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Habitat use by two Atyid Shrimps *Caridina Sakishimensis* and *Caridina typus* in Urabaru stream, Kikai-jima Island

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Abstract: Habitat use of two atyid shrimps *Caridina sakishimensis* and *Caridina typus* was studied along the continuum of Urabaru stream, Kikai-jima Island from May 2007 to April 2008. Occurrence of shrimps was studied at six different microhabitats those were (1) Rocky shelf; (2) Stooping plants; (3) Walls; (4) Green algae (5) Pebble sand and stone (PSS); (6) Bared ground, all these stations were established along river continuum .*C. typus* occurred at all six microhabitat types; however most preferred habitat by this species was plants. *C. sakishimensis* and was mainly found at rocky shelf only, it was found with low abundance at other stations. Habitat preference among different life cycles of both species was also studied. All stages of *C. typus* were found co-existing at plants, On the contrary *C. sakishimensis* mature individuals and ovigerous females were found associated with Rocky shelf and juveniles were found with plants only. This study revealed that both co-existing species have preferences for different microhabitat, and there is no any competition for space between both of these species.

Keywords: Atyid Shrimps *Caridina Sakishimensis* and *Caridina typus*

1. INTRODUCTION

In stream ecosystem habitat is one of the key factor of community structure and the distribution of organisms (Frissell *et al.*, 1986; Allan, 1995; Richardson, 2006). Specific habitat preferences of specific species can be affected by various spatial and temporal scales. Habitat preferences of a species can be varied from one development stage to another.

Shrimps are most important faunal components of stream ecosystems, they play key role in energy flow in stream ecosystem. They serve as intermediate bridge, linking production of periphyton and detritus with other animals belonging to higher trophic groups (Camara *et al;* 2009; Browder *et al.,* 1994; Frederick and Spalding, 1994). Shrimp can exploit a wide range of detrital, algal and animal food resources with their highly specialized chelae. Shrimp-dominated lotic systems show potentially different biotic interaction from insect-and fish dominated systems (Power 1990a, Hart 1983 and McAuliffe 1984), with important implications for community structure such as primary production and detrital processing. Due to their role in nutrition cycling or energy flow in aquatic energy flow in aquatic ecosystem they are said to be keystone species (Pringle *et al.*, 1993).

Caridina typus H. Milne Edwards, and *Caridina sakishimensis* have been reported as key stone species in Kikai-jima, (Soomro *et al.*, 2010).

Caridina typus has a wide distribution range thus known as cosmopolitan species (Soomro *et al.*, 2011). On the other hand *C. sakishimensis* is listed as endangered species (Kagoshima Red Data Book, 2003) and is only reported in central and southern Ryukyu Islands (Yonaguni-jima, Ishigaki-jima, and Miyako-jima in the south; and Kume-jima, Okinoerabujima, and Kikai-jima in the center) (Shokita, 1979; Suzuki and Satoh, 1994; Soomro *et al.*, 2010). Both of these species are reported as co-existing species in six headwater streams of Kikai-jima Island (Soomro *et al.*, 2011. This paper presents the first data on habitat utilization of two atyid species on micro habitat level in Urabaru stream, Kikai-jima Island. The aim of this study is to describe the ecological aspects of both of these species on spatial scale, which will further be helpful to understand the possible interactions and competition level between the two species.

2. MATERIALS AND METHODS

Kikai-jima is a part of the Ryukyu Group of Islands, which are located in the southern part of the Japanese Archipelago totaling 140 subtropical islands. These islands have a history of more than one period of land-bridge connection in various combinations with adjacent landmasses (Kizaki and Oshiro, 1980; Maki, 2001). Among the Ryukyu Islands, Kikai-jima is fairly a small island measuring only 56.9 km^2. The island lies 50 km east of the Amami-oshima group within the central Ryukyus and is categorized under the "flat islands" (Soomro *et al.*, 2011). Urabaru a small, slower and shallower water body, located in the south of Kikai-jima Island. Length and low elevation of this stream make this river a suitable habitat for the study due to easy accessibility from headwater to river mouth **(Fig. 1)**.

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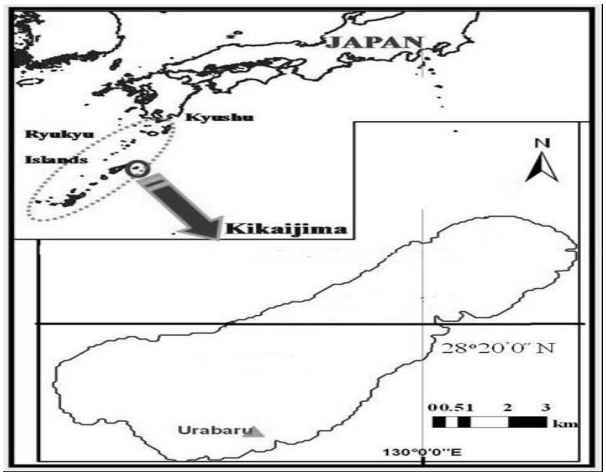

Fig. 1. Map of Kikai-jima showing its location in ryukyu Islands and the location of Urabaru stream in kai-jima Island.

Study was carried out from May 2007 to April 2008, over the period of one year; sampling could not be carried out in March 2008. Eight stations were established along the longitudinal gradient in Urabaru stream from main pool to stream mouth, those were1. Station 1 (Sta.1), which was a headwater pool (680 meter from river mouth); Station, 2-1 (Sta. 2-1), was selected before the cascade and station 2-2 (Sta.2-2) was selected after the cascade; Station, 3-1 (Sta. 3-1) was located before the cascades, and station 3-2 (Sta. 3-2) was below the cascade; Station 4-1 (Sta.4-1) and Station 4-2 (Sta. 4-2) were located after the cascades. Station 5 (Sta. 5) was at river mouth Maximum altitude was (12 meter) recorded at sta.1 (main Pool), and minimum (0 meter) was noted at Sta.4-2 and 5 **(Fig. 2)**.

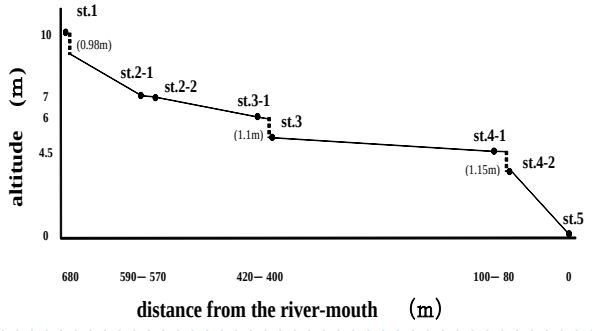

Fig. 2. Profile of Urabaru stream showing all seven stations with the height of cascades in brackets.

Different habitat types were classified qualitatively, those were (1) Rocky shelf (The shelf under the large boulders which were only associated with Sta. 1); (2) Stooping plants (Stooping plants were immensely observed from Sta.2-1 to Sta. 5); (3) Walls are the dikes of main pool (St. 1), which were made up of concrete; (4) Green algae was also observed from St. 2-1 to Sta. 4-2; (5) Pebble sand and stone (PSS). Constituted the substrate along the river length; Bared ground (which was made up of concrete) **(Table 1)**.

Tables 1. Profile of stations at reach scale and micro habitat scale

Stations	Distance from river mouth	Width	depth	Microhabitat profile
Station 1	680	580	51.75	Rocky shelf, Wall
				Pebble sand and stones
Sta. 1-2	590	148.33	5.5	Bared ground,
				pebble, sand and stones
Sta.2-2	570	90	3.5	Bared ground,
				Green algae
Sta.3-1	420	143	0	Pebbles sand and stones
				aquatic plants
Sta.3-2	400	237.5	2.875	P.S and stones, Green algae
				aquatic plants
Sta. 4-1	100	345	2.375	Pebbles sand and stones
				aquatic plants
Sta.4-2	80	245	16.25	Pebbles sand and stones
				aquatic plants
Sta.5	0	263.5	18.75	aquatic plants

Shrimps were sampled separately from each habitat at all assigned stations by hand scoop net, and then they were released in the water filled buckets tagged with the name of habitat. Live shrimps were identified and measured at the orbital total length then were released back. Shrimps were not killed for conservation purpose and studies were carried out in the field. Number of each species was also recorded for all habitat types separately during all months to calculate their abundance.

For the habitat selection by different life cycle stages shrimps were sorted out according their known length at particular stage which was adopted by Soomro *et al.* 2011. *Caridina typus* individuals < 8 mm are juveniles, < 12 mm were categorized as immature and > 12 mm were mature. In *C. sakishimensis* < 8 mm are juveniles, < 16 mm were categorized as immature and > 16 mm were mature (Personal observation).

Relative abundance of each species was calculated according to soomro *et al.* 2010); Relative abundance = (Total number of specimens collected) / (Number of sweeps). High abundance of species at any micro habitat was considered as a scale of its habitat preference.

3. RESULTS AND DISCUSSIONS

Caridina typus appeared as most dominant species during the study and it was found associated with all six habitat types, High abundance of *C. typus* was found associated with plants and then at rocky shelf. The abundance of *C. typus* was also comparatively high at green algae, however the number

of *C. typus* occurring at wall, concrete and pebble, sand and stones was comparatively small. *Caridina sakishimensis* was mainly found at rocky shelf and wall, abundance of individuals occurring at few individuals were found associated with plants, large number was found associated with rocky shelf **(Fig. 3)**.

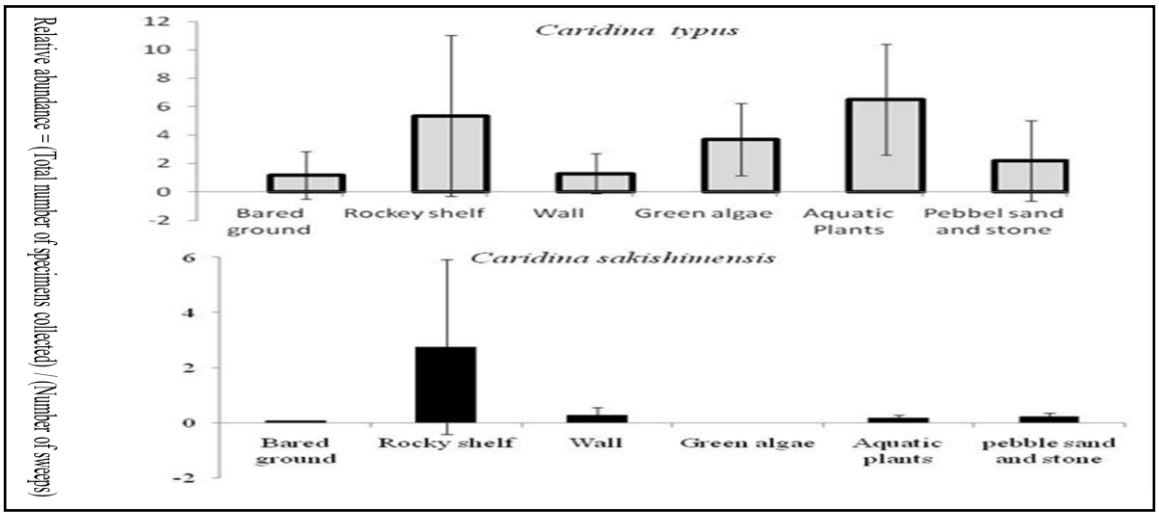

Fig 3. Relativeabundance of *Caridina typus* and *C. sakishimensis* at different microhabitat types

Caridina typus individuals representing all developmental stages (Juveniles, young, mature and ovigirous) were found associated with plant, algae, PSS and bared ground. However, the maximum numbers of individuals of each life stage were found only at aquatic plants. The presence of large number of ovigerous females can be justified with probable ampidromous life cycle of *C. typus*, since aquatic plants mainly occurred at the stations located at low elevations (Sta. 3-1 to Sta. 5). Diadromy of *C. typus* is previously reported by Suzuki (2001) however, detailed studies on the migration of this species will further elaborate its life cycle strategies. No juveniles were seen in rocky shelf (Figure 4), which further support the amphidromy of the species, since the rocky shelf was only restricted to Sta. 1 only (Table 1) and juveniles of amphidromous species always found in small number at headwaters. *Caridina typus* is cosmopolitan species its presence at different kind of habitats suggests that this species can survive in any habitat type. It was also noted that the juveniles were found linked with the roots of the plants (Personal observation) suggesting that shrimp get the support of plants to avoid the displacement through water current during upward migration.

Caridna sakishimensis young, mature, and ovigerous females occurred at rocky shelf, and only juveniles occurred at all type of habitats other than algae. However only young *C. sakishimensis* occurred at pebble sand and stone **(Fig. 4and 5)**. It was observed that high abundance of *C. sakishimensis* occurred mainly at rocky shelf which is found at Sta. 1 (headwater) only (Table 1). The relative abundance of shrimps found at other habitat located towards low altitude was very low (Fig. 3), suggesting that the life cycle strategy of this species is key factor for the habitat preference of this species, however a detailed study on the life cycle *C. sakishimensis* strategies of this species along the river continuum will further justify our hypothesis.

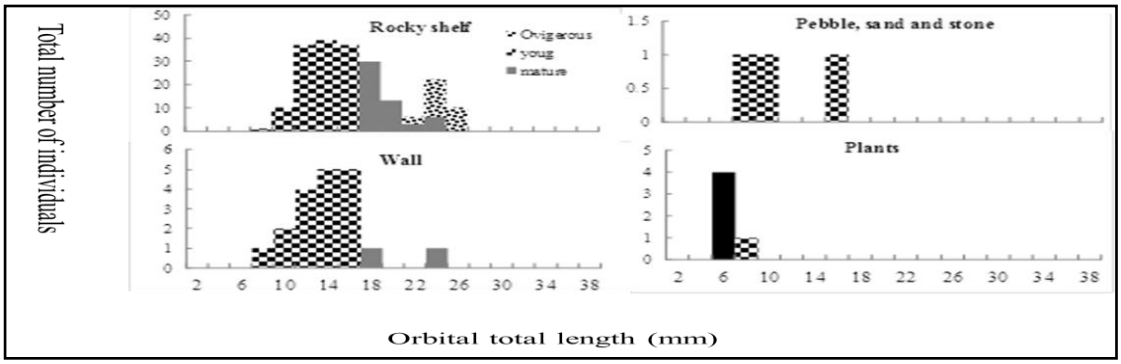

Fig. 4. Size frequency distribution of different life stages of *Caridina sakishimensis* at different microhabitats

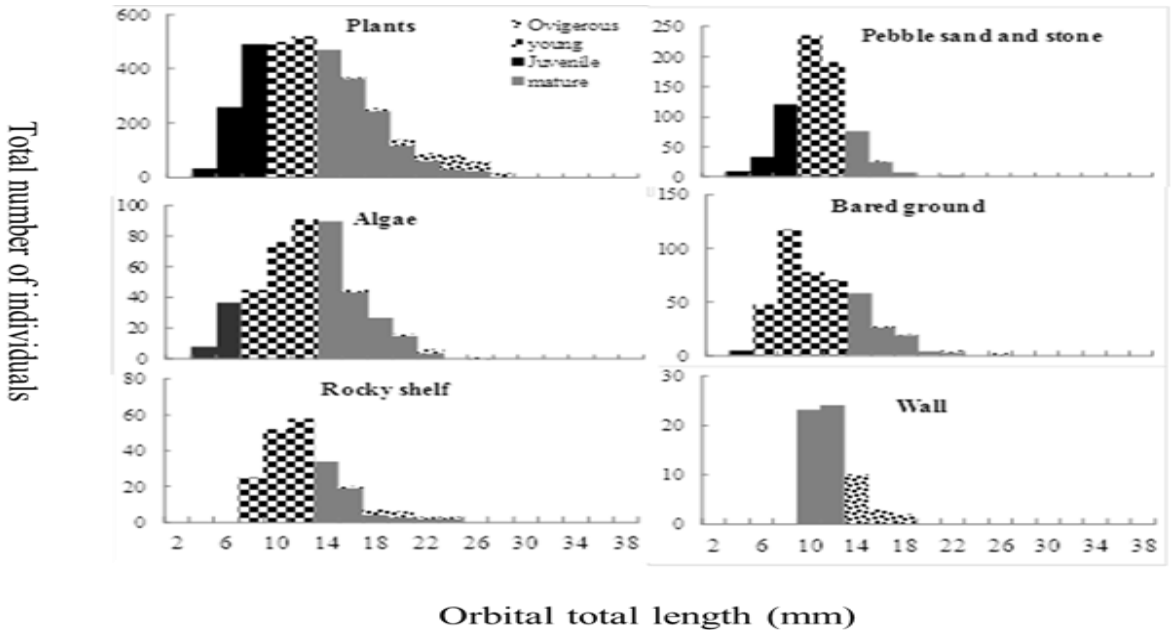

Fig. 5 .Size frequency distribution of different life stages of *Caridina typus* at different microhabitats

Despite the fact that both of the species are co-existing they prefer different environment at microhabitat scale thus are not in competition for space and food. This can therefore be concluded that endangered *C. sakishimensis* has no any threat for space and food from co-existing *C. typus* in Urabaru stream, Kikai-jima.

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