2.1 INTERNATIONAL STATUS

Research undertaken in different places reveals the community structures and variety of rocky tidepools, emphasising the richness and distribution patterns of macrobenthic organisms as well as their interactions within the community. Because of regional environmental factors and the activities of humans, the formation of rocky littoral zones and tidepools differs greatly between countries. Hard surfaces and tidal impacts define the rocky intertidal zone, which is home to a variety of communities determined by biotic and abiotic variables such as biological interactions, resource availability, and local species pools (Peter *et al.*, 2008). Rocky shore biodiversity is greatly impacted by geomorphic features such as pools, pits, cracks, crevices, and ledges that vary spatially as a result of geological contingencies. These characteristics provide habitats that provide protection from predators and wave stress, as well as reducing desiccation stress at low tide.

Research has indicated that species richness and abundance are influenced by geomorphic characteristics and rock type; higher biodiversity is supported by complex landforms and related rock types (Naylor *et al.*, 2022). Due to the shortcomings of more conventional techniques, including measuring tapes and quadrates, new landscape-based strategies and geospatial technologies are required in order to collect data in these zones at different scales (Corey and Garza, 2019). In contrast to emergent substrata, tidepools, as discrete elements of these zones, have separate community patterns driven by the tidal cycle and less obvious vertical zonation (Metaxas and Scheibling, 1993). Tidepools make great subjects for experimental investigations on community organisation because of their physical attributes, which include depth, volume, orientation, and flushing rate. These attributes also add to the tidepools' spatial variability (Metaxas and Scheibling, 1993).

With a focus on rock pools along the coast of South Africa, this study reveals important correlations between salinity and pool size, as well as environmental characteristics such as species composition. The results underscore the significance of comprehending these relationships in warm temperate ecosystems by indicating that habitat characteristics and seasonal variations have a

substantial impact on species survival and food web dynamics (Gusha *et al*., 2021). The Portuguese study focuses on how shore height and size affect species composition and diversity. According to Martin *et al*. (2007), it is revealed that mature pools have a complex assemblage that is impacted by volume and depth, and that environmental stress highlights the impact of pool size on ecosystem functioning. The study investigates the distribution and abundance of motile benthic species in tidepools in Nova Scotia. It finds that environmental conditions have an impact on the abundance, which peaks in the summer and is low in the early spring (Metaxas and Scheibling, 1994). The variety and assemblage of invertebrates in tide pools are investigated in UK research, which reveals that deeper pools have distinct assemblage structures and lesser diversity, whereas shallower pools support more diversity and holdfasts. The study (Bussell *et al*., 2007) highlights the intricate relationships that exist between environmental factors and the organisation of invertebrate communities.

The Sydney study examines how mobile macro-invertebrate diversity and abundance in intertidal rock pools are influenced by microhabitats, particularly overhangs and pits. It reveals the necessity of management interventions to improve habitat complexity and biodiversity (Schaefer *et al*., 2023). Significant physical variable gradients occur in Maine Coast tidepools in England during their transition from ocean to terrestrial habitat and from the open coast to the inside bays. Algal, invertebrate, and vertebrate groups of physical and biological factors were compared using a tidepool survey dataset. The interactions between species exhibit a cyclical cycle, characterised by low trophic level relationships during the early summer, high trophic level associations throughout the late summer and autumn, and structural disintegration due to winter storms and ice scour in the autumn.

According to Jordaan *et al*., (2011), the seasonal pattern shows nested species composition shifts along a horizontal wave energy gradient. Salinity variations caused on by tidal movements and wave action have an impact on the rocky intertidal zones seen in the Baltic and Arctic regions. These zones are rich in species exclusive to the littoral zone, and each of these ecological units has its own

unique species composition and physical characteristics (Den and Hartog, 1968). According to long-term research conducted in Port Valdez, Alaska, salinity and sedimentation are two local physical factors that alter intertidal community structures. These factors also drive predators away from low salinity refugia, which has an impact on prey populations and community dynamics (Blanchard *et al.*, 2017). No discernible correlation was found between the parameters of the tidepool and community factors, neither were there any notable variations 0between the months. Deeper tidepools were found to have lower species richness and diversity, as shown by a negative correlation between tidepool height and these variables (Castellanos-Galindo *et al.*, 2005). Conversely, eco-engineering techniques have improved the rocky intertidal zones of the Persian Gulf, especially in the Strait of Hormuz. According to Shirin *et al.*, (2024), the integration of artificial rock pools into concrete-block breakwaters has led to a notable increase in species variety and abundance. This suggests that such interventions may be effective in reducing the adverse impacts of artificial coastal construction.

Artificial tidepool modules have been created in Japan in imitation of natural environments, offering critical habitat for marine life and seaweed. According to Akira *et al.*, (1999), these units maintain water retention during low tide and produce micro-topographies like cracks and crevices, which are essential for sustaining a variety of biota. In the United Kingdom, man-made rockpools have been created as part of eco-engineering projects, including man-made coastal infrastructure such as seawalls and breakwaters. It has been demonstrated that these characteristics maintain sediment and provide habitats that resemble natural mudflats for benthic animals. These artificial rockpools are successful in increasing biodiversity on hard structures because the faunal assemblages there are more similar to lower coast mudflats (Jessica *et al.*, 2022).

Sponge diversity may be observed in both tropical and temperate seas. The World Porifera Database (WPD) https://www.marinespecies.org/porifera (Boury-Esnault *et al.*, 2014) listed 9,637 total species of sponges, including Calcarea (812), Demospongiae (7,985), Hexactinellida (704), and Homoscleromorpha (136). It has been suggested that there could be further species, though. As part of the global effort to create an inventory of all marine

organisms, the WPD is a database that contains all recent sponges that have ever been described (Vinod, 2024). Known for its reef formations, the Costa do Descobrimento in Brazil is habitat to a rich sponge assemblage with 101 morphotypes spanning 22 species, demonstrating the region's richness and the distinct species composition of its reefs (Bettcher *et al*., 2023).

Eighteen sponge species were found along Morocco's Mediterranean coast; the most diverse was found along the shore of Belyounech, a sign of the area's high sponge variety and richness (Krikech *et al*., 2020). Underwater studies conducted in southern India, from Enayam to Kollam, identified 24 species of sponges, with maximal diversity found in Adimalathura, Vizhinjam, and Enayam. These findings highlight the regional differences in sponge richness (Kaungal *et al*., 2014). The taxonomic information provided by the fossilised siliceous spicules of Demospongiae and Hexactinellida is invaluable in reconstructing the phylogeny of sponges and comprehending their evolutionary background (Domala, 2022).

Sea anemones, corals, jellyfish, and other cnidarians have a special home in tidepools, which are intertidal zones. With over 1000 species spread over the globe from pole to pole, sea anemones (Order, Actiniaria) are especially effective in these conditions (Gomes *et al*., 2016). Due to phenotypic variety and a lack of strong morphological characteristics, sea anemones are relatively uncommon compared to other groups; this has an impact on biogeographical and ecological research, but it also makes their evolutionary relationships unclear (Gomes *et al*., 2016). Another category of jellyfish found in tidepools is called Staurozoa, or stalked jellyfish; there are around 50 species in all. In intertidal and shallow subtidal zones, these species are frequently affixed to substrates including algae, rocks, and seagrasses, while some may be found at depths greater than 3000 meters (Miranda *et al*., 2018).

With 54 species distributed over three families, Ceriantharia is remarkably diverse, including in the case of tube-dwelling anemones. However, in order to completely comprehend their richness and distribution, comprehensive species-by-species studies are still required (Stampar *et al*., 2020). Another class of cnidarians that may be found in tidepools and other marine habitats are called pennatulaceans, or sea pens. There are over 200 species of these creatures, which

can be found in depths of up to 6100 meters and in polar seas and equatorial tropics (Williams, 2011). Tidepools include zoantharians, which are colonial cnidarians that are often found on shallow tropical coral reefs. For instance, symbionts from the Symbiodiniaceae family have been identified in species such as *Palythoa caribaeorum* and *Zoanthus sociatus* that are found in Trinidad (Belford, 2021).

Studies on platyhelminth species in tidepools and other coastal environments have shown a remarkable variety, despite the lack of complete worldwide data that is especially relevant to tidepools. 398 different species of platyhelminth have been identified by research conducted in the eastern North Sea surrounding the island of Sylt. However, a significant number of species remain unidentified or undescribed, especially in subtidal waters (Armonies, 2023). This implies that similar ecosystems throughout the world have a great potential for species richness. Two novel polyclad species discovered in barnacle shells in the southern Mexican Pacific suggest that tidepool habitats can support unusual species interactions (Ramos-Sanchez *et al.,* 2021). According to Tsuyuki *et al*., (2019), the finding of *Prosthiostomum torquatum* sp. nov. in Japan's rocky intertidal zone emphasises the existence of unique species in these environments (Tsuyuki *et al*., 2019).

The variety of platyhelminths in coastal habitats is further shown by the checklist of Aspidogastrea trematodes, which covers species found in intertidal zones and has 61 species identified worldwide (Alves *et al*., 2015). A significant degree of cryptic diversity is also shown by the extensive distribution of Microstomum lineare in fresh and brackish environments, including tidepools, and the molecular taxonomy-based identification of three new species (Atherton and Jondelius, 2018). The variety of platyhelminths known to exist in tidepool habitats has increased with the description of four new *Gyrodactylus* ectoparasite species from intertidal fishes in Chile (Lebedeva *et al.,* 2021).

Research on annelid species found in tidepools worldwide reveals an abundance of variety shaped by a range of environmental conditions. Field collections conducted between 2000 and 2002 in the ria of Ferrol, Galicia, NW Spain, discovered 76 polychaete species and 18 oligochaete species, indicating the

notable prevalence of annelids in this region's rocky intertidal zones (Parapar *et al*., 2009). Comparably, studies in the western region of Lagos Lagoon, Nigeria, found 55 annelid species, including 31 previously unknown species, suggesting a significant variety impacted by pollution levels and seasonal variations (Ogunwenmo and Kusemiju, 2004). Due in part to the polychaete Spirorbis coralline's notable abundance in tidepools in Washington State, the red alga *Corallina officinalis* was linked with a significant number of invertebrates (Dethier, 1982). Furthermore, the known variety of annelids in tidepool habitats was further expanded with the description of two new species of the genus *Trilobodrilus* from intertidal and subtidal areas in San Diego, California (Kerbl *et al*., 2018).

Up to 60% of all species on the planet are part of the phylum Mollusca (Gosliner et al., 1996). There are around 1.75 million species on the globe, of which 46,000 have been identified as species of marine molluscs (Bouchet *et al.*, 2016). Research on Mollusca species found in tidepools worldwide suggests an increased level of diversity caused by a variety of environmental conditions. For example, a targeted evaluation of molluscs in Portuguese rock pools revealed 37 species, with grazing gastropods accounting for the majority (62.2%), followed by bivalves (27.0%) and chitons (10.8%) (Goncalves *et al.*, 2023).

Studies have been reported that 80,000–100,000 species of molluscs are thought to exist worldwide, comprising 15,000 bivalves and 50,000 gastropods (Venkatesan, 2010). 212 distinct species of invertebrates, including molluscs, were found by specific investigations, including those conducted on the turf-forming red alga *Corallina officinalis* throughout the UK and Ireland. These studies demonstrated great heterogeneity in community patterns at both local and large scales (Bussell, 2003). Algal abundance, pool shape, and wave exposure all affect the molluscan communities in rock pools like those examined in Portugal; the most common species are grazing gastropods (Goncalves, 2023).

The study conducted by Alberto *et al.,* (2022) in the Mediterranean Sea focused on heterobranchs found in anthropized rock pools in the western Adriatic. The research revealed 19 species, some of which were newly recorded, and highlighted the variety of trophic assemblages that mirror the species richness

seen in these urban areas. There is a consistent upper and lower distribution range for the mussel *Mytilus californianus*, which is distributed in a well-defined zone along rocky intertidal shorelines in western North America. Larval recruitment to a variety of substrates, such as the red alga *Endocladia muricata*, forms the band. The mussels may be pushed downward or washed inward if they escape predators like *Pisaster ochraceous*. It is suggested that mussels dominate the environment because predation promotes cohabitation among possible rivals. The suggestion that intertidal communities are subject to physical control is challenged by the pattern's persistence across time (Paine, 1974). Many investigations conducted in various geographical locations have shown that tidepools harbour a wide diversity of crab species. For example, studies carried out on Qeshm Island's intertidal rocky coastlines have revealed 15 species of crabs from 8 families; the maximum species richness is found in the Portunidae family (Fatemi *et al.*, 2012). The Portunidae family once again exhibited the highest species richness among the 22 families detected in research conducted in the Gulf of Oman, which revealed 37 crab species from 17 families in intertidal zones (Ghotbeddin, 2011).

Seven thousand species of Echinodermata may be found in the world's ocean based on a thorough analysis of records that have been published (Raghunathan *et al*., 2016). Within 1142 genera, 149 families, and 37 orders, the Echinodermata is one of the well characterised phyla, with over 13,000 extinct and 7,000 current species. The live representatives of this phylum are exclusively found in marine environments (Bather *et al*., 1900). Furthermore, research on the effects of species that modify habitat, like the purple sea urchin in temperate rocky intertidal zones, has shown that these organisms create unique microhabitats that change the structure of communities at fine spatial scales. In occupied pits, empty pits, and nearby flat spaces, different assemblages of algae, sessile fauna, and mobile fauna have been observed (Timothy *et al.*, 2015).

A study conducted in West Java, Indonesia, on macroinvertebrates in tide pools found that 31 species had a high relative abundance of *Ophionereis dubia*. The study also discovered that extreme water temperature ranges had an impact on species diversity, suggesting that some species were able to withstand difficult environmental conditions (Pribadi and Kanza, 2017). Global tidepools display a

range of community interactions influenced by biotic and abiotic elements. The dynamics of predator-prey in California's tidepools demonstrate how environmental factors like temperature and pH levels have a big impact. For example, it has been demonstrated that ocean acidification inhibits herbivorous snails' (*Tegula funebralis*) anti-predator behaviour, which increases grazing and decreases top-down control by keystone predators like *Pisaster ochraceus*, changing the structure of the food web (Jellison *et al.,* 2022). In the same way, Trait-Mediated Indirect Interactions (TMIIs) have been shown in which the presence of small predatory sea stars (*Leptasterias* spp.) drives snails into microhabitats of refuge, reducing grazing pressure and promoting greater algal development (Gravem and Morgan, 2019).

Fish community structures in tropical rockpools on Brazil's southeast coast are impacted by factors such as pool morphometry, water quality, and ecological interactions like predation and competition. Certain pools exhibit different communities depending on how close they are too estuarine like conditions and how many niches they have (Macieira and Joyeux, 2011). Research conducted on St. Martin's Island, Bangladesh, revealed a wide variety of 441 specimens belonging to 23 different species of tidepool fish. The diversity and richness varied over intertidal zones and were positively connected with tidepool surface area (Sharifuzzaman *et al*., 2021).

Additionally, this study from Portugal suggests that rocky intertidal pools function as nursery environments for juvenile marine fish, offering protection, warmer water, and an abundance of food, all of which increase the survival rates of larvae and juvenile fish (Dias *et al*., 2016). With unique assemblages in tidepools and boulder fields, as well as remarkable interannual and regional fluctuations in species composition and abundance in California, the distribution of intertidal and shallow littoral fishes also reflects temporal and spatial patterns (Ronald *et al.,* 1986). A five-year study in the intertidal zones of La Paz, Mexico, found significant spatiotemporal variations in temperature, salinity, and dissolved oxygen. These variations were highly correlated with changes in species dominance and fish community structure, showing the dynamic nature of these ecosystems (Emelio *et al*., 2022).

Rocky intertidal fish assemblages on Colombia's Pacific coast are distinguished by a stable community structure, with species like *Buthygobius ramosus* and *Abudefduf concolor* dominating. There is a negative correlation between tidepool height and species richness and variety in these pools, indicating that more varied populations are supported by lower pools (Gustavo et al., 2005). Research on fish biota in beach rock tidepools in northeastern Brazil revealed the significance of regional characteristics in structuring fish communities, such as substrate heterogeneity and depth, with fish diversity and composition exhibiting yearly stability (Luis et al., 2017).

The first comprehensive research on tidepool fishes in the northern Bay of Bengal highlights the ecological relevance of intertidal zones and provides important data for increasing our understanding of marine biodiversity in regions where there is a dearth of information (Sharifuzzaman *et al.,* 2021). There are 292 species of fish found in the shallow tidepools of Mauritius whose ecological functions are examined in this study report. It draws attention to how these communities are declining as a result of alterations in the environment and human activity (Arndt and Fricke, 2019). Environmental stressors like temperature and salinity changes affect the distribution of macroalgae in tidepools in Brittany, France. Different vegetation zones arise according to the species' tolerance for these circumstances and interactions, like grazing (Wiebe *et al*., 1989).

Herbivory and physical components like wave action also influence seasonal variations in algal abundance; various species exhibit different growth and decline patterns throughout the year (Megan and Dethier, 1982).

Overall, a variety of physical elements, biological processes, and human activities influence the formation of rocky littoral zones and tidepools; significant regional variations have been noted (Peter *et al*., 2008). Additionally, studies conducted through experimentation have shown that greater biodiversity in tidepools, specifically, species richness and functional diversity, increases human interest and offers advantages for culture and education. These findings imply that conservation initiatives aimed at preserving or restoring biodiversity can have a

major positive influence on human interactions with these ecosystems (Fairchild *et al*., 2018).

2.2 NATIONAL STATUS

Significant spatial and temporal variability is seen in the community structure and diversity of India's rocky tidepools, which are impacted by a variety of natural and man-made processes. The study emphasises the variety, conditions, and richness of rockpool ecosystems and highlights the significance of considering both biotic and abiotic elements (Aturu and Uppaluri, 2013).

A total of 169 species across 15 groups were identified, with polychaetes (64.98%) and amphipods (25.23%) dominating the infauna, alongside gastropods, bivalves, and decapods from Bay of Bengal off northeast India (Ganesh & Raman, 2007). From Port Blair coast, south Andaman, A total of 112 macrofaunal taxa belonging to 4 major and 2 minor phyla were recorded Polychaeta was the most dominant taxa followed by Amphipoda (Ganesh & Pandey, 2019)The Mahanadi Estuarine System (MES) on India's east coast, faces intense anthropogenic activity affecting sediment-dwelling biota. A study (2013–2017) analysed 73 taxa from 64 genera and 48 families, with polychaetes (81.41%) and crustaceans (15.42%) as dominant contributors to macrobenthic diversity (Nayak et al., 2022).

With 2078 taxa, mostly polychaetes, gastropods, and bivalves, the North West Indian coast is a highly industrialised area that supports rich macrobenthic biodiversity. Anthropogenic pressures, sediment texture, and salinity all have an impact on this biodiversity, and intertidal areas show distinct zonation patterns (Sukumaran et al., 2021).

Furthermore, Majithiya and Gohel's work included more comprehensive studies of marine ecology, such as how environmental factors affect metabolic activity and the conservation of living resources, which indirectly assists in our comprehension of the composition of invertebrate communities in these environments (Majithiya and Gohel, 2022). Bivalves and nematodes are less common, indicating a similar pattern of distribution in tidepools, whereas polychaetes, gastropods, and crustaceans are more common in the subtidal macrobenthos in the Gulf of Kutch (Shivanagouda, 2013). The study demonstrates

the varied structure of tidepool ecosystems throughout the Veraval coast and the influence of physical characteristics on faunal variety, such as substratum and depth (Chavda and Kundu, 2021).

A total of 486 species of marine sponges have been described from the coral reef regions in the Indian Seas (Thomas, 1998). The coral reef areas in Indian waters are rich in sponge fauna. The Gulf of Mannar and Palk Bay (319 species) has the most variety, followed by the Gulf of Kachchh (25 species), the Andaman and Nicobar Islands (95 species), and the Lakshadweep Islands (82 species). Thirteen species of coral-boring sponges have been identified so far; they include eight from the Lakshadweep reefs, five from the Andaman and Nicobar Islands, and twenty from the Gulf of Mannar and Palk Bay (Venkataraman and Wafar, 2005).

The authors of the review on India's coastal and marine biodiversity have listed 451 different species of sponges, spanning 169 taxa and 65 families. Thorough field research in the as-yet-undiscovered regions might result in the discovery of several new species that have not yet been previously documented (Vinod, 2024). The earlier documentation (Annandale, 1915; Panikkar, 1936, 1937 & 1939; Parulekar, 1967, 1968, 1969, 1971; Parulekar, 1990) has provided information on Indian sea anemones, listing 40 species of sea anemones from 33 genera, 13 of which were reported from India for the first time, along with their ecological attributes. A study conducted in the intertidal zone of Gujarat's Saurashtra coast summarises the 15 species of actiniarians that belong to 10 genera and 5 families, 13 of which are newly reported to Gujarat (Shah *et al*., 2017). Thanks to suitable circumstances, the study finds that *Palythoa* is highly abundant in the intertidal area of Sutrapada. It frequently outgrows *Porites* spp. and exhibits lateral rage and point settlement. It also suggests that *Palythoa* may be the dominant species in the area, offering a limited space for other species (Pandya *et al*., 2012). The study indicates a mutualistic association between the gastropod *Nassarius olivaceus* at Narara Reef in the Gulf of Kachchh and a tiny sea anemone. The gastropod's shell is habitat to the sea anemone, which benefits from increased feeding opportunities. All seasons are consistent with this unique symbiotic interaction (Dave and Mankodi, 2009). The study finds hitherto

undocumented fauna connected with zoanthid colonies and suggests a symbiotic interaction between zoanthids and hermit crabs. This suggests that a variety of organisms improve within zoanthid colonies, impacted by biochemical substances generated by the zoanthids (Upadhyay and Mankodi, 2014).

The study reports the discovery of the aggregating sea anemone *Anthopleura elegantissima* for the first time in Indian oceans. Along the rocky coastlines, the species produces dense clonal aggregations. It is characterised by a pale grey green to white column and acrorhagia with stinging cells. According to Shah *et al*., (2017), this study closes a large gap in the biogeographical records of sea anemones in India. According to the study, zoantharians can control space by preventing barnacles from growing, but they can only settle on vertical surfaces. According to the research, intertidal community patterns are shaped by a complex interaction of ecological variables (Poriya and Kundu, 2017).

Twelve species were found and new records for Gujarat and India were published by the study on intertidal hydroids in the Gulf of Kutch, India. The study also revealed specific collection techniques and predator-prey relationships. The results highlight the significant marine biodiversity of the area and the significance of ongoing research and conservation initiatives (Nagale and Apte, 2014). According to Trivedi and Vachhrajani (2014), Sutrapada's rocky intertidal zone supports a rich macro faunal population, but Veraval's small region limits it. This suggests that the high sediment load in Saurashtra's coastal waters may contribute to *Palythoa mutuki's* existence.

The understanding of platyhelminth diversity in tidepools and related coastal environments has been further enhanced by the discovery of two new marine flatworm species in the Lakshadweep Islands, India (Dixit and Sreeraj, 2024).

The study of the Indian marine flatworm *Pseudoceros susanae* reveals insights into the distribution and variety of polyclad species along the Gujarat coast. It reveals a distinct colour pattern and points out gaps in the knowledge of Gujarat's polyclad fauna. The research highlights the importance for more

investigation to comprehend the variety of polyclads in Gujarat and other regions (Chavda and Mankodi, 2022).

In 2000, Beesley *et al*. reported that there are roughly 8,500 polychaetes species in the globe, divided into 1,100 genera, with about 400 of those species occurring in India (Misra, 1991).

Research conducted on the honeycomb worm *Neosabellaria clandestinus* on a biogenic reef located in Gujarat, India, highlights the worm's significance as an ecosystem engineer, providing shelters and food supplies for a variety of species. According to the study, species diversity is higher in deteriorated reef stages due to competition for resources and space, but diversity is still decreased. The research highlights how dynamic biogenic reefs are (Chaudhari *et al*., 2017).

The marine macrofauna in Diu, Gujarat's rocky intertidal zone is extensive, with 70 species from several phyla identified; the most diverse group is the Mollusca (Bambhaniya and Raval, 2023). The study emphasises the significance of rocky environments for the habitation of gastropods and the influence of environmental variables on the distribution of intertidal species. It also emphasises the vital role of gastropods as indicators of an aquatic ecosystem (Pandey *et al*., 2017).

The significance of these microhabitats in the larger intertidal ecosystem is highlighted by the presence of strong species in rock pools, such as limpets, which rely on these habitats for eating, shelter, and reproduction (Vakani and Kundu, 2020). Three genera of Vermetids were found throughout the survey, with *Ceraesignum* exhibiting the highest density. According to the study, there was no discernible substrate preference among the taxa for Vermetids; instead, they were mainly found in hard substrates, especially silt on rock and living corals (Joshi and Mankodi, 2016).

The research investigates the variety of mollusc species on Gujarat's Chorwad coast's intertidal zone. The area is well-known for its rocky beaches and is home to a wide variety of marine life. The variety of species is influenced by seasonal fluctuations, with winter being more advantageous. The research (Vadher *et al*., 2014) highlights the significance of biodiversity surveys and

conservation initiatives. Vakani *et al*. (2017) studied the distribution and population ecology of seven dominant gastropod species in the intertidal areas of the Veraval coast. They found that there were notable spatiotemporal differences and that some species, such *Cellana karachiensis* and *Turbo coronatus*, predominated in distinct intertidal zones.

The research investigates the structure of the bivalve community in the Northern Gulf of Kachchh, with particular attention to species richness, distribution, and diversity. Sanghi has the largest variety among the 16 species that were discovered. Seasonal differences imply that monsoon seasons promote more variety. The results offer important new information on the structure of the bivalve communities throughout the Indian coast (Kardani *et al*., 2011). The populations of Cerithium caeruleum cerithiid and Clypeomorus moniliferus are more aggregative than randomly dispersed, according to the study. Conspecifics, or other snails of the same species, have a greater impact on their grouping than does the intricacy of the rock substrate. Their aggregation is less affected by topographic complexity, whereas other invertebrate species are more affected (Jethva *et al*., 2022).

A diverse amphipod community comprising 71 species from 40 genera and 23 families was found in the Gulf of Kachchh Marine Protected Area, according to studies. Lower intertidal zones showed higher functional diversity because of increased resource use strategies, while upper zones showed lower diversity because of environmental filtering (Tatiparthi *et al*., 2020). According to the study, three new stomatopod species *Manningia arabica*, *Alimopsis supplex*, and *Oratosquilla quinquedentata* were found in Gujarat, India. These species, which were formerly exclusive to the Arabian Sea, are essential to conservation and marine biodiversity initiatives. The socioeconomic significance of these species in fisheries and aquaculture is also highlighted by the study (Vadher *et al*., 2023).

Eleven species of intertidal, epibiotic, and fouling barnacles were recorded by Trivedi *et al*., (2021) who focused on the variety of barnacle assemblages in Gujarat and the Gulf of Oman, highlighting the biogeographical parallels between the two regions. In order to get a better understanding of the ecological interactions and resource use patterns in the intertidal zones, Patel *et al*.,

investigated the shell utilisation and resource partitioning of two sympatric hermit crab species, Clibanarius rhabdodactylus and Clibanarius ransoni, in relation to gastropod shell species (Patel *et al.,* 2022). The Gulf of Kachchh's Stomatopoda variety and distribution are documented, with four new species identified and a nine-species annotated checklist that advances knowledge of the region's Stomatopod diversity (Vadher *et al*., 2022).

Trivedi and Vachhrajani (2014) conducted research on the shell utilisation of *Clibanarius zebra* crabs in Gujarat, India, and found that the crabs showed a preference for specific gastropod shells based on parameters such as size, weight, and availability. According to the study, *Leptodius affinis* is a species with distinct morphological traits that is most abundant beneath rock surfaces and is mostly found in upper intertidal zones. It also recommends more research throughout India's western coast (Trivedi and Vachhrajani, 2012).

A total of 777 species, including 319 genera, 87 families, and 29 orders of echinoderms, are found in India. The Andaman and Nicobar Islands are habitat to the greatest number of echinoderm species (499), followed by the East Coast (340 species, including 175 species in the Gulf of Mannar region), the West Coast (123 species), and the West Coast, thirty species from the Gulf of Kachchh and 166 species in Lakshadweep (Raghunathan et al., 2016).

With 35 species identified, the study on ornamental fishes in tidal pools along the South Andaman coast reveals a remarkable richness. Ecosystems are dominated by juvenile fish, which highlights the importance of juvenile animals in life cycles. Pollution and human activity-caused environmental risks, however, are severe. According to the study, significant conservation effort is required to maintain these important biological niches (Santhosh Kumar *et al.,* 2016). 386 fish species were discovered during the ichthyofaunal diversity and ecology research of intertidal rock pools in Goa, India. The most prevalent family was determined to be the Blenniidae. The species with the highest abundance was Istiblennius dussumieri. Significant variations in salinity were also discovered by the study, suggesting that fish communities are able to adjust to shifting environmental circumstances. Hand and dip net research methods was used. (Tsering *et al*., 2012)

A great richness is revealed by the study conducted on the intertidal macrofauna along Gujarat's Dwarka coast. A total of 27 species of seaweed were discovered. In addition, the research investigates at the impact of humans and environmental variables including salinity, pH, and temperature of the water. Porifera, Coelenterate, Arthropoda, and Mollusca comprise the majority of the macrofaunal population; dominant species include sea anemones, while habitat-specific species include sand crabs (Gohil and Kundu, 2012).

Anthropogenic activities, such as oil spills, had significant impacts on the rocky intertidal area of Colaba, Mumbai. Following the spill, there was an initial decrease in macrobenthic variety, but the inhabitants eventually recovered and showed resilience (Sukumaran, 2014). In order to improve the influence on marine ecosystems, the study highlights the complex interaction that exists between environmental conditions and human activity (Bhadja *et al*., 2014). It also emphasises the necessity of ongoing monitoring and conservation efforts. The research comes to a finding that the macrobenthic community's structure in the coastal Arabian Sea is greatly influenced by the occurrence of high biological productivity and organic matter flux during the FIM period, which is essential for the survival and recruitment of benthic organisms (Ingole *et al.,* 2014).

2.3 LACUNA

Gujarat, a marine state with the longest coastline in all over India, is still lacking in records of macrobenthic faunal diversity of tidepool. The coastal regions of Gujarat are separated into three main areas: the Gulf of Khambhat (GoK), the Saurashtra coast, and the Gulf of Kachchh. Various marine ecosystems, including mangroves, coral reefs, rocky coastlines, sandy coasts, and mud flats, are supported by the coastal areas of these three regions. The majority of intertidal diversity investigations were conducted in the Gulf of Khambhat and the Gulf of Kachchh.

The community structure and distribution patterns of the intertidal invertebrate macrofauna in Gujarat have been investigated in previous studies (Sanagoudra & Bhat, 2013; Bhadja *et al*., 2014; Bambhaniya et al., 2023). These studies, however, did not particularly address tidepools. In order to fill this gap,

the current studies aim to investigate the Community structure and diversity of rocky tidepool along the southern coast of Saurashtra. The comprehension of the distinct biological processes and biodiversity present in these particular ecosystems is subject of this study. Focusing on rocky tidepools allows us to learn more about the species distribution, abundance, and interactions that differentiate them apart from other intertidal zones.

AIM

To study the community structure and diversity of rocky tidepools from South Saurashtra coast of Gujarat, India.

To fulfil this aim, the following objectives have been set.

OBJECTIVES

1. To study structure of rocky littoral zone and tidepools, geo-morphic spatial organization.
2. To prepare baseline taxonomic database of the diversity of fauna and flora present in the tidepools of rocky littoral zone along the South Saurashtra Coastline using Morphological and taxonomic tools.
3. To study the community interaction within the tidepools of selected intertidal areas.