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Assessment of penaeid prawn fishery by small mechanized trawlers off Visakhapatnam, east coast of India

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Abstract

Study was conducted to assess penaeid prawn fishery by small mechanized trawlers along Visakhapatnam coast during 2011 to 2015. Penaeid prawn landings, fishing effort, CPH and species composition was collected from small mechanized trawlers. Expected penaeid prawn landings (t) were estimated by Schaefer production model (CEDA) based on fishing effort and penaeid prawn catch. Study discovered that there was considerable rise in fishing effort (h) (33.7%) and penaeid prawn landings (17.35%) during the study period with that of 2006-10. Drop in catch per hour (12.24%) and penaeid prawn proportion (12.39%) was registered. Mean fishing effort (h) per unit was registered as 115h and catch per hour of penaeid prawns ranged from 3.37 to 5.73 kg h^{-1} . All in all, penaeid prawn landings accounted for 3,598 t annually and attributed to 14.8% of the total fish catch.

Keywords: Prawn catch, catch per hour, penaeid proportion, fishing effort

Introduction

Small mechanized trawlers were introduced for commercial fishing off Visakhapatnam coast during 1964. Voyage fishing was in practice along the Andhra coast from 1987 to 1990 [1]. Trawl nets were the major gears which were exploiting more than 90% of penaeid shrimp along the east coast. In 1985, mini trawlers (16m L_{OA}) were introduced and operated along Visakhapatnam coast [2].

Small mechanized trawlers are operated for harvest of penaeid prawns off Visakhapatnam, east coast of India. Catch, effort, species composition of penaeid prawns of trawl catch were studied along Kakinada coast, from 1967 to 1978 [2]. Fishery and catch trends of trawlers were studied during 1967-70 and 1970-74 [3, 4]. In 1964, Resource exploitation by small mechanized trawlers began and continuous growth was observed along Kakinada coast [5].

Small mechanized trawlers with 9 to 11 m L_{OA} and 65 to 86 HP engine operated for 2-7 days cruise to catch penaeid prawns up to a depth range of 70 m along Visakhapatnam coast. Trawlers operated with the mesh size (cod end) of 20 mm, 2-3 t fish hold capacity and with 6-member crew [6]. Study was conducted to assess penaeid prawn fishery by small mechanized trawlers along Visakhapatnam coast for a period of five years from 2011 to 2015.

Material and Methods

Samples collected from Visakhapatnam landing centre once in a week during 2011-15. Penaeid prawn landings, fishing effort, catch per hour (CPH) and species proportion was collected from small mechanized trawlers. Data collected by using multi stage random sampling method of ICAR- CMFRI [7]. Annual catch was estimated based on the catch data of observation days and same raised to monthly catch based on the number of fishing days in a month. Status of exploitation and expected penaeid prawn landings (t) were estimated by Schaefer production model (CEDA) based on fishing effort and penaeid prawn catches from small trawlers for the ten year period from 2006 to 2015 [8].

Results and Discussion

East coast constitutes nearly half of the marine fish landings in India. Visakhapatnam is one of the foremost fishing harbors with significant units of marine trawl landings in east coast. There was considerable rise in fishing effort (h) (33.7%) and penaeid prawn landings (17.35%)

during the study period from 2011 to 2015 with that of 2006-10. Fall in catch per hour (12.24%) and penaeid prawn proportion (12.39%) was registered. In all, 22 species from 7 groups (generas) comprised to total penaeid prawn landings by small mechanized trawlers at Visakhapatnam fishing harbor.

On an average, annually 5,177 to 10,206 units (trips) of small mechanized trawlers were operated with the mean at 8,244 units. As a whole, annually fishing effort of small mechanized trawlers was estimated at 9.49 lakh h. Mean fishing effort (h) per unit was registered as 115h with the range between 97.2 h (2014) to 151.7 h (2013). Fishing effort, total fish catch and penaeid prawn landings were predominant in the year, 2013. Gradual swell in fishing effort (h) during 1967-77 and drop during 1978 along Kakinada coast was reported^[9]. Men effort per unit (h) increased from 27.3 to 103.7 h during the period 2001 to 2010^[6].

All in all, penaeid prawn landings accounted for 3,598 t annually and varied from 2,498 t to 4,924 t during the study period. Prawns composed 6,191 t in 1977 and descended to 2,026 t in 1978 along Kakinada coast^[2]. Catch per hour of penaeid prawns speckled from 3.37 to 5.73 kg h⁻¹ with mean at 3.8 kg h⁻¹. Decline in cph was observed at the rate of 12.24% with that of 2006-10. Catch per hour of penaeid prawns were reported at 3.55 kg h⁻¹ along Visakhapatnam coast^[6]. Annual catch per hour for prawns was reported as 3.0 kg and 2.7 kg for the period 1982-83 and 1983-84 respectively for small trawlers off Visakhapatnam^[10]. Average catch per hour indicated the abundance of prawns along Kakinada coast during the period 1967-78^[2].

Mean penaeid prawns attributed about 14.8% of the total fish catch of the small mechanized trawlers (Table 1). Maheswarudu *et al.*, 2015 and Rajkumar, 2004 reported prawns contribution as 13.7% and 11.9% respectively to the total landings^[6, 1]. Penaeid prawns formed 9.8% of total catch along the east coast^[11]. Shrimps constituted 13.8% to the total fish catch by small mechanized trawlers off Visakhapatnam

during 1982-84^[10].

Pinnacle proportion of penaeid prawn was observed in the month of June (20.9%) followed by August (17.2%). Peak in CPH of penaeid prawns were observed in the month of August (5.1 kg h⁻¹) followed by September (4.9 kg h⁻¹). Upper limit of fishing effort was estimated in the month of January (h) and December (units). Fish (4,078 t) and prawn landings (659 t) were paramount in the month of September (Table 2). In all, 22 species of penaeid prawns were composed to trawl catch with the ascendancy of *Metapenaeus monoceros* (20%) followed by *Solenocera crassicornis* (14%) and *Metapenaeopsis barbata* (9.4%) (Fig.1). Small trawlers catch was exceeded by *M. monoceros*, *M. dobsoni*, *S. crassicornis* and *P. stylifera* off Visakhapatnam during the period 2006-10^[6]. Muthu, 1968 and Maheswarudu *et al.*, 2015 reported 37 species and 24 species respectively from Visakhapatnam coast^[5, 6].

Overall, 7 groups of penaeid prawns were represented and the catch was excelled by *Meatapenaeus* (28.2%) followed by *Solenocera* (19.9%) and *Metapenaeopsis* (17.4%) (Fig.2). Plunge in species catch was observed for *F. merguensis*, *M. monoceros*, *M. dobsoni* and *P. stylifera* during the study period with that of 2006-10. There was considerable grow in penaeid prawn species catch (12.7%) during the study period with that of 2006-10. Drop in catch per hour and species proportion was registered (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 2006-2015 (Fig. 3). The r² value for fishing effort and penaeid prawn catch was projected as 0.62. Over exploitation of prawns were observed in 2008-09 & 2013, and under exploited during 2010-12 & 2014 with that of expected penaeid prawn landings. Penaeid prawns were underexploited during 2001-2005 and overexploited during 2006-10^[6]. In view of penaeid prawn harvest, fishing effort of small mechanized trawlers ought to confine at current intensity.

Table 1: Mean catch and effort of small mechanised trawlers off Visakhapatnam coast during 2011-15

Year	Effort (units)	Effort (h)	Effort (h)/ trip	Penaeidprawn catch (t)	Total fish catch (t)	CPH of penaeid prawns (kg h ⁻¹)	CPH of total fish catch (kg h ⁻¹)	Penaeid prawn catch (%)
2011	9658	980543	101.5	3436	22167	3.50	22.61	15.50
2012	10206	1031576	101.1	3481	22583	3.37	21.89	15.41
2013	9625	1460356	151.7	4924	37482	3.37	25.67	13.14
2014	6556	636982	97.2	3650	24711	5.73	38.79	14.77
2015	5177	635453	122.7	2498	14705	3.93	23.14	16.99
Mean (2011-15)	8244	948982	114.85	3598	24330	3.98	26.42	15.16
Mean (2006-10)	9217	709752	77	3066	18159	4.32	25.59	16.88
± (%)	-10.55	33.71	49.49	17.35	33.98	-12.24	0.19	-12.39
Standard Deviation	2237	340942	22.93	868	8269	1.00	7.06	1.39
Standard Error	1000	152474	10.25	388	3698	0.45	3.16	0.62

Table 2: Mean penaeid prawn catch and fishing effort by small mechanized trawlers along Visakhapatnam coast during 2011-15

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Effort (units)	731	771	737	372	0	646	851	901	1035	583	701	917	8244
Effort (h)	117107	101037	83445	37420	0	53333	94105	85630	135453	71787	80184	89482	948982
Total fish catch (t)	1958	2942	1970	898	0	1177	1962	2514	4078	1873	2155	2803	24330
Penaeid prawn catch (t)	288	308	259	118	0	245	308	434	659	244	307	388	3557
% of penaeid prawn in total fish catch	14.7	10.5	13.1	13.1	0	20.9	15.7	17.2	16.2	13	14.2	13.8	15.0
CPH of penaeid prawns	2.5	3.0	3.1	3.1	0	4.6	3.3	5.1	4.9	3.4	3.8	4.3	3.75
Penaeid prawn catch (t)													
<i>Penaeus monodon</i>	9.3	8.6	8.0	3.1	0	7.1	9.8	26.5	23.6	10.0	21.9	13.4	141
<i>Fenneropenaeus indicus</i>	11.6	12.2	8.5	3.0	0	10.4	18.8	59.7	36.4	15.4	36.0	20.1	232
<i>F. merguensis</i>	0.0	0.0	0.0	0.0	0	0.7	0.1	0.0	0.0	0.0	0.0	0.0	1
<i>Marsupenaeus japonicus</i>	5.9	2.1	0.7	1.2	0	2.8	2.3	9.7	9.6	7.8	20.7	9.7	73

<i>P. semisulcatus</i>	5.9	3.3	12.4	1.7	0	3.5	3.4	12.3	13.5	7.0	35.7	11.7	110
<i>Metapenaeus monoceros</i>	78.2	93.9	77.3	38.5	0	69.3	67.5	63.2	81.5	65.2	0.0	87.1	722
<i>M. affinis</i>	8.9	2.2	2.2	0.6	0	26.6	10.6	12.4	1.4	5.7	14.9	3.6	89
<i>M. dobsoni</i>	14.7	2.8	20.7	8.4	0	10.1	35.1	20.5	29.7	13.3	18.1	18.4	192
<i>Solenocera crassicornis</i>	60.4	62.8	43.8	7.1	0	8.9	22.2	55.7	58.3	35.6	49.7	92.9	497
<i>S. melantho</i>	21.0	39.0	25.1	35.8	0	22.6	11.1	10.4	10.4	10.8	9.8	14.0	210
<i>Trachypenaeus curvirostris</i>	24.5	30.0	15.9	4.3	0	10.8	17.1	10.7	12.8	10.8	26.7	40.2	204
<i>T. granulatus</i>	0.8	11.3	6.1	1.3	0	0.5	7.7	22.0	33.6	4.4	7.4	3.8	99
<i>T. sedili</i>	0.1	1.7	3.6	0.1	0	0.1	0.6	2.0	0.1	1.7	0.5	5.4	160
<i>Metapenaeopsis barbata</i>	30.0	26.1	21.3	8.5	0	21.8	21.3	56.0	40.2	27.6	44.9	37.7	336
<i>M. stridulans</i>	1.2	3.8	2.4	0.0	0	12.2	10.4	8.7	213.6	3.1	10.8	3.9	270
<i>M. mogiensis</i>	0.0	0.0	0.1	0.0	0	0.7	0.5	0.6	11.5	0.0	0.0	0.0	13
<i>Parapenaeus longipes</i>	2.4	7.8	1.7	4.0	0	0.0	0.4	0.7	23.8	0.3	0.3	1.4	43
<i>Parapenaeopsis stylifera</i>	8.6	0.0	8.2	0.0	0	4.2	20.5	47.2	13.6	4.1	2.4	0.0	109
<i>P. coromondelica</i>	0.0	0.0	0.0	0.0	0	0.1	2.0	0.3	5.1	4.0	0.0	0.0	12
<i>P. hardwickii</i>	0.0	0.0	0.0	0.0	0	0.0	0.8	5.7	15.8	5.6	1.1	4.4	33
<i>P. uncta</i>	4.4	0.0	0.0	0.0	0	18.3	17.9	8.5	22.5	10.5	3.6	5.8	92
<i>P. maxillipedo</i>	0.2	0.0	0.5	0.0	0	14.6	28.1	0.9	2.2	0.6	2.3	14.5	64
Total	288	308	259	118	0	245	308	434	659	244	307	388	3557

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

Species	Catch (t)			cph (kg)			Species Composition (%)		
	2011-15	2006-10	Increase/decrease (%)	2011-15	2006-10	Increase/decrease by %	2011-15	2006-10	Increase/decrease (%)
<i>Penaeus monodon</i>	141.2	75.9	86.1	0.175	0.106	64.7	4.1	2.9	40.0
<i>Fenneropenaeus indicus indicus</i>	232.1	133.1	74.4	0.292	0.185	57.8	6.4	5	27.6
<i>F. merguensis</i>	0.8	1	-24.0	0.001	0.001	32.0	0.0	0	0.0
<i>Marsupenaeus japonicus</i>	72.6	19.9	264.6	0.097	0.028	245.5	2.2	0.8	178.2
<i>P. semisulcatus</i>	110.3	45.9	140.2	0.133	0.064	107.7	3.5	1.7	104.8
<i>Metapenaeus monoceros</i>	721.7	1255.6	-42.5	0.820	1.749	-53.1	21.0	28.3	-25.9
<i>M. affinis</i>	89.1	76.9	15.8	0.125	0.107	16.9	2.8	2.9	-4.6
<i>M. dobsoni</i>	191.7	364.6	-47.4	0.254	0.508	-50.0	5.8	13.8	-57.8
<i>Solenocera crassicornis</i>	497.4	317.4	56.7	0.594	0.442	34.5	14.3	12	19.3
<i>S. melantho</i>	210.1	189.5	10.9	0.289	0.264	9.4	7.1	7.2	-0.9
<i>Trichypenaeus curvirostris curvirostris</i>	203.7	130.2	56.4	0.243	0.181	34.4	6.6	4.9	35.5
<i>T. granulatus</i>	98.9	31.4	215.0	0.096	0.044	117.5	2.2	1.2	86.5
<i>T. sedili</i>	15.9	5	218.7	0.031	0.007	339.4	1.2	0.2	481.2
<i>Metapenaeopsis barbata</i>	335.6	146.6	128.9	0.394	0.204	93.2	9.2	5.5	67.9
<i>M. stridulans</i>	270.3	86.9	211.0	0.204	0.121	69.0	4.3	3.3	29.1
<i>M. mogiensis</i>	13.4	11.9	12.9	0.017	0.017	0.7	0.2	0.4	-54.0
<i>Parapenaeus longipes</i>	42.7	28.2	51.5	0.040	0.039	2.1	1.1	1.1	-4.1
<i>Parapenaeopsis stylifera</i>	108.7	151.6	-28.3	0.142	0.211	-32.5	2.9	5.7	-48.8
<i>P. coromondelica</i>	11.6	2.2	425.4	0.017	0.003	482.5	0.4	0.1	302.4
<i>P. hardwickii</i>	33.5	21.1	58.6	0.036	0.029	23.3	0.6	0.8	-31.0
<i>P. uncta</i>	91.6	37.7	142.9	0.120	0.053	126.3	2.4	1.4	74.6
<i>P. maxillipedo</i>	64.0	22.2	188.4	0.089	0.031	186.9	1.7	0.8	116.0
Total	3557	3155	12.7	4.210	4.394	-4.2	100	100	

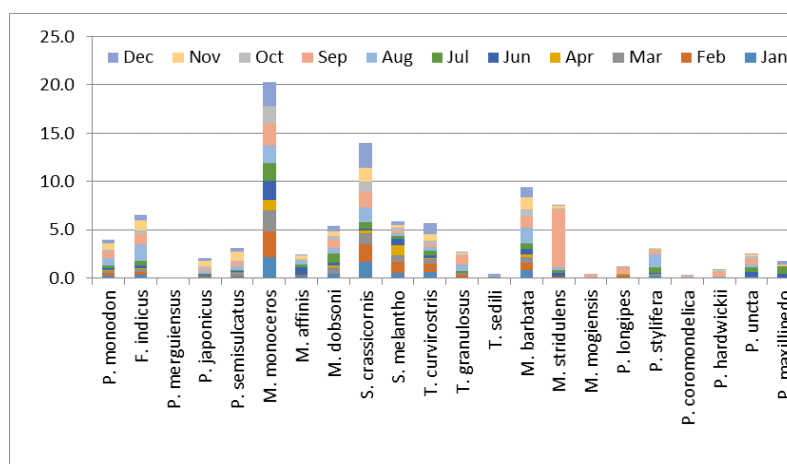


Fig 1: Penaeid prawn species proportion (%) to total landings by small trawlers

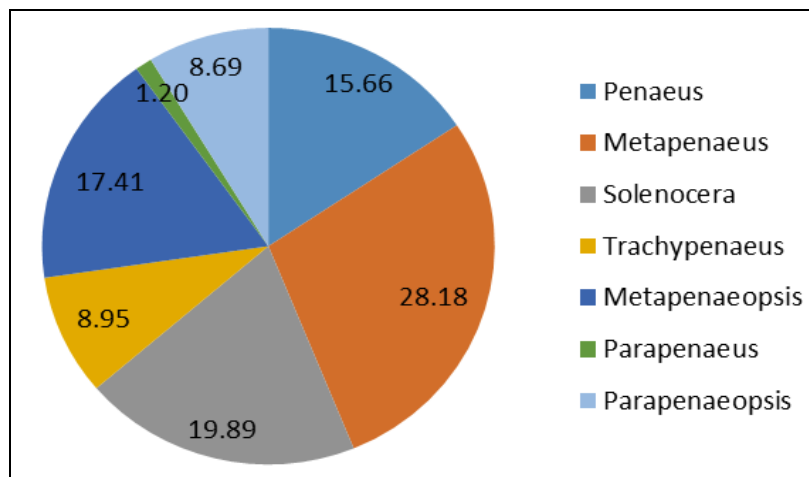


Fig 2: Group-wise mean proportion (%) of penaeid prawns landed by small trawlers

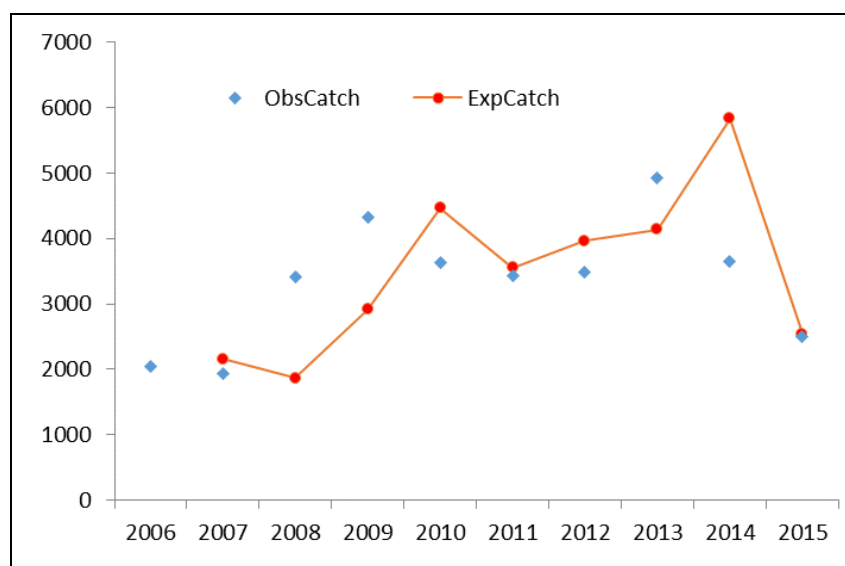


Fig 3: Expected (thin line) and observed landings (t) of penaeid prawns by small trawlers

Conclusion

Study disclose that there was considerable rise in fishing effort (h) (33.7%) and penaeid prawn landings (17.35%) during the study period (2011 to 2015) with that of 2006-10. Drop in catch per hour (12.24%) and penaeid prawn proportion (12.39%) was registered. Mean fishing effort (h) per unit was registered as 115h and catch per hour of penaeid prawns ranged from 3.37 to 5.73 kg h^{-1} . Penaeid prawn landings accounted for 3,598 t annually and attributed to 14.8% of the small mechanized trawl landings. All in all, over exploitation of prawns were observed in 2008-09 & 2013 with that of expected penaeid prawn landings.

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