Research in Marine Sciences
Volume 8-Issue 1- 2023
Pages 103-118

Population dynamics of the Indian white prawn (Penaeus indicus H. Milne Edwards, 1837) in the Oman Sea (coastal waters of Sistan and Baluchistan)

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Received: 2023-02-27 *Accepted: 2023-04-05*

Abstract

Shrimp fishing is considered a precious industry among the fishing communities of Sistan and Baluchistan province, which is a part of the income of fishermen and related industries. Carapace length (CL) (mm) and total weight (g), and the catch data of *Penaeus indicus* were collected from the sampling sites in the eastern and western coastal waters of Sistan and Baluchestan. The samples were collected duringa period of 30 months, from 21 March 2018 to 22 September 2020, which come from the bottom gillnets made of nylon monofilament and stretched mesh sizes of 35 and 53 mm. The length ranged from 14 to 67 mm CL, averaging (±standard error) at 39.3±0.88 mm CL. Recruitment occurred in two periods,one in early spring and another in late summer. Growth parameters for males were calculated as L_∞ = 62.75 mm CL, and K=1.57 year^{-1} andt_0 =-0.0813 year^{-1}, and for females the parameters wereL_∞ = 71.01 mm CL, and K=1.23 year^{-1} andt_0 =-0.101year^{-1}. According to the Y/R model, the optimal mean length at first capture corresponding to the maximum yield per recruit ($Lm_{50opt.}$) was estimated as Lc50 opt=47.2 mm CL for *P. indicus*, which showed the maximum fishing effort to harvest the stock. When the current fishing mortality

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is applied to the model, Lc_{50} was calculated as 45.4 mm, suggesting the maximum fishing effort is suggested the fishing fleet. The average CPUE showed that in the last week of September, its level is at its maximum value and reached the lowest level in late October. These results provide the parameters needed to establish the appropriate times of opening and closing the shrimp fishing period in the region for each year, aiming at harvesting the stock at an optimal fishing effort level.

Keywords: *P. indicus*; Y/R model; LC_{50}; CPUE; Oman Sea.

1. Introduction

Concerns about the sustainability of marine fisheries stocks began in the 1990s (Pauly and Zeller, 2003) when credible scientific papers published the risk of stock depletion (Orensanz *et al.,* 1998). Beyond the environmental problems, the destruction of marine aquatic resources has severe consequences, which require effective management based on scientific findings for the sustainability of the resources, the proper development of the socio-economic situation along with the protection of the environment and the preservation of biodiversity, especially in developing countries (FAO, 2018; Hardin, 1968). Sea shrimp fishing can be considered as one of the most profitable and harmful harvesting activities in the world, whose high share in the world trade of aquatics caused the exploitation of these reserves to reach an unsustainable level (FAO, 2020).

The main management measures of shrimp stocks include: 1) annual control of the exploitation level (catch quota) and fishing effort limitation, 2) changing the mesh size of the netsused 3) monitoring the catch of juvenile shrimp population in estuariesand 4) seasonal closure of fishing (Watson, 1993; Mosha and Gallardo, 2013).

Indian white shrimp (*Penaeus indicus* H. Milne Edwards, 1837) belongs to the Arthropoda Phylum, Crustacea subphylum, and Penaeidae family, which is found in depths of 2 to 90 meters and often in depths of less than 30 meters. It lives in muddy or sandy beds (Dall *et al.,* 1990).

P. indicus is a marine shrimp that spawns in this environment. The three main characteristics of penaeus shrimp include: 1) rapid growth rate due to high environmental temperatures, 2) short life span, and 3) presence of juvenile shrimp in coastal waters, where they are often subjected to extreme environmental changes,and recruitment and the stock size are affected by the condition of the coastal area (Garcia, 1984).

In the coastal waters of Sistan and Baluchistan, in addition to *P. indicus*, which is the dominant species (about 60 percent of the total catch of all shrimp species), there are four other species, including green tiger shrimp (*Penaeus semisulcatus*), black tiger shrimp (*Penaeus monodon*), banana shrimp (*Penaeus merguiensis*), and Jinga shrimp (*Metapenaeus affinis*) in the composition of shrimp catch (Hosseini *et al.,* 2022).

Shrimp fishing is considered a very valuable industry among the fishing communities of Sistan and Baluchistan, which is a part of the income of fishermen and related industries. Despite the importance of *P. indicus* stocks, very few studies are available on the stock assessment of this species in this region. In the Indian Ocean, studies conducted on the population dynamic parameters of *P. indicus* and the harvesting level from the stock on the west coast of India (Sarad, 2006), the Oman Sea (Mehanna *et al.*, 2012), and in the coastal waters of northern Indonesia (Saputra *et al.*, 2019). In the Gulf of Oman, Iran, in Gwatar bay, there are also some studies on the length frequency composition of *P. Indicus* (Mohammed Khani, 1999) in the coastal waters of Chabahar regarding biological parameters (Hosseini, 2004), and in the coastal waters of Jask, about the population dynamics (Kiyabi and Kamrani, 2001).

The harvest of the important stock of *P. indicus* with the aim of responsible fishing has always been emphasized by theexecutive sector (i.e., fisheries sector) of Sistan and Baluchistan province.Every year, only based on the catch data from the previous years, a short fishing period in the fall season (between October and November) is announced by the fisheries sector in cooperation with the research center in the region. When the fishing period starts, fishing licenses are issued for a certain number of fishing boats. After the end of the fishing period, shrimp fishing is prohibited in the rest of the year. Gillnets are the only allowed fishing method for shrimp in the coastal waters.

Therefore, to achieve sustainable fishing, the present study has been carried out to suggest the appropriate fishing period of *P. indicus* and also to estimate the population dynamic parameters required for determining the optimum of fishing period for the next years.

2. Materials and methods

The data required for the analysis included the biological data of length and weight and non-biological data of the catch and fishing effort of *P. indicus*, which was collected from the two sampling sites in the eastern (Gwatar and Pasbandar) and western (Pazm and Konarak) coastal waters of Sistan and Baluchestan (Figure 1). Collection of the data was done throughout the year except in July and August, in a period of 30 months from 21 March 2018 to 22 September 2020. The bottom gillnets used for shrimp fishing had nylon monofilament threads with stretched mesh sizes of 35 and 53 mm, which was set at a short distance from the coast, less than a mile, and at a depth of less than 8 meters.

During the field data collection, after identifying shrimp species and determining the sex (male or female), the carapace length (CL) was recorded using a caliper to the nearest 1 mm and the weight using a digital scale to the nearest 1 g. Collection of shrimp catch data including the amount of catch and fishing effort per vessel/ day, was made only during the fishing period announced in the autumn season for around one month (late October to late September 2019).

Growth parameters L_∞ (asymptotic length), K (growth rate), and theoretical age at birth (t_o) of *P. indicus* population were calculated based on the length frequency data and with the help of FiSAT II software. According to this, using the range of L_∞ estimated by the Maximum Length Estimation routine from the SUPPORT menu and the range of K values based on existing studies, K and L_∞ were calculated by Shepherd's method with scoring through Response surface.

To calculate (to), Pauly's empirical formula (1986) was used as follows:

$$Log_{10}(-t_0) = -0.392 - 0.275Log_{10} L_\infty - 1.038Log_{10}K$$

P. indicus growth curve (i.e., the length at age, L_t) was fitted by the von Bertalanffy growth function (VBGF) (Sparre and Venema, 1998) through the input of growth parameters per length group:

$$L_t = L_\infty(1 - exp\left(-K\ (t_0 - L_t)\right))$$

Life span (t_{max}) and growth performance index (φ') were calculated based on growth parameters, respectively, using the experimental formulas of Pauly (1983) and Pauly and Munro (1984):

$$\varphi' = Log_{10}(K) + 2Log_{10}(L_\infty)$$
$$t_{max} = t_0 + 2.996/k$$

Note that the life span (t_{max}) is the age at which 99% of the shrimp population by numbers would die in an unexploited state (Sekharan, 1975; Cushing, 1981).

Total mortality (Z) was calculated using a length-converted catch curve (Sparre and Venema, 1998), and the natural mortality (M) by the empirical equation (Pauly, 1980), based on L_∞, K, and the mean annual sea surface temperature (26.5ºC) measured directly from the sea trials.

The fishing mortality (F) was computed as F = Z – M, and the exploitation rate was computed from the rate F/Z (Pauly and Munro, 1984). The yield per recruit (Y/R = catch in weight, per recruit) and biomass per recruit (B/R) models were estimated using the modified model of Beverton and Holt (1966) (Sparre and Venema, 1998).

3. Results

3.1. Length frequency distribution

A number of 2700 *P. indicus* were measured for carapace length (CL) and total weight data from the catch composition of the bottom gillnets. By pooling length data over the sampling period, the results of a length frequency distribution by month are shown in Figure 2.

Generally, the smallest and largest carapace length in the catch composition was 14 and 67 mm CL, respectively, corresponding to males and females. The average length (±standard error) of the *P. indicus* population was calculated as 39.3±0.88 mm CL.

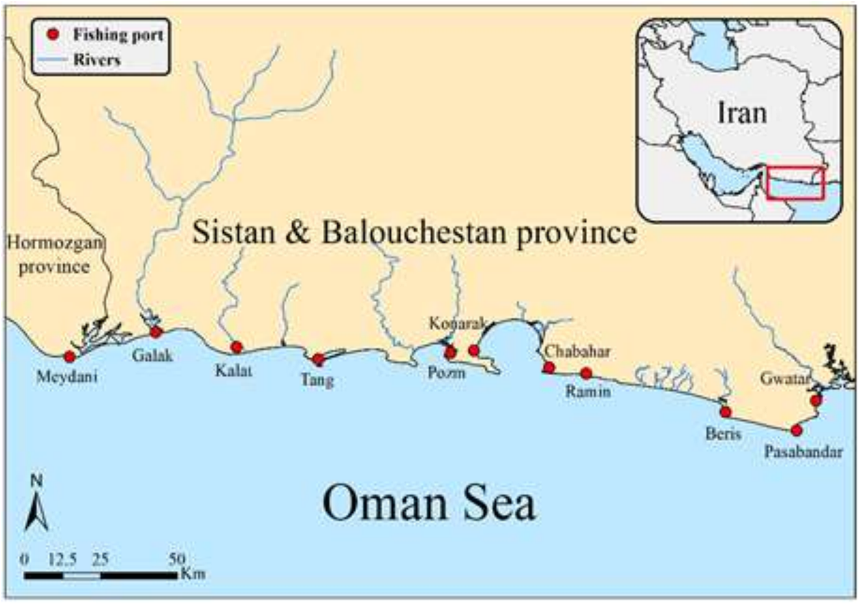

Figure 1. Fishing ports and sampling sites of *p. indicus* in the eastern (Pasbandar and Gwatar) and western (Pazm and Konarak) coastal waters of Sistan and Baluchistan province in the Oman Sea.

In the spring season, the length range of 39-44 mm CL was the most frequent (Table 1). In this season, in April and May, young *P. indicus* with a length range of 15-26 mm CL appeared in the fishing ground, and the average lengths of the whole samples by month were recorded as 39.2 ± 0.8 and 41.5 ± 0.6 mm CL, respectively. In summer (i.e., September), smaller-sized *P. indicus* with a length range of 30-41 mm CL had a considerable abundance, which resulted in a decrease in the average length (36.2 ± 0.8 mm CL).

Entering the autumn season, *P. indicus* in a range of 30-47 mm CL was observed as the model length (Table 1). In October, young shrimps (between 14 and 26 mm CL) entered the fishing cycle of gillnets, in which the model length was 30-47 mm CL. The average length of *P. indicus* compared to the previous month (September) increased to 38.1±0.3 mm CL. The average length increased again in November (44.2 ± 0.4 mm CL), but decreased to 37 ± 0.2 mm CL in December. In the winter, almost similar to the autumn, the model length of 33-44 mm CL was observed in the catch composition, in which the average length increased from 37.9 ± 0.5 mm CL in January to 41.8 ± 0.7 mm CL in March (Table1).

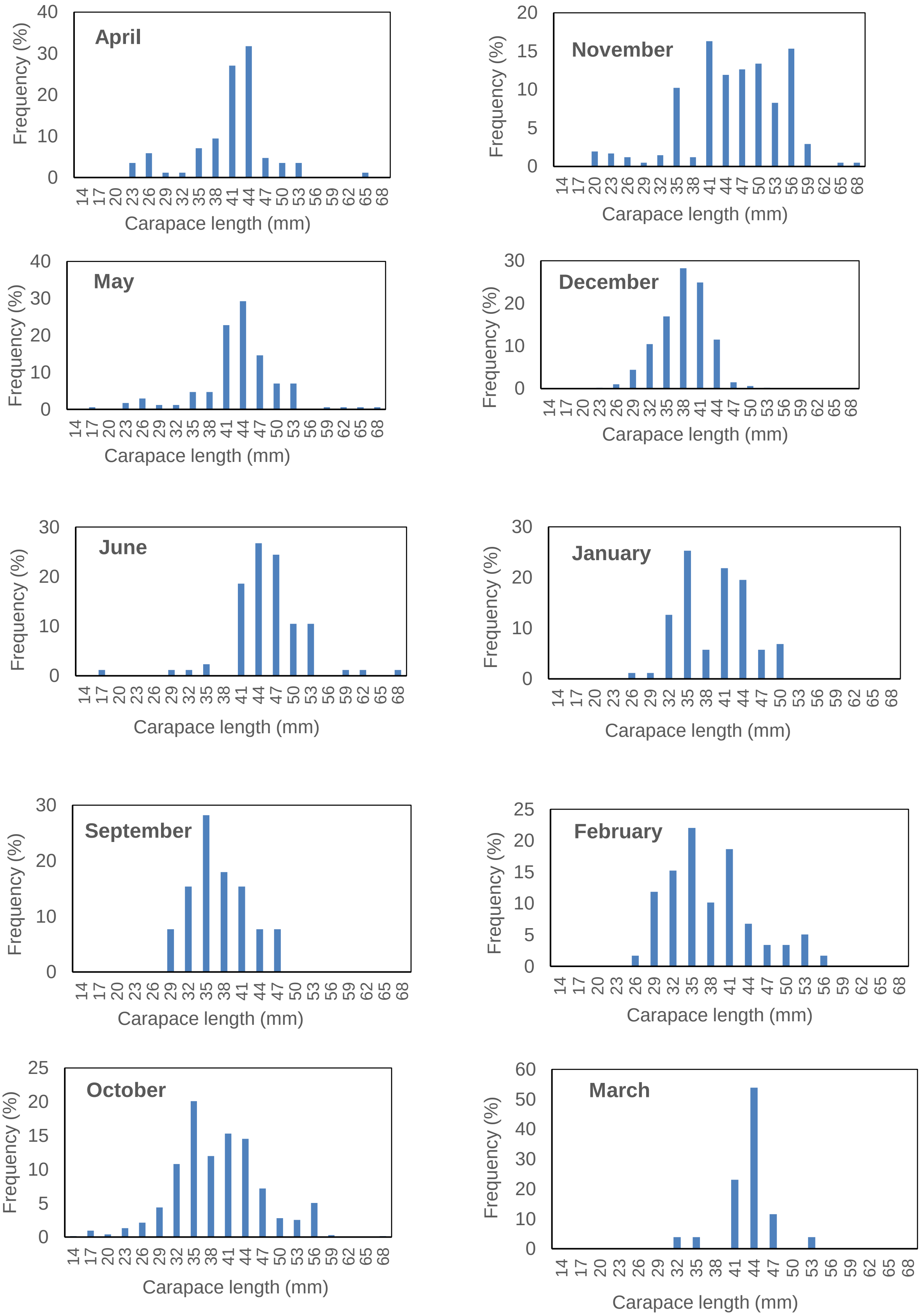

Figure 2. Length frequency distribution of *P. indicus* in the catch composition of gillnets in the Oman Sea.

Table 1. Length (CL) parameters in mm for *P. indicus* by season in the catch composition of gillnets in the Oman Sea

Season	Minimum (mm)	Maximum (mm)	Aerage (±standard error)	Model length (mm)
Spring	17	67	41.5±0.4	39-44
Summer(September)	28	46	36.2±0.8	30-41
Autumn	14	67	39.3±0.2	30-47
Winter	25	54	38.2±0.4	33-44
Whole year	14	67	39.3±0.88	33-44

3.2. *Population dynamic parameters*

The asymptotic length of the male (L_∞= 62.75 mm CL) was smaller than that of the female (L_∞=71.01 mm), according to which the growth rate of the male (K=1.57 year^{-1}) was greater than female shrimp (K=1.23 year^{-1}) (Table 2). The growth performance index for males is estimated as φ' =3.79, for females is φ'=3.79, and for the whole population φ'=3.80. The results indicated that the maximum life span of males is 12 months while that of females is 18 months.

The comparison of the growth rate of *P. indicus* by sex showed that males have a faster growth rate (45.8 mm CL) compared to females (45.6 mm CL) until the age of 10 months, after which the growth rate of females increases (Figure 3).

The total mortality rate of females (Z=5.95 year^{-1}) was calculated as higher than that of males (Z=4.64 year^{-1}), which was obtained as Z=4.43 year^{-1} for the whole population (Figure 4 and Table 2). Conversely, the natural mortality rate calculated for males (M=1.90 year-1) was higher than females (M=1.57 year^{-1}). The exploitation rate of males was E=0.59 and females E=0.74 (Table 3).

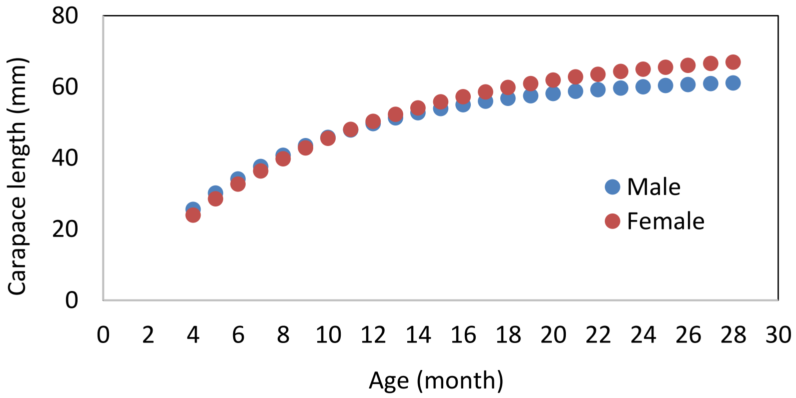

Figure 3. Length by age (month) and growth incrementof *P. indicus*by sex in Oman Sea

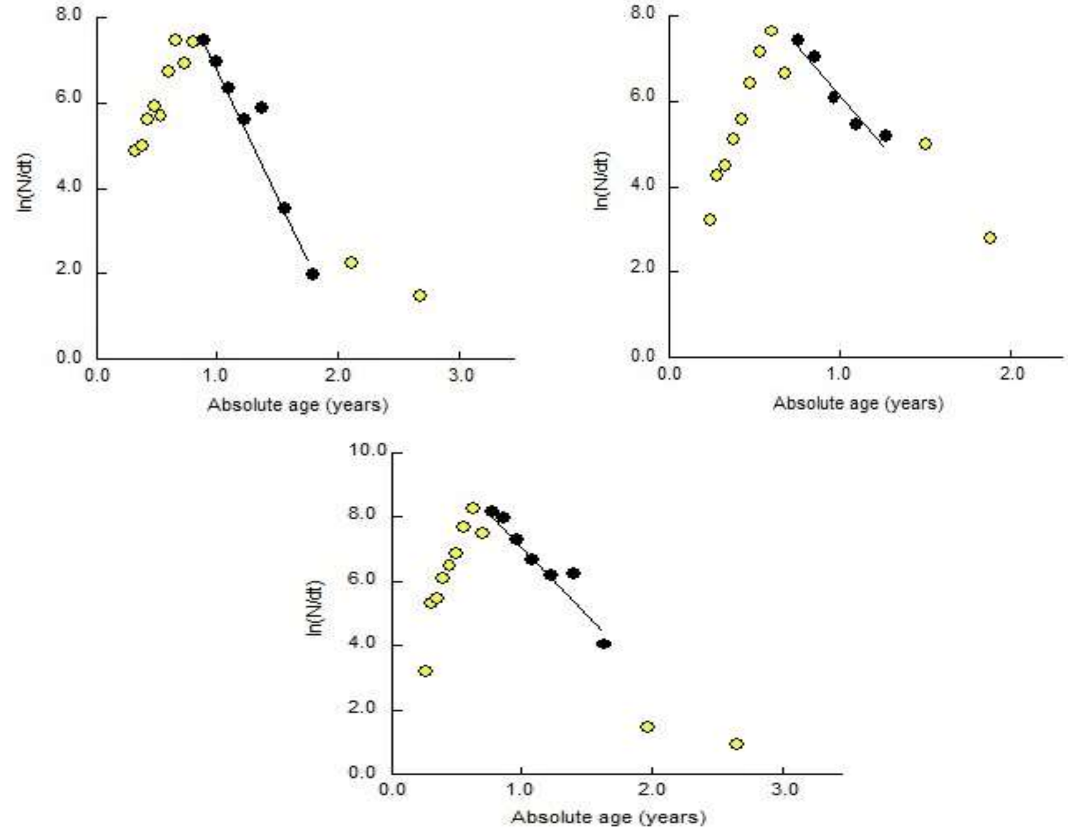

Figure 4. Length converted catch curve of *P. indicus* by sex, estimated from gillnets fishery inOman Sea. The left curve for female; right one for males, and the middle for the whole population.

Table 2. Growth parameters of *P. indicus* by sex-estimated from length frequency data of gillnet fishery in Oman Sea.

Sex	L_∞ (mm)	K (year^{-1})	t_0 (year^{-1})	φ'
Male	62.75	1.57	-0.0813	3.79
Female	71.01	1.23	-0.101	3.79
Pooled	66.88	1.40	-0.090	3.80

Table 3. Mortality parameters of *P. indicus* by sex,estimated from length frequency data of gillnet fisheryin Oman Sea.

Sex	Z(year^{-1})	M (year^{-1})	F(year^{-1})	E (year^{-1})
Male	4.64	1.90	2.74	0.59
Female	5.96	1.57	4.39	0.74
Pooled	4.43	1.73	2.70	0.61

3.3. Yield per Recruit (Y/R) model

Since usually the female population of *P. indicus* has a higher growth in weight and abundance compared to males (Hosseini, 2022), in this research, the yield per recruit (Y/R) curve of the species has been analyzed based on the female population. Based on this, the optimal mean length at first capture corresponding to the maximum amount of yield per recruit ($Lm_{50opt.}$) was estimated as Lc50 opt=47.2 mm CL for *P. indicus*, which contained 16.94 g yield (i.e., catch in weight) per recruit (Figure 5). Taking Lc50 opt=47.2 into account, the Y/R curve in different amounts of fishing mortality (F) did not have a maximum value. It showed the maximum fishing mortality of F=6.8 year^{-1} for harvesting *P. indicus* stock (Figure 6a).

When the current fishing mortality of F=4.39 year^{-1} is considered the input in Y/R model, the maximum yield per recruit was estimated as 16.88 g, corresponding to mean length at first capture (Lc_{50}) of 45.4 mm CL (Figure 5). In other words, with the reduction of fishing mortality from the maximum value of F= 6.8 year^{-1} to F= 4.39 year^{-1}, the yield per recruit decreased by only 6 percent. In addition, considering Lc_{50} =45.4 mmCL, the Y/R curve still does not have a peak and showed the maximum fishing effort to harvest *P. indicus* (Figure 6b).

Unlike the Y/R curve in both situations (Figures 6a, 6b), with the increase in fishing mortality, biomass per recruit (B/R) showed a decreasing trend. In other words, when the fishing effort is not applied to the stock in a virgin state, the biomass in weight of *P. indicus* is at its maximum, which decreases from its initial value with the increase of the fishing effort.

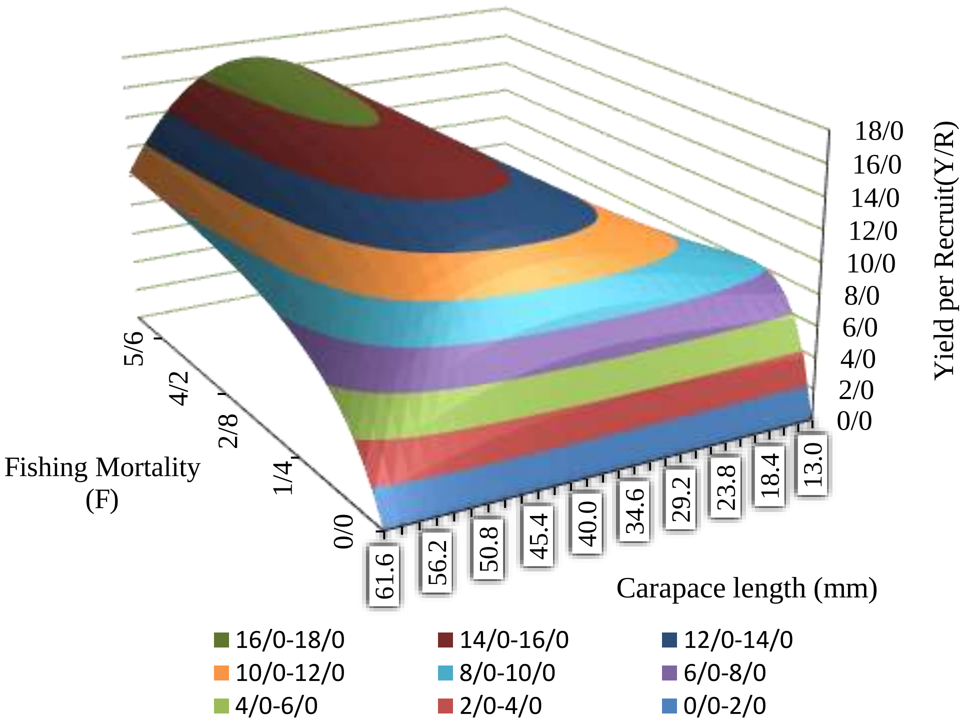

Figure 5. Yield isopleth diagram for *P. indicus* as the function of fishing mortality (F) and mean length at first capture (Lc_{50}), estimated from gillnet fishery in Oman Sea.

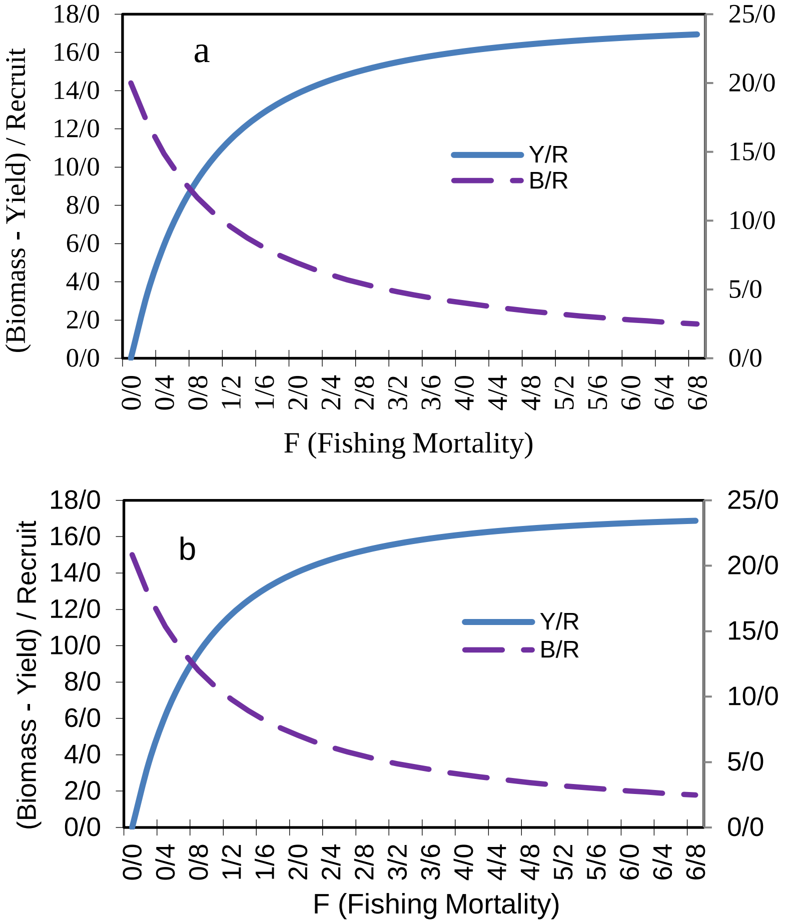

Figure 6. Yield per recruit as a function of fishing mortality (F) for*P. indicus*, estimated from gillnet fishery in Oman Sea. The top figure (a) shows the results for $Lc_{50opt.}$ = 47.2 mm and the bottom figure (b) for Lc_{50}=45.4 mm.

3.4. Catch data

Due to the impossibility of separating the species, the sampled catch data presented here are related to all shrimp species, which were only collected during a period of 29 days from September 27 to October 25, 2019, which falls within the shrimp fishing period.

The trend of catch per unit effort (CPUE) based on the time series of fishing days showed a linear relationship that had a significant correlation ($p<0.05$) (Figure 7). Accordingly, the amount of catch per unit effort (CPUE) of different shrimp species at the beginning of the fishing period was calculated 22.8 kg per boat/fishing day. With continued fishing activity, the amount of CPUE reached its lowest level, i.e., 3.4 kg per boat/fishing day, which was 15% of its value at the beginning of the fishing period. Based on the number of total active vessels in the entire region during the fishing period, which is 1020 fishing boats, the total catch of different shrimp species in coastal waters of Sistan and Baluchistan during the fishing period was estimated at around 460 tons in 2019.

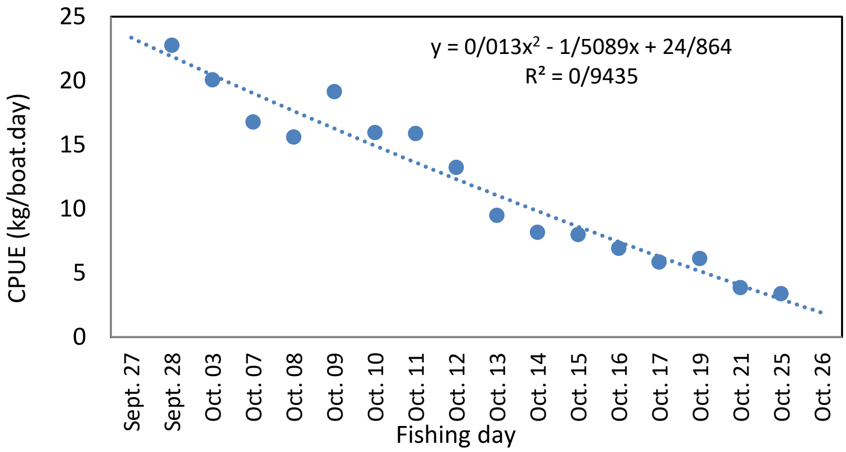

Figure 7. The trend of the average catch per unit effort (CPUE) of different shrimp species for the sampled fishing boats during the fishing period from Sept.27 to Oct. 25, 2019 from gillnets fishery in the Oman Sea.

4. Discussion

In this research, the carapace length (CL) range was recorded as 14-67 mm with an average of 39.3 ± 0.88 mm for *P.indicus* in the catch composition of gillnet fisheries, which is different from the results presented by other studies. Zarei (1993) found the range of CL to be 39-88 mm with an average of 60.5 mm in the Gwatar Bay in the Oman Sea for *P.indicus*, but Mohammadkhani (1999) reported a length range of 16-59 mm in the same area; while the report from Hosseini (2004) reported that the length ranges from 22 to 54 mm CL, averaging at 37.3 mm, in the western and eastern fishing grounds of Sistan and Baluchistan waters. In the Omani waters (Mehanna *et al.*, 2012), carapace length for *P.indicus* reported as 18-64 mm, in the eastern coast of India (Subramanian, 1987) 20-53 mm, in the western Indian Ocean (Ivanov and Krylov, 1980) 21.7-47.6 mm, in the Red Sea estuaries (Branford, 1981)12-42 mm and 16-52 mm in Sofala bank, Mozambique (Brinca *et al.*, 1983). By comparing the results presented above, it can be concluded that the difference in the CL range can be affected by the region and the sampling method.

Based on the monthly frequency distribution of *P.indicus*, it is clear that with the beginning of spring and at the end of summer (in September), recruitment and young shrimps with a length range of 14 to 26 mm CL appeared in the fishing grounds in two periods, one in early spring and another in late summer. This issue is also consistent with the decrease in the average length of *P.indicus*, where the average CL in September is 36.2±0.8 mm compared to the previous time in June (43.8±0.7 mm). We also found a similar situation in April, when the average CL decreased to 39.2±0.8 mm compared to March (41.8±0.7 mm).

In this research, the lifespan of male and female is estimated to be 22 and 28 months, respectively, based on which it is concluded that male *P.indicus* have a shorter lifespan than females, despite the rapid growth rate in the early stages of life,and the reason for that can be their natural death after reproduction (Lalitha devi, 1987). In total, the growth rate (K) of males (1.4 $year^{-1}$) was higher than that of females (1.23 $year^{-1}$) and they reached the asymptotic length (L_∞) faster. However, according to age, the results have been different. In the first year, males grow to 49.7 mm CL and females to 48.1 mm CL, while at the age of 1.5 years, females grow faster, reaching a larger size of 57.3 mm CL, and males, with a slower growth rate, reach a smaller size of 56.8 mm CL.

Some studies show that the growth rate of males is higher than of females *P.indicus*, which includes the results obtained in the Oman Sea in the waters of Jask (Zarshenas *et al*., 2009), south west India (Sarad, 2006), Indonesia (Saputra *et al.,* 2019) and the Oman Sea (Mehanna *et al.*,2012) (see Appendix). In contrast, some other studies also indicate that females reach L_∞ with a faster growth rate (Jayewardene *et al.*, 2002; Lalitha devi, 1986).

According to theyield per recruit (Y/R) model, the optimal mean length at first capture (Lc50 opt.) of *P. indicus* in the coastal waters of Sistan and Baluchistan is 47.2 mm CL, in which we found the highest amount of yield per recruit (16.94 g). In this situation, by using the full capacity of the fishing fleet with maximum fishing effort (by controlling the number of fishing vessels, the number of fishing days and the number of nets used), it ispossible to harvest the species stock.With the reduction of fishing mortality from the maximum value (F=6.8 $year^{-1}$) to the current value (F=4.39 $year^{-1}$), which corresponds to Lc_{50}= 45.4 mm CL, there is also the ability to use the maximum fishing effort available during the opening fishing period.

A point that should be considered is the duration of the shrimp fishing period, which is influenced by the amount of fishing effort used. By using less fishing effort, the duration of the fishing period becomes longer, and as a result, the catch share of each fishing vessel becomes less compared to more fishing effort used, which can be investigated in the following studies in terms of the economic shrimp fishing.

Usually, the Y/R curve has a peak that corresponds to the optimal fishing effort (F_{msy}) (King, 2007). In the present research, although the Y/R curve does not have a peak point, by reducing the size of Lc_{50}, the Y/R curve can be reached at peak, corresponding to less fishing effort.In this case, naturally, the total allowable catch (TAC) from the stock is less and not economical.

The Y/R model is influenced by three essential parameters: growth rate (K), natural mortality (M) and mean length at first capture (Lc_{50}) of the stock; from the operational point of view, the only controllable parameter is Lc_{50}, which is influenced by selectivity of the net used, in which the mesh size is an essential role (Pauly and Munro, 1984).

Investigating the effect of the mesh size of the existing gillnets (35 and 53 mm) in terms of fishing efficiency or CPUE as well as size selectivity of *P.indicus* is an important issue in sustainable fisheries, which needs future study. In this way, it is possible to suggest the appropriate mesh size of nets with the aim of higher fishing efficiency and shrimp with Lc_{50} at least equal to Lc_{50opt}. Different sizes of Lc_{50} of *P. indicus* have been reported in the Indian

Ocean, depending on the fishing area and fishing gear used (Saputra *et al.,* 2019; Jayawardane *et al.,* 2002).

The estimated total shrimp catch of 460 tons in this region in 2019 shows the relatively high commercial fishing capacity of shrimp in the coastal waters of Sistan and Baluchistan province. *P. indicus* is the dominant species (about 60 percent of the total catch) in the region, and therefore these data can indicate the catch trend of this species.

The average CPUE of *P. indicus* during the fishing period of about one month decreases from 22.8 kg per boat/fishing day at the beginning of the fishing period to 3.4 kg per boat/fishing day at the end of the period, which is 85% of the initial catch level. This level of catch is the best time to end shrimp fishing, because 15% of the remaining catch ensures the necessary stock for reproduction and the recruitment to the fishing ground required to the harvestable population for the next year. Therefore, based on the population dynamics parameters obtained in this research and by regularly recording length data in the field for at least three months before the beginning of the expected fishing period, it is possible to announce the optimal time of opening the fishing period of *P. indicus* for every year (Sparre and Venema, 1998).

Finally, the use of selective gillnets with appropriate mesh size along with prohibition of fishing in a period of the year for *P. indicus* in the area can be suggested as a management tool to prevent the possible overfishing of the spawning stock biomass (Arellano-Torres *et al.,* 2006; Burgos-Leon *et al.,* 2009).

Conclusions

Taking into account the present situation of the artisanal fishery, i.e., gillnets fishing, of *P. indicus* in the coastal waters of Sistan and Baluchistan province, which harvests the stock without limiting criteria, it is important to take management measures without delay to ensure the sustainability of stock fishing in future. The main applicable management measures are: 1) Determination of the fishing period and a ban on the fishing seasons 2) Overall control of exploitation level by fishing effort limitation 3) Protection of juvenile shrimps.

Based on the population dynamics parameters obtained in this research and by regularly recording length data in the field for at least three months before the beginning of the expected fishing period, it is possible to announce the optimal time of opening the fishing period of *P. indicus* for every year (Sparre and Venema , 1998). The fishery could be banned at the time when the CPUE is at its low levels, and the recruitment is most intensive. The latter would avoid the exploitation of the large numbers of fast-growing immature juveniles. Based on the calculated annual total allowable catch (TAC), it is possible to control the fishing effort, in which the catch share and the resulting income could to be determined for each fishing boat. From an purely economic point of view, it should be noted that the increase in fishing pressure on juveniles leads to a decrease in the overall value of the catch. Estuaries are the main habitats of juvenile shrimps, and the annuall exploitation level of shrimps depends on the abundance of recruitments from these areas. Therefore, it is necessary to protect the important estuaries and monitor the status of shrimp communities in these habitats.

Acknowledgment

The authors gratefully acknowledge the financial support of the “Iranian Fisheries Science Research Institute” (Project No. 24-78-12-013-970643).

Appendix

Growth and natural mortality parameters of *P. indicus* by study area in the Indian Ocean.

Region	Sex	L_∞ (mm)	K ($year^{-1}$)	t_0 ($year^{-1}$)	M ($year^{-1}$)	Life span (month)	Author (s)
The south west coast of India	Male	178.8 (TL)	1.4	-	1.7	-	Sarad, 2006
	Female	183 (TL)	1.2	-	1.5	-	
Oman Sea	Male	57.1(CL)	2.11	-	2.35	12	Mehanna *et al.*, 2012
	Female	78.6 (CL)	1.69	-	1.93	18	
Sri Lanka	pooled	56 (CL)	1.8	-0.1	3.04	24	Jayakody and Costa,1988
Sri Lanka	Male	192 (TL)	1.51	-	1.73	12	Jayawardane *et al.*,2002
	Female	199 (TL)	1.87	-	1.73	-	
East coast of India	Male	200 TL	2	-	2	12	Rao *et al.*, 1993
	Female	230 TL	2	-	2	-	
The south coast of India	Male	227 (TL)	1.8	-	2.9	-	Lalithadevi, 1986
	Female	219 (TL)	2.0	-0.0729	3.3	-	
Indonesia	Male	37 (CL)	0.97	-0.0154	1.67	-	Saputra *et al.*,2019
	Female	38.5 (CL)	0.85	-0.103	1.52	-	
Oman Sea (Iran's coast)	Male	41.5 (CL)	1.5	-	2.57	24.0	Zarshenas *et al.*, 2009
	Female	53.0 (CL)	1.3	-	2.26	27.6	
Oman Sea (Iran's coast)	Male	62.75 (CL)	1.57	-0.0813	1.90	22	Present study
	Female	68.01(CL)	1.23	-0.105	1.59	28	

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