Longline Fishery And Length-Weight Relationships For Selected Fish Species In Gökova Bay (Aegean Sea, Turkey)

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Abstract:

This study reports to the investigations on longline fishery in two main fishing ports, Akyaka and Akçapınar in Gökova Bay (Aegean Sea) between September 2002 and August 2003. A total of 50 fishermen, registered with Akyaka and Akçapınar fishery cooperatives are fished in Gökova Bay. Numbers of 49 fishing boats are 6-9 meters in length and 9-32 hp in engine power. The fish species caught from longline fishery were typical of those that inhabit coastal embayments in the Mediterranean. *Epinephelus aeneus, Epinephelus costae, Pagellus erythrinus, Sparus aurata,* and *Saurida undosquamis* dominated the commercial catch. A total of 25 fish species were identified. CPUE in biomass of fish in Gökova Bay was found as 8.43±1.02 kg.day^{-1}. The Length-weight relationship parameters of 8 demersal fish species (belonging to 3 families) are presented. The *b* values were between 2.736 and 3.109 with mean *b* equal to 2.960 (95% CI=2.743-3.177).

Key words: Longline, Catch composition, Length-weigth relationship, Gökova Bay, Aegean Sea.

INTRODUCTION

Gökova Bay, total area of 52000 hectares, is located in the connection zone of Aegean Sea and the Mediterranean and has been declareted as "private environment protection zone-PEPZ" since 1989. It is one of the eight marine protected areas in Turkey. There is no stream entrance to the bay, however, because the land is karstic, rain water goes through the rocks and provides rich mineral input in coastal parts of the region. This rich mineral input from the sea bottom increases the biological productivity. In the bay, existence of deep water zones and dispersion of Lessepsian species increase the species diversity [1].

Until now, there have been only a few oceanographic studies in Gökova Bay. Cihangir *et al.* [1] investigated on the physical marine water characteristics, demersal trawl fishery and many other hydro-biological properties in the Gökova and its surroundings. Cirik *et al.* [2] determined and listed the seaweeds and marine phanerogams at 0-70 m depths of the bay. Like *Caulerpa taxifolia*, which is the cause of ecological disaster in the Mediterranean, *C. racemosa*'s rapid growth has been determined in Gökova Bay. Öğretmen *et al.* [3] reported that a total of 144 fish species belong to 62 families from Gökova Bay.

This study aims to characterize the longline fishery, which is the most important fishing method in the bay, for the first time, as to catch effort, catch composition, and to present the length-weight relationships of some selected fish species from longlining.

MATERIAL AND METHODS

This study carried out in the two main fishing ports, Akyaka and Akçapınar, in Gökova Bay (Figure 1) with monthly sampling between September 2002 and August 2003.

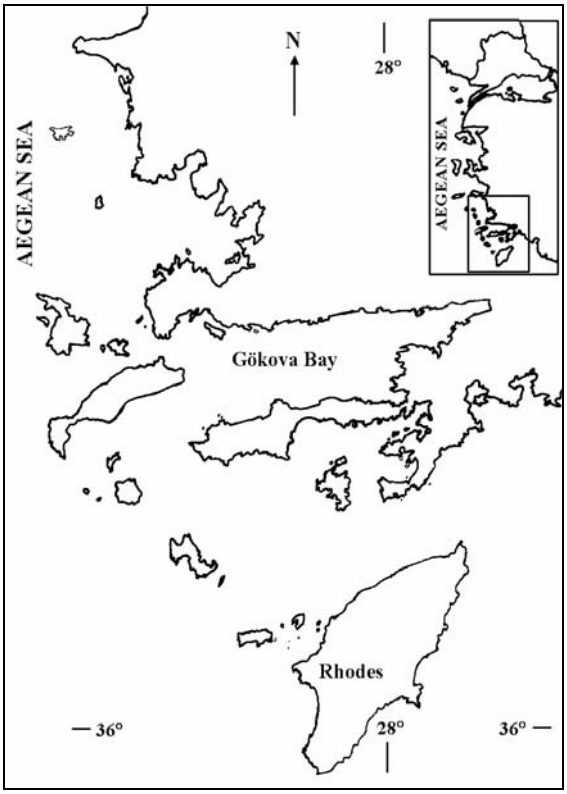

Figure 1. Study area

Operations have been carried out with 43 longliners, catch volume and species have been recorded along with sampling areas, vessel lengths, engine powers, material of vessels. Information has been obtained by questionnaires. Total lengths (TL) of fishes have been measured to nearest ± 0.1 cm and weights to ± 0.1 g. The length-weight relationship (LWR) parameters of eight demersal fish species were estimated through logarithmic transformation, log W= log *a* + *b* log L with *a* and *b* determined via least-squares regression.

In the calculation of catch per unit effort (CPUE), according to De Metrio and Megalafonou [4] equation, f = (a'/1000) x *g* and CPUE = kg/f, have been used. In this equation, (a'/1000) shows unit of effort for 1000 hooks, which are deployed daily and *g* is the working days.

RESULTS

All vessels were made up of wooden material with total lengths (LOA) varying from 6.6 to 9 m and engine powers from 9 to 32 hp. Overall, the average of motor engine power was 13.6 ± 2.3 hp (Table 1).

Table 1. Distribution of vessels by length and engine power in the Gökova Bay (s.e., standard error; hp, horse power).

		Vessel Length (m)		Engine Power (hp)			
Fishing port	Number of boats	6-7	8-9	Min.	Max.	Mean ± s.e.	Total
Akyaka	24	13	11	9	32	12.3±1.3	296.0
Akçapınar	25	7	18	9	28	14.7±1.2	368.5
Total	49	20	29	9	32	13.6±2.3	664.5

In the fishing ports, only 19 of 49 vessels (38.8%) have used longline while 24 vessels (49%) have used both longline and set nets. Vessels used longline and set nets alternatively in their operations the whole year. Generally nets were used mainly February, March, April and May and longline in June, July, August and September. Usually three baskets of bottom longlines have been found in the vessels and these have been operated from sunset to the sunrise. From 100 to 1300 hooked longlines were used with body diameters of 0.60 to 1.5 mm and arm diameters from 0.30 to 0.90 mm. Hook numbers have varied from 7 to 15, related to the target catch. In longlines, flattened tinned hooks (Ref:2315 DT coded) have been used.

A total of 25 fish species have been identified in longline fishery in Gökova Bay (Table 2). Per total weight, *E. aeneus* with 41.4% has been the most dominant species from longlining, followed by *Pagellus erythrinus* and *Sparus aurata* with percentages of 15.8% and 12.1%, respectively. Total ratio of the groupers was 47.6% from 44 landings. Length and weight averages of some species, collected in Gökova Bay by longline are given in Table 3.

Table 2. Landed species and their weight proportion by longline sampling in Gökova Bay (N, number; W, weight).

Species	N	W (g)	W %
Boops boops (Linnaeus, 1758)	5	509	0.20
Conger conger (Linnaeus, 1758)	1	100	0.04
Coryphaena hippurus Linnaeus, 1758	4	2687	1.05
Dentex gibbosus (Rafinesque, 1810)	1	9800	3.81
Dentex maroccanus Valenciennes, 1830	3	299	0.12
Dicentrarchus labrax (Linnaeus, 1758)	2	1067	0.42
Diplodus annularis (Linnaeus, 1758)	124	8267	3.22
Diplodus sargus (Linnaeus, 1758)	6	1042	0.41
Diplodus vulgaris (Geoffroy Saint-Hilaire, 1817)	68	10263	4.00
Epinephelus aeneus (Geoffroy Saint-Hilaire, 1817)	187	106167	41.39
Epinephelus costae (Steindachner, 1878)	44	14951	5.82
Epinephelus guaza (Linnaeus, 1758)	2	1016	0.40
Lithognathus mormyrus (Linnaeus, 1758)	30	5216	2.03
Merluccius merluccius (Linnaeus, 1758)	10	3474	1.35
Oblada melanura (Linnaeus, 1758)	7	1803	0.70
Pagellus erythrinus (Linnaeus, 1758)	104	40538	15.80
Puntazzo puntazzo (Cetti, 1777)	1	131	0.05
Saurida undosquamis (Richardson, 1848)	108	13945	5.43
Scorpaena porcus Linnaeus, 1758	1	400	0.16
Seriola dumerili (Risso, 1810)	2	982	0.38
Serranus cabrilla (Linnaeus, 1758)	10	368	0.14
Sparus aurata Linnaeus, 1758	161	31087	12.11
Sparus pagrus Linnaeus, 1758	12	1600	0.62
Trigla lucerna Linnaeus, 1758	4	727	0.28
Umbrina cirrosa (Linnaeus, 1758)	1	325	0.13
Total	*1198*	*256464*	*100*

Table 3. Total length and weight averages and standart errors of some species caught by longline in Gökova Bay (N, number; s.e., standard error).

		TL (cm)			Total Weight (g)		
Species	N	Min.	Max.	Mean ± s.e.	Min.	Max.	Mean ± s.e.
P. erythrinus	322	14.4	41.0	19.1±0.17	35.0	713.0	93.5±3.22
L. mormyrus	29	16.0	25.6	20.4±0.46	47.0	159.8	35.3±6.54
E. aeneus	121	18.6	71.0	31.2±0.58	71.7	3746.0	375.8±35.91
S. aurata	120	14.5	32.6	23.6±0.41	47.7	543.5	197.2±9.40
D. annularis	157	9.5	19.0	14.8±0.19	15.8	105.1	60.5±2.00
D. vulgaris	54	9.6	26.5	18.8±0.63	14.2	286.0	124.0±9.84
S. undosquamis	80	19.6	33.1	26.1±0.36	48.0	237.0	121.9±5.11
E. costae	59	14.6	45.0	26.7±0.74	37.3	822.0	236.5±20.20

The landings were estimated between 0.65 and 11.13 kg.day^{-1} for 44 operations, randomly chosen and the mean CPUE has been calculated as 8.43 ± 1.02 kg.day^{-1} (range: 1.3 – 36.9) for longline fishery in Gökova Bay.

The parameters *a* and *b* of the LWR use for eight species collected from Gökova Bay are given in Table 4. The *b* values varied from 2.736 (*E. costae*) to 3.109 (*Saurida undosquamis*) with mean *b* equal to 2.960 (95% CI=2.743-3.177). All regressions were highly significant (*t*-test, $P<0.001$).

Table 4. Length-weight relationship parameters and related statistics for 8 fish species in Gökova Bay (N, number; s.e., standard error; s.d., standard deviation).

		Length Characteristics (cm)				Parameters of LWR			
Family/Species	N	Min	Max	Mean	s.d.	*a*	*b*	s.e.(*b*)	R^2
Sparidae									
D. annularis	159	9.5	19.0	14.8	2.4	0.0179	2.985	0.041	0.971
D. vulgaris	69	9.6	26.5	19.2	4.3	0.0145	3.034	0.041	0.988
L. mormyrus	36	16.0	27.8	21.0	2.7	0.0098	3.043	0.117	0.952
P. erythrinus	365	12.0	30.0	18.9	2.8	0.0176	2.885	0.038	0.942
S. aurata	141	14.5	32.6	23.7	4.2	0.0122	3.034	0.047	0.967
Serranidae									
E. aeneus	125	18.6	56.6	30.9	5.4	0.0178	2.855	0.064	0.942
E. costae	59	14.6	45.0	26.7	5.7	0.0266	2.736	0.068	0.966
Synodontidae									
S. undosquamis	80	19.6	33.1	26.1	3.2	0.0046	3.109	0.080	0.951

DISCUSSION

Gökova Bay is qualified and effective fishing area with its rich biological diversity and a reasonable number of fishermen, for as long as this area is kept away from some inputs such as pollution and large-scale fishing activities. Cihangir *et al*. [1] described that the absence of stream entering the bay is an advantage because of pollution but at the same time it is a disadvantage for marine productivity.

In this study, the top five species from longline fishery are white grouper, *E. aeneus*; common pandora, *P. erythrinus*, gilt-head sea bream, *Sparus aurata*; goldblotch grouper, *E. costae* and brushtooth lizardfish, *S. undosquamis*. White grouper is the most important species for the region. However, probably due to fishing pressure on *Epinephelus* spp., a reduction in length for this species has been found. The average lengths of white grouper and goldblotch grouper were 31.2 ± 0.58 cm (range: 18.6 – 71 cm) and 26.7 ± 0.74 cm (range: 14.6 – 45 cm), respectively. The "Circular of Regulations in Commercial Fishery at Sea and Inland Waters" published by the Turkish Republic Ministry of Agriculture – General Directorate of Protection and Control [5] forbids the catching of white groupers which are smaller than 30 cm. However, it has been observed that 50.4% of white groupers caught were undersized and other species lengths were generally included in their legal sizes. Throughout the sampling period, there has been only two dusky groupers (*Epinephelus marginatus*) caught and length reductions of white groupers have been observed. Also trammel nets for common dentex, *Dentex dentex* have been used to catch pink dentex, *Dentex gibbosus* in rocky habitats by surrounding these areas with the nets. Often, these nets can not be taken back and thus prevent the use of these habitats by groupers or pink dentex. The effect of these lost nets, *i.e.* ghost nets, on the habitats is an important topic to be researched. This may partly explain the situation why dusky groupers are rarely seen in the region.

The *b* values varied between 2.736 (*E. costae*) and 3.109 (*S. undosquamis*) with all regressions highly significant (*t*-test, $P<0.001$). These values are different within the limits reported by Can *et al.* [6] from Iskenderun Bay for five fish species (*S. undosquamis, E. aeneus, E. costae, D. vulgaris* and *S. aurata*). Dulcic and Kraljevic [7] stated that various factors may be responsible for the differences in parameters of LWRs among seasons and years, such as temperature, salinity, food (quantity, quality and size), sex, time of year and stage of maturity.

In Gökova Bay, CPUE has been determined and the average has been found to be 8.43 ± 1.02 kg.day^{-1} (range: 1.3 – 36.9). In some vessels, daily catch may not reach to 2 kg. Moreover, some fishermen declared that they could not go fishing because of bad weather conditions for much of the year and that on some days they came back without fish. Many fishermen have been making 3-4 days trips in order to catch more fish. Low CPUE values can be explained with low stock abundance of target species.

For sustainable longline fishery in Gökova Bay, suitable landing size and exact fishing period of target species have to determine and some reserve areas should be separated for to improve grouper stocks.

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