



Diversity and distribution of mysids (Crustacea: Mysida) from the northwest coast of India

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Received: 30 Jun 2016, Accepted: 30 Dec 2016, Published: 10 Jan 2017

Original Article

Abstract

Diversity and distribution of mysids collected from the northwest coast of India are presented. Twelve species of mysids belonging to eight genera of four-sub families are identified from 10 localities covering 69 stations, of which three species, *Siriella hansenii*, *Erythrope minuta*, *Acanthomysis anomala* are new reports from this area. Mysids occurred in all areas except at Veraval. Maximum density of a mono specific species *Mesopodopsis orientalis* (8792/100m³) is found at Dahanu. *Mesopodopsis orientalis* is the most abundant species and occurred in aggregations at Bassein, Dahanu and Mithapur. *Indomysis nybini* is found to be next in abundance (2117/100m³) even though they occurred only in Mithapur. *Rhopalophthalmus vijayai* occurred in abundance at Bhavnagar which contributed 80.4% of the total population of this area and occurred in small aggregations. All other species reported are either moderately or sparsely represented.

Keywords: Crustacea, mysids, diversity, distribution, northwest coast, India

Introduction

The northwest coast of India extends from 16°N to 24°N comprising the maritime states of Gujarat and Maharashtra and Union territory of Daman and Diu. The length of the coastline is 2,347 km and the continental shelf area is 27,600 km². Relatively shallow waters of this region is complex as this part is greatly affected by the monsoons, river run off, currents, tides and land based activities including waste water discharges. This narrow inshore strip of the coastal waters even though occupies a very small area of the Indian Ocean, contributes significantly to the overall production potential. The rivers opening into the near shore waters enhance the availability of nutrients that triggers the biological productivity. The productivity of the coastal waters is nearly five times greater than that of the open ocean (Mann, 1968). The coastal areas are sheltered environments, having pockets of localized fertile zones, which form an ideal nursery ground for a wide variety of fish and shellfish including many species of commercial importance.

Crustacean mysids are one of the major constituents of zooplankton in the near shore waters. They play an important role in the ecological system and their role in the food chain has been well documented (Mees *et al.*, 1994; Moffat, 1996; Biju *et al.*, 2009; Hanamura *et al.*, 2010; Biju and Panampunnayil, 2011). The

shallow water mysids are of immense economic value because of their ability to multiply rapidly. They feed mainly on detritus and diatoms and play an important role in nutrient regeneration. The order Mysida consists of approximately 1132 described species and 178 genera found across all latitudes throughout the waters of the world (Meland *et al.*, 2015). In the Indian waters approximately 108 species and 36 genera of mysids were recorded. The shallow water mysids of the Indian region are rich and diverse and our knowledge on them is limited to the works of Tattersall (1906, 1908, 1914, 1915, 1922); Pillai (1957, 1961, 1964) Gajbhiye *et al.* (1980) and Biju and Panampunnayil (2009). Hence an extended knowledge of mysids from the northwest coast is desirable and an attempt is made here in this direction.

Material and methods

Zooplankton samples collected from 10 locations were studied (Fig. 1). The number of stations sampled at each locality, and the months of sampling are given in Table 1. In all locations, depth was between 5 to 20 m. Samples were collected using a Heron-Tranter net (Tranter *et al.*, 1972) with a mouth area of 0.25 m² and a mesh size of 0.33 mm. Oblique hauls of 6 minutes duration was taken. Water samples from surface waters were collected using a polyethylene bucket for the estimation of temperature and salinity.

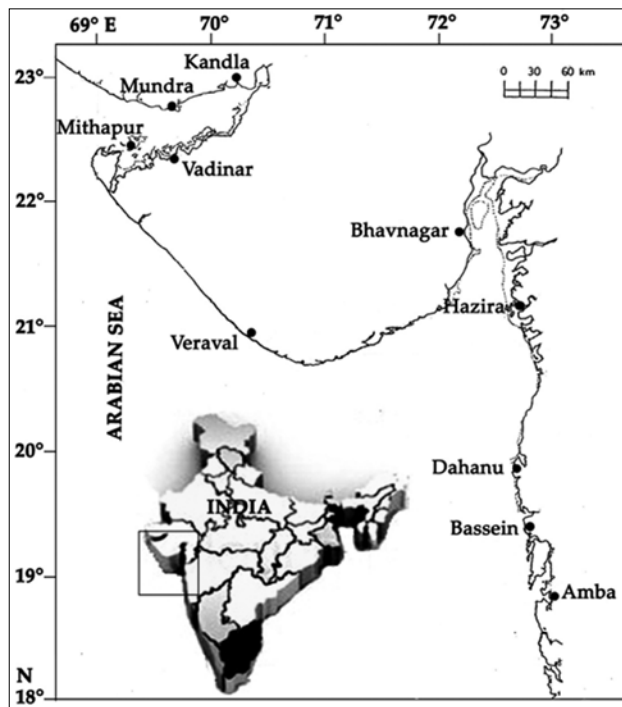


Fig.1. Map showing location of collection sites

The zooplankton samples were preserved in 5% formaldehyde solution. In the laboratory mysids were sorted out from the samples and identified to species level following Tattersall (1908, 1914, 1915, 1922), Hansen (1910) and Pillai (1973).

Table 1. Location and sampling frequency in shallow waters off northwest coast of India.

Location	No. of Stations	Month and Year
Mundra	10 stations	April 2007 and May 2007
Kandla	7 stations	December 2006
Vadinar	7 stations	November 2005
Mithapur	10 stations	December 2003, April 2004, and May 2004
Veravel	5 stations	September 1999
Bhavnagar	7 stations	March 2007 and November 2007
Hazira	3 stations	December 2005 and May 2006
Dahanu	6 stations	February 2007
Bassein	7 stations	January 2006, May 2006, and October 2006
Amba	7 stations	May 2005, 2006 and 2007

Results

Of the 10 localities, twelve species of mysids belonging to eight genera of four-sub families were identified (Table 2), of which three species, *Siriella hanseni*, *Erythroptis minuta* and *Acanthomysis anomala* are new records from this area. In this study mysids occurred at all sampling areas except at Veraval.

Table 2. Taxonomic list of mysids recorded during the study period

ORDER MYSIDA BOAS, 1883
Family MYSIDAE Dana, 1850
Subfamily SIRIELLINAЕ Norman, 1892
Tribe Siriellini Czerniavsky, 1882
Genus <i>Siriella</i> Dana, 1850
<i>Siriella dubia</i> Hansen, 1910
<i>S. hanseni</i> W.M.Tattersall, 1922
<i>S. jonesi</i> Pillai, 1964
Subfamily RHOPALOPHTHALMINAE Hansen, 1910
Genus <i>Rhopalophthalmus</i> Illig, 1906
<i>R. mumbayensis</i> Panampunnayil and Biju, 2006
<i>R. anishi</i> Panampunnayil and Biju, 2006
<i>R. vijayai</i> Panampunnayil and Biju, 2006
Subfamily GASTROSACCINAE Norman, 1892
Genus <i>Gastrosaccus</i> Norman, 1868
<i>Gastrosaccus dunckeri</i> Zimmer, 1915
Genus <i>Eurobowmaniella</i> Murano, 1995
<i>Eurobowmaniella muticus</i> W.M.Tattersall, 1915
Subfamily MYSINAE Hansen, 1910
Tribe Erythropini Hansen, 1910
Genus <i>Erythroptis</i> G.O. Sars, 1869
<i>Erythroptis minuta</i> Hansen, 1910
Tribe Mysini, Hansen, 1910
Genus <i>Acanthomysis</i> Czerniavsky, 1882
<i>Acanthomysis anomala</i> Pillai, 1961
Genus <i>Mesopodopsis</i> Czerniavsky, 1882
<i>Mesopodopsis orientalis</i> W.M. Tattersall, 1908
Genus <i>Indomysis</i> W.M. Tattersall, 1914
<i>Indomysis nybini</i> Biju and Panampunnayil, 2010

Table 3. Percentage composition of different species of mysids at different locations in the northwest coast of India

	<i>S. dubia</i>	<i>S. hanseni</i>	<i>S. jonesi</i>	<i>R. mumbayensis</i>	<i>R. anishi</i>	<i>R. vijayai</i>	<i>G. dunckeri</i>	<i>E. muticus</i>	<i>E. minuta</i>	<i>A. anomala</i>	<i>M. orientalis</i>	<i>I. nybini</i>
Mundra	-	-	-	-	-	-	0.1	-	-	-	99.9	-
Kandla	-	-	-	-	-	-	-	-	-	14.29	85.71	-
Vadinar	0.62	-	7.79	-	-	-	91.59	-	-	-	-	-
Mithapur	-	0.1	-	-	-	-	1.3	-	-	-	42.02	56.6
Veravel	-	-	-	-	-	-	-	-	-	-	-	-
Bhavnagar	-	-	-	6.63	3.51	80.36	1.56	-	0.52	-	7.42	-
Hazira	2.2	-	-	-	-	-	0.44	-	-	-	97.36	-
Dhahanu	-	-	-	-	-	-	-	-	0.04	-	99.96	-
Bassien	-	-	0.76	0.33	1.41	-	3.63	0.13	0.2	-	93.54	-
Amba	-	-	-	4.25	-	-	-	-	-	-	95.75	-

Maximum density (8792/100m³) was found at Dahanu and was constituted by a single species *Mesopodopsis orientalis*. It is the most abundantly caught species and occurred in aggregations at Bassein, Dahanu and Mithapur. *Indomysis nybini* was the next in abundance (2117/100m³) even though they occurred only in Mithapur. *Rhopalophthalmus vijayai* was the most abundant mysid at Bhavnagar, contributed 80.4% of the total population of this area and often occurred in small aggregations. All other species were either moderately or sparsely represented. The percentage composition of different mysid species encountered at different localities is given in Table 3. Maximum species richness occurred in the Bassein (7) followed by the Bhavnagar (6), Mithapur (4), Hazira and Vadinar (3). Species richness of all the other localities is shown in Table 3.

Siriella dubia

This species is a shallow water form and was collected from 9 - 0 m depth and occurred in temperature of 28°C and salinity 35 psu. This species occurred along with *Siriella jonesi* and *Gastrosaccus dunckeri* at Vadinar. One adult female obtained was found to carry only 11 eggs in its brood pouch.

Distribution: Hitherto this species has been recorded from East Indies (Hansen, 1910), Andaman Island, Great Barrier Reef, Philippine island (Tattersall, 1922, 1936, 1951), Arabian Sea (Pillai, 1964, 1973; Biju and Panampunnayil, 2009), South China Sea (Li, 1964) and Malacca strait (Tattersall, 1965).

Siriella hanseni

This species is sparsely represented at Mithapur and occurred in temperature and salinity of 27.2°C and 33 psu respectively.

Distribution: Pamban, Gulf of Mannar (India) (Tattersall, 1922), Arabian Gulf (Murano, 1998), Singapore (Tattersall, 1960) and North East Australia (Bacescu, 1986). The present record is the first report of this species from the northwest coast of India.

Siriella jonesi

In Vadinar, this species occurred along with *Siriella jonesi* and

S. dubia, and in Hazira and Bassein, along with *G. dunckeri*. This is a littoral form living close to the coast in shallow waters. It has been occurring in temperature and salinity ranging from 24.5-33°C and 31.3-37 psu respectively.

Distribution: From the available information this species has a restricted distribution and is confined to the Arabian Sea. The three earlier records of this species are from the Arabian Sea (Pillai, 1964; Biju and Panampunnayil, 2009) and the present record is also from the same area.

Rhopalophthalmus mumbayensis

Rhopalophthalmus mumbayensis is littoral in habitat and in the present collection this species was observed along with *R. anishi* and *Gastrosaccus dunckeri*. The temperature and salinity recorded ranged from 26-34°C and 31-36.4 psu respectively. Adult female of *Rhopalophthalmus mumbayensis* was found to carry 20 eggs in their marsupium.

Distribution: The present report of this species from Bhavnagar, Bassein and Amba estuary and is the second record of this species from the Indian waters. Panampunnayil and Biju (2006) reported this species from Dharamtar, Thane and Bassein.

Rhopalophthalmus anishi

It is a shallow water form and occurred along with *R. mumbayensis*, *Gastrosaccus dunckeri* and *Mesopodopsis orientalis*. It has been found in temperature and salinity of 27-27.5°C and 30-33 psu respectively. The numbers of eggs in various broods were found to vary between 9-13.

Distribution: In the present collection this species is taken from Bhavnagar and Bassien. Its previous record is from the Kasheli, which is the interior part of Bassein creek.

Rhopalophthalmus vijayai

At Bhavnagar this species alone contributed 80.36% of the total mysid population. In most of the stations, this species was observed along with *Gastrosaccus dunckeri*, *Erythrops minuta*

and *Mesopodopsis orientalis* and occurred in temperature and salinity ranging from 28.4 to 30.0°C and 24.2 to 34 psu respectively. Females of *Rhopalophthalmus vijayai* were found to carry 7-18 eggs in their marsupium.

Distribution: This species has been collected from Bhavnagar only and the present record is the second record of this species. Its distribution is confirmed to Arabian Sea and the previous record has been from Dhahej (Panampunnayil and Biju, 2006).

Gastrosaccus dunckeri

It is a coastal form and were moderately represented at Vadinar, Mithapur and Bassein and sparsely distributed at Hazira, Bhavnagar and Mundra. This species occurred along with *Siriella jonesi*, *Rhopalophthalmus mumbaiensis*, *R. anishi*, *R. vijayai* and *Indomysis nybini*. They occurred in the temperature range of 24-30.4°C and salinity of 27.3- 40 psu. In *Gastrosaccus dunckeri*, the brood size varied between 6 – 9.

Distribution: This species is cosmopolitan in distribution and have been recorded from Indian and Pacific Oceans. In Indian waters, this species has been recorded from different localities, Orissa (Tattersall, 1922), coastal waters of Kerala (Pillai, 1957, 1961), Arabian Sea (Pillai, 1973) and shallow coastal waters of Gujarat and Mumbai (Biju and Panampunnayil, 2009).

Eurobowmaniella muticus

During the study, this species was represented at Bassein only and coexisted with *Rhopalophthalmus mumbaiensis* and *Mesopodopsis orientalis*. They occurred in the temperature and salinity of 32.5°C and 30.3 psu respectively.

Distribution: This is a shallow water coastal form and endemic in the Indian Ocean. It has been recorded from Chilka Lake, Orissa, Gangetic delta (Tattersall, 1915, 1922), Kerala coast (Kurian, 1954; Pillai, 1957, 1961) and Waltair coast (Shyamasundari, 1973).

Erythroops minuta

Erythroops minuta is a coastal form, probably living with the littoral algae. In the present collection this species occurred along with *Rhopalophthalmus anishi*, *R. vijayai*, *Gastrosaccus dunckeri* and *Mesopodopsis orientalis* and the temperature and salinity of 32.5 - 33°C and 30 - 34.8 psu respectively. The number of eggs in a single brood of *Erythroops minuta* was mostly 7.

Distribution: *Erythroops minuta* has been previously recorded from the Gulf of Siam (Hansen, 1910), Gulf of Mannar (Tattersall, 1922), Singapore Strait (Tattersall, 1960), Formosa (Li, 1964), Arabian Sea (Pillai, 1964, 1973), Malacca strait (Tattersall, 1965), Andaman Sea (Shyamasundari, 1973), Bahrain waters (Grabe *et al.*, 2004). *E. minuta* obviously has a restricted distribution in

the Pacific and Indian Ocean. The present collection is from the Arabian Sea and does not extend beyond its known distribution.

Acanthomysis anomala

In the present collection, *A. anomala* occurred only at Kandla along with *M. orientalis*. They occurred in the temperature and salinity of 23°C and 37 psu respectively.

Distribution: This species was previously recorded only from south west coast of India (Pillai, 1961) and the present occurrence extends its distribution to north.

Mesopodopsis orientalis

In the present study *M. orientalis* was the dominant species and occurred at 8 stations. It is a gregarious form and observed along with *Rhopalophthalmus mumbaiensis*, *R. vijayai*, *Eurowbowmaniella muticus*, *Erythroops minuta*, *Acanthomysis anomala* and *Indomysis nybini*. They tolerate wide range of salinity and temperature. It usually lives in swarms/shoals/aggregations. In the present study a sample of swarm taken at Dahanu. (station 4), consisted of 32.42% mature males, 16% immature males 14.13% immature females, 16.7% brooding females, 11.32% spent females and 9.43% juveniles. Brood size were found to vary between 9 -13 depending on the length of the animals (8.3 mm to 9.7 mm respectively).

Distribution: *Mesopodopsis orientalis* is widely distributed throughout the northwest and southwest coast of India and endemic in Indian Ocean.

Indomysis nybini

This species observed along with *S. hanseni*, *G. dunckeri* and *M. orientalis*. They are tolerant to a wide range of salinity and temperature and can actively breed in salinity as low as 10.5 psu and as high as 80.3 psu. The temperature in which it occurred ranged from 26.5 to 36°C. The number of eggs in each brood varied from 9-13.

Distribution: This species have been recorded from the Tarut Bay (Murano, 1998), Baharine (Grabe *et al.*, 2004), salt pans of Mumbai (Biju and Panampunnayil, 2010) and South of Iraq (Naser *et al.*, 2012).

Discussion

A total of eight genera and twelve species were represented in the collections. *Mesopodopsis orientalis* was the most common and dominant mysid and occurred at 8 localities with relatively high percentage at Mundra, Hazira, Dahanu, Bassein and Amba. *Indomysis nybini* was the second dominant species. All the other species were either moderately or sparsely represented.

Genus *Siriella* was represented by three species, *S. dubia*, *S.*

jonesi and *S. hanseni*. In the Indian Ocean *S. dubia* has so far been recorded from the Andaman and Arabian Sea only. Pillai (1973) had stated that this is a rare species and has a restricted distribution and is confined to the area north of 10°N in the Indian Ocean and western part of the Pacific Ocean. It does not occur in the Atlantic Ocean. In the present collection it occurred at Vadinar. *Siriella jonesi* occurred in moderate numbers at Vadinar, Hazira and Bassien and judging from the available information it is a coastal form and is confined to the Arabian Sea. Earlier studies reveal that *Siriella hanseni* is distributed in the Indian and Pacific Oceans. In the present collection this species occurred only at Mithapur. The genus *Rhopalophthalmus* is represented by nine species in the Indian waters, three of them, viz. *R. mumbayensis*, *R. anishi*, and *R. vijayai* were represented in the study area. In general, species of *Rhopalophthalmus* are neritic in habitat and when present occur in swarms (Pillai, 1973). *R. vijayai* occurred in small aggregations and is definitely a gregarious form; the other two species were only sparsely represented. *R. mumbayensis* and *R. anishi* were found at Bhavnagar and Bassein, while *R. vijayai* was confined to a particular locality at Bhavnagar. All the three species are endemic in the Indian waters. The genus *Gastrosaccus* is represented by three species in the Indian waters and the present material contains only one species, *G. dunckeri*. This species is common along the coastal waters of India. In the present collection this species was encountered in moderate numbers at Mundra, Vadinar, Mithapur, Bhavnagar, Hazira and Bassein. *G. dunckeri* has been recorded from several localities in the Indian and Pacific Oceans. Genus *Eurobowmaniella* is represented by two species; *E. simulans* and *E. muticus* in the Indian waters and the present material contain *E. muticus* only. This species occurred at Bassein and earlier records reveal that this species is confined to Indian waters. In the present collection, genus *Erythrope* is represented by *Erythrope minuta* and occurred sparsely at Bhavnagar, Bassein and Dahanu. This species was found along with *Rhopalophthalmus vijayai*, *Gastrosaccus dunckeri* and *Mesopodopsis orientalis*. Present record is the first report of *E. minuta* from the study area. This species is distributed in Indian and Pacific Oceans. The genus *Acanthomysis* includes 14 species and is distributed in the Indian, Pacific and Atlantic Oceans. Murano (1984) reported this as the most abundant mysid in the neritic waters of Japan and had been abundantly found in the stomach of soles and penaeid shrimps. So far only five species are known from India. In the present collections the genus is represented by only one species, *A. anomala*. The present record is the first report of this species from the present study areas and is an endemic form in the Arabian Sea. *Mesopodopsis orientalis* is the most abundantly caught species and occurred in aggregations at Dahanu (February 2007), its breeding intensity is found to be in the premonsoon periods. Curious to note that aggregations of this species are mostly monospecific and consisted of individuals

of different age groups and do not co-exist with other species. Bhattacharya and Kewalremani (1972) reported the occurrence of large numbers of juveniles of *M. orientalis* in the coastal waters of Bombay during May-June and November-January. This suggests that the adults from estuary and back waters migrate to the coastal waters and breed there, as the juveniles may not be able to survive in estuaries and backwaters where the salinity will be very low in the rainy seasons. In the present study *Indomysis nybini*, was encountered only at Mithapur. This species is a shallow water form inhabiting the salt pans and the adjacent creeks where the salinity and temperature undergo marked fluctuations. This high saline species is endemic in the Indian Ocean. Biju and Panampunnayil (2010) reported it from Thane salt pan. This species is widely distributed in brackish water system in the Persian Gulf (Naser *et al.*, 2012).

Maximum numbers of mysid species (7) were recorded from Bassein. *Siriella dubia*, *S. jonesi*, *Rhopalophthalmus mumbayensis*, *R. anishi*, *R. vijayai*, *Gastrosaccus dunckeri*, *Eurobowmaniella muticus*, *Mesopodopsis orientalis* and *Indomysis nybini* were previously known from in and around the study area, all the other species are first records from the respective areas of their collection.

Table 4. List of mysid species so far recorded from the northwest coast of India.

Species	Gajbhiye <i>et al.</i> (1980)	Biju and Panampunnayil (2009)	Present study
<i>Siriella dubia</i>	-	+	+
<i>Siriella jonesi</i>	-	+	+
<i>Siriella hanseni</i>	-	-	+
<i>Siriella</i> sp.	+	-	-
<i>Rhopalophthalmus macropsis</i>	+	-	-
<i>Rhopalophthalmus mumbayensis</i>	-	+	+
<i>Rhopalophthalmus murudi</i>	-	+	-
<i>Rhopalophthalmus vijayai</i>	-	+	+
<i>Rhopalophthalmus anishi</i>	-	+	+
<i>Gastrosaccus dunckeri</i>	-	+	+
<i>Eurobowmaniella muticus</i>	-	+	+
<i>Erythrope minuta</i>	-	-	+
<i>Acanthomysis pelagica</i>	-	+	-
<i>Acanthomysis platycauda</i>	+	+	-
<i>Acanthomysis macrops</i>	-	+	-
<i>Acanthomysis microps</i>	-	+	-
<i>Acanthomysis anomala</i>	-	-	+
<i>Afromysis dentisinus</i>	-	+	-
<i>Mesopodopsis orientalis</i>	-	+	+
<i>Mesopodopsis zeylanica</i>	+	-	-
<i>Indomysis annandalei</i>	-	+	+
<i>Indomysis nybini</i>	-	-	+

At present, 22 species of mysids were recorded from the northwest coast of India (Table 4). *Mesopodopsis orientalis* and *Indomysis nybini* occur in large numbers and tolerate wide range of environmental parameters, are known for completing their life cycles in a few days and hence are suitable for bioassay tests to determine the potential impacts of various pollutants on all life stages.

Acknowledgements

The authors are grateful to the Director, National Institute of Oceanography, Goa and to the Scientist in-Charge, Regional Centre, NIO, Kochi for the encouragements and facilities provided. Thanks are due to the Scientist-in-Charge, NIO, Mumbai for providing the study material. We are also thankful to Dr. V. R. Nair, Dr. N. V. Madhu, Dr. P. K. Dineshkumar, Dr. R. Jyothisbabu and Mr. K. R. Muraleedharan, Scientists, NIO, R. C. Cochin for valuable help and suggestions.

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