

# INTERIM REPORT

**Project title: Technical backstopping for strengthening sustainable harvest of shrimp and cephalopod trawl fishery of Kerala**

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

## 1. Inshore shrimp species -

*Metapenaeus dobsoni*

Area	Indicators	2019 Stock Status Determination	
<b>South-East Arabian Sea (SW coast of India)</b>	Catch 2019 20862.54 t Average catch 2009-2019 - 20157.51 t		
	MSY (1000 t) [18.2-23.7]		20.6
	F <sub>msy</sub> [0.494-701]		0.594
	B <sub>msy</sub> (1000 t) [28.7-43.5]		34.7
	F/F <sub>msy</sub> [0.703-1.69]		1.11
	B/B <sub>msy</sub> [0.755-1.3]		1.01
	B/B <sub>0</sub> [0.377-0.665]		0.519

$B/B_{msy} > 1$  and  $F/F_{msy} > 1$  – denoting the stock is healthy but overfishing is happening.

*Parapenaeopsis stylifera*

Area	Indicators	2019 Stock Status Determination	
<b>South-East Arabian Sea (SW Coast of India)</b>	Catch 2019 14107 t Average catch 2009- 2019 8569.63 t		
	MSY (1000 t) [9.1-14.8]		10.8
	F <sub>msy</sub> [0.483-671]		0.574
	B <sub>msy</sub> (1000 t) [15-26.6]		19
	F/F <sub>msy</sub> [0.564-1.54]		0.952
	B/B <sub>msy</sub> [0.844-1.45]		1.14
	B/B <sub>0</sub>		0.57

	[0.422-0.725]	
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**B/B<sub>msy</sub>>1 and F/F<sub>msy</sub><1 denoting healthy stock and sustainable fishing pressure**

## 2. Finfish species

### Stock status of the threadfin breams *Nemipterus randalli* and *Nemipterus japonicus*

The stock status of *Nemipterus randalli* and *N. japonicus* were assessed using Catch-based CMSY/BSM method with the time series catch and effort data are the inputs. The analysis was carried out by CMSY package in R platform. It is a Monte Carlo method (CMSY) for estimating fisheries reference points from catch, resilience, and qualitative stock status information on data-limited stocks. It also presents a Bayesian state-space implementation of the Schaefer production model (BSM), fitted to catch and biomass or catch per unit of effort (CPUE) data. BSM estimates of  $r$ ,  $k$ , and  $MSY$  were used as benchmarks for the respective CMSY estimates and were not significantly different in 76% of the stocks analysed using this method.

The analysis was carried out using the catch and effort data for the period 2000-2019. The average annual catch of threadfin breams landed in trawls were 36916 tonnes which was about 20% of the average annual total trawl landings during the period in Kerala. The highest landings of 65195 t were in 2011 and the lowest of 20761 t was in 2003. *Nemipterus randalli* dominated in the catch with an estimated landing of 22000 tonnes which formed about 60% of the total threadfin breams landed by trawls in the state. The highest catch of *N. randalli* of 42377 t was in 2011 and the lowest of 12457 t was in 2003. The stock status analysis using the above method indicates that the stock of *N. randalli* harvested by trawls in Kerala is in a stage of marginal overfishing as the exploitation status  $F/F_{MSY}=1.03$  is slightly higher than 1 (Fig 2). The stock can be retained in sustainable level by slightly reducing the fishing effort to  $F_{MSY}$  level. The following are the stock parameters for *N. randalli* harvested by trawls in Kerala

Species	Stock indicators	Value
<i>Nemipterus randalli</i>	Average annual Catch	22000 tonnes
	Catch in the last year (2019)	17682 tonnes
	MSY (1000 t)	23.3 (95% CL = 20.9 - 26.5)
	F <sub>MSY</sub>	0.432 (95% CL = 0.289 - 0.614)
	B <sub>MSY</sub> (1000 t)	54.0 (95% CL = 38.1 - 82.3)
	F/F <sub>MSY</sub>	1.03 (0.643-1.66)
	B/B <sub>MSY</sub>	0.935 (0.642 -1.24)

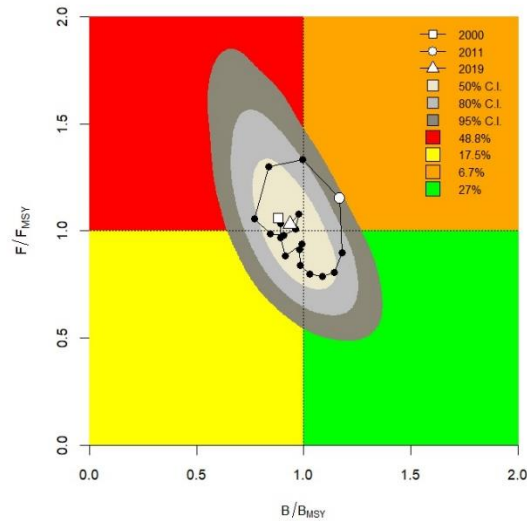


Fig. 1. Kobe plot depicting the stock status and exploitation of threadfin bream *Nemipterus randalli* harvested by trawls in Kerala.

The estimated annual average catch of *Nemipterus japonicus* during 2000-2019 was 22000 tonnes which formed about 37% of the total threadfin breems landed by trawls in the state. The highest catch of *N. japonicus* of 24731 t was in 2012 and the lowest of 7474 t was in 2003. The stock status analysis using the above method indicates that the stock of *N. japonicus* harvested by trawls in Kerala is in a stage of marginal overfishing as the exploitation status ( $F/F_{MSY}=1.02$ ) is slightly higher than 1 (Fig 3). The stock can be retained in 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.

Species	Stock indicators	Value
<i>Nemipterus japonicus</i>	Average annual Catch	13673 tonnes
	Catch in the last year (2019)	8705 tonnes
	MSY (1000 t)	14.7 (95% CL = 12.9 - 17.8)
	$F_{MSY}$	0.383 (95% CL = 0.252 - 0.573)
	$B_{MSY}$ (1000 t)	38.2 (95% CL = 26.3 - 60.2)
	$F/F_{MSY}$	1.02 (0.601-1.69)
	$B/B_{MSY}$	0.919 (0.635-1.24)

### 3. Cephalopod species

#### *Uroteuthis Photololigo duvaucelii*

Area	Indicators		2019 Stock status determination
South west Coast	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**

#### *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**

#### *Amphioctopus neglectus*

Area	Indicators		2022 Stock status determination
Kerala	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)	
	F/Fmsy	0.836(0.491-.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**

#### 4. Preliminary status report on the interaction of sawfishes and guitar fishes with trawl fishery

##### Guitarfishes

The average annual catch of guitarfishes in Kerala during 2007-2022 was 201 tonnes with the highest landings of 545 tonnes in 2013 and the lowest of a meagre 33 tonnes in 2019 and 2021. Of the total guitarfish landings of the state during the period, 81% (163 t) were landed by trawl nets. The gearwise catches of guitarfishes during the period indicate that bulk of the catches were by multiday trawlnet units (68.4%; 138 t), followed by single day trawls (12.9%; 26t), other mechanized gears (10.4%) and outboard gillnet units (5.5%).

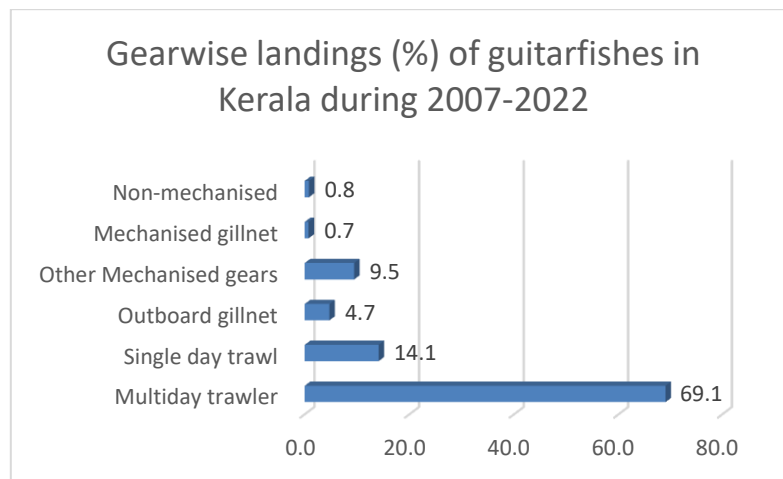


Fig. 1. Gearwise landings of guitarfishes in Kerala during 2007-2022

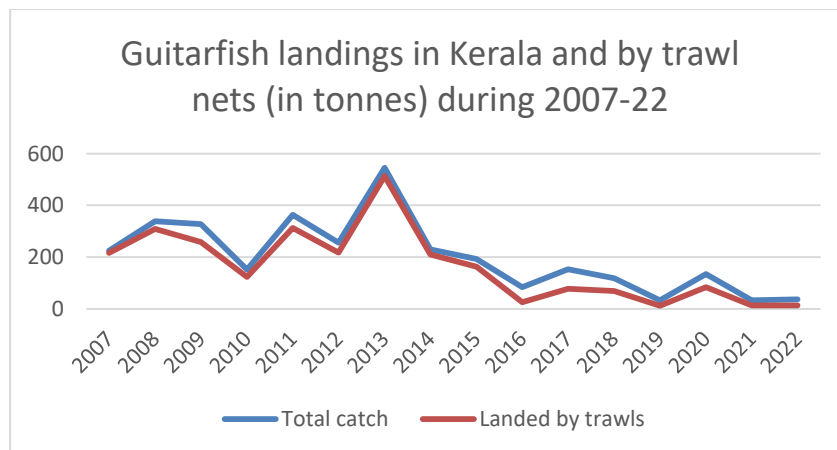


Fig. 2. Guitarfish landings in Kerala and by trawl nets during 2007-2022

The annual average catch rate (CPUE) of guitar fishes by trawls were 0.77 kg/unit with the highest catch rate of 2.58 kg/unit was in 2013 and the lowest of 0.07 kg/unit in 2019.

Table 1. Time series data on guitarfish total landings as well as landed by trawls in Kerala during 2007-2021.

Year	Total catch (t)	Catch by trawls (t)
2007	225	216
2008	339	309
2009	327	258
2010	152	123
2011	363	312
2012	256	218
2013	545	513
2014	229	210
2015	192	162
2016	83	26
2017	154	77
2018	118	69
2019	33	12
2020	134	84
2021	33	13
2022	37	13

Six species of guitarfishes appeared in trawls during 2007-21 in Kerala. *Rhynchobatus djiddensis* dominated with 36% of the guitarfishes, immediately followed by *Rhinobatos* spp. (35%), which was followed by *Rhynchobatus* spp. (17%), *Glaucostegus granulatus* (*Rhinobatos granulatus*) (11%) and *Rhina ancylostoma* (1%). All the above species of guitarfishes are now included under the protected species under the Wildlife Protection Act.

During 2007-2022, 394 kg of large tooth sawfish *Pristis microdon* was landed in 2016 by multiday mechanized trawlers along the Kerala coast. This species inhabits sandy or muddy bottoms of shallow coastal waters, estuaries, river mouths.

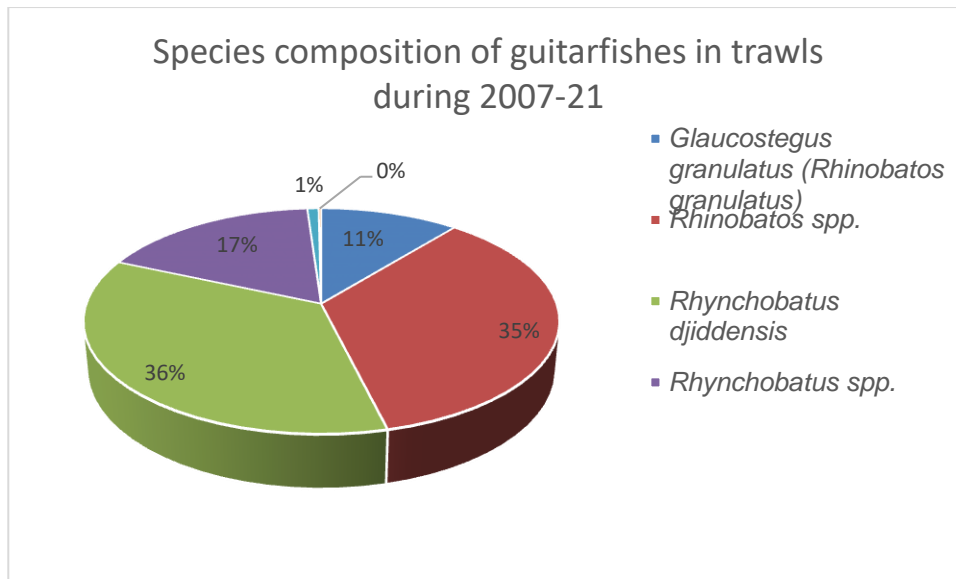


Fig. 3. Species composition of guitarfishes appeared in trawls during 2007-22

Stray occurrences of sawfishes and juvenile sharks in trawl landings are being regularly observed from November 2023 onwards through direct samples collections as well as dedicated questionnaire surveys. The monthly data will be compiled and analyzed in due course.

#### 5. Progress report on the status of three deep-sea shrimps- *Aristeus alcocki*, *Heterocarpus woodmasoni* and *H 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 November 2023, a total of 16.5 kg of deep-sea shrimp samples which included 6.2 Kg of *Aristeus alcocki*, 3 Kg of *Heterocarpus woodmasoni*, and 7.3 Kg of *Heterocarpus chani* was collected. The sex ratios (F:M) were calculated as 1.41:1, 1.68:1, and 0.95:1 for *Aristeus alcocki*, *Heterocarpus woodmasoni*, and *Heterocarpus chani*, respectively. Additionally, random deep-sea discard samples were obtained from the same location.

In December 2023, a total of 14.7 kg of deep-sea shrimp samples and 4.5 kg of deep-sea discard samples were collected and analyzed. The deep-sea shrimp samples included 4.1 kg of *Aristeus alcocki*, 3.1 kg of *Heterocarpus woodmasoni*, and 7.5 Kg of *Heterocarpus chani*. The sex ratios (F:M) were calculated as 2.05:1, 1.08:1, and 2.30:1 for *Aristeus alcocki*, *Heterocarpus woodmasoni*, and *Heterocarpus chani*, respectively. The deep-sea discard samples collected during these months were analysed and the data was digitised and stored for further analyses.

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