

Investigations on the Stocks of the Striped Venus (*Chamelea gallina* L., 1758) in Ordu's Coastal Zone of the Eastern Black Sea

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Abstract: In this study population structure of striped venus (*Chamelea gallina* L., 1758) was investigated between Akçay and Gülyalı at the depth of 5-15 m in Ordu's coastal zone of the Eastern Black Sea in December 2002 and June 2003. Totally 87 operations were conducted with a boat equipped with hydraulic dredge used for commercial clam fishing and sub samples were taken to collect data after each operation. Length-weight distributions and meat yield of 1332 individuals of *C. gallina* belonging to the stock at the site from Akçay to Cape Ünye were calculated. Mean meat yield was found to be 8.04 %. Total weight distributions were between 0.09 g and 5.7 g, while shell lengths were between 6.4 mm and 30 mm. Most of the clam shells were empty and only a few clams were live in all sites, except some parts of the site from Akçay to Cape Ünye. Present attitude was discussed according to the results.

Key words: Striped venus, *chamelea gallina*, meat yield, black sea

INTRODUCTION

Chamelea gallina is a burrowing venerid clam found on well-sorted fine sand in shallow waters (0-15 m in depth) and wide-spread all over the coasts of Mediterranean and the Black Sea (Fisher *et al.*, 1987). During the 1970s and 1980s, with improved fishing technology and use of hydraulic dredge, landing of *C. gallina* increased greatly and was estimated to be up to 100.000 tons per year in Italy (Frogliola, 1989). Recently, *C. gallina* dredging in Italy has passed through a critical period, due to difficulties related to management of the resource and natural mortality following anoxic conditions occurring during the summers of 1991, 1993, 1996, 1998 and 2000 nevertheless it has saved the first place with the annual yield of 34.191 tones in the total world capture in 2003 (Pampanin *et al.*, 2002; Anonymous, 2005a). Because of the natural disasters Italy was encountered which were ecologically important as well as the damage given to the country's economy, scientific studies had been supported with special funds by EU commission.

C. gallina widespread in the regions of Kefken, Karasu, Kocaeli, Akçakoca, and Samsun in the Western Black Sea and also in other parts of the Black Sea (Deval, 1990). It is caught by boats equipped with hydraulic dredge then processed in the factories and total production is exported to European countries. The annual production of *C. gallina* was about 19.692 tons and its income contributed approximately 1.5 million dollars to the Turkish economy in 2003 (Anonymous, 2005b).

Although the status of bivalve beds (Gaspar *et al.*, 2002; Vaccarella and Paparella, 1998) and physiological responses of *C. gallina* to unusual conditions of sea water (Ballarin *et al.*, 2003; Da Ros *et al.*, 2003; De Zwaan *et al.*, 2002) has been extensively studied by some authors from Mediterranean countries, a few investigations have been conducted on this species in our country in spite of its high economic value. The studies are just about the general characteristics of the Marmara region populations (Alpbaz and Önen, 1989; Deval and Oray, 1992; Oray *et al.*, 1992; Deval, 1995).

According to the law, regulating fishing, related fishing seasons of 2004-2006, dredging of clams is only and partially free in the Black Sea. Over fishing at the same region has resulted the decrease in the amount of sizes and this has led the exporter firms in a difficult position. Because of this reason, the study appeared by the help of a private firm which exports *C. gallina* from Fatsa, Ordu. The objective of the present study was to investigate the population structure of striped venus on the coasts of Ordu in the Eastern Black Sea.

MATERIALS AND METHODS

The fishing surveys were occurred by a commercial dredging vessel which is called 'Çağla' belong to harbor Karasu on the Southern East coast of the Black Sea (Fig. 1). Surveys were performed on board fishing vessel (16 m length and 155 hp) along the coasts of Ordu between Akçay (on the border between Samsun and

Table 1: The position and characteristics of the experimental sites (Healthy stock: Suit stock for commercial clam dredging; 99% empty shell: In the sample 99% of the clam is death)

Sampling sites	Position	Depth (m)	Dredging (number)	<i>Chamelea gallina</i>
Akçay-Cape Ünye	Between 41° 08' N 37° 13' E and 41° 08' N 37° 17' E	5-15	24	Healthy stock
Cape Ünye-Fatsa	Between 41° 08' N 37° 17' E and 41° 02' N 37° 30' E	5-15	18	99 % empty shell
Fatsa-Bolaman	Between 41° 02' N 37° 30' E and 41° 03' N 37° 36' E	5-15	16	99 % empty shell
Cape Yason-Perembe	Between 41° 08' N 37° 41' E and 41° 04' N 37° 46' E	5-15	9	99 % empty shell
Perembe-Ordu	Between 41° 04' N 37° 46' E and 40° 59' N 37° 53' E	5-15	8	99 % empty shell
Ordu-Gülyalı	Between 40° 59' N 37° 53' E and 40° 57' N 38° 06' E	5-15	12	99 % empty shell

Table 2: The position of 8 sampling stations and details of tows made in the survey of *C. gallina* in the experimental site (Akçay-Cape Ünye)

Station number	Start position	Finish position	Depth (m)	Length of tow (km)
1	41° 08' 56" N 37° 13' 35" E	41° 08' 57" N 37° 14' 06" E	8	0.67
2	41° 08' 57" N 37° 14' 13" E	41° 08' 57" N 37° 14' 41" E	12	0.67
3	41° 08' 59" N 37° 13' 49" E	41° 08' 59" N 37° 14' 18" E	10	0.65
4	41° 08' 52" N 37° 13' 40" E	41° 08' 52" N 37° 14' 04" E	6	0.56
5	41° 08' 52" N 37° 14' 06" E	41° 08' 54" N 37° 14' 30" E	7	0.57
6	41° 08' 54" N 37° 14' 33" E	41° 08' 56" N 37° 14' 55" E	6	0.56
7	41° 08' 54" N 37° 13' 51" E	41° 08' 56" N 37° 14' 15" E	10	0.57
8	41° 08' 56" N 37° 14' 22" E	41° 08' 59" N 37° 14' 44" E	9	0.57

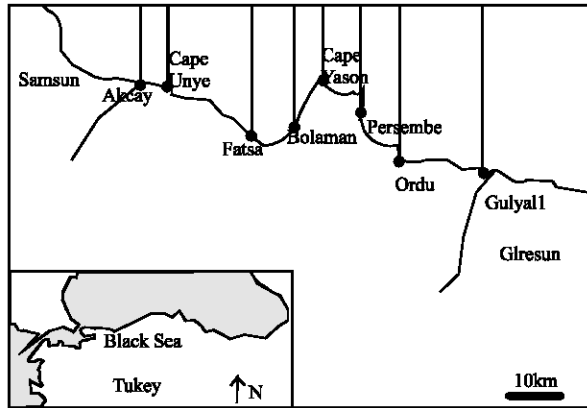


Fig. 1: The study area

Ordu, 41° 08' N, 37° 13' E) and Gülyalı (on the border between Ordu and Giresun 40° 57' N, 38° 06' E) at the depth of 5-15 m with the permission of the Ministry of Agriculture where clam dredging was forbidden in December 2002 and June 2003. The study site was divided into 7 regions in such a way as to take the borders of the center of populations in order to make the article comprehensible (Fig. 1). Dredge survey wasn't realized at the region between Bolaban and Cape Yason due to absence of suitable fields for dredge surveys. Dredge had a length of 3 m mouth, height of 50 cm, tooth spacing of 2 cm, tooth length of 10 cm and 10 mm distance between the bars of the iron grid. Also radar and an echo-sounder were used to determine location and the depth of the

sampling area. To standardize sampling, the dredge was pulled for 10 min at each station. Sampling stations were selected from local knowledge and usually after a cursory inspection by depth sounding.

Totally 87 operations were conducted with a boat equipped with hydraulic dredge used for commercial clam dredging and sub-samples were taken without any selection in a way that represented the whole yield and transferred to the laboratory in a cooling box for measurements. Each clam was measured with a caliper with 0.1 mm accuracy along three axes; length (the straight line distance from the anterior to the posterior margins of the shell), height (the straight line distance measured perpendicularly from the umbo to the ventral margin of the shell) and width (Fig. 2). Total weight, shell weight and meat weight of 1332 *C. gallina* were recorded with 0.01 g sensitivity. The length-weight relationships were applied according to (Ricker, 1973). The results were given with their standard errors (Fig. 1 and 2).

RESULTS

The research area in the coastal zone of Ordu was divided into 7 regions (Fig 1). The fishing surveys were carried out at different depths. The positions and characteristics of the regions were given at Table 1.

After dredging, about 99% of clams were dead or empty shells, only very few live clams were found at the depth of 5-15 m in the sites of Cape Ünye-

Table 3: Some biometric results of *C. gallina* dredged from Akçay to Cape Ünye (H = Height, L = Length, W = Width, TW = Total Weight, MW = Meat Weight, SW = Shell Weight)

	L (mm)	H (mm)	W (mm)	TW (g)	MW (g)	SW (g)
Min-Max	6.4-30	5.8-28	2.9-14	0.09-5.7	0.01-0.46	0.03-4.01
Mean(±Sx)	17.96±0.19	16.47±0.18	8.42±0.09	1.88±0.06	0.15±0.01	1.22±0.04

Table 4: Regression and confidence intervals of allometric growth for biometrics parameters of *C. gallina* (H = Height, L = Length, W = Width, MW = Meat Weight, TW = Total Weight)

Variables (Dependent-independent)	n	R	Log a	b	95% Confidence Intervals
H-L	1332	0.998	-0.0479	1.0080	1.0017-1.0143
W-L	1332	0.973	-0.3635	1.0267	1.0004-1.0530
MW-L	1332	0.932	-4.2724	2.7123	2.5983-2.8263
TW-L	1332	0.968	-3.1408	2.6918	2.6163-2.7672

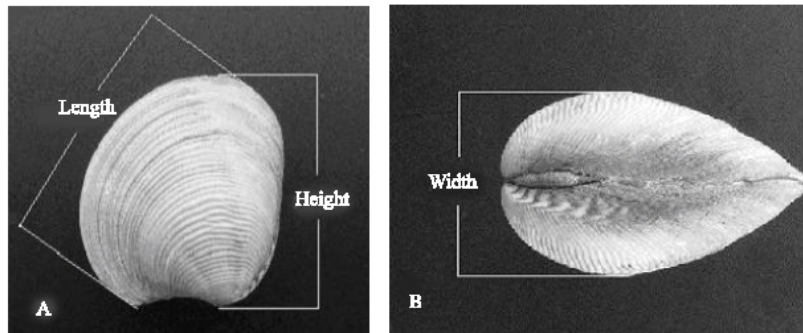


Fig. 2: The biometric measurements of *C. gallina* (A: length and height; B: width)

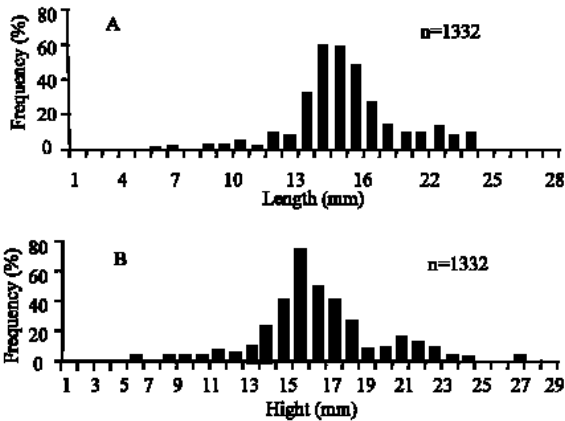


Fig. 3: The frequencies of both length (A) and height (B) values of *C. gallina* from Akçay to cape Ünye

Fatsa (18 tows), Fatsa-Bolaman(16 tows), Cape Yason-Perpembe(9 tows), Perpembe-Ordu (8 tows), Ordu-Gülyalı(12 tows). Live *C. gallina* was sampled just from 8 tows of those 24 tows in Akçay-Cape Ünye site. Dredge contents of these 8 tows were analyzed in the course of survey. The position of those 8 sampling stations and details of tows made in the survey was given in Table 2. Mean values of biometric results were summarized in Table 3. Length and height frequencies of 1332 clams from site Akçay-Cape Ünye were shown in Fig. 3 Table 2 and 3.

As can be seen from Table 3 the average length, height and width of *C. gallina* from the coastal zone of Ordu was 17.96±0.19 mm, 16.47±0.18 mm and 8.42±0.09 mm, respectively. Mean total weight was 1.88±0.06 g while mean edible weight of the clams was 0.15±0.01 g. The meat yield of the clams was 8.04 %. The percentage of commercial clams (=20 mm) in the yield was 14.1%. According to regressions relationship for length and width with total weight for *C. gallina* was positively linear. However the relationship of the dimensional and the weight parameters was exponential. There is an allometric growth between all variables (Table 4).

DISCUSSION

Mutlu *et al.*, (1993) investigated the molluscs of soft bottom of the Anatolian coasts of the Black Sea. The study was realized in 20 stations including the coastal zone of Ordu in September, 1988 and January 1989. Even though 4 species of mollusc were determined on the coast of Ordu *C. gallina* wasn't found. The reason may be that the station chosen on the coasts of Ordu was at 63 m depth and this depth isn't habitat of *C. gallina*.

According to Deval and Oray (1992) length variation was ranging from 20 to 32 mm for *C. gallina* from the western Black Sea (Karasu, Kocaeli and Melenađzi) and they couldn't sampled any *C. gallina* under 20 mm length because of their sampling

equipment. Tuncer and Erdemir were studied some properties for *C. gallina* from Karabiga-Çanakkale. The area is at the southern coasts of Marmara and still forbidden for commercially clam dredging. The length variations of clams in their experiment were from 18.1 to 35 mm, which had an average of 25.2 ± 1.09 mm (Cebeci, 1994) reported that the *C. gallina* which were fished from the Marmara Sea had a maximum shell length of 34 mm with an average of 20 mm and the percentage of commercial sizes (= 20 mm) were 14.6 % in the yield. In the present study the average length, height and width of the clams from the coast of Ordu were 17.96 ± 0.19 mm, 16.47 ± 0.18 mm and 8.42 ± 0.09 mm, respectively. The maximum length of the clam was found to be 30 mm and the percentage of commercial sizes (= 20 mm) was 14.1 %. The relationships between the weight and the dimensional parameters, calculated from regression and correlation analyses, the growth was determined to be allometric. The growth of *C. gallina* studied in the Marmara Sea and Algarve coast was also allometric (Deval, 2001; Gaspar *et al.*, 2001).

Synergetic interactions between unusual hydrometeorological conditions, water column stratification, water mass exchange rates and external nutrient input can cause some anoxic events in the bottom waters. These extensive hypoxic and anoxic events cause negative effects on sedentary and benthic species, particularly on bivalves (Pampanin *et al.*, 2002).

The massive amount of empty shells of *C. gallina* were observed around the river sites on the sea coast of Black Sea during winter season in 2002 and these events were announced by the masmedia as news (Anonymous, 2002). In the present study, high rate of empty shells (about 99 % of samples) in the samples from the experimental sites of Cape Ünye-Fatsa, Fatsa-Bolaman, Cape Yason-Perþembe, Perþembe-Ordu and Ordu-Gülyalı were showed that natural *C. gallina* stocks may be destroyed by the anoxia or other natural events. Similar results have been reported from Italy (Justic, 1987; Degobbis, 1989; Cattani and Vitali, 1995).

As a result, findings from this experiment showed that reasons of the high amount of empty clam shells caused by the ecological problems should be investigated for the Black sea stock. All stock of clams from the Black Sea should be examined before to open economically clam fishing to determine population structure. The present results will be very good base for future experiments for this important species of Turkey.

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