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Feeding regime of sea cucumber *Stichopus herrmanni* on coral reefs of southeast of the Qeshm Island, Persian Gulf

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ABSTRACT

Sea cucumbers are the echinoderms that have an important role in benthic habitats by feeding activity. In this study we investigate that what is sea cucumber *Stichopus herrmanni* eat in corals reef of Southeast Qeshm Island in Persian Gulf. For this aim qualitative Analysis of gut content was done and It was found various types of diatoms, algae, small benthoses and detritus plant and animals and sediment. Also Environmental factor including Temperature, dissolved oxygen, pH, conductivity and turbidity were measured to know living conditions of this species.

1. Introduction

The Persian Gulf is a shallow semi-enclosed sea that a series of islands extending along the western coast have fringing and patch coral reefs, representing one of the most diverse habitats of the Gulf. Despite the extreme environmental conditions, a wide variety of marine life is found in the Gulf that many of these animals are endemic and heavily dependent on the Gulf environment (UNEP, 1999; 2002). Among these holothurians is one of the animals which effected on structure and functioning of corals reef communities (Bakus, 1973; Birkeland, 1989). Generally holothurians are found throughout all oceans and seas, at all latitudes, from the shore down to abyssal plains. Some species live on hard substrates, rocks, coral reefs, or as epizoites on plants or invertebrates. Most of the species inhabit soft bottoms, on the sediment surface or buried in the sediment. The gut is composed of a pharynx, an esophagus, a stomach, all of which are short structures, and a very long intestine. The intestine consists of 3 portions, a descending, an ascending and finally a descending loop that connects to both the rectum and the cloaca opening outwards through the anus. Sea cucumbers are divided into two groups based on dietary habits (filter feeders and deposit feeders). The first group was fed on plankton, algae, single-celled, microscopic and small animals floating in the water are. The second groups are eating sediment. This type of sea cucumber undermined in a flower bed and ingests sediment and in hence moved tons of sediment each year (yahyavi et al., 2014).

S. herrmanni is deposit feeders holothurians that occur in a wide range of shallow tropical habitats (Conand, 1990). There are several ever known species of sea cucumbers in the waters of the Persian Gulf that seems to be the dominant species in coral reefs around the islands of Persian Gulf is *Stichopus herrmanni* Semper, 1868 that was shown in Fig. 1 (Sarhadizadeh et al., 2014).

Corals reef are the very productive habitats that surrounded by oligotrophic waters and hence recycling materials in these areas is important and Feeding activity of deposit feeders such as sea cucumbers is very important as recycling materials in habitat. In this study *S. herrmanni* live at depths between 4-15 m and is observed in all regions of the coral islands of Lark and Qeshm and Bastami and colleagues reported this species in 2012, from the Qeshm Island (Yahyavi et al., 2014). In this study we investigate that what is *Stichopus herrmanni* feed and changes of environmental factor during season.

2. Material and method

The area of study including one sampling stations at coral reef in Southeast Island (Persian Gulf) (Fig. 2). In this area, sampling was done using scuba

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diving (10 to 15 samples each season) and samples were transported to the beach with using special bags and the contents of the gut was stabilized by 10% formaldehyde. Coloring intestinal content using Rose Bengal (1gr/lit for 45 min) in order to separated and identified meiofauna was done.

Fig. 1: Sea cucumbers *Stichopus herrmanni* at the corals of Persian Gulf

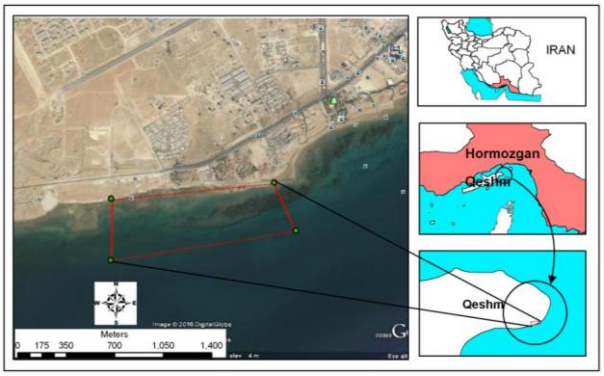

Fig. 2: Geographical location of sampling area

Also environmental factor was measured by multi meter in each season for reporting the condition of habitat that these spices live in.

3. Results and discussion

The results of the study of intestinal contents showed that the live food of these animals consisted of three parts: diatoms, algae and benthos. The qualitative observation suggests the existence of a large amount of plant detritus in the gut of these animals. Also inorganic compounds such as inorganic benthos remains included a large amount of materials in gut content of these animals.

According to other studies, Generally The sediments ingested by deposit feeding holothurians comprise mainly inorganic compounds (coral debris, shell remains, coralline algae, foraminiferal tests, inorganic benthos remains, and silicates), organic detritus (sea grass, algae, dead and decaying animals), microorganisms (bacteria, diatoms, protozoan and cyanophycean), or the fecal pellets of other animals or their own fecal pellets (Massin, 1982b). According to The results of the present study benthos animals (meiofauna) also added to this category. Also intestine of sea cucumbers genus Stichopodidae filled by the remaining large algae, seaweed, shellfish, crustaceans, barnacles, echinoderms ossicle, benthic and pelagic diatoms, and many Framinifera (Haukson, 1979) that somewhat is same as present study.

Despite diatoms and algae in the same study states that generally benthos in coral sediment comprise only 1% organic carbon and therefore do not play an important role in feeding of this animals (Uthicke, 1999). According to different studies, it seems that diatoms are important food sources for sea cucumbers (Uthicke, 1999). Same Study on feeding sea cucumber is done on species *Actinopega mauritiana.* This species that lived in a low-energy coral reef habitat, fed from the growing diatoms. In addition, the absorption coefficient is calculated at 46.9% for consumed diatoms (Yingst, 1976). Also in other studies of benthic microalgae mentioned that microalgae as food for this animals witch they are so important for nutrients recycling in coral reefs habitats (Uthicke, 2001).

On the other hand a large amount of detritus in the intestine of this species showed that this materials are the most important source in feeding regime of sea cucumbers, As said that, deposit-feeding sea cucumbers process large volumes of benthic sediments, from which they assimilate bacterial, fungal and detrital organic matter (OM) (Slater et al., 2011; Yokoyama, 2013). The main food sources of holothurians are reported to be bacteria and detritus (Bakus, 1973; Moriarty, 1982; Massin, 1982a). However, there are, indications that holothurians may digest microalgae and cyanobacteria as well (Yingst, 1976). The feeding processes of both deposit and suspension feeders (most holothurians are deposit feeders) result in the transfer of large quantities of energy and matter between the pelagic and benthic ecosystems (Frechette and Bourget, 1985; Young and Emson, 1995). Bioturbation caused by the feeding activities of deposit feeders results in the burial of organic material and the transfer of organic and inor- ganic matter to the water column (Bakus, 1973; Massin, 1982b). In coral reef ecosystems, these animals are important recyclers of inorganic nutrients and are thus a part of the close cycling of materials. Although high holothurian densities in experiments may reduce benthic microalgal production and biomass (Moriarty et al., 1985; Uthicke, 1999), feeding activity in natural densities is beneficial for the sediment microalgal community due to the ammonium excreted from the holothurians (Uthicke and Klumpp, 1997).

This species lived in corals reef of shallow waters of Persian Gulf same as Conand (1993) said that the Stichopodidae, although particularly common in reef habitats and in the shallow waters of the tropical Indo-Pacific the diversity is higher. The result of environmental factor measurement showed in Table 1.

As Table 1 shows the minimum and maximum of temperature respectively belonging to winter and summer, and according to that, we can say this species probably lives in approximate temperature

range between 19.98 - 32.5 (winter and summer) in the Persian Gulf. Variations of temperature mentioned in the various seasons are shown in Fig. 3.

Table 1: Result of environmental factor during different season

	spring	summer	autumn	winter
temperature	30.4 c^0	32.5 c^0	22.62 c^0	19.98c^0
dissolved oxygen	4.8 mg/lit	4.5 mg/lit	7.20 mg/lit	8.1mg/lit
salinity	37.2ppt	37.3ppt	44ppt	44ppt
alkalinity	8.08	7.9	7.26	7.11
turbidity	12 m	10 m	8 m	15m

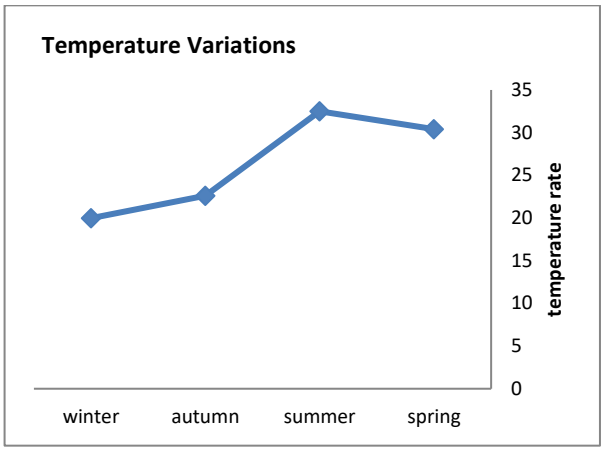

Fig. 3: Variations of temperature during different seasons

Also about dissolved oxygen this species are faced with range between 4.5ml/lit- 8ml/lit that respectively belonging to winter and summer. Variations of dissolved oxygen mentioned in the various seasons are shown in Fig. 4.

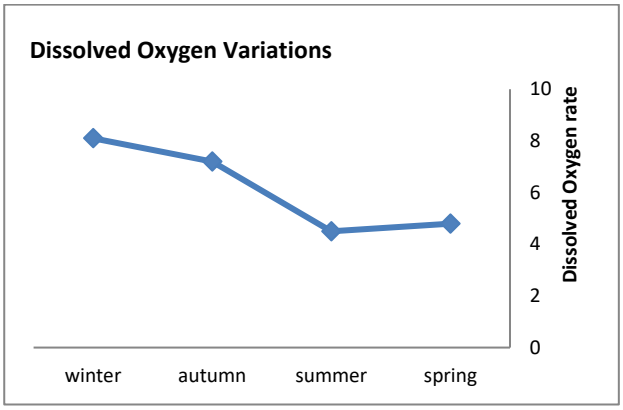

Fig. 4: Variations of dissolved oxygen during different seasons

Minimum and maximum salinity is 37.2 and 44 in spring and autumn and winter respectively. Corals living in the Persian Gulf are adapted to live at the lowest winter and highest summer temperatures and also highest salinities, and Holothurians are common and large invertebrates that live in coral reef communities. Variations of salinity mentioned in the various seasons are shown in Fig. 5.

Alkalinity doesn't show specific changes during different season and was between 7-8. Variations of Alkalinity mentioned in the various seasons are shown in Fig. 6.

Measurement of turbidity showed that maximum range in winter (15m) and minimum range in autumn (8m). Variations of turbidity mentioned in the various seasons are shown in Fig. 7.

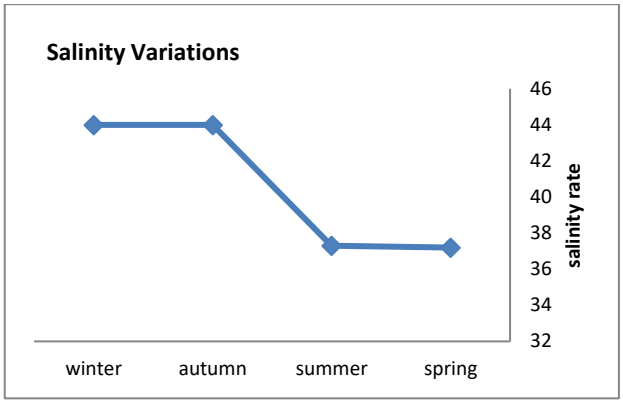

Fig. 5: Variations of salinity during different seasons

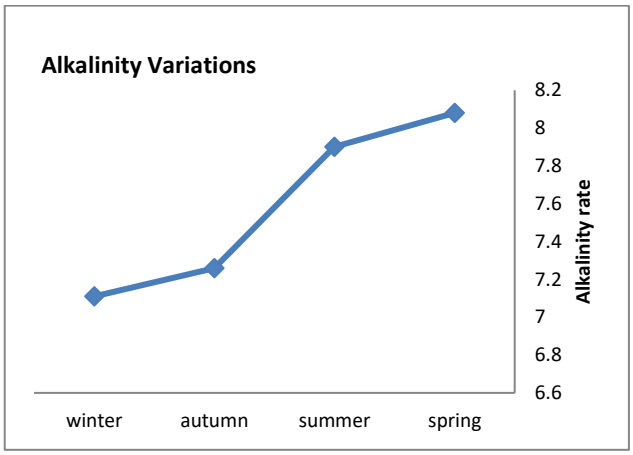

Fig. 6: Variations of alkalinity during different seasons

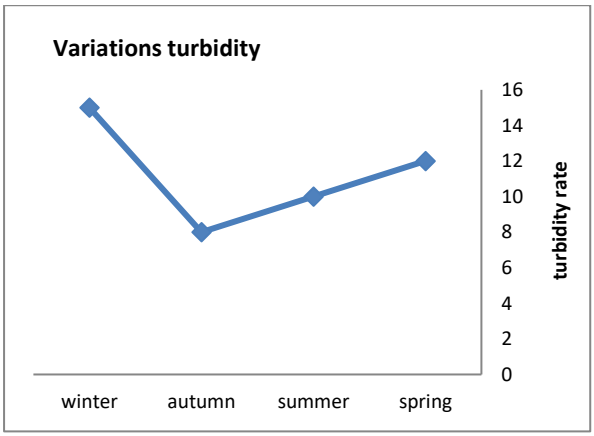

Fig. 7: Variations of turbidity during different seasons

4. Conclusion

The Persian Gulf is a unique environment that is due to Fringing coral reefs and communities and

their environmental conditions such as temperature and salinity. Holothurians that lived in this corals and their condition such as *Stichopus herrmanni* has very important rules in recycling of nutrition in the ecosystems. According to this study *Stichopus herrmanni* fed on diatoms, algae, benthos and detritus. Also this animals suffered high temperature and salinity in coral reefs of Southeast of the Qeshm Island Persian Gulf.

References

Bakus GJ (1973). The biology and ecology of tropical holothurians. In: Jones OA and Endean R (eds.), Biology and geology of coral reefs. Academic Press, New York, USA.

Birkeland C (1989). The influence of echinoderms on coral-reef communities. In: Jangoux M and. Lawrence JM (eds.), Echinoderm studies 3. Balkema, Rotterdam, Netherlands.

Conand C (1990). The fishery resources of Pacific island countries: Holothurians (Fisheries Technical Paper). Food and Agriculture Organization, Rome, Italy.

Conand C (1993). Ecology and reproductive biology of Stichopus Variegatus an indo-pacific coral reef sea cucumber (Echinodermata: Holothuroidea). Bulletin of Marine Science, 52(3): 970-981.

Frechette M and Bourget E (1985). Energy flow between the pelagic and benthic zones: Factors controlling particulate organic matter available to an intertidal mussel bed. Canadian Journal of Fisheries and Aquatic Sciences, 42(6): 1158-1165.

Haukson E (1979). Feeding biology of Stichopus tremolus a deposit feeding holothurian. Sarsia, 64(3): 155–160.

Massin C (1982a). Effects of feeding on the environment: Holothuroidea. In: Jangou M and Lawrence JM (eds.), Echinoderm nutrition: 493–497. Balkema, Rotterdam, Netherlands.

Massin C (1982b). Food and feeding mechanisms: Holothuroidea. In: Jangou M and Lawrence JM (eds.), Echinoderm nutrition: 43-53. Balkema, Rotterdam, Netherlands.

Moriarty DJW (1982). Feeding of holothuria atra and stichopus chloronotus on bacteria, organic carbon and organic nitrogen in sediments of the Great Barrier Reef. Australia Journal Marine Freshwater Research, 33(2): 255–263.

Moriarty DJW, Pollard PC, Hunt WG, Moriarty CM, and Wassenberg TJ (1985). Productivity of bacteria and microalgae and the effect of grazing by holothurians in sediments on a coral reef flat. Marine Biology, 85(3): 293–300.

Sarhadizadeh N, Afkhami M, and Ehsanpour M (2014). Evaluation bioactivity of a Sea cucumber, Stichopus herrmanni from Persian Gulf. European Journal of Experimental Biology, 4(1): 254-258.

Slater MJ, Geffs AG, and Sewell MA (2011). Organically selective movement and deposit-feeding in juvenile sea cucumber, Australostichopus mollis determined in situ and in the laboratory. Journal of Experimental Marine Biology and Ecology, 409(1): 315–323.

UNEP (1999). Overview on land-based sources and activities affecting the marine environment in the East Asian Seas. UNEP/GPA Coordination Office and ROPME, United Nations Environment Programme, Earthscan, London, UK.

UNEP (2002). Global environmental outlook 3. United Nations Environment Programme. Earthscan, London, UK.

Uthicke S (1999). Sediment bioturabation and impact of feeding activity of Holothuria (Holodeima) atra and Stichopus chloronotus, two sediment feeding holothurians at Lizard island, Great Barrier Reef. Bulletin of Marine Science, 64(1): 129-141.

Uthicke S (2001). Interactions between sediment-feeders and microalgae on coral reefs: grazing losses versus production enhancement. Marine Ecology Progress Series, 210: 125-138.

Uthicke S and Klumpp DW (1997). Ammonium excretion by holothurians enhances production and turnover in benthic diatom communities. In the 8th International Coral Reef Conference, Smithsonian Tropical Research Institute, Panama, Central America: 873-876.

Yahyavi M, Afkhami M, and Ehsanpour M (2014). Biodiversity sea cucumbers. New Publications, Tehran, Iran.

Yingst JY (1976). The utilization of organic matter in shallow marine sediments by an epibenthic deposit-feeding holothurian. Journal of Experimental Marine Biology and Ecology, 23(1): 55-69.

Yokoyama H (2013). Growth and food source of the sea cucumber Apostichopus japonicus cultured below fish cages potential forintegrated multi-trophic aquaculture. Aquaculture, 372: 28–38.

Young CM and Ernson RH (1995). Rapid arm movements in stalked crinoids. The Biological Bulletin, 188(1): 89-97.