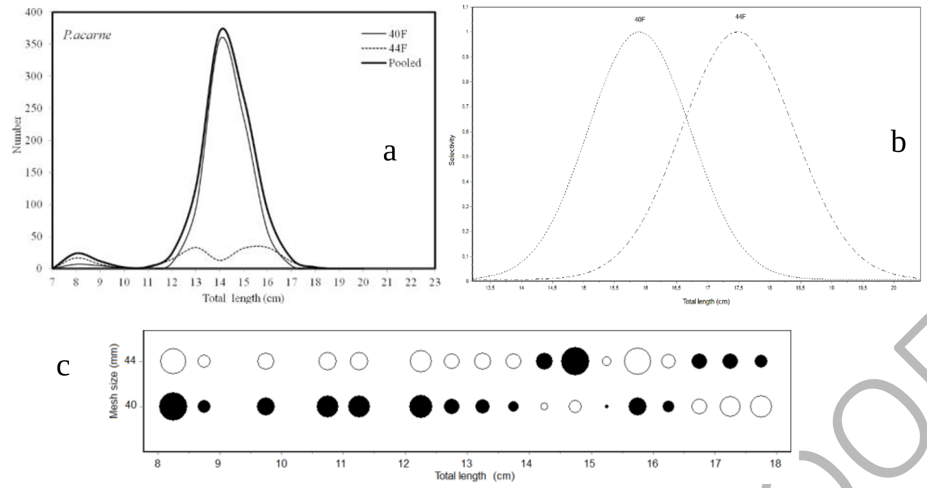

Figure 1. *P. acarne*: (a) Length frequency distributions, (b): Selectivity curves of trammel nets, (c): Deviance residual plot. Open circle indicates a positive residual and full circle indicates a negative residual.

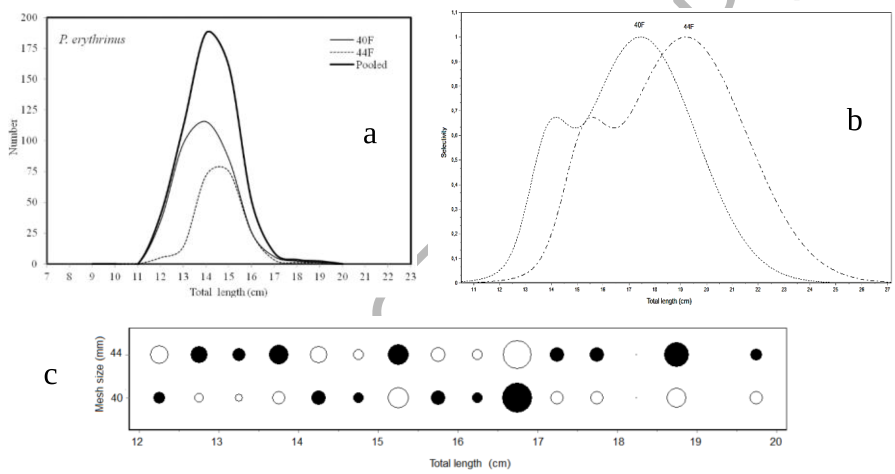

Figure 2. *P. erythrinus*: (a) Length frequency distributions, (b): Selectivity curves of trammel nets, (c): Deviance residual plot. Open circle indicates a positive residual and full circle indicates a negative residual.

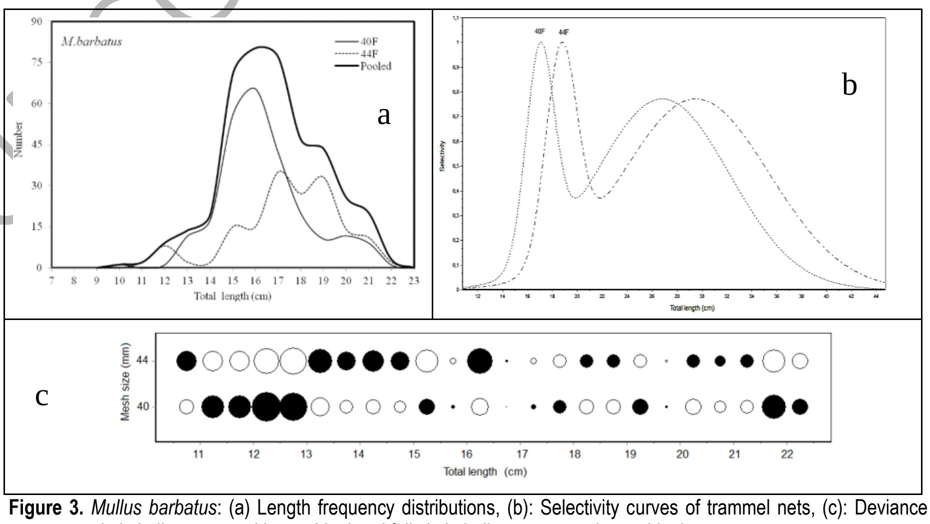

Figure 3. *Mullus barbatus*: (a) Length frequency distributions, (b): Selectivity curves of trammel nets, (c): Deviance residual plot. Open circle indicates a positive residual and full circle indicates a negative residual.

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Table 4. Selection parameters for *M. barbatus*, *P. erythrinus* and *P. acarne* estimated by the SELECT method (MD: Model deviance, df: degree of freedom).

		Equal fishing powers		Fishing power α mesh-size			
Species	**Model**	**Parametrelers**	**M.D.**	**Parametrelers**	**M.D.**	**df**	**p-value**
M. barbatus	Normal scale	(k_1, k_2) = (0.45167, 0.05509)	63.7	(k_1, k_2) = (0.37563, 0.03939)	63.6	22	0.0000
	Normal location	(k, σ) = (0.44910, 2.56953)	67.7	(k, σ) = (0.37289, 1.68820)	67.7	22	0.0000
	Gamma	(k, a) = (0.00835, 54.84526)	67.7	(k, a) = (0.00434, 87.99562)	67.7	22	0.0000
	Log normal	(μ_1, σ) = (2.91311, 0.14670)	70.8	(μ_1, σ) = (2.72531, 0.10958)	70.8	22	0.0000
	Bi-normal	(k_1,k_2,k_3,k_4,c) = (0.42321, 0.02845, 0.65042, 0.14232, 0.60070)	30.8	(k_1,k_2,k_3,k_4,c) = (0.34388, 0.01601, 0.41407, 0.04806, 2.07397)	30.7	19	0.0437
P. erythrinus	Normal scale	(k_1, k_2) = (0.38516, 0.04079)	33.2	(k, σ) = (0.38942, 0.04052)	33.2	13	0.0217
	Normal location	(k, σ) = (0.38221, 1.76846)	27.6	(k_1, k_2) = (0.38685, 1.77917)	27.6	13	0.0053
	Gamma	(k, a) = (0.00465, 83.33448)	27.5	(k, a) = (0.00465, 84.33448)	27.6	13	0.0217
	Log normal	(μ_1, σ) = (2.73880, 0.0.11772)	25.4	(μ_1, σ) = (2.75151, 0.11272)	25.3	13	0.0364
	Bi-normal	(k_1,k_2,k_3,k_4,c) = (0.34665, 0.01774, 0.43628, 0.05347, 2.49643)	10.0	(k_1,k_2,k_3,k_4,c) = (0.34759, 0.01774, 0.44277, 0.05296, 3.15928)	10.0	10	0.4558
P. acarne	Normal scale	(k_1, k_2) = (0.42557, 0.03477)	28.1	(k_1, k_2) = (0.42829, 0.03461)	28.1	16	0.0310
	Normal location	(k, σ) = (0.45209, 1.97370)	37.0	(k, σ) = (0.45698, 1.98434)	37.0	16	0.0021
	Gamma	(k, a) = (0.00490, 93.48117)	37.0	(k, a) = (0.00490, 94.48117)	37.0	16	0.0021
	Log normal	(μ_1, σ) = (2.97968, 0.0.12560)	41.2	(μ_1, σ) = (2.99545, 0.12560)	41.2	16	0.0005
	Bi-normal	(k_1,k_2,k_3,k_4,c) = (0.39579, 0.02151, 0.50278, 0.05848, 2.31129)	13.9	(k_1,k_2,k_3,k_4,c) = (0.39689, 0.02144, 0.50709, 0.05741, 2.87191)	13.9	13	0.3806

Table 5. Modal length and spread values for the best-fitting model of trammel net selectivity curves.

		40 mm mesh		44 mm mesh	
Species	**Model**	**Modal Length**	**Spread**	**Modal Length**	**Spread**
M.barbatus	Bi-normal	17.0	1.14	18.7	1.25
P. erythrinus	Bi-normal	13.9	0.71	15.3	0.78
P. acerna	Bi-normal	15.7	0.86	17.5	0.94

DISCUSSION

The fish caught methods (gilled, wedged, trammeled and pocketed) determine the length frequency distribution range and the optimum selectivity model (Erzini *et al.,* 2006). Uni-modal selectivity curves (normal scale, normal location, gamma and log normal) are useful for curves described as bell shaped curves and the length distribution range is narrower. Bi-modal curves are especially appropriate if the fish are caught by two or more methods, and the length distribution range is wider (Millar and Holst, 1997; Hovgard *et al.,* 1999). These trap mechanisms were reflected in the shapes of the size distributions (skewed to the right, bi-modal or multi-modal) and in the selectivity models that revealed the best fits. The smaller mode tends to correspond to the smaller types that are gilled or wedged while the larger mode is associated with the trammeling or pocketing of larger ones. (Erzini *et al.,* 2006).

In the present study, the SELECT method was used to estimate size selectivity of *P. erythrinus*, *P. acarne* and *M. barbatus* caught by trammel nets. Bi-normal model selectivity curves provided the best fit according to trammel net data comparison. The estimated modal lengths of three species compared with previous studies in the Mediterranean Sea are shown in Table 6. The differences between the optimum length may be due to the season, the characteristics of the nets, (stretching ratio, thickness, mesh size, etc.) and different selectivity methods. According to our results, shown in Table 6, it is the opinion of the authors , that size selectivity was clearly a function of the smaller mesh of the inner panels, with modal length generally increasing with inner panel mesh size for many species. Other authors also report that the catches and the size selectivity of trammel nets depend primarily on the mesh size of the inner net (Erzini *et al.,* 2006). In contrast, Stergiou et al. (2006) find that the outer panel mesh size does not significantly affect species' selectivity and catch rates.

Many studies with gill and trammel net selectivity trials (Dinçer and Bahar, 2008; Petrakis and Stergiou, 1995, 1996; Karakulak and Erk, 2008; Madsen *et al.,* 1999; Fujimori and Tokai, 2001; Dos Santos *et al.,* 2003; Erzini *et al.,* 2003; Hovgård, 1996; Erzini *et al.*, 2006; Park *et al.,* 2004; Sbrana *et al.,* 2007) reported that the bi-modal model was clearly the best selectivity model for many fish species according to the obtained data. However, other studies (Stergio and Erzini, 2002; Erzini *et al.,* 2003; Fonseka *et al.,* 2005; Karakulak and Erk, 2008) showed that normal scale, log-normal and gamma models were also useful for fish species.

A total of 35 species were caught, including 22 target species. When considering the number of target species and individual specimens caught by trammel nets with mesh sizes of 40 and 44 mm, there were 22 species and a total of 1672 specimens for the 40 mm mesh, 21 species and 625 specimens for the 44 mm mesh. Regarding the discarded species and individual specimens caught, there were 11 species and 133 specimens for the 40 mm mesh, 13 species and 153 specimens for the 44 mm mesh. The trammel net with a mesh size of 40 mm caught fewer discarded species and specimens, and more commercial species and specimens than the 44 mm mesh sizes. The value of CPUE (100 m/kg/day) of trammel nets according to the mesh sizes were 0.7 kg and 0.31 kg, for the 40 mm and 44 mm mesh size, respectively.

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Table 6. Results of the selection data obtained in the present study and in other studies carried out in the Mediterranean Seas and North-eastern Atlantic. (LF: Length frequency distribution, MS: Mesh size; UM: Used mesh)

Species	Area	LF (cm)	Selectivity method/ model	MS (mm)	Used mesh	Modal Length(cm)	Spread	Referans
M.barbatus	Aegean (Greece)	11-23	HOLT/normal	38	GN	15.4	1.05	Petrakis and Stergiou,1996
				42	GN	17.1		
				46	GN	18.8		
	Aegean (Turkey)	-	HOLT/normal	40	GN	14.4		Özekinci, 1997
				44	GN	15.0		
	Aegean (Greece)	12-30	SELECT/log-normal	44	GN	20.2	2.24	Stergio and Erzini, 2002
	Adriatik Sea	14-19	SECHİN model	45	GN	16.7		Fabi et al., 2002
	Aegean (Turkey)	6-19	Direkt method	44	GN	17.3		İlkyaz, 2005
	East Black Sea	11-20	SELECT/bi-normal	40	GN	17.8		Dinçer and Bahar, 2008
				44	GN	19.8		
	Antalya Bay	10-22	SELECT/normal scala	40	TN	17.0	1.14	This study
				44	TN	18.7	1.25	
P. erythrinus	Aegean (Greece)		HOLT/normal	46	GN	14.4 (FL)		Petrakis and Stergiou, 1996
	Aegean (Greece)		SELECT/bi-normal	40	TN	~11.0		Erzini et al.,2006
	Antalya Bay	11-19	SELECT/bi-normal	40	TN	13.9	0.71	This study
				44	TN	15.3	0.78	
P.acerna	Portugal	13-34	SELECT/normal scala	60	GN	23.1	2.73	Erzini et al., 2003
	Aegean (Greece)	10-23	HOLT/normal	42	GN	15.4	1.08	Petrakis and Stergiou, 1996
				46	GN	16.9		
		16-36	SELECT/bi-normal	60	GN	21.3	1.61	Petrakis and Stergiou, 1995
	Aegean (Turkey)	10-16	Direkt method	44	GN	13.7		İlkyaz, 2005
	Aegean (Turkey)	9-17	SELECT/bi-normal	40	GN	15.2	0.63	Karakulak and Erk, 2008
				44	GN	16.8	0.69	
		12-19	SELECT/bi-normal	40	TN	17.7	2.21	
				44	TN	19.5	2.21	
	Antalya Bay	8-18	SELECT/bi-normal	40	TN	15.7	0.86	This study
				44	TN	17.5	0.94	

When evaluating the length of captured specimens, by considering the Minimum Landing Sizes (MLS: 13 cm TL for M.barbatus; 15 cm TL for P. erythrinus) and first maturity size (14 cm TL for P.acarne), we can say that the estimated modal lengths of 40 mm and 44 mm trammel nets were bigger than the MLS of M. barbatus. But, at the specimens of P. acarne and P. erythrinus, the ratio of undersized fish captured by the 40 mm and 44 mm meshes were 65% - 55%, and 61% - 54%, respectively.

There have been few studies on the selectivity of trammel nets in European waters and there are only two previous studies on trammel net selectivity of the three species examined in the present study. Fabi *et al.* (2002), using the Sechin method for estimating selectivity, reported that the optimal catch size of *M. barbatus* was 16.7 cm, captured by trammel nets with a mesh size of 45 mm in Adriatic and Ligurian waters. In another study (Karakulak and Erk, 2008), using the SELECT model for estimating selectivity of 40 and 44 mm trammel nets, optimum lengths for *P. acarne* were 17.7 cm and 19.5 cm, respectively.

In Turkish fishery management, control over these gill net and trammel net fisheries is very limited. In order to make regulations for better management, the gill and trammel net fisheries should be strictly controlled (Karakulak and Erk, 2008). In the fishing activities of the Antalya Bay, 36, 40 and 44 mm mesh sized gill and trammel nets are used for targeting different species (red mullets, sea breams, blotched picarel, shrimp species, etc.) during the year. In Antalya Bay, it is very difficult to manage multi-species fisheries based only on mesh size and/or trammel adjustments, since the optimal mesh varies considerably according to the different target species.

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