

Current fishery status of ribbonfish *Trichiurus lepturus* Linnaeus, 1758) (Trichiuridae) from Makran coast (northeast Arabian Sea)

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Introduction

Ribbonfishes are typical inmates of pelagic waters of the world oceans and it is a cosmopolitan species (Parin, 1968., 1988; Nakamura and Parin, 1993). It is a slim, commercially important marine species of Pakistan. Ribbonfish are spread in the Indo-Pacific and Atlantic areas as well as throughout the Indian coast with plenty in the northwest and central east coasts (Nair and Prakasan, 2003). They belong to the family Trichiuridae and are represented in Pakistani waters by two species namely, *Trichiurus lepturus*, and *Lepturacanthus savala*. These species are found all over the year but

the abundant species in Pakistan is *T. lepturus* (Bianchi, 1985).

The important Trichiuridae fishes were caught with bag nets, seine nets and with trawlers (Bianchi, 1985). Ribbonfish were not the basic target of interest of Pakistani fishermen in the past, and were consumed locally in fresh condition or practiced as attractive baits for catching larger fishes. Ribbonfish were mostly exported in sundried or salt cured condition to countries like Sri Lanka and Malaysia. In the last ten years, ribbonfish have been able to slowly reach the status of one of the dominant marine resources

of Pakistan. The landings of ribbonfish varied between 31623 tons in 1999 and 20375 tons in 2009 (MFD, 2012). Now chilled ribbonfish are exported to more than 30 countries globally including China, Singapore, Republic of Korea, and Japan. It is rated seventh in order of fame among the abused fish group (James *et al.*, 1986). The most suitable season for rearing of the species was during December and May (Rizvi and Nautiyal, 2002). They live in groups and are pelagic and wandering fishes. During the maturing period, they shift places from the coastal areas to deeper areas (Lazarus *et al.*, 1992).

T. lepturus was landed in large quantities at many landing sites in Sindh and Balochistan. The reports on the length-weight relationship and landing data from the Sindh coast are available (MFD., 2012; Tabassum *et al.*, 2013), but the length-weight data and landing statistics from the Makran coast, Balochistan is not available in documented form. Thus, the aim of this study was to analyze the length-weight relationship and to collect and document the landing data of *T. lepturus* from the major fish harbors of Makran coast.

Material and methods

The data for the length-weight relationship (LWR) were collected for a period of eight months from October 2015 to May 2016 from the landing sites and commercial trawlers operating in the coastal waters of Balochistan coast. The total length (TL) was

calculated from tip of the snout to the tip of the caudal fin. Total weight (TW) of the specimen was recorded on the electronic balance in nearest gram. The TL and TW of *T. lepturus* ranged from 33-131.4 cm and 50-2000 g, respectively.

The Length-weight relationship (LWR) was estimated by using the equation $W = aL^b$ (Ricker, 1973, 1975). The data were log transformed and least square method was applied which gave a regression equation $\log W = \log a + b \times \log L$. where 'W' is the body weight of the fish, 'L' is the total length, 'a' is the intercept of the regression curve and 'b' is the regression coefficient.

The data for the estimation of landing and total earnings were collected from Marine Fisheries Department, Sindh (MFD, 2012) and Directorate of Fisheries, Balochistan.

Results and discussion

LWR analysis of Trichiurus lepturus

LWR parameters are important in determining the fish health. The minimum and maximum values of length and weight of 519 individuals of *T. Lepturus* was given in Table 1. The total length ranged from 33 - 129.5 cm with 60-2000 g in weight. The length-weight relationship data shows negative allometric growth of fish except for the month of December when the fish show positive allometric growth ($b=3.407$). The lowest value of b was obtained from the month of April ($b=2.064$). The significant correlation was observed between LWR parameters ($p < 0.05$).

Table 1: LWR parameters of *Trichiurus lepturus*: length parameters (Min=minimum length in cm; Max= maximum length in cm); weight parameters ((Min=minimum weight in g; Max=maximum weight in g; mean and standard deviation); parameters of the LWR (N=number of specimens sampled, a=intercept, b=slope and r=Pearson correlation), and type of growth [allometric (positive or negative)].

Months	Length (cm)		Weight (g)		N	LWR parameters			Growth type
	Min - Max	Mean (\pm SD)	Min- Max	Mean (\pm SD)		a	b	r	
October	45.97-129.54	82.4 (25.203)	90-2000	615.7 (542.99)	47	-2.906	2.912	0.984	Allometric -
November	33 - 127	71.8 (24.80)	60 - 2000	432.9 (500.45)	66	-1.87	2.346	0.819	Allometric -
December	55 - 116	82.9 (16.08)	90 - 1300	495.4 (359.94)	70	-3.932	3.407	0.878	Allometric +
January	54.3 - 114	78.7 (17.70)	100-1400	497.4 (354.49)	74	-2.408	2.667	0.78	Allometric -
February	50 - 109	71.2 (11.46)	100 - 1200	311.8 (202.08)	52	-1.94	2.38	0.821	Allometric -
March	41.1 - 123.5	77.7 (22.48)	90 - 1400	533.1 (495.8)	52	-2.684	2.777	0.956	Allometric -
April	41 - 117.5	70.5 (17.03)	90 - 1200	321.9 (250.8)	73	-1.36	2.064	0.732	Allometric -
May	40.5 - 123.5	72.5 (19.09)	90 - 1800	409.9 (390.2)	85	-2.347	2.6	0.907	Allometric -

The total logarithmic length-weight relationship is shown in Fig. 1 which also indicates the negative allometric growth trend in *T. lepturus* ($b=2.366$). The majority of the individuals fall in the 60-69.9 cm class (Fig. 2). The LWR data of the present study are compared with earlier reports in Table 2.

The obtained values of LWR parameters are in the same range as reported from other parts of the world. However, the length-weight data indicate that present estimates of fish length were higher in size as compared to the earlier reported data from Pakistan. However, our data are comparable with the reports from the surrounding region. (Tabassum *et al.*, 2013) reported the size range of 35-65 cm from Pakistani waters. (Chkravarty *et al.*, 2012) reported the size range of 13.5-36 cm and 30-850 g in weight which is comparatively a smaller size. The differences in the size of fish might be due to the difference in the collection methods.

Fishery statistics of T. lepturus

Fig. 3 shows that the total landing of ribbonfish has been reduced from 31,623 metric tons in 1999 to 20375 metric tons in 2009. The lowest landing was recorded in 2001 when only 16352 metric tons ribbonfish were landed in Pakistan. The fisheries of ribbonfish showed declining trends from 1999 to 2009 in the Sindh coast, while that for ribbonfish increased in the Makran coast during the same period.

Table 3 shows ribbonfish landings only from Pasni at Makran coast from January 2015 to December 2015. A total of 310.98 metric tons of ribbonfish were landed during this period which is equivalent to USD 497386.1207. The highest landings were recorded from October to December (47.554 - 51.441 metric tons), and lowest during March to June (6.247 - 1.015 metric tons). The lowest catch was recorded in the months of January and February (14.93 and 17.1 metric tons, respectively).

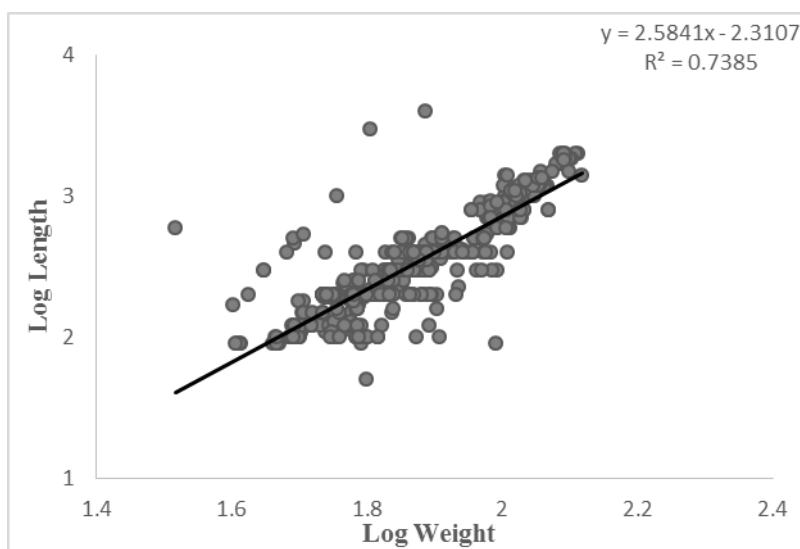


Figure 1: Relationship between total length and weight in *Trichiurus lepturus* from October 2015 to May 2016.

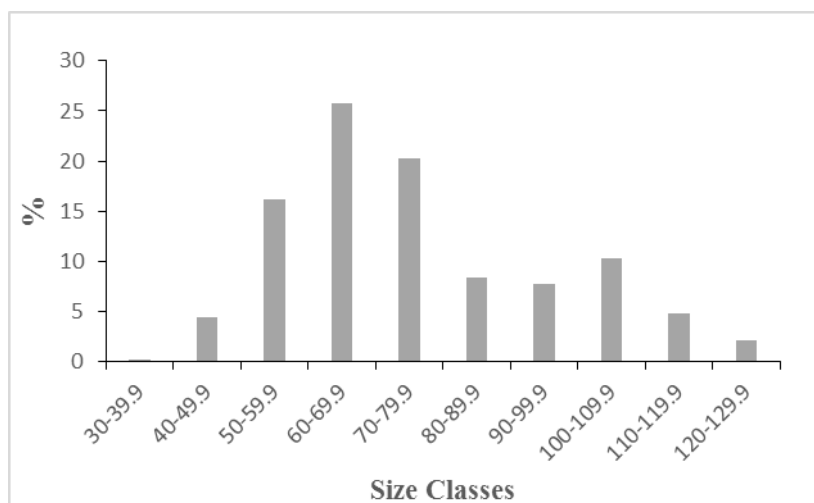


Figure 2: Distribution of *Trichiurus lepturus* in different size classes.

Table 2: Comparison of reported LWR parameters of *Trichiurus lepturus* with present study.

	Length (cm)	Weight (g)	b	r ²	Source
India (Veraval)	38 - 134.1	-	3.587	0.98	Ghosh <i>et al.</i> , 2009
India (Visakhapatnum)	13.5 - 36	30-850	2.7146	0.746	Chkravarty <i>et al.</i> , 2012
Kenya	41 - 99	-	-	-	Mwakiti <i>et al.</i> ,2016
Pakistan	35 - 65	40-275	2.65	-	Tabassum <i>et al.</i> ,2013
	33 - 129.5	60-2000	2.584	0.7385	Present study

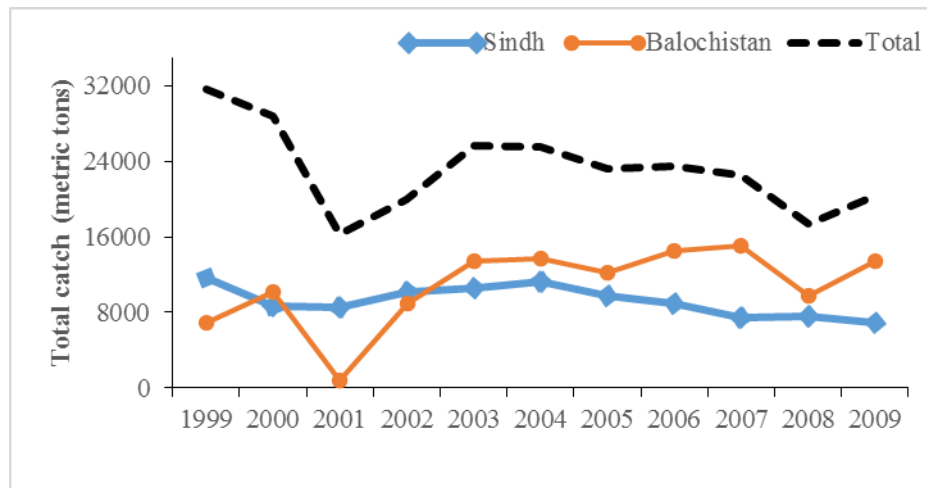


Figure 3: Overall landing data (total catch in metric tons) of the Ribbonfish fishery in Pakistan during 1999–2009. (Source: MFD, 2012)

Table 3: Landing data of Ribbon fish and its value at Pasni, Balochistan Coast from January 2015 to December 2015.

Ribbon fish	Total quantity in Metric tons	Total value in Pak Rupees	Total value in U.S Dollar
January	14.93	1343700	12826.46048
February	17.1	1539000	14690.72165
March	6.247	562230	5366.838488
April	8.1	1053000	10051.54639
May	1.577	283860	2709.621993
June	1.015	162400	1550.210004
July	26.715	4808700	45902.06186
August	38.825	6988500	66709.62199
September	47.554	8559720	81707.90378
October	51.441	9259380	88386.59794
November	47.066	8471880	80869.41581
December	50.41	9073800	86615.12027
Grand Total	310.98	52106170	497386.1207

*Source: Directorate of fisheries, Balochistan.

The main landing sites of *T. lepturus* at Makran coast was given in Table 4. Gwader, Pasni and Damb are the main fishing grounds for *T. Lepturus*. The total landing at Jiwani was high (5490.50 metric tons) in 2014. The total landings of ribbonfish in 2011 from all landing centers of Makran coast were 1466.128 metric tons (Table

3) which is equivalent to 733056400 Pakistani rupees or USD 6997483.772. The catch increased in 2013 (16436.188 metric tons) which was equal to USD 7171813.994. However in 2014, the catch declined to 10122.46 metric tons.

Table 4: Overall landing data of Ribbonfish fishery, total catch in (metric tons), total value in (Pakistani rupees), from 2011-2014 in all landing centers of Balochistan coast of Pakistan.

Year	Jiwani	Pishukan	Gwader	Surban-dar	Pasni	Ormara	Damb	Gaddani	Total catch (metric tons)	Total Value in Pakistani rupees	Total value in U.S Dollar
2011	533.154	351.194	5044.276	531.101	3640.14	1930.123	631.140	2000.0	14,6661.128	73,3056400	69,97483.772
2012	630.10	318.14	5036.11	1423.36	5718.40	930.13	125.96	832.12	15,014.32	73,4835900	70,14470.218
2013	1271.972	455.430	5482.673	1090.074	2095.601	1318.164	3536.339	1185.935	16,436.188	75,1319234	71,71813.994
2014	5490.50	134.98	948.17	312.93	2185.60	297.49	561.69	191.10	10,122.46	23,3165385	22,25710.052

*Source: Directorate of fisheries, Balochistan.

The *T. lepturus* is also a major fishery contributor in tropical and temperate waters (Khan, 2006; Raesi *et al.*, 2011). The landing statistics at Pasni fish harbor indicate that from September to December is the peak season for ribbonfish fishery and the low catch during the summer season was due to the increased efforts towards the catch of sardines, cat fishes, mackerels, and queen fishes. The main targeted fishery during June was the catch of jelly fish (284.541 in metric tons; source Directorate of Fisheries, Balochistan).

Pakistan earns annually USD 497386.1207 from the catch of ribbonfish in the Makran coast which is proof that ribbonfish is a highly exported fish of Pakistan. The high exploitation of this fish requires further research to manage this important resource from declining. The development of a management plans for the sustainable exploitation of ribbonfish is highly recommended.

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