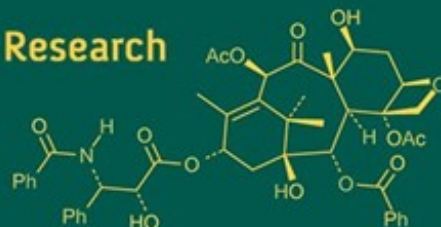


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Catch composition and operational performance of a two-seam designed trawl net operated with 15 m bridle along the Mangaluru coast off Karnataka, India

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ABSTRACT

An experimental two-seam trawl rigged with a 15 m bridle length was used for fishing along the Mangaluru coast of Karnataka to document its catch composition, month-to-month variability and fuel use under a fixed set of operating conditions. Thirty three-hour of hauls were carried out between December 2024 and April 2026, with the statutory monsoon closure excluded, Fishing was carried out at depth of about 30 m and having a towing speed of 2.9-3.0 knots, the engine used was 350 HP stern trawler. Total catch across the thirty hauls came to 10,492.5 kg, with an average of 349.75 ± 59.20 kg haul⁻¹ and ranging from 261 to 483 kg. Seventeen species or fish groups identified. Were *Fenneropenaeus indicus* made up the largest share at 19.86%, with *Metapenaeus dobsoni* (13.43%) and *Rastrelliger kanagurta* (13.05%) close behind. Pelagic finfishes accounted for 43.40% of the catch and penaeid shrimps for 38.30%; together the two groups made up 81.70% of what was landed. Fortnightly catch ranged from 550.0 to 901.0 kg, pointing to moderate variation across the sampled months. Fuel consumption averaged with 25.80 ± 0.26 L h⁻¹, or 77.4 L for three-hours of haul, giving a cumulative catch productivity of 4.52 kg L⁻¹. Overall, the 15 m bridle produced a fairly consistent mixed Pelagic-Crustacean catch under the conditions tested, and the results offer a documented baseline for further instrumented work on bridle geometry, trawl spread and catches obtained in locally built Two-Seam trawls along the South-West coast of India.

Keywords: Two-seam trawl, Design, Bridle, Catch composition, Fuel efficiency, Variation temporal, Mangaluru Coast

1. Introduction

Trawling is an active method of fishing, and to know how will it works depending on the shape of the net together with its spreading devices, bridles, warps and the way it is towed. In mid-water trawling in particular, performance hinges on the vertical position of the net and how wide it opens, since the whole point of the gear is to intercept organisms by spreading through the water column. Net-mouth size and towing speed both have affect on the Fish catch, and how fish behave near the mouth, wings, sweeps and bridles would decides whether they enter into the gear, avoid it, or manage to escape (Itaya *et al.*, 2007; Graham *et al.*, 2004; Winger *et al.*, 2010) [2, 1, 3]. For this reason, trawl catch is best read as a mix of how many aquatic organisms were actually available and how it was caught into the gear itself is not as a straightforward count of what lives in the area.

India's Trawl fisheries work carried out highly mixed Tropical communities, where finfish, crustaceans and cephalopods often turn up together in the same catch. Reviews of Trawling in India point to major shifts over time in vessel power, fishing range and net design, including a move toward pelagic and high-speed trawling in some areas were studied by Dineshbabu *et al.*, 2016 [4]. Karnataka is a major mechanized-fishing state, and catches along the Mangaluru and Malpe stretch are known for their multispecies makeup along with considerable variation from place to place and month to month was noticed by (Dineshbabu *et al.*, 2009; Dineshbabu *et al.*, 2012) [5, 6]. Work on low-value bycatch at Mangaluru has also shown that trawls pick up a wide range of commercially important fish species, including *Decapterus russelli* and *Rastrelliger kanagurta* (Mahesh *et al.*, 2019) [7].

Bridles are a key part of the front end of a Trawl they carry the spreading force from the otter boards to the wing ends, and they can also trigger behavioural reactions in fish before those fish ever reach the net mouth. Early Indian trials found that bridle length on its own could change trawl catches, and pointed to the combined role of swept area and herding (Mathai *et al.*, 1984) [8]. Later international work has shown that bridle and sweep effects differ a great deal between species. Somerton *et al.* (2001) [9], Somerton (2003) [10] and

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Somerton *et al.* (2007) [11] measured bridle-related herding in survey trawls, while Somerton (2004) [12] found that some species barely react to doors and bridles at all. Underwater footage backs up by showing wide differences between species in how they orient, swim and try to escape at the Trawl mouth (Piasente *et al.*, 2004; Bayse *et al.*, 2016) [14, 13]. Taken together, these findings make a good case for treating each rigging setup as a complete fishing system, rather than assuming catch is determined by net dimensions alone.

The waters off Mangaluru also seen strong seasonal swings. The coast sits within the Malabar upwelling system, and long-term records have tied seasonal oceanographic shifts to the pelagic fishery, Mackerel and Oil sardine especially was studied by Krishnakumar and Bhat, 2008 [15]. Indian Mackerel (*Rastrelliger kanagurta*) and Oil sardine (*Sardinella longiceps*) are among the leading resources of the Mangalore and Malpe sector (Rohit *et al.*, 2004; Rohit *et al.*, 2003) [16, 17]. Penaeid shrimps such as *Metapenaeus dobsoni* have likewise been a long-standing part of the regional Trawl fishery (Ramamurthy *et al.*, 1978; Sukumaran *et al.*, 1993) [18, 19] and the Indian squid *Uroteuthis duvaucelii* supports an important inshore fishery off Mangaluru (Naik *et al.*, 2017) [20]. Month-to-month changes in what an experimental trawl catches can therefore reflect recruitment, schooling behaviour, vertical movement and local availability, on top of whatever the gear itself contributes.

Fuel use matters too, since towing a Trawl demands continuous power to overcome drag through the water. Globally, mobile fishing gears are a major contributor to fuel consumption and greenhouse-gas emissions across fishing fleets (Tyedmers *et al.*, 2005; Parker *et al.*, 2018) [22, 21], and Indian studies point the same way, flagging mechanized trawlers as fuel-heavy and stressing the value of cutting drag and improving energy efficiency (Vivekanandan *et al.*, 2013; Remesan *et al.*, 2020) [24, 23]. Fuel is also a major cost item for mechanized fleets (Aswathy *et al.*, 2017; Aswathy *et al.*, 2020) [25, 26]. Reporting catch alongside fuel use gives a fuller picture of how an experimental trawl actually performs than catch figures alone would.

This work concentrated on the 15 m bridle configuration as a stand alone part of a larger field trial. It sets out to describe (i) Overall catch performance, (ii) How the catch broke down by species and resource group, (iii) How catch varied month to month, and (iv) Fuel-use productivity of the Two-seam Trawl under this single, fixed 15 m Bridle Rig. It does not compare bridle treatments against one another; the aim instead is to lay down a detailed empirical baseline that later comparative and instrumental studies can build on.

2. Materials and methods

2.1 Study area and sampling design

Fishing trials were carried out from Jetty Fishing Harbour, Mangaluru, towards the grounds off Ullal in the Eastern Arabian Sea. Sampling carried from December 2024 to April 2026, Skipping the

statutory Monsoon closure, at a working depth of carried 30 m and Thirty observations were collected for the 15 m bridle length and made up of two standardized operations in each of 15 sampled months. The same general fishing-ground sector was used wherever this was practically possible, and the vessel, gear, nominal towing speed, bridle length and haul duration were all kept constant to limit procedural variation between each hauls.

2.2 Experimental trawl and fishing vessel

The gear was towed from the wooden stern trawler *Shri Brahmalingeswara*, driven by a six-cylinder 350 HP Ashok Leyland marine diesel engine. The vessel was 15.24 m long overall, with a 4.54 m beam and a 1.78 m mean draft. A parallel-drum winch and about 275 m of towing warp were used. Each haul ran for three hours at 2.9-3.0 knots. Keeping towing time and speed standardized mattered because changes to towing conditions and net opening can shift trawl catch efficiency (Itaya *et al.*, 2007; Sayana *et al.*, 2018) [2, 27].

The experimental gear was a two-seam otter trawl built from blue polyethylene twine. The body used roughly 1.5 mm twine and the codend about 3.0 mm twine. Mesh size stepped down gradually from the forward panels to the rear guiding sections, ending in a 35 mm codend. A 48 m polyamide headrope and a 52 m polyamide footrope formed the mouth of the net. Seven spherical HDPE floats, about 18 cm across, Were fitted to the headrope, and a 39.5 m Galvanized-iron chain weighted the footrope. Horizontal spread came from a pair of rectangular wooden Otter boards reinforced with iron fittings, having 1500 × 750 mm and with a weight of 75 kg. Bridle length was fixed at 15 m for every observation reported.

2.3 Catch processing and analytical approach

At the end of each haul, the catch was sorted specieswise and size-wise from the catch group and weighed in kilograms. Cumulative species catch was found by summing among all 30 Fishing operations, and percentage contribution was worked out as species catch divided by total catch, times 100. For a broader view, catches were also grouped into Pelagic finfishes, Penaeid shrimps, Ponyfishes, Indian squid, Portunid crabs and Miscellaneous category. Month-wise totals came from pooling the two observations recorded in each sampled month. Since the monsoon closure broke up the calendar sequence, temporal patterns are discussed descriptively rather than treated as an unbroken annual time series.

Fuel consumption was recorded during fishing trip as litres per hour. Fuel consumption per haul was worked out to be for the fixed three-hour tow, and total fuel use was consumed for across all 30 hauls were recorded. Fuel productivity was calculated as cumulative catch divided by cumulative towing fuel (kg L^{-1}). Descriptive statistics reported are includes the mean, standard deviation, minimum, maximum and coefficient of variation ($\text{CV} = \text{SD}/\text{mean} \times 100$). No statistical comparison between bridle lengths is presented here, since the purpose of this paper is to characterize a single fixed configuration.

Table 1. Technical specifications of the Experimental Trawl fishing gear its operational accessories.

Parameter	Specification
Gear type	Two-seam otter trawl
Bridle used	15 m
Main netting / Webbing	Blue PE; 1.5 mm twine
Codend	35 mm mesh; 3.0 mm PE twine
Headrope / Footrope	48 m / 52 m; polyamide
Floats	7 spherical HDPE floats; with 18 cm diameter
Sinker	39.5 m galvanized-Iron link chain
Otter boards	Rectangular wooden, Iron reinforced; having a dia of 1500 mm × 750 mm; 75 kg each
Vessel / Engine	Wooden Stern Trawler; 350 HP Marine Diesel Engine
LOA / beam / mean draft	15.24 / 4.54 / 1.78 m
Working depth	30 m

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Parameter	Specification
Towing speed / duration	2.9-3.0 knots / hr ; for 3 hours
Total no. of Trips	30

3. Results of the fishing operation

3.1 Overall catch obtained and fuel consumption

Across the 30 standardized three-hour hauls having a total catch was 10,492.5 kg. Mean catch was 349.75 ± 59.20 kg per haul, with individual hauls ranging from 261.0 to 483.0 kg, a coefficient of variation

of 16.93%, moderate variation between sampling trips. Fuel consumption averaged 25.80 ± 0.26 L h⁻¹ was ranged from 25.4 to 26.2 L h⁻¹. At that average rate, each three-hour haul used 77.4 L, putting cumulative towing fuel across all 30 hauls at 2,322 L. That works out to a cumulative catch productivity of 4.52 kg L⁻¹. Fuel use varied far less than catch did – a CV(%) of 0.99 against 16.93%.

Table 2. Statistical study for the catch and fuel consumption for the 15 m bridle length during Trawling.

Variable	N	Mean	SD	Minimum	Maximum	CV (%)
Catch (kg haul ⁻¹)	30	349.75	59.20	261.0	483.0	16.93
Fuel use (L h ⁻¹)	30	25.80	0.26	25.4	26.2	0.99
Monthly catch (kg)	15	699.50	94.60	550.0	901.0	13.52

3.2 Species and resource-group composition

Seventeen fish species turned up across the trial. *Fenneropenaeus indicus* was the single biggest contributor at 2,083.5 kg (19.86%), with *Metapenaeus dobsoni* next at 1,409.1 kg (13.43%) and *Rastrelliger kanagurta* close behind at 1,369.6 kg (13.05%). *Encrasicholina devisi*

added 899.8 kg (8.58%), *Decapterus russelli* 683.4 kg (6.51%) and *Stolephorus indicus* 640.8 kg (6.11%). Between them, these six species made up 67.54% of the total catch, with the remainder spread across other Penaeid Shrimps, Scads, Sardines, Ponyfishes, Crabs, Indian Squid and Miscellaneous fishes.

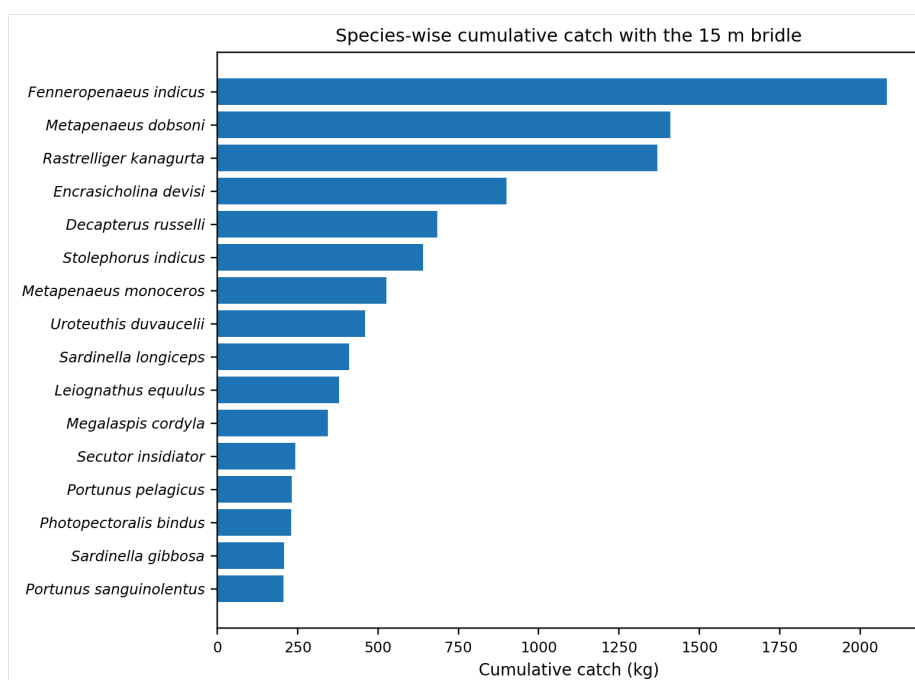


Figure 1. Species-wise cumulative catch recorded with the 15 m bridle Miscellaneous fishes omitted for clarity during fishing operation.

At the resource-group level, Pelagic Finfishes led the way at 4,554.2 kg (43.40%), with penaeid shrimps not far behind at 4,018.4 kg (38.30%) together the two groups made up 81.70% of the total catch. Ponyfishes contributed 8.10%, Indian squid 4.38%, portu-

nid crabs 4.17% and miscellaneous fishes 1.65%. Overall, this Rig produced a mixed Pelagic-Crustacean assemblage rather than a catch dominated by any single resource.

Table 3. Species-wise catch composition and percentage contribution recorded with the 15 m bridle length used during fishing operation.

Sl. No.	Species/Genera	Catch composition (kg)	Contribution (%)
1.	<i>Fenneropenaeus indicus</i>	2,083.5	19.86
2.	<i>Metapenaeus dobsoni</i>	1,409.1	13.43
3.	<i>Metapenaeus monoceros</i>	525.8	5.01
4.	<i>Portunus pelagicus</i>	232.0	2.21
5.	<i>Portunus sanguinolentus</i>	205.6	1.96

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Sl. No.	Species/Genera	Catch composition (kg)	Contribution (%)
6.	6. <i>Rastrelliger kanagurta</i>	1,369.6	13.05
7.	7. <i>Decapterus russelli</i>	683.4	6.51
8.	8. <i>Megalaspis cordyla</i>	343.8	3.28
9.	9. <i>Sardinella longiceps</i>	410.1	3.91
10.	10. <i>Sardinella gibbosa</i>	206.7	1.97
11.	11. <i>Stolephorus indicus</i>	640.8	6.11
12.	12. <i>Encrasicholina devisi</i>	899.8	8.58
13.	13. <i>Leiognathus equulus</i>	378.8	3.61
14.	14. <i>Photopteralis bindus</i>	229.1	2.18
15.	15. <i>Secutor insidiator</i>	241.6	2.30
16.	16. <i>Uroteuthis duvaucelii</i>	459.2	4.38
17.	17. <i>Miscellaneous spp.</i>	173.6	1.65
18.	18. Total	10,492.50	100

Table 4. Catch composition by major resource group under the 15 m bridle configuration.

Sl.No.	Resource group available during the study period	Catch (kg)	Contribution (%)
	Pelagic finfishes	4,554.2	43.40
2.	Penaeid shrimps	4,018.4	38.30
2.			
3.	Ponyfishes	849.5	8.10
3.			
4.	Indian squid	459.2	4.38
4.			
5.	Portunid crabs	437.6	4.17
5.			
6.	Miscellaneous	173.6	1.65
6.			
7.	Total	10,492.50	100
7.			

3.3 Month-wise catch variability

Monthly catch ranged from 550.0 kg in April 2026 up to 901.0 kg in March 2025 which is averaging 699.5 ± 94.6 kg. Highest totals also obtained during October 2025 (801.0 kg), March 2026 (791.0 kg),

April 2025 (784.0 kg) and January 2026 (758.0 kg), while the lowest figures during April 2026 and August 2025 (571.0 kg). The monthly CV of 13.52% points to a clear seasonal pattern, though catch never collapsed entirely in any single sampled month.

Table 5. Month-wise catch obtained with the 15 m bridle length during the study period.

Sl. No.	Sampling Period (month)	Catch (kg)	Contribution (%)
	December 2024	647.0	6.17
2.	2. January 2025	634.0	6.04
3.	3. February 2025	629.0	5.99
4.	4. March 2025	901.0	8.59
5.	5. April 2025	784.0	7.47
6.	6. May 2025	642.5	6.12
7.	7. August 2025	571.0	5.44
8.	8. September 2025	709.0	6.76
9.	9. October 2025	801.0	7.63
10.	10. November 2025	691.0	6.59
11.	11. December 2025	669.0	6.38
12.	12. January 2026	758.0	7.22
13.	13. February 2026	715.0	6.81
14.	14. March 2026	791.0	7.54
15.	15. April 2026	550.0	5.24

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SI. No.	Sampling Period (month)	Catch (kg)	Contribution (%)
16.	16. Total	10,492.50	100

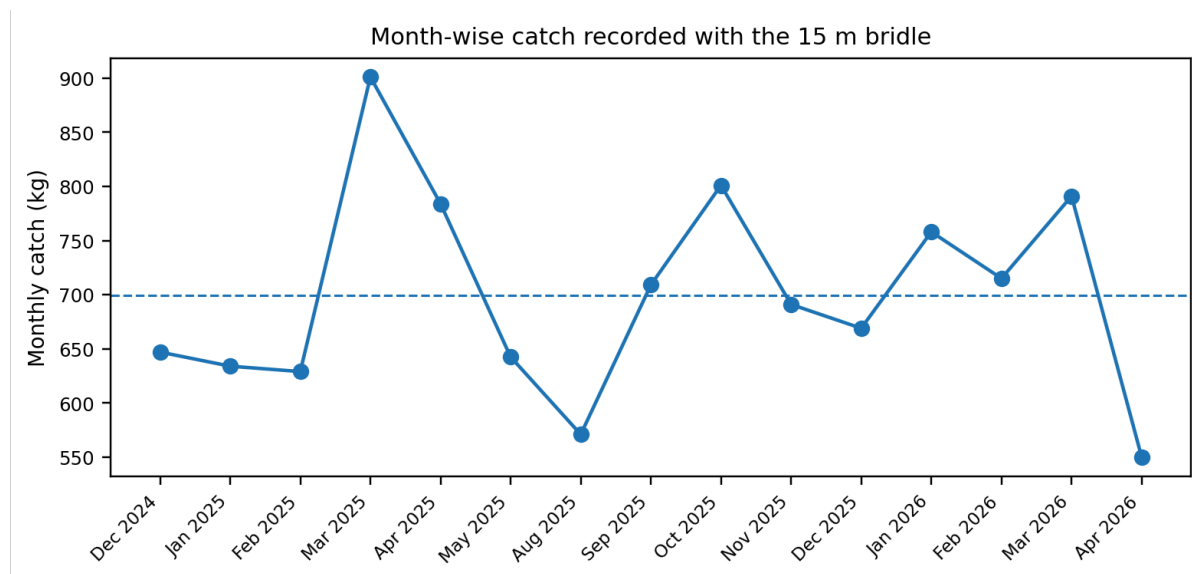


Figure 2. Month-wise catch recorded with the 15 m bridle, with the dashed line marking the mean monthly catch.

4. Discussion

4.1 Catch composition of the 15 m bridle length

The 15 m bridle setup gave a steady field platform for characterizing the trawl. An average catch of roughly 350 kg per haul, together with a catch Coefficient of variation (CV) under 20%, suggests that the catches held up reasonably well during fishing operations, while still showing the kind of variation you'd expect in a dynamic coastal fishery. The much smaller CV for hourly fuel consumption shows that towing itself stayed operationally steady even as the biological catch moved around and that distinction matters, because fish availability can shift catch even when the vessel and towing conditions barely change. Trawl-efficiency work elsewhere has made the same point repeatedly: standardizing the gear does not remove variability that comes from where the fish are how they behave and their geometry to the net actually achieves while being towed (Graham *et al.*, 2004; Itaya *et al.*, 2007; Somerton *et al.*, 2007) [1, 2, 11].

These results shouldn't be read as a direct measurement of door spread, wing spread, headline height or bridle angle none of those were instrumented in this field programme. That gap matters, because the area where trawl actually samples can differ from its nominal mouth dimensions, and fish may respond to the front end of the gear well before reaching the net itself (Somerton *et al.*, 2001; Somerton, 2003) [10, 9]. Underwater observation studies also show that the odds of capture are very species-specific: depending on body shape and swimming ability, fish may be herd in turn away, slip under the ground gear, hold position ahead of the net, or squeeze through the meshes (Piasente *et al.*, 2004; Bayse *et al.*, 2016) [14, 13]. So the catch reported here is best understood is that complete 15 m bridle length produced under the conditions tested, not as a direct index of how abundant these species actually are in that operational area.

4.2 Non-targeted regional fishery

The clearest feature of the catch composition was closely to the pelagic finfishes (43.40%) and penaeid shrimps (38.30%) ran neck to neck. Non targeted kind of mix fits with what's known about Karnataka's multispecies Trawl fishery. Dineshbabu *et al.* (2012) [6] documented sharp spatial and seasonal swings in trawl bycatch along Karnataka coast and Dineshbabu *et al.* (2016) [4] described behaviour of Indian trawling diversification technologically over time. Mahesh *et al.* (2019) [7] found high finfish diversity in low-value trawl bycatch, including commercially important pelagic and semi-pelagic

species along Mangaluru coast. Mid-water trawl research elsewhere in the Arabian Sea has turned up diverse Teleost, Cephalopod and Crustacean catches rather than anything close to a single-target fishery (Abdul Azeez *et al.*, 2024) [28]. It was also observed that, the 15 m catch fits what would be expected from a Tropical shelf fishery where the fishing depth cuts across several Ecological groups at once. Penaeid shrimps made up a large share of this mixed catch. *Fenneropenaeus indicus* alone accounted for almost a fifth of the total biomass, and *Metapenaeus dobsoni* together with *M. monoceros* added a further 18.44%. *M. dobsoni* has been recognized as an important resource along the Mangalore coast for decades (Ramamurthy *et al.*, 1978) [18]. Later assessments confirmed under sustained exploitation in coastal Indian waters (Sukumaran *et al.*, 1993) [19]. The strength of the penaeid component suggests that the net was working effectively lower in the water column for at least part of each tow, though without headline and footrope. The depth sensors can't be pinned down to an exact vertical position.

Among the pelagic fishes, *Rastrelliger kanagurta* was the leading species (13.05%), followed by Anchovies and Scads – consistent with how important Indian Mackerel is known to be in the Mangalore and Malpe fishery (Rohit *et al.*, 2004) [17]. Sardines and Anchovies added further schooling components, and Oil Sardine in particular has long been a major resource along this stretch of coast (Rohit *et al.*, 2003) [16]. The presence of *Uroteuthis duvaucelii* also fits the regional picture, since the species supports a significant Inshore Squid fishery and shows extended reproductive activity off Mangaluru (Naik *et al.*, 2017) [20]. Altogether, the catch composition looks like a biologically reasonable assemblage for this ground, not an unusual mix produced by the gear itself.

4.3 Temporal fluctuations in the coastal fisheries

Catch changed a good deal from month to month, even with haul duration and towing speed held essentially fixed. March 2025 gave the highest monthly total catch and in April 2026 the lowest catch was found. This kind of swing is expected along the Mangaluru, which had strongly the region is shaped by South-West Monsoon upwelling. Post-monsoon productivity and seasonal movement of pelagic schools. Krishnakumar *et al.* (2008) [15] showed that the Mangalore pelagic fishery tracks the Malabar upwelling system, with Mackerel and Oil-Sardine abundance varying substantially with oceanographic conditions. The monthly pattern seen here should therefore be read as a mix of changing biological availability and the fixed catchability of the gear.

This variability is also a reminder for why a single-month trial which could be misleading in a multispecies fishery. Monthly catch CV (13.52%) came out lower than haul-level catch CV (16.93%), but the gap between the highest and lowest monthly totals was still substantial. Bycatch studies from the South-West coast reported similar month-to-month shifts in trawl composition and volume (Gibinkumar *et al.*, 2012; Dineshbabu *et al.*, 2012) [29, 6]. A longer sampling window, in other words, makes a baseline gear trial more useful, since it cuts the risk that conclusions are driven by one short-lived aggregation or recruitment event.

4.4 Herding effect of bridle length and fish behaviour

It's worth treating the 15 m bridle as a condition of the whole anterior gear rather than just a length of rope. Mathai *et al.* (1984) [8] showed that Indian Trawl trials that bridle length alone can change the catch, pointing to both swept-area and herding effects. Later, research has shown herding isn't consistent across taxa as studied by Somerton (2004) [12] found weak Bridle has responses in some Roundfish, while Somerton *et al.* (2007) [11] found large whole-gear efficiency effects for several flatfish species. Winger *et al.* (2004) [30] also showed that fish size and swimming ability shape and herding behaviour of fish. Findings like this has explained why the same nominal bridle setup can catch Mackerel, Anchovies, Penaeids, Ponyfishes and Squid of quite different rates.

This study did not directly observe how fish reacted to the bridle to net mouth, so it makes no claim about a measured herding mechanism a distinction worth being clear about. Current Trawl research increasingly relies on Cameras, Acoustic systems and Geometry Sensors to tell abundance effects apart from gear-performance effects (Graham *et al.*, 2004; Bayse *et al.*, 2016) [1, 13]. Reviews of Trawl selectivity make a similar point: front-end changes like sweeps and bridles can matter a great deal, but assessing their effects properly calls for adequate replication and species-specific interpretation (Boopendranath *et al.*, 2005; Kennelly *et al.*, 2021) [31, 32]. The 15 m bridle length data set reported here is best used as a field baseline that instrumented trials of this kind can be measured against.

4.5 Fuel consumption and operational significance during fishing operation

Fuel consumption stayed tightly clustered around 25.8 L h⁻¹ even as catch swung much more widely. That resulted 4.52 kg L⁻¹ Therefore to captures the Biological productivity achieved from a fairly stable energy input. Trawl drag depends on netting area, towing speed, gear accessories and hydrodynamic loading, and Indian studies have shown that lower-drag designs and thinner high-strength netting can reduce fuel demand without necessarily costing catch rate (Sayana *et al.*, 2018; Remesan *et al.*, 2020) [27, 23]. This fuel figure is a useful baseline for this particular vessel-gear combination, but shouldn't be generalized to other vessels, engines or fishing grounds. Fuel efficiency matters for more than trip cost alone. Tyedmers *et al.* (2005) [22] and Parker *et al.* (2018) [21] showed how much fuel consumption will contribute to the environmental footprint during capture fisheries and Vivekanandan *et al.* (2013) [24] found that mechanized Indian Trawlers carry comparatively high carbon emissions per unit catch. In Karnataka, diesel is also a major share of operating cost for mechanized fishing (Aswathy *et al.*, 2017) [26]. Reporting both catch per haul and catch per litre gives a more useful Engineering picture than catch figures on their own, especially when weighing future changes meant to alter net spread, drag or fishing efficiency.

4.6 The scope of future work

The scope of what can be concluded here is limited to one vessel, one experimental trawl and the 15 m bridle condition. Natural abundance, current, sea state and school position were all outside the study's control. Door spread, wing-end spread, headline height, bridle angle, tow tension and exact net depth were not measured directly, so the study can't separate hydrodynamic mechanisms from biological availability. The monsoon closure also left a gap in the annual catch. Future trials

should pair the same standardized catch protocol with trawl-depth sensors, door- and wing-spread measurements, tow-tension logging, environmental observations and species-size data. That would let catch per haul and catch per litre be linked directly to in-water geometry and fish behaviour, rather than inferred from catch figures alone.

5. Conclusion

The experimental two-seam designed trawl fished with a 15 m bridle length produced a 10,492.5 kg for the 30 hauls found to be carried out off Mangaluru, averaging 349.75 ± 59.20 kg per haul. The catch was multispecies, dominated by pelagic finfishes (43.40%) and followed by Penaeid Shrimps (38.30%), with *Fenneropenaeus indicus*, *Metapenaeus dobsoni* and *Rastrelliger kanagurta* as the leading individual species. Monthly catches ranged from 550.0 to 901.0 kg, confirming real temporal variability across the sampled fishing season. Fuel consumption was stable at 25.80 ± 0.26 L h⁻¹ giving a cumulative fuel productivity of 4.52 kg L⁻¹ was observed. Together, these results set a clear biological and operational baseline for the 15 m bridle length used during trawl operation and environmental variables, worked out with the mechanisms behind catchability and proper evaluate on alternative for the rigging arrangements was found during the study period.

Declarations

Conflict of interest: The authors declare no conflict of interest.

Ethical statement: The study involved commercial fishery catches and did not involve experimental manipulation of live vertebrate animals beyond normal fishing operations.

Data availability: The data is supporting the findings which are contained in the study dataset and are available from the corresponding author on reasonable request.

Author contributions: Rohini Swami: investigation, data curation, analysis, visualization and manuscript preparation. Jaya Naik: supervision, methodology, review and editing.

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