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Appraisal of penaeid prawn fishery by large mechanized trawlers (Sona boats) off Visakhapatnam, SE coast of India

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Abstract

Surge in fishing effort and penaeid prawn catch was recorded during the study period with that of 2006-10. Decline in Catch per Hour (CPH) and penaeid prawn ratio (%) to total fish catch was observed. Penaeid prawns accounted for 15.5% of the sona boat landings. Annually, mean penaeid prawn landings were estimated at 6,184 t. Prawn catch excelled by *M. monoceros* (20.5%), *S. crassicornis* (13.7%) and *M. barbata* (7.8%).

Keywords: Large trawler, sona boat, penaeid prawn, Visakhapatnam

Introduction

Trawlers constitutes utmost to total marine fish landings in India. Before introduction of trawlers, indigenous crafts and gears were in operation for harvest. British steam trawler premier operated for the first time off Bombay coast in 1900^[1]. Small mechanised trawlers were introduced by Indo-Norwegian project along east coast for bottom trawling^[2-5]. Trends in landings of commercial trawlers were reported during 1967-74^[6]. In 1985, mini trawlers were introduced and operated along Visakhapatnam coast^[7, 8].

In 1987, sona boats were introduced for voyage fishing in east coast of India. Sona boats are larger in size and worthy to cover distant areas of sea^[9]. Voyage fishing was carried out in the months of October to March during 1987 to 1990^[10]. Sona boats (large trawlers) (13-15m OAL) are capable for fishing up to depth range of 100 m. Large trawlers with 20 mm mesh size (cod end), 5 m height mouth opening, 102 hp engine capacity were engaged for fishing. Study conducted to appraise penaeid prawn fishery by large (sona boats) mechanized trawlers.

Materials and Methods

Multi stage random sampling method of ICAR- CMFRI was followed to collect data on fish catch and fishing effort by large (sona boats) trawlers off Visakhapatnam coast from 2011 to 2015^[11]. Sampling was carried out once in a week to estimate catch and species composition. Data was collected on fish catch, fishing effort and CPH (Catch per Hour) through direct observation and enquiry. Total fish catch was estimated based on the total fishing days of the month. Status of exploitation and expected penaeid prawn landings (t) were estimated by Schaefer production model (CEDA) based on fishing effort and penaeid prawn landings by large trawlers^[12].

Results and Discussion

Visakhapatnam is one of the major fishing harbours in east coast of India. Mechanized trawlers play vital role in penaeid prawn harvest. Large trawlers (sona boats) comprises significantly to total trawl catch. Study conducted to assess penaeid prawn fishery by large (sona boats) mechanized trawlers from 2011 to 2015. Sona boats operated throughout the year except during the fishing ban period. Surge in fishing effort, penaeid prawn catch and fish catch was recorded during the study period with that of 2006-10. Decline in Catch per Hour (CPH) and penaeid prawn proportion (%) to total fish catch was observed.

Annually, about 8,979 units of sona boats were under operation from Visakhapatnam fishing harbor with the mean fishing effort at 15.1 lakh h (Table 1) during the study period. Due to involvement of sona boats in multiday fishing, fishing effort per trip was varied from 152.3 h

To 218.8 h with the mean at 172.7h. Maheswarudu *et al.*, 2018 reported about 7,575 units with an average at 10.2 lakh h of fishing ^[13]. Rao *et al.*, 1988 reported similar trend in fishing effort ^[6].

After successful completion of multiday fishing trip, sona boats lands fish catch at Visakhapatnam fishing harbor. Annually, mean penaeid prawn landings were estimated at 6,184 t. Penaeid prawn landings depends on abundance, because of that monthly landings varied from 141 (April) to 887 t (Aug.) (Table 2). Prawn landings by trawlers increased from 132 t (1967) to 6,191 t (1977) and declined to 2,026 t in 1978 ^[7]. Maheswarudu *et al.*, 2018 reported 4,601 t annual catch of penaeid prawns ^[13].

Because of divergence in landings, mean penaeid prawn catch per hour (CPH) was estimated at 4.25 kgh⁻¹ with the peak in January (5.49 kgh⁻¹). Sastry and Chandrasekhar, 1986 reported annual CPH for prawns as 3 kg and 2.7 kg for the period 1982-83 and 1983-84 respectively ^[14]. Rao *et al.*, 1988 reported that CPH indicated abundance of prawns in four phases ^[6]. Maheswarudu *et al.*, 2018 reported CPH of penaeid prawn at 4.53 kg h⁻¹ ^[13].

Due to diversity in the catch, pinnacle of penaeid prawn composition (20.3%) was estimated in the month of June with the mean at 15.5%. Rajkumar, 2004 also reported 11.9% prawns to total marine fish landings ^[10]. Prawns formed 16.7% and 30.2% of total trawl catch in 1968 and 1972 respectively ^[6]. Penaeid prawns accounted for 9.8% and 15.9% of the total marine fish catch respectively ^[13, 15].

Alltogether, seven groups (generas) of penaeid prawns comprised to the total catch with the paramount of

Metapenaeus sp. (34.65%) and *Solenocera* sp. (18.4%) (Fig.1). Out of the 22 species, prawn catch exceeded by *Metapenaeus monoceros* (20.5%), *Solenocera crassicornis* (13.7%) and *M. barbata* (7.8%) (Fig. 2).

Muthu, 1968 observed 37 species of penaeid shrimps from the commercial catch at Visakhapatnam and Kakinada ^[8]. Maheswarudu *et al.*, 2014 reported 19 species of penaeid prawns along Andhra coast ^[15]. Maheswarudu *et al.*, 2018 reported 24 species of penaeids and the catch was dominated by *M. Monoceros* (1813 t) ^[13].

In general, surge in fishing effort and penaeid prawn catch was recorded during the study period with that of 2006-10. Decline in Catch per Hour (CPH) and penaeid prawn proportion (%) to total fish catch was observed. Overall, rise in catch was estimated for *Trachypenaeus* sp. (604.3%) followed by *P. japonicus* (149.1%), *P. semisulcatus* (101%), *Metapenaeopsis* sp. (79.6%) *P. monodon* (60.4%), *Parapenaeopsis* sp. (56.6%). *M. affinis* (52.3%), *P. indicus* (37.1%) and *Solenocera* spp. (21.8%). Decline in catch and CPH (kgh⁻¹) was observed for *P. merguensis*, *M. Monoceros*, *M. dobsoni* and *Parapenaeus* spp. (Table 3).

Expected penaeid prawn landings (t) were estimated by Schaefer production model (CEDA) based on fishing effort and penaeid prawn catch for the period 2006 to 2015. Figure 3 illustrates the present status of penaeid prawn landings and expected penaeid prawn landings. The r² value for fishing effort and penaeid prawn catch was 0.6. Out of the ten years period (2006 to 2015), penaeid prawns were under exploited in the year 2013 and over exploited in 2008, 2010 and 2014.

Table 1: Catch and effort of large (sona boats) trawlers off Visakhapatnam coast

Year	Effort (units)	Effort (X 1000 h)	Effort (h) / trip	Penaeid prawn catch (t)	Total fish catch (t)	CPH of penaeid prawns (kgh ⁻¹)	CPH of total fish (kgh ⁻¹)	Penaeid prawn contribution to total fish catch (%)
2011	9948	1520	152.8	7509	48037	5.02	31.61	15.52
2012	11331	1726	152.3	6628	47854	3.95	27.73	13.64
2013	6808	1490	218.8	3907	27313	2.70	18.33	14.84
2014	7469	1347	180.4	7075	52681	5.71	39.10	16.05
2015	9337	1485	159.0	5817	35013	3.86	23.58	17.46
Mean (2011-15)	8979	1513	172.7	6184	42180	4.25	28.07	15.50
Mean (2006-10)	8724	1175	135.0	5360	33023	4.56	28.09	16.2
± (%)	2.92	28.75	27.90	15.38	27.73	-6.83	-0.07	-4.31
SD	1843	136	28.2	1420	10597	1.16	7.89	1.42
SE	824	61	12.6	635	4739	0.52	3.53	0.63

Note: Annual mean values are given in the table for the period 2011 to 2015

Table 2: Month-wise fishing effort and penaeid prawn landings

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Effort (units in no's)	812	895	782	359	0	557	913	1058	1107	710	855	932	8979
Effort (X1000 h)	145	131	123	50	0	84	162	200	184	122	151	163	1513
Total fish catch (t)	4548	3939	2626	1195	0	1908	4178	5788	6005	3007	3932	5055	42180
Penaeid prawn catch (t)	679.1	515.7	386.8	140.5	0	445.0	677.2	887.3	745.7	487.1	503.0	717.0	6184.4
Penaeid prawn contribution to total fish catch (%)	14.4	15.7	15.0	16.5	0	20.3	16.1	15.0	13.9	15.1	13.1	15.4	15.5
CPH of penaeid prawns (kgh ⁻¹)	5.49	4.20	3.32	4.05	0	4.57	4.52	4.24	4.11	4.30	3.28	4.64	4.25
Penaeid prawn catch (t)													
<i>Penaeus monodon</i>	31.3	16.9	13.9	4.4	0	15.4	34.2	92.7	28.8	24.1	43.5	26.1	331
<i>Penaeus indicus</i>	31.4	19.9	17.1	4.1	0	20.8	53.1	107.7	47.7	32.3	45.7	37.6	417
<i>Penaeus merguensis</i>	0.0	0.1	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
<i>Penaeus japonicus</i>	17.8	0.0	0.0	1.2	0	4.1	10.8	19.8	12.1	23.4	25.1	14.8	129
<i>Penaeus semisulcatus</i>	21.6	2.7	18.0	2.1	0	5.1	16.4	23.1	17.8	23.9	36.0	16.1	183
<i>Metapenaeus monoceros</i>	280.3	121.3	100.7	42.2	0	142.4	151.0	120.5	100.3	65.4	25.8	118.6	1268
<i>Metapenaeus affinis</i>	57.9	2.5	3.6	0.9	0	107.8	30.8	39.4	3.6	13.9	32.6	7.1	300
<i>Metapenaeus dobsoni</i>	37.0	0.0	36.3	15.6	0	22.2	80.2	102.6	54.1	94.0	52.9	79.3	574
<i>Solenocera crassicornis</i>	96.2	117.8	88.1	20.3	0	10.5	50.8	114.2	62.5	51.2	100.9	137.6	850

<i>Solenocera melantho</i>	28.2	89.8	30.7	23.7	0	25.3	23.2	27.4	11.7	2.9	12.9	11.9	288
<i>Trachypenaeus curvirostris</i>	35.9	55.9	20.4	9.4	0	12.6	32.7	30.0	15.1	29.2	35.6	77.7	355
<i>Trachypenaeus granulosus</i>	0.8	21.6	4.9	2.9	0	0.7	14.4	9.8	33.2	10.9	6.8	6.7	113
<i>Trachypenaeus sedili</i>	0.2	2.9	4.8	0.1	0	0.1	0.6	5.1	0.4	2.2	0.6	4.3	21
<i>Metapenaeopsis barbata</i>	31.0	48.0	18.6	9.6	0	22.7	31.6	58.9	47.9	73.6	58.1	84.8	485
<i>Metapenaeopsis stridulans</i>	1.7	6.7	2.3	0.0	0	11.5	15.8	23.7	234.6	6.4	20.7	18.4	342
<i>Metapenaeopsis mogiensis</i>	0.0	0.0	0.1	0.0	0	0.7	0.9	1.2	11.5	0.0	0.0	0.0	14
<i>Parapenaeus longipes</i>	2.4	9.5	1.6	3.9	0	0.2	0.4	0.2	12.3	0.7	1.0	3.6	36
<i>Parapenaeopsis stylifera</i>	3.6	0.0	24.9	0.0	0	4.9	50.1	84.6	15.4	5.5	0.5	0.0	190
<i>Parapenaeopsis coromondelica</i>	0.0	0.0	0.0	0.0	0	0.1	3.1	1.4	15.8	12.2	0.0	0.0	33
<i>Parapenaeopsis hardwickii</i>	0.0	0.0	0.0	0.0	0	0.0	2.1	6.7	12.8	1.7	0.8	0.0	24
<i>Parapenaeopsis uncta</i>	1.8	0.0	0.0	0.0	0	19.4	28.7	17.4	4.8	12.3	2.0	19.7	106
<i>Parapenaeopsis maxillipedo</i>	0.1	0.0	0.6	0.0	0	18.4	46.2	0.8	3.5	1.2	1.4	52.8	125
Total	679	516	387	141	0	445	677	887	746	487	503	717	6184

Note: Month-wise mean values for the five years period, 2011 to 2015 are given in the table

Table 3: Comparison of catch (t), CPH (Kgh⁻¹) and proportion (%) of penaeid prawns for the period 2011 to 2015 and 2006 to 2010

Species	Catch (t)			CPH (kgh ⁻¹)			Species contribution (%) to total fish catch		
	2011-15	2006-10	Increase/decrease (%)	2011-15	2006-10	Increase/decrease by %	2011-15	2006-10	Increase/decrease (%)
<i>P. monodon</i>	331.4	206.6	60.4	0.219	0.176	24.4	4.8	3.9	22.4
<i>P. indicus</i>	417.4	304.5	37.1	0.276	0.259	6.5	6.1	5.7	6.6
<i>P. merguensis</i>	0.1	9.0	-99.1	0.000	0.008	-100.0	0.0	0.2	-99.4
<i>P. japonicus</i>	129.1	51.8	149.1	0.085	0.044	93.8	1.8	1	84.6
<i>P. semisulcatus</i>	182.8	90.9	101.0	0.121	0.077	56.8	3.4	1.7	99.9
<i>M. Monoceros</i>	1268.4	1813.5	-30.1	0.838	1.543	-45.7	22.5	33.8	-33.3
<i>M. affinis</i>	300.1	197.1	52.3	0.198	0.168	18.0	4.3	3.7	16.8
<i>M. dobsoni</i>	574.2	708.1	-18.9	0.379	0.602	-37.0	7.5	13.2	-43.5
<i>Solenocera spp.</i>	1137.8	933.8	21.8	0.735	0.794	-7.4	19.8	17.4	13.8
<i>Trachypenaeus pp. curvirostris</i>	488.6	69.4	604.3	0.321	0.059	444.3	8.8	1.3	578.2
<i>Metapenaeopsis spp.</i>	841.0	468.4	79.6	0.552	0.398	38.8	13.1	8.7	50.3
<i>Parapenaeus spp.</i>	35.8	60.6	-40.9	0.024	0.052	-54.5	0.8	1.1	-26.2
<i>Parapenaeopsis spp.</i>	477.7	305.0	56.6	0.313	0.259	20.7	7.1	5.7	24.3
Others	0.0	141.4	-100.0	0.000	0.06	-100.0	0.0	2.6	-100.0
Total	6184	5360	15.4	4.250	4.560	-6.8	100	100	

Note: Species-wise mean values for the period 2011 to 2015 and 2006 to 2010 are given in the table

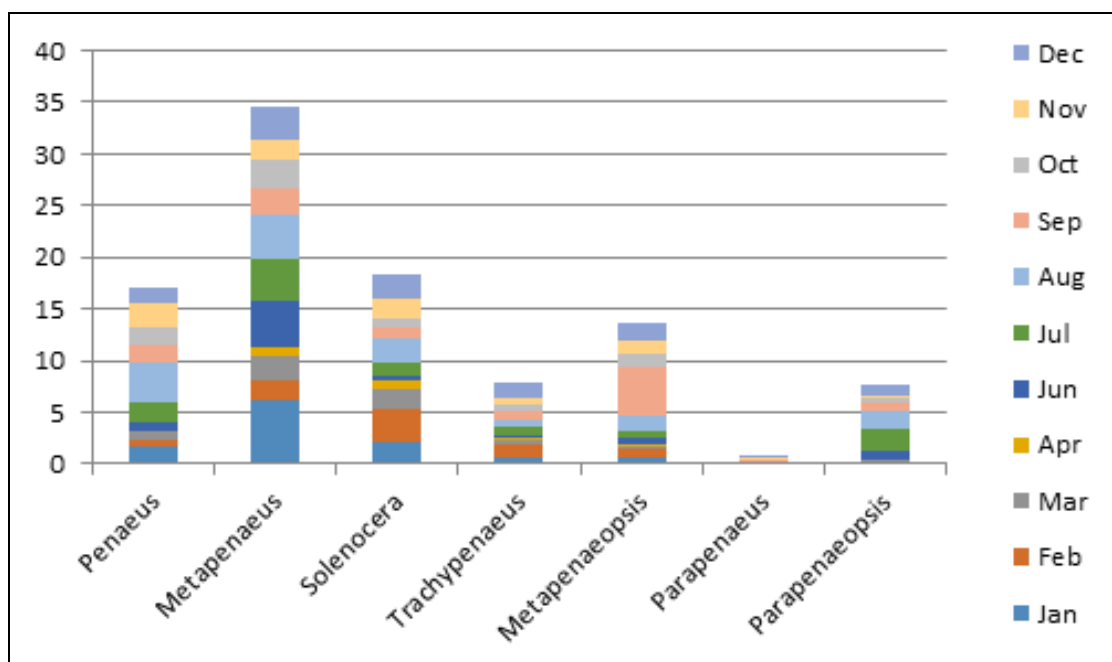


Fig 1: Group-wise mean proportion (%) of penaeid prawns landed by large trawlers from 2011 to 2015

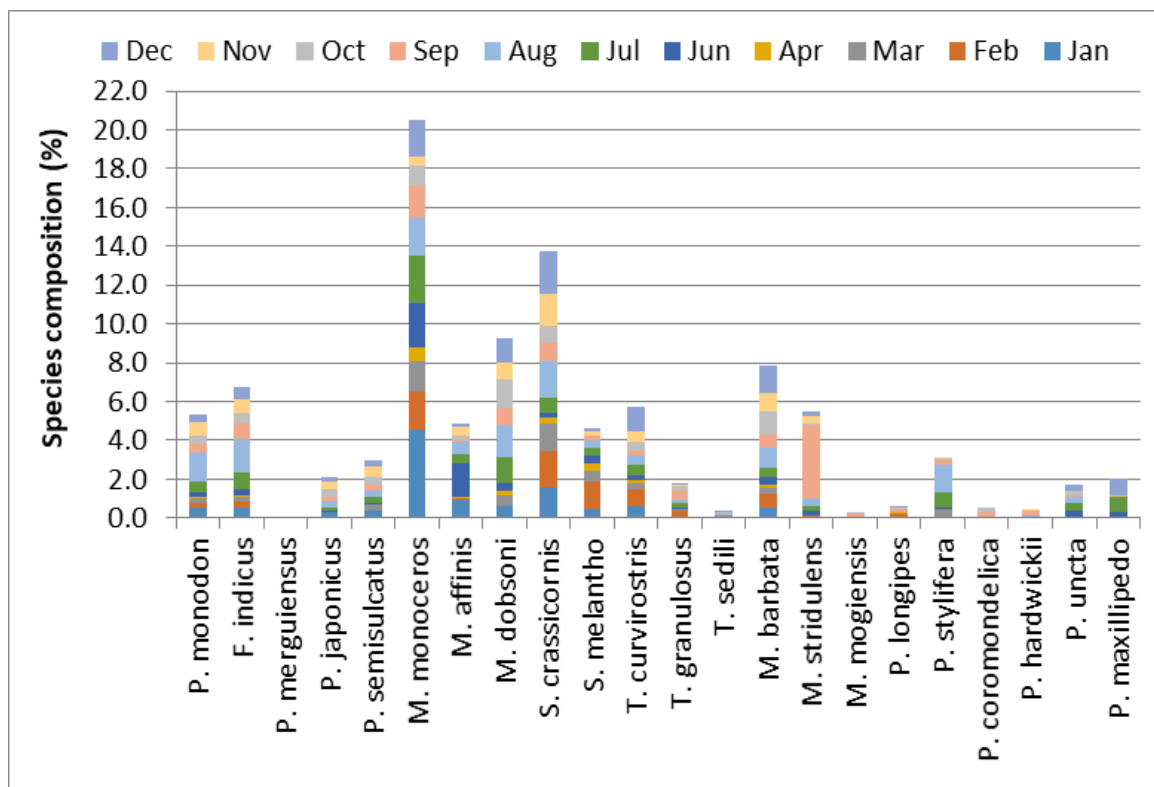


Fig 2: Species composition (%) of penaeid prawns landed by large (sona boats) trawlers

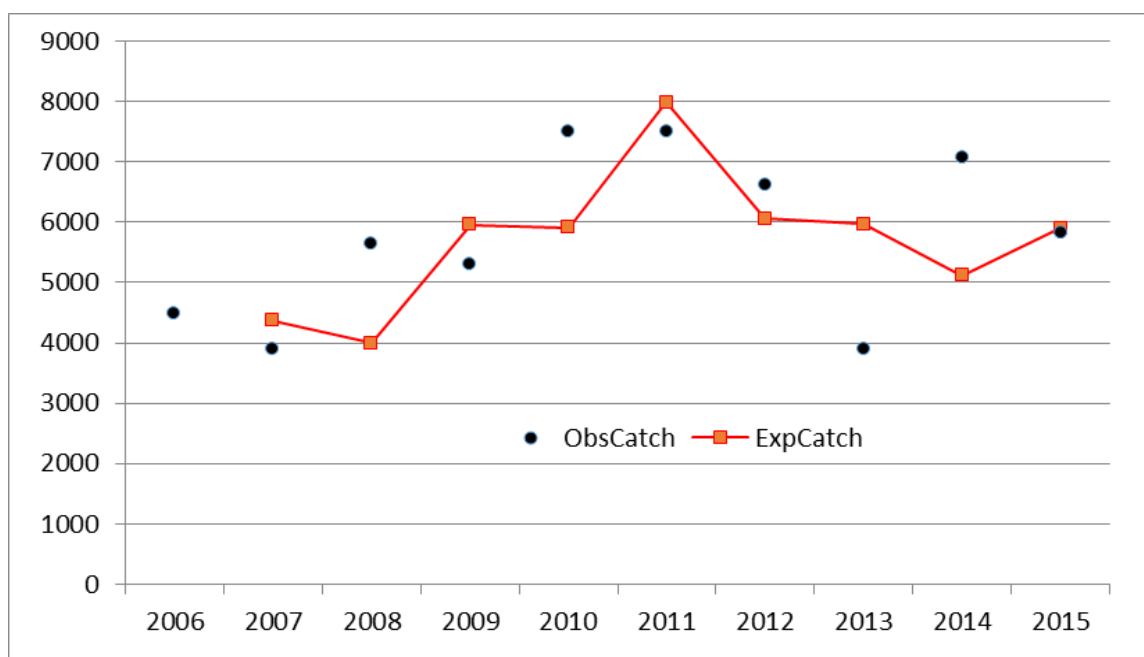


Fig 3: Expected (thin line) catch (t) and observed catch (t) of penaeid prawns from 2006 to 2015

Conclusion

Study revealed that, surge in fishing effort and penaeid prawn catch was recorded during the study period with that of 2006-10. Decline in Catch per Hour (CPH) and penaeid prawn proportion (%) to total fish catch was observed. Penaeid prawns accounted for 15.5% of the sona boat landings. Annually, mean penaeid prawn landings were estimated at 6,184 t. Mean penaeid prawn catch per hour (CPH) was estimated at 4.25 kg^h⁻¹. Penaeid prawns were over exploited in 2008, 2010 & 2014 with that of expected catch. As a whole, sona boats constantly harvesting penaeid prawns in sustainable manner and it is advised to confine fishing effort at current altitude of operation.

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