasoni* Pati & Thackeray, 2018	+	–	–	1006	Yes	NE
Genus *Snaha* Bahir & Yeo, 2007	–	–	+	327–2350	Yes	
45. *Snaha aruna* Bahir & Yeo, 2007	–	–	+	1800	Yes	DD
46. *Snaha escheri* (Roux, 1931)	–	–	+	327–2350	Yes	DD
Genus *Travancoriana* Bott, 1969	–	+	+	127–2472	No	
47. *Travancoriana charu* Bahir & Yeo, 2007	–	–	+	339–920	Yes	DD
48. *Travancoriana convexa* (Roux, 1931)	–	+	+	141–1300	Yes	LC
49. *Travancoriana granulata* Pati & Sharma, 2013	–	–	+	1708–2472	Yes	NE
50. *Travancoriana kuleera* Bahir & Yeo, 2007	–	+	–	728–800	Yes	DD
51. *Travancoriana pollicaris* (Alcock, 1909)	–	+	+	338–1244	Yes	DD

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52. *Travancoriana schirnerae* Bott, 1969	–	+	+	127–2231	No	LC
Genus *Vanni* Bahir & Yeo, 2007	–	+	+	24–2200	Yes	
53. *Vanni ashini* Bahir & Yeo, 2007	–	+	+	118–975	Yes	DD
54. *Vanni deepta* Bahir & Yeo, 2007	–	–	+	685	Yes	DD
55. *Vanni giri* Bahir & Yeo, 2007	–	+	+	661–1570	Yes	DD
56. *Vanni malabarica* (Henderson, 1912)	–	+	+	24–628	Yes	DD
57. *Vanni nilgiriensis* (Roux, 1931)	–	+	–	816–2200	Yes	DD
58. *Vanni pusilla* (Roux, 1931)	–	+	–	2100	Yes	DD
59. *Vanni travancorica* (Henderson, 1913)	–	+	+	100–1094	Yes	DD
Genus *Vanni* Bahir & Yeo, 2007	–	+	+	728–2231	Yes	
60. *Vela carli* (Roux, 1931)	–	+	–	728–1116	Yes	DD
61. *Vela pulvinata* (Alcock, 1909)	–	+	–	901–2231	Yes	DD
62. *Vela virupa* Bahir & Yeo, 2007	–	–	+	1050–1140	Yes	DD

NWG: Northern Western Ghats; CWG: Central Western Ghats; SWG: Southern Western Ghats; ASL: above sea level; WG: Western Ghats; IUCN: International Union for Conservation of Nature; '+' present; '–' absent; NE: Not evaluated; DD: Data Deficient; LC: Least Concern; VU: vulnerable

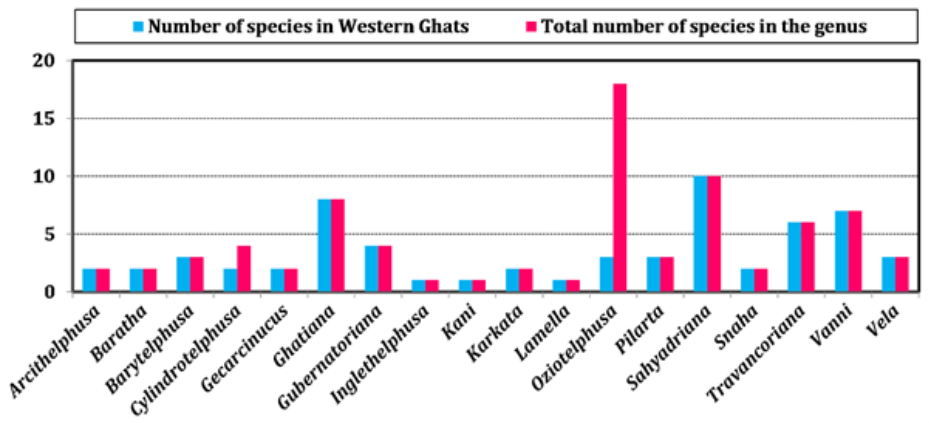

Figure 2: Freshwater crab genera of the Western Ghats, each showing number of species in the Western Ghats and total number of species.

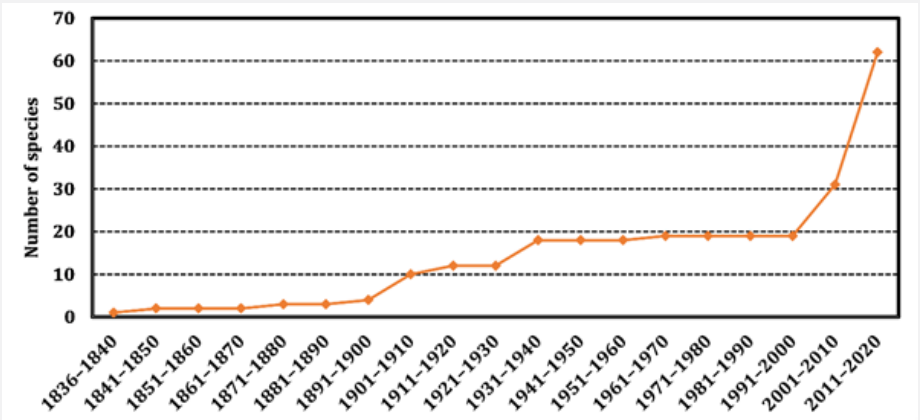

Figure 3: Species-accumulation curve for the freshwater crabs of the Western Ghats during 1836–2019.

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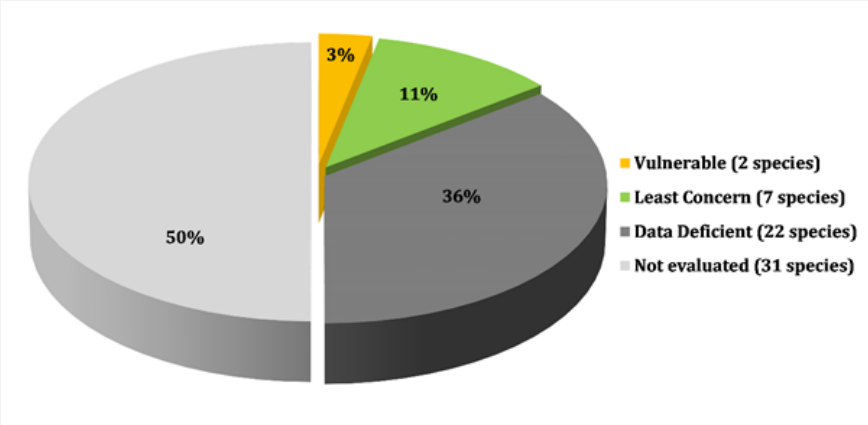

Figure 4: Composition of the conservation status of the Western Ghats crabs according to the IUCN Red List.

Distribution

The freshwater crabs of the Western Ghats are distributed all over the region from low-lying areas to high mountain peaks (3–2472 m above sea level) (Table 1). As many as 10 genera (56%) and 21 species (34%) are found above the average elevation (1200 m) of the Western Ghats (Table 1). Seven species, viz. *Barytelphusa cunicularis*, *Snaha escheri*, *Travancoriana granulata*, *Travancoriana schirnerae*, *Vanni nilgiriensis*, *Vanni pusilla*, and *Vela pulvinata*, dwell above 2000 m elevation (Table 1). While most of these species are also found at relatively lower altitudes, *Travancoriana granulata* and *Vanni pusilla* are always restricted to highly elevated areas (1708–2472 m) [17, 31,35,36,39,53].

Among the freshwater crabs of the Western Ghats, 27 species in 6 genera are found in the Northern Western Ghats; 21 species in 8 genera in the Central Western Ghats; and 27 species in 12 genera in the Southern Western Ghats (Table 1). *Barytelphusa cunicularis* is the only species that widely occurs in the Western Ghats. On the other hand, most of the genera and species show a distinct pattern of distribution within the Western Ghats. Some of these genera (*Gecarcinucus* and *Lamella*) and species (*Barytelphusa guerini* and *Oziotelphusa wagrakarowensis*), however, are also found beyond the limit of the Western Ghats. Among the genera, *Gecarcinucus*, *Gubernatoriana*, *Inglethelphusa*, and *Sahyadriana* are distributed in the Northern Western Ghats only; *Arcithelphusa* in the Central Western Ghats only; and *Baratha*, *Kani*, *Karkata*, *Lamella*, *Pilarta*, and *Snaha* in the Southern Western Ghats only (Table 1). Among the species, *Barytelphusa guerini* and all the species of *Ghatiana* except for *Ghatiana basalticola* are distributed in the Northern Western Ghats only; *Ghatiana basalticola*, *Oziotelphusa wagrakarowensis*, *Travancoriana kuleera*, *Vanni nilgiriensis*, *Vanni pusilla*, *Vela carli*, and *Vela pulvinata* in the Central Western Ghats only; and *Cylindrotelphusa breviphallus*, *Oziotelphusa ravi*, *Travancoriana charu*, *Travancoriana granulata*, *Vanni deepta*, and *Vela virupa* in the Southern Western Ghats only (Table 1).

Endemism

Currently, nearly 63% genera (22/35 genera) and 86% species (107/125 species) of the freshwater crabs are endemic to India. Similarly, the Western Ghats crabs also show a high level of endemism, with 67% endemic genera (12/18 genera) and 82% endemic species (51/62 species) (Table 1). Nearly half of the endemic species of the Western Ghats (25/51 species) are highly restricted in distribution and so far, known only from their type locality [10,14–17,31,39,49,52,55].

Among the endemic crabs of the Western Ghats, *Gubernatoriana* (4 species), *Inglethelphusa* (1 species), and *Sahyadriana* (10 species) are restricted only to the Northern Western Ghats; *Arcithelphusa* (2 species) only to the Central Western Ghats; and *Baratha* (2 species), *Kani* (1 species), *Karkata* (2 species), *Pilarta* (3 species), and *Snaha* (2 species) only to the Southern Western Ghats (Table 1). In addition to the species of these endemic genera, as many as 18 endemic species of the Western Ghats are restricted only either to the Northern Western Ghats (e.g., *Ghatiana aurantiaca*, *Ghatiana botti*, *Ghatiana hyacintha*, *Ghatiana pulchra*, *Ghatiana rathbunae*, and *Ghatiana splendida*) or the Central Western Ghats (e.g., *Ghatiana basalticola*, *Travancoriana kuleera*, *Vanni nilgiriensis*, *Vanni pusilla*, *Vela carli, and Vela pulvinata*) or the Southern Western Ghats (e.g., *Cylindrotelphusa breviphallus*, *Oziotelphusa ravi*, *Travancoriana charu*, *Travancoriana granulata*, *Vanni deepta*, and *Vela virupa*) (Table 1).

Conservation

Conservation of freshwater crabs is essential because the proportion of freshwater crabs threatened with extinction is almost equal to that of reef-building corals and exceeds that of Odonata, freshwater fishes, reptiles, birds, and mammals [7]. The conservation of the Western Ghats crabs is nevertheless a challenge because the majority of the species (53/62 species, 86%) are either 'Data Deficient' (22 species, 36%) or not being evaluated for their conservation status (31 species, 50%) by the

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International Union for Conservation of Nature (IUCN) (Figure 4) (Table 1) [58]. While seven species (11%) were given the status of 'Least Concern', only two species (*Oziotelphusa biloba* and *Oziotelphusa wagrakarowensis*) had been categorized as 'Vulnerable' by the IUCN (Figure 4) (Table 1) [58].

Conclusion

Most of the freshwater crabs of the Western Ghats are known either from the type locality or from a few localities only. More surveys and explorations, especially from the Central- and Southern Western Ghats, are, therefore, needed to know their actual distributional range. With the rapid discovery rate, it is currently difficult to estimate their actual diversity. Many more taxa are yet to be described from this region, especially from the cryptic habitats. That is why a complete monograph on the Western Ghats crabs is a few decades away. Some genera (*Arcithelphusa*, *Barytelphusa*, *Cylindrotelphusa*, *Travancoriana*, and *Vanni*) need an urgent taxonomic revision. Moreover, a complete phylogeny of the freshwater crabs of the Western Ghats is likely to reveal many changes in their systematic position. Conservation of freshwater crabs of the Western Ghats is a matter of concern because most of the species lack important information like distributional range and population size, which are very crucial in the assessment of the conservation status. Most of the species in the Western Ghats, however, are endemic and can only tolerate a small range of environmental conditions. Those species are very likely to face severe threats. In these situations, the present review will aid as updated and baseline information in advancing our understanding of the freshwater crabs of the Western Ghats.

Acknowledgement

The first author is grateful to Dr Kailash Chandra, Director (Zoological Survey of India, Kolkata) for research facilities and constant encouragement. The first author gratefully acknowledges Dr Peter K.L. Ng and Dr Darren C.J. Yeo (National University of Singapore) for their continuous guidance on the subject. We would like to thank the following for their contributions on material, data, and time: Dr Santanu Mitra (Crustacea Division, Zoological Survey of India, Kolkata); Dr P.M. Sureshan (Western Ghat Regional Centre, Zoological Survey of India, Kozhikode); Dr A. Biju Kumar, Smrithy Raj and L. Rajesh (Department of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram, Kerala, India); Dr A.R. Sudha Devi and P.S. Sujila (Department of Zoology and Research Centre, Mary Matha Arts and Science College, Mananthavady, Kerala, India); S. Sheeja (Department of Zoology, Holy Cross College, Nagercoil, Tamil Nadu, India); T. Thackeray (a wildlife conservationist from Mumbai).

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How to cite this article: Pati S K, Pradhan R N. An Overview of the Freshwater Crabs (Brachyura: Gecarcinucidae) of the Western Ghats, India. Oceanogr Fish Open Access J. 2020; 12(3): 555836. DOI: 10.19080/OFOAJ.2020.12.555836

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DOI: 10.19080/OFOAJ.2020.12.555836

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