Evaluation of demersal trawl survey data for assessing the Biomass and Catch Per Unit Area (CPUA) of Platycephalidae

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Abstract

Biomass and Catch Per Unit of Area (CPUA) of Platycephalidae family were investigated in the northern coast of Oman Sea based on trawl survey results in 2015. The study area was stratified to five strata (I, II, III, IV, and V) covering the 10-20, 20-30, 30-50 and 50-100 m depth layers. Samples were collected at a total 65 trawl stations selected a stratified random procedure. The total CPUA and biomass of different species of Platycephalidae were estimated 268.9 kg/nm^2 and 124.8 tons and it made up 1.01% of total catch weight in five stratums. The highest values of CPUA (80.95 kg/nm^2), and biomass (43.47 tons) for *Grammoplites suppositus* were recorded in stratum IV in 30-50 m depth layer. The highest values of CPUA (15.61 kg/nm^2), and biomass (8.34 tons) for *Platycephalus indicus* were recorded in stratum IV in 10-20 m layer depth. The most obvious finding to emerge from this study is that strata IV (Northwest of Oman Sea) and 30-50 meter-depth layer is the best fishing area from the point of higher density and distribution of Platycephalidae in Oman Sea.
Keywords: CPUA; Biomass; Platycephalidae; Trawl survey; Oman Sea.

1. Introduction

Food from aquatic environments makes an important contribution to human nutrition. Increase in seafood utilization lead to expand fishing activity throughout the world. In fact, the over-exploitation and use of natural resources due to fishing activities, and some issues like contamination of water bodies led to habitat destruction of marine organisms and vulnerability of aquatic communities (Lowe-

McConnell, 1990). Platycephalidae are marine demersal fish, generally can find on the seabed and sometimes buried in mud (Barnes *et al*., 2011). They are present in a variety of depths, starting from 10 m to the edge of the continental shelf at depths of about 300 m (Mastrototaro *et al*., 2007). Flatheads are carnivorous, feeding on small fish and crustaceans (Abdurahiman *et al*., 2007). *Platycephalus indicus* and *Grammoplites suppositus* are most valuable demersal species from family of Platycephalidae

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and a part of the diet of the southern coast of Iran. These species catch by handling and seining in shallow waters and by trawling in deep waters. Moreover, due to the employ harmful fishing techniques which lead to marine habitat destruction and organisms in their way, it was essential to annual assessment of quantity and quality of the stock levels for conservation and to sustainable commercial fisheries. Therefore, trawl surveys were set up to study abundance, distribution, and growth, biomass and maturity data for target populations.

Different studies over the past decades have provided important information on abundance of demersal fish resources in the Persian Gulf and Oman Sea. The first attempt of bottom trawls as regional fishery survey in southern Iranian waters was from 1976 to 1979 (Kesteven *et al*., 1981). Recently, several trawl surveys have been conducted to investigate Catch Per Unit of Swept Area (CPUA) and biomass of demersal fish resources in the Oman Sea (Valinassab *et al*., 2006; Abbaspour *et al*., 2010; Ghotbeddin *et al*., 2014). Although extensive research has been carried out on Biological characteristics (Raeisi *et al*., 2014), growth rate (Mohammadikia *et al*., 2014), population biology (Hashemi *et al*., 2014) of Platycephalidae, no single study exists which adequately covers distribution, biomass and CPUA of this family in the Southern waters of Iran. This study therefore sets out to assess the amount of CPUA and biomass of a commercial fish species, *P. indicus*, and *G. suppositus* for different strata and depth layers in the northern part of Oman Sea, Iranian territorial waters.

2. Materials and methods

The survey was conducted in the northern region of the Oman sea from Meidani (58º55' E) to Gwatre Bay (61º30' E) using a research trawler vessel (Kavian) equipped with fish bottom-trawl net (headline 72 m) during a period of 20 days in September 2015. The study area divided into five strata (I, II, III, IV, and V) and each stratum was divided into four substrata on the basis of depth: 10-20, 20-30, 30-50, and 50-100 m (Figure 1, Table 1). The whole study area, stratum area and different depth were calculated by platometer. A total of 66 stations were chosen based on the random stratified sampling method. Each trawl session lasted for 60 min at speed of 3 knots. Furthermore, the sampling date, sampling time, towing distance, towing speed, water depth, and geographic location, were recorded at each sampling station. The whole catch was transferred on board and all fishes were separated (*P. indicus* and *G. suppositus*) counted and weighed.
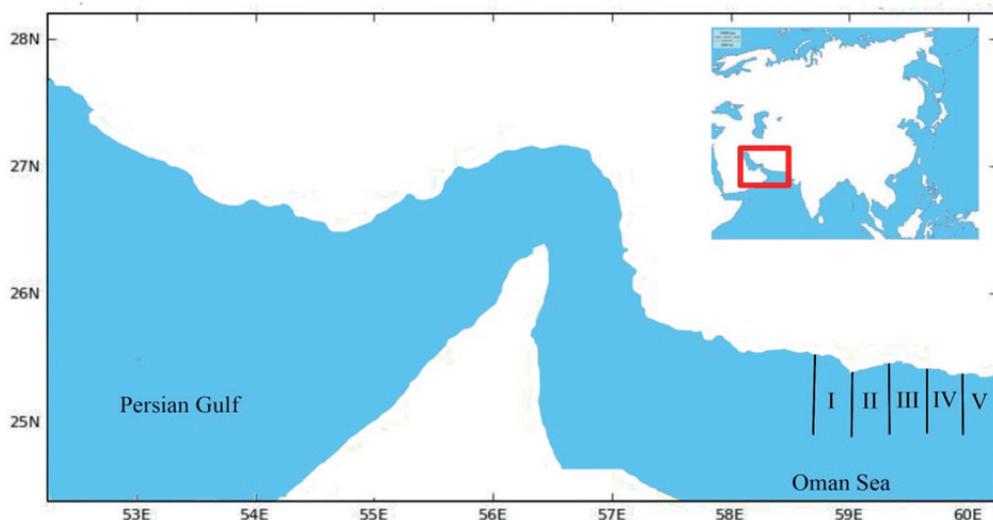

Figure 1. Map of sampling area along the Oman Sea

Table1. Number of trawl stations, stratum area, and location of each stratum in Oman Sea

Stratum	Geographical area		Area (nm²)	Number of stations
	Start	End		
I	58°55'E	59°25'E	116	7
II	59°25'E	59°55'E	180.9	12
III	59°55'E	60°25'E	235	13
IV	60°25'E	60°55'E	268.5	20
V	60°55'E	61°25'E	363.8	14

The following equations were used to calculate biomass and CPUA in trawl survey (Valinassab *et al*., 2006):

$$CPUA = Cw/a.$$

which the Cw is catch weight (kg), and a is swept area (nm²) for each hauling that is calculated by:

$$a = D.h.X_1$$

which D is the distance covered (nm), h is the headline height (m), and X_1 is the wing spread coefficient (is equal to 0.6). In addition, the biomass in each station substratum is calculated as follows (Sparre and Venema, 1998):

$$b = CPUA / X_2$$

which CPUA is catch per unit area in each station at different stratum, and X_2 is equal to 0.5 as the catch coefficient. Moreover, the total biomass is calculated by:

$$B = CPUA \times A / X_2$$

which A is the total area (nm²).

3. Results

Platycephalidae was the target family of this investigation amongst the total collected samples. Among all identified species, *G. suppositus* had the highest frequency (92%) and the main dominate species. The second dominate species was *P. indicus* with 8% of total platycephalidae catch. The total CPUA and biomass of Platycephalidae were estimated 268.9 kg/nm² and 124.8 tons and it included 1.01% of the total catch of demersal fishes from swept-area biomass and CPUA estimations from trawl survey. A comparison among different strata represented that the highest mean CPUA and biomass of *G. suppositus* were in stratum IV with 80.95 kg/nm² and 43.47 tons, respectively. Whereas the monitoring the CPUA and biomass showed that the lowest values were in strata I (19.50 kg/nm²), and V (9.18 tons) [Figure 2].
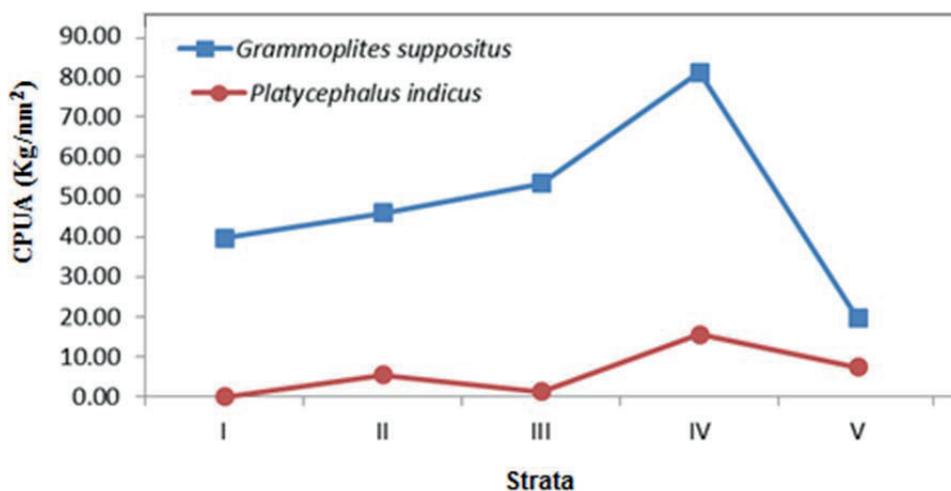

Figure 2. CPUA of *G. suppositus* and *P. indicus* for different strata in the Northern coast of Oman Sea
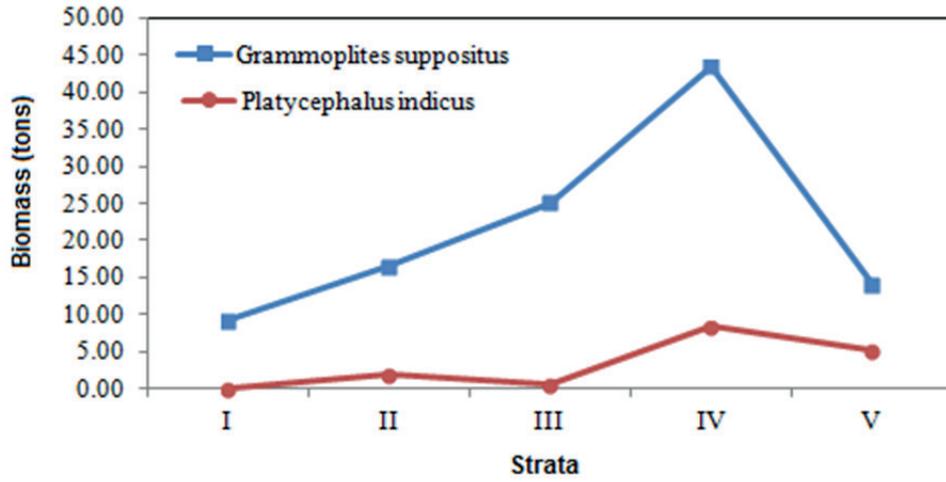
Figure 3. Biomass of *G. suppositus* and *P. indicus* for different strata in the Northern coast of Oman Sea
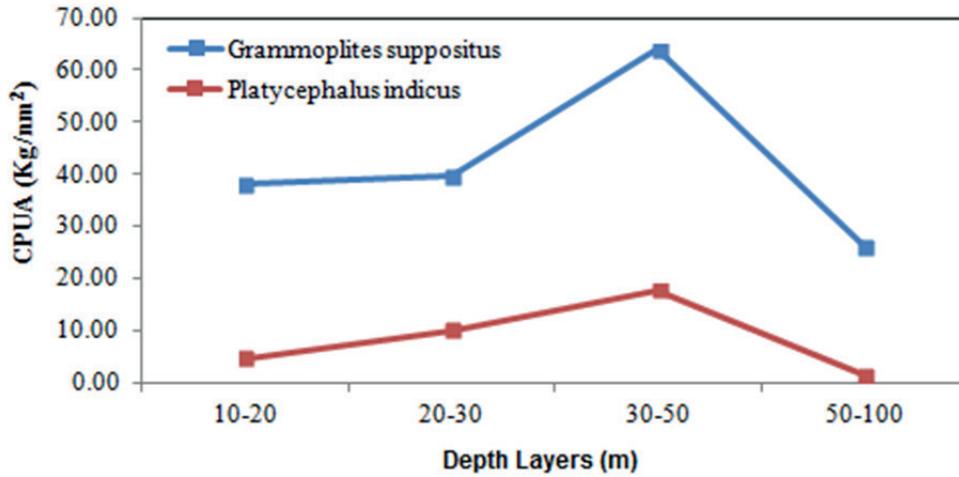

Figure 4. CPUA of *G. suppositus* and *P. indicus* for different depth layers in the Northern coast of Oman Sea
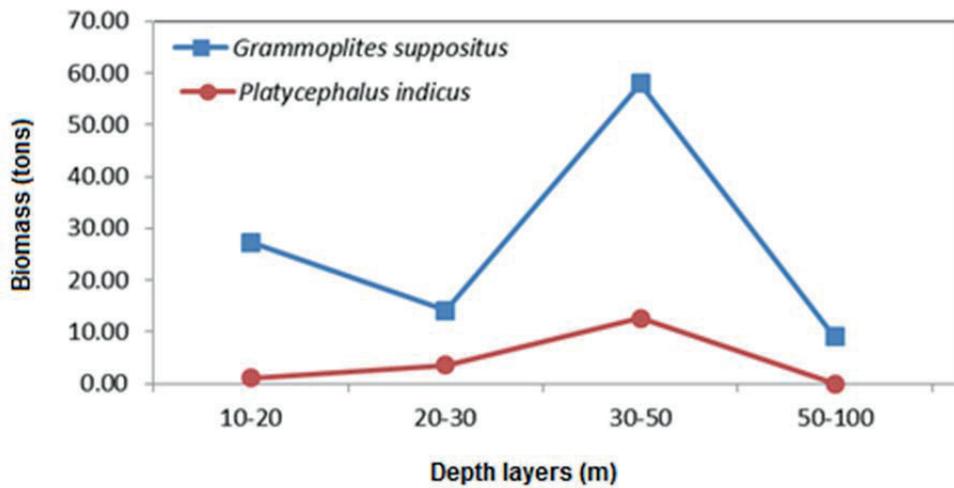

Figure 5. Biomass of *G. suppositus* and *P. indicus* for different depth layers in the Northern coast of Oman Sea

The results showed, the highest mean of CPUA and biomass of *P. indicus* were observed in stratum IV with 15.61 kg/nm² and 8.34 tons, respectively. In contrast, no *P. indicus* sample was observed in stratum I (Figure 3).

This comparison was conducted for different depth layers and the maximum CPUA (63.94 kg/nm²) and biomass (58.00 tons) of *G. suppositus* were observed in 30-50 m depth (Figure 3). While, the lowest values of CPUA (26.11 kg/nm²) and biomass (9.09 tons) of *G. suppositus* were observed in 50-100 m depth (Figure 4). Furthermore, the maximum CPUA (17.64 kg/nm²) and biomass (12.64 tons) of *P. indicus* were observed in 30-50 m depth. There was an ascending trend of CPUA and biomass with increase of depth. The mean CPUA (0.24 kg/nm²) and biomass (0.08 tons) of *P. indicus* decreased sharply to near zero value at a depth of 30 to 50 meters and reached to zero at depth of 50-100 meters (Figure 5).

4. Discussion

Biomass and CPUA evaluation can be used as a stock index for management of aquatic resource (Sparre and Venema, 1998). The present study was designed to determine the amount of CPUA and biomass of the commercial fish species, include G. suppositus and P. indicus for different strata and depth layers. The results found that strata IV had the highest value of CPUA and biomass, which can be considered as the main fishing area for these two species to recommend the fishermen to obtain their more commercial fishing activities in these strata. The main reasons of reducing the abundance of Platycephalidae in the stratum "I" may be due to overexploitation of fish, use of non-standard fishing equipments and gears, more catch per unit of effort (CPUE) for example lots of fishermen, boats, ships, and fishing gears especially gillnets. The study showed that total mean CPUA and biomass of Platycephalidae were 26.88 kg/nm2 and 12.48 tons, and it included 1.01% of the total catch of

demersal fishes. In fact, the CPUA for P. *indicus* in Iran increased from 8.3 kg/nm² in 2008 to 14.1 kg/nm² in 2011 (IUCN, 2016).

Valinassab *et al.* (2006) reported Platycephalidae was 1.4% of the total catch in a study on the abundance of demersal fish resources in the Oman Sea during 2003-2004. Possible reasons for the occurrence of such differences in CPUA and biomass may be due to tow duration, number of hauls, survey season, fishing gear and engine powder. As an overall review of Platycephalidae frequency of the total catch in current and previous studies, it can be concluded that excessive use of commercial fish stocks leads to decline in the Platycephalidae stocks in the Oman Sea. The current study found that in 30 to 50 meters depth, Platycephalidae population was in good condition. While, the minimum density of this family observed in deep layers (50 to 100 m). The maximum amount of biomass and CPUA of *G. suppositus* was from 10 to 50 meters (with emphasize on 30-50 m). These results are in line with Valinassab's findings, which performed a similar series of experiments in the 2013 and reported that the most biomass was in 30-50 m depth layer. In contrast, the maximum CPUA and biomass of *P. indicus* were found in 30-50 m depth, with an ascending trend with increasing the depth to 50 meters. These findings suggest that in general the best recommended depths for *G. suppositus* and *P. indicus* fishing is between 30 to 50 meters. In addition, it can be drawn from the present study that strata IV is the best fishing area from the point of higher density and distribution of Platycephalidae in the study area.

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