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The meat yield variations of *Patella caerulea* (Linnaeus, 1758) in Urla, Izmir Bay

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Abstract: *Patella caerulea* were investigated to see whether differences in seasonal meat yield in Izmir Bay. Limpets were collected from sublittoral rocky shores seasonally. Biometric parameters were recorded. Shell length varied between 25.13±0.77 mm and 29.88±0.87 mm. The average weight changed from 2.85±0.26 g to 3.92±0.29 g. When the temperature was low in winter, the meat yield showed peak (41.20±1.18) which can be relation to reproductive time. *P. caerulea* is most common Mediterranean limpet but are not consumed in Turkey except for only coastal cities little. This study may provide preliminary results on limpet in Izmir Bay.

Keywords: *Patella caerulea*, Limpet, Meat yield, Izmir Bay.

Introduction

Limpets are important controlling distribution of algae, structuring agents of intertidal assemblages and consuming sessile, mobile prey (Culha and Bat, 2010). The Patella genus includes species northeast Atlantic Indo-West Pacific and southern Africa (Christiaens, 1974). The native Mediterranean limpet, *Patella caerulea* is among the most common of rocky shores in the whole infralittoral and midlittoral Mediterranean basin (Bannister, 1975) and mostly feed on Cyanophyceae species (Ayas, 2010).

Patella caerulea may reach a length of 70 mm (Kastanevakis et al., 2008). Falakalı Mutaf and Akşit (2007) were determined *P. caerulea* 2.80±0.30 mm in shell length in Antalya Bay, south coast of Turkey. Espinosa et al. (2006) measured 28.51±2.39 mm in length and 2.99±0.75 g in weight of *P. caerulea* individuals in North Africa.

For the consumers and specific data for the processing industry, the information on meat yield of seafood products is significant (Vascancelos et al., 2009). Meat yield of gastropods (*Hexaplex trunculus* (37%), Vasconcelos et al., 2009; *Thais coronata* (15%), Udoh and Abiaobo, 2014; *Patella vulgata* (8.03 g), Thomas and Moninno, 2017) was better than bivalves such as *Ostrea edulis* (10%) (Acarli et al., 2011). Meat yield could be related with reproductive cycles. Especially temperature, salinity and wind speed has often correlated to the reproductive cycles of *Patella* species (Orton et al., 1956; Fretter and Graham., 1976; Belkhodja et al., 2010).

Patella caerulea is very prevalent in Turkish seawater (Öztürk and Ergen, 1996). Generally morphological, heavy metals and taxonomy studies on *P. caerulea* are being conducting in central Black Sea coast of Turkey (Culha and Bat, 2010; Bat et al., 1999). In this study, *P. caerulea* were investigated to see whether differences in seasonal biometric measurements and meat yield in Izmir Bay.

Materials and Methods

Limpet individuals, *P. caerulea*, were collected from sublittoral rocky shores seasonally between March 2004 to February 2005 from Urla-Iskele (38˚21"86'N 26˚46"31'W), Izmir. 60 specimens were randomly picked up from rocky shore by knife. During limpet sampling, water temperature was measured by a mercury thermometer (ranged -10 to 100±0.5ºC), salinity (‰) was determined by hand refractometer. Biometric parameters (length, width and height) were measured using Vernier callipers (IP-66-Mitutoyo Absolute) and the total wet weight was weighted by 0.01g precision electronic laboratory scales (GE 412 Sartorius). Then, limpets were dissected and wet meat was seperated from their shell and weighted. Meat yield (%) was calculated via the following

Table 1. The biometric measurements of *Patella caerulea.*

	Length (mm)	Width (mm)	Height (mm)	Weight (g)
Spring	29.87±0,81	24.6±0.728	7.43±0.33	3.62±0.28
Summer	29.88±0.87	24.76±0.76	8.53±0.37	3.92±0.29
Fall	25.13±0.77	20.56±0.65	6.58±0.32	2.85±0.26
Winter	29.4±0.85	24.3±0.76	8.25±0.35	3.61±0.23

There was not significant difference between biometric parameters (length, width, height, weight) (P>0.05).

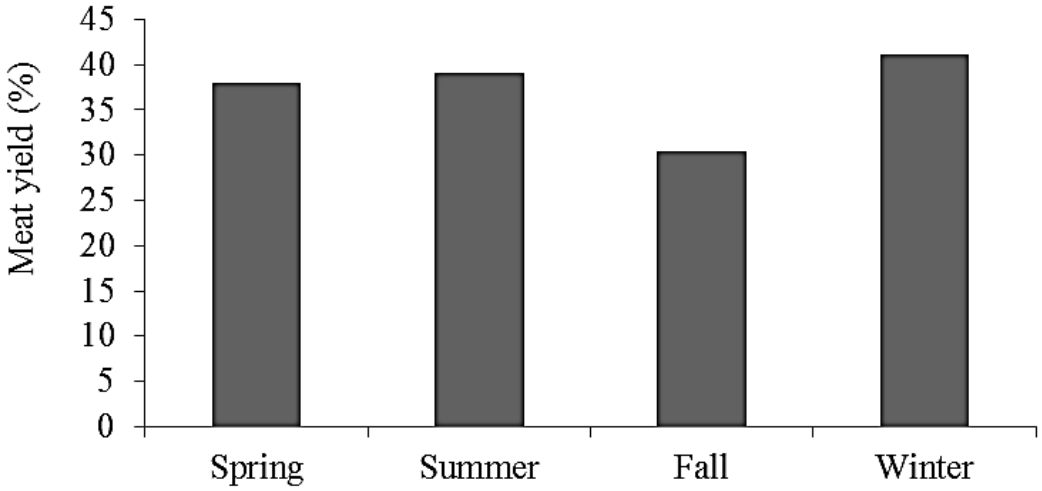

Figure 1. The changing of the meat yield.

formula:

Meat yield (%) = Wet meat weight / total wet weight * 100 (Crosby and Gale, 1990)

The results were expressed as the mean±standard error. The biometric measurements and the condition indices were analized by using Microsoft Excel Program. The percentage of condition indices was calculated after transforming the variable by arcsin. Kruskal-Wallis test was used to check differences in condition indices between months during study period and Mann-Whitney U was used with the software SPSS 15.

Results

Biometric parameters were showed in Table 1. Shell length varied between 25.13±0.77 mm in fall and 29.88±0.87 mm in summer. The weight was maximum in summer (3.92±0.29mm) and minimum in fall (2.85±0.26 mm). The average height changed from 6.58±0.32 g to 8.53±0.37 g.

The condition index was maximum (41.20±1.18%) in winter and minimum (30.46±1.54%) in fall. There was significant difference between meat yield according to the season and the summer was more different than the other season (P≤0.05) The water temperature decreased to 13.6ºC in winter and increased 20.6ºC in summer. Salinity was observed between 35‰ and 37‰ during study period (Fig. 1).

Discussion

Sizes of limpets were affected by water parameters (temperature, salinity, etc.), availability of foods, waves, etc. So biometric parameters varies according to region. The mean length and weight of *P. caerulea* were 28.51±2.39 mm. in length and 2.99±0.75 g in weight in North Africa (Espinosa et al., 2006). Although shell length was 2.80±0.30 mm in south coast of Turkey (Falakalı Mutaf and Akşit, 2007). Deniz Ayas (2010) was found bigger *P. caerulea* individuals (shell length average 27.48 mm. width 22.32 mm. height 7.36 mm) the coast of Viranşehir of Turkey. In this study, biometric parameters were found higher than the other studies as 29.88± 0.87 mm in shell length.

Meat yield of gastropods vary according to species such as 15% in *Thais coronata* (Udoh and Abiaobo, 2014) 37% in *Hexaplex trunculus* (Vasconcelos et al., 2009), 8.03g in *Patella vulgata* (Kenneth and Mannino, 2017),

and 37% in this study. Parry (1982) reported that limpets spawn in winter (November, January, February, March). Reproductive cycle of *P. rustica* was between November and December in Adriatic Sea (Prusina et al., 2014). In this study, the meat yield was the highest (41.20±1.18%) in winter season which can be related with to reproductive time. As we know just before spawning of gastropods, meat ratio can reach to the highest level. Water conditions especially temperature can also affect both meat yield and reproduction of *Patella* species. Temperature has often related to the reproductive cycles of *Patella* species (Ortan et al., 1956; Fretter and Graham, 1976).

Patella caerulea is most common in Turkish seawaters, having a wider distribution but are not consumed in Turkey except for only coastal cities (Öztürk and Ergen, 1996) although is most endangered marine invertebrate in the western Mediterranean rocky shores (Ramos, 1998). This study may provide preliminary results on limpet in Izmir Bay. In the future studies, histology provides a more precise and accurate evaluation of gonad developmental stages.

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