

**Preliminary study on the little tunny (*Euthynnus alletteratus*, Rafinesque, 1810),
caught by common purse seine fisheries in the north-eastern
Mediterranean coast of Turkey**

M. Zengin¹, F. S. Karakulak²

¹Central Fisheries Research Institute, Trabzon, Turkey

²Istanbul University, Faculty of Fisheries, Ordu Cad. No:200, 34470 Laleli-Istanbul, Turkey

Abstract

This research was conducted on some fishing and population parameters of little tunny (*Euthynnus alletteratus*) caught by common purse seines in the northeastern Mediterranean (Iskenderun Bay) during the pelagic fishing season of 1998-1999. According to the findings; catch per unit effort for these species caught by sardine purse seines between October-May was estimated to be 0.2 kg/HP/day. During the fishing season, the highest value of catch amount per month was estimated as 19.0 kg/HP/month for spring (April) and 4.6 kg/HP/month for autumn (November). The fishing effort in the study area generally characterized by coastal fisheries and in terms of landed catch the medium and large scale fishing fleet is not profitable. The length distribution of the population was found to be monomodal in the autumn and bimodal in the spring. A year class group in autumn (October-November) was found approximately 35-40 cm TL. A year class group in the spring (March-April-May) dominated with young population of 35-40 cm and mature population of 60-65 cm TL. According to the equation of length-weight relationship for total individuals, *a*-value, *b*-value and R^2 were estimated 0.0323, 2.7457 and 0.9382 respectively.

Introduction

The north-eastern Mediterranean coast of Turkey (Iskenderun Bay) is one of the major fishing grounds of Turkey. Due to its topography, this area differs greatly from the entire Mediterranean basin. The continental shelf is rather wide as sediment is transported and accumulated by the rivers. The majority of the fishing areas are located along the continental shelf, and depth ranges are between 40 and 130 m (Bingel, 1987). The eastern Mediterranean as a whole is known to be nutrient poor; productivity has increased in the deltas, on grounds on the wide continental shelf and in eddy areas (Bingel, 1987). The main rivers which are discharged into this area are Göksu, Lamas, Tarsus, Seyhan and Ceyhan. Fishing activities have also been concentrated in the discharges of these rivers. Biomass levels are strongly correlated with nutrient input (Kosswig, 1953). Kosswig (1953) also noted that this region is very productive where among the small pelagic, sardines were the main fish species. Rich species composition and the presence of fish species which migrate from the Red Sea (Ilessepsian) have encouraged fishing activities other than artisanal fishing (Bingel, 1987).

Besides the commercial demersal/benthic species, small and large pelagic fishes in the fishing ground of north-eastern Mediterranean Sea are found. Sardine species (*Sardinella aurita* and *Sardinella maderensis*) are the most important target species

which are mostly caught in purse seine fisheries. In this ground, in addition to bluefin tuna (*Thunnus thynnus*) population (Karakulak, 2004), bullet tuna (*Auxis rochei*), bonito (*Sarda sarda*), little tunny (*Euthynnus alletteratus*), albacore (*Thunnus alalunga*), chub mackerel (*Scomber japonicus*) and Atlantic mackerel (*Scomber scombrus*) populations are distributed respectively (Fisher *et al.*, 1987; Golani *et al.*, 2006). The official catch statistics belonging to small tunas, except for bonito, chub mackerel and Atlantic mackerel, caught from Mediterranean coast of Turkey; have been recorded under the national register since second half of 1990's (1996). In this group, the catch statistics of bullet tuna, little tunny and albacore have been recorded since 2004 (Figure 1) (TUIK, 1998; 1999).

In Turkish waters (Aegean and Mediterranean), the total catch amount of little tunny is obtained in this region. (Kahraman, 2005). Due to the official statistics, the landed catch is ranging approximately from 500 to 1200 t. No comprehensive research on population and catch characteristics of the species in Turkish waters is existent. In the two different studies carried out by Kahraman and Oray (2001) and Kahraman (2005); some basic population parameters (such as age, length-weight relationship) for this species were determined in Turkish waters. For the entire eastern Mediterranean Sea, the investigations on bio-ecologic and fishing parameters of the species are limited.

This study aimed to provide some information on population characteristics, landed catch and catch parameters of little tunny (*Euthynnus alletteratus*) which is an important species in the north-eastern Mediterranean fishing ground since the end of 1990's.

Materials and Methods

Field surveys were conducted off Iskenderun, Mersin, Karatas, Yumurtalik and Samandag coasts from September 1st, 1998 to May 15th, 1999 on a monthly interval (Fig. 2). Purse seining vessels were carefully monitored and followed after each operation. Fish and catch data were directly obtained from the fishing vessels carrying out pelagic fisheries in the region (Sparre *et al.*, 1989). The quantity landed and other data related to the fishing operations were recorded using the “*Fish Market Sampling Questionnaire*” Vessels were classified into three categories based on their overall length: small (10-19 m), medium (20-29 m) and large (30-41 m). The samples were obtained from six vessels (two in each category), and catch data on the pelagics were taken from six vessels, cross-checking both vessel forms and market records. The total catch was separated by species, boxed and weighed. Bigger species such as little tunny and bluefish were placed into boxes in two rows with 14 fish in each. Quantities of less than one box were weighed separately and recorded. Qualifications of these reference vessels are given in Table 1. All equipment used during the fishing operations was recorded. General characteristics and information on the fishing carried out in this region, such as the number of fishing days, was obtained by personal communications with fishermen, skippers, wholesalers and retailers.

Catch per unit effort (CPUE) data was derived and used as an index for fishing performance, as vessel engine power (HP) which was used as an effort criterion. This was calculated by; Phiri and Shirakihara (1999). $CPUE = (\Sigma C / \Sigma PSV) / (\Sigma f / \Sigma PV)$ where

CPUE is the fishing index for month; C is the catch of the all vessels sampled (kg); f is the fishing effort (HP); PV is the number of purse seine vessels in the fleet.

The length-weight relationship was estimated according to exponential regression equation suggested by Ricker (1975) ($\log W = \log a + b * \log TL$). In the equation; W: total body weight (weighted to the nearest 0.01g), TL: total length (cm), *a* and *b* parameters are the regressions calculated by least squares fitting method.

Results

1. Characteristics of the pelagic vessel

36 fishing vessels were registered in the main fishing port in Iskenderun in the fishing season of 1998-1999. Fleet overall lengths varied between 10 and 44 m (average 19.3 m). Engine powers ranged from 16 to 1500 HP (average 501 HP). In addition, there were encircling nets and gill-nets which use small boats up to 10 m. The mean length and depth of the purse seine nets of the 36 vessels were 718 m (432-1512 m) and 104 m (72-153 m).

2. Composition of the landings

According to the findings; including little tunny, 12 different species of pelagic fishes were caught by purse seines during the fishing period (Table 2). In addition to these pelagic species, not directly targeted, 16 benthic, demersal and bentopelagic species were caught as by catch (Table 2). The number of fish species in the catch was high, the catch being extremely low (2.5%). Sardine (*Sardine sp*) is the most abundant species in the total commercial catch composition with the catch range of 85.5%, followed by little tunny (4.4%), chub mackerel (3.7%), grey mullets (2.8%), bogue (1.0%), horse mackerel (0.8%) and bluefish (0.7%).

3. Catch and effort parameters

The daily catch per unit effort data, fishing parameters and fishing intensity of the pelagic species are shown in Table 3. Vessels in the 10-19 m length category (mean 12.2 m) had the highest fishing intensities, followed by the 20-29 m (23.9 m) and 30-44 m (35.3 m) length groups. These length groups had CPUE values of 0.6 kg/HP/day, 0.2 kg/HP/day and 0.2 kg/HP/day, respectively. The small length group caught significantly more fish per unit engine power than the other vessel sizes. On the other hand; daily catch of the large vessels were found to be significantly higher than small and medium vessels ($p < 0.05$) (Table 3, Fig. 2).

Although little tunny were caught in all the months during the fishing season, the highest productivity was observed in April (19.0 kg/HP/month). November and May was the second productive months at 4.6 and 4.4 kg/HP/month respectively (Fig. 3). Monthly catch curve had a decreasing trend in the winter time, and the lowest CPUE was realized between December (0.3 kg/HP/month) and March (1.9 kg/HP/month).

4. Population parameters

Length composition: The monthly length distribution of little tunny is lower in autumn (October-November) than that in spring (March, April, May) (Figure 4). The mean length distribution was estimated to be 39.8 ± 1.04 (33.2-58.5) cm for the autumn and 46.7 ± 2.91 (32.0-84.5) cm for the spring.

Length-weight relationship: According to the equation of length-weight relationship for total individuals (N:116), a -value, b -value and R^2 were estimated 0.0323, 2.7457 and 0.9382 respectively (Fig. 5).

Discussion

Little tunny and other high migratory species (*Auxis rochei*, *Thunnus alalunga*, *Thunnus thynnus*, *Scomber japonicus*, *Xiphias gladius* etc.) are generally caught by purse seines in the sardine fishery in the North-Eastern Mediterranean Coast of Turkey.

In the fishing season of 1998-1999, the pelagic fishing effort throughout north-eastern Mediterranean coast of Turkey is generally characterized by coastal fisheries. The purse seine vessels length distribution ranged between 10-44 m (average 19 m) and the engine power ranging between 16-500 HP (average 501 HP). Fishing is mostly carried out at the depth ranges from 50 to 100 m. It was found that this ground was in terms of the purse seine fishery of 16 different benthic, demersal and semi-demersal species caught as by catch. The vessels operating with purse seines destroy the benthic and demersal habitats. Fishing with purse seines is allowed down to 18 m waters depths (Anonymous, 2006). According to the achieved results, the catch of fish with purse seines of 70 m and 140 m length should be restricted in waters near the shore. The catch should be restricted at a minimum depth of 50 m. especially in the spring months; big quantities are caught by purse seines near the shores. Fish as (*Spratus auratus*, *Dipladus annularus*, *Mullus surmelatus vb*) and other aquatic organisms (such as *Loliginadae sp*, *Sepia sp*, *Penaidae sp*) are caught.

The highest value of catch per unit effort was calculated for the small vessel groups. While the estimated catch amount for the small vessels was 205 t. 179 and 98 t for the other groups respectively. In terms of the landed catch, the medium and large scale fishing fleets carrying out the little tunny fishery in the coastal waters of north-eastern Mediterranean was not profitable.

When considering the seasonal length composition of the landed catch, it was observed that the catch in the spring was lower than the catch in autumn. (Fig. 3). This seasonal difference in CPUE is to a large extent may be attributed to the bio-ecological characteristics of the species. Meanwhile, this opinion is supported by the fact that large fish are caught mostly in spring north eastern Mediterranean Sea (Levantine Sea) is a spawning area for Scombridae (Karakulak *et al.*, 2004; Oray *et al.*, 2005). *Euthynnus alletteratus* spawns between May and September in the Mediterranean Sea (Valerias and Abad, 2006; Froese and Pauly, 2008; Kahraman *et al.*, 2008). The abundance of individuals of 55 cm and 55 cm > in spring is related to the spawning migration in this season (Fig. 4). The length distribution of the population was found to be monomodal and bimodal in autumn and spring respectively. A year class group in autumn (October-November) was found approximately to be 35-40 cm in the spring (March-April-May) dominated a young population of 35-40 cm and mature population of 60-65 cm (Fig. 4).

Comparing the length-weight relationship parameters for *Euthynnus alletteratus* with the results of the conducted research on the same area and different regions of

Mediterranean, almost similar results were found (Table 4). This may be attributed to the population growth characteristics which are characteristic for Mediterranean Sea.

They are caught by without any selectivity with a net of mesh size of 12 mm, where fishing pressure occurs on the little tunny populations. The length at first maturity (fork length) for male and female individuals of *Euthynnus alletteratus* was 57 and 56 cm in the western Mediterranean Sea, respectively (Rodriguez-Roda, 1966). In Turkish waters, it was determined that the sexually maturity length of this species was always over 60 cm FL (Kahraman et al., 2008). When considering the length at first maturity for this fishery, it is observed that the majority of the little tunny caught in fishing season of 1998-1999 was below the mentioned length group (Fig. 4).

The minimum length restriction for little tunny caught in the Turkish coasts is 45 cm during the fishing season 2006-2008 (Anonymous, 2006). The period that the study was conducted the minimum catch length restriction was 30 cm in 1998-1999 (Anonymous, 1998). In this period, according to the minimum catch size, the first catch length restriction is not realistic at all (Fig. 4). With regard to the year class length and spawning period, a catch restriction of the little tunny fishery in the eastern Mediterranean Sea from the beginning of the early spring (the end of March) is needed. On the other hand, the minimum catch length of 45 cm for Turkish waters is not realistic (Kahraman and Oray, 2001). In order to avoid the catch of 35-40 cm individuals distributed in autumn and spring, an appropriate fishing gear instead of the sardine purse seines should be used. The minimum sizes of this species in other Mediterranean countries is 30 cm (Albania, EC Italy), 40 cm (Algeria) and 45 cm (Turkey). In order to have a sustainable fishing, all the countries bordering the Mediterranean Sea should respect the common fishing rules.

The catch statistics of little tunny have been recorded since 2000's in Turkey (TUIK, 2004). The reported catch per year was approximately higher than 500 t. The majority of the catch was obtained from north-eastern Mediterranean coast. The catch amount of Iskenderun Bay estimated in this research confirmed the official catch statistics (508 ton) (Fig. 1, Tab. 3). The basic little tunny fisheries management criteria are inadequate as well as the fishing methods. A new monitoring and control system based on real data which implements realistic measures is urgently needed. Regarding the little tunny and other small tunas, all the Mediterranean countries should work together.

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Table 1. Vessel characteristics of the purse seines monitored in the research (*L: Large, M: Medium, S: Small*).

Name of the vessel	Overall length m	Engine power (HP)	Net properties			
			Type	Length (m)	Depth (m)	Mesh (mm)
Ceyhan Balıkçılık	36 (L)	844	Sardines	1512	144	12
Yusufogulları	31 (L)	800	Sardines	1512	144	12
Topcu Kardesler	27 (M)	1000	Sardines	864	144	12
Mehmet Ege	23 (M)	750	Sardines	864	117	12
Yılmaz Tuleyli	13,5 (S)	165	Sardines	576	90	12
Hüseyinogulları	13 (S)	128	Sardines	504	72	12

Table 2. Catch distribution of commercial fish species caught by purse seines in Iskenderun Bay. (*P: Pelagic, SP: Semi pelagic, D: Demersal*).

Species name	Scientific names	Habitat type	Sampling of landings (kg)	Catches %
Sardines	<i>Sardina sp</i>	<i>P</i>	309164.0	85.5
Little tunny	<i>Euthynnus alletteratus</i>	<i>P</i>	15876.0	4.4
Chup mackerel	<i>Scomber japonicus</i>	<i>P</i>	14198.0	3.7
Grey mullets	<i>Mugil sp</i>	<i>SP</i>	10099.0	2.8
Bogue	<i>Boops boops</i>	<i>D</i>	3792.5	1.0
Horse mackerel	<i>Trachurus sp.</i>	<i>P</i>	2939.5	0.8
Blue fish	<i>Pomatomus saltator</i>	<i>P</i>	2391.5	0.7
Saury	<i>Saurida undosquanis</i>	<i>D</i>	1107.5	0.5
Sea bream	<i>Spratus auratus</i>	<i>SP</i>	314.8	0.09
Annular bream	<i>Dipladus annularus</i>	<i>SP</i>	288.5	0.08
Blue fin tuna	<i>Thunnus thynnus</i>	<i>P</i>	283.0	0.08
Corb	<i>Umbrino cirrhose</i>	<i>SP</i>	279.5	0.08
Picaral	<i>Spicare flexuosa</i>	<i>SP</i>	207.0	0.06
Angel shark	<i>Squantina oculata</i>	<i>D</i>	175.0	0.05
Leer fish	<i>Lichia amia</i>	<i>SP</i>	146.2	0.04
Pompano	<i>Trachinotus ovatus</i>	<i>SP</i>	135.5	0.04
Squid	<i>Loliginadae sp</i>	<i>B</i>	133.5	0.04
Striped red	<i>Mullus surmelatus</i>	<i>D</i>	90.0	0.02
Striped seabream	<i>Lithognathus marmyrus</i>	<i>B</i>	71.0	0.02
Shark	<i>Mustelus mustelus</i>	<i>SP</i>	41.5	0.01
Sword fish	<i>Xiplias gladius</i>	<i>P</i>	24.0	0.007
Red mullet	<i>Mullus barbatus</i>	<i>D</i>	21.5	0.006
Cuttle fish	<i>Sepia sp</i>	<i>D</i>	19.0	0.005
Prawn	<i>Penaidae sp</i>	<i>D</i>	17.5	0.005
Gar fish	<i>Belona belona</i>	<i>P</i>	14.9	0.004
Tripletail	<i>Lobotes surinamensis</i>	<i>D</i>	10.7	0.003
Sand smelt	<i>Atherinidae</i>	<i>SP</i>	5.0	0.001
Waker	<i>Epinephelus aeneus</i>	<i>D</i>	2.5	0.0007

Table 3. Fishing effort and other parameters of the little tunny by purse seines in the Iskenderun Bay in fishing season of 1998/99 (f: engine power (HP), C: mean catch (kg/day), SE: standard error, CPUE: catch per unit effort (kg/HP/day), N: number of the fishing boats, n: number of the vessel samples), *T_C: total landing fish (kg))

Vessel Categories (m)	Fishing (HP) (f)	Effort	Number of the vessel survey (n)	Mean catches (kg/day) ±SE (C)	CPUE (kg/HP/day)	Total estimated landings of the fleet (kg) (T _C)
Small (10-19)	167.2 (N=18)	(16-320)	32	92.2±47.2 (2-1200)	0.6	205790.4
Medium (20-29)	540.1 (N=14)	(250-1000)	109	103.0±28.6 (6-1546)	0.2	178808.0
Large (30-44)	886.0 (N=4)	(400-1500)	22	198.8±58.7 (120-1560)	0.2	98604.8
General	531.1 (N=36)	(16-1500)	163	113.8±25.0 (2-1596)	0.2	508003.2

**It is assumed that the actual fishing season lasted 124 days in the research area in 1998/99.*

Table 4. Different little tunny length-weight relationships published (*FL*: fork length, *TL*: total length).

Equation	N	Length range (cm)	Sex	Area	Reference
$W=0.0000575FL^{2.697}$	145	55-85	All	Aegean Sea	Kahraman and Oray, 2001
$W=0.0000476FL^{2.725}$	1454	52-97	All	Eastern Mediterranean	Kahraman and Oray, 2001
$W=0.044098FL^{2.7549}$	217	56-86	All	Western Mediterranean	Macías et al, 2006
$W=0.0001FL^{2.4683}$	63	58-83	All	Eastern Mediterranean	Kahraman, 2005
$W=0.00002FL^{2.9563}$	41	64-63	All	Eastern Mediterranean	Kahraman, 2005
$W=0.00002218FL^{2.9149}$	325	40-90	All	Western Mediterranean	Rodríguez-Roda, 1966
$W=0.0323TL^{2.7457}$	116	32-85	All	Eastern Mediterranean	This study

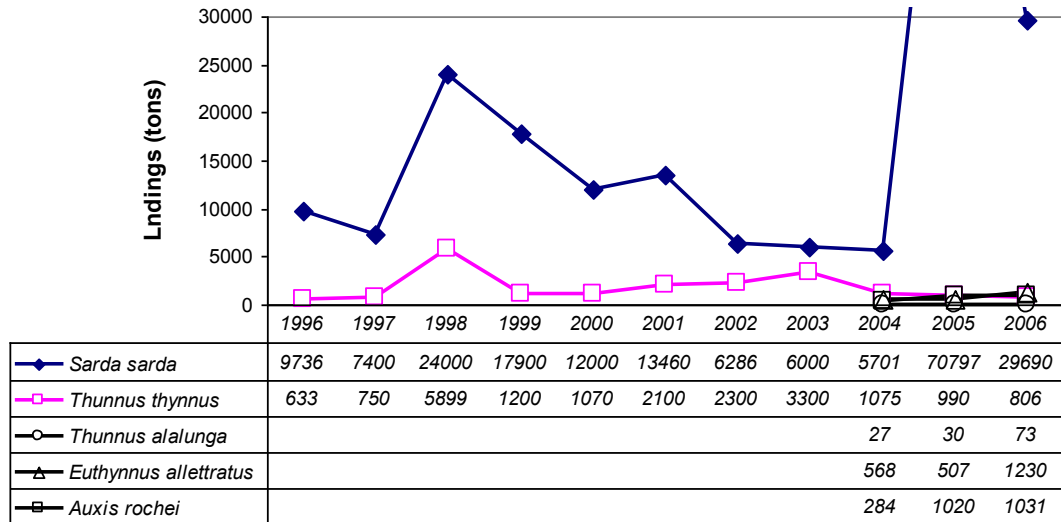


Figure 1. The catch statistics of small and large tunas belonging to 1996-2004 in Turkey.



Deep (m) 0-50 50-200 200-2000

Figure 2. Study area (Microsoft-Encarta, 1999).

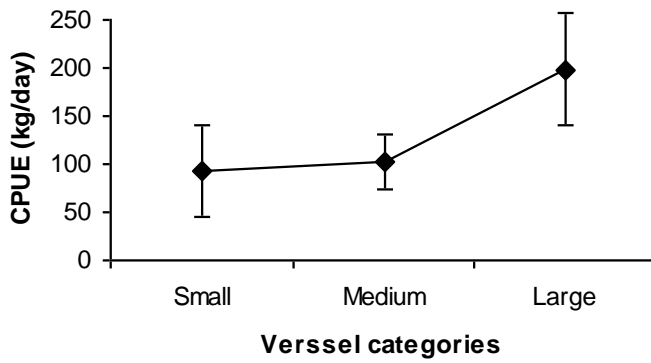


Figure 2. Distribution of the little tunny catch in vessel categories in Iskenderun Bay, during the fishing season of 1998/99 (*mean daily catch and standard error*).

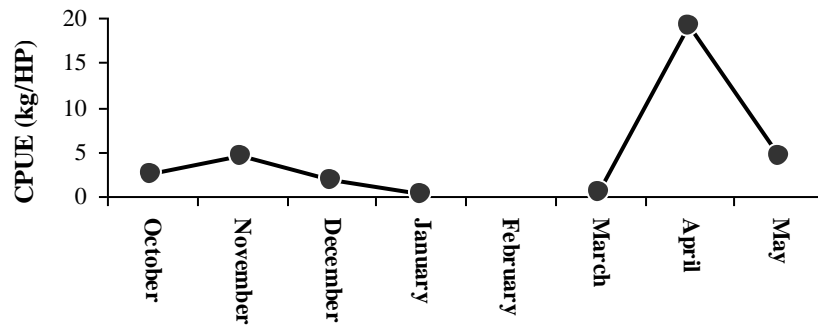


Figure 3. Variations in CPUE of the little tunny on monthly changes in the Iskenderun Bay in fishing season of 1998/99.

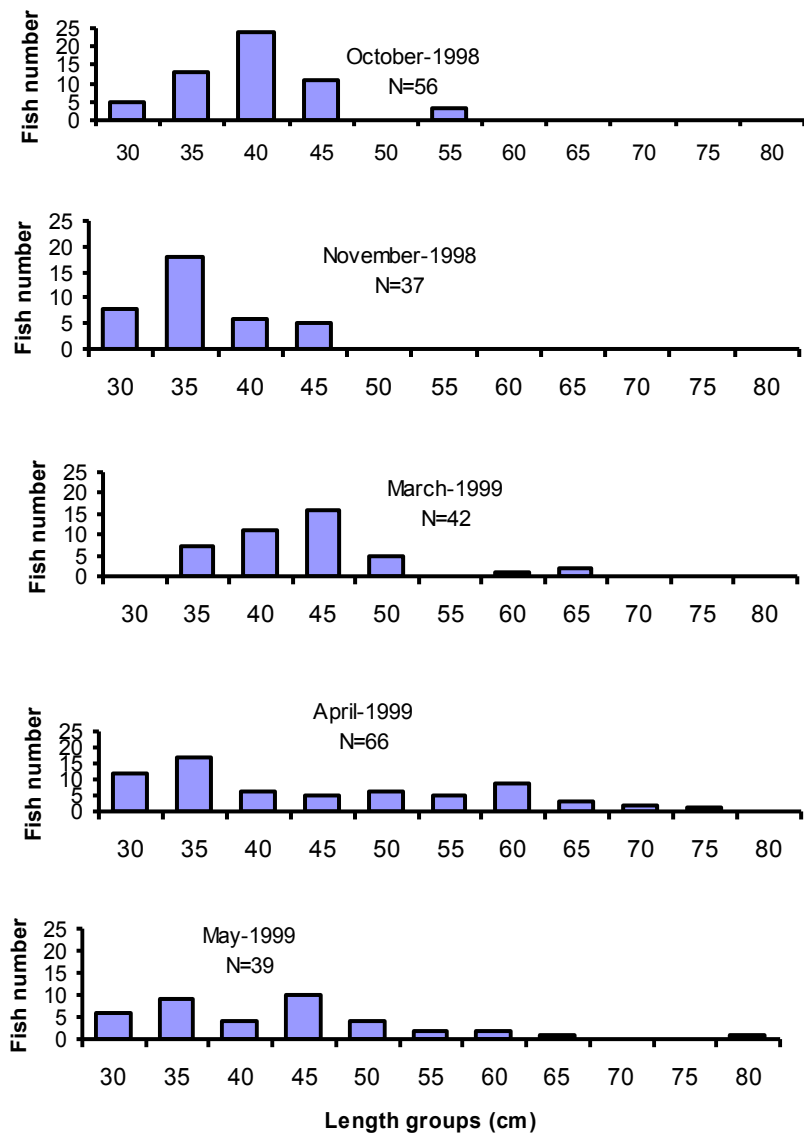


Figure 4. Monthly catch distribution of little tunny population caught by purse seines in north-eastern Mediterranean coast during the fishing season of 1998-1999.

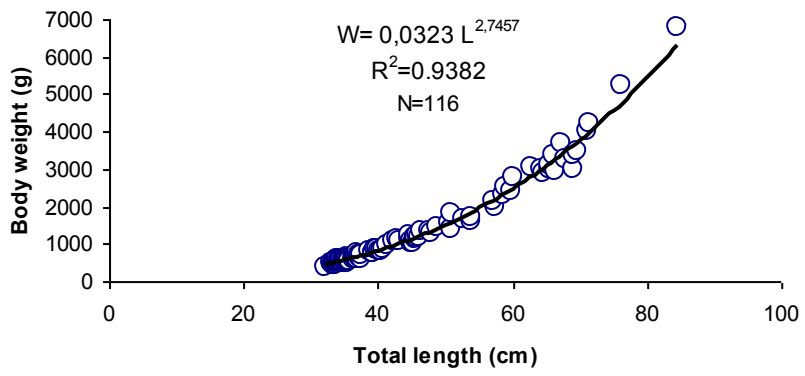


Figure 5. The length-weight relationship for little tunny population