

Faunal affinity and zoogeography of Recent marine ostracoda from Karwar, West Coast of India

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The occurrence of 80 Recent marine ostracode taxa around Karwar, West Coast of India, has been recorded. Their ecology, affinity and zoogeographic distribution are also discussed briefly.

RECENT ostracodes, also called proxy indicators or seed shrimps, have gained much importance in the recent years in view of their environmental significance and application in search for oil and gas in the offshore regions of India. Studies of these bivalved microcrustaceans are, therefore, important for a better understanding of their fossil counterparts of these regions.

Besides, they also serve as indicator organisms in pollution studies.

A perusal of literature on Recent ostracodes from West Coast of India reveals that little attention has been paid to their taxonomic, ecological and zoogeographic studies. Most of the publications¹⁻⁶ are preliminary in nature and/or make only a casual reference¹¹⁻¹⁵ to them. The only important studies⁷⁻¹⁰ report 13 taxa (2 new genera, 1 new subgenus, 1 new species) from the Anjidiv Island⁹, followed by the record number (56) of species (1 new genus, 1 new subgenus and 16 new species) from Mandvi Beach⁷ in Gujarat and 34 species (including 4 new species) from Kerala Coast⁸. The present investigation is based on systematic studies of Recent ostracoda around Karwar, North Karnataka Coast, facing the Arabian Sea (Figure 1). In all 228 sediment samples, an average of 11 samples from each of the fourteen beaches and two deltas (A-P) and one each from forty-eight (1-48) inner-shore stations (19-71 m depth) were collected for micropalaeontological studies. These

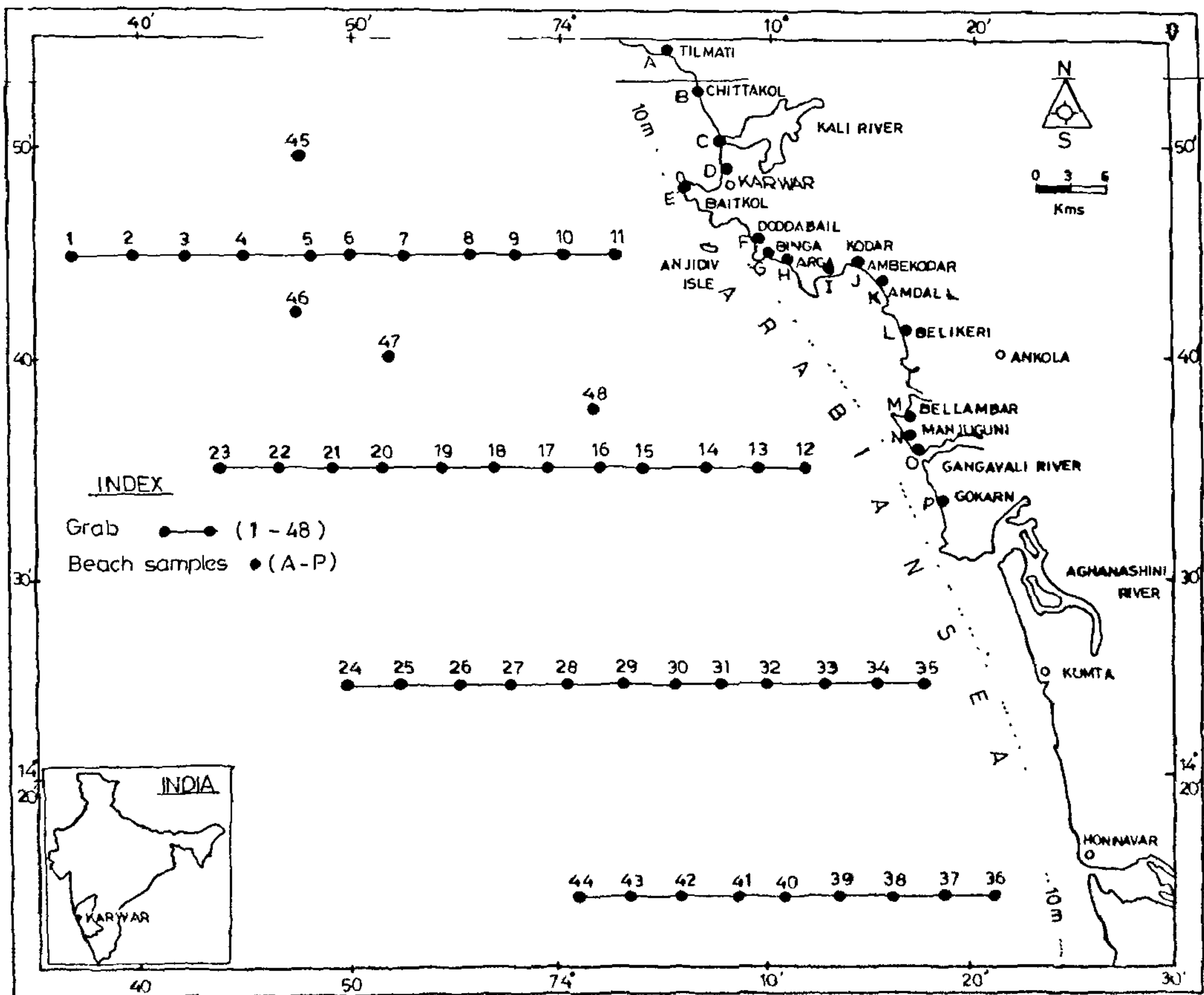


Figure 1.

RESEARCH COMMUNICATIONS

Table 1. The checklist of Recent ostracoda, their frequency and zoogeographic distribution from Karwar, West Coast of India

Ostracode taxa	Areas								Frequency
	West coast						East coast	Indo-Pacific	
	1	2	3	4	5	6			
*1. <i>Cytherella hemipuncta</i> Swanson, 1969	x							x	C
2. <i>C. semutalis</i> Brady, 1868	x		x		x			x	C
3. <i>Cytherelloidea leroyi</i> Keij, 1964	x						x	x	C
†4. <i>Cytherelloidea</i> sp.	x								C
*5. <i>Bairdoppilata (Bairdoppilata) cushmani</i> (Tressler)	x							x	C
6. <i>B. (B) alcyonicola</i> Maddocks, 1969	x							x	A
*7. <i>B. paraalcyonicola</i> Titterton and Whatley, 1988	x							x	C
*8. <i>Neonesidea elegans</i> (Brady)	x							x	C
*9. <i>N. woodwardiana</i> (Brady)	x							x	C
†10. <i>Neonesidea</i> sp.	x								C
11. <i>Hemicytheridea paiki</i> Jain, 1978	x		x		x				A
†12. <i>Hemicytheridea</i> sp.	x								C
13. <i>Neomonoceratina iniqua</i> (Brady)	x		x	x	x			x	A
14. <i>Neomonoceratina</i> sp. A	x								R
15. <i>Neomonoceratina</i> sp. B	x								R
†16. <i>Paijenborchella</i> sp.	x								A
17. <i>Jankeicythere mckenziei</i> (Annapurna and Sarma)	x		x				x		C
18. <i>Callistocythere</i> cf. <i>C. flavidofusca intricatoides</i> (Ruggieri)	x			x				x	C
19. <i>Tanella gracilis</i> Kingma, 1948	x		x	x	x	x	x	x	R
20. <i>T. gracilis</i> morphotype A	x				x				C
21. <i>T. gracilis</i> morphotype B	x								R
*22. <i>Paracytheroma ventrosinuosa</i> Zhao and Whatley, 1989	x							x	R
23. <i>Cypredies</i> sp.	x								R
24. <i>Cushmanidea quhai</i> Jain, 1978	x				x	x			A
25. <i>Hemikrithes peterseni</i> Jain, 1978	x		x	x	x			x	A
26. <i>Actinocythereis scutigera</i> (Brady)	x	x	x	x	x	x		x	A
27. <i>Henryhowella (Neohenryhowella) hartmanni</i> (Jain)	x	x	x	x	x				A
28. <i>Indet</i> genus and sp. A	x					x			C
29. <i>Indet</i> genus and sp. B	x								C
30. <i>Alocopocythere reticulata indoaustratica</i> Hartmann, 1964	x		x	x	x			x	A
†31. <i>Alocopocythere</i> sp.	x								C
32. <i>Chrysocythere ketji</i> Jain, 1978	x		x		x		x		A
33. <i>Stigmatocythere indica</i> (Jain)	x		x		x		x	x	A
34. <i>S. kingmai</i> Whatley and Zhao, 1988	x		x	x	x	x	x	x	C
35. <i>Moosella cochinesis</i> Jain, 1981	x		x						C
†36. <i>Moosella</i> sp.	x								C
†37. <i>Hemitrachyleberis</i> sp.	x		x					x	A
†38. <i>Puricythereis</i> sp.	x								C
39. <i>Keijella karwarensis</i> (Bhatia and Kumar)	x		x		x			x	A
40. <i>K. nealei</i> Jain, 1978	x		x		x				A
41. <i>K. whatleyi</i> Jain, 1981	x		x					x	A
*42. <i>K. reticulata</i> Whatley and Zhao, 1988	x							x	A
43. <i>Ruggieria darwini</i> (Brady)	x				x			x	C
44. <i>R. indoiranica</i> Jain, 1981	x		x		x				A
*45. <i>R. indopacifica</i> Whatley and Zhao, 1988	x							x	C
†46. <i>Ruggieria</i> sp.	x								C
47. <i>Lankacythere coralloides</i> (Brady)	x		x		x			x	A
†48. <i>Lankacythere</i> sp.	x								C
49. <i>Basslerites liebauti</i> Jain, 1978	x		x		x		x		A
50. <i>Mutilus pentoekensis</i> Kingma, 1948	x				x			x	C
†51. <i>Mutilus</i> sp.	x								C
52. <i>Bradleya andamanae</i> Benson, 1972	x			x				x	C
53. <i>Quadracythere</i> sp.	x								R
54. <i>Caudites javana</i> Kingma, 1948	x				x	x		x	A
*55. <i>C. sublevis</i> Bonaduce et al., 1980	x				x			x	R
†56. <i>Caudites</i> sp.	x								C
57. <i>Caudites</i> sp. A	x								R
*58. <i>Falsocythere maccagnoi</i> (Ciampo)	x							x	C
59. <i>Atjehella simplicata</i> Kingma, 1948	x				x	x		x	A
60. <i>Loxocancha lilljeborgii</i> Brady, 1868	x		x		x		x	x	C

Table 1. (Contd.)

Ostracode taxa	Areas								Frequency
	West coast						East coast	Indo-Pacific	
	1	2	3	4	5	6			
61. <i>L. gruendeli</i> Jain, 1978	x		x		x				C
62. <i>L. mandviensis</i> Jain, 1978	x				x				C
63. <i>Loxoconchella anomala</i> (Brady)	x				x			x	C
*64. <i>Paracytheridea pseudoremanei</i> Bonaduce et al., 1980	x							x	C
65. <i>Paijenborchellina indoarabica</i> Jain, 1981	x		x		x				A
*66. <i>Cytheropteron rhombiformis</i> Chen, 1981	x							x	C
67. <i>Cytheropteron</i> sp.	x								R
†68. <i>Baltraella</i> sp.	x								C
†69. <i>Bythoceratina</i> sp. A	x								C
†70. <i>Bythoceratina</i> sp. B	x								C
†71. <i>Bythoceratina</i> sp. C	x								C
72. <i>Paradoxostoma</i> sp. A	x								R
73. <i>Paradoxostoma</i> sp. B	x								R
†74. <i>Propontocypris</i> (<i>Propontocypris</i>) sp.	x			x				x	C
75. <i>P.</i> (<i>Schedopontocypris</i>) <i>bengalensis</i> Maddocks, 1969	x							x	A
†76. <i>Propontocypris</i> (<i>Schedopontocypris</i>) sp.	x		x						C
77. <i>Propontocypris</i> (S) sp. A	x								C
78. <i>Paracypris</i> sp.	x								R
79. <i>Phlyctenophora orientalis</i> (Brady)	x	x	x	x	x	x	x	x	C
†80. <i>Phlyctenophora</i> sp.	x		x		x				A

† New species
 * First recorded species
 R Rare (up to 5 specimens)
 C Common (6-49 specimens)
 A Abundant (over 50 specimens).

1 Karwar
 2 Mangalore
 3 Kerala
 4 Bombay and Ratnagiri Coast
 5 Mandvi Beach, Kutch in Gujarat
 6 Miani Lagoon, Saurashtra.

samples are composed of medium to fine-grained sand, sandy clay and clayey sand, and moderate to well-sorted sediments with dominating sand grains. Besides, the samples invariably contain ostracode, foraminifer and gastropod shells, fish teeth, etc.

The ostracode assemblage of Karwar area comprises 80 species belonging to 18 families and 44 genera (Table 1). Of these, 47 are already known, including 12 species (marked with an asterisk (*) in Table 1) recorded here for the first time from the Indian waters. The already known taxa have been recorded from Indian coastal margins¹⁻¹³, Gulf of Oman¹⁴, Persian Gulf^{14, 15}, Red Sea^{16, 17}, China Sea¹⁸, Malacca Straits^{18, 19} and Solomon Islands²⁰. The remaining 33 taxa are left under open nomenclature, of which 19 (marked with a dagger (†) in Table 1) are new ones.

The parameters that control the abundance and diversity of these ostracodes are the nature of the substrate, the salinity and the depth, as reported by the earlier workers²¹⁻²³. Their highest values are noticed in the substrate of medium to fine-grained sand with organic debris and the lowest values in coarse-grained sand with poor carbonate content dominated by quartz grains. The intensity of water currents is another factor influencing the frequency distribution of these faunas. It is opined that the present ostracode assemblage belongs to warm-shallow-water/inner-neritic environment.

An attempt is also made here to understand the faunal affinity and zoogeographic implications. The ostracode fauna recorded herein (Table 1) not only show marked similarity with those of other parts of East Coast and West Coast of India, but also exhibit close affinity with those of Gulf of Oman¹⁴, Persian Gulf¹⁵ and Red Sea^{16, 17}. The ostracode taxa common to those recorded by Bate²⁴ from Abu Dhabi Lagoon are: *Cytherella semitalis*, *Alocopocythere reticulata indoaustraliana*, *Callistocythere* cf. *C. flavidofusca intricatoides*, *Paijenborchellina indoarabica*, *Stigmatocythere kingmai*, *Keijella karwarensis*, *Ruggieria indoiranica*, *Lankacythere reticulata*, *Tanella gracilis*, etc. Besides these, there also exist certain taxa which are identical to faunas of Oman and Persian Gulf as recorded by Paik¹⁴, and they include: *Alocopocythere reticulata indoaustraliana*, *Neomonoceratina iniqua*, *Hemicytheridea paiki*, *Hemikrithe peterseni*, *Tanella gracilis*, *Cushmanidea guhai*, *Actinocythereis scutigera*, *Hemitrachyleberis* sp., *Henryhowella* (*Neohenryhowella*) *hartmanni*, *Callistocythere* cf. *C. flavidofusca intricatoides*, *Keijella karwarensis*, *K. reticulata*, *Ruggieria indoiranica*, *R. whatleyi*, *R. indopacifica*, *Ruggieria* sp., *Falsocythere maccagnoi*, *Atjehella semiplicata*, *Loxoconcha grundeli*, *Bythoceratina mandviensis*, *Cytheropteron* sp. and *Propontocypris* sp. Further, *Alocopocythere reticulata indoaustraliana* and *Falsocythere maccagnoi*, *Paracytheridea pseudoremanei*, *Puricythereis*

sp. recorded by Hartmann²⁵ and Bonaduce^{16, 17}, respectively, from Red Sea are also occurring in the Karwar material, thus suggesting a strong affinity between the present faunal assemblages with those of the aforementioned adjacent areas.

It is also interesting to note the close affinity or identity of several Recent marine ostracoda from Karwar area with those from Solomon Islands²⁰, China Sea¹⁸ and Malacca Straits^{18, 19}. These include: *Bairdoppilata* (*Bairdoppilata*) *paraalcyonicola* and *Neonesidea woodwardiana* from Solomon Islands, and *Cytherella hemipuncta*, *C. semitalis*, *Cytherelloidea leroyi*, *Neomonoceratina iniqua*, *Tanella gracilis*, *Hemikrithe peterseni*, *Actinocythereis scutigera*, *Stigmatocythere indica*, *S. kingmai*, *Keijella karwarensis*, *K. reticulata*, *Ruggieria darwini*, *R. indopacifica*, *Lankacythere corolloides*, *Bradleya andamanae*, *Atjehella semiplicata*, *Loxoconcha lilljeborgii*, *Cytheropteron rhombiformis*, *Paradoxostoma* sp. A., *Phlyctenophora orientalis*, etc., from China Sea and Malacca straits. This again reveals close zoogeographical relationship between these coastal margins.

The species *Carinocythereis* (*Tandonella*) *indica*^{7, 8}, transferred to *Stigmatocythere* by Whatley and Zhao¹⁸, also occurs in the Karwar material and Bhatia²⁶ opines its close affinity with *Hiltermannicythere bassouni*²⁵ from West Coast of Australia. This warrants the possible faunal links between these two coastal margins. The following taxa are common to those of Indonesian assemblages: *Neomonoceratina iniqua*, *Tanella gracilis*, *Stigmatocythere kingmai*, *Caudites javana* and *Atjehella semiplicata*, which is suggestive of westward migration of these taxa by equatorial currents, as also observed by Bate²⁴ and Bhatia²⁶.

Further, lineages and/or phylogenetic relations of several living taxa in the present material, namely, *Callistocythere* cf. *C. flavidofusca intricatoides*, *Actinocythereis scutigera*, *Henryhowella* (*Neohenryhowella*) *hartmanni* and *Alocopocythere reticulata indoaustraliana*, can be traced through Palaeogene and Neogene Tethyan taxa, which possibly evolved in the Tethyan corridor and subsequently migrated eastwards and southeastwards in Quaternary times, as also viewed by Bhatia²⁶.

Thus, it is concluded that the strong affinity observed between the present West Coast faunas of India with those of the Persian Gulf, Gulf of Oman and Red Sea certainly indicates the possibility of single faunal province. Besides, the faunal links between the Indo-Pacific region, viz. the Malacca Straits, Solomon Islands,

Indonesia, South China Sea, and West Coast of India are suggestive of westward migration, probably by clockwise or anticlockwise equatorial currents. Similar observations have also been made by Titterton and Whatley²⁷.

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