REPORT 2024

Technical backstopping for strengthening sustainable harvest of shrimp and cephalopod trawl fishery of Kerala

Client: Seafood Exporters Association of India (SEAI), Kochi

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ICAR-Central Marine Fisheries Research Institute
Kochi - 682018

Contents

1. Inshore shrimps species

Brief introduction

Metapenaeus dobsoni and *Parapenaeopsis stylifera* are Kerala's major inshore penaeid shrimp fishery resources. *M. dobsoni* is mainly caught in trawl nets (50-60%) and ring seines. 96% of *P. stylifera* are from trawl net. *M. dobsoni* has an estuarine phase in its life cycle as that in several other penaeid shrimp, with the juvenile/subadult emigrating to the sea to spawn. The species dominates the inshore shrimp fishery of Kerala followed by *P. stylifera*. The trend in the landings of the two resources *M. dobsoni* and *P. stylifera* are shown in Figs.1, 2.

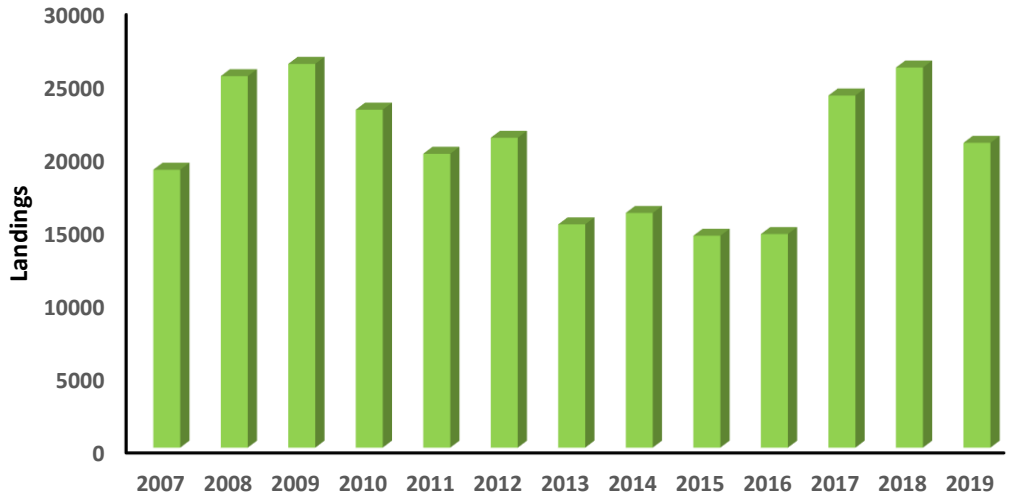


Fig.1 Landing trend of *Metapenaeus dobsoni* from 2007 to 2019

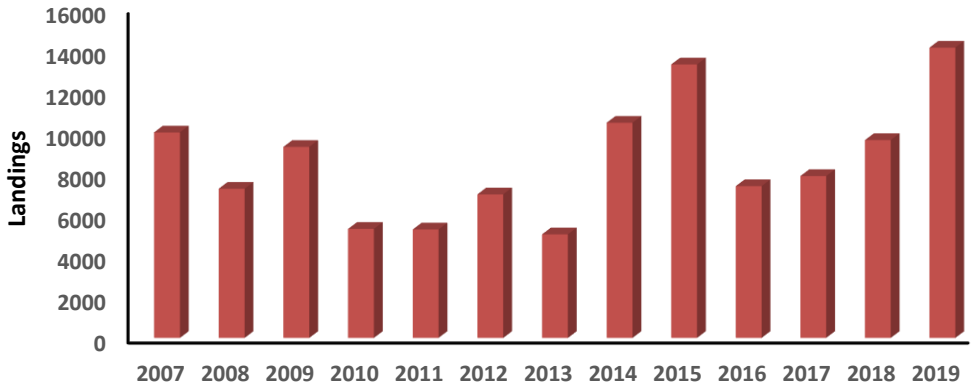


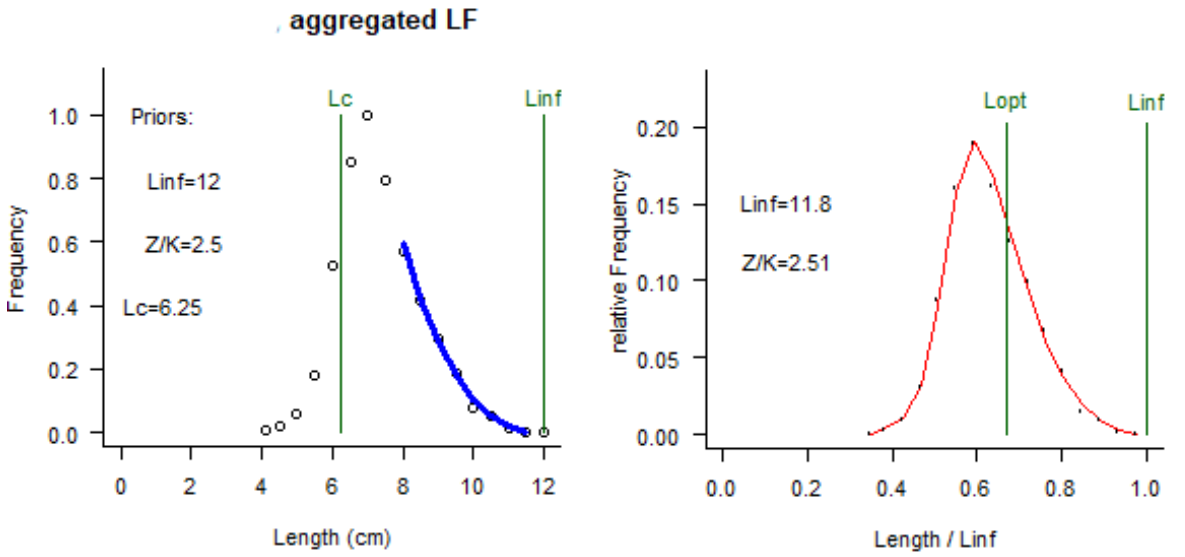
Fig 2. Landing trend of *Parapenaeopsis stylifera* from 2007 to 2019

Methodology

The length-based Bayesian method (Froese et al, 2018) or LBB method was performed on the length frequency data from January 2017 to December 2019 to derive information on fishing pressure and stock status.

Analysis

A



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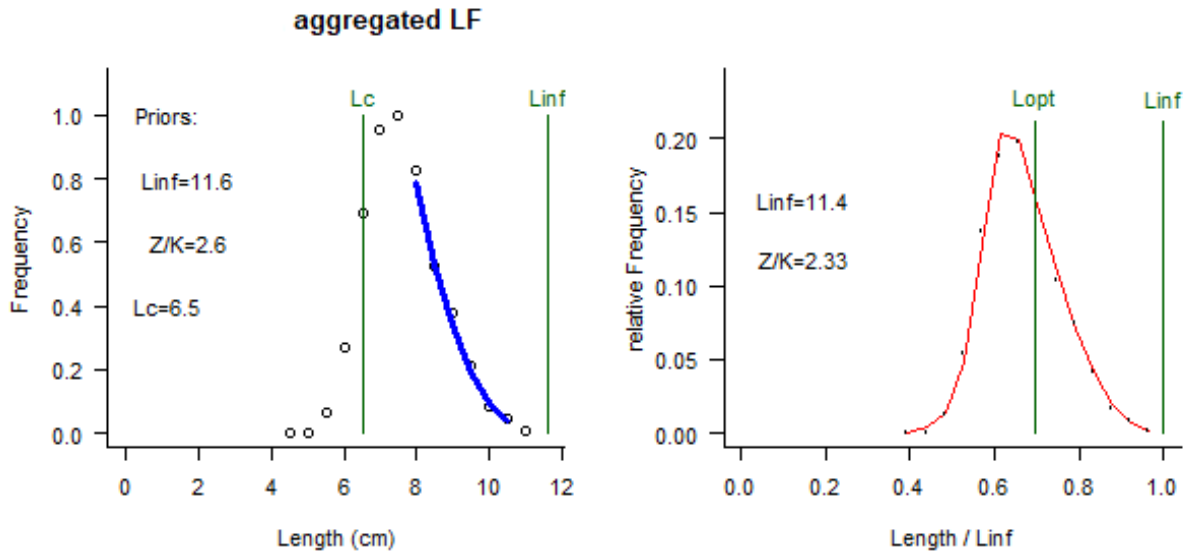


Fig. 3. LBB plots A) *M. dobsoni*, B) *P. stylifera*. The left curve shows the fit of the fits of the model to the length data. The right curve depicts the predictions of the analysis where L_c is

the length of 50% of individuals captured by the gear, L_{inf} is the asymptotic length, and L_{opt} is the length at which the maximum biomass of the unexploited biomass is obtained.

i) *Metapenaeus dobsoni*

Lc_{50} = 6.11 (6.07-6.16) cm

Lc_{95} = 7.3

Lmean/Lopt= 0.94, Lc/Lc_opt=0.89

F/M = 0.91 (0.6-1.4)

B/B_0 = 0.38 (0.21-0.59)

B/B_{msy} = 1 (0.56-1.6)

ii) *Parapenaeopsis stylifera*

Lc_{50} = 6.45 (6.41-6.5) cm

Lc_{95} = 7.45, alpha=2.94 (2.88-3.02)

Lmean/Lopt= 0.98, Lc/Lc_opt=1

F/M = 0.761 (0.49-1.4)

B/B_0 = 0.44 (0.21-0.86), best LF fit year 2018=0.439 (0.21-0.86)

B/B_{msy} = 1.2 (0.55-2.3)

Interpretation indicating the stock status

M. dobsoni - The LBB results indicate that the resource is fully exploited as B/Bmsy = 1 (0.8≤B/Bmsy≥1.1 denotes fully exploited stock. It is the ratio of observed biomass to the biomass that would provide maximum sustainable yield).

P. stylifera **-** The resource is healthy at the current fishing level with F/M (fishing pressure) = 0.76 and B/B_{msy} =1.2.

2. Cephalopods species

i) Uroteuthis Photololigo duvaucelii

Area	Indicators		Stock status determination
South west Coast 2007-2022	MSY (1,000 t)	29(25-35.4)	
	Fmsy	0.428(0.276-0.621)	
	Bmsy(1,000 t)	67.8(43.4-118)	
	F/Fmsy	0.978 (0.637-.1.53)	
	B/Bmsy	1.07(0.812-1.33)	
	Current Biomass (1,000 t)	72.1(43.4-128)	

F/Fmsy < 1 and B/Bmsy>1. Therefore, the stock is in healthy condition

ii) Sepia pharaonis

Area	Indicators		2022 Stock status determination
Kerala	F/Fmsy	0.84	
	B/Bmsy	1.16	

F/Fmsy < 1 and B/Bmsy>1. Therefore, the stock is in healthy condition

iii) Amphioctopus neglectus

Area	Indicators		2022 Stock status determination
Southwest coast 2007-2022	MSY (1,000 t)	4.03 (3.16-5.84)	
	Fmsy	0.415(0.265-0.644)	
	Bmsy (1,000 t)	9.75(6.14-17.3)	
	F/Fmsy	0.836(0.491-1.36)	
	B/Bmsy	1.43(1.19-1.67)	
	Current Biomass (1,000 t)	13.9(8.03-26.5)	

F/Fmsy < 1 and B/Bmsy>1. Therefore, the stock is in healthy condition

3. Finfish species

i) Threadfin breams Nemipterus randalli and Nemipterus japonicus

The stock status of *Nemipterus randalli* and *N. japonicus* exploited by trawls in Kerala were assessed using length-based methods such as LBB and Length-Cohort Analysis. The LBB analysis was carried out by customized codes in R platform. The data on length frequency for the period 2017-2019 were used for both the analyses. The stock status results using the above methods indicates that the stock of *N. randalli* harvested by trawls in Kerala is marginally overfished as the status of current biomass to the biomass at MSY level is slightly lower (B/BMSY=0.9) than 1. However, the length based Cohort analysis indicate that the spawning stock biomass estimated was 79.3% of the standing stock biomass of the species. The stock can be retained at sustainable level by slightly reducing the fishing effort from the current level. The following are the estimated stock parameters for *N. randalli* harvested by trawls in Kerala.

Species	Stock indicators	Value
Nemipterus randalli	Spawning stock biomass(t)	31392
	Standing stock biomass(t)	39601
	Percentage of spawning stock biomass	79.3%
	Total yield(t)	24837
	Recruitment (Nos)	2760509

Table 1. The stock indicators for the threadfin bream *Nemipterus randalli* harvested by trawls in Kerala

Name	Linf	Lc_opt	Lc_opt/Linf	F/M	Z/K	B/Bo	B/Bmsy	Assessment
Nemipterus randalli	29.0	17	0.51	1.1	3.7	0.33	0.9	Marginally overfished
Nemipterus japonicus	34.8	22	0.55	1.3	3.9	0.29	0.8	Marginally Overfished

Fig. 2. Stock status and exploitation of threadfin bream *Nemipterus randalli and Nemipterus japonicus* in Kerala using LBB method.

The stock status results using the above methods indicates that the stock of *N. randalli* harvested by trawls in Kerala is in in marginally overfished stage as the status of current biomass to the biomass at MSY level is lower (B/BMSY=0.8) than 1. The length based Cohort analysis indicate that the spawning stock biomass estimated was 84% of the standing stock biomass of the species. The stock can be brought back to sustainable level by slightly reducing the fishing effort to FMSY level. The following are the stock parameters for *N. japonicus* harvested by trawls in Kerala.

Table 3. The stock indicators for the threadfin bream *Nemipterus japonicus* harvested by trawls in Kerala

Species	Stock indicators	Value
Nemipterus japonicus	Spawning stock biomass(t)	213138.3
	Standing stock biomass(t)	253421
	Percentage of spawning stock biomass	84%
	Total yield(t)	42469.82
	Recruitment (Nos)	3684977

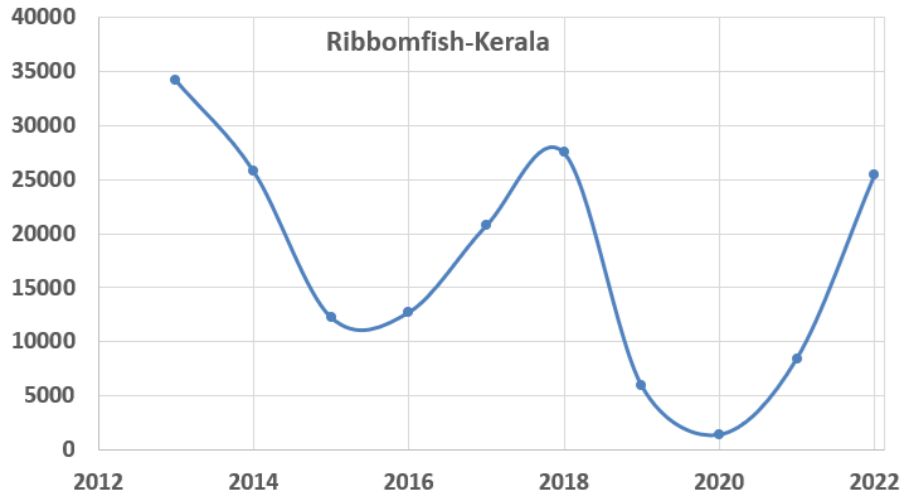
ii) Ribbon fish Trichiurus lepturus

The common ribbonfish, *Trichiurus lepturus* is widely distributed in the seas around Indian coats. They form one of the major components of trawl fishery along the Kerala coast and had good domestic and export demand. The present report will provide an insight into the impact of the trawl fishery on the resource.

Fishing effort, catch and biological characteristics of species by trawl along the Kerala coast were monitored during 2017-2020. The stock health assessment was carried using catch-effort and biological data using standard stock assessment tools.

Catch: Ribbonfishes were caught mostly by trawls as a non-targeted resource during fishing for shrimps and cephalopods. Their catch in other gears (gillnets and seines) were very nominal. Fishery was supported by single species, *Trichiunonrus lepturus* along the region.

During the decade there has been considerable fluctuation in the catch between 1,365 ton in 2020 and 34,220 t in 2013.



Size composition in the catch

Fishery was supported mostly by adult fishes during the assessment period. Fishes of 36 to 113 cm size having a mean size 74.9 cm, with 7.2% immature ones during 2017 (Fig 2). During 2018 and 2019 entire catch was by adult fishes having mean size 73.4 and 77.1 cm. Size of the species at first capture varied between 50.6 and 56.7 during the period, which was much larger than their size at maturity (48.2 cm). These biological characteristics suggested that fishing along the region is highly healthy and sustainable for the species.

The species attain sexual maturity at 48 cm at an age of 7-8 months and spawn round the year, the present exploitation pattern, which harvest mainly adults indicated that most of them are getting at least a chance to spawn once in their life. This indicated only minimal stress on spawning stock due to fishing.

Exploitation level and spawning stock biomass

Exploitation level of the species varied between 0.39 and 0.47 with 0.424 as mean against an Emx level of, 0.577. The spawning stock in the present fishing ground is large above 50%, which varied between 53.4 and 63.6% during the period.

Stock status

Detailed annual evaluation of stock status of the species for 2017, 2018 and 2019 for region was carried out. Outcome of the analysis indicated the resource as under fished, with exploitation rates much smaller than the maximum safe limit of fishing. The analysis also highlighted presence of large biomasses of spawning stocks, to the tune of more than 50% of their respective standing stocks. The prediction attempts, further pointed to the scope of much higher sustainable yield levels, compared to present levels of production.

Year	Stock status
2017	
2018	
2019	

Status indicator *

Sustainable		*Overfishing*	
Overfished		*Not assessed*	

Way forward

Under the present mode of non-targeted nature of ribbonfish fishing, there is no need for any management interventions.

Elasmobranchs

Observations on the occurrence in trawl fishery of Kerala

The samples, especially the bycatches, landed by mechanized trawlers were collected from CFH, Munambam, Kochi and Sakthikulangara, Kollam during January to April 2024. They were preserved in ice-filled boxes and transported to the laboratory, where they were sorted and stored for subsequent analysis. The samples were washed and sorted, and their length and weight measurements were documented. The analysis of individual specimens included length and weight, maturity stage, gonad weight, and gut weight, etc. Samples of gut and gonads were collected and further examination was conducted. Photographs of the samples were taken for further identification.

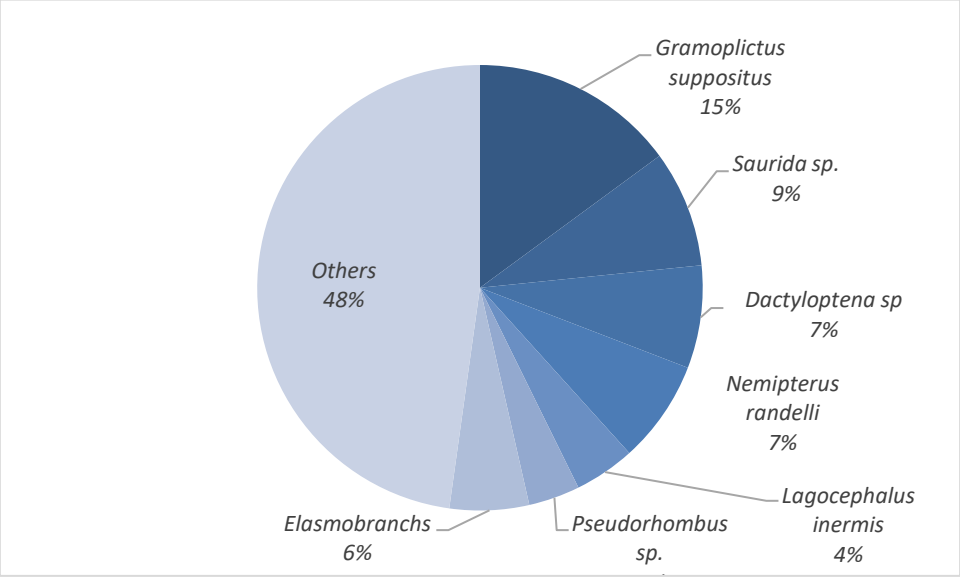


Fig. 1. Percentage composition of various species/groups in the trawl landings at Munambam Fishing Harbour

Table 4. The numbers of various species/groups identified from the trawl bycatches from Munambam Fishing Harbour

Name	Count
Grammoplites suppositus	44
Saurida sp.	25

Dactyloptena sp	22
Nemipterus randelli	22
Lagocephalus inermis	13
Pseudorhombus sp.	11
Elasmobranchs	17
Others	141

The analysis of samples collected from Munambam revealed a plethora of species of which *Gramoplictus supositus, Neminpterus randalli, Suarida sp.* and *Dactyloptena sp.* were found to be the most in number. A total of 55 species were noted. 10 specimens of the juveniles of the shark *Scoliodon sp.* were also collected. Data of *Echinorhinus brucus* and *Chimaera* species was also collected from Shakthikulangara. The data was digitized and stored for further analysis.

The samples collected from Shakthikulangara indicated that the species *Bembrops caudimacula* and *Gavialiceps taeniola* were found to be the most in number. A total of 35 species were noted. Data of *Echinorhinus brucus* and *Chimaera* species was also collected from Shakthikulangara. The data were digitized and stored for further analysis.

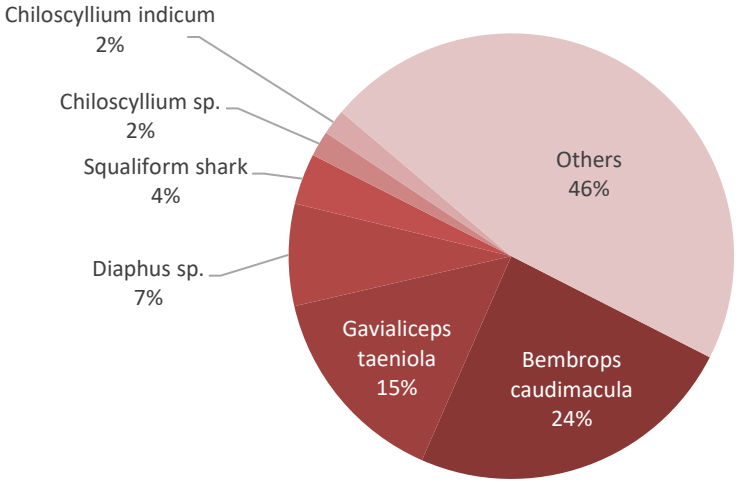


Fig. 3. Percentage composition of various species/groups in the trawl landings at Sakthikulangara Fishing harbour

Table 5. The numbers of various species/groups identified from the trawl bycatches from Sakthikulangara Fishing Harbour

Name	Count
Bembrops caudimacula	13
Gavialiceps taeniola	8
Diaphus sp.	4
Squaliform shark	2
Chiloscyllium sp.	1
Chiloscyllium indicum	1
Others	25

The samples from Cochin Fisheries Harbour were collected and analyzed. The analysis identified 41 species of finfish/shellfish groups, of which *Gramoplictus supositus*, *Suarida endosquamous*, and *Trichurus sp.* were found to be the most in number. The data was digitized and stored for further analysis.

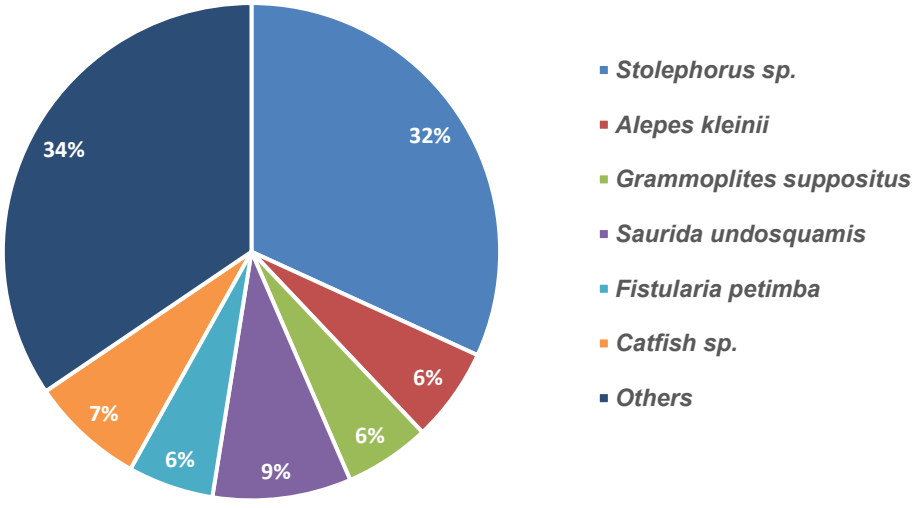


Fig. 5. Percentage composition of various species/groups in the trawl landings at CFH

Table 6. The numbers of various species/groups identified from the trawl bycatches from Cochin Fisheries Harbour

Name	Count
Stolephorus sp.	120
Alepes kleinii	23
Grammoplites suppositus	21
Saurida undosquamis	34
Fistularia petimba	21
Catfish sp.	28
Others	130

4. Deep-sea shrimps *Aristeus alcocki, Heterocarpus woodmasoni* and *Heterocarpus chani*

Deep-sea shrimp samples were collected from Sakthikulangara, Kollam, fortnightly. The collected samples comprised of various deep-sea shrimp species. The samples were preserved in ice-filled boxes and transported to the laboratory, where they were sorted and stored for subsequent analysis. For the deep-sea shrimp samples, individual specimen length and weight, along with maturity stage, gonad weight, and gut weight, were recorded. Samples of gut and gonads were also collected and preserved for further examination. Concerning the deep-sea discard samples, they were washed, sorted, and their length and weight measurements were documented. Photographs of the samples were taken for further identification.

In January 2024, a total of 4.4 kg of deep-sea shrimp samples were collected and analyzed. The deep-sea shrimp samples included 2 kg of *A. alcocki* and 2.4 Kg of *H. chani*. The sex ratio (F:M) was calculated as 1.84 for *H. chani*. The deep-sea discard samples collected during these months were digitized and stored for further analysis.

In February 2024, a total of 9.7 kg of deep-sea shrimp samples and 7.5 kg of deep-sea discard samples were collected and analyzed. The deep-sea shrimp samples included 1.8 kg of *A. alcocki*, 3.8 kg of *H. woodmasoni*, and 4.1 Kg of *H. chani*. The sex ratios (F:M) were calculated as 9.4:1, 0.84:1, and 1.33:1 for *A. alcocki*, *H. woodmasoni*, and *H. chani*, respectively. The deep-sea discard samples collected during these months were digitized and stored for further analysis.

In March 2024, a total of 13 kg of deep-sea shrimp samples and 7.48 kg of deep-sea discard samples were collected and analyzed. The deep-sea shrimp samples included 3.67 kg of *A. alcocki*, 3.18 kg of *H. woodmasoni*, and 6.2 Kg of *H. chani*. The sex ratios (F:M) were calculated as 1.54:1, 0.675:1, and 1.525:1 for *A. alcocki*, *H. woodmasoni*, and *H. chani*, respectively. The deep-sea discard samples collected during these months were digitized and stored for further analysis.

In April 2024, a total of 6.9 kg of deep-sea shrimp samples and 1.5 kg of deep-sea discard samples were collected and analyzed. The deep-sea shrimp samples included 2.2 kg of *A. alcocki*, 3.7 kg of *H. woodmasoni*, and 1 Kg of *H. chani*. The sex ratios (F:M) were calculated as 0.8:1, 1.2:1 and 1.5:1 for *A. alcocki*, *H. woodmasoni*, and *H. chani*, respectively. The deep-sea discard samples collected during these months were digitized and stored for further analysis.

In May 2024, a total of 2.8 kg of deep-sea shrimp samples was collected and analyzed. Deep-sea discard samples were not available. The deep-sea shrimp samples included 700g of *Aristeus alcocki*, 1.4 kg of *H. woodmasoni*, and 700g of *H. chani*. The sex ratios (F:M) were calculated as 5.2:1, 1.166:1, 3.833:1 for *A. alcocki*, *H. woodmasoni*, and *H. chani*, respectively. (*H. woodmasoni* is yet to be done) The deep-sea discard samples collected during these months were digitized and stored for further analysis.

References

Froese, R.; Winker, H.; Coro, G.; Demirel, N.; Tsikliras, A.C.; Dimarchopoulou, D.; Scarcella, G.; Probst, W.N.; Dureuil, M.; Pauly, D. 2018. A new approach for estimating stock status from length frequency data. ICES J. Mar. Sci, 75, 2004–2015.

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Report compiled by Dr P Laxmilatha with contributions from Drs. Lakshmi Pillai, Vidya R, T M Najmudeen and Rekha Devi Chakraborty.