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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 11 (5): 788-792, 2008
ISSN 1028-8880

Population Growth of the Tellinid Bivalve *Tellina foliacea* in the Hendijan Coast, Persian Gulf

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Abstract: Length-frequency and growth of one of the dominant species, *Tellina foliacea* (Linnaeus, 1758) (Bivalve, Tellinidae) 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 6.5 mm length, being mainly formed by individuals 3 to 4 mm, that were dominant in winter. Recruitment rate was low and the major contribution of recruits was found in spring. Growth parameters of the Von Bertalanffy growth function were estimated to be L_∞ = 7.70 mm, K = 1.200 y^{-1}, t_0 = 0.9 y.

Key words: Seasonal growth, population structure, *Tellina foliacea*, Hendijan coast, Persian Gulf

INTRODUCTION

Tellina foliacea (Linnaeus, 1758) was the dominant species after *Circenita callipyga* (Von Born, 1778) in this region (Schroeder, unpubl. data) and it is only the species of Tellinidae family in this region. *Tellina foliacea* is an endemic of the Red sea (Oliver, 1992). This species has high frequency in Queensland, Great Barrier Reef, North Western Australia, Indo-pacific, Philippines, South and East China Seas and Taiwan (Bernard *et al*., 1993). Habitat of this species is sands in intertidal, shallow subtidal and subtidal water (Oliver, 1992). Young species are more tolerant of high temperature than are older species (Dekker and Beukema, 1999).

Bivalves are one of the important fauna in aquatic ecosystems that they are food for many aquatic species and they can effect on cycle of energy (Paine, 1996). Few studies on growth and production of the Tellinid bivalve exist. In Wadden sea, growth rate of the bivalve *Macoma balthica* (Linnaeus, 1758) have been investigated during a period of eutrophication by Beukema and Cadee (1991). Zwart (1991) studied seasonal variation in body weight of the bivalves *Macoma balthica*, *Scrobicularia plana* (Da Costa, 1778), *Mya arenaria* (Abbott, 1974) and *Cerastodrma edule* (L.) in the Dutch Wadden Sea. Harvey and Vincent (1990) studied density, size distribution, energy allocation and seasonal variations in shell and soft tissue growth at two tidal levels of a *Macoma baltihca* population. In the Hendijan coast *Tellina foliacea* encounters high temperatures with average maximum and minimum 31.3 and 13.9°C, (Schroeder, unpubl. data). The objective of this study is to determine seasonal growth, population structure of a *T. foliacea* population in the Hendijan coast.

MATERIALS AND METHODS

Length-frequency and growth of dominant species (*T. foliacea*) of Tellinidae family 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 *et al*., 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 *Tellina foliacea* in all samples,

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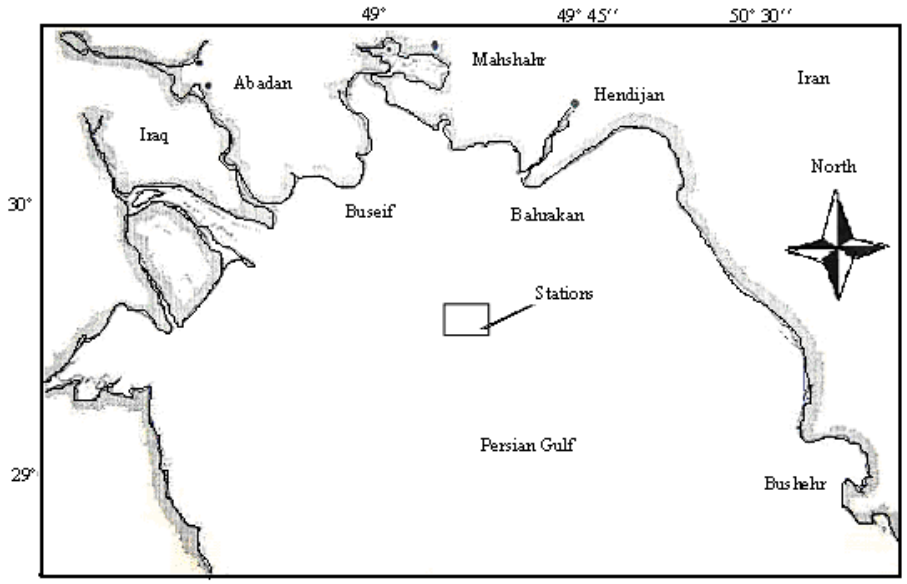

Fig. 1: Sampling site in the Hendijan Coast, West South Iran

we focused on its population variation to study whole Tellinid 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 7 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 the study, *Tellina foliacea* belong to Tellinidae family with 2388 No. m^2 was identified. Juveniles were 9.93% in ratio and 971 No. m^2 (Fig. 2).

During the study period salinity ranged between 38.4 and 43.3 mg kg^{-1} and mean seawater temperature was between 13.9 and 31.3°C. The Von Bertalanffy function:

$$L_t = 7.70 \text{ mm } (1 - e^{-1.200(t+0.9)})$$

The diagram of frequency-length groups in different seasons shows that the frequency of *Tellina foliacea*

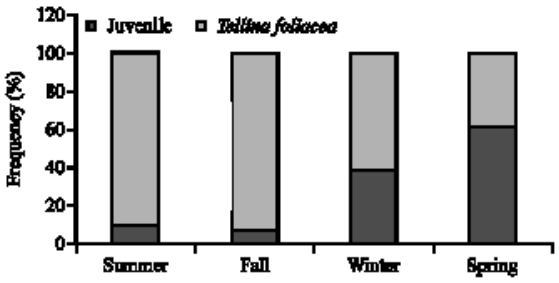

Fig. 2: Percentage of frequency of *Tellina foliacea* and juveniles in 4 seasons

Fig. 3: Length-frequency distribution and age groups of *Tellina foliacea* in summer

fluctuated a lot in different seasons. This diagram shows that most diversity of the length of *Tellina foliacea* in winter and spring and the least diversity was reported in summer. The diagram of frequency-length groups shows two age groups in winter, spring and summer. The number of age groups increases from 2 to 3 in autumn and decreases from 3 to 2 in winter (Fig. 3-6, Table 1). The

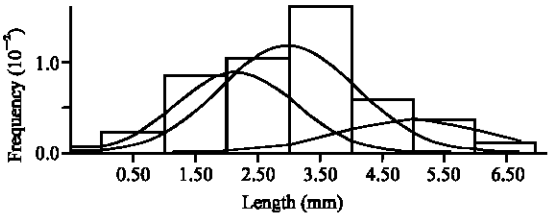

Fig. 4: Length-frequency distribution and age groups of *Tellina foliacea* in autumn

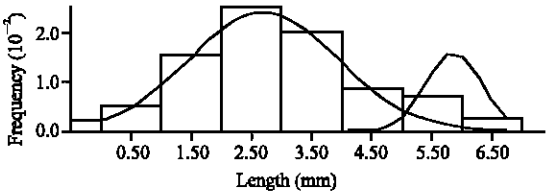

Fig. 5: Length-frequency distribution and age groups of *Tellina foliacea* in winter

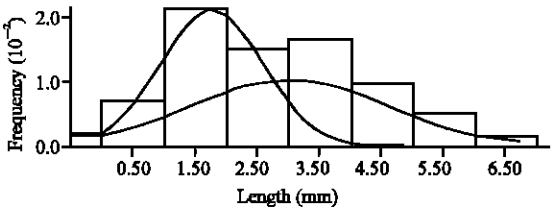

Fig. 6: Length-frequency distribution and age groups of *Tellina foliacea* in spring

Table 1: Number of age groups, size mean, SD, population in each age groups and S.I. of *Tellina foliacea* in studied seasons

Season	Group	Mean±SD	Population
Summer	1	1.77±0.720	190
	2	3.00±0.870	222
Autumn	1	2.17±0.950	211
	2	3.00±1.100	322
	3	5.00±1.190	105
Winter	1	2.70±1.230	740
	2	5.86±0.460	181
Spring	1	1.76±0.820	434
	2	3.00±1.600	411

oldest people present in age groups 2 and 3 in autumn and winter and are omitted after that.

DISCUSSION

The study of population growth on different aquatic fauna is controversial. There is not any research on identification and determination growth of dominant species of Tellinid family in this area. So in this research we studied the identification of dominant species of Tellinid family and their growth determination. In the study 1 species of Tellinidae was identified: *Tellina foliacea*. The species recorded in this study have been reported in previously in Persian Gulf and Oman sea (Daghoghy, 2001; Hoseinzade Sahafi *et al*., 2000).

Tellina foliacea (Linnaeus, 1758) is an endemic of the Red sea (Oliver, 1992). This species has high frequency in Queensland, Great Barrier Reef, North Western Australia, Indo-pacific, Philippines, South and East China Seas and Taiwan (Bernard *et al*., 1993). Habitat of this species is sands in intertidal, shallow subtidal and subtidal water (Oliver, 1992).

It is important to study growth and reproduction season of *T. foliacea*. 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 *T. foliacea* and its relation with population variation; length groups for the less than 7 mm of individuals were investigated. The results of age groups study of *T. foliacea* showed that the maximum number of tall individual (Bivalves in 2 and 3 age groups) in autumn and winter and it can be because of presence of adult shells (Table 1). Also the maximum frequency of small individual (Bivalves in 1 age groups) in this population are reported in spring (Table 1). This is because of beginning of spawning in spring (O'Clair and O'Clair, 1998; Honkoop *et al*., 1999). Beukema *et al*. (1985) reported that recruitment of new generation of *Macoma balthica* (Bivalve, Tellinidae) in the Dutch Wadden Sea occurred in summer and the best growth of them occurred in 4-16°C in spring. In this study we had temperature ranged between 13.9°C in winter so the best growth of this species occurred in winter and the spawning of them occurred in spring. Due to presents of different age groups in each season it is probable to spawn in all seasons but peak of spawning of *T. foliacea* happens in spring. High percent of adult in autumn and winter shows that they are prepare for spawning. In spring 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 increasing in temperature is the cause of increasing spawning in spring (Kennedy and Mihursky, 1971). Jorg (2002), Loosanoff and Davis (1963), Giese and Pearse (1974), Sastry (1979),

Giese and Kanatami (1987) and Barber and Blake (1991) opined that temperature plays a major role in reproductive cycle of bivalve.

Diagram of age group in *T. foliacea* illustrate that determined age classes in each season overlap to same extent and it shows *T. foliacea* 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 *T. foliacea* is almost long life and low rated growth species. For this species $L_\infty = 7.70$ mm, $k = 1.200\ y^{-1}$, $t_0 = 0.9$ y. Frederic and Janet (1982) cited that *Macoma balthica* (Bivalve, Tellinidae from San Francisco Bay, California, is slow growth and intermittent recruitment species. The result of statistical correlation test among age groups with frequency showed that frequency is related to age groups ($sig = 0.005$, $p<0.01$) 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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