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## A Comparative Study on Growth Rates of Mussels, *Mytilus galloprovincialis* Lamarck, 1819 and *Modiolus barbatus* Linnaeus, 1758, in Dardanelles

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**Abstract:** In this study, bioecological characteristics of the Mediterranean mussel, *Mytilus galloprovincialis* (Lamarck, 1819) and the Horse mussel, *Modiolus barbatus* (Linnaeus, 1758) occurring in Dardanelles were studied between May 2002 and March 2003. Physico-chemical characteristics of sea water were also evaluated. The samples were collected by free diving and using R/V BILIM-I and R/V Uni-Dardanos. A total of 1282 *Mytilus galloprovincialis* and 280 of *Modiolus barbatus* were used in experiments.

**Key words:** Dardanelles, *Mytilus galloprovincialis*, *Modiolus barbatus*, growth performance

### INTRODUCTION

Mussels, an important class of Mollusca, are yielded through both hunting in nature and breeding. Mussels position themselves onto the surface by the help of their bisus fibres and provide food through filtration<sup>[1]</sup>. They feed on organic and inorganic particles in a scale of 2-100 µm. Mussels with a scale of 7-8 cm, can filter 10-15 lt sea water per hour<sup>[2]</sup>. *Mytilus galloprovincialis* exists in the Black Sea, the Bosphorus, the Marmara and the Mediterranean Sea, but is rarely seen in the Dardanelles and the Aegean Sea. Mussels, existing in the range of the coastline from the Black Sea and the Izmir Bay, live in the area between Izmir (Urla) and the Mediterranean Samandıra<sup>[1]</sup>. As for *Modiolus barbatus* (Linnaeus, 1758), it inhabits Ayvalık abundantly and it is exported<sup>[3]</sup>.

In this study, the growths of *Mytilus galloprovincialis* and *Modiolus barbatus*, situated at different stations chosen in Çanakkale, have been comparatively researched. The scales, total weights of and interrelations between the mussels have been statistically revealed by analyzing some physico-chemical parameters, directly or indirectly effective in the growth of the mussels.

### MATERIALS AND METHODS

This study was carried out between May 2002 and March 2003 at four stations chosen in the direction of North to South in Çanakkale. During the research 1282 species of *Mytilus galloprovincialis* and 280 species of *Modiolus barbatus* were used.

After breeding in special nets produced by Cotton Plus® (Spain-Galicia), species were wrapped with ropes and stabilized onto concrete vaults of 65 kg<sup>[4-5]</sup>. Then, the nets with the species in were tied up to floats<sup>[6-11]</sup>. The development of the species at the stations were observed and analyzed the seawater parameters temperature (°C) and salinity (‰) monthly. The relations between the species as statistical were determined by using Multiple Comparative Tests and General Linear Model.

### RESULTS AND DISCUSSION

Various growth rates which can be observed in the population of *Mytilus galloprovincialis* and *Modiolus barbatus* have resulted from the fluctuations in the environmental factors<sup>[12]</sup>. Temperature and food conditions are to affect the growth of mussels<sup>[13-15]</sup>. There is a striking connection between the growth of the mussels and the amount of the available food<sup>[16]</sup>. Generally, growth of the mussel species begins with the increase in the abundance of phytoplankton and zooplankton with the increase of the temperature of the seawater in Spring<sup>[17]</sup>. Salinity and temperature values of the stations have been given in Fig. 1.

In Table 1-4, 8-monthly length and weight changes and rates of the species *Mytilus galloprovincialis* and *Modiolus barbatus* have been shown. In Table 5, changes in terms of the length and the weight of the mussel species have been given.

As far as the research results concern, the smallest mean length of the species *Mytilus galloprovincialis* has been observed at station 1 as 38.8±2.92 mm (Table 1) and

Table 1: Average lengths of *Mytilus galloprovincialis* species (mm) for months

Months	n	1. station	n	2. station	n	3. station	n	4. station
May-02	49	37.4±2.43*	45	37.4±1.73	50	35.2±1.95	48	42.3±3.06
Jun-02	19	35.1±1.80	33	42.4±1.92	48	42.7±4.47	48	37.7±2.08
Jul-02	41	40.4±2.37	44	46.0±2.17	50	41.1±2.47	40	45.7±2.82
Sep-02	20	41.8±2.44	39	39.4±2.62	47	43.1±3.43	46	42.1±1.90
Oct-02	10	39.1±1.94	20	50.1±2.84	18	39.6±1.75	31	41.3±2.66
Nov-02	25	42.8±2.60	38	44.6±3.80	19	42.9±2.31	35	45.9±2.50
Mar-03	50	36.8±2.30	50	47.9±2.50	50	41.3±2.30	50	44.3±3.90
Σ <sub>ort.</sub>	n=214	38.8±2.92	n=269	43.6±2.75	n=282	40.7±3.10	n=298	42.6±2.98

Table 2: Average weights of *Mytilus galloprovincialis* species (g) for months

Months	n	1. station	n	2. station	n	3. station	n	4. station
May-02	49	4.75±0.77	45	4.26±0.38	50	3.45±0.89	48	5.99±0.72
Jun-02	19	4.54±1.03	33	6.22±1.35	48	6.17±1.35	48	4.38±0.57
Jul-02	41	7.05±0.76	44	8.05±1.07	50	6.06±0.67	40	8.81±0.82
Sep-02	20	8.46±1.27	39	6.20±1.16	47	6.88±0.84	46	6.05±0.59
Oct-02	10	4.74±0.81	20	8.44±0.99	18	3.75±0.57	31	5.94±1.17
Nov-02	25	9.10±1.23	38	9.58±1.93	19	7.36±0.63	35	8.13±1.30
Mar-03	50	4.62±0.57	50	6.54±2.59	50	5.75±0.65	50	7.73±1.25
Σ <sub>ort.</sub>	n=214	5.99±1.33	n=269	6.90±2.10	n=282	5.64±1.11	n=298	6.66±1.11

Table 3: Average lengths of *Modiolus barbatus* species (mm) for months

Months	n	1. station	n	2. station	n	3. station	n	4. station
Jul-02	31	41.7±3.26*	27	42.5±2.85	31	41.3±2.58	34	42.5±2.75
Sep-02		***	29	43.0±2.78	14	38.9±2.45	16	41.4±2.56
Oct-02		***		***	17	42.6±2.27	28	43.6±2.54
Nov-02		***		***	37	40.2±3.00	16	42.1±2.20
Mar-03		***		***	***			**
Σ <sub>ort.</sub>	n=31	41.7±3.26	n=56	42.7±2.78	n=99	40.8±2.82	n=94	42.6±2.64

Table 4: Average weights of *Modiolus barbatus* species (g) for months

Months	n	1. station	n	2. station	n	3. station	n	4. station
Jul-02	31	7.44±1.10	27	9.22±1.24	31	6.87±0.91	34	8.01±1.39
Sep-02		***	29	7.27±1.26	14	6.05±0.70	16	8.98±1.42
Oct-02		***		***	17	6.73±1.72	28	9.20±0.70
Nov-02		***		***	37	7.11±1.11	16	8.30±0.66
Mar-03		***		***	***			**
Σ <sub>ort.</sub>	n=31	7.44±1.10	n=56	8.21±1.65	n=99	6.82±1.27	n=94	8.58±1.50

n= Sample number, \*Standard error, \*\* Sampling cannot did, \*\*\*Species cannot adaptation their habitat

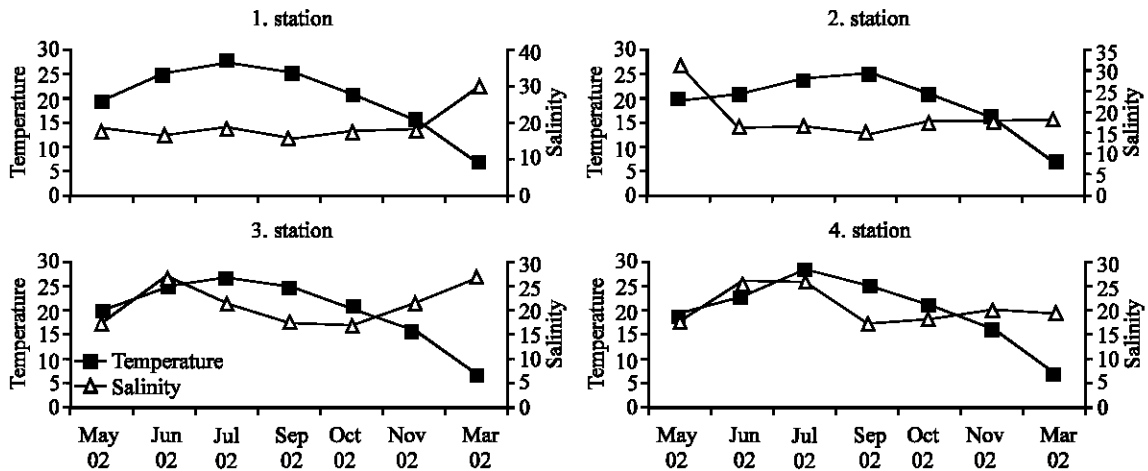


Fig. 1: Salinity and temperature values of stations

Table 5: Length and weight relationships of *Mytilus galloprovincialis* and *Modiolus barbatus*

		1. station		2. station		3. station		4. station	
		<i>Mytilus</i>	<i>Modiolus</i>	<i>Mytilus</i>	<i>Modiolus</i>	<i>Mytilus</i>	<i>Modiolus</i>	<i>Mytilus</i>	<i>Modiolus</i>
Length	Minimum	35.1±1.80	41.7±3.26	37.4±1.73	42.5±2.85	35.2±1.95	38.9±2.45	37.7±2.08	41.4±2.56
	Maximum	42.8±2.60	41.7±3.26	50.1±2.84	43.0±2.78	43.1±3.43	42.6±2.27	45.9±2.50	43.6±2.54
	Difference	7.7	-	12.7	0.5	7.9	3.7	8.2	2.2
Weight	Minimum	4.54±1.03	7.44±1.10	4.26±0.38	7.27±1.26	3.45±0.89	6.05±0.70	4.38±0.57	8.01±1.39
	Maximum	9.10±1.23	7.44±1.10	9.58±1.93	9.22±1.24	7.36±0.63	7.11±1.11	8.81±0.82	9.20±0.70
	Difference	4.56	-	5.32	1.95	3.91	1.06	4.43	1.19

Table 6: Comparison of mean between station and species

Stations	Species	$\bar{x} \pm S \bar{x}$
1	<i>Mytilus galloprovincialis</i>	38.8±0.40Ca
	<i>Modiolus barbatus</i>	41.7±1.05Ab
2	<i>Mytilus galloprovincialis</i>	43.6±0.36Aa
	<i>Modiolus barbatus</i>	42.7±0.78Ab
3	<i>Mytilus galloprovincialis</i>	40.7±0.35Ba
	<i>Modiolus barbatus</i>	40.8±0.59Aa
4	<i>Mytilus galloprovincialis</i>	42.6±0.34Aa
	<i>Modiolus barbatus</i>	42.5±0.60Aa

Note 1: Differences between stations shown with different capital letter(s) are significant ( $p < 0.01$ )

Note 2: Differences between species shown with different letters are important ( $p < 0.01$ )

Table 7: Comparison between stations and mussel species

Station	$\bar{x} \pm S \bar{x}$	Species	$\bar{x} \pm S \bar{x}$
1	6.7±0.25 <sup>a</sup>	<i>Mytilus galloprovincialis</i>	6.3±0.08 <sup>a</sup>
2	7.5±0.19 <sup>b</sup>	<i>Modiolus barbatus</i>	7.8±0.17 <sup>b</sup>
3	6.2±0.15 <sup>a</sup>		
4	7.6±0.15 <sup>b</sup>		

Note: The differences between the rates of the stations shown with the same letters are unimportant

the smallest mean weight rate at station 3 as 5.64±1.11 g (Table 2). For the species *Modiolus barbatus*, the smallest mean length has been observed at station 3 as 40.8±2.82 mm (Table 3) and the smallest mean weight again at station 3 as 6.82±1.27 g (Table 4).

The highest length and weight rates have been observed in the species of *Mytilus galloprovincialis* at station 2; 43.6±2.75 mm and 6.90±2.10 g (Table 1 and 2). These particular rates have been observed in the species of *Modiolus barbatus* as 42.7±2.78 mm and 8.58±1.50 g (Table 3 and 4). Among mussels, when compared with the summer months it has been determined that the growth is slow in terms of both length and weight in the winter months, in which temperature of the sea is low (Fig. 1).

According to the results of the variance analyses carried out in terms of length, the stations have been compared separately ( $p=0.049$ ). Accordingly, it has been found out that bioecological features of station 2 and 4 are alike in the values of temperature and salinity. When the growth of the species *Mytilus galloprovincialis* and *Modiolus barbatus* have been compared at each station separately, it has been found out that station 1 and 2 and station 3 and 4 have manifested similar growth patterns (Table 6).

According to the results of variance analyses carried out in terms of weight, istasyonlarda *Mytilus galloprovincialis* and *Modiolus barbatus* have been compared at each station separately, it has been found out that station 1 and 3 and station 2 and 4 have manifested similar growth patterns ( $p < 0.01$ ). As a result, the biological features at stations have affected the growth of the both species differently (Table 7).

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