The present study recorded a diverse range of brachyuran crab species. A total of 10 species were identified, belonging to 7 families and 9 genera. Notable contributions were observed from the families Ocypodidae, Dotillidae, and Pilumnidae, each contributing two species. Whereas, one species was recorded belonging to families Matutidae, Sesarmidae, Macrophthalmidae, and Portunidae. Overall, the study provides valuable information on the diversity, morphology, and distribution of brachyuran crab species in the specified region, contributing to the broader understanding of marine biodiversity in the Gulf of Khambhat.

Besides that, study has provided valuable insights into the habitat characteristics, sedimentological variations, and distribution patterns of burrowing brachyuran crab species. Kamboi Coast exhibits distinct zonation patterns influenced by sedimentological characteristics, hydrodynamic processes, and morphological attributes. The four identified zones (I to IV) showcase a range of soil compositions and microhabitats, contributing to the ecological diversity of the intertidal area. Each zone presents unique features, such as flooding in Zone I during high tide, a muddy composition with high biodiversity in Zone II, a beach slope and water overflow in Zone III, and a predominantly fine sandy composition in the intertidal Zone IV. The sediment temperature varies significantly across seasons and intertidal zones. Maximum temperatures are recorded during the summer season, gradually decreasing in monsoon and winter seasons. These temperature variations likely influence the behaviour and distribution of burrowing crab species. *Austruca sindensis* (Alcock, 1900), *Ilyoplax sayajiraoi* JN Trivedi, Soni, DJ Trivedi & Vachhrajani, 2015 and *Dotilla blanfordi* (Alcock, 1900) are abundantly distributed in the study area. Burrow density, abundance, and frequency of occurrence vary among species and across seasons. *A. sindensis*, *I. sayajiraoi*, and *D. blanfordi* exhibit seasonal fluctuations in burrow density and abundance, with different preferences for seasons. Other species (*Macrophthalmus sulcatus*, *Eurycarcinus orientalis*, and *Scylla serrata*) show less abundance in the study site. Each brachyuran crab species demonstrates a distinctive distribution pattern across the identified zones.

The study highlights the preference of each species for specific sediment compositions and microhabitats within the intertidal area. Seasonal fluctuations

in distribution ranges indicate dynamic responses to environmental conditions. Results of the present study helps to understand the complex interplay between sediment characteristics, environmental factors, and the distribution of brachyuran crab species. These insights have ecological implications for the Kamboi Coast, providing valuable information for conservation and management efforts.

The study provides a comprehensive analysis of the burrow architecture of *A. sindensis* across different seasons and zones. The investigation involved the examination of various burrow shapes, morphometric parameters, and temperature profiles. The results reveal a diversity of burrow shapes, including J-shaped, S-shaped, Spiral, Single tube, J-shaped with branch, U-shaped with single opening, and Multi-branched burrows. Each burrow type exhibited distinctive characteristics in terms of dimensions, volume, inclination angles, and the presence of chambers. Notably, the study explored the variation in burrow architecture between male and female crabs, indicating differences in burrow dimensions. Male crab burrows generally exhibited larger diameters, lengths, and volumes compared to female crab burrows. The study observed correlations between crab carapace length and various burrow parameters, providing insights into the influence of crab size on burrow characteristics.

The investigation into temperature profiles within the burrows highlighted consistent patterns across different burrow shapes. The temperature within the burrows remained relatively cooler than the surface temperature, offering a potential thermoregulatory advantage for the inhabiting crabs. Furthermore, the Principle Component Analysis (PCA) conducted for different seasons and intertidal zones revealed clustering of burrows, emphasizing similarities in burrow morphologies within specific contexts. Overall, the findings contribute valuable information about the burrow architecture of *A. sindensis*, shedding light on the species' ecological adaptations and behaviours in response to varying environmental conditions. The study's comprehensive approach, spanning different seasons and intertidal zones, enhances our understanding of the complex interactions between crabs and their burrow environments.

The results of the time lapse study reveal a significant correlation between lunar phases and environmental factors, particularly temperature and burrowing behaviour of three common crab species (*A. sindensis*, *I. sayajiraoi*, and *D. blanfordi*) on Kamboi coast, Gulf of Khambhat, Gujarat. Nocturnal luminosity showed a clear association with lunar phases, with the highest values during the full moon and near absence of light during the new moon. Temperature variations during sampling hours were significantly different across lunar phases. The highest and lowest temperatures were recorded during various lunar phases, indicating an effect of temperature on density and abundance of crabs. Each crab species exhibited distinct burrow densities during different lunar phases. For *A. sindensis*, full moon days had the highest density, while waning crescent days had the lowest. *I. sayajiraoi* showed the highest burrow density on waxing gibbous days and the lowest on new moon days. *D. blanfordi* exhibited the highest density on full moon days and the lowest on new moon days. Burrow diameters varied among species, with some showing little variation during specific lunar phases.

The study observed variations in burrow densities throughout the 6-hour sampling period for each species. *A. sindensis* had the highest burrow densities on full moon days, and the pattern varied across different hours during sampling. *I. sayajiraoi* and *D. blanfordi* also showed hourly variations in burrow densities, with specific lunar phases influencing their burrowing activities at different times. *A. sindensis* engaged in burrowing activity for the entire 6-hour sampling period, with variations in density based on lunar phases. *I. sayajiraoi* and *D. blanfordi* had shorter burrowing durations (4.5 hours and 3 hours, respectively), with lunar phases influencing the timing and density of their burrowing activities. Overall, the study highlights the intricate relationship between lunar phases, environmental conditions, and the burrowing behaviour of crab species. The findings contribute to understanding how lunar cycles may influence ecological processes in coastal ecosystems.

The study investigated the foraging behaviour and bioturbation potential of two fiddler crab species, *A. sindensis* and *I. sayajiraoi*, shedding light on their burrowing activities and mud balling patterns. For *A. sindensis*, the Carapace Length (CL) showed positive correlations with various mud balling metrics,

including burrow opening diameter (BOD), total foraging area (TFA), total number of mudballs (TNM), total weight of mudballs (TWM), average mudball size (AMS), and average distance between mudballs (ADM). Male and female *A. sindensis* exhibited differences in mud balling patterns, with females constructing more mudballs that were smaller in size, resulting in a denser arrangement compared to males. The foraging rate of *A. sindensis* did not vary significantly between male and female individuals. In *A. sindensis*, Mudballs were created using surrounding surface sand, and the crabs carried them to the burrow entrance using their walking legs. Both male and female *A. sindensis* engaged in mudballing, with significant differences in the number, size, and weight of mudballs. Female individuals created more mudballs, but these were smaller in size compared to males. The BOD, TFA, and TWM showed significant differences between male and female *A. sindensis*. Whereas in *I. sayajiraoi*, there was a difference in foraging rates between male and female *I. sayajiraoi*, with females exhibiting a greater foraging area. Both genders of *I. sayajiraoi* created mudballs, with variations in the number, size, and weight. Females produced more mudballs than males, and the mudballs were slightly larger. The BOD, TFA, ADM, and CL showed significant differences between male and female *I. sayajiraoi*.

The bioturbation study revealed a strong positive correlation between burrow opening diameter and dry weight of mudballs for both *A. sindensis* and *I. sayajiraoi*. *A. sindensis* demonstrated a higher bioturbation potential as compare to *I. sayajiraoi*. The study provides valuable insights into the intricate foraging behaviours and bioturbation potential of *A. sindensis* and *I. sayajiraoi*, highlighting gender-specific differences and emphasizing the importance of these ecological activities in coastal ecosystems. These findings contribute to our understanding of the roles played by these crab species in shaping their environments.

The study not only enhances our knowledge of the coastal ecosystem but also emphasizes the need for continued monitoring to assess the long-term impact of environmental changes on the biodiversity and distribution of brachyuran crab species in the Gulf of Khambhat.