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STUDY ON BIOLOGICAL CHARACTERISTICS OF *PARASTROMATEUS NIGER* IN THE SEA OF OMAN (COASTAL WATERS OF SISTAN AND BALUCHISTAN PROVINCE)

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ABSTRACT
Parastromateus niger is one of the most important species which studied in the project of "stock assessment of demersal resources by swept area method in the Oman sea (2004-2005). A series of 4 research cruises were conducted by R/V Ferdows_1. the area which studied was from Meidani (58° 55' E) to Gwatre Bay (61° 30' E) having depths of 10 to 100m.The studied area of 1164 n.sq.mil was divided in to 5 sub regions (A, B, C, D&E) each covering 30Minutes width, each region was divided in to 4 depth stratum: 10_20, 20_30, 30_50 and 50_100 meters. In each cruises, sampling was carried out for more than 90 stations using a bottom trawler. The seasonal and annual biomass for each region and stratum was estimated. The average annual biomass for the whole area was calculated to be 616.37 tons and for each stratum of 10_20, 20_30, 30_50 and 50_100 m. indicating 276.62, 105, 66.5 and 168.27 tons respectively. It is clear that the maximum biomass located at the depth of 10_20 m. where the minimum found at the depth of 30_50 meters. The annual average biomass for different region of A, B, C, D and E was calculated as 75.27, 48.91, 224.03, 97.64 and 170.53 tons respectively. The fork length and total weight of 1258 specimens of p. niger were measured that fork length ranged from 14.5- 58.5 centimeters. Comparing of distribution patterns indicated that the p. niger inhabits mainly in front of estuary of Galak, Gordim and the head of Pozm. The seasonal and annual parabolic equations of length weight relationship were studied.
In this regard, there was no significant difference between seasonal and annual b_value with each other's.

KEY WORDS: *Parastromateus niger, Sea of Oman, stock assessment, demersal resources.*

INTRODUCTION

This is one of the most important species of commercial fishes, its flesh being highly appreciated and often occurring in large landings along the coastal line of the Oman Sea (Chabahar coastal waters) from east to west such as Gwatre, Passabandar, Beris, Ramin, Chabahar, Ties, Konarak, Pozm, Tang and Galak. local fishermen catch many kinds of aquatic animals by using different kinds of fishing gears and were improving methods of fishing according results of research projects that were carried out every year. For compensating of decrease of catches had chosen some policies like: entering to far sea waters (African waters) and to increase numbers of fishing gears and in some cases were used illegal gears.

An important fishery for *P. niger* has developed in Chabahar and usually separate statistics is reported. Mohammad khani, 1995 reported total landings of about 666.1 ton in 1994. With respective above mentioned and importance of catch and effort and also supporting and conservations of aquatic animals against over fishing and applying optimal management for sustainable exploitation caused be done the project: assessment of demersal resources by swept area method in the Sea of Oman in the offshore fisheries research centre Chabahar by using of ferdows_1 research vessel from meidani (west) to Gwater bay (east).

The main goals were: assessment of demarsal resources on the base of depth layers and strata at the different times of year until requested measurements were done for optimal fishing management and exploitation and the other was obtaining of zoogeographical distribution pattern for aquatic species. Sampling was done by bottom trawl in the depth layers 10- 20, 20- 30, 30-50 and 50 – 100 meters and hauling time was one hour per station.

MATERIALS AND METHODS

In this research was used the research vessel Ferdows 1 that its characteristics are as follows;

1. Total length: 45.4m
2. Wide: 10m
3. Capacity: 673 ton.
4. Max draft: 3.8m
5. Main power: 1600HP
6. Velocity: 12knot

And also it was equipped with navigation equipments such as colored ecosounder, GPS, RADAR, platter and wireless HF and VHF.

Bottom trawl net

1. Mesh size: 400 to 80 mm from mouth to sac.
2. Length: 62.4m 3. length of head rope: 50m
4. Length of foot rope: 30m

For biometric works were used:

1. Digital scale: (1 gr) 2. General scales (20 and 50 gr)
3. Biometric board: (1cm) 4. Loop Nikon
5. Planimeter

For analysis data were used some Excel software stat graph and spss.

METHODS

The studied area of 1164 n. sq.mil.(58 55 61 30) having depth of 10 to 100m was divided to 5 sub region A,B,C,D and E that each covering 30 minutes width and the last was 35 minutes. Each region was divided in to 4 depth stratum: 10 - 20, 20-30, 30-50 and 50-100m. The area of each stratum was calculated by planni meter (table 1). With respective of velocity of vessel for hauling (3 knots) and the bed of studied area divided to rectangles of 1*3 n. sq.mil (20). For determining the place of each station, having of sub region, stratum and number of stations was used randomized numbers table.

Marine cruises

Geographical positions of determined stations (more than 90) in each cruise were recorded and addition a log sheet was used for recording of requested data. Sampling was done from west to east. Hauling time per station was 1 hour and after finishing trawl net was opened on shipboard and total measurements were done according Sparre and venema, 1992. At last after filling catch data sheet with respective area of each stratum, average of CPUA and catch ability coefficient (0.5) amount of biomass was calculated.

Area swept biomass analysis

Briefly, biomass estimates are made for each species using the area swept methods of Alverson and pereyra (1969). The formula for catch per unit area swept by the trawl for each species k in haul j within stratum i ($CPUA_{ijk}$) is:

$$\mathbf{CPUA_{ijk} = W_{ijk} / (D_{ij} * T_{ij}) * C_{jk}}$$

Where Wijk is the weight of each species in haul j, Dij is the distance trawled during haul j, Tij is the trawl width and Cjk is the catch ability probably varies considerably between species and stations, there is no practical method for measuring this parameter. The area swept by the trawl is the products of the distance fished and trawl width. The mean CPUA for a strata with n_i stations is then:

$$\mathbf{CPUA_{ik}} = \sum_{j=1}^{ni} \mathbf{CPUA_{ijk} / n_i}$$

And the biomass estimate, B_{ik} is:

$$\mathbf{B_{ik} = Area_i * CPUA_{ik}}$$

Where $Area_i$ is the total area of stratum $_i$.

Length weight relationship

The length weight relationship was calculated using the formula: $W=aL^b$ (16), where W is the weight of the fish in grams and L is the length of the fish measured in centimeters. The parameter a (proportionality constant) and b (regression coefficient) of the length weight relationship were estimated by the method of least square regression (Zar 1984). The significance of variation in the estimate of b from the expected value B (=3) for an ideal fish was tested by the t-test (12) in 4 seasons: $t=b-B/S_b$

RESULTS

1. Length frequency

The fork length range was 14.5-58.5cm which classified 2cm intervals using the sturge's Rule (7). Figs 1_4 show length frequency data on the base of four seasons that the ranges of length in the spring, summer, autumn and winter were 14.5-52.5, 16.5-56.5, 16.5-56.5 and 18.5-58.5cm respectively. Maximum frequency in the seasons observed in the average of length intervals 28.5, 32.5, 26.5and 30.5cm respectively. The number of biometric data in the four seasons was 334,333,188 and 403 specimens respectively and in totally was 1258 specimen. Fig 5 shows maximum frequency observed in the length size of 30.5 cm and in fact the length sizes from 24.5-34.5cm are considerable in this case.

2. Length weight relationship

Figs 6_9 show seasonally length weight relationship of P.niger and the fig 10 shows annually equation. The parabolic equations are as follows:

Fig 6(spring): $W=0.0218FL^{3.0297}$, $R^2=0.9657$, N=334 and $Se_{(b)}=0.0313684$

Fig 7(summer): $W=0.0675FL^{2.7172}$, $R^2=0.9458$, N=333 and $Se_{(b)}=0.0362427$

Fig8 (autumn): $W=0.0389FL^{2.8631}$, $R^2=0.9583$, N=188 and $Se_{(b)}=0.0437663$

Fig 9(winter): $W=0.0832FL^{2.6575}$, $R^2=9438$, N=403 and $Se_{(b)}=0.0323723$

Fig 10(annually): $W=0.0562FL^{2.7668}$, $R^2=0.958$, N=1239 and $Se_{(b)}=0.0385532$

Variations of determination of coefficient weren't high value throughout the year. The value of R^2 ranged from 0.9438-0.9657. The value of b ranged from 2.6575-3.0297.

The value of $Se_{(b)}$ ranged from 0.031-0.044.

Table1. The Area of each depth layers (N. sq. mil), percent and number of stations (2004-2005).

Region	longitude	10 _ 20			20 _ 30			30 _ 50			50 _ 100			Sum	%	Staion no.
		Area(N.sq.mil)	Staion no.	%	Area(N.sq.mil)	Staion no.	%	Area(N.sq.mil)	Staion no.	%	Area(N.sq.mil)	Staion no.	%			
A	58 55 59 25	21.12	2	18.19	9.43	2	8.12	13.78	2	11.9	71.68	6	41.7	116	10	10
B	59 25 59 55	37.3	3	20.6	21.03	3	11.6	32.8	3	18.2	89.8	7	49.6	181	15.5	16
C	59 55 60 25	74.1	6	31.5	31.8	3	13.5	28.7	3	12.3	100.4	8	42.7	235	20.2	20
D	60 25 60 55	54.2	4	20.2	30.3	3	11.3	47.9	4	17.8	136.1	11	50.7	269	23	22
E	60 55 61 30	171.6	10	47.2	85.7	7	23.5	50.9	4	14	55.6	3	15.3	364	31.3	24
sum	58 55 61 30	358.40	25	30.7	178.3	18	15.3	174.2	16	15	453.6	35	38.9	1164	100	94

Table2. Seasonal and annual estimation of biomass of P.niger (ton) in the base of strata in the Oman Sea 2004-2005

Row	season	10--20	20-- 30	30-- 50	50--100	Sum
1	Spring	102.69	41.52	57.11	452.54	653.86
2	Summer	495.80	124.57	14.90	0.00	635.27
3	Autumn	139.65	130.00	43.93	19.73	333.31
4	Winter	368.35	123.85	150.05	200.80	843.05
Annual average		276.62	104.99	66.50	168.27	616.37

Table3. Seasonal and annual estimation of biomass of P.niger (ton) in the base of region in the Oman Sea 2004-2005.

Row	season	A	B	C	D	E	Sum
1	Spring	89.69	13.18	404.04	69.84	77.11	653.86
2	Summer	36.94	81.89	228.86	71.34	216.24	635.27
3	Autumn	47.36	33.02	65.32	39.55	148.06	333.31
4	Winter	127.08	67.53	197.91	209.84	240.69	843.05
Annual average		75.27	48.91	224.03	97.64	170.53	616.37

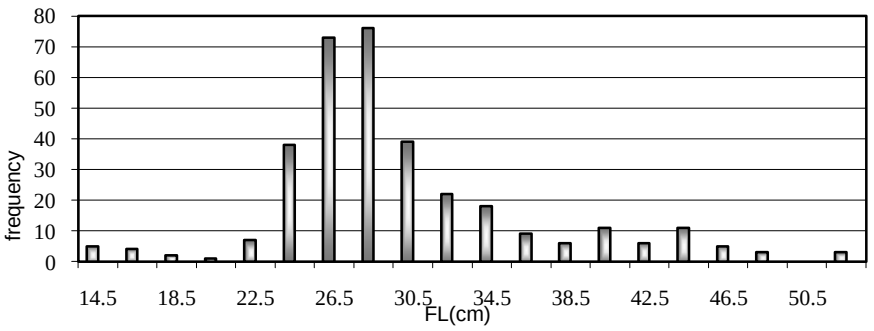


Fig 1: length frequency of *P. niger* in the Oman Sea , Spring 2004-2005

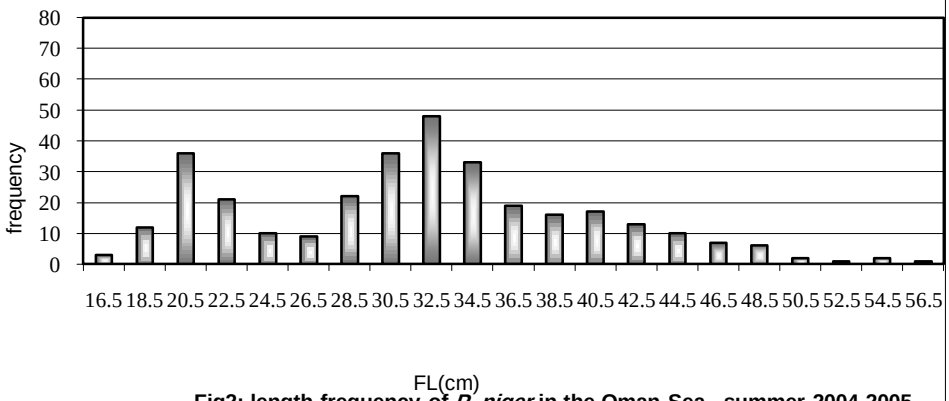


Fig2: length frequency of *P. niger* in the Oman Sea , summer 2004-2005

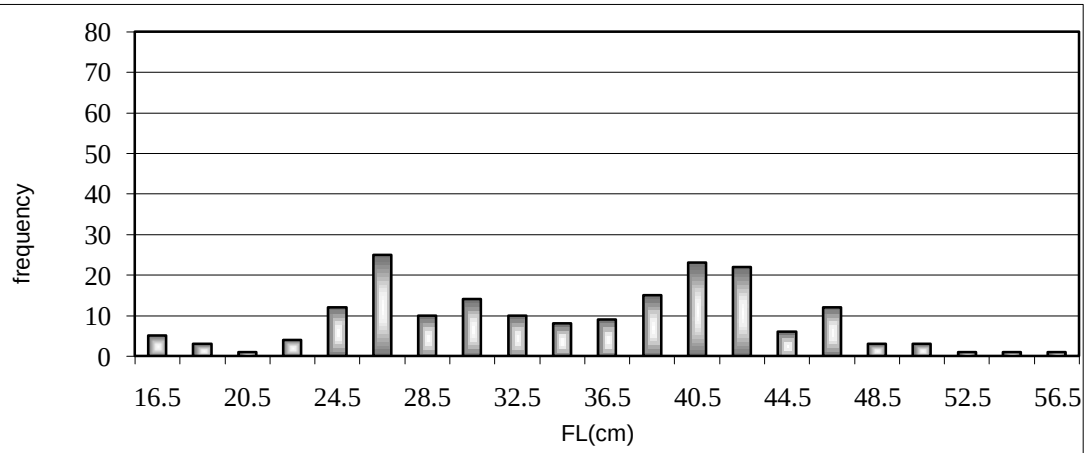


Fig 3: length frequency of *P. niger* in the Oman Sea , Autumn 2004-2005

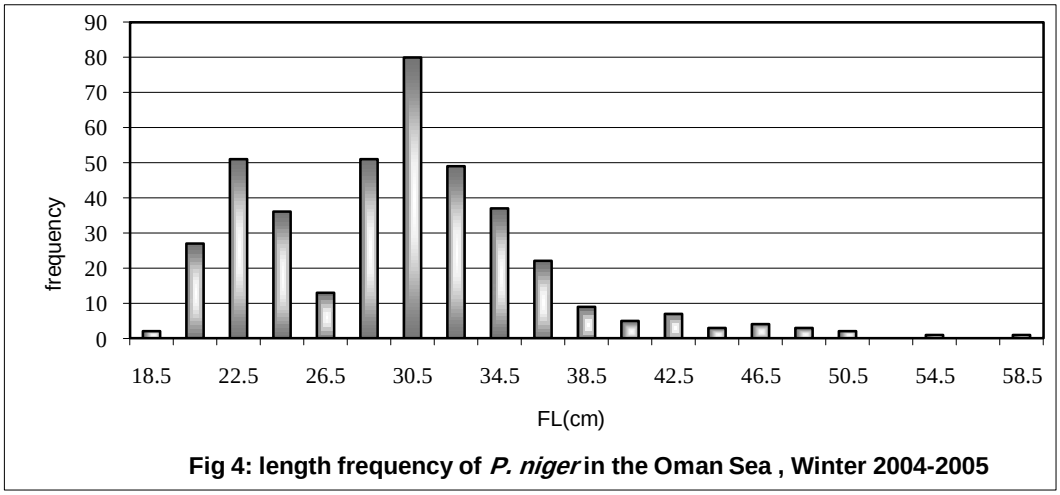


Fig 4: length frequency of *P. niger* in the Oman Sea , Winter 2004-2005

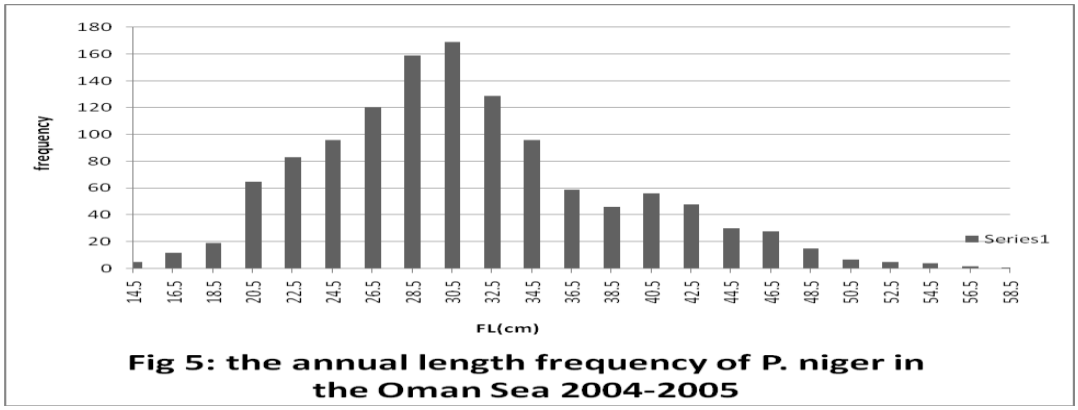


Fig 5: the annual length frequency of P. niger in the Oman Sea 2004-2005

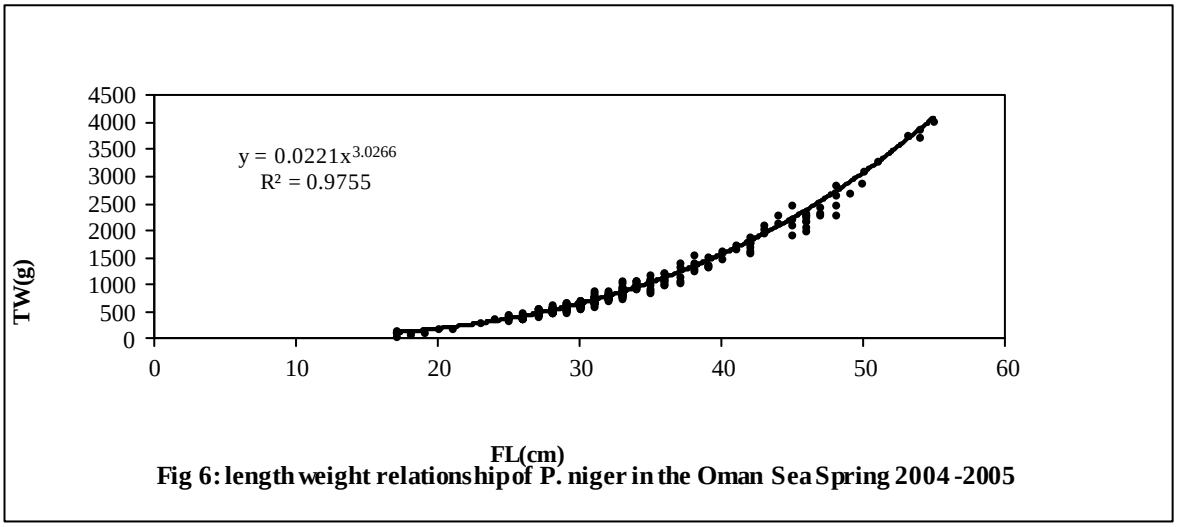


Fig 6: length weight relationship of P. niger in the Oman Sea Spring 2004 -2005

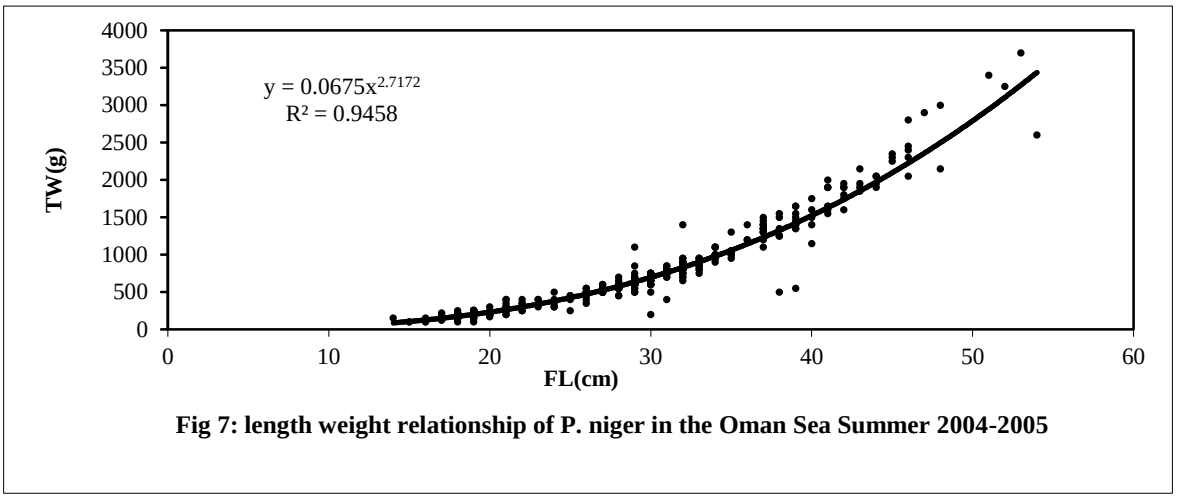


Fig 7: length weight relationship of P. niger in the Oman Sea Summer 2004-2005

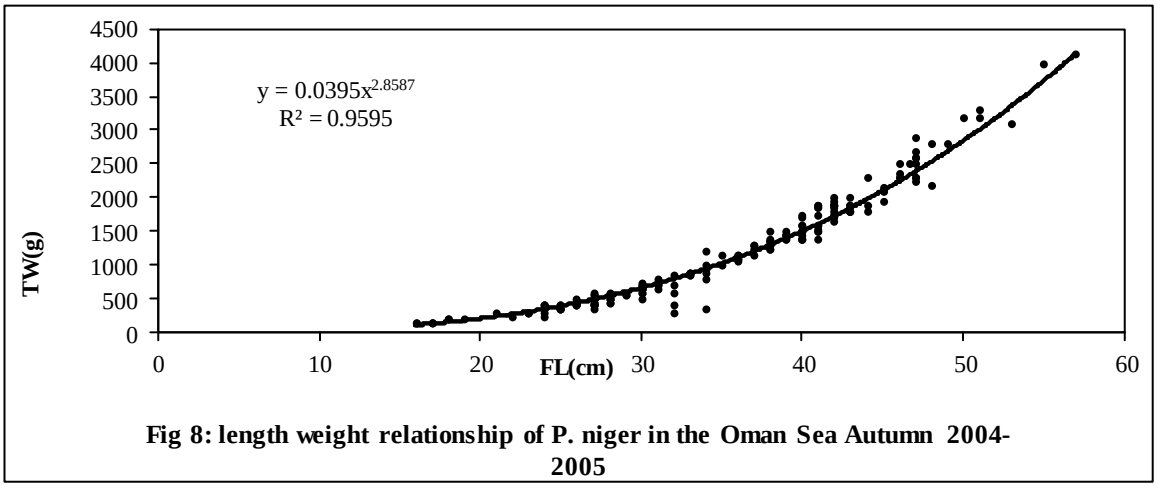


Fig 8: length weight relationship of P. niger in the Oman Sea Autumn 2004-2005

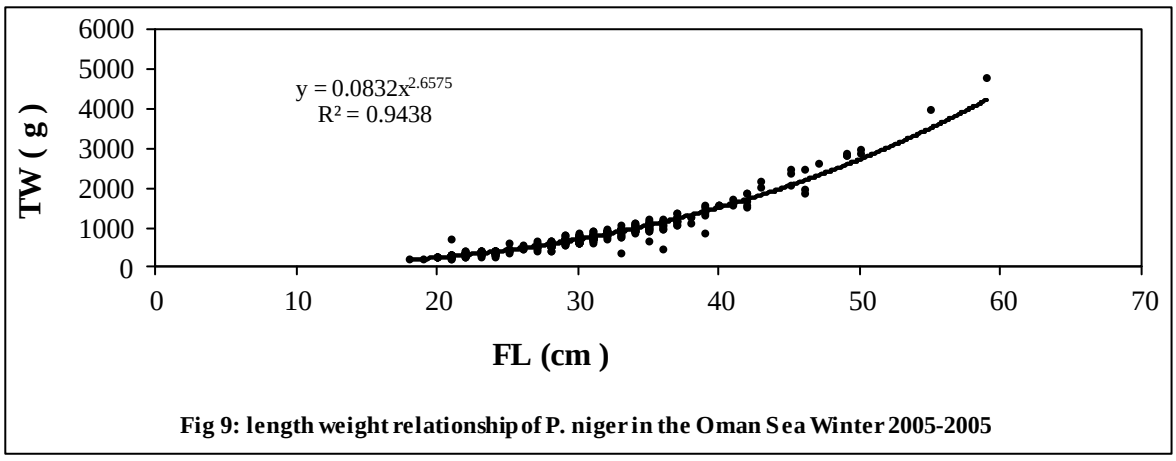


Fig 9: length weight relationship of P. niger in the Oman Sea Winter 2005-2005

Fig 11 : Geographical distribution pattern of black pomfret (P.niger) in the Oman sea (Chabahar coastal waters)
Spring 2004-2005

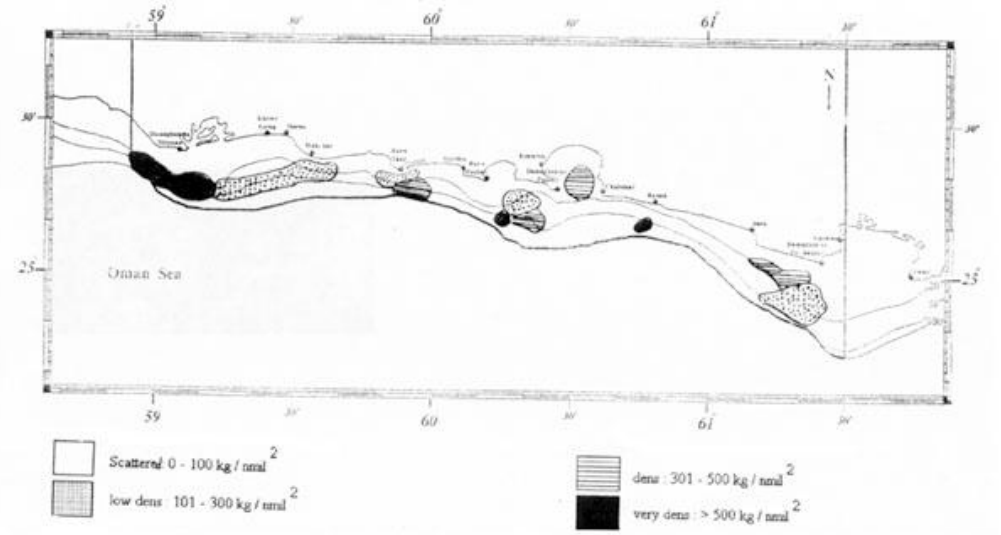


Fig 12 : Geographical distribution pattern of black pomfret (P.niger) in the Oman sea (Chabahar coastal waters)
Summer 2004-2005

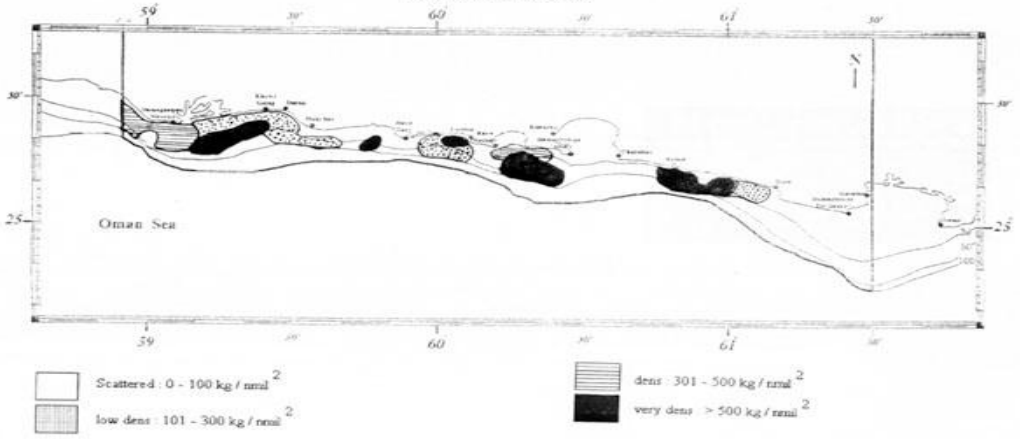


Fig 13 : Geographical distribution pattern of black pomfret (P.niger) in the Oman sea (Chabahar coastal waters)
Autumn 2004-2005

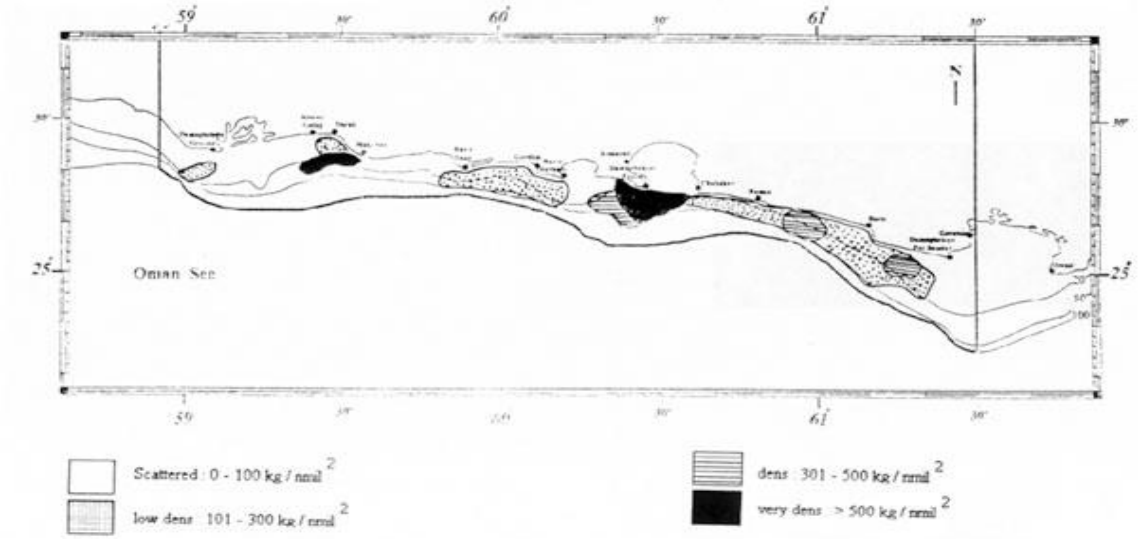
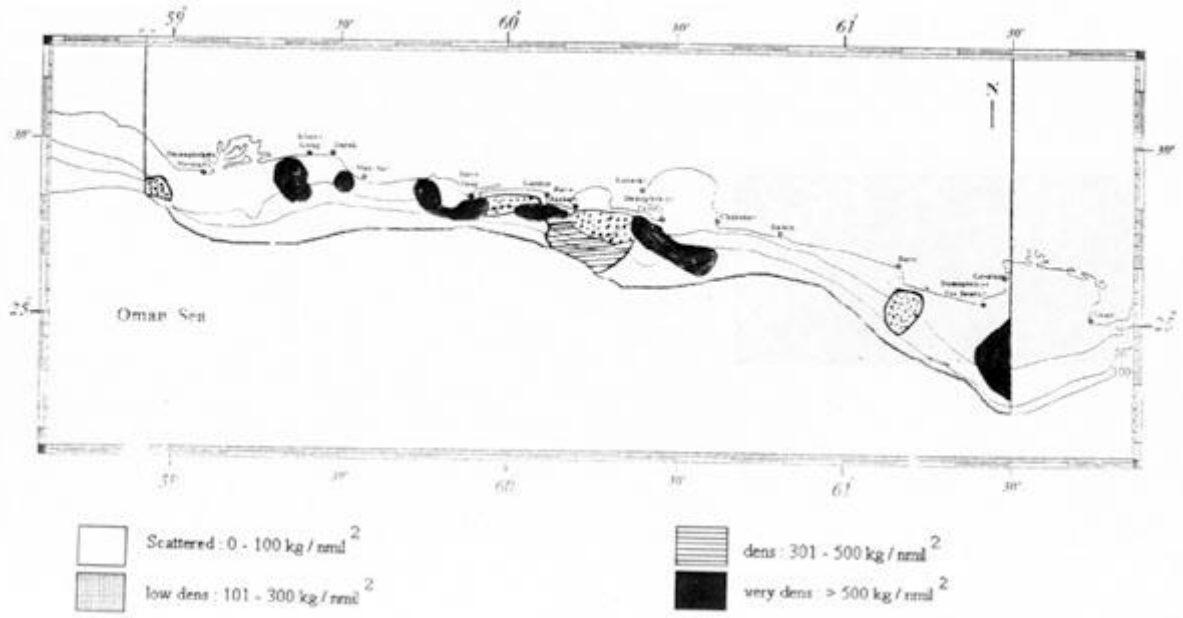
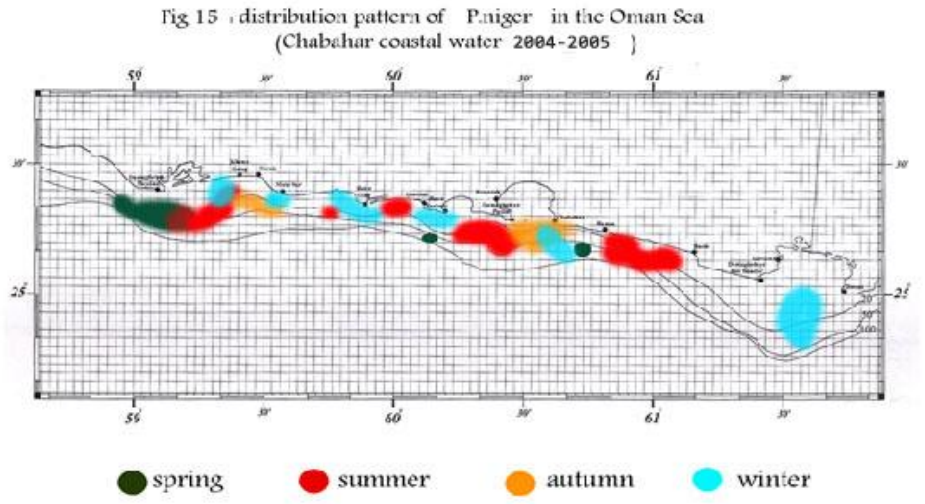


Fig 14 : Geographical distribution pattern of black pomfret (P.niger) in the Oman sea (Chabahar coastal waters)
Winter 2004-2005





3. Zoogeographical distribution pattern

The amount of calculated CPUA per stations for P. niger was used for preparing distribution pattern and then according countering method (20) were obtained as follows:

Scattered: shows very low dense of CPUA which calculated less than 100 kg per nautical square mile.

Low dense: shows amount of CPUA from 101-300 kg per n.sq.mil.

Dense: shows amount of CPUA from 301-500 kg per n.sq.mil.

Very dense: shows amount of CPUA more than 500 kg per n.sq.mil.

Fig 11 shows distribution of P. niger in spring season that all patterns obtained as follows: **Very dense area**: found facing of the head of Meidani, Gordim and Ramin. **Dense area**: found confronting of the head of Tang, Pozm, Chabahar bay, and Passababdar. **Low dense area:** observed in front of estuary of Galak**,** Darak, Makisar, Tang (inshore), Pozm (inshore) and Passabandar (offshore) and the other area were scattered.

Fig 12 shows distribution in summer. All patterns determined as follows: **very dense area:** facing of estuary of Galak (offshore), Tang, Gordim (inshore), the head of Rashedi and Ramin. **Dense area**: confronting of the head of Median and Rashedi till Pozm. **Low dense area:** in front of Median till Makisar (inshore), Tang, Gordim and Beris (inshore).and the other area were scattered. Fig 13 shows distribution in the autumn. All patterns determined were as follows: **Very dense area:** a head of Darak and Gulf of Pozm. **Dense area**: confronting of Pozm, Lipar and Passabandar. **Low dense area:** across of Tang till Pozm, Chabahar till Lipar and Beris. The other areas were scattered. Fig 14 shows distribution in the winter and all patterns determined were as follows: **Very dense area:** confronting of estuary of Galak, Darak, Tang, Rashedi, Pozm and Passabandar. **Dense area:** a head of Gordim (offshore)**. Low dense area:** facing of Gordim (inshore).

Estimation of biomass

Table 2 shows the annual and seasonal estimated biomass on the base of stratum which in the spring, summer, autumn and winter indicating 653.86, 635.27, 333.31and 843.05tons respectively. It is clear in the spring season maximum biomass lies at the depth 50-100m whereas minimum found at the depth 20-30m. In summer maximum biomass was estimated at the 10-20m and P. *niger* was not caught at the depth of 50-100m. In autumn maximum and minimum biomass were estimated at depths 10-20 and 50-100m respectively and in winter maximum and minimum of biomass were estimated at depths of 10-20 and 20-30m respectively. And also table 2 shows annually biomass of depths 10-20, 20-30, 30-50 and 50-100m indicating 276.62, 104.99, 66.50 and 168.27tons respectively. Table 3 shows estimated biomass of sub region A, B, C, D and E were calculated 75.27, 48.91, 224.03, 97.64 and 170.53 tons respectively.

DISCUSSION

The technique used to determine the standing stock and the limitations of such estimates has been discussed by Alverson, 1960. The method is founded on the basic assumption that catch per unit of effort is a function of stock density in the area being surveyed and that changes in catch per unit of effort are directly proportional to changes in density (18; 10).the aims of these exploratory fishing surveys were : (1) to describe the zoogeographic distribution patterns of the animals encountered and relationship of such patterns to observed environmental features : (2) to determine their relative abundance in time and space and each other and their vulnerability to sampling gears: and (3) where possible, to establish approximations of the magnitude of important or potentially important commercial species together with estimates of the physical yields that these resources might provide (3).
P. niger usually is found over muddy bottoms between 15 and 4om depth, near the bottom during the day , rises the surface at night .feeds on zooplankton , crustaceans and small fishes, sexually ripe specimens found in august to October. Maximum total length is 55cm and common to 30 cm, caught with gillnets and trawls (6). A despite of above mentioned that *P. niger* found near bottom (40m) during the day in the coastal waters of Pakistan at the Oman sea where as in this paper observed at the depth to 100m and also its biomass was calculated more than depths of 10-20 and 20-30m. in the Serilanka waters usually found between 5 to 20m over muddy bottom, it is not caught easily in large schools (9).maximum fork length was observed here 58.5cm and common to 30.5cm, Where as in the Pakistan waters total length was 55cm and common to 30cm. it is so clear that total length of P. niger here is larger than measured in Pakistan waters and its habitat is deeper too.

The importance of depth layer of 10-20m and sub region C were cleared because of maximum estimated biomass and also depth of 50-100 and sub region E were considerable although their area should be respected for comparing each other's.

Length weight relationships of fishes are important in fisheries biology because they allow the estimation of the average weight of the fish of given length group by establishing a mathematical relation between the two (5). They are also useful for assessing the relative wellbeing of fish population (8). The monthly relationship equations of P.niger were determined and no significant differences were calculated between t_c (calculated t) and t_s (statistical t) and its reproductive biology was studied, the peak of spawning obtained in july-september in the Chabahar coastal waters (14). In this research significant differences were not obtained in the b_value between four seasons together and each season to annually b_value. Since the Calculated standard errors of b_value were so less therefore could not increase or decrease from the value of exponent b that according to Hill (1936) and Martin (1949) usually range between 2.5 and 4.0.

The monthly Comparing of all distribution patterns showed main habitat of P. niger located against estuary of galak, gordim and the head of pozm. With respective maximum amount of calculated CPUA more than 500 kg per n.sq.mil. (minimum limit of very dense area pattern) it could be noted , black pomfrets form large aggregations when living in the coastal waters of depth 10-50m specially are in the sub region C (59 55_ 60 25). From other side, size group of 26.5-32.5cm has formed large quantities in the catch composition therefore it could be designed a special fishing strategy for fisheries of P. niger with some species having high similarity of shape, habitat and the length at which should be exploited completely. In fact, in fig No. 15 the areas with high density (i.e. over 500 kg) during all seasons have been shown, in the other hand, the distribution of this species during whole year round has been indicated.

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