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RESEARCH ARTICLE **ARAŞTIRMA MAKALESİ**

Length-weight relationship of cartilaginous fish species from Central Aegean Sea (Izmir Bay and Sığacık Bay)

Orta Ege Denizi'ndeki (İzmir Körfezi ve Sığacık Körfezi) kıkırdaklı balıkların boy-ağırlık ilişkisi

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Özet: Bu çalışmada Orta Ege Denizi'nden yakalanmış 30 kıkırdaklı balık türünün (11 köpekbalığı, 18 vatoz ve 1 Chimaera) 16'sının boy-ağırlık ilişkisi incelenmiş ve sunulmuştur. Örnekler bir araştırma gemisi ve bir ticari trol teknesi ile <500 m derinlikten 2008-2009 yılları arasında yakalanmıştır. Boy-ağırlık ilişkisi parametrelerinden b değeri 2.79 (*Torpedo marmorata*) ile 3.78 (*Scyliorhinus stellaris*), a değerleri 0.0002 (*Scyliorhinus stellaris*) ile 0.9713 (*Dasyatis pastinaca*).arasında değişmiştir. Bu çalışma doğu Akdeniz'de yapılmış çalışmalar arasında en yüksek tür sayısını elde etmiş ve incelemiştir.

Anahtar kelimeler: Boy-ağırlık ilişkisi, Kıkırdaklı balıklar, İzmir Körfezi, Sığacık Körfezi, Orta Ege Denizi.

Abstract: In this study, length–weight relationship parameters of 16 out of 30 caught cartilaginous fish species examined (11 Sharks, 18 Batoids and 1 Chimaera) from the Central Aegean Sea and presented. Samples were caught from depths of <500 m by research vessel and a commercial trawler, between 2008-2009. The values of the slope b in the length-weight relationship parameters ranged from 2.79 (*Torpedo marmorata*) to 3.78 (*Scyliorhinus stellaris*), a values from 0.0002 (*Scyliorhinus stellaris*) to 0.9713 (*Dasyatis pastinaca*). This study has optained and examined the most chondrichthyan species among the studies in the eastern Mediterranean.

Keywords: Length-weight relationship, Cartilaginous fishes, Izmir Bay, Sığacık Bay, Central Aegean Sea.

INTRODUCTION

Cartilaginous fishes (Chondrichthyes) in Turkish seas, corresponds to 75% of the chondrichthyes fauna in Mediterranean (Bradai *et al.* 2012) and 13% of the fish fauna of Turkey with 66 cartilaginous species and almost all (61 species) inhabits in the Aegean Sea (Bilecenoğlu *et al.,* 2014). Even though Aegean Sea has the most diverse cartilaginous fish fauna after Turkish waters of Mediterranean due its unique oceanographic (physical, biological and chemical) features, unfortunately there is not enough information concerning their ecological role in the trophic chain or their biology and the knowledge; ones we have are mostly on a few species due to their commercial value. Some species that occurs in the area have a commercial value as food resource (such as *Mustelus mustelus*, *Raja clavata*) and after being processed exported to other countries or lately fished as an aquarium species (such as *Sycliorhinus canicula* or *Myliobatis aquila*) but they are usually bycatch species and are utilized by fish meal factories as an ingredient.

There are relatively few but increasing studies on chondrichthyan species biology in the Turkish waters. The studies are mostly on their morhology (Filiz and Taşkavak, 2006), length-weight relationship (LWR) (Filiz and Mater, 2002; Yeldan and Avsar, 2007) and some on their diets (Yıgın and Işmen, 2010a; Eronat and Ozaydin, 2014) and reproduction biology (Saglam and Ak, 2012). The studies on their LWR main interest is mainly on bony species but there are few studies specifically on chondrichthyans (Filiz and Mater, 2002; Ismen *et al.* 2009; Yıgın and Ismen, 2008).

Length and weight data are a useful and standard result of fish sampling programs. These data are needed to estimate growth rates, length and age structures, and other components of fish population dynamics (Kolher *et al.,* 1995). It also allows fisheries scientists to convert growth-in-length equations to growth-in-weight for stock assessment models (Pauly, 1993).

The aim of the study is to determine the cartilaginous fish fauna of Central Aegean Sea and to estimate the length and weight parameters for further studies.

MATERIALS AND METHOD

The study areas (Izmir Bay and Sığacık Bay) are positioned in central Aegean Sea and have different ecological features due to their geographical positions, bathymetry and human pressure (Figure 1). Where most parts of Izmir Bay are banned for commercial trawlers, Sığacık Bay is one of the most densely trawled area of the Central Aegean Sea.

The trawl operations were completed between 2008-2009 in Izmir and Sığacık Bay, Central Aegean Sea. One research vessel and a commercial trawler were used during the survey. During the operations, a traditional bottom trawl gear (48 mm mesh size in codend) and cover net were used and hauls were limited with 30 minutes and speed was an average of 2.5 knot.

Specimens were identified according to Compagno *et al.* (2005) and Fricke *et al.* (2007). The length and weight parameters were measured for statistical analysis. Except for large ones, specimens were brought fresh to the laboratory; abundant ones were put in 30 lt barrels with a 4-8 % concentration of formaldehyde solution and preserved. In laboratory, sex determinations were made macroscopically from outside by the existence of claspers. Total length (TL) and Pre-Supra caudal length (PSCL) measurements were made with a measuring board with sensitivity of 1 mm, and for weight measurements, during trawl operations a scale with sensitivity of 1 g for very large specimens and those which were brought to the laboratory an electronic scale with a sensitivity of 0.01 were used.

LWR are of power type, i.e., $W=a L^b$. In this equation, where (*W*) is the total weight (*g*), (*L*) is the total length (cm), a is the coefficient of body shape, and it gets values around 0.1 for fishes which are small sized and with a rounded body shape, 0.01 for streamlined-shaped fishes and 0.001 for eel-like shaped fishes. In contrast, b is the coefficient balancing the dimensions of the equation and its values can be smaller, larger or equal to. In the first two cases (i.e., $b<3$ and $b>3$) fish growth is allometric (i.e., when $b<3$ the fish grows faster in length than in weight, and when $b>3$ the fish grows faster in weigth than in length), whereas when $b=3$ growth is isometric (Karachle and Stergiou, 2012).

LWR for species more than 5 individuals, mean lengths and weights, and size ranges were determined and for the species less than 5 individuals their LWRs were not taken into account due to insufficient data but length and weight measurements were given. LWR of species over 5 individuals, except only for *Chimaera monstrosa* where for (*L*) PSCL (cm) was used, for LWR parameters for (*L*) TL (cm) mesurements were used.

Specimens were divided to male, female and total (♀, ♂, and ∑) then; minimum, maximum and average lengths of females, males and total were calculated along with some descriptive statistical parameters and their growth types were identified and tested using Microsoft Office Excel and Statsoft Statistica 7.0 package programs.

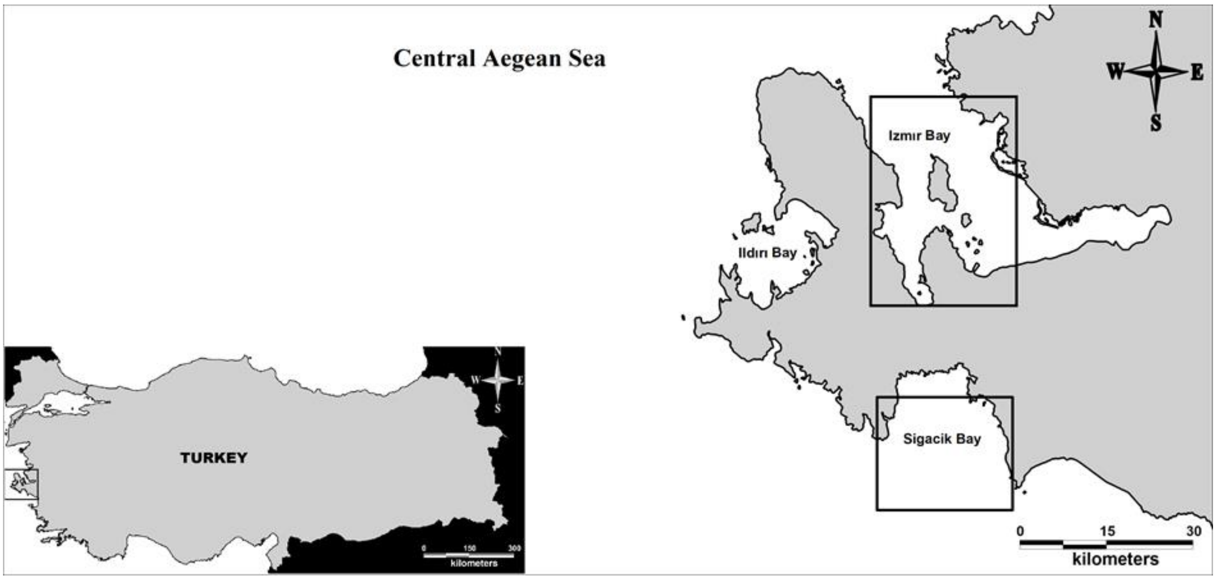

Figure 1. Map showing the study areas.

RESULTS

During the study from 2511 individual; 11 Shark species belonging to 3 Order, 8 Family; 18 Batoid species belonging to 2 Order, 5 Family and 1 Chimaera belonging to 1 Order, 1 Family were identified. In total 30 cartilaginous fish species from 6 Orders, 13 Family (from Sığacık Bay 15 species and from Izmir Bay 21 species) were captured.

One of the species (*Mustelus punctulatus*) LWR parameters were calculated and given in as a first for Turkish waters with the other 15 species in Table 1.

The rest of species, which were under 5 individuals, only their minimum and maximum of the length and weight are shown in Table 2.

Table 1. Length and weight relationships descriptive statistics and parameters of 16 cartilaginous fish species in the central Aegean Sea.

Species	Mesurment	Sex	n	Length Characteristics (cm)			Weight Characteristics (g)			Parameters of the Relationship				Growth Type
				Min	Max	Mean ± SE	Min	Max	Mean ± SE	a	B	R^2	SE (b)	
		♂	130	8,9	37,2	14.18±0.344	1,13	162,42	10.69±1.747	0,0019	3,15	0,952	0,062	(+) Allometry
Galeus melastomus	TL*	♀	105	9,2	45	14.57±0.466	1,94	278,77	13.32±3.281	0,0019	3,14	0,949	0,072	(+) Allometry
		∑	235	8,9	45	14.35±0.282	1,13	278,77	11.86±1.754	0,0019	3,14	0,95	0,047	(+) Allometry
		♂	590	7,8	51,2	20.23±0.492	0,31	458	57.37±4.402	0,0012	3,25	0,973	0,022	(+) Allometry
Scyliorhinus canicula	TL*	♀	620	7,8	50,9	20.18±0.478	0,63	461,66	59.67±4.391	0,0011	3,27	0,983	0,017	(+) Allometry
		∑	1210	7,8	51,2	20.21±0.343	0,31	461,66	58.55±3.108	0,0012	3,26	0,978	0,014	(+) Allometry
		♂	14	25,8	69,7	50.42±3.05	60,13	1685,6	609.99±136.07	0,0006	3,46	0,968	0,182	(+) Allometry
Scyliorhinus stellaris	TL*	♀	5	41,6	46,6	44.56±0.83	265,84	423,26	325.13±29.81	0,0002	3,78	0,658	1,573	Isometric
		∑	19	25,8	69,7	48.88±2.31	60,13	1685,6	535.03±103.83	0,0006	3,46	0,964	0,161	(+) Allometry
		♂	28	41,8	91,5	72.08±2.81	121,8	2690	1301.43±139.15	0,0006	3,39	0,981	0,093	(+) Allometry
Mustelus mustelus	TL*	♀	13	42	113,3	72.74±6.50	190	4780	1732.76±431.54	0,0017	3,16	0,971	0,164	Isometric
		∑	41	41,8	113,3	72.29±2.77	121,8	4780	1438.19±166.28	0,001	3,27	0,971	0,091	(+) Allometry
		♂	5	70,9	89,3	82.64±3.34	1104	2244	1738.14±212.15	0,0026	3,03	0,954	0,383	Isometric
Mustelus punctulatus	TL*	♀	1	-	-	55	-	-	451,91	-	-	-	-	-
		∑	6	55	89,3	78.03±5.35	451,91	2244	1523.77±275.60	0,0012	3,21	0,991	0,157	Isometric
		♂	62	8,9	26,4	16.73±0.591	2,71	81,01	25.78±2.713	0,0031	3,12	0,981	0,056	(+) Allometry
Etmopterus spinax	TL*	♀	67	8,6	31,7	17.52±0.645	2,2	150,81	30.08±3.434	0,0039	3,04	0,978	0,056	Isometric
		∑	129	8,6	31,7	17.14±0.439	2,2	150,81	28.01±2.209	0,0035	3,08	0,98	0,04	(+) Allometry
		♂	149	17,8	60	27.22±0.867	16	881,18	127.78±15.641	0,0049	2,95	0,963	0,048	Isometric
Squalus blainvillei	TL*	♀	159	16,2	70,5	26.15±0.878	5,18	1587,37	133.91±20.516	0,0046	2,98	0,94	0,06	Isometric
		∑	308	16,2	70,5	26.67±0.617	5,18	1587,37	130.94±12.997	0,0048	2,96	0,95	0,039	Isometric
		♂	48	10	27,9	16.10±0.68	24,57	413,29	104.54±13.77	0,0365	2,79	0,985	0,051	(-) Allometry
Torpedo marmorata	TL*	♀	59	9,6	39,3	18.92±1.075	7,98	1310,42	235.36±43.444	0,0188	3,02	0,985	0,102	Isometric
		∑	107	9,6	39,3	17.66±0.677	7,98	1310,42	176.68±25.44	0,023	2,96	0,939	0,066	Isometric
		♂	4	19	46,5	31,38	14,78	285,04	118,5	0,0038	-	-	-	-
Dipturus oxyrinchus	TL*	♀	4	18,1	44,5	29,9	15,37	227,11	103,68	0,0039	-	-	-	-
		∑	8	18,1	46,5	30.64±4.286	14,78	285,04	111.09±37.816	0,0309	3,13	0,995	0,093	Isometric
		♂	8	9,7	22,3	12.7±1.52	19,41	218	58.09±24.15	0,0276	2,9	0,992	0,109	Isometric
Torpedo nobiliana	TL*	♀	2	11,9	13,6	12,75	35,13	47,99	41,56	-	-	-	-	-
		∑	10	9,7	22,3	12.71±1.206	19,41	218	54.79±19.201	0,0284	2,89	0,989	0,108	Isometric
		♂	9	18,5	33	26.11±1.755	20,1	143,15	70.4±14.788	0,0008	3,46	0,992	0,116	(+) Allometry
Raja asterias	TL*	♀	8	19	41,5	30.84±2.289	19,28	311,5	124.82±30.558	0,0006	3,52	0,996	0,067	(+) Allometry
		∑	17	18,5	41,5	28.34±1.497	19,28	311,5	96.01±17.212	0,0007	3,47	0,994	0,097	(+) Allometry
		♂	59	12,7	60,5	28.26±1.357	5,97	1200	140.2±26.443	0,0007	3,5	0,974	0,044	(+) Allometry
Raja clavata	TL*	♀	78	12,6	70,2	30.19±1.319	6,01	2160	192.83±38.396	0,0007	3,48	0,991	0,079	(+) Allometry
		∑	137	12,6	70,2	29.4±0.951	5,97	2160	170.16±24.671	0,0006	3,52	0,963	0,049	(+) Allometry
		♂	6	41,5	57,4	51.9±2.439	418,58	1160	891.43±118.897	0,0035	3,14	0,959	0,335	Isometric
Raja radula	TL*	♀	10	43,2	61,2	54.03±1.696	480	1604	1115.41±107.263	0,0018	3,33	0,946	0,281	Isometric
		∑	16	41,5	61,2	53.23±1.376	418,58	1604	1031.42±82.858	0,0017	3,33	0,94	0,226	Isometric
		♂	4	29,3	33	30.7±0.871	118,56	170,11	140.2±11.063	-	-	-	-	-
Rostroraja alba	TL*	♀	6	25,1	124	51.92±15.238	74	15000	2804.29±2444.288	0,0014	3,35	0,997	0,087	(+) Allometry
		∑	10	25,1	124	43.43±9.46	74	15000	1738.65±1476.751	0,0016	3,32	0,997	0,063	(+) Allometry
		♂	36	36,5	80	57.01±1.806	295,14	4000	1438.13±147.36	0,0021	3,29	0,954	0,124	(+) Allometry
Dasyatis pastinaca	TL*	♀	42	33,4	138	64.77±3.519	191,38	21100	3309.24±713.501	0,9713	3,51	0,971	0,095	(+) Allometry
		∑	78	33,4	138	61.19±2.104	191,38	21100	2445.65±402.264	0,0011	3,46	0,968	0,072	(+) Allometry
		♂	14	41,1	87,5	60.09±4.47	67,65	2260	897.32±205.793	0,0009	3,29	0,776	0,51	Isometric
Myliobatis aquila	TL*	♀	40	43,5	179,5	96.27±5.656	168,6	15800	4783±715.256	0,0004	3,5	0,963	0,111	(+) Allometry
		∑	54	41,1	179,5	86.89±4.843	67,65	15800	3775.6±579.877	0,0005	3,42	0,946	0,114	(+) Allometry
		♂	40	7,8	43,3	14.73±1.195	4,9	557,6	53.56±18.413	0,0108	2,89	0,969	0,084	Isometric
Chimaera monstrosa	PSCL**	♀	57	8,2	45,5	14.69±1.154	4,79	1038,2	79.77±28.388	0,0062	3,11	0,984	0,053	(+) Allometry
		∑	97	7,8	45,5	14.71±0.834	4,79	1038,2	68.96±18.297	0,0076	3,03	0,978	0,047	Isometric

* TL: Total Lenght **PSCL: Pre-Supra Caudal Lenght

Table 2. Length and weight measurements of 14 cartilaginous fish species, which were less than 5 individuals.

Species	Sex	n	Length Characteristics (cm)		Weight Characteristics (g)	
			Min	Max	Min	Max
Heptranchias perlo	♀	1	99.6		4382	
Galeorhinus galeus	♀	1	99.8		3340	
Mustelus punctulatus	♂	5	70.9	89.3	7.47	1104
	♀	1	55		451.91	
	∑	6	55	89.3	13.12	451.91
Oxynotus centrina	♂	1	56.3		1180.84	
	♀	1	61.5		2845.36	
Dalatias licha	♂	2	39	54.7	284.62	786.39
	♀	3	32.1	36.6	151.68	195.69
	∑	5	32.1	54.7	151.68	786.39
Dipturus batis	♂	1	47		880.26	
	♀	1	56.1		3125.75	
Leucoraja fullonica	♂	2	9.3	34.6	24.98	144.75
	♀	1	28		74.95	
	∑	3	9.3	34.6	24.98	144.75
Leucoraja naevus	♂	2	51.2	58	791.14	985.42
	♀	1	62		1497.32	
	∑	3	51.2	62	791.14	1497.32
Raja miraletus	♂	1	21.2		129.03	
	♀	1	31.8		141.13	
Raja montagui	♀	1	46.6		593.65	
Raja polystigma	♂	2	53.9	55.5	902.59	979.41
Dasyatis tortonesei	♀	1	41.7		385.3	
Gymnura altavela	♀	4	33	43.8	949.44	2005.32
Pteromylaeus bovinus	♀	2	73	106	720.84	2364.68

The most abundant species were *Scyliorhinus canicula* (n=1210), *Squalus blainvillei* (n=308), *Galeus melastomus* (n=235). In total the TL ranged from 7.8 (*Scyliorhinus canicula*) to 179.5 cm (*Myliobatis aquila*). The values of the slope b ranged from 2.791 (*Torpedo marmorata*) to 3.778 (*Scyliorhinus stellaris*). The a values ranged from 0.0002 (*Scyliorhinus stellaris*) to 0.226 (*Raja radula*).

Growth type according to b values of both sexes was identified as (+) allometry for 3 shark, 4 batoid, while 1 shark and 2 batoid was identified as isometric. Additionally, growth type difference was observed between sexes of 3 sharks, 4 batoid and 1 chimaera species. But when these differences were tested with ANCOVA it resulted as there were no growth type difference between sexes of *Torpedo marmorata, Dasyatis pastinaca* (2 Batoid) and *Chimaera monstrosa.*

DISCUSSION

The other studies conducted in study areas (Izmir Bay and Sığacık Bay) mostly focus on bony fish of the areas but few have given some information on cartilaginous fish species. This study was compared with six studies from northern Aegean, three studies from central Aegean, four studies from Mediterranean and one from Black Sea and one from the Sea of Marmara. The LWR estimations and growth types for some of the other studies are given in Table 3.

Table 3. Length (L)–weight (W) relationships comparison with the studies from Turkish seas. *B: Black Sea; CA: Central Aegean; NA: Northern Aegean; M: Marmara; MED: Mediterranean. GT: growth type, + A: positive allometry, I: isometric, - A: negative allometry.

Species	n	W-L	GT	Authors	Study Areas*	Present Work n	Present Work W-L	Present Work GT
Raja clavata	29	$W=0.0016L^{3.29}$	+ A	Filiz and Mater 2002	NA-CA	137	$W=0.0007L^{3.50}$	+ A
	37	$W=0.0016L^{3.30}$		Filiz and Bilge 2004	CA			
	32	$W=0.0322L^{2.60}$	I	Yarmaz 2009	NA			
	112	$W=0.0132L^{3.12}$		Ismen *et. al.* 2007	NA			
	226	$W=0.00163L^{3.32}$		Yigin and Ismen 2008	NA			
	77	$W=0.0037L^{3.08}$		Yeldan and Avşar 2007	MED			
	75	$W=0.023L^{2.64}$		Basusta *et. al.* 2012	MED			
	792	$W=0.0018L^{3.26}$	+ A	Saygu 2011	MED			
	27	$W=0.0019L^{3.24}$	+ A	Demirhan and Can 2007	B			
Raja radula	23	$W=0.0029L^{3.21}$	I	Yarmaz 2009	NA	16	$W=0.0017L^{3.33}$	I
	25	$W=0.0030L^{3.21}$		Karakulak *et. al.* 2006	NA			
	49	$W=0.01131L^{3.25}$		Ismen *et. al.* 2007	NA			
	204	$W=0.00205L^{3.32}$		Yigin and Ismen 2008	NA			
	295	$W=0.00121L^{3.36}$		Yeldan and Avşar 2007	MED			
	62	$W=0.0174L^{3.07}$	+ A	Saygu 2011	MED			
Rostroraja alba	11	$W=0.009L^{3.49}$		Ozaydın *et al.* 2007	CA	10	$W=0.0016L^{3.32}$	+ A
	43	$W=0.00662L^{3.20}$		Ismen *et. al.* 2007	NA			
	126	$W=0.00194L^{3.27}$		Yigin and Ismen 2008	NA			
Scyliorhinus canicula	110	$W=0.0016L^{3.18}$	+ A	Filiz and Mater, 2002	NA-CA	1210	$W=0.0012L^{3.26}$	+ A
	637	$W=0.0012L^{3.26}$		Filiz and Bilge 2004	CA			
	187	$W=0.0006L^{3.44}$		Ozaydin *et al.* 2007	CA			
	1501	$W=0.00169L^{3.17}$		Ismen *et. al.* 2007	NA			
	1888	$W=0.0017L^{3.17}$		Ismen *et. al.* 2009	NA			
	108	$W=8E-06L^{2.88}$	I	Yarmaz 2009	NA			
	189	$W=0.004L^{2.87}$		Demirel and Dalkara 2012	M			
Scyliorhinus stellaris	12	$W=0.0009L^{3.37}$		Ismen *et. al.* 2009	NA	19	$W=0.0006L^{3.46}$	+ A
Squalus blainvillei	299	$W=0.00345L^{3.06}$		Ismen *et. al.* 2007	NA	308	$W=0.0048L^{2.96}$	I
	27	$W=0.0030L^{3.07}$		Ismen *et. al.* 2009	NA			
	22	$W=0.0139L^{3.10}$		Karakulak *et. al.* 2006	NA			
	20	$W=0.05920L^{2.64}$		Ismen *et. al.* 2007	NA			
Torpedo marmorata	20	$W=0.0488L^{2.69}$	- A	Filiz and Mater 2002	NA-CA	107	$W=0.023L^{2.95}$	I
	37	$W=0.0273L^{2.91}$		Filiz and Bilge 2004	CA			
	12	$W=0.0535L^{2.39}$		Ozaydin *et al.* 2007	CA			
	9	$W = 0.1297L^{2.47}$	I	Yarmaz 2009	NA			
	22	$W=0.0139L^{3.10}$		Karakulak *et. al.* 2006	NA			
	20	$W=0.05920L^{2.64}$		Ismen *et. al.* 2007	NA			
Torpedo nobiliana	92	$W= 0.015L^{3.06}$		Basusta *et. al.* 2012	MED	10	$W=0.028L^{2.89}$	I

The differences between LWR estimations of the other studies may caused by, especially for different regions, to ecological differences of the sampling areas. Also may be the result of lack or abundance of food, specimens age, reproductive stage (immature, maturing or mature), season of the sampling, differences between sampling depth and also to the fishing gears selectivity such as longlines could only sample specimens over some size when trawl can sample more diversely sized samples. On the subject of growth type there were difference with the result of this study and with Bilge *et al.* (2010), Demirhan and Can (2007), Filiz and Mater (2002), Ismen (2003), Saygu (2011) and Yarmaz (2009) studies which were conducted in Central Aegean Sea, Black Sea, North and Central Aegean Sea, Mediterranean Sea, Mediterranean Sea and North Aegean Sea, respectively. In general there were difference between sampling methodology (fishing gear and sampling season) but the differences can be the result of some other reasons listed in previous sentences.

In general, the results were similar to previous studies in other countries but there were few differences may have caused by insufficient number of species. A study from western Mediterranean by Merella *et al.* (1997) estimated *Scyliorhinus canicula* (n=262), *Squalus blainvillei* (n=27), *Raja asterias* (n=11) and *Raja clavata* (n=18) species (a) values were 0.0016, 0.0012, 0.0018 and 0.0024, and (b) values were 3.16, 3.37, 3.27 and 3.20, respectively. The results in this study were close (*Scyliorhinus canicula* n=1210 $W=0.0012L^{3.26}$, *Squalus blainvillei* n=308 $W=0.0048L^{2.96}$, *Raja asterias* n=17 $W=0.0007L^{3.48}$ and *Raja clavata* n=187 $W=0.0005L^{3.61}$). When comparing with a study from southern Portugal by Santos *et al.* (2002); estimated parameters (a) and (b) for species *Galeus melastomus* and *Scyliorhinus canicula* as 0.0022 and 3.056, 0.0017 and 3.180, respectively which were close to the findings of *Galeus melastomus* (0.0019 and 3.14) and *Scyliorhinus canicula* (0.0012 and 3.26) species from this study. Another study from eastern-central Atlantic estimated parameter (a) for species *Galeus melastomus* (n=98) as 0.00145 and for *Mustelus mustelus* (n=14) as 0.00162 and parameter (b) for *Galeus melastomus* as 3.161 and for *Mustelus mustelus* as 3.178 (Ferreira *et al.* 2008). Ferreira *et al.* (2008) also estimated the species parameter (a) by setting (b) to 3 because of insufficient number of *Rostroraja alba* (2 specimens) as 0.00638. When compared with this study the findings were also close but differed as a result of more sufficient sampling in this study (*Galeus melastomus* n=235, a=0.0019 and b=3.14; *Mustelus mustelus* n=41, a=0.001 and b=3.27; *Rostroraja alba* n=10, a=0.0016 and b=3.32).

In conclusion; this study obtained and examined the most chondrichthyan species (11 Sharks, 18 Batoids and 1 Chimaera) among the studies in the eastern Mediterranean and estimated LWR for 16 species. This study will be a valuable resource for future studies on the subject and for the study areas.

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