

Mortality, Exploitation and Yield per Recruit of Javelin Grunter, *Pomadasys kaakan*, in the Iranian Waters of the Persian Gulf

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Abstract: The Mortality, exploitation rate and yield per recruit of Javelin Grunter, *Pomadasys kaakan* from the Iranian waters of the Persian Gulf were studied. A total of 3498 specimens were monthly collected from different landings of Bushehr province between April 2009 and March 2010. The mean catch length in the study samples was 43 cm \pm 3 (24-63 cm). Total mortality (Z), natural mortality (M) and fishing mortality (F) were estimated as 1.16 year⁻¹, 0.57 year⁻¹ and 0.59 year⁻¹, respectively. The exploitation rate (E) was found as 0.5. Relative yield-per-recruit and biomass-per-recruit analyses gave $E_{max} = 0.49$, $E_{0.1} = 0.41$ and $E_{0.5} = 0.3$. Results show that the fish stock is moderately exploited in the study area.

Key words: Mortality • Yield per recruit • Javelin grunter • *Pomadasys kaakan* • Persian Gulf

INTRODUCTION

The Javelin grunter, *Pomadasys kaakan* (family: Haemulidae), is commercially important species [1]. It is distributed from eastern Africa, the Red Sea and the Persian Gulf to Serilanka. This species is one of the most abundant commercial fish in the Persian Gulf [2]. In the Persian Gulf, it is mainly caught by traps (locally named Gargoor) and Gillnets. The total annual catch of this fish was about 832 tons in Bushehr's water in 2008 [3]. Because of its commercial importance, a number of research studies have been carried out on *P. kaakan* in its distribution areas. Various aspects of its biology and population dynamics have been addressed, including studies of reproduction biology [4], growth and mortality [1, 5, 6] and food and feeding study [7]. The knowledge of exploitation status of fishes is necessary for fishery management. The objective of present study was to evaluate the status of *P. kaakan* and provide biological reference points and other pertinent information necessary for planning and management. Specific objectives are including mortality, exploitation rate and yield per recruit of this species from the Iranian water of the Persian Gulf.

MATERIALS AND METHODS

Length frequency data of the *P. kaakan* were collected monthly from commercial coastal artisanal

fisheries, North part of the Persian Gulf between April 2009 and March 2010. The fish species were selected randomly from three landing sites in the Bushehr province (Fig. 1). Total lengths of all samples were recorded to the nearest 1 cm. The length frequency data were analyzed using the FAO ICLARM Stock Assessment Tools II (FiSAT II) software for the estimation of the fish population parameters [8].

Natural mortality of Javelin Grunter was estimated from Pauly's [9] following multiple regression formula:

$$\ln M = -0.0152 - 0.279 \ln L_{\infty} + 0.6543 \ln K + 0.463 \ln T$$

Where M is natural mortality in a given stock, L_{∞} is asymptotic length, K is growth coefficient and the value of T is the annual mean temperature (in °C) of the surface water. Non seasonal growth parameters, L_{∞} and K, were estimated with Von Bertalanffy growth formula in the FiSAT computer programme [10].

From the estimate of growth parameters (L_{∞} , K), the instantaneous rate of total mortality (Z) was estimated using the length converted catch curve method [11]. The instantaneous fishing mortality (F) was taken as the difference between total and natural mortality; $F = Z - M$ and the exploitation rate (E) was calculated by the quotient between fishing and total mortality [12]:

$$E = F/Z.$$

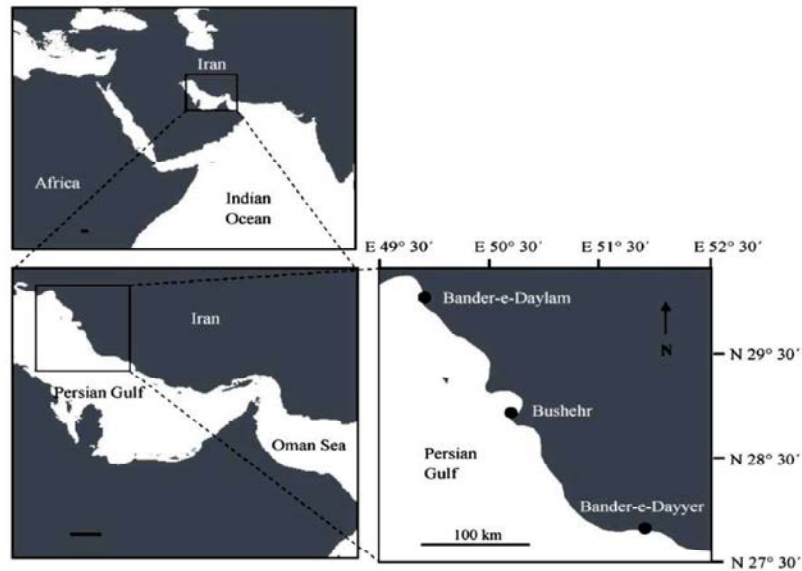


Fig. 1: Map showing the three locations sampled from the Persian Gulf, Iran

The probabilities of capture were estimated using backwards extrapolation of the length converted catch curve. A selectivity curve was generated by linear regression fitted to the ascending data points from a plot of the probability of capture against length, which was used to derive values of the lengths at capture at probabilities of 0.25 (L_{25}), 0.5 (L_{50}), 0.75 (L_{75}) and 1 (L_{100}). To evaluate the exploitation status of *P. kaakan*, relative yield-per-recruit (Y'/R) and relative biomass-per-recruit (B'/R) were estimated according to the Beverton and Holt model using the knife-edge selection [13].

RESULTS

A total of 3498 individuals have been collected throughout the 12 consecutive months (April 2009- March 2010). The length frequency data ranged from 24 to 63 cm TL and the mean length was 43 cm \pm 3 (Fig. 2).

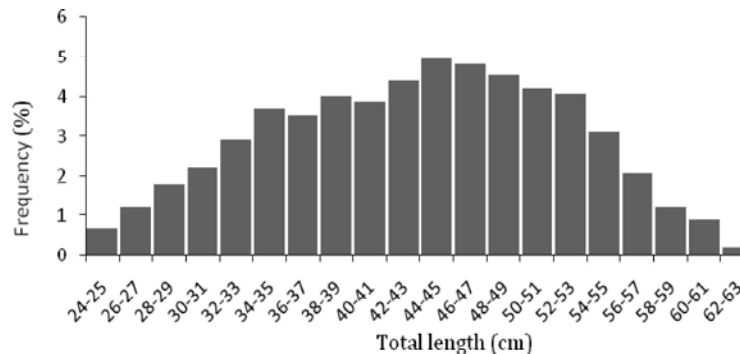


Fig. 2: Percentage frequency of length *P. kaakan* from Persian Gulf, Bushehr water (2009- 2010)

Mortality Rates: Using the empirical equation of Pauly, the growth parameters (L_{∞} , K) that calculated as 65.63 cm and 0.26 year⁻¹ respectively and the annual mean temperature of the surface sea (26°C), the annual instantaneous rate of natural mortality, M was estimated at 0.57 years⁻¹. The total mortality coefficient (Z), from length-converted catch curve was found to be $Z=1.16$ years⁻¹ (Fig. 3). The estimation of fishing mortality gave $F=0.59$ years⁻¹.

Exploitation and Yield per Recruit: Using the values of Z and F , the exploitation ratio (E) estimated at 0.5. The value of M/K ratio was found to be 2.19. The relative yield-per-recruit analysis showed the following values: The level of exploitation which lead to maximum sustainable yield (E_{max}) = 0.49, a marginal increase of relative yield per recruit which is 0.1 of its value at $E=0$. ($E_{0.1}=0.41$) and a reduction in the stock to 50% of its unexploited size ($E_{0.5}=0.3$) (Fig. 4).

Table 1: Various mortality rates estimated for *P. kaakan* from different locations

Locality	Z	F	M	Reference
Persian Gulf (Kuwait)	0.24- 0.36	-	0.2	Al-Husaini <i>et al.</i> , 2002
Persian Gulf (Kuwait)	0.87	0.47	0.4	Lee <i>et al.</i> ,1992
Persian Gulf (Iran)	1.2	0.62	0.58	Fakhri <i>et al.</i> , 2011
Persian Gulf (Iran)	1.16	0.59	0.57	Present study

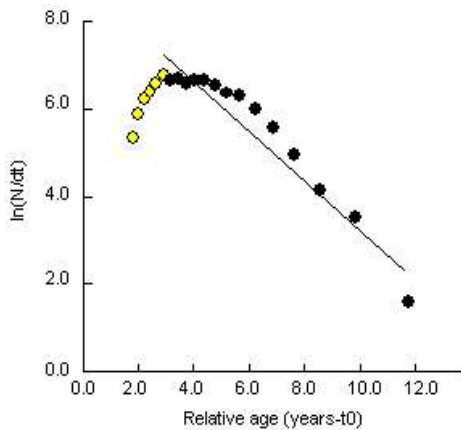


Fig. 3: Length-converted catch curve for *P. kaakan* collected from Persian Gulf (2009- 2010)

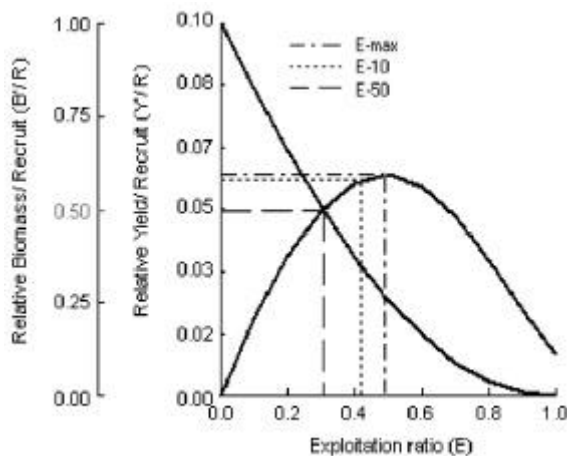


Fig. 4: Yield per recruit (Y'/R) and biomass per recruit (B'/R) analyses for *P. kaakan* collected from Persian Gulf (2009- 2010)

DISCUSSION

P. kaakan is mainly exploited by gillnets and traps in the Persian Gulf. The maximum catch length of individual in the study was 63 cm TL and mean length was 43 cm±3. This is in agreement with Valinasab *et al.* [2] that obtained the maximum length of 61 cm TL in the Persian Gulf. Our estimate of the total mortality, Z was in agreement with the estimates of Fakhri *et al.* [5] from the same area but it was upper than the estimates of Al-Husaini *et al.* [1] from

Kuwait waters. The estimated value of natural mortality was similar to the results of Lee *et al.* [14], Fakhri *et al.* [5], but differences were found between the present study and Al-Husaini *et al.* [1]. The reliability of the estimated natural mortality, M was ascertained using the M/K ratio because it has been reported within the ranges of 1.12-2.50 for most of the fish [15]. The value of this ratio was 1.52 in the present study and it was within the range of 1.12- 2.50, so the natural mortality estimated for this species was reliable. The dynamic mathematical models [15, 16], were useful for predicting future yields and fisheries management. From the relative yield-per-recruit analysis, the computed current exploitation rate $E_{cur} = 0.5$ is approximately similar to the values of $E_{max} = 0.49$. In conclusion, this study provides the exploitation status for *P. kaakan* in the Northern part of Persian Gulf, Bushehr, Iran. The results indicated that this species is moderately exploited in the region.

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