

Bottom trawl discards along Kerala coast : A case Study

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Abstract

A pioneer attempt has been made to quantify the discards from bottom trawlers operated off Kerala on the basis of assessment made onboard the vessel. The quantity of discards thrown back into the sea during 2000-01 and 2001-02 were quantified as 2.62 and 2.25 lakh tonnes respectively. The discards were grouped into 11 taxa. The number of species encountered in each category were : finfishes 103, gastropods 65, bivalves 12, shrimps 8, stomatopods 2, crabs 12, cephalopods 5, echinoderms 3 and four species of jellyfishes. The average quantity in lakh tonnes worked out in respect of the above groups during the study period are as follows: fin fishes- 0.95, gastropods- 0.22, crabs- 0.68, jellyfishes 0.03, cephalopods- 0.029, stomatopods- 0.4, juvenile shrimps - 0.05, soles- 0.03, eggs-0.089, echinoderms - 0.018, snakes- 0.001. In both the years, finfish appeared as the dominant group among the discards. Discards were highest during September in both the years, whereas it was least in November in 2000-01 and in December 2001-02. The edible portion of the discards during 2000-01 was quantified as 0.87 lakh tonnes, which accounted for 33.3% while in 2001-02 it was 0.8 lakh tonnes accounting for 35.5% of the total discards. The average catch per hour of discards was 58.8 and 52.5 kg/hr during the first and second years respectively while the average catch per unit during the preceding and succeeding years were 359 and 307 kg/unit respectively. During the first year catch per unit as high as 800 kg was recorded in September while in the second year, the highest value recorded was 692 kg/hr in August.

Introduction

The introduction of mechanised trawlers to exploit the demersal resources beyond the traditional fishing grounds of Kerala in the early fifties was an important event in the marine fisheries of Kerala and due to the high returns it became widespread all along the trawlable coastal grounds. As trawling was found to be the most efficient method for the exploitation of shrimps, its number has shown an exponential increase along the coastal

waters of Kerala. Among the mechanised boats operating along Kerala coast more than 90% belong to bottom trawl specifically aimed for the exploitation of shrimp resources of the inshore waters (Ravindran and Baiju, 1998). Kurup and Rajasree (in press) enumerated the number of bottom trawlers operated from 11 major and minor fisheries harbours of Kerala as 4,960. Bottom trawling being a non selective fishing gear, it hauls up all the organisms dwelling at the sea bottom and therefore, its destructive effect to the non-target

organisms of the sea bottom is a matter of grave concern on a global basis (Jennings and Kaiser, 1998). Saila (1983) estimated that 6.72 million tonnes of biota were discarded back to the sea while Andrew and Pepperal (1992) estimated a total global discards of 16.7 million tonnes from shrimp fisheries alone. Commercial bottom trawling globally produce 27 million tonnes of discards and this represents more than half of all fish produced annually from marine capture fisheries for direct human consumption (Alverson *et al.*, 1994). Quantification of discards have been made based on discards landed at various harbours (Rao, 1998; Menon, 1996) but no concerted attempts have been made to quantify the discards by collection of data onboard the bottom trawlers operated along Kerala coast. Therefore, in the present study a pioneer attempt was made to quantify the discards from the bottom trawlers of Kerala.

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Material and methods

The quantification of discard on board the trawlers were done on the basis of data generated from fishing operation of 375 bottom trawlers operated from 6 major

fisheries harbours such as Sakthikulangara Neendakara, Cochin, Munambam, Beypore and Puthiyappa along the southwest coast of India during April 2000 to March 2002. Besides, the trawl catch composition was analysed from 100 boats operating beyond 100 m on the basis of samples collected from the last haul and preserved in tubs. The trawl catch composition was also examined by collecting samples from 120 boats during trawling operations carried out in the regular fishing grounds with the help of a hired boat during the study period. Data during second half of June and full month of July could not be collected due to the ban imposed on bottom trawling along Kerala coast. The units of bottom trawlers for monthly onboard participation from various harbours were selected following Alagaraja (1984). The fishing endurance of the selected units varied from 1-3 days. The number of hauls in each voyage varied from 1-8 depending on the endurance and availability of fish. The catches from individual hauls were examined separately and the components were sorted into target, non-target and discards following McCaughran (1992) and species/group level identification was done following FAO, (1984), Munro (2000) and Dance (1977). The marketable fraction of the catch was sorted out and packed in trays of 20kg and the number of boxes was counted to compute the total weight. The discards were also sorted group/species-wise, weighed and 10% of the assorted sample was taken for detailed analysis in the laboratory. Details such as cruise time, facilities on board, OAL, cod end mesh

size, fishing endurance and actual fishing hours together with the number of hauls, number of units operated in the vicinity and details of crew, duration, depth of fishing, fishing ground, etc. were also collected and entered on to proforma. The daily discarded fraction from the trawl catch was computed by multiplying the average catch arrived at from individual units multiplied by total units operated from the harbour on a daily basis. The monthly catch was estimated by multiplying the daily landings with actual fishing days of each month. The discards were categorized under finfishes, soles, crabs, gastropods, shrimps, cephalopods, jellyfishes, stomatopods, eggs, juvenile shrimps and sea snakes. The effort in terms of fishing hours was worked out on the basis of actual time spent for fishing following Kurup and Rajasree (in press). The catch per hour and catch per unit of the discards were computed following Scariah *et al.* (1999).

Results

Quantification of discards

The discards were grouped into 11 taxa. The number of species observed under various groups were: finfishes 103, gastropods 70, bivalves 20, shrimps 9, stomatopods 3, crabs 12, cephalopods 7, echinoderms 5 and four species of jellyfishes. The total quantity of discards during 2000-01 was estimated to be 2.62 lakhs tonnes while during 2001-02 the same was slightly less with 2.25 lakh tonnes. The quantity of various groups discarded during the first and second years are shown in Figures 1 & 2. During both the years, the highest

fraction of the discards was comprised of fishes, crabs and stomatopods. The average for 2000-01 and 2001-02 of various discarded groups in lakh tonnes were as follows: fin fishes- 0.95, gastropods- 0.22, crabs- 0.68, jellyfishes- 0.03, cephalopods- 0.029, stomatopods- 0.4, juvenile shrimps -0.05, soles- 0.03, eggs-0.089, echinoderms- 0.018 and sea snakes- .001. The pattern of monthly variation of discards from bottom trawlers in Kerala during the study period is depicted in Figure 3. Highest discards in the first year were recorded in September (0.57 lakh tonnes) followed by March (0.45 lakh tonnes) while it was lowest in November (0.072 lakh tonnes). During the second year, even though September accounted for the maximum discards (0.32 lakh tonnes), the quantity was much lesser compared to previous year. During December, the least quantity (0.058 lakh tonnes) of discards were recorded in the second year. During both the years, the discarded fraction was very low during post monsoon whereas a gradual increasing trend was observed during the late pre monsoon period.

The edible and non-edible fractions of the total discards from bottom trawlers during 2000-01 and 2001-02 were worked out and the results are depicted in Figures 4 & 5. During 2000-01, the quantity of the edible portion discarded was 0.87 lakh tonnes which accounted for 33.3% of the total discarded catch from Kerala coast. During the succeeding year, there was a slight increase in the edible portion (35.5%) though there was a slight decrease in the quantity (0.8 lakh tonnes). The seasonal

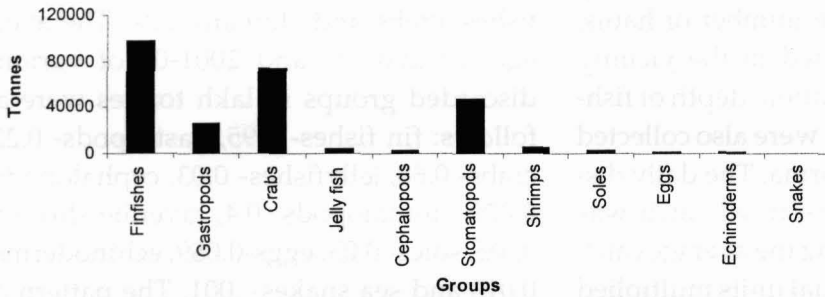


Fig.1. Estimated quantity of discards (Major groups) April 2000 - March 2001

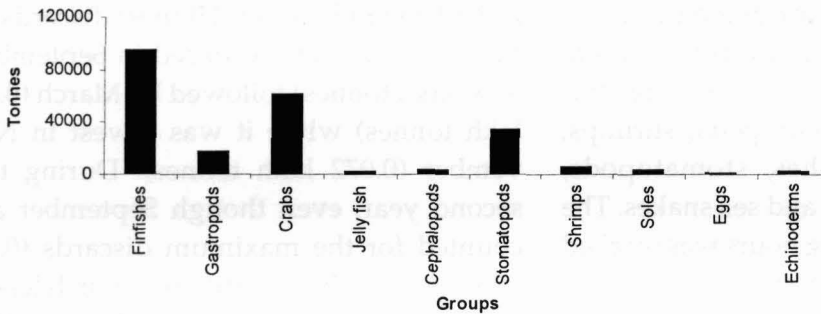


Fig. 2. Estimated quantity of discards (Major groups) April 2001 - March 2002

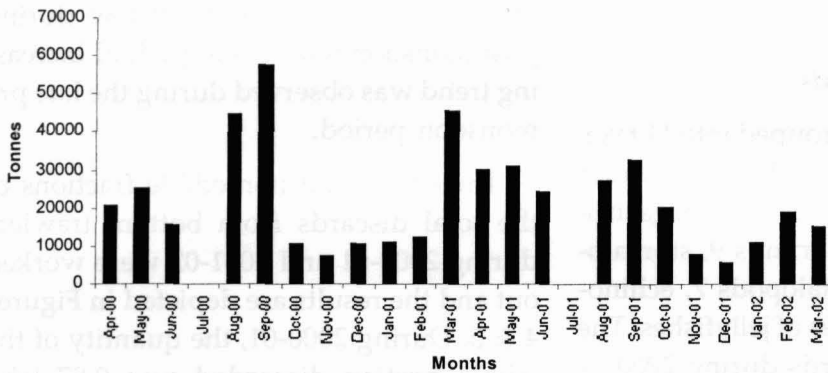


Fig. 3. Temporal variations in onboard discards (April 2000 - March 2002)

variation in catch per hour of discards from bottom trawling was computed for 2000-01 and 2001-02 and the results are shown in Figure 6. In both the years, highest catch per hour could be registered during mon-

soon followed by pre-monsoon and the least was observed during post monsoon. Highest catch per hour of 83.4 kg/hr was observed in monsoon during 2000-01 while the least was during post monsoon of 2001-02 with a mere 26.6 kg/hr. The high catch per hour of discards registered during the monsoon months is due to hectic trawling activities immediately after lifting of ban imposed on bottom trawlers for a period of 45 days along the Kerala coast. The discards during the monsoon were glaringly dominated by *Charybdis smithii* with a catch rate up to 1200kg/haul off Cochin in August

2000. The discards of the pre-monsoon period was predominated by *Charybdis granula* which was found distributed all along the coast up to 75 m, followed by *Oratosquilla nepa* with a similar distribu-

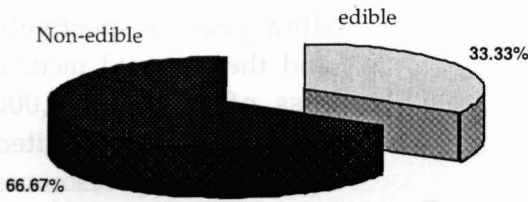


Fig. 4. Percentage composition of edible and non-edible biota (April 2000-March 2001)

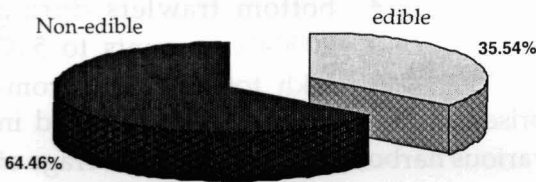


Fig. 5. Percentage composition of edible and non-edible biota (April 2001-March 2002)

tion pattern showing highest abundance in northern Kerala. Data for the monsoon months of June and July were not available due to the imposition of ban on bottom trawling along the Kerala coast.

Catch per hour of discards

During the first year, it varied from 18 to 101 kg/hr (M= 59 kg/hr) while during the second year it was in the range of 20 to 91 kg/hr (M= 52 kg/hr). Finfishes (46 kg/hr) constituted the dominant group. On the contrary, during the second year, crabs (48 kg/hr)

emerged as the dominant discard (Fig. 7).

Catch per unit of discards

During 2000-01 it ranged from 134 - 800 kg/unit (M= 359 kg/unit) with highest in September (800 kg/unit) while it was least in October with 134 kg/unit. Finfishes (346 kg/unit) and crabs (450 kg/unit) dominated. During 2001-02, the range was from 91 to 692 kg/unit (M= 307 kg/unit). The highest value was recorded in August with 692 kg/unit. During both the years *Charybdis smithii* dominated among the crabs in August, registering 395 and 326 kg/unit respectively (Fig. 8).

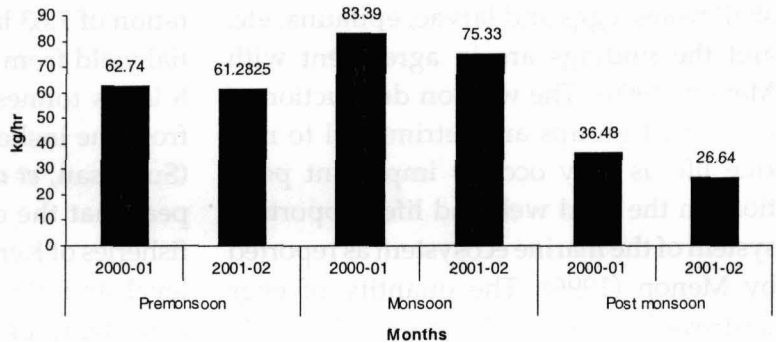


Fig. 6. Seasonal variations in catch per hour of onboard discards 2002

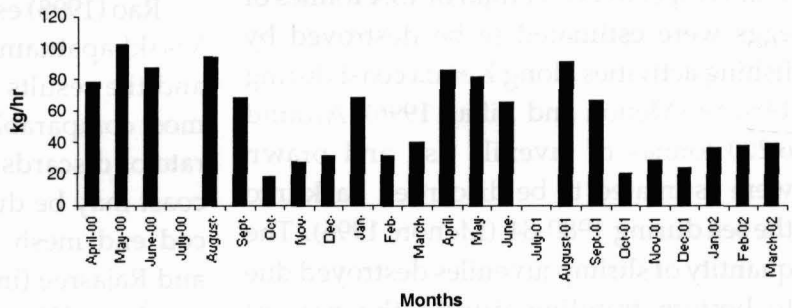


Fig. 7. Temporal variation in catch per hour of onboard discards (Apr. 2000-Mar. 2002)

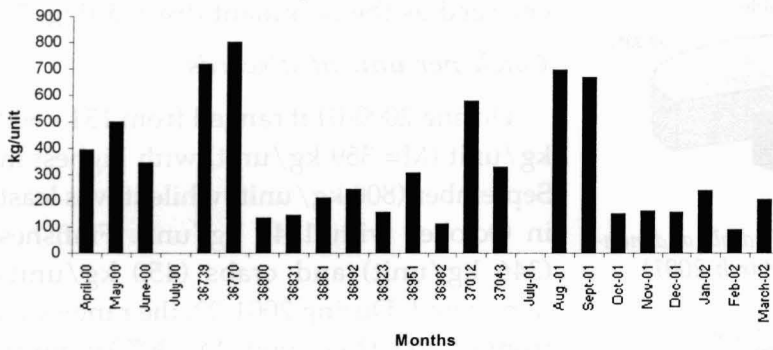


Fig. 8. Catch per unit of onboard discards (Apr. 2000 - Mar. 2002)

Discussion

The results of the present study revealed that bottom trawling destroys annually around 2.5 lakh tonnes of living organisms off Kerala which is comprised of juveniles of commercially important finfishes and shell fishes, eggs and larvae, epifauna, etc. and the findings are in agreement with Menon (1996). The wanton destruction of non-target groups are detrimental to marine life as they occupy important positions in the food web and life supporting system of the marine ecosystem as reported by Menon (1996). The quantity of eggs destroyed per annum is computed as 1,041 and 739 tonnes during the first and second years respectively. A total of 13.4 tonnes of eggs were estimated to be destroyed by fishing activities along Kerala coast during 1980-86 (Menon and Pillai, 1996). Around 6,200 tonnes of juvenile fish and prawn were estimated to be discarded back into the sea during 1980-84 (Menon, 1996). The quantity of shrimp juveniles destroyed due to bottom trawling during the present study is quantified as 5,110 and 5,662 tonnes during the preceding and succee-

ding years respectively and these would incur a loss of at least 30,000 tonnes to the exploited shrimp fishery resources of the state. The results of the present study show that the total catch from bottom trawlers during 2000-01 amounts to 5.07 lakh tonnes which com-

prised of the fishery resources landed in various harbours of Kerala. The average of the edible portion in the discards of two years worked out to 0.83 lakh tonnes and by the addition of this quantity to the highest landings ever recorded from Kerala would thus worked out to a total exploitation of 7.63 lakh tonnes. The total potential yield from Kerala coast is estimated as 8 lakhs tonnes of which the contribution from the inshore waters is 5.7 lakh tonnes (Sudarsan, *et al.*, 1990). It would thus appear that the exploitation level of marine fisheries of Kerala is nearing potential stock level and the situation calls for the enforcement of strong fishery regulatory measures for sustenance of the stock.

Rao (1998) estimated the discards from Visakhapatnam coast as 2,00,000 tonnes and the results of the present study is almost comparable with this. The very high rate of discards observed from the Kerala coast may be due to the use of very small cod end mesh size. According to Kurup and Rajasree (in press), 94% of the bottom trawlers of Kerala use less than 18 mm cod end mesh size against the statutory mesh size of 35 mm prescribed by the Govern-

ment of Kerala. Ye *et al.* (2000) estimated the discards from bottom trawls of Kuwaiti waters as 7.5 fold higher than the annual finfish landings. The total bycatch and discards of Kuwait shrimp fishery alone varied between 34,740–55,000 tonnes and more than 98% of the bycatch was discarded into the sea. In the North Mediterranean Sea, bottom trawl discards accounted for 39-40% of the total catch and the quantity estimated was 13,500-22,000 tonnes annually (Machias *et al.*, 2001).

Even though quantity of discards was more in pre monsoon, catch per hour was higher in monsoon because of lesser trawling effort during the period. Increased discards during premonsoon can be attributed to operation of trawl nets rigged with heavy tickler chains, thereby scraping the bottom vigorously and bringing up a lot of epifaunal organisms, which clog the net and results in hauling of discards in higher quantities. The results of the present study revealed that the discards were found highest in September and August during 2000-01 and May and September during 2001-02. Scariah *et al.* (1999) reported that the average annual landings of Kerala were higher during the monsoon months. Interestingly, in the present study the highest fraction as discards were found during monsoon months. The reasons by which fishes are discarded back in to the sea has been identified as due to wrong species, of wrong size, wrong sex, damaged fishes, poisonous nature, rapid spoilage, lack of storage space onboard, lack of refrigeration, lack of market value, lack of marketing infrastructure, etc. as expressed by

Clucas (1997) and Gordon (1991). Factors influencing the quantum of bycatch in shrimp trawl catches appeared to be the number of species of shrimp present in that particular fishing ground, its abundance, cod end mesh size and trawl characteristics, time of trawling, endurance of voyages, fishing depth and the intensity of fishing. (Sivasubramaniam, 1990).

The increased discards during the pre-monsoon in the present study can be attributed to the hectic trawl fishery targeting *Metapenaeus dobsoni*. The species is encountered during these months (Scariah, *et al.*, 1999). The peak abundance of *M.dobsoni* and its fishery during the month of March has earlier been reported by Ramanamurthy *et al.* (1978) and Kurian and Sebastian (1987). The discards during the pre-monsoon were predominated by stomatopods (Rajeshwari, 1996). The peak breeding period and abundance of stomatopods is reported as January and March (James and Thirumilu, 1993). In the present study also, the highest abundance of *Oratosquilla nepa* was encountered during pre-monsoon. Squilla accounted for 81% of the annual landings of trawlers in the southern region of India during 1985-90 (Menon, 1996). On the contrary in the present study the percentage contribution of Squilla was 18% and 15% during the first and second year of study respectively. The discards during monsoon were dominated by *C.smithii*, whose abundance had been reported along the Kerala coast in the same period by Zamorov *et al.* (1991); Balasubramanian and Suseelan (1998) and Balasubramanian (1993).

Gordon (1991) has estimated that 25-30% discards were comprised of juvenile shrimps along the Visakhapatnam coast. However, in the present study, the share of shrimps was only 2.23% of the total discards. Shrimp trawl bycatch in Visakhapatnam is constituted by 85 species (Sivasubramaniam, 1990) in contrast, the discards from Kerala was represented by 214 species, and this shows the richness and species diversity in the coastal waters of Kerala. The results of the present study would suggest the necessity of the rational utilisation of the discarded fraction for the preparation of fishery products and by products, high quality fish meals, etc whereby the wastage of this high valued protein could be avoided.

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