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Biomass and CPUA estimation and distribution pattern of carangids in the northwest of Persian Gulf

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ABSTRACT

This research was carried out to assess the amount of biomass and Catch Per Unit of Area (CPUA) and also to determine the distribution pattern of Carangid family as one of the most important and commercial fish species in the northwest of Persian Gulf based on trawl survey results in 2011. Samples were collected at a total 65 trawl stations selected a stratified random procedure. The catch rates of CPUA and biomass of different species of Carangids were estimated to be approximately 398.0 kg/nm^2, 3652.7 tons, respectively. The highest value of CPUA was recorded in the east of the study area (stratum E, Dayer to Ras-Naiband, approximately 1520.0 kg/nm^2) and for depth layer of 30-50 m with value of 718.8 kg/nm^2. The highest biomass was found 1863.5 and 2777.2 tons in stratum C (Genaveh to Bordkhoon) and depth layer 30-50 m, respectively. The CPUA index in stratum E and depth layer of 30-50 m showed significant differences with other strata and depth layers ($P < 0.05$). It was concluded that the density and frequency of carangids showed ascending trend with increasing the depth. As an overall result, in the northwest of Persian Gulf, the stratum E and 30-50 m depth layer was found as the best fishing ground with the highest biomass and density.

Keywords: CPUA, Biomass, Distribution, Fishing area, Carangids, Persian Gulf

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INTRODUCTION

The fisheries and exploitation of marine fishes, represent the second most important natural resources (next to oil), and the most important renewable natural resources [1] in the Persian Gulf and about 100,000 fishermen are active and employee in this industry both as traditional and industrial fisheries in this area [2]. The Persian Gulf is in the subtropical zone, lying almost entirely between the latitudes of 24° 00'N and 30° 30'N, and longitudes 48° 00'E to 56° 25'E (Fig. 1). It is a semi-enclosed water body with average depth of 35 m connected to the Oman Sea through the Strait of Hormuz, which is 56 km at its narrowest point [3] and then is connected to the open sea of the Indian Ocean through the Arabian Sea. The most common fishing methods are gillnet, trap, two-boat purse seine, hook and line, and shrimp trawl to catch different ecological group fishes with emphasize on demersal fishes [4]. As an important fisheries management policy, the fish trawling has been banned from 1993 due to rehabilitation and to decrease the fishing effort [5]. The amount of total catch in the Persian Gulf for years 2009, 2010 and 2011were estimated 227000, 245100, and 275500 tons, respectively in which the quota of the northwest of the Persian Gulf (Bushehr and Khuzestan Provinces) were 94890, 104700, and 97000 tons [2] namely 42, 43 and 35 % . Carangid is one of the most important Pelagic fishes (caught in demersal trawls) both in traditional and industrial fisheries [1, 4-7] with total catch of 5135, 5291, and 5768 tons for years 2009, 2010, and 2011 in the northwest of Persian Gulf,

Iranian waters [2]. It should be noted that meanwhile the amount of catch of Carangids is not as significant as total catch but they have commercial and economical importance in the region for fishermen.

Carangid fishes contain a big family of bony fishes belong to Perciformes order with a total of 48 identified species in the Persian Gulf [13]. A high variety of form, size, scale and fins are observed amongst them [1] and mostly in front of their anal fin, 1-2 spine is observed with scutes on peduncle [Smith-Vaniz, 2002]. They live in schools and some species dependent on substrate as demersal fishes and some of them are pelagic but mostly are caught with bottom trawls because of low depths but all of them are categorized as commercial species [Fischer and Bianchi, 1984]. Some of the most important species of carangids in the study area are *Parastromateus niger*, *Scomberoides commersonianus*, *Megalaspis cordila*, and *Trachinotus mookalee*.

In order to have sustainable exploitation of marine fish resources, it is advised to monitor the aquatic resources and find out the trend of catch per unit of effort, catch statistics as fishery indices and also to carry out research cruises to estimate other expertise indices such as catch per unit area or CPUA [8] for further management advises.

The first studies on trawl survey in the study area were carried out in 1976-1979 under a United Nations Food and Agriculture Organization regional project covering all southern and northern Persian Gulf and Oman Sea waters using four research vessels [9]. Further studies in the northern Persian Gulf waters to estimate the biomass of demersal fishes took place between 1994 and 1995 based on seasonal cruises [10]. Then from year 2002, it was decided in order to provide further advise for the management of demersal resources, a comprehensive research project, covering all Iranian waters of the Persian Gulf and Oman Sea, was designed [5] using swept area method [8].

The main objectives of this research are to estimate the amount of catch per unit area (CPUA) and biomass of one of the main commercial families (Carangids) for different strata and depth layers in the northwest Persian Gulf and to have a comparison with previous estimations to find any ascending or descending trend of changes. The other important objective is to prepare the distribution pattern and determine the main fishing area of Carangids.

MATERIALS AND METHODS

The study area was restricted to the Iranian waters of the northern Persian Gulf (Khuzestan and Bushehr provinces waters), between longitudes 49° 00' E borderline of Iran and Kuwait in the west and 52° 45' E, Ras-Naiband in the east as borderline of Bushehr and Hormuzgan provinces; and isobaths of 10 to 50 m depth (Fig.1). The total area was stratified into 5 strata (A to E) and then each stratum was classified into three depth layers: 10-20, 20-30, and 30-50 m.

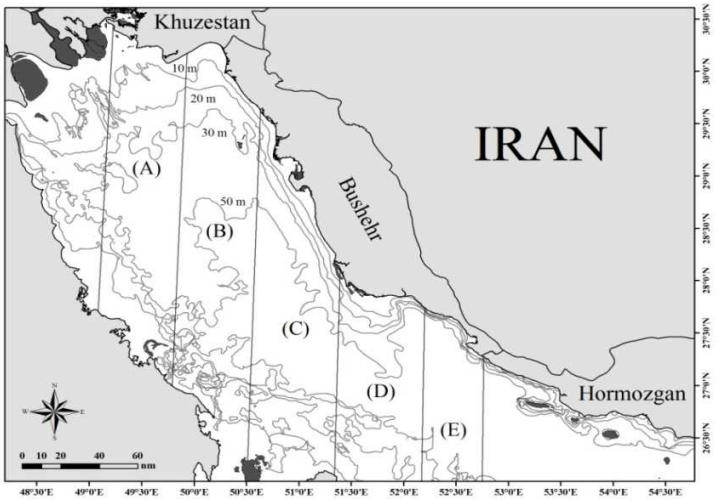

Figure 1. Map of the study area for assessment of Carangids stock

The total area and area of each stratum or depth layer was calculated with a plannimeter (Tables 1, 2). A total of 65 trawl stations were selected randomly and the number of hauls in each substratum being proportional of the stratum and depth layer.

Table 1. The number of trawl stations and area of each stratum in the northwest of Persian Gulf

Stratum	A	B	C	D	E	Total
Area (nm^2)	621.7	1415.6	1415.1	909.1	227.5	4589.0
Proportion of total area (%)	13.5	30.8	30.8	19.8	5.1	100
Station	3	19	21	16	6	65

Table 2. The number of trawl stations and area of each depth layer in the northwest of Persian Gulf

Stratum	10-20m	20-30m	30-50m	Total
Area (nm^2)	1554.8	1102.5	1931.7	4589.0
Proportion of total area (%)	33.9	24.0	42.1	100
Station	23	19	23	65

A total of two cruises were in 2011 using R/V Ferdows-1. This vessel is a stern bottom trawler was equipped with a fish bottom-trawl net (headline 72m and mesh size of cod end 80mm). For each trawl, date, time, duration, bottom depth, GPS position, towing distance, and towing speed were recorded in special log sheets. Each trawl lasted 1h following which the net was transferred on board and then the following operations consist of separation, identification, counting and weighing of Carangids were done.

The amount of biomass and CPUA index were estimated based on Sparre and Venema [8] using following formula: Swept area of each haul was estimated as:

$a = d^* h^* X_1$

Where: d: towing distance (nautical mile, nm) registered by Simrad Plotter; a: swept area (nm^2); d: towing distance (nm); h: headline (m) and divided on 1852 to change it to nautical mile (nm); X_1: wingspread coefficient = 0.65 [4].

The catch per unit area (CPUA) is then given by:

$CPUA = Cw / a$

Where: Cw = catch amount of Haemulids and Shyraenids separated from the total catch; a: swept area (nm^2)

and after estimating the mean CPUA, the total biomass(B) is estimated as:

$B = CPUA * A / 0.5$

Where: A: total area (nm^2); and 0.5: catch coefficient [8].

Statistically, according to Kolmogorov-Smirnov test there was no normal distribution in CPUA values for Carangids, therefore the non-parametric test of Kruscal-Wallis was used to determine any significant difference between strata and depth layers; and if there was found significant differences, then Man-Whitney test was applied for comparing the mean CPUA for different strata and depth layers. The Natural log transform was applied to normalize the CPUA data; and then One-way ANOVA and Tukey tests were used to determine any significant differences between calculated values for different strata or depth layers. Also, the Arc-GIS software (Version 9.2) was used for preparing the distribution pattern maps accompany with Inverse Distance Method.

RESULTS

The total mean CPUA and biomass of Carangids were estimated 186.5 kg/nm^2 and 2476.8 tons and it contains 7.6% of total catch of demersal fishes in this trawl survey using Swept Area method in 2011. Among all identified species

of Carangid family, the most abundant and the main identified species with following frequencies were of *Parastromateus niger* (Balck pomfret) 6.5%; *Alectis indicus* (Indian threadfin trevally) 6.5%; *Scomberoides commersonianus* (Talang queenfish) 3.6%; *Megalaspis cordyla* (Torpedo scad) 0.6% and *Trachinotus mookalee* (Indian pompano) <0.05%. Due to high abundance of Carangids' species, the remained species were categorized as "Other Carangids" with frequency of 83%. In A & B strata (Khuzestan Province waters) no Indian pompano, talang queenfish and torpedo scad were found. In Bushehr Province waters only Indian pompano in 20-30 m depth layer and C strata (Genaveh to Bordkhoon) was not recorded.

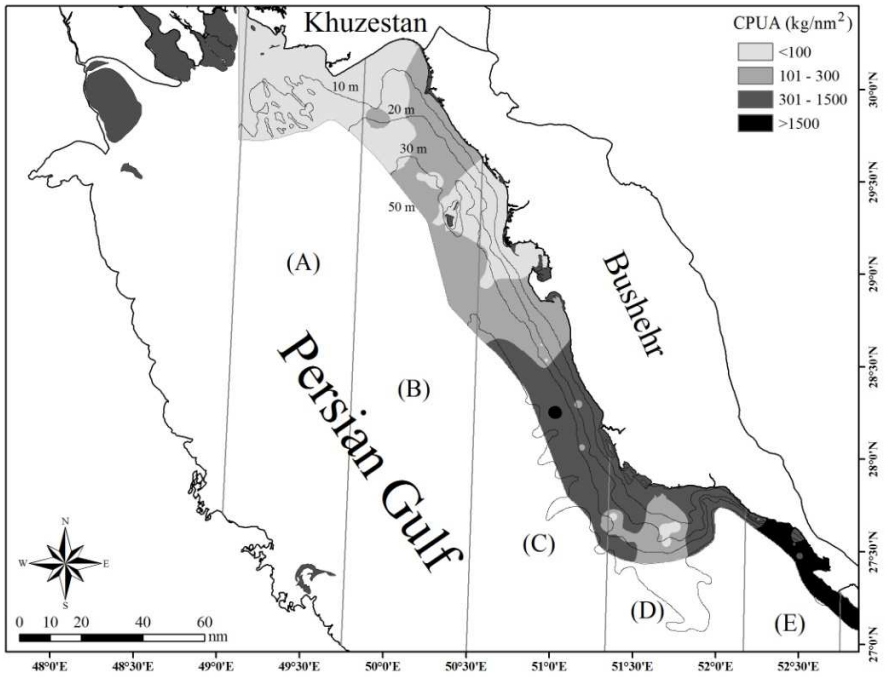

Figure 2. The distribution pattern of Carangids' species in the northwest of Persian Gulf

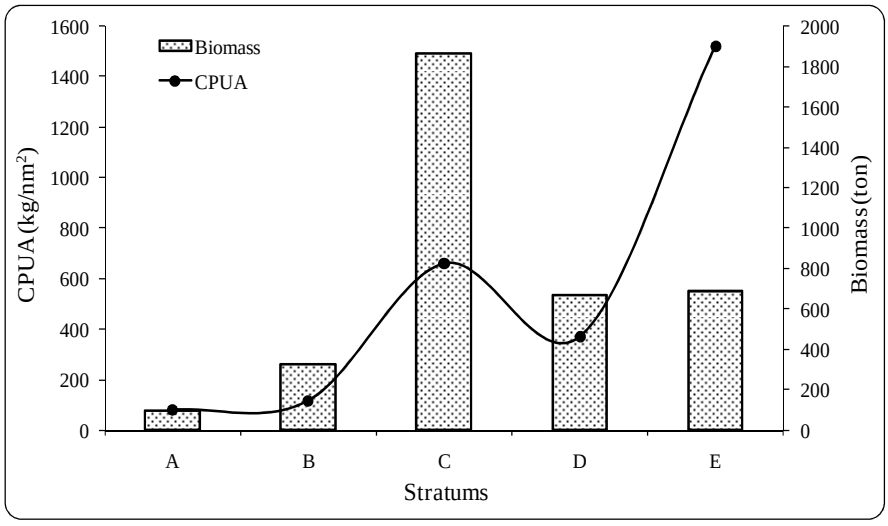

Figure 3. CPUA and biomass of Carangids for different strata in the northwest of Persian Gulf

The highest mean CPUA of Carangids was found in stratum E (Dayer to Naiband) with 1520.0 kg/nm^2 and follows with 658.4 kg/nm^2 in stratum C (Genaveh to Bordkhoon)(Figs. 2, 3) and the highest biomass were in stratum C with value of 1863.5 tons and equal value was estimated for strata D and E (Bordkhoon to Naiband) (Fig. 3).

This comparison was done for different depth layers and the maximum CPUA (718.8 kg/nm^2) and biomass (2777.2 tons) were observed in waters of 30-50 m depth (Fig. 4). Amount of these two values were more or less the same for depth layers of 10-20 and 20-30 m; but with increase of depth there was a significant ascending trend of CPUA and biomass of Carangids for depth layer of 30-50 m in which the amount of CPUA was increased 4.2 times more and amount of biomass increased 6.3 times more.

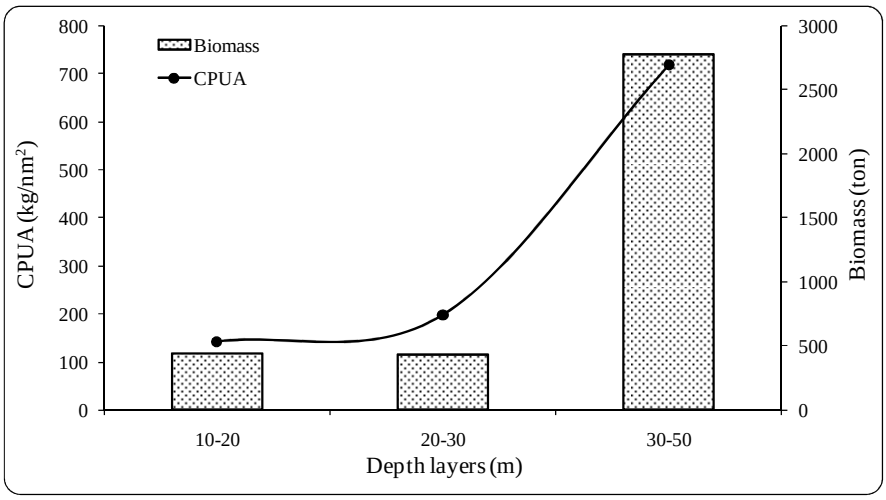

Figure 4. CPUA and biomass of Carangids for different depth layer in the northwest of Persian Gulf

The estimated CPUA values wernot normal and therefore non-parametric Kruscal-Wallis test with confidence of 95 % was applied and significant differences were observed for different depth layers and strata. The Mann-Whitney statistical test (95% confidence) showed significant difference between stratum E (Dayer to Naiband) with all four other strata. The stratum B (daylam to Genaveh) had this difference with stratum D (Bordkhoon to Dayer). Also, depth layer 30-50 m had significant difference with two other depth layers ($P<0.05$).

The CPUA values were normalized using Natural Log Transform, and then parametric analysis of One-Way ANOVA with 95% confidence interval was used to control any significant differences between different depth layers and strata of which theses differences were approved. The Tukey test revealed significant difference between strata A to C (west of Khuzestan Province to Bordkhoon) with strata D to E (Bordkhoon to Naiband); and this difference was found between depth layer of 30-50 m with other depth layers ($P<0.05$).

DISCUSSION

Although the highest amount of CPUA of Carangids was estimated for stratum E (Dayer to Bordkhoon) but the highest biomass was observed for stratum C (Genaveh to Bordkhoon); in which is due to their difference in calculated area (by plannimeter) of two regions. The area of stratum E is so small in it contains only 5% of total study area in northwest of the Persian Gulf. Meanwhile, the stratum C contains 31% of total area (Table 1). Also, a comparison between different depths indicate that the area of depth layer 30-50m comparing to the other depth layers is significantly more and because of it, including to have the highest amount of CPUA, it contains the highest biomass too. The results of this study reveal that density and frequency of Carangids in stratum E and depth layer 30-50m are significantly more than other strata and depth layers.

The strata A and B in Khuzestan Province waters showed the lowest amount of CPUA in year 2011. This result is in agreement with the findings of research cruises in 1993 to 2010 in which as a permanent finding the lowest value of CPUA belonged to strata A and B [12, 4, 6], therefore as an overall result it can be concluded that the lowest density and frequency of Carangids is found in Khuzestan Province waters in border with Kuwait waters. One of the main

reasons of the low density and abundance of Carangids in the strata A and B located in Khuzestan Province waters can be due to high activity of illegal fisheries, higher fishing effort (cpue) and using non-standard fishing gears in which have damaged to Carangids' resources or by overexploitation of other fishes in food web leading to decrease the amount of food and preys. King [11] believes that the overexploitation cause lack of having a safe and suitable ecosystem and consequently cause the obligatory migration of fishes to other areas and shifting to a new fishing grounds.

The highest amount of CPUA for years 2004, 2005 and 2008 was found for stratum E but for years 2003, 2007, 2009 and 2010 belongs to stratum D [12, 4, 6]. According to the same obtained result of this study in 2011, the Carangids with the highest catch per unit of area and density are mostly found in Bordkhoon to Naiband. But during years 2003 to 2010, the highest biomass were estimated for stratum D, Bordkhoon to Dayer with less than 20% of total study area.
During years 2003-2004, the highest index of CPUA was estimated for depth layer 20-30 m [12, 4], but during years 2005-2010 the highest value was found in depth layer 30-50 m [4, 6]. The findings of this study in 2011 reveals that the CPUA of Carangids in depth layer 20-30 m has increased up to 40% and there was an ascending trend of CPUA with increase of depth. The highest amount of biomass of Carangids from years 2003 to 2010 have consistently observed in depth layer 30-50 m in which is in agreement with our finding (Fig. 4). Fischer and Bianchi [14] and Smith-Vaniz [15] reported that the habitat of different species of Carangids is in offshore and deeper waters in which is completely in agreement with findings of this study.

As an overall review on previous studies and including the obtained findings of this investigation, it can be concluded that the stratum D (Bordkhoon to Dayer) located in Bushehr Province have higher abundance of Carangids in the northwest of Persian Gulf and they have higher distribution in these areas and they are considered as the main fishing grounds for this family of commercial fishes and can advise and lead the fishermen to have their more commercial fishing activities in above-mentioned stratum. From point of depth, the best depth layer for commercial fishing is depth layer 20-30m.

REFERENCES

[1] Carpenter K E; Krupp F; Jones D A; Zajonz U', *FAO Species Identification Field guide for Fishery Purposes*, **1997**, 293 p.
[2] Planning and Programming Department', *Iran Fisheries Company*, **2012**, 42 p.
[3] Reynolds R M', *Marine Pollution Bulletin*, **1993**, 27. 35-60.
[4] Valinassab T; Daryanabard R; Adjeer M; Momeni M; Mobarezi A; Safikhani H; Dehghani R', Final Report, *Iranian Fisheries Research Organization Press*, **2011**, 324 p.
[5] Valinassab T; Daryanabard R; Dehghani R; Pierce G J', *Journal of Marine Biological Associations*, **2006**, 86.1455-1462.
[6] Valinassab T; Daryanabard R; Adjeer M; Dehghani R; Mobarezi A; Hashemi M', Final Report, *Iranian Fisheries Research Organization Press*, **2013**, 341 p.
[7] Dehghani R; Kamali E; Darvishi M; Behzadi S; Valinassab T', *Final report of Persian Gulf and Oman Sea Ecological Institute*, **2003**, 87 p.
[8] Sparre P; Venema S C', *Manual FAO Fisheries Technical Paper*, **1992**, 376 p.
[9] Sivasubramaniam K', *UNDP/FAO Regional Fishery Survey and Development Project*, **1981**, 122 p.
[10] IFRO Experts Group', *Final report of Iranian Fisheries Research Organization*, **1996**, 87 p.
[11] King M', *Fishing News Books*, **1995**, 340 p.
[12] Valinassab T; Daryanabard R; Dehghani R', *Final Report of Iranian Fisheries Research Organization Press*, **2005**, 112 p.
[13] Valinassab T', *Fishes of the Persian Gulf, Oman sea and Caspian Sea, Mooj-e- Sabz Press*, **2013**, 173 p.
[14] Fischer W; Bianchi G', FAO *Species Identification sheets for Fishery Purposes, Western Indian Ocean*, **1984**, 413 p.
[15] Smith-Vaniz W F', CARANGIDAE, *The Living Marine Resources of the Western Central Atlantic*, **2001**.