Chapter 4

GEOGRAPHICAL DISTRIBUTION AND HABITAT PREFERENCES OF PRAWNS AND SHRIMPS FOUND IN DIFFERENT COASTAL REGIONS OF GUJARAT

CONTENST

4.1 Introduction

In the most straightforward words, the habitat of an organism is the location where it lives (Odum, 1971). Habitats are the resources and conditions available in a local area that produce the occupancy, including the survival and reproduction, by a given organism. Habitat selection is the hierarchical process through which the body decides which habitats to use at different scales. It depends on various factors that influence habitat selections for an individual (e.g., competition, cover, and predation) (Krausman, 1999). It's also affected by the biotic and abiotic factor of the coastal habitats, such as coral reef, mussel beds, rocky, and open sand habitats, etc. and provide significant ecosystem role and services, as several species use them at a few or all stages of their life cycle (Rönnbäck et al., 2007; Seitz et al., 2014). They are highly productive regions, inhabited by various marine invertebrates, and serve as essential areas for feeding, nursery, spawning, and migration for commercially and ecologically important species. All marine habitats vary in terms of sediment structure, structural complexity, hydrodynamics, and community structure.

To compare the biological diversity of any group in different regions or habitats, two different approaches have been applied. The more traditional

taxonomic way of analyzing biodiversity is based on species identities, whereas the other method is focusing on the biological traits of organisms, often defined as any morphological, physiological, phenological, or behavioral characteristic of an organism affecting its performance (Violle et al., 2007). It has been suggested that the biological trait approach is better suited to explain the function of the ecosystem, as it is not species identification but also the fundamental characteristics which dictate their interactions, responses, and ecological role within food webs and ecosystems (Dıaz and Cutter, 2001; Bremner et al., 2003; Gagic et al., 2015).

Species composition and habitat preference of marine invertebrates is the fundamental requirement to understand the existence of different species in benthic communities, thus adding the baseline information for successful conservation of the habitat and benthic fauna. Studies on the distribution and diversity of local fauna are of great importance because they give the best knowledge of the structure, function, and problems of the local organisms and community (Fransozo et al., 1992; Hebling et al., 1994). Mainly, a marine ecosystem has more attention and awareness. It provides shelter to unique and rare animal communities because it gives shelter to unique and rare animal communities (MacArthur, 1972). Organisms living in the intertidal area have to develop different kinds of adaptations because they experience a broad range of physical stress, including temperature variations, aerial exposure, salinity, and hydrodynamic forces. The two species or organisms show somewhat different preferences for their habitat and food habits, and that habitat was more important than food as a segregating niche dimension.

Various ecological studies are although carried out on prawns and shrimps found on different shores; several environmental questions regarding the Spatio-temporal distribution pattern of faunal communities inhabiting the habitat are not explained. Recent studies have identified several knowledge gaps in understanding different beaches, including their macro and micro-habitats. The occurrence and variability in the local faunal community structure depend on their ability of adaptability and

colonization to the changes occurring in the habitat at the local level. The inter and intra-species competition also plays a substantial role in the structure of the macro-faunal community. Systematic classification of regional fauna richness on the local range is essential to know the spatiotemporal variation of the local faunal community.

In India, only a few studies are available on the distribution and habitat preference of prawns and shrimps. A few reports have described their association with other coastal fauna. In 1962, Sankarankutty reported the occurrence of symbiotic crustaceans associated with other echinoderms, and later it was also recorded from the Gulf of Mannar and Andaman and Nicobar Islands (Sastry, 1977; 1981). In 2011, Prakash and his team reported the symbiotic association of *P. chagoae* with sea cucumber collected from the rocky intertidal area. Later in 2016, they observed the symbiotic relation of *Lysmata debelius* with giant moray eels (*Gymnothorax* sp.) and *Lysmata amboinensis* with large groupers and eels. Prakash and his team reported five caridean shrimps *Synalpheus carinatus, Synalpheus comatularum*, *Synalpheus stimpsonii*, *Palaemonella pottsi*, *Pontoniopsis comanthi* with the association of crinoids from Lakshadweep Archipelago. In this chapter, the distribution pattern of marine prawn and shrimp species in the different coastal regions of Gujarat are detailed.

The availability of the various macro and micro intertidal habitats has significantly impacted the intertidal species diversity of the particular area. In 2020 Prakash and Marimuthu reported five caridean shrimps species *Synalpheus carinatus* (de Man, 1888); *S. comatularum* (Haswell, 1882); *S. stimpsonii* (de Man, 1888); *Palaemonella pottsi* (Borradaile, 1915); and *Pontoniopsis comanthi* (Borradaile, 1915) with the association of some crinoid respectively *Phanogenia gracilis* and *P. multibranchiata*; *Phanogenia distincta* (Agatti Island), *P. gracilis* (Amini Island) and *Stephanometra indica; Comaster multifidus* (Kalpeni Island), *Phanogenia gracilis* (Agatti Island), *P. multibrachiata* (Kavaratti Island); *Phanogenia gracilis;* and *Phanogenia distincta.* Later Akash et al. (2020) reported *Urocaridella arabianensis* from the bottom curve coral boulder. They

observed that most of the specimens are matured and ovigerous females, which indicates, the bottom region serves as a shelter and schooling place. Komai et al. (2020) recorded two species of mud shrimp *viz. Upogebia hexaceras* and *Upogebia nithyanandan* from the burrows in colonies of a sponge. All the species of the genus *Upogebia* are generally soft-sediment burrowers.

4.2 Material and Methods

Since the coast of Gujarat is very long and has distinct and widely variable habitats, the species distribution was recorded in two different ways:

1. Geographical region-wise distribution of the species in the Gulf of Kachchh, Saurashtra, and Gulf of Khambhat.

2. Habitat wise distribution to understand the ecological role of the shrimp species.

4.2.1 Region-wise distribution

The coastline of Gujarat is divided into three major regions, namely the Gulf of Kachchh, the Saurashtra coast, and the Gulf of Kachchh. All three areas have distinctive characters and habitat variations. There is a total of 15 coastal districts of Gujarat, where the Kachchh has the longest coastline. The Gulf of Kachchh is bound by 4 districts, the Saurashtra coast by 6 districts, and the Gulf of Khambhat by 8 districts, including the lower south Gujarat extension. During the sample collection at each sampling site, the prawn and shrimp species present were listed with latitude and longitude information. All the data were maintained in the excel sheets for the analysis.

4.2.2 Habitat-wise distribution

During 2015 to 2019 field surveys, the coastal regions of Gujarat were conducted to study the habitat preference and distribution of the species. In the present study, the habitats are divided mainly into types of shore (macro-habitat) as rocky, sandy, mudflats, and sub-littoral or pelagic

regions of the coastal ecosystem (fig. 4.1). At each sampling site, the prawn and shrimp species present were listed, dominant species of animal and type of shore were notated. The zonation pattern is the most important phenomenon observed in the intertidal area. Here in the present study, different zones have been identified based on the presence of the dominant animal community. The microhabitat preference by the intertidal species was also studied. On the sighting of animals, micro-habitat type and zone type were recorded.

Micro-habitat classification- Macro-habitats (types of shore) were further divided into six different micro-habitats (figs. 4.2 & 4.3).

EnZ (Endozoic): Always recorded in an internal association with a particular species of animal.

EZ (Epizoic)**:** Always recorded in an external association with a particular animal species (e.g., coral reef and sea anemone)***.***

H (Hard Substrate): Recorded associated with hard substrates (e.g., rock).

M (Mangrove): Recorded amongst mangroves.

OM (Open Mudflats): Recorded in the areas of open mudflat coast.

SS (Soft Substrate)**:** Recorded associated with soft substrates, sand, or mud tide pools (e.g., sand and mud).

Figure 4.1 Macro-habitats or intertidal habitats: a) Rocky shoreline at Harshad (Saurashtra); b). Muddy shoreline at Kambhoi (Gokh); Sandy shoreline at Mandvi (GoK).

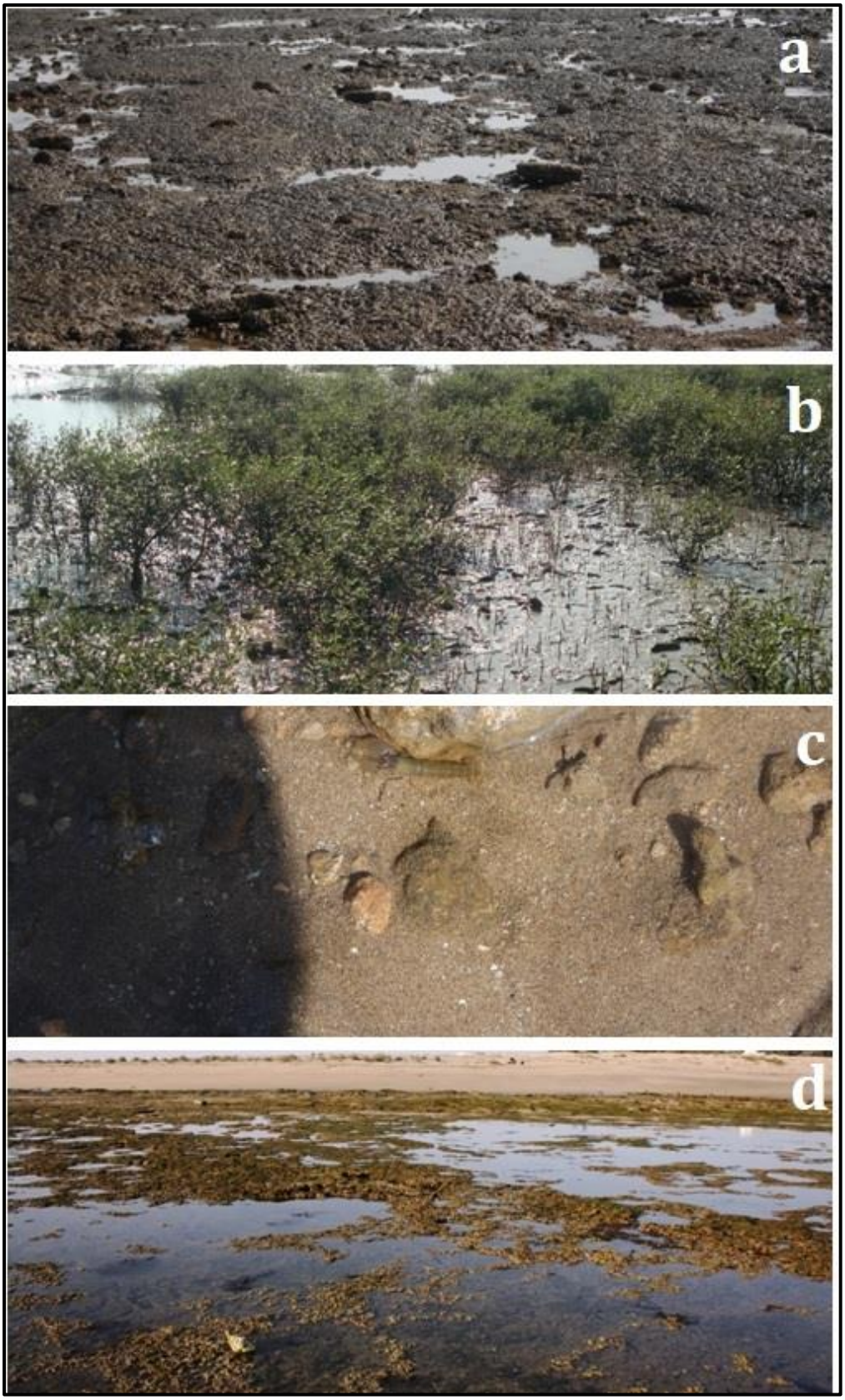

Figure 4.2 Type of micro-habitats or intertidal habitats: a) Open mudflat; b). Mangrove mudflat; c) Soft substrate; d) Hard substrate.

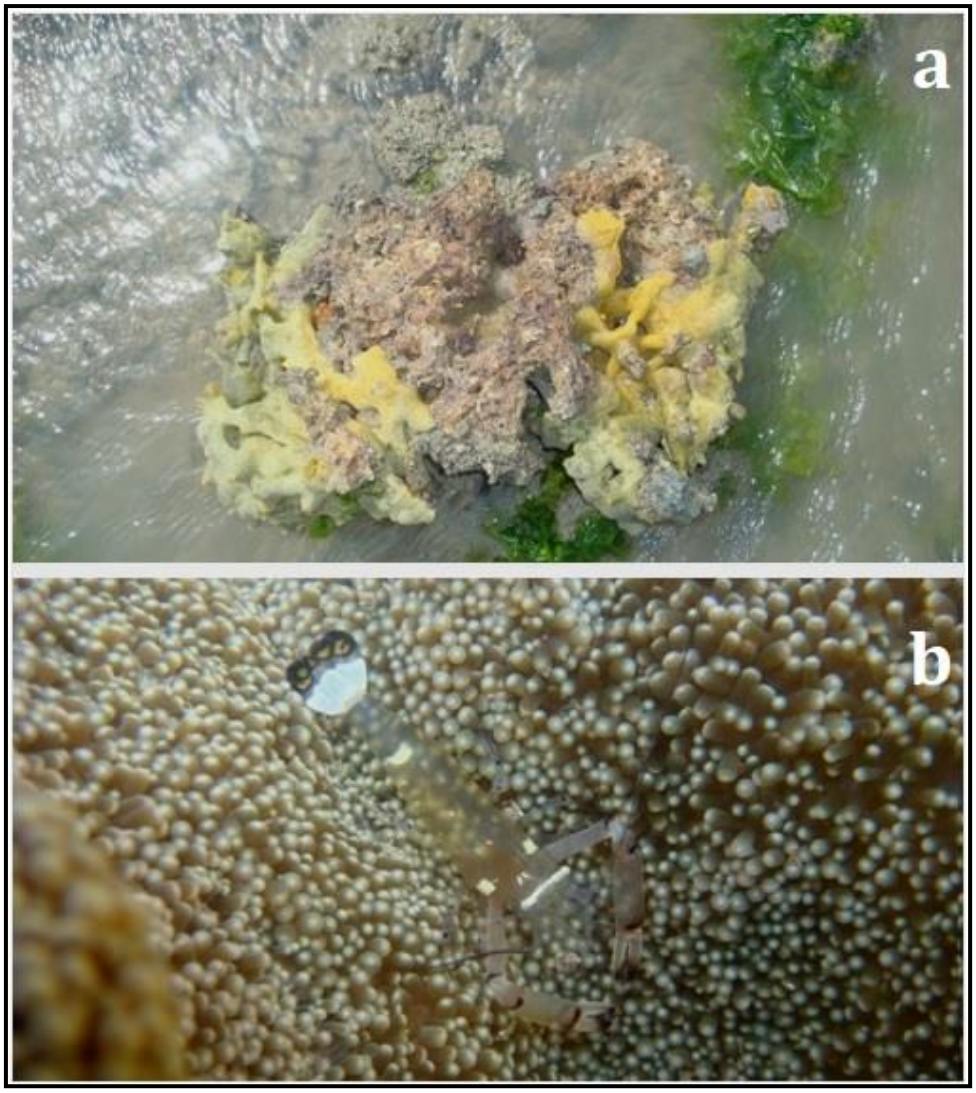

Figure 4.3 Types of micro-habitats or intertidal habitats: a) Endozoic; b) Epizoic.

4.3 Data analysis and Results

In the present study, a total of 52 species of shrimps, representing 2 suborders, 4 infraorders, 4 superfamilies, 11 families, and 27 genera were recorded from three different regions of Gujarat (Table 4.1). The maximum species diversity was reported from the Saurashtra coast (43 species), followed by the Gulf of Kachchh (33 species) and Gulf of Khambhat (22 species) (fig. 4.4). The Gulf of Kachchh is considered one of the biologically most productive marine habitats. The intertidal area of Saurashtra and the Gulf of Kachchh supports the growth of various aquatic fauna due to unique marine habitats such as mangroves, seagrasses, coral reefs, rocky and

sandy shores. A single intertidal shrimp species *Alpheus lobidens*is reported from all three regions, and a few shrimp species like *Gilvossius rotundicaudata*, *Alpheus pacificus, Athanas parvus*, *Synalpheus coutierei*, *Thor amboinensis*, *Lysmata vittata*, *Upogebia carinicauda,* and *Microprosthema validum* were recorded from the single study site only. In the case of site-wise diversity, the maximum number of the species (6 species) are reported from the Shivrajpur region, located on the Saurashtra coast of Gujarat, which supports various kinds of habitat like the coral reef, sandy, and rocky shore. Because of the habitat variation, the maximum numbers of species occur in this region.

Table 4.1 Region-wise distribution of Marine prawns and shrimps identified during the present study.

S. No.	Species	GoK	SAU	GoKh
1	*Ganjampenaeopsis uncta*	+	+	+
2	*Megokris granulosus*	-	+	-
3	*Megokris sedili*	-	+	-
4	*Metapenaeopsis barbata*	-	+	-
5	*Metapenaeopsis stridulans*	-	+	-
6	*Metapenaeus affinis*	+	+	+
7	*Metapenaeus brevicornis*	+	+	+
8	*Metapenaeus dobsoni*	+	+	+
9	*Metapenaeus kutchensis*	+	+	+
10	*Metapenaeus monoceros*	+	+	+
11	*Metapenaeus moyebi*	+	+	+
12	*Mierspenaeopsis hardwickii*	+	+	+
13	*Mierspenaeopsis sculptilis*	+	+	+
14	*Parapenaeopsis stylifera*	+	+	+
15	*Parapenaeus fissuroides indicus*	-	+	-
16	*Parapenaeus longipes*	-	+	-
17	*Penaeus canaliculatus*	+	+	-
18	*Penaeus indicus*	+	+	-

19	*Penaeus japonicus*	+	+	-
20	*Penaeus latisulcatus*	+	+	+
21	*Penaeus merguiensis*	+	+	+
22	*Penaeus monodon*	+	+	+
23	*Penaeus penicillatus*	+	+	-
24	*Penaeus semisulcatus*	+	+	-
25	*Trachysalambria curvirostris*	-	+	-
26	*Solenocera choprai*	-	+	-
27	*Solenocera crassicornis*	+	+	+
28	*Solenocera koelbeli*	-	-	+
29	*Gilvossius rotundicaudatus*	-	+	-
30	*Neocallichirus jousseaumei*	+	+	-
31	*Upogebia carinicauda*	+	-	-
32	*Alpheus chiragricus*	-	+	-
33	*Alpheus edwardsii*	-	+	-
34	*Alpheus lobidens*	+	+	+
35	*Alpheus malabaricus*	-	-	+
36	*Alpheus pacificus*	-	+	-
37	*Athanas dimorphus*	+	+	-
38	*Athanas parvus*	+	-	-
39	*Synalpheus coutierei*	-	+	-
40	*Latreutes anoplonyx*	+	-	-
41	*Saron marmoratus*	+	+	-
42	*Exhippolysmata ensirostris ensirostris*	+	-	+
43	*Lysmata vittata*	-	+	-
44	*Thor amboinensis*	+	-	-
45	*Ancylocaris brevicarpalis*	+	+	-
46	*Cuapetes grandis*	+	+	-
47	*Nematopalaemon tenuipes*	+	+	+
48	*Palaemon styliferus*	+	+	+
49	*Palaemon pacificus*	-	+	+
50	*Palaemon serrifer*	-	-	+

51	*Procletes levicarina*	-	+	-
52	*Microprosthema validum*	+	-	-

GoK-Gulf of Kachchh; SAU-Saurashtra; GoKh-Gulf of Khambhat

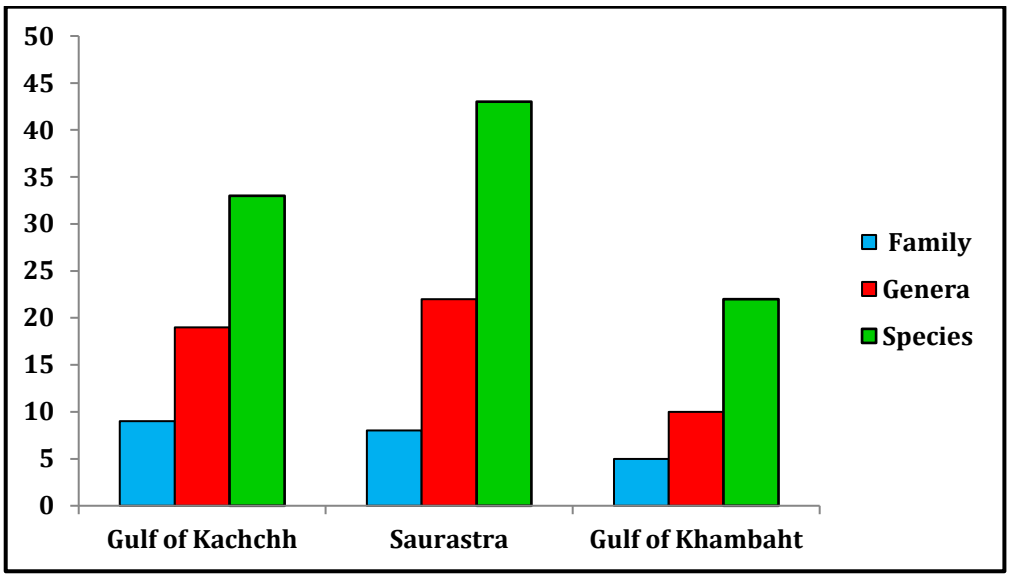

Figure 4.4 Region-wise distribution of marine prawns and shrimp identified during the present study.

Four different kinds of micro-habitats viz. muddy shore, Sandy shore, Rocky shore, and pelagic were observed. Shrimp species also showed a preference for different macro-habitat as they fulfill their requirements of microhabitats to perform various activities. The maximum diversity of prawns was recorded from the pelagic region (Table 4.2). Species belonging to the suborder Dendrobranchiata were found in the pelagic or sub-tidal zone. The distribution and species diversity of Dendrobranchiata varies with the depth of the water. In the case of intertidal species, the maximum species diversity was observed on the rocky shore, followed by the sandy and muddy beach (fig. 4.5). The other micro-habitats were supporting the more or a less number of species diversity. Families like Alpheidae is generally dominantly found on the rocky shore, coral reef, and under rock boulders. The ghost shrimp *G. rotundicaudata* and *N. jousseaumei* were reported from the sandy and muddy bottom substratum of the coral reef area. The species utilizes a sandy and muddy bottom for feeding and burrowing. These shrimps play

an important role in the ecology of the intertidal zone by their bioturbation, which can alter the sediment properties and there by affect the animal communities.

Table 4.2 Macro-habitat wise distribution of the prawn and shrimp species identified during the present study.

Sr. No.	Name of Species	Rocky Shore	Sandy Shore	Muddy shore	Pelagic
1	*Ganjampenaeopsis uncta*	-	-	-	+
2	*Megokris granulosus*	-	-	-	+
3	*Megokris sedili*	-	-	-	+
4	*Metapenaeopsis barbata*	-	-	-	+
5	*Metapenaeopsis stridulans*	-	-	-	+
6	*Metapenaeus affinis*	-	-	-	+
7	*Metapenaeus brevicornis*	-	-	-	+
8	*Metapenaeus dobsoni*	-	-	-	+
9	*Metapenaeus kutchensis*	-	-	-	+
10	*Metapenaeus monoceros*	-	-	-	+
11	*Metapenaeus moyebi*	-	-	-	+
12	*Mierspenaeopsis hardwickii*	-	-	-	+
13	*Mierspenaeopsis sculptilis*	-	-	-	+
14	*Parapenaeopsis stylifera*	-	-	-	+
15	*Parapenaeus fissuroides indicus*	-	-	-	+
16	*Parapenaeus longipes*	-	-	-	+
17	*Penaeus canaliculatus*	-	-	-	+
18	*Penaeus indicus*	-	-	-	+
19	*Penaeus japonicus*	-	-	-	+
20	*Penaeus latisulcatus*	-	-	-	+
21	*Penaeus merguiensis*	-	-	-	+
22	*Penaeus monodon*	-	-	-	+

23	*Penaeus penicillatus*	-	-	-	+
24	*Penaeus semisulcatus*	-	-	-	+
25	*Solenocera choprai*	-	-	-	+
26	*Solenocera crassicornis*	-	-	-	+
27	*Solenocera koelbeli*	-	-	-	+
28	*Trachysalambria curvirostris*	-	-	-	+
29	*Gilvossiusrotundicaudata*	+	-	-	-
30	*Neocallichirus jousseaumei*	+	+	-	-
31	*Alpheus chiragricus*	+	-	-	-
32	*Alpheus edwardsii*	+	+	+	-
33	*Alpheus lobidens*	+	+	+	-
34	*Alpheus malabaricus*	-	+	-	-
35	*Alpheus pacificus*	+	-	-	-
36	*Athanas dimorphus*	+	+	+	-
37	*Athanas parvus*	+	-	-	-
38	*Synalpheus coutierei*	+	-	-	-
39	*Exhippolysmata ensirostris ensirostris*	-	-	-	+
40	*Latreutes anoplonyx*	-	-	-	+
41	*Saron marmoratus*	+	-	-	-
42	*Lysmata vittate*	+	-	-	-
43	*Thor amboinensis*	+	-	-	-
44	*Ancylocaris brevicarpalis*	+	+	-	-
45	*Cuapetes grandis*	+	+	-	-
46	*Nematopalaemon tenuipes*	-	-	-	+
47	*Palaemon pacificus*	+	+	-	-
48	*Palaemon serrifer*	+	+	+	-
49	*Palaemon styliferus*	-	-	+	+
50	*Procletes levicarina*	-	-	-	+
51	*Upogebia carinicauda*	+	-	+	-
52	*Microprosthema validum*	+	-	-	-

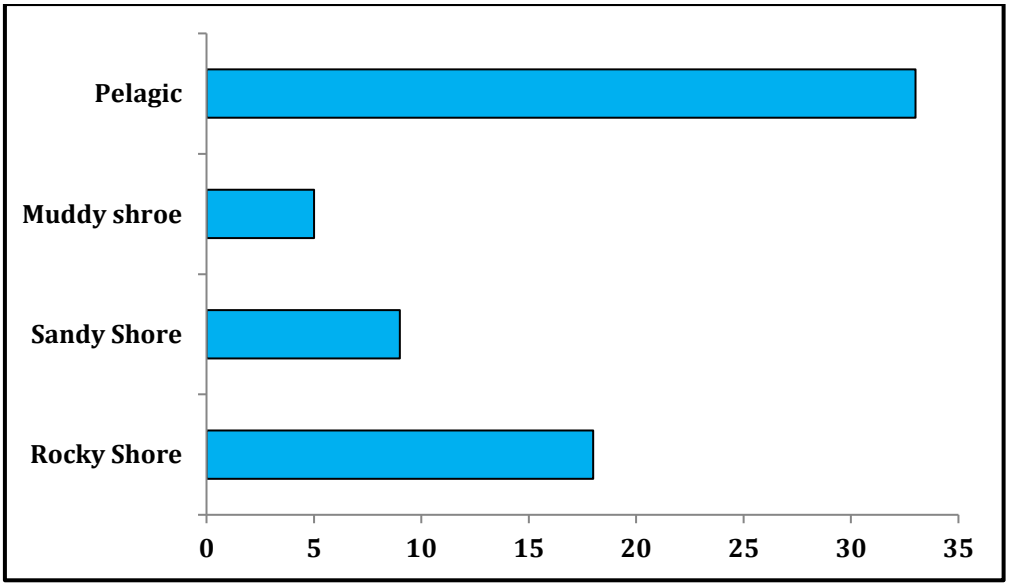

Figure 4.5 Number of species associated with macro-habitats.

A total of 20 species was reported from the intertidal area during the present study. In the case of micro-habitat, the maximum species were reported from the Epizoic or coral reef region (12 species) followed by the soft substrate (11 species), Hard Substrate (9 species), open mudflats (4 species), mangrove, and endozoic (Figure 4.6). In the Endozoic habitat, only a single species *Synalpheus coutierei* was collected from the internal canals of unidentified sponges (Table 4.3). *Alpheus lobidens* is the only individual species present over here, which is found under rock boulders, coral reefs, mangrove swamps, mudflats, sandy and muddy substrates with rock rubbles. All these microhabitats provide the species hiding sites from the predators and the algae growing on the surfaces. In the case of the *Alpheus* species, crevices offer the best feeding ground. The hard substrate consists of different kinds of micro-habitats like shallow tide pools, deep tide pools, rock boulders, and rock crevices, and these kinds of microhabitats provide shelter to different shrimp species. A number of caridean shrimp species were recorded in the tide pools (e.g., *Alpheus chiragricus,* and *Alpheus pacificus*). The species diversity, richness, and abundance in tide pools are also dependent upon the size of the tide pools, depth, and location in the intertidal zone. Two species viz. *Alpheus lobidens* and *Alpheus malabaricus* were reported from the mangrove area and mudflats. These are burrowing shrimps. The substrate type, structure,

composition, texture, and shelter presence may strongly affect the population and community structure of the burrowing shrimps, as well as their burrowing behavior of the shrimp species.

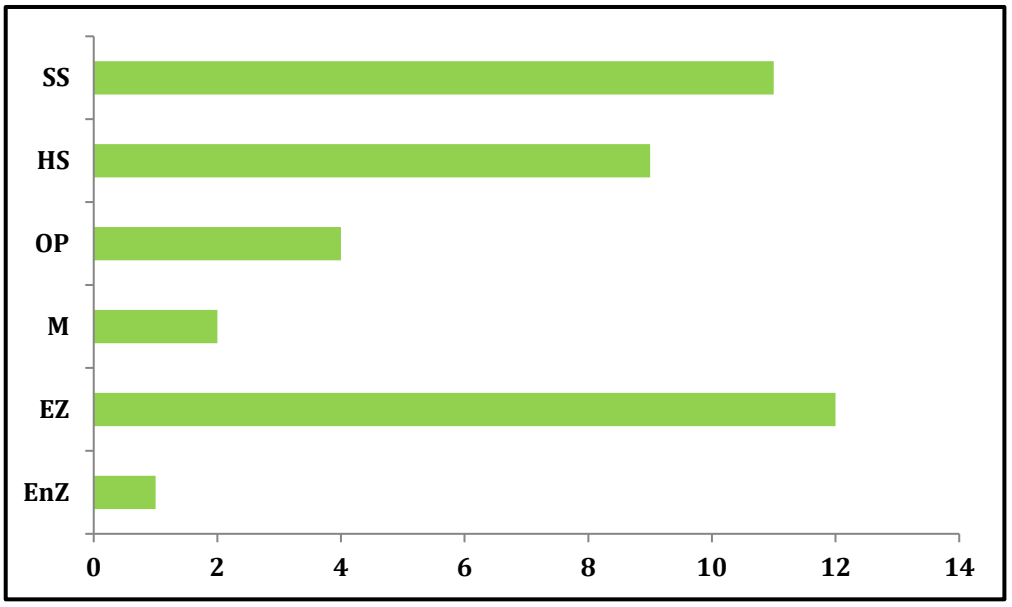

Figure 4.6 Number of species associated with intertidal micro-habitats.

Table 4.3 Micro-habitat wise distributions of the intertidal shrimp species collected during the present study.

S. No	Species	*EnZ*	*EZ*	*M*	*OM*	*HS*	*SS*
1	*Gilvossius rotundicaudata*	-	+	-	-	-	+
2	*Neocallichirus jousseaumei*	-	+	-	-	-	+
3	*Alpheus chiragricus*	-	-	-	-	+	+
4	*Alpheus edwardsii*	-	+	-	+	+	+
5	*Alpheus lobidens*	-	+	+	+	+	+
6	*Alpheus malabaricus*	-	+	+	+	-	-
7	*Alpheus pacificus*	-	-	-	-	+	-
8	*Athanas dimorphus*	-	+	-	-	+	+
9	*Athanas parvus*	-	+	-	-	-	-
10	*Synalpheus coutierei*	+	-	-	-	-	-
11	*Latreutes anoplonyx*	-	+	-	-	-	-
12	*Saron marmoratus*	-	+	-	-	-	-
13	*Lysmata vittate*	-	-	-	-	+	+

14	*Thor amboinensis*	-	+	-	-	-	-
15	*Ancylocaris brevicarpalis*	-	+	-	-	-	-
16	*Cuapetes grandis*	-	+	-	-	+	-
17	*Palaemon pacificus*	-	-	-	-	+	+
18	*Palaemon serrifer*	-	-	-	+	+	+
19	*Upogebia carinicauda*	-	-	-	-	-	+
20	*Microprosthema validum*	-	+	-	-	-	-

4.4 Discussion

The geographical distributions illustrated in this study are only approximate. Samples were collected in different months over five years, thus obscuring seasonal and inter-annual variation, and the water column was not sampled regularly. Despite these limitations, patterns can be discerned for individual groups of taxa and in the pelagic shrimp assemblage. The deep-water habitat and pelagic zone are mostly occupied by the specific shrimp species not found in other zones or habitats. The distribution and diversity of the prawn species vary with the depth of the water. The prawn species belonging to the suborder Dendrobranchiata are found in benthic or pelagic regions. Few shrimp species of suborder Pleocyemata like *Exhippolysmata ensirostris ensirostris, Latreutes anoplonyx, Nematopalaemon tenuipes, Palaemon styliferus,* and *Procletes levicarina* were also recorded from the benthic or pelagic region.

In this study, caridean shrimp are ubiquitous in the intertidal region found under rocks, in small or large intertidal pools, living in burrows in sand or mud substrates. The rocky shores are among the most intensively studied habitat for different ecological aspects for two main reasons, like easy accessibility to the habitat and abundant natural resources. Rocky shore supports the various kind of micro-habitats, and tidepools are an area where a high shrimp diversity occurred, particularly in spring and summer sessions (Vinagre et al., 2015). Two alpheids shrimps, namely *Alpheus chiragricus* and *Alpheus pacificus,* were collected from the large rocky tidepool.

During the winter session, the entire rocky shore is covered by seaweed growth. The seaweed growth provides the feeding ground for many herbivore shrimp species. The algal growth also provides the best camouflage environment for many carnivore species. The smaller species belonging to the family Alpheidea occur in high densities in algal assemblage, while the larger species of the family mostly prefer deep rocky-sandy tide pools. Species belonging to families like Alpheidea occur in high frequency in microhabitats like Hard and soft substrates. These micro-habitats provide the shelters and hiding ground from the predators, and the algae growth on the surfaces of crevices give the best feeding ground. These factors make the rocky zone more suitable for many intertidal shrimp species to inhabit the region. Shrimp of the family Alpheidae are abundant cryptic crevice-dwelling organisms with habitats that include coral and oyster reefs, rocky substrates, and sponge cavities (Williams, 1984). *Synalpheus coutierei* is mostly found with symbiotic association with the sponges in which the sponges provide critical predator-free habitat for these shrimp (Ďuriš et al., 2011). Sometimes, snapping shrimps are also found with the association of heterosexual pairs (Boltana and Thiel, 2001). S*aron marmoratus*, also known as marble shrimp, is a nocturnal species belonging to the family Hippolytidae, usually found with a fringe reef (*Sclerectinia* corals) (Kumar et al., 2015). We reported this species from the lower intertidal zone during this study, where the zoanthids are abundant at Veraval and Sutrapada sites. Zoanthids and coral beds provide camouflage. The caridean shrimp-like *Thor amboinensis* and *Ancylocaris brevicarpali s*are found with the association with Actiniaria (sea anemone). *Ancylocaris brevicarpalis* was collected from *Stichodactyla haddoni*, and the symbiotic relationship was reported by Guo et al. (1996) from Taiwan.

Generally, we consider a palaemonid shrimp species to be 'free-living' if, in general, they do not live on or inside a host animal. However, they can potentially enter rarely for the short-term interaction with a putative host taxon, e.g., living for a short period in a single coral colony. Symbiotic

species (*i.e.,* not free-living) are those who are regularly observed inside body cavities (endosymbiosis) or on the surface (ectosymbiosis) of animal hosts. However, they occasionally may occur away from these, for example, when searching for mates. Species like are free-living *Cuapetes grandis*, *Palaemon pacificus,* and *Palaemon serrifer* were recorded from the coral reef area.

Among all the shrimps observed during the present study, *Lysmata vittata* is one of the most attractive and extensively traded organisms in the marine ecosystem in terms of the marine aquarium industry (Calado, 2008). Interestingly, these shrimps are associated with fishes, particularly the groupers and giant moray eels (*Gymnothorax spp*.). These shrimps display a cleaning behavior that removes fish ectoparasites (Vaughan et al., 2018). We collected this species from the coral reef region under the rock and hard substrate during this study.

The two alpheids shrimp species were collected from the mangrove habitat viz. are *Alpheus lobidens* and *Alpheus malabaricus*. *A. malabaricus* is a single species that was exclusively reported only from the mangrove habitat. The physical interactions among mangroves forests consider as highly productive ecosystems; they provide essential economic and ecological services (Wagner et al., 2004; Pawar, 2011). Besides, mangrove forests support fisheries' production by providing suitable habitat for organisms, temporary feeding, nursery grounds, and permanent resident habitats for fish and invertebrates (Ellison, 2012). The export of mangrove primary production, as dissolved or detritus organic material, also enhances near-shore waters' productivity.

Various species of benthic animals like crabs, shrimps excavate burrows in soft bottom sediments. These burrows protect from desiccation and predation and play an important role in the regional ecosystem by increasing the sediment/water interface area and circulating the lower sediment layers with oxygen-rich water (Kinoshita, 2002). These burrows also provide a habitat for many other species of small organisms (Tamaki,

1988). Shrimps belong to infraorder's Gebiidea and Axiideae are among the dominant large burrowers in sand and mud tidal flats. Families like Callianassidae and Upogebiidae were recorded from the soft bottom of the coral reef region during the present study.

The intertidal zonation pattern was studied in detail for marine invertebrates like barnacles, mussels, snails, and limpets (Chavanich and Wilson, 2000). Even there are only a few studies available on the symbiotic association of shrimp species from Indian waters. The present work observed that the availability of various micro-habitats has an immense impact on the intertidal shrimp diversity of the particular area. The damage of a specific micro-habitat can harm the diversity and population of the shrimp species inhabiting that specific habitat. Further studies are needed to examine the variation in the abiotic and biotic properties of specific microhabitat on the species inhabiting that micro-habitat.