

STUDIES ON INTERTIDAL AND BENTHIC MACROFAUNA OF DAMMAM CORNICHE AND HALF MOON BAY BEACHES OF THE ARABIAN GULF

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ABSTRACT

The present study was carried out to understand the difference in occurrence of the intertidal macrobenthic fauna in two types of ecological niches namely Dammam Corniche and Half moon bay beaches of Arabian Gulf Coast around Dammam, Eastern Province, Saudi Arabia. The different types of intertidal macrobenthic faunal composition existing in two different areas have been discussed in relation to the temperature and salinity recorded in the respective areas of study. The present study has also revealed the influence of the substratum in the distribution and abundance of the intertidal and macrobenthic fauna in the rocky shore of Dammam Corniche and the sandy shore of Half moon bay beaches of the Arabian Gulf. Poor faunal representation has been found in the sandy shore than in the rocky shore.

INTRODUCTION

THE STUDY of intertidal and macrobenthic fauna has been well understood in recent years as a basic part of the trophic cycle. The role of benthic fauna as the food of demersal fishes is also very important. Nearly half of the world's commercial fish catch from the sea consists of shell fish and demersal fish whose main food item comes from the benthic animals. The detailed and complete knowledge of benthic fauna is very important for the determination and development of demersal fisheries of any area (Anvar Batcha, 1984). The abundance of benthic animals in an area has close relationship with its environment and is regarded as an indicator organism in discussing the conditions of nature and characteristics of that ecological niche (Kitamori, 1963). Similarly the intertidal and benthic macrofauna are very sensitive to environmental stress. Hence water quality biologists use them to study the environmental changes.

The study of intertidal and benthic fauna has special reference to recent days' problems of human impact on natural ecosystems, in that it serves as a model for establishing the 'base line' in the undisturbed state (Parker, 1975).

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AREA OF STUDY

The Arabian Gulf extends north-west from the straight of Hormuz to Kuwait and Iraq. It is shallow, the deepest part being along the Iranian coastline, whence the seabed rises towards Arabian Peninsula. The water is shallow along the Arabian side of the Gulf that, in many places ships cannot approach the shore and have to load - discharge cargo many kilometers away from the shore (Fig. 1).

The whole of the Arabian coastline is excellent for collecting intertidal and benthic macrofauna especially molluscs. Its long stretches of beaches are ideal for collecting bivalves, gastropods and burrowing animals (Kathaleen, 1982). For the present study two different types of beaches are selected around Dammam, one is away from the city known as the Half moon bay beach and the other area is Dammam Corniche, opposite to the Dammam Oberoi Hotel, having small pieces of rocky stones along the shore which provides the solid substratum for the attaching animals.

MATERIAL AND METHODS

The materials for the present study were collected from two different areas of the Arabian

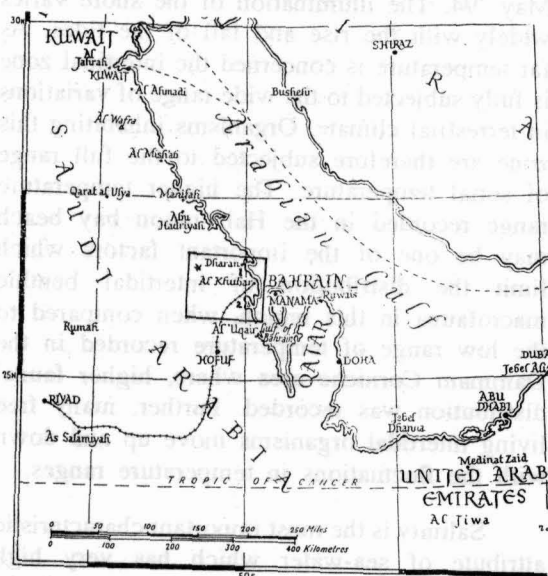


FIG. 1 Showing the location of the sample collection areas in the map of the Arabian Gulf.

Gulf coastline around Dammam during May '94 from Half moon bay beach and in October '94 from Dammam Corniche beach. Temperature was measured with a sensitive mercury thermometer calibrated in degree celcius. Water samples for salinity estimation were collected in clean blue bottles after rinsing with sea water. Later in the laboratory chlorinity was estimated using the Mohr-Knudsen's relation (Barnes, 1959) and salinity was calculated applying the formula $S=1.80655 CL\%$. (Grasshoff, 1976).

The intertidal and macrobenthic faunal samples were collected using hand and drag nets. Dead shells were hand picked and live shells were separated from the substratum by chisel and scalpel. Bottom living annelids and molluscs were scooped with spatula. The sea anemones were uprooted by hand with gloves using large forceps. Crabs were collected with drag net and fish with hand net. The collected materials were preserved in 5% formalin

immediately. Further sorting of the preserved samples were done in the laboratory by sieving with suitable mesh and resorting after washing with tap water. The intertidal and benthic macrofauna were separated group wise and identified upto species level, counted and preserved in 5% neutral formalin.

RESULTS

In all about 38 taxa of intertidal and benthic macrofauna were identified of which molluscs were dominating with 15 species of gastropoda, followed by 10 species of bivalves,

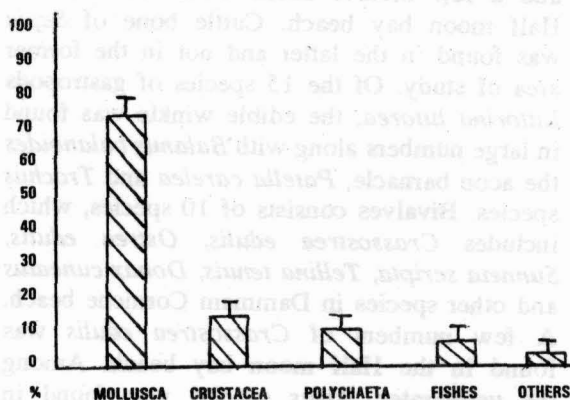


FIG. 2 Percentage composition of different fauna

1 species each of scaphopoda and cephalopoda, with 4 species of crustacea, 3 species of polychaeta, 1 species each of coelenterata and sea wading bird. Percentage composition of different groups of fauna is shown in Fig. 2.

Coelenterata

Coelenterates represented by a single species was found commonly distributed in the Dammam Corniche, but not in the Half moon bay beach. Dahlia sea anemone (*Tealina felina*) was found in the water covered area, deep rooted in the substratum.

Polychaeta

Polychaetes were largely represented by *Nereis diversicolor* along with *Arnicola marina* and *Sabellaria alveolata* in the Dammam Corinche beach, but not found in the Half moon bay beach.

Crustacea

Among the crustaceans the hermit crab *Pagurus bernhardus* was found commonly occurring along with *Scylla serrata*, *Carcinus menaeus* and Ocypode crabs. The latter are abundant in occurrence in Dammam Corniche beach than in Half moon bay beach.

Mollusca

The molluscan fauna of the study area was very rich, mainly composed of gastropods and bivalves, in the Dammam Corniche beach and a few bivalve shells were found in the Half moon bay beach. Cuttle bone of *Sepia* was found in the latter and not in the former area of study. Of the 15 species of gastropods *Littorina littorea*, the edible winkle was found in large numbers along with *Balanus balanoides* the acon barnacle, *Patella carelea* and *Trochus* species. Bivalves consists of 10 species, which includes *Crassostrea edulis*, *Ostrea edulis*, *Sunneta scripta*, *Tellina tenuis*, *Donax cuneatus* and other species in Dammam Corniche beach. A few numbers of *Crassostrea edulis* was found in the Half moon bay beach. Among the vertebrates, *Arius* species was found in Dammam Corniche and Tripod fish was recorded in the Half moon bay. The Sea herring gull *Larus argentatus* was found in large numbers in the Dammam Corniche.

DISCUSSION

Of the total intertidal macrobenthic fauna studied the major taxa was represented by mollusca which constituted about 72% followed by crustacea 11%, polychaeta 8%, fishes 5% and the rest of the fauna form about 4%. In the present study, two different ecological niches around Dammam in the Arabian Gulf Coast were selected to know about the distribution of intertidal macrobenthic fauna with reference to the most influencing environmental factors like temperature, salinity and substratum.

Temperature is an important ecological physical factor which has profound influence on the activities and distribution of organisms in the intertidal and benthic regions (Kinne, 1970). During the period of collection of sample

in Dammam Corniche the temperature ranged from 20.8°C to 32.5°C in October '94. In Half moon bay, during the sample collection period, the temperature ranged from 32°C to 40°C in May '94. The illumination of the shore varies widely with the rise and fall of the tides. As far temperature is concerned the intertidal zone is fully subjected to the wide range of variations in terrestrial climate. Organisms inhabiting this zone are therefore subjected to the full range of serial temperature. The higher temperature range recorded in the Half moon bay beach may be one of the important factors which limit the distribution of intertidal benthic macrofauna in this region, when compared to the low range of temperature recorded in the Dammam Corniche area where, higher faunal distribution was recorded. Further, many free living intertidal organisms move up and down with the fluctuations in temperature ranges.

Salinity is the most important characteristic attribute of sea-water which has very high influence on the intertidal benthic macrofauna (Freidrich, 1965). The salinity of Dammam Corniche area during the study period ranged from 34‰ to 35.8‰. Salinity ranged slightly more in the Half moon bay area from 35‰ to 38‰ due to higher evaporation in some areas of Gulf Coast (Kathaleen, 1982). Salinity also fluctuates during change in seasons. Occurrence of less intertidal macrobenthic fauna in the Half moon bay beach may also be due to higher salinity range recorded in this area when compared to the salinity recorded in the Dammam Corniche beach which is much less. The high salt level may be a reason for the small size of many molluscan species in the Gulf Coast and the degree of deformity of their shells which is sometimes seen (Kathaleen 1982).

Substratum is the surface upon which the organism rests or moves. It can also be the material within which it lives. The fundamental needs of the organisms which may be provided by the substratum are attachment, shelter and nourishment (Lewis, 1964). There are two types of substrata available for organisms in the

marine environment. They are (1) solid substrata like rock, wood, shells and (2) particulate substrata such as sand and mud. In the marine environment, the greatest amount of substratum is available in the intertidal zone, where rocks, sand and mud and in special situations, mangroves, provide good habitats. Many benthic animals are influenced by the physical nature of the substratum and are characteristically associated with the substrata (Newell, 1970). The fauna and flora living in a particular area depend to a great extent on the nature of the substratum, its nutritive content and the degree of stability. Many organisms are known to select a substratum, suitable for settlement and growth (Sverdrup *et al.*, 1942). Rocks provide secure places for firm attachment, but even these could be bored through by many organisms (Ray, 1959). In the case of soft substratum like sand additional factors also come into play. The inhabitants of these substratum have to undergo many difficulties. Every distinct type of substratum will have its characteristic faunal assemblage (Barnes, 1965). In the present area of study, the Dammam Corniche beach has more or less the characteristics of a substratum with pieces of rocks and stones lying throughout the shore,

providing enough surface for the intertidal and benthic macrofauna for attachment.

In spite of the variables like tides, temperature and salinity the rocky shores represent one of the densely populated regions of the intertidal zone. Hence many intertidal benthic attached and free living macrofauna were recorded in the Dammam Corniche beach. On the other hand, the Half moon bay beach happens to be completely a fine sandy shore which is an unfavourable habitat for many marine organisms, mainly due to the shifting nature of the substratum caused by the incoming and outgoing tides. Thus the sandy shore, quite in contrast to the rocky shore, presents an almost barren appearance, when uncovered by the falling tide. Another important reason for the poor assemblage of intertidal and benthic macrofauna may be due to the increased human activity in the Half moon bay beach as a recreational spot.

In general, the present study has clearly revealed that there exists wide variations in the occurrence and distribution of intertidal and benthic macrofauna in the Dammam Corniche and Half moon bay beaches, due to temperature changes, salinity increase and substratum differences.

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