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Study the present trawl fishery of *Penaeus monodon* (Fabricius, 1798) in coastal waters off digha coast, West Bengal, India

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Abstract
During the present study the average annual catch of *Penaeus monodon* during 2011 - 2013 was 281.29±9.67 ton, which contributed 0.41 % to the total trawl net catches at Digha coast. The average catch rate was 43.41 kg/h. The percentage of *P. monodon* to total shrimp catch was 1.91% in trawl landings at Digha coast. Monthly mean landings were 28.13±0.97 t from the trawl nets. Peak landings were observed from June to November with a maximum of 56.46±1.97 t in September and lean landings were observed from December to March with a minimum of 6.12±0.21 t.

Keywords: Fishery, *Penaeus monodon*, Digha coast, India

1. Introduction
India is a significant marine fisheries sector that plays important role in the country's economy and has been an important source of income and occupation and livelihood for not only the coastal communities but also for the millions of people inhabiting our country. In capture fishery besides fishes, shrimps are also very important both biologically and economically. The penaeid shrimps constitute the backbone of seafood export industry and are the major foreign exchange earner as from fishery sector which is the source of livelihood for millions of peoples whose involve with fishery sector directly and indirectly. Some of the important penaeid shrimps that support commercial fisheries along the Indian sea water and available also at Digha coast. *Penaeus indicus* (Indian white prawn), *P. semisulcatus* (Green tiger prawn), *P. monodon* (Giant tiger prawn), *P. merguiensis* (Banana prawn), *P. Japonicus* (Kuruma prawn), *P. Penicillatus* (Red-tail prawn), *Metapenaeus dobsoni* (Flower-tail prawn), *M. monoceros* (Speckled prawn), *M. affinis* (Jinga prawn), *M. Kutchensis* (Ginger shrimp), *M. brevicornis* (Yellow prawn), *Parapenaeopsis stylifera* (Kiddi prawn), *P. hardwickii* (Spear prawn), *P. sculptilis* (Rainbow prawn), *P. maxillipedo* (Torpedo prawn), *P. uncta* (Uncta prawn), *Trachypenaeus curvirostris* (Rough prawn), *Metapenaeopsis stridulans* (Fiddler shrimp), *Parapenaeus longipes* (Flaming prawn), *Solenocera crassicornis* (Coastal mud prawn) and *S. choprai* (Coastal mud prawn). The coastal length of West Bengal is 158 km [1]. Here, marine fishing activity is an important source of income for coastal living people. There are enormous literature on the estuarine prawn fishery resources of West Bengal [2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]. However, very little information is available on the marine prawn fisheries of Wet Bengal. There are limited information on the seasonal bag net fishery [15] and on the prawn fishery of the large trawlers operating off the West Bengal coast [16, 17, 18, and 19]. No published information available till date on the trawl fishery of *P. monodon* from Digha Coast of West Bengal, India. The present study aims to provided details information on trawl fishery of *P. monodon* in coastal waters of Digha Coast, India.

2. Materials and Methods
Data on catch and effort expended in trawls for *P. monodon* were obtained for the period from January 2011 to December 2013 from Digha Mohana landing centre. The monthly and annual estimates of catch and effort were made on based on the catch data of observation days and raised to monthly catch based on the number of fishing days in a month.

The monthly and annual estimates of catch and effort were made following the Multistage Stratified Random Sampling Technique devised by Fishery Resource Assessment Division of Central Marine Fisheries Research Institute, India [20]. Catch data were expressed in terms of numbers. Each sampling days was multiplied by the number of boats engaged in fishing on the day of sampling to obtain average daily catch. Average daily catch was multiplied by the number of fishing days in the particular month to obtain the monthly catch.

3. Results

3.1 Species composition

Species composition of penaeid prawn Digha landings center in West Bengal during 2011 - 2013 shows about 11 commercial species of penaeid prawns, of which five are large sized species *viz*., *Penaeus monodon* (1.9%), *P. indicus* (3.6%), *P. merguiensis* (6.3%), *P. penicillatus* (1.3%), *Metapenaeus monoceros* (5.9%), *M. affinis* (7.2%), *M. dobsoni* (13.3%), *Parapenaeopsis stylifera* (11.7%), *P. hardwickii* (18.7%), *Solenocera* spp (13.2%) and *Metapenaeopsis spp* (8.6%). Small sized commercial species (*M. lysianassa* and *M. moyebi*) also contributed in very low quantities to the landings at the Digha coast during my research. (Figure 1).

3.2 Annual landing

The average annual catch of *P .monodon* for the period 2011 – 2013 was 281.29±9.67 ton, which contributed 0.41% to the total trawl net catches at Digha coast (Table 1). The average catch rate for the period was 43.41 kg/h (Table 2). The percentage contribution of *P. monodon* to total trawl net catch fluctuated between 0.36% (2013) to 0.39 % (2012) (Table 3). The percentage contribution of *P. monodon* to total shrimp catch was 1.94% from trawl landings at Digha coast during the study period (Table 4).

3.3 Month wise landing

Monthly mean landing of 28.13±0.97 t was recorded from trawl nets during 2011-2013 (Table 5 and 6). Peak landing was observed from June to November with a maximum of 56.46±1.97 t in the month of September and lean landing was observed during December to March with minimum landings of 6.12±0.21 t in March.

4. Discussion

The marine landings of West Bengal exhibit wide inter-annual fluctuations with an average of around 3 lakh tons, of which the contribution of penaeid prawns is around 5%. According to Maheswarudu [21] in India the average contribution of penaeid prawns is around 7.4% and of non penaeid prawns is around 5.4%. Recent contribution of penaeid prawns in West Bengal has decreased from 6.4% observed during 1996 - 2011. *P. monodon* is caught in small numbers throughout the season in the Kerala backwater fishery. Similarly in the Gautami estuary, though catch is recorded in all the months, intense fishery is from November to early January [22]. In Philippines, the ‘sugpo` fry season starts from May and ends by October. In Mumbai, the commercial catches observed from August to October. However, the fishing season was generally not evident at most of the places year to year variation in my present study. The catch of *P. monodon* was observed to be steady throughout the year with maximum from June to November. Catch and catch rates recorded in the present study is commensurate with the marine landings recorded by CMFRI from West Bengal over the years [23]. The catch recorded along the north-east coast has increased in recent years due to trawlers extending their range of operations and the duration of voyage [19].

5. Conclusion

This is the first study particularly *Penaeus monodon* at Digha coast. The shrimp trawl fishery at Digha targets of catch a wide variety of penaeid prawns and not *P. monodon* alone. This catch data is authentic and there is no available data at Digha coast on *P. monodon* before my study. This paper will be helpful for further study.

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Table 1: Study the year wise catch of *P. monodon* from Digha coast during January 2011 to December 2013

Year	Catch (t)	Catch rate (kg/h)	% shrimp catch	% total trawl catch
2011	264.26	40.78	2.00	0.41
2012	297.73	45.95	2.00	0.42
2013	281.88	43.50	1.83	0.39
Average	281.29	43.41	1.94	0.41

Table 2: Study the year wise monthly catch rate (kg/h) of *P. monodon* (Mean±SE) from Digha coast during 2011-2013

Month	2011	2012	2013	Mean±SE
January	13.89	15.65	14.81	14.78±0.51
February	9.84	11.08	10.49	10.47±0.36
March	8.87	10.00	9.47	9.45±0.32
April	61.97	69.82	66.11	65.97±2.27
June	55.98	63.07	59.71	59.58±2.05
July	59.55	67.10	63.52	63.39±2.18
August	81.86	92.23	87.32	87.14±2.99
September	43.98	49.55	46.91	46.82±1.61
October	47.45	53.46	50.62	50.51±1.74
November	24.41	27.50	26.04	25.98±0.89
December	40.78	45.95	43.50	43.41±1.49

Table 3: Study the year wise monthly percentage of *P. monodon* landings in total trawl catch (Mean±SE) from Digha coast during January 2011to December 2013

Month	2011	2012	2013	Mean±SE
January	0.15	0.16	0.15	0.15±0.005
February	0.14	0.19	0.17	0.17±0.01
March	0.14	0.14	0.13	0.14±0.004
April	0.60	0.63	0.56	0.60±0.02
June	0.60	0.55	0.56	0.57±0.01
July	0.52	0.54	0.49	0.52±0.02
August	0.65	0.69	0.62	0.65±0.02
September	0.40	0.40	0.38	0.39±0.01
October	0.38	0.39	0.35	0.37±0.01
November	0.23	0.24	0.22	0.23±0.01
December	0.38	0.39	0.36	0.38±0.01

Table 4: Study the year wise monthly percentage of *P. monodon* landings in total shrimp landings (Mean±SE) from Digha coast during January 2011to December 2013

Month	2011	2012	2013	Mean±SE
January	0.90	0.95	0.85	0.90±0.03
February	1.03	1.09	0.98	1.03±0.03
March	1.40	1.48	1.32	1.40±0.04
April	4.26	4.50	4.04	4.27±0.13
June	2.08	2.20	1.97	2.08±0.07
July	2.86	3.02	2.71	2.86±0.09
August	2.25	2.38	2.13	2.26±0.07
September	1.78	1.68	1.69	1.72±0.03
October	1.57	1.30	1.19	1.35±0.11
November	1.27	1.35	1.21	1.28±0.04
December	1.94	1.99	1.81	1.91±0.07

Table 5: Study the year wise monthly catch (t) of *P. monodon* (Mean±SE) from Digha coast during January 2011to December 2013

Month	2011	2012	2013	Mean±SE
January	9.00	10.14	9.60	9.58±0.33
February	6.38	7.18	6.80	6.79±0.23
March	5.75	6.48	6.13	6.12±0.21
April	40.16	45.25	42.84	42.75±1.47
June	36.27	40.87	38.69	38.61±1.33
July	38.59	43.48	41.16	41.08±1.41
August	53.05	59.76	56.58	56.46±1.94
September	28.50	32.11	30.40	30.34±1.04
October	30.75	34.65	32.80	32.73±1.12
November	15.82	17.82	16.87	16.84±0.58
December	26.43	29.77	28.19	28.13±0.97

Table 6: Study the average monthly abundance of *P. monodon* from Digha coast during January 2011to December 2013

Month	Catch (t)	Catch rate (kg/h)	% in shrimp catch	% in total catch
January	28.74	14.78	0.90	0.15
February	20.36	10.47	1.03	0.17
March	18.36	9.45	1.40	0.14
June	128.24	65.97	4.26	0.60
July	115.83	59.58	2.08	0.57
August	123.23	63.39	2.86	0.52
September	169.39	87.14	2.25	0.65
October	91.01	46.82	1.71	0.39
November	98.20	50.51	1.33	0.37
December	50.51	25.98	1.27	0.23
Total	843.87	434.09	1.94	0.41

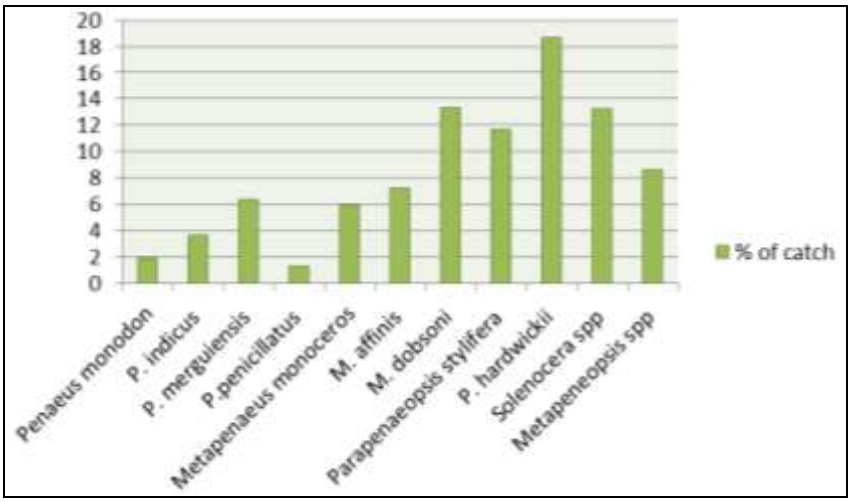

Fig 1: Study the species composition of penaeid prawn landings from Digha coast during January 2011 to December 2013

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