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Key findings on juvenile settlement of sea Cucumber *Holothuria pardalis* at sikka coast, gulf of Kachchh, Gujarat, India

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ABSTRACT

This paper highlights habitat of juvenile settlement of *Holothuria pardalis* at Sikka coast. We studied habitat, population structure and length frequency of encountered juveniles. Field data collected using belt transect method, near Gujarat State Fertizer Company's Jetty (GSFC Jetty), at Sikka, Gujarat, India. Juveniles observed after settling underneath coral skeleton or rock at reef flat covered by algal complex. We consider these results in relation to other similar observations that habitat of juvenile settlement is different than that of the adults.

Key words *: Sea cucumber, Holothuria pardalis, Habitat, Juvenile settlement, Gulf of Kachchh*

Introduction

Holothurians are exclusively marine invertebrates that commonly inhabit tidal flats, sea grass beds and coral reefs. They play an important ecological role in nutrient cycling and bioturbation processes in marine benthic communities (Samyn, 2000; Uthicke *et al.*, 2004). All species of Holothuria are protected under schedule 1 of Wildlife Protection Act, India. For marine invertebrates i.e. Holothurians during their development, the larvae do not metamorphose and settle unless they found specific conditions (Giese *et al.*, 1991). Selection of suitable habitat for settlement of larvae often determines the long-term survival of juveniles and adults (Barker, 1977; Pearce and Scheibling, 1990). The factors affecting survival of newly settled juveniles have received even less attention, although it is widely accepted that post-settlement habitat type, food availability and predation may influence the recruitment and final distribution (Gosselin and Qian, 1997; Hunt and Scheibling, 1997). Juvenile holothurians have the potential to be misidentified given their potential for morphological differences relative to the adult form (Wiedemeyer, 1994). They occupy habitats different to that of the adults (James *et al.*, 1994; Mercier *et al.*, 2000; Eriksson *et al.*, 2012). The difficulty in locating juvenile sea cucumbers is perhaps highlighted by the fact that studies relevant to juvenile ecology often results from fortuitous encounters (Conand, 1993; Mercier *et al.*, 1999).

Research gap was highlighted in case of habitat preference of juvenile holothurians (Eriksson *et al.*, 2012) where as Shiel (2004) stated before a decade that there is relative scarcity of knowledge obtained through direct observation of field based juvenile

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sea cucumbers. We observed post settlement pattern of juvenile *H. pardalis* during our field visit at intertidal zone near GSFC Jetty (22° 27′ 39.23" N and 69° 48′ 16.64" E. *H. pardalis* usually found on reefs and coastal areas and it occurs below rocks on reef flats, rocky shores and in sea-grass areas. It is distributed from the Red Sea to Hawaii islands (Tortonese, 1980) and Indo-west Pacific Ocean to Australia (Rowe and Gates, 1995). In India it is common at Andaman Islands and Lakshadweep and also found at Pullivasal Island of Gulf of Mannar (James, 1989). In Gujarat it is recorded at Okha reef and Adatra reef in Gulf of Kachchh (Gopalakrishnan, 1970; Subba Rao and Sastry, 2005). However, none of the studies describes settlement of juvenile *Holothuria pardalis*. We studied habitat, population structure and length frequency of juvenile *H. pardalis* with reference to presence of other fauna and flora.

Study Area

The Gulf of Kachchh is situated in the state of Gujarat, western part of India. The Region is an arid peninsula, the mouth of Gulf is a shallow water basin about 60 m deep then sloping up to a depth of less than 20 m at the head, visited by 'mixed semidiurnal' tides it experiences two high tides and two low tides of variable ranges every day-. The Gulf is rich in marine wealth and biodiversity. The Gulf of Kachchh Marine National Park and Sanctuary (MNP&S) was established by a set of state notifications during the period of 1980-1982. It is an area of 457.92 sq km along the coast of Saurashtra in the southern Gulf of Kachchh. Our study was focused on intertidal area near GSFC Jetty Sikka, located at middle of the southern part of Gulf of Kachchh (Fig. 1). However, the reef flat immediately behind the reef ridge up to 500m from the low tide level supports diverse and abundant algal flora. A total of 42 species of marine algae are reported from this region with the dominance by species of *Sargassum spp., Lystoseira spp., Dictyota spp., C. indica, L. majuscula* and *Caulerpa* and two species of sea grass *Halophila ovata* and *Halodule uninervis* were also recorded (Nair, 2012).

Materials and Methods

We investigated holothurians during low tide at day time at the interval of 15 days (twice a month), during January-February, 2013. Digital photographs have been used for identification of specimens. Pilot survey has been done perpendicular to shore line from reef edge up to one kilo meter towards high tide line and found that Sea cucumber has been observed at first 500 meter belt from reef edge. The belt transect method was used for quantitative sampling of juvenile *H. pardalis*. A transect belt (n=1) was laid out perpendicular to the shore line from reef edge towards the high tide line and surveyed four times (Fig. 1). In the entire transect belt (500 m x100 m) coral skeletons and rocks were overturned whenever encountered on the reef flat to study density of juveniles. Densely populated area of transect was studied for abundance. At each encounter of juvenile, presence of other fauna underneath the coral skeleton and rock was also recorded. Algal cover also recorded for entire transect belt. *H. pardalis* individuals were measured along their centerline to the nearest 5 mm.

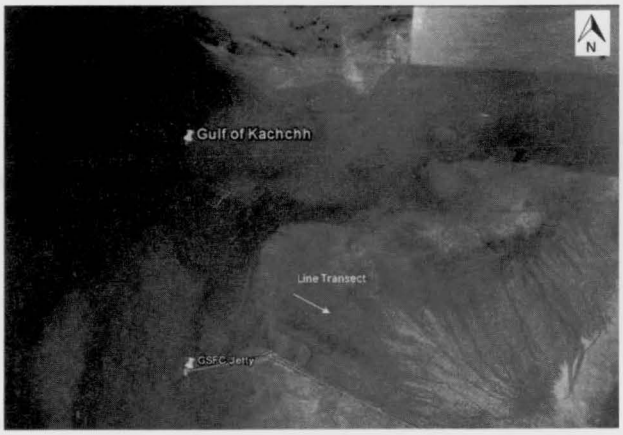

Image source: Google Maps

Fig. 1. Satellite image of study area

Results

Habitat

The area of transect belt is reef flat consisting of live coral reef, dead corals with sandy and muddy patches. Which is followed by intertidal marsh (500m) behind the upper reef flat is covered with dead reef and mudflats towards the mangrove swamp. During low tide, water is totally receded while in some parts water depth is 10-30 cm where tide pool present and during high tide water depth is 1-2 meter. A total of 254 individuals of *H. pardalis* were encountered in reef flat area. Five species of

Table 1. Length (L) data of encountered juvenile *H. pardalis*

Date	2/1/2013	16/1/2013	2/2/2013	16/2/ 2013
Average L (cm)	6.71	7.27	7.56	8.25
SD (L)	±2.08	±2.01	±2.09	±1.71
Min L (cm)	3	3.2	3.5	5.2
Max L (cm)	10	11	11.2	11

marine algae and six species of corals were mainly found at reef area. In case of algae *Sargassum spp., Padina spp., Colurappa spp., Ulva spp.* and *Gracilaria spp.* have been recorded. Among them *Sargassum spp.* was highly dominated and followed by *Gracilaria spp.* Small scattered patches of *Holodule univeris* was found. In case of corals *Favia favus, Favia bestae, Goniastrea spp., Goniopora nigra, Goniopora minor* and *Porites spp.* were recorded. *Siphonchalina spp.* (sponge), *Stichodactyla gigantia* (sea anemones), two species of zoanthus, *Sabellastate indica* (annelid), *undosus spp.* (mollusca), *Charybdis acutifrons* and *Mennipe rumphii* (crustacean) was observed throughout the transect belt underneath the coral skeleton and/or rock. While the sea bristle worm (Annelida), *Scutus unguis* (Gastropoda), *Asterina spp., Salmacis bicolor,* Britle star and *Ophionereis spp.* (Echinodermata) *Schizophrys aspera* and juvenile Peneid shrimp (Crustacea) is found only in reef flat underneath the coral skeleton and /or rock.

Population structure

Maximum numbers of Juvenile *H. pardalis* (n=79) were recorded on January, 2, 2013. The average 2-3 individual/ coral skeleton or rock was recorded. Population densities ranged from 54-79/ 5 hectare. The average length of juvenile *H. pardalis* was 7.4 cm. The smallest observed was 3.0 cm and the largest was 11.2 cm (Table 1). Length frequency data juvenile *H. pardalis* of suggests that highest frequency of body length was 8-9 cm (Fig. 2).

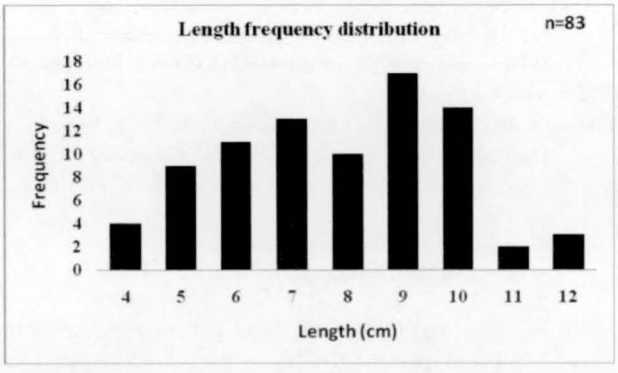

Fig. 2. Length frequency distribution of Juveniles *H. pardalis*

Discussion

Juvenile *H. pardalis* (Fig. 3) was found at reef flat where algal cover and live corals were present which is similar to earlier observation where many scientists have concluded that presence of Sea grass and marine algae are important for settlement of juveniles (Sloan and Bodungen, 1980). Conand (1993) also reported a similar pattern for S. herrmanni recruiting into shallow waters includes shallow reef flats and sea grass beds (Mercier et al., 1999). During field survey Asterina spp. (juv.), Brittle star (juv.) and Ophionereis sps (juv.) (Echinodermata), Schizophrys aspera (juv.) and Peneid shrimp (Crustacean) were recorded while encountering Juv. *H. pardalis* underneath of coral skeleton and/or rock. Findings clearly suggest GSFC jetty reef flat is an important habitat for invertebrate juvenile settlement.

Juvenile *H. pardalis* have been encountered throughout the field survey while none of the adult animal was reported in study area during the survey period that may suggest habitat of adult is different than that of the juveniles. When individual grow into larger size i.e. adult they may migrate to the harder substrate of back reef (Eriksson *et al.*, 2012)]. Here we can assume the similar pattern of migration in case of adult *H. pardalis*. However further studies are required for confirming adult habitat in the study area.

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