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Population Growth of the Venerid Bivalve *Circenita callipyga* in the Hendijan Coast, Persian Gulf

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Abstract: Length-frequency and growth of dominant species, *Circenita callipyga* (Bivalve, Veneridae) in the Hendijan coast, Khuzestan province (Persian Gulf) were studied from summer 2005 to spring 2006. Sampling was done seasonally with vanveen grab from 5 stations. Stations were located 0.5 mile apart and samples were collected from approximately 8 m depth. The population structure presented a size range between 0.5 and 9.5 mm length, being mainly formed by individuals from 3 to 4 mm, that were dominant in autumn. Recruitment rate was low and the major contribution of recruits was found in winter to spring. Growth parameters of the Von Bertalanffy growth function were estimated to be L_∞=25.06 mm, k= 0.180 year^{-1}, t_0 = 0.11 year.

Key words: Seasonal growth, population structure, *Circenita callipyga*, Hendijan coast, Persian gulf

INTRODUCTION

Circenita callipyga was the dominant species in this region (Schroeder, unpublished data). In Chabahar coast and Faror island (Persian Gulf) *Circenita callipyga* has been reported dominant species of Veneridae family (Ashjae ardalan, 1993; Daghoghy, 2001). *Circenita callipyga* (Von Born, 1778) is an endemic of the Red sea (Tillier and Bavay, 1905). This species has high frequency in Indian ocean (Graham, 1992). Habitat of this species is sands in shallow water, also in sandy and mud at mid-tide level (Bosch and Bosh, 1989).

Bivalves are one of the important fauna in aquatic ecosystems that they are food for many aquatic species (Paine, 1996) and they can effect on cycle of energy (Pandian, 1987; Pinder, 1989). Few studies on growth and production of the Venerid bivalve exist. In Chile, population dynamics of *Eurhomalea exalbida* have been investigated by Urban and Tesch (1996). Monti (1991) studied demography and growth of *Anomalocardia brasiliana* (Bivalve, Veneridae) in a mangrove, in Guadeloupe (French West Indies). Population dynamics of *Gafrarium tumidum* (Bivalve, Veneridae) have been investigated by Kurihara (2003). The reproductive cycle of *Eurhomalea exalbida* (Bivalvia: Veneridae) have been investigated by Morriconi *et al*., 2002 (Lomovasky *et al*., 2002). Urban (1996) studied population dynamics of *Venus antique*, *Tagelus dombeii* and *Ensis mancha* from Chile at 36°S. In the Hendijan coast *Circenita callipyga* encounters high temperatures with average maximum and minimum 31.3 and 13.9°C, (Schroeder, unpublished data). The objective of this study is to determine seasonal growth, population structure of a *C. callipyga* population in the Hendijan coast.

MATERIALS AND METHODS

Length – frequency and growth of dominant species (*C. callipyga*) of the Hendijan coast was studied (49°15′′ E and 29°51′ N) from summer 2005 to spring 2006 (Fig. 1). Sample was done seasonally with vanveen grab from 5 stations. Samples were collected from approximately 8 m depth and sieved through 500 μ mesh size. Salinity and temperature in each season were measured.

Sediment was sieved through 250 μ mesh size and bivalves were isolated and stained with Rose Bengal. The inner features of all shells were observed and they were identified using keys identification (Bruyne, 2003; Hoseinzade Sahafi, 2000; Graham, 1992). Abundance of species is expressed as numbers m^{-2}. Total length of the individual (maximum length in ventral margin) measurement with micrometer in optic lens of stereomicroscope (Carpenter *et al*., 1997). Structure of one population dependent on size and age of individual in this population. Therefore in each stage of study, we can study the population with use dominant species or dominant age group (King, 1995). Due to the present and excessive frequency of *Circenita callipyga* in all samples,

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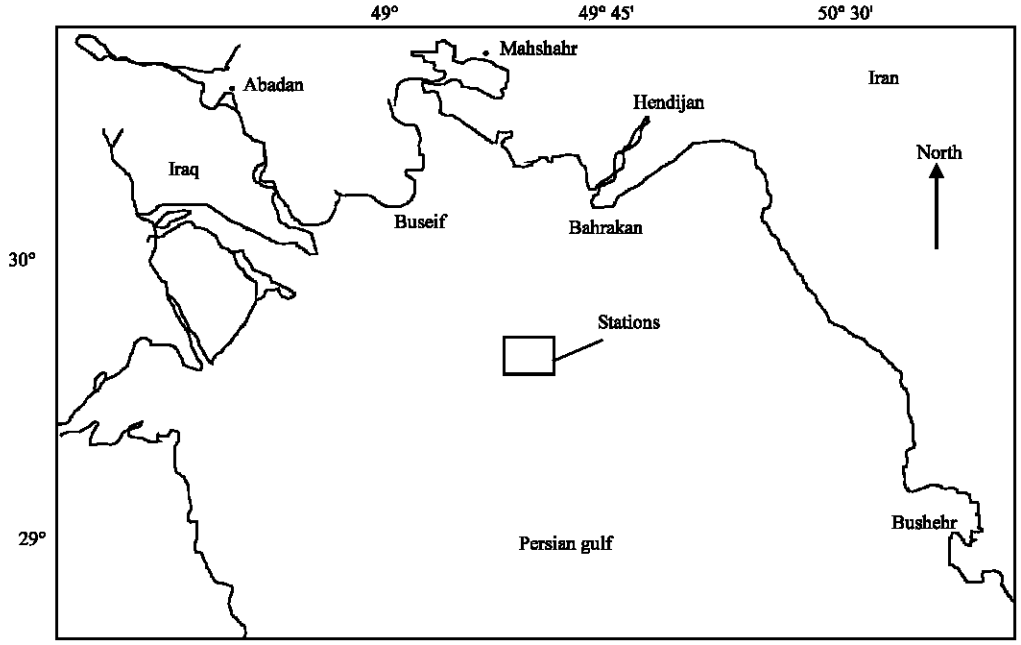

Fig. 1: Sampling site in the Hendijan Coast, West South Iran

we focused on its population variation to study whole Venerid family. Measured length sizes were sorted in groups with 1 mm domain.

The Von Bertalanffy growth model was fitted to the shell length:

$$L_t = L_\infty (1 - e^{-k(t-t_0)}) \text{ [mm, y]}$$

Where L_∞ is the asymptotic length, k is the growth constant, t the age and t_0 the age at zero length. They were estimated with FISAT statistic and ELEFAN method. Length groups for the less than 10 mm individuals was investigated. Individuals were divided age groups with Bhattacharya's method (Gayanilo *et al*., 1996). The age groups of populations were determined on the base of length groups. Statistical correlation test determined among age groups with frequency.

RESULTS

In this study 5 species of Veneridae were identified: *Circenita callipyga, Gafrarium pectinatum, Bassina calophylla, Paphia gallus* and *Paphia textile*. Among these species, *Circenita callipyga* with ratio of 88.69% and abundance of 8668 No. m^{-2} was the highest frequency and other species had low ratio with 1.318% and 34 number in abundance in m2. Juveniles were 9.93% in ratio and 971 No. m2 (Fig. 2).

During the study period salinity ranged between 38.4 mg kg^{-1} and 43.3 mg kg^{-1} and mean seawater temperature ranged between 13.9°C in winter and 31.3°C in summer.

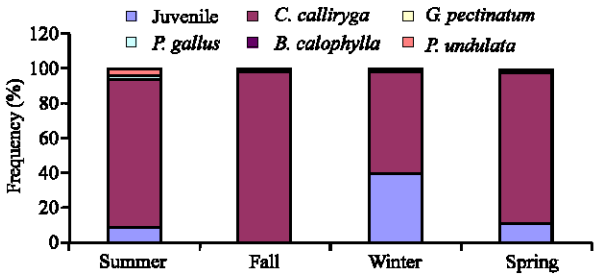

Fig. 2: Percentage of frequency of vary species and juvenile in 4 seasons

The Von Bertalanffy function:

$$L_t = 25.06 \text{ mm } (1\text{-}e^{-0.180\,(t+0.11)})$$

The diagram of frequency- length groups in different seasons shows that the frequency of *Circenita callipyga* fluctuated a lot in different seasons. Figure 3 shows that most diversity of the length of *Circenita callipyga* in autumn and the least diversity was reported in spring. The diagram of frequency-length groups shows two age groups in spring and summer. The number of age groups increases from 2 to 4 in autumn and decreases from 4 to 3 in winter (Fig. 3-6 and Table 1). The oldest people present in age group 4 in autumn and are omitted after that.

DISCUSSION

The study of population growth on different aquatic fauna is controversial. There is not any research on

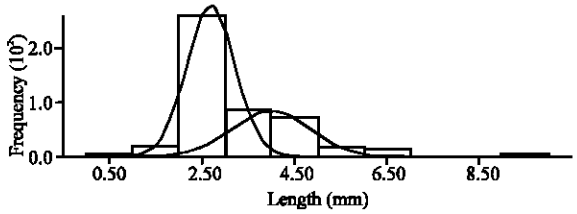

Fig. 3: Length- frequency distribution and age groups of *Circenita callipyga* in summer

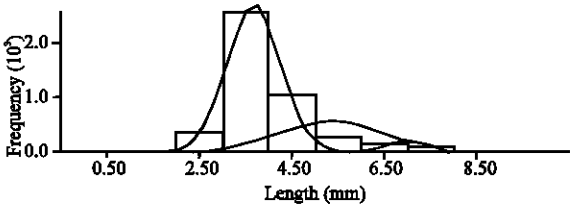

Fig. 4: Length- frequency distribution and age groups of *Circenita callipyga* in autumn

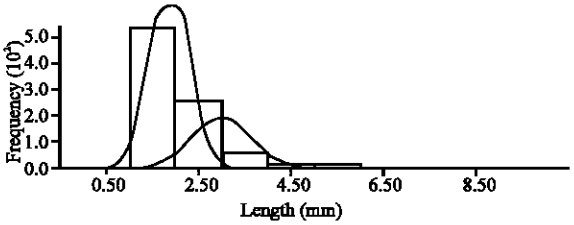

Fig. 5: Length- frequency distribution and age groups of *Circenita callipyga* in winter

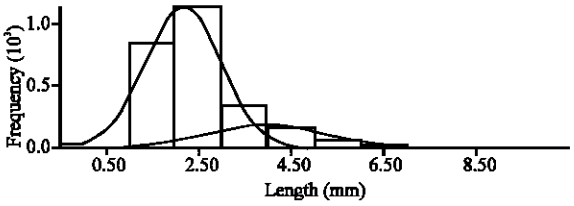

Fig. 6: Length- frequency distribution and age groups of *Circenita callipyga* in sprin

Table 1: No. of age groups, size mean, SD, population in each age groups and SI of *Circenita callipyga* in studied seasons

Season	Group	Mean	SD	Population	SI
Summer	1	2.70	0.520	363	na
	2	4.00	0.820	173	1.940
Autumn	1	3.69	0.590	3980	na
	2	5.36	1.140	1643	1.930
	3	7.00	0.530	286	1.960
	4	8.00	5.040	115	0.360
Winter	1	1.88	0.410	787	na
	2	3.00	0.660	320	2.090
	3	5.00	1.210	15	2.140
Spring	1	2.20	0.810	2333	na
	2	4.00	1.230	569	1.760

na: not abundance

identification and determination growth of dominant species in this area. So in this research it was studied the identification of dominant species and their growth determination. in the study 5 species of Veneridae were identified : *Circenita callipyga, Gafrarium pectinatum, Bassina calophylla, Paphia gallus* and *Paphia textile.* The species recorded in this study have been reported in previously in Persian Gulf and Oman sea (Ashjae Ardalan, 1993; Hoseinzade Sahafi, 2000). The result indicated that *Circenita callipyga* was the dominant species in this region (Fig. 2). In Chabahar coast and Faror island *Circenita callipyga* has been reported dominant species of Venerid family (Ashjae Ardalan, 1993; Daghoghy, 2001).

Circenita callipyga (Von Born, 1778) is an endemic of the Red sea (Tillier and Bavay, 1905). This species has high frequency in Indian ocean (Graham, 1992).

It is important to study growth and reproduction season of *C. callipyga*. Individual of each age groups are born in a same period of time. So population of different group are not similar and population of each group are fluctuating according to number of age groups. Since length of fish and invertebrate are related to age obviously, it is possible to find the characteristics of different age groups of a population with determining the length groups. Also in a population the individuals of one age group are similar in size (King, 1995). For inspecting the trend of length variation of the *C. callipyga* and its relation with population variation; length groups for the less than 10 mm of individuals were investigated. The results of age groups study of *C. callipyga* showed that the maximum number of tall individual (Bivalves in 3 and 4 age groups) in autumn and it can be because of presence of adult shells (Table 1). Also the maximum frequency of small individual (Bivalves in 1 and 2 age groups) in this population are reported in winter and spring (Table 1). This is because of beginning of spawning in winter (Guacira and Jose, 2004) and its continue in spring. In spring the length of individuals increases gradually and it shows a decrease in spawning and an increase in growth. Morsan and Kroeck (2005) reported that recruitment of new generation of *Amiantis purpurata* (Bivalve, Veneridae) in northern Patagonia (Argentina) occurred in winter. Due to presents of different age groups in each season it is probable to spawn in all seasons but peak of spawning of *C. callipyga* happens in winter. Lomovasky *et al.* (2002) reported that the spawning of *Eurhomalea exabida* (Bivalve, veneridae) in the Beagle Channel, Tierra del Fuego is continue with a main peak in October and September. High percent of adult in autumn shows that they are prepare for spawning. In winter the percent of

juvenile (>1 mm) are high and the most individual are belonged to 1-2 mm age groups and the percent of individual belong to high length decrease (Table 1). It is probably that changing and sever decreasing in temperature is the cause of increasing spawning in winter. Loosanoff and Davis (1963), Giese and Pearse (1974), Sastry (1979), Giese and Kanatami (1987), Barber and Blake (1991) opined that temperature plays a major role in reproductive cycle of bivalve.

Diagram of age group in *C. callipyga* illustrate that determined age classes in each season overlap to same extent and it shows *C. callipyga* is low rated growth and long spawning period species and probably each generation spawns several times a year. King (1995) cites in diagram of frequency-length belonging to high rate growth and short spawning period species are completely separate.

When the growth rate is low, probability of combining of age groups increases with length increase (King, 1995). It is obtained that *C. callipyga* is almost long life and low rated growth species. For this species $L_{\infty} = 25.06$ mm, $k = 0.180\ y^{-1}$, $t_0 = 0.11$ y. Lomovasky *et al.* (2005) cited that *Tawera gayi* (Bivalve, veneridae) in the Ushuaia Bay, Beagle channel with $L_{\infty} = 28.03$ and $k = 2.88$ is low rated species. Kurihara (2003) found that the average rate of growth in *Gafrarium tumidum* is low and about 0.2-44.5 μ m $year^{-1}$. The result of statistical correlation test among age groups with frequency showed that frequency is related to age groups (sig = 0.008, $p<0.01$) but reverse. On the other words, like many other animals, the frequency of percent individuals in age class decreases with age increase.

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