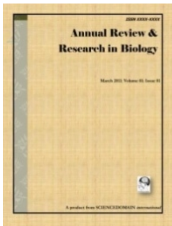

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Abundance of Cutlassfish *Trichiurus lepturus* (Linnaeus, 1758) in Bushehr Waters, Persian Gulf

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Research Article

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ABSTRACT

The abundance of cutlassfish was studied in the fishing grounds of Bushehr waters between May to August 2010. Stratified random sampling scheme from 40 trawl stations was used. Catch rates (catch per unit area, CPUA) and total biomass of all the samples were estimated. Mean CPUA and the total biomass of *Trichiurus lepturus* were estimated as 6104.6 ± 956.4 $kgnm^{-2}$ and 3765.9 tonnes respectively. There was a significant difference between the mean CPUA of different depths and seasons. This study has provided the first study of biomass and CPUA in Bushehr Waters. The data collected in this study can be used as the basis for a long-term stock monitoring program in the region.

Keywords: Swept area; CPUA; Trichiurus lepturus; Bushehr; Persian Gulf.

1. INTRODUCTION

Persian Gulf is in the subtropical zone, lying almost completely between the latitudes 24° and 30°N and longitudes of 48° and 52°30′E (Fig. 1). Maximum depth of the Persian Gulf is 100m, with an average 36m depth and most of the basin is less than 60m depth (Carpenter et al., 1997; Reynolds 1993; Kampf and Sadrinasab, 2006).

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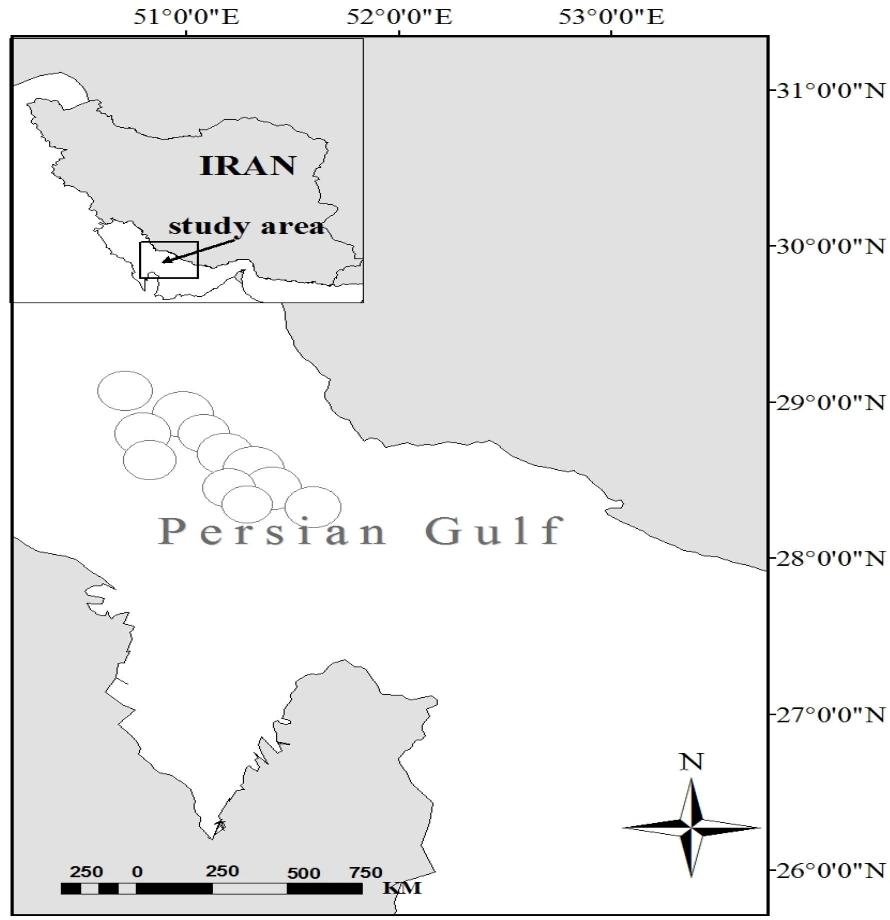

Fig. 1. Location of study area in Bushehr waters, Persian Gulf. Circles show the sampling area

The largehead cutlassfish, *Trichiurus lepturus,* is a bentho-pelagic species occurring along continental shores and islands in tropical and temperate seas, mainly between 45°S and 60°N (Randall, 1995; Nakamura and Parin, 1993). It is a coastal species fished in warm and warm-temperate waters around the world (Raeisi et al., 2011) with a nominal worldwide catch of 1345911 tonnes in 2009 (FAO, 2009).

Cutlassfish are voracious predators (Martins and Haimovici, 1996; Bitter and Benneditto, 2009) reported dramatically in the Indian Ocean, particularly Persian Gulf. The most abundant species of Cutlassfish in the Persian Gulf is *T. lepturus*. The cutlassfish fisheries of the Persian Gulf are the most lucrative fisheries in the recent years (Raeisi et al., 2011). Large concentrations of this species has been associated with low catches of important commercial shrimps, such as *Penaeus semisulcatus*, *Metapenaeus stebbingi,* and *Metapenaeus affinis*, by southern Iranian fisherman which suggesting that Cutlassfish has a significant impact on the stock of shrimps (Raeisi et al., 2011).

Some research has been conducted to investigate the effect of environmental conditions on the distribution of this species (Lee, 1979, Baik and Park, 1986; Dekun and Cungen, 1987;

Munekiyo, 1990; Martins and Haimovici, 1996; Raeisi et al., 2011; Meriem et al., 2011) which indicate the abundant of this species in subtropical zone.

Despite the existence of studies about some aspect of cutlassfish population from the Persian Gulf, available information about the abundance and distribution are very dispersed and slight. This article presents the first quantitative data on CPUA and catch per unit effort of cutlassfish in the fishing grounds of Bushehr waters of Persian Gulf.

2. MATERIALS AND METHODS

2.1 Study Area and Sampling Stations

Data were collected on monthly basis during 1st May 2010 to 10 August 2010 of fishing grounds of *Trichiurus lepturus* in Bushehr province (SW of the Persian Gulf). The survey areas were restricted to Iranian waters between the longitudes of 50° 00´to 52°20′E and covers fishing grounds of *Trichiurus lepturus* (Fig. 1). The total area was calculated with a plannimeter. A total of 40 trawl stations were selected following a stratified random procedure.

2.2 Sampling

The cruises were carried out using Commercial vessel. *Kish 811* that is a stern trawler (43.5 m length, 450 kW) equipped with a Global Positioning System (GPS), echo sounders and a bottom-trawl net with a cod-end mesh size of 75mm and a 45m headline. Trawl duration ranged from 1.5 to 4h (mean 3.26 ± 0.14) at speed of about 3 ± 0.55 knots (depending on weather and/or bottom conditions). During the sampling, duration of trawling, GPS position, towing distance and towing speed were recorded.

The end of each hauling, total catch emptied on the deck then bycatch were separated from the target species (cutlassfish). Target species was spilling to trays then weighed and counted. The biomass and CPUA were estimated based on Sparre and Venema (1992). The towing distance at a given station (D in nautical miles, n.m.) was measured by GPS or using the formula:

$$D= 60x\sqrt{(Lat_1 - Lat_2)^2 + (Lon_1 - Lon_2)^2 \cos^2(0.5(Lat_1 + Lat_2))}$$

where:

Lat1 = latitude at start of haul (degrees).
Lat2 = latitude at end of haul (degrees).
Lon1 = longitude at start of haul (degrees).
Lon2 = longitude at end of haul (degrees).

Swept area (a, n.m.^{2}) at each station was then estimated as:

a_j = D.h.x2

where *h* is the length of the head-rope and *D* is the cover of distance. *X*= wing spread coefficient = 0.66 (Valinasab et al., 2006).

The catch per unit area (CPUA, kg n.m.$^{-2}$) for each station is given by:

$$\mathrm{CPUA_j} = \frac{\mathrm{Cw}}{\mathrm{a}} \mathrm{kg/nm^2}$$

where *Cw* = catch in weight of a haul and *a* = swept area (n.m.^{2}) for each haul

The total biomass was estimated as:

$$\overline{CPUA} = \sum_j \frac{CPUA_j}{N}$$

$$B = \frac{\overline{CPUA}}{0.5} \times A$$

where *A*=total area *N*= number of stations in 0.5= catch coefficient (using the value proposed by Sparre and Venema, 1992, for demersal group in tropical and subtropical areas).

2.3 Data Analysis

Two-factor analysis of variance (ANOVA) was used to assess the mean differences of CPUA between seasons and depths. Shapiro–Wilk's and Levene tests were used to analyze normality of the data and homogeneity of variances, respectively (Zar, 1999). To compare the means, Duncan's new multiple range test was used. For normality data and homogeneity variance, data were transformed by $\log_{10}{}^{(x+1)}$.

Kolmogorov–Smirnov tests were used to determine whether the size composition of individual *T. lepturus* was significantly differed between seasons and depth. Because this is a pair-wise comparison, interactions between season and depth were not considered.

3. RESULTS

The mean catch per unit area and biomass values for *T. lepturus* are given in Table 1.

Table 1. Number of Trawl Hauls (n), Mean CPUA

Species				**CPUA (kg nm^{-2})**			
	n	**Season**	**Depth**	**Mean**	**S.E.**	**Min**	**Max**
T. lepturus	4	Spring	>50	2064.86	457.3	1438.32	2955.17
	4	Spring	50-60	6521	1152.21	4223.66	7826.2
	6	Spring	60-70	16948.47	2045.96	13975.35	20869.86
	4	Summer	>50	2071.42	166.03	1852.25	2397.05
	6	Summer	50-60	3135.24	281.9	2838.3	3698.78
	16	Summer	60-70	5400.64	978.65	1609.96	13022.79

Mean CPUA and total Biomass for T. lepturus in the fishing grounds of Bushehr; S.E.: standard error; Min: minimum, Max: maximum

3.1 Seasonal Trend

The Mean CPUA values (F = 19.77; P<0.05) differed significantly between seasons with higher catches in spring (Fig. 2).

Length–frequency distribution of the *T. lepturus* was differed significantly between the examined seasons for seasonal variation in the size structure of their populations. Kolmogorov–Smirnov tests showed that *T. lepturus* had significantly higher proportions of smaller individuals during summer (Fig. 3).

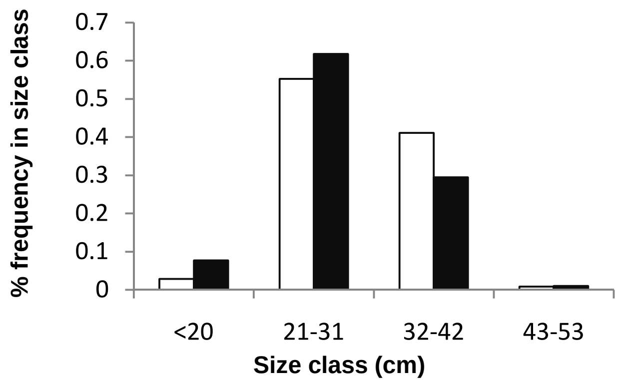

Fig. 2. Percentage of length–frequency distributions of *T. lepturus* caught in the spring (white bars) and summer (black bars) fishing seasons.

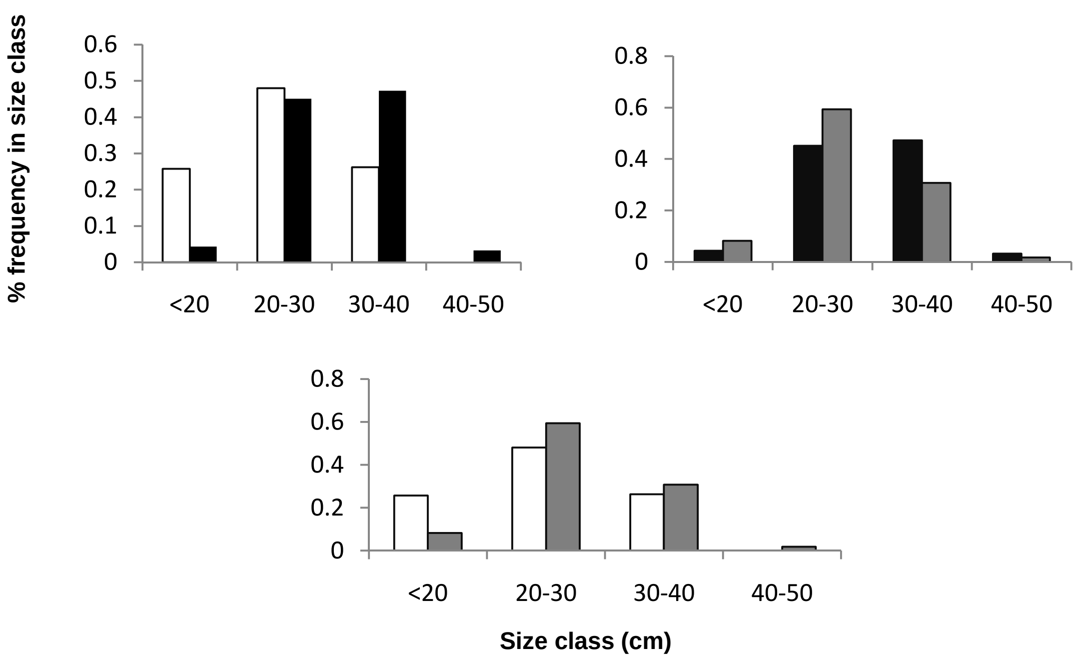

Fig. 3. Percentage of length–frequency distributions of *T. lepturus* caught in the <50 depth (white bars), 50-60m depth (gray bar) and 60-70m depth (black bars).

3.2 Depth Trends

The mean CPUA values were between depths, with minimum CPUA ($F = 26.21$; $P<0.05$) in >50m depth. The mean CPUA did not differ significantly between depths of 50 to 60 and 60 to 70 m ($P>0.05$) (table 2).

The size composition of the *T. lepturus* differed significantly between different depths. Smaller individuals of *T. lepturus* was caught in >50m depth (Fig. 3).

3.3 Diel Trends

There was a significant difference in the mean CPUA of depths in combination with season ($F = 10.61$; $P<0.05$) (Table 2).

Table 2. Summary of the two-factor fixed ANOVAs for CPUA of *T. lepturus* in the Persian Gulf; testing for differences between seasons and depth

Species	Season(1)	Depth(2)	Season × depth (1)
Trichiurus lepturus	19.77***	26.21***	10.61***

4. DISCUSSION

The total biomass of *T. lepturus* from the fishing grounds of Bushehr waters was estimated to 3765.9 tonnes. In the previous reports from Oman Sea, the total biomass of *T. lepturus* was estimated to 1430 tonnes (Shojaei and Taghavi, 2011). The difference in the total biomass can also be explained by the restrictions imposed by the Iranian fisheries organization for limiting the number of trawls, fishing gears in the Persian Gulf.

We conducted our surveys during the periods May to August but other studies (Valinassab et al., 2005; Shojaei and Taghavi, 2011) were conducted during in December and August to October respectively.

Also, bottom fish trawling previously was used but it is banned in this region since 1992 (Nia-Meimandi and Khorshidian, 1993; Valinasab, 2006) to prevent over-exploitation which has helped the recovery of fish resources. Also In previous investigations (Valinassab et al., 2005) survey was performed using the R.V.Ferdows11 (45.5 m, 1200 kW), which was equipped with a bottom trawl net with a mesh size of 80 mm in the cod-end and a 72 m headline but we conducted our surveys with an improved design with a cod-end mesh size of 75 mm and a 45 m headline.

Our results show that season and depth are important determinants of the CPUA rate and the size composition of *T. lepturus*. The variation of CPUA between shallow and deep water indicates differences in the horizontal distribution of the species. The horizontal distribution of a species can depend on the density of the population and so may change between seasons (Maccall, 1990; Swain and Wade, 1993; Petrakis et al., 2001).

Additionally, differences in the size composition of the catch have also been observed between spring and summer catches (Beamish, 1966; Walsh, 1988; Engas and Soldal, 1992), which suggest recruitment is seasonal. For many demersal fish, a positive correlation between size of fish and depth has been reported (Macpherson and Duarte, 1991; Sinclair, 1992; Swain, 1993; Petrakis et al., 2001).

5. CONCLUSION

Due to short duration of this study, spatial variations and CPUA obtained for *T. lepturus* were not conclusive. Despite this problem, this study has provided the first study of spatial variations and CPUA of cutlass fish trawl in fishing grounds of Bushehr waters of the Persian Gulf. The collected data showed that Persian Gulf has rich cutlass fish stocks and could be use as a commercial fishery resource.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Baik, C.I., Park, J.H. (1986). Relationship between oceanographic condition and catch of the hairtail, *Trichiurus lepturus* LinnC from the Stow Net. Bull. Fish Res. Dev. Agency, 39, 29-41.

Beamish, F.W.H. (1966). Vertical migration by demersal fish in the Northwest Atlantic. Journal of Fisheries Research Board of Canada, 23, 109–139.

Bittar, V.T., Beneditto, A.P.M. (2009). Diet and potential feeding overlap between *Trichiurus lepturus* (Osteichthyes: Perciformes) and *Pontoporia blainvillei (Mammalia: Cetacea*) in northern Rio de Janeiro, Brazil. Zoologia, 26(2), 374-378.

Carpenter, K.E., Krupp, F., Jones, D.A., Zajonz, U. (1997). Living marine resources of Kuwait, Eastern Saudi Arabia, Bahrain, Qatar and UAE. FAO Species Identification Field guide for Fishery Purposes, 1-293. Rome, Italy, FAO Publication.

Dekun, Z., Cungen, Y. (1987). The relation of the environment of fishing ground with the occurrence of hairtail in winter off the middle part of Zhejiang. 1. Fish. China, 11, 195-204.

Engas, A., Soldal, A.V. (1992). Diurnal variations in bottom trawl catch rates of cod and haddock and their influence on abundance indices. ICES Journal of Marine Science, 49, 89–95.

FAO. (2009). Fishery Statistics Yearbook. Catches and Landings. Vol. 91.2009. FAO, Rome.

Kampf, J., Sadrinasab, M. (2006). The circulation of the Persian Gulf: a numerical study. Ocean Sci., 2, 27–41.

Lee, S. (1979). Species composition and distribution of the Taiwan Ribbonfishes. Bull. Inst. Zool., Acad. Sin., 18, 29-37.

Maccall, A.D. (1990). Dynamic geography of marine fish populations. University of Washington Press, Seattle, WA. 153 pp.

Macpherson, E., Duarte, C.M. (1991). Bathymetric trends in demersal fish size; is there a general relationship? Marine Ecology Progress Series, 71, 103–112.

Martins, A.S., Haimovici, M. (1996). Distribution, abundance and biological interactions of the cutlassfish *Trichiurus lepturus* in the southern Brazil subtropical convergence ecosystem. Fisheries Research, 30, 217-227.

Meriem, S.B., Al-Marzouqi, A., Al-Mamry, J., Al-Mazroui, A. (2011). Stock Assessment and Potential Management of *Trichiurus lepturus* Fisheries in the Arabian Sea, Oman. Journal of Fisheries and Aquatic Science, 6(3), 212-224.

Munekiyo, M. (1990). Diurnal vertical migration of a Ribbon Fish in the Western Wakasa Bay. Bull. Jpn. Sot. Sci. Fish, 56, 1193-1197.

Nakamura, I., Parin, N.V. (1993). FAO species catalogue. Vol. 15. Snake mackerels and cutlassfishes of the world (Families Gempylidae and Trichiuridae). An annotated and illustrated catalogue of the snake mackerels, shocks, escolars, gemfishes, sack fishes, domine, oilfish, cutlassfishes, scabbardfishes, hair- tails, and frostfishes known to date. Fisheries Synopsis No. 125, Vol. 15. FAO, Rome, pp. 136.

Nia-Maymandi, N., Khorshidian, K. (1993). Stock assessment of demersal resources in the Persian Gulf (Bushehr waters). Final Report. Bushehr, Iran: Persian Gulf Research Center.

Randall, J.E. (1995). Coastal fishes of Oman. Crawford House Publishing Pty Ltd., Bathurst, New South Wales, Australia, 439 pp.

Petrakis, G., MacLennan, D.N., Newton, A.W. (2001). Day–night and depth effects on catch rates during trawl surveys in the North Sea. ICES Journal of Marine Science, 58, 50–60.

Raeisi, H., Hosseini, S.A., Paighambari, S.Y., Taghavi, S.A.A., Davoodi, R. (2011). Species composition and depth variation of cutlassfish (*Trichiurus lepturus* L. 1785) trawl bycatch in the fishing grounds of Bushehr waters. Persian Gulf, 10(76), 17610-17619.

Reynolds, R.M. (1993). Physical oceanography of the Gulf, Strait of Hormuz, and the Gulf of Oman: results from the Mitchell Expedition. Marine Pollution Bulletin, 27, 35-60.

Shojaei, M., Taghavi, A. (2011). The Catch Per Unit of Swept Area (CPUA) and Estimated Biomass of Large Head Hairtail (*Trichiurus lepturus*) with an Improved Trawl in the Persian Gulf and Gulf of Oman, Iran, 24, 209-217.

Sinclair, A. (1992). Fish distribution and partial recruitment: the case of Eastern Scotian Shelf cod. Journal of Northwest Atlantic Fisheries Science, 13, 15–24.

Sparre, P., Venema, S.C. (1998). Introduction to tropical fish stock assessment, FAO Fisheries Technical Paper. 450pp.

Swain, D.P., Wade, E.J. (1993). Density-dependent geographic distribution of Atlantic cod (Gadus morhua) in the southern Gulf of St Lawrence. Canadian Journal of Fisheries and Aquatic Sciences, 50, 725–733.

Valinassab, T., Dehghani, R.E., Khorshidian, K. (2005). Biomass estimation of demersal resources in the Persian Gulf and Gulf of Oman by swept area method. Final Report. Iranian Fisheries Research Organization (IFRO), Tehran. 121pp.

Valinassab, T., Daryanabard, R., Dehghani, R., Pierce, G.J. (2006). Abundance of demersal fish resources in the Persian Gulf and Oman Sea. Journal of the Marine Biological Association of the United Kingdom, 86, 1455-1462.

Walsh, S.J. (1988). Diel variability in trawl catches of juvenile and adult yellowtail flounder on the Grand Banks and the effects on resource assessment. North American Journal of Fisheries Management, 8, 373–381.

Zar, J.H. (1999). Biostatistical Analysis. 4th edition. Prentice-Hall, Englewood Cliffs, New Jersey, p. 929.
