

Population Dynamics of the Tigertooth croaker, *Otolithes ruber* in the Persian Gulf

Nassir Niamaimandi
Persian Gulf Fisheries Research Center – Bushehr
E_mail:
HYPERLINK "mailto:nmairandi@yahoo.com"
nmairandi@yahoo.com

ABSTRACT:

Growth parameters and mortality of the tigertooth croaker (*Otolithes ruber*) were estimated from length frequency data collected during trawl surveys in the Persian Gulf (Bushehr waters) from 1997-1998. LFDA and FiSAT Programs were used for data analyses. Growth parameters were estimated as $L_{\infty} = 58$ cm and $K = 0.8$ per year. The estimate of total mortality is $Z = 2.7 \text{ year}^{-1}$ giving a fishing mortality of $F=1.46 \text{ year}^{-1}$ and on exploitation ratio of $E = 0.55$. Natural mortality was estimated from the Pauly's formula (1980) which resulted in $M=1.24 \text{ year}^{-1}$. Biomass estimation of swept area survey in 1994 was applied to calculate MSY. The MSY of *Otolithes ruber* is assessed between 145.8-154.4 tonnes. Results of the research indicate the fishery is operating very close to its maximum sustainable yield (MSY) level and that no further increase in fishing effort is advisable.

INTRODUCTION:

Bushehr is located in the middle part of northern Persian Gulf. Total landings of *Otolithes ruber* in this area by artisanal fishery are approximately 1000 t. annually with a fluctuation (381 tonnes-1187 tonnes) for the past few years. Tigertooth croaker (*Otolithes ruber*) locally called "Shorideh", for domestic consumption is one of the most economically species.

Generally, bottom trawling in the Persian Gulf (Iranian waters) has been banned since 1991. The exception is the shrimp season of approximately two months taking place in August-September. Gillnets are the primary fishing gear utilized for harvesting the tigertooth croaker.

In the Bushehr area three studies have been completed to assess growth parameters, mortality and biomass of this species. Continued research of growth and mortality estimates for this species is under way. Project's objective is to obtain new information for comparison to previous data which will result in better management decisions.

MATERIALS AND METHODS:

The Persian Gulf is a shallow sea basin. Average water depth of study area is 25m, and maximum depth is 75m. The study Covered the whole Bushehr area with water depths raging from 10 to 75m.

Samples were collected aboard research vessel Lavar 2 from October 1997 to September 1998. Lavar 2 is a trawler with a 40mm mesh cod-end. Head rope and ground rope were 24 and 27m, respectively. Trawling speed averaged 3 knots and haul duration one hour (Figure 1). Monthly survey operations were carried out at 23 fixed stations. Total length was measured to nearest centimeter. Data was processed with FiSAT and LFDA programs to estimate growth and mortality. Natural mortality (M), was obtained from Pauly (1980) as follows:

$$\log_{10} M = 0.0066 - 0.0279 \log_{10} L_{\infty} + 0.65431 \log_{10} K + 0.4634 \log_{10} T$$

Where T was set equal to the average annual temperature of the Bushehr waters.

Using the above estimate of L_{∞} and K , a length – converted catch curve was constructed applying the pooled data set over all months. From the analysis of the length – converted catch curve an estimate of Z was obtained. Together with the assumed value of M this estimate of Z was used to obtain fishing mortality (F) and exploitation rate $E = F/Z$.

The measured biomass by the swept area method and average of annual catch in 1994 was applied to estimate MSY. Cadima formula (or Troadec,1977) was used to estimate MSY.

$$MSY = 0.5 \times Z \times \bar{B}$$

$$MSY = 0.5 \times (Y + M \times \bar{B})$$

Where Z is total mortality, \bar{B} is biomass in winter by swept area method and Y is total of winter catch.

RESULTS:

The estimation of growth parameters was at first carried out using the length frequency data grouped into 3cm class intervals.

Over all, it was found that 4 cm class intervals produced modes, which were easier to interpret. Therefore, 4cm classes were used to estimate the growth and related parameters.

FiSAT and LFDA programs estimated the values of K, L_{∞} and t_0 . The best estimation of K and L_{∞} obtained from FiSAT while LFDA produced the best estimate of t_0 . As a first step, curve fitting by eye was used to find a good starting point. Next, the response surface was inspected to find the best values of L_{∞} and K. The best estimates K and L_{∞} are respectively 0.8 year^{-1} and 58 cm (Figure 2).

Using the Pauly's empirical formula, a value of 1.24 is obtained for natural mortality, at an average temperature of 26 °C. Basic data requirements for the estimation of Z are observed length distributions represented over an annual period. Graphical representation of catch curve is exhibited in figure 3. The estimate of Z is 2.7 and the fishing mortality F is therefore $2.7 - 1.024 = 1.46$. The exploitation rate becomes $E=F/Z=0.55$. Using L(and K in the LFDA program, the constant t(was estimated to be -0.3 year.

MSY (Maximum Sustainable Yield) was estimated by the Troedec formula (1977). Two data formulae were used as follows:

$$MSY = 0.5 \times Z \times \bar{B} = 0.5 \times 2.7 \times 108 = 145.8 \text{ tonnes (1)}$$

$$MSY = 0.5 \times (Y + M \times \bar{B}) = 0.5 \times (179 + 1.2 \times 108) = 154.4 \text{ tonnes (2)}$$

In formula 1, Z is total mortality and (B is value of biomass, was obtained in 1993 (winter) by swept area method. In formula 2, where Y is total catch, M is natural mortality and (B is biomass in 1993. The MSY of tigertooth croaker using of two data (formula 1 and 2), had a differentiation of about 9 tonnes.

DISCUSSION:

In Iranian waters of the Persian Gulf five trawl survey projects have been completed on *Otolithes ruber* from 1990 to 1998. Estimation of growth and mortality parameters was an objective of all five projects. Results of these estimates are shown in table1.

Table 1) The growth and mortality parameters of *Otolithes ruber* in the Persian Gulf (Iranian waters)

YEAR	AREA	L_{∞} CM	K YEAR ⁻¹	M	F	Z	E
1990	Bushehr	50	1.5	1.95	1.72	3.67	0.47
1991	"	56	1.2	1.6	2	3.6	0.55
1992	Hormozgan	61.5	0.32	0.62	1.91	2.6	0.74
1993	Khozestan	46.6	0.43	0.83	1.35	2.18	0.61
1998	Bushehr	56	0.8	1.24	1.46	2.7	0.55

The estimated growth parameters for two years 1990 and 1991 in Bshehr aren't significantly different, but in

1998, K exhibited a decline. The Q values ($\text{Log } K + 2 \text{ Log } L_{\infty}$ / Pauly and Munro, 1984), lie between 8.23 in 1990, 8.23 in 1991 and 7.82 in 1998. In the other area (Hormozgan and Khozestan provinces), there is a significant difference in growth parameters. It seems in the Iranian waters of the Persian Gulf there are two populations of *Otolithes ruber*.

Comparing the mortality coefficient (Z, F, M) and exploitation rate (E) different years and different area, over fishing is evident in Hormozgan in 1992. (Over fishing occurs if $M \leq F$ or $E > 0.5$, Golland, 1971). But in Bushehr waters after increase of fishing mortality and exploitation rate from 1990 to 1991, these coefficients are more or less constant in 1998. In the Persian Gulf (Iranian waters), trawling has been banned from 1991 and it just open for two months (August and September) for shrimping season. This is an assumption that, prohibition of trawlers had a positive effect on the demersal resources.

The peak of the catch of *Otolithes ruber* in Bushehr waters is in the winter season. For this study peak season has been used for the estimation of MSY. Comparing the total catch in winter (179 tonnes) and estimations of MSY (145.8 – 154.4 tonnes), or exploitation rate (0.55), the data indicates the fishery is operating beyond the maximum sustainable yield and no further increase in fishery effort is advisable.

REFERENCES:

Gulland, J. A., *The fish resources of the ocean*, FAO/Fishing news book, 1971.

Pauly, D., *On the interrelationships between natural mortality, growth parameters, and mean environmental temperature in 175 stocks*, 1980.

Pauly, D. and Munro, J. L., *Once more on growth comparison in fish and invertebrates*. Contribution to tropical fisheries biology. P: 81, 1984.

Parsamanesh, A., *The annual report of the stock assessment of marine resources in the Khozestan area*, 1993.

Razmjou, G. et al., *Final report of the stock assessment of marine resources in the Hormozgan area*, 1992.

Troade, J. P., *Methods semi-quantitative devaluation FAO circ. Peches*, 1977.