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Craft & gear analysis of mechanized trawlers operating from Bhidiya Fishing Harbour, Gujarat

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Abstract

A field-based survey was conducted to assess the craft and gear characteristics of mechanized trawlers operating from Bhidiya Fishing Harbour, Gujarat, India. The study was based on nine selected fishing craft, and data were collected through a structured questionnaire, direct onboard observations, and interactions with boat owners and crew members. Information on craft specifications, including boat name and registration number, ownership, type of craft, storage capacity, length overall, gross and net tonnage, crew strength, ice and fuel capacity, and engine details, was systematically documented. In addition, gear specifications such as type of fishing gear, mesh size, materials used for gear fabrication, fishing grounds and locations, fishing seasons, closed seasons, and duration of fishing trips were recorded. Catch composition was noted to identify the major fish species associated with trawler operations, and catch per unit effort (CPUE) was estimated to evaluate fishing efficiency. The results revealed notable variations in craft dimensions, engine power, gear configurations, and operational patterns among the surveyed trawlers, reflecting adaptive strategies to local fishing conditions and resource availability. The observed fish assemblage consisted predominantly of commercially important demersal and pelagic species, indicating the multispecies nature of trawl fisheries in the region. The findings provide valuable baseline information on trawler craft and gear characteristics at Bhidiya Fishing Harbour and may support sustainable fisheries management, gear regulation, and policy formulation for mechanized trawl fisheries along the Gujarat coast.

Keywords: Trawlers, Craft, Gear, CPUE, Bhidiya Harbour

1. Introduction

Fishing plays a vital role in global and national food security by providing a major source of animal protein, employment, and income for millions of coastal communities. In India, marine fisheries contribute significantly to nutritional security, livelihood generation, and the overall coastal economy. The mechanization of fishing craft and the development of efficient fishing gears have greatly enhanced fish production, particularly along the western coast of India, including Gujarat, which is one of the leading marine fish producing states.

Gujarat State possesses substantial aquatic and coastal resources that strongly support its fisheries and allied sectors. The state has a coastline length of approximately 1,600 km and an Exclusive Economic Zone (EEZ) covering 2.14 lakh square kilometres, along with a continental shelf area of 1.64 lakh square kilometres, indicating significant marine fishery potential. Inland water resources are also extensive, with a total river and canal length of about 3,865 km. Gujarat has reservoirs covering 3.48 lakh hectares, while ponds and tanks occupy 0.22 lakh hectares. Additionally, the brackishwater area extends over 3.76 lakh hectares, contributing to aquaculture development. The state also has a potential area of 0.89 lakh hectares suitable for brackishwater aquaculture, highlighting its strong scope for further fisheries and aquaculture expansion (Commissioner of Fisheries, 2024) [3].

During the year 2024-25, Gujarat State recorded a total fish production of 1,042,557 metric tonnes, of which 764,343 metric tonnes were contributed by marine fisheries and 278,214 metric tonnes by inland fisheries. The total value of fish production during the same period was estimated at ₹19,013.54 crore, with marine fisheries contributing ₹13,427.01 crore and inland fisheries contributing ₹5,586.53 crore. Furthermore, fish and fishery product exports from Gujarat State during 2024-25 amounted to 282,158 metric tonnes, generating an export revenue of ₹5,889.29 crore, highlighting the significant contribution of the fisheries sector to the state's economy (Commissioner of Fisheries, 2024) [3].

At the national level, the estimated marine fish landings along mainland India during 2024 amounted to 3.45 million tonnes, representing a 2% decline from 3.53 million tonnes recorded in 2023. The Andaman and Nicobar Islands

contributed an additional 16,990 tonnes, reflecting an 8% decrease compared to the previous year, thereby bringing the total marine fish landings of the country to 3.47 million tonnes (FRAD & CMFRI, 2022) [6, 2]. Gujarat maintained its leading position in marine fish landings, recording 7.54 lakh tonnes despite an 8% decline, and contributed approximately 22% of the national total. In contrast, Tamil Nadu, West Bengal, and Maharashtra registered notable increases in landings, with Maharashtra exhibiting the highest growth rate of 47% compared to the previous year (FRAD & CMFRI, 2022) [6, 2].

According to the Marine Fisheries Census 2016 (CMFRI, Kochi) and the Gujarat State Census, the total fishermen population in Gujarat was 5.86 lakh, comprising 3.55 lakh marine fishermen and 2.31 lakh inland fishermen. Of this total population, 1.56 lakh fishermen were actively engaged in fishing activities. The state also reported a substantial fishing effort, with 16.38 lakh fishing gears and nets recorded during the census period. Furthermore, Gujarat had a total of 1,095 fishing villages and centres, including 280 marine fishing villages and 815 inland fishing villages, reflecting the extensive spread of fisheries-dependent communities across the state (CMFRI-DoF, 2020) [2].

At the state level, Gujarat has 187 fishing centres and 280 fishing villages, encompassing 67,610 fishing families. The total fishermen population stands at 3,54,992, including 1,84,353 males and 1,70,639 females. Among them, 59,464 fishermen are engaged in full-time fishing, 8,188 in part-time fishing, and 2,409 in fish seed collection, leading to an overall active fisheries population of 75,471 persons (Commissioner of Fisheries, 2024) [3].

During 2023-24, the marine fisheries sector of Gujarat comprised a total of 26,418 fishing boats, including 16,664 mechanised vessels such as trawlers, gill netters, dol netters, deep-sea vessels, and other categories. In addition, 9,439 motorised boats and 315 non-mechanised boats were recorded. In the inland fisheries sector, a total of 9,312 fishing boats were reported, of which 8,447 were traditional boats, 566 were motorised boats, and 299 were mechanised boats. These figures reflect the substantial fishing capacity and technological diversity present across both marine and inland fisheries of Gujarat State (Commissioner of Fisheries, 2024) [3].

Fishing gears are broadly classified into active and passive types based on their mode of operation. Passive fishing gears depend on the natural movement and behaviour of fish and remain stationary during operation. Examples include gill nets, longlines, traps, and hooks and lines. These gears are generally species-selective, require lower energy input, and cause minimal disturbance to the aquatic environment. In contrast, active fishing gears are operated by moving the gear through water or over the seabed to capture fish. Active gears require greater energy input and mechanized craft and are widely used in commercial fisheries due to their higher catch efficiency.

Several types of active fishing gears are employed in marine fisheries worldwide, including trawls, purse seines, ring seines, and dredges. Purse seines are mainly used for capturing pelagic shoaling fishes, while ring seines are commonly operated in coastal waters for small pelagic species. Dredges are used to harvest benthic organisms such as bivalves. Among all active gears, trawl nets are the most widely used due to their versatility and ability to exploit a wide range of fishery resources.

Trawling involves towing a cone-shaped net through the water column or along the sea bottom using mechanized vessels. Trawl nets are broadly classified into bottom trawls, mid-water trawls, and pelagic trawls, depending on their mode of operation and target species. Bottom trawls are designed to capture demersal fishes, crustaceans, and molluscs, while mid-water and pelagic trawls target pelagic fish stocks. The design, mesh size, and material of trawl nets vary according to fishing grounds, target species, and operational depth.

Trawl fisheries offer several advantages, including high catch efficiency, multispecies harvest, adaptability to different fishing grounds, and economic viability for mechanized fishing operations. However, trawling also has certain limitations, such as high fuel consumption, bycatch of non-target species, capture of juveniles, and potential impacts on benthic habitats, particularly in bottom trawling. These concerns highlight the need for continuous assessment of trawler craft and gear characteristics to improve fishing efficiency while ensuring sustainable resource utilization.

Gir Somnath district emerges as the leading contributor to trawl fishing activity in Gujarat, with 3,489 trawlers, accounting for a substantial share of the state's total 9,310 trawlers. This dominance highlights Gir Somnath as a major hub of mechanised marine fishing operations in the state. In comparison, other key fishing districts such as Porbandar (2,495 trawlers) and Junagadh (2,048 trawlers) also contribute significantly, though at notably lower levels (Commissioner of Fisheries, 2024) [3].

In Gir Somnath district, fisheries activities are supported by 11 fishing centres and 28 fishing villages, with a total of 14,515 fishing families. The fishermen population of the district comprises 42,872 males and 40,666 females, accounting for a total of 83,538 individuals. Of these, 14,452 fishermen are engaged in full-time fishing and 1,987 in part-time fishing, while 124 individuals are involved in fish seed collection, resulting in a total active fisheries workforce of 15,663 persons (Commissioner of Fisheries, 2024) [3].

Thus, Gujarat, and particularly Gir Somnath district, represents a major centre of mechanised trawl fisheries in India, contributing substantially to marine fish production, employment, and export earnings. In view of the increasing fishing pressure, declining landings, and growing concerns over sustainability, there is a strong need for systematic evaluation of trawler craft and gear characteristics to enhance operational efficiency while ensuring responsible and sustainable exploitation of marine resources.

Materials and Methods

Study Area

The present study was carried out at Bhidiya Fishing Harbour, located along the Saurashtra coast of Gujarat, India (Fig. 1). The harbour supports a mechanized fishing fleet and serves as an important landing centre for trawl fisheries in the region. Trawlers operating from this harbour exploit both inshore and offshore fishing grounds of the Arabian Sea and contribute significantly to local marine fish production.

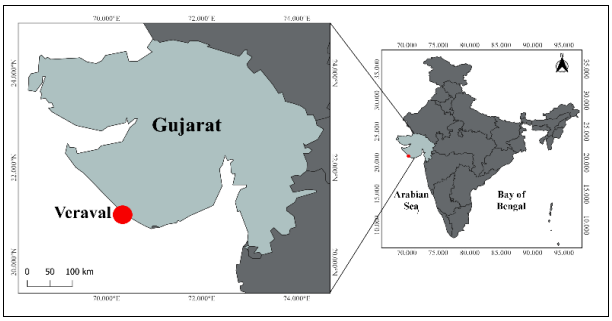


Fig 1: Location of study area

Selection of Fishing Craft

A total of nine mechanized trawlers operating regularly from Bhidiya Fishing Harbour were purposively selected for the study. The selection was based on vessel availability, operational regularity, and willingness of boat owners and crew members to participate in the survey. The selected trawlers were considered representative of the trawl fleet operating from the harbour.

Data Collection

Data were collected through a structured questionnaire, direct onboard observations, and personal interviews with boat owners, skippers, and crew members. The questionnaire was designed to obtain detailed information on craft specifications, gear characteristics, and operational parameters.

Information related to craft characteristics included boat name, registration number, ownership details, type of craft, storage capacity, length overall (LOA), gross tonnage (GT), net tonnage (NT), number of crew members, ice capacity, engine specifications, and fuel capacity.

Details of gear specifications included type of fishing gear used, mesh size, materials used for gear fabrication, and configuration of the trawl net. Operational aspects such as fishing ground, fishing location, fishing season, closed season, duration of a single fishing trip, and frequency of operations were also recorded.

Catch Composition

The catch composition of the surveyed trawlers was documented by recording the major fish species landed during fishing operations, while information on fish species occurring in the Bhidiya fishing grounds was compiled from secondary data sources.

Result and Discussion

The results of the present study on the craft and gear characteristics of mechanized trawlers operating from Bhidiya Fishing Harbour, Gujarat are presented and discussed based on data obtained from the survey of nine selected trawlers. Different trawlers at the study area is shown in (Fig. 2). The findings are summarized in tabular form (Table 1) to clearly illustrate variations in craft specifications, gear configurations, operational parameters, and fishing performance. The observed trends in vessel dimensions, engine power, crew strength, gear type, mesh size, and catch per unit effort (CPUE) are discussed in relation to fishing practices, operational efficiency, and resource utilization patterns prevalent in the study area.

Fig 2: Different Trawler at the study area

Craft Dimensions and Storage Capacity

The Length Overall (LOA) of the surveyed crafts ranged from 15.41 m to 15.49 m, indicating a high degree of uniformity in vessel size across the trawl fleet as seen in (Fig. 3). Gross Tonnage (GT) varied between 17 and 22 tons; specifically, Boat 9 exhibited a higher GT compared to Boat 8, likely reflecting differences in hull depth or internal volume. Storage capacity—measured by the volume of fish holds and ice storage—ranged from 30 to 35 units, with Boat 9 and Boat 7 demonstrating superior capacities for extended voyages.

Furthermore, the Net Tonnage (NT), which here denotes the effective catch holding capacity, varied between 4,000 kg and 6,000 kg. These variations are often influenced by the vessel's age and modifications made to the hold to accommodate specific high-value catch like cephalopods or crustaceans. Such technical specifications are critical as they directly influence the vessel's stability, fuel consumption, and overall operational efficiency in the Arabian Sea (Pillai *et al*., 2024) [10].

Fig 3: Surveyed crafts

Table 1: Craft details and specification

No.	Questions	Boat 1	Boat 2	Boat 3	Boat 4	Boat 5	Boat 6	Boat 7	Boat 8	Boat 9
1	Boat name	Bajarang Sagar	Sanskruti	Dhanprasad	Halari	Maruti Nandan	Ankleshwar	Shree Gebi Hanuman	Ganesh prasad	Hare Krushna
2	Boat Reg. No.	IND- GJ-32-MM-2352	IND- GJ-32-MM-2155	IND- GJ-32-MM-7868	IND- GJ-32-MM-2183	IND- GJ-32-MM-7524	IND- GJ-32-MM-2743	IND- GJ-32-MM-2672	IND- GJ-32-MM-2671	IND- GJ-32-MM-7797
3	Owner name	Harilal Baraiya	Mavji Sikotariya	Shreyansh Sikotariya	Lakham Solanki	Vitthal Solanki	Hardik Vansh	Jadhav Lodhari	Dhanji Lodhari	Suryakant Bamaniya
4	Type of craft	Trawl Net	Trawl Net	Trawl Net	Trawl Net	Trawl Net	Trawl Net	Trawl Net	Trawl Net	Trawl Net
5	Storage capacity of craft	32	35	30	33	30	35	34	30	35
6	Length overall	15.43 m	15.60 m	15.40 m	15.45 m	15.37 m	15.56m	15.47m	15.41m	15.49m
7	Gross tonnage	20 tons	24 tons	20 tons	20tons	18 tons	24 tons	21 tons	17 tons	22 tons
8	Net tonnage	Depend upon the availability of catch(5000Kg.)	Depend upon the availability of catch(6000Kg.)	Depend upon the availability of catch(500Kg.)	Depend upon the availability of catch(5500Kg.)	Depend upon the availability of catch(4500Kg.)	Depend upon the availability of catch(6000Kg.)	Depend upon the availability of catch(6000Kg.)	Depend upon the availability of catch(4000Kg.)	Depend upon the availability of catch(4000Kg.)
9	Crew member	8	8	8	8	8	8	8	8	8
10	Ice capacity	100	150	120	120	130	150	120	130	100
11	Engine	150 HP	215	180	180	150	215	215	180	180
12	Fuel capacity	3000	4000	3000	3000	3000	4000	4000	3000	4000
13	Type of gear	Trawl net	Trawl net Gillnets (Jada Jal)	Trawl net	Trawl net	Trawl net	Trawl net	Gillnets (Jada Jal)	Trawl net	Trawl net
14	Mesh size	40mm	40mm	40mm	40mm	40mm	40mm	40mm	40mm	40mm
15	Material used for gear fabrication	HDPE	Nylon	HDPE	HDPE	HDPE	HDPE	Nylon	HDPE	HDPE
16	Fishing location	Maharashta	Porbandar, Okha, Dwarka	Maharashtra	Maharashtra	Maharashtra	Goa, Maharashra	Porbandar, Okha, Dwarka	Maharashtra	Gujarat
17	Closed season	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th	june 1st to August 15th
18	Duration of one trip	22	25	20	18	20	26	18	22	17
19	Catch per unit effort (CPUE)	500-800 kg	600-800 kg	500-700 kg	600-800 kg	400-600 kg	700-900 kg	500-800 kg	600-700 kg	600-800 kg

Crew Strength, Ice and Fuel Capacity

All nine trawlers operated with a uniform crew strength of eight members. The ice capacity of the vessels ranged from 100 to 130 units (typically measured in blocks or crates); Boat 8 maintained a higher ice capacity, which is essential for ensuring the post-harvest quality of high-value perishables during extended trips.

Conversely, Boat 9 carried comparatively less ice, which may suggest a focus on shorter trip durations or proximity to landing centers. Fuel capacity ranged from 3,000 to 4,000 liters, with Boats 7 and 9 possessing the largest storage volumes. This higher fuel endurance is a strategic advantage, enabling an extended operational range and the flexibility to access distant fishing grounds beyond the traditional coastal zones (Pillai *et al*., 2024) [10]. Such fuel storage capacities are typical for trawlers engaged in trips lasting 7 to 10 days, where fuel costs represent the most significant component of total operational expenditure.

Engine Power and Operational Characteristics

Engine power among the surveyed vessels ranged from 180 HP to 215 HP, reflecting the modernization of the fleet to accommodate heavier gear and deeper fishing grounds. Boat 7 was equipped with the highest engine power (215 HP); this increased horsepower supports a higher trawling speed and greater bollard pull, which are essential for efficient towing of large-mesh demersal trawls and maintaining stability during extended offshore operations.

In contrast, Boats 8 and 9 were fitted with moderate engine power (180 HP), a capacity widely regarded as the "standard" for medium-range trawling along the Gujarat coast. While 180 HP engines offer sufficient thrust for coastal multi-species trawling, they are often preferred by operators looking to optimize the Fuel Consumption Ratio (FCR), as higher HP engines—while more powerful—significantly increase the break-even catch requirements due to escalated fuel expenses (Pillai *et al*., 2024) [10].

Gear Characteristics

While trawl nets were the dominant fishing gear, Boat 7 primarily operated gillnets—locally known as Jada Jal—indicating a strategic shift toward gear diversification within the fleet. This move toward "multi-gear" operations is often a response to the seasonal fluctuations of target species and a way to mitigate the high operational costs associated with continuous trawling. The mesh size was recorded as a uniform 40 mm across all vessels.

Gear fabrication materials varied between vessels, reflecting specific operational priorities: Boat 7 utilized Polyamide (Nylon), preferred for its high tensile strength and elasticity in gillnetting, while Boats 8 and 9 employed High-Density Polyethylene (HDPE) for their trawl nets. HDPE is the material of choice for active towing gears due to its superior abrasion resistance against the seabed, lower water absorption, and cost-effectiveness compared to synthetic fibers like Nylon or Dyneema (Boopendranath, 2013) [1]. These material preferences underscore a balance between the technical requirements of the gear and the economic constraints of the vessel owners.

Fishing Grounds and Seasonal Pattern

Fishing activities were carried out across diverse locations, including the waters off Porbandar, Okha, Dwarka, and extending into Maharashtra, indicating a broad spatial coverage of trawl operations originating from the Bhidiya Fishing Harbour (Veraval). This extensive operational range, often crossing maritime state boundaries, is a hallmark of the "long-voyage" multi-day fleet which follows the seasonal migration of high-value demersal and pelagic stocks along the North-western continental shelf.

Crucially, all surveyed trawlers strictly adhered to the uniform closed fishing season from 1st June to 15th August. This 75-day "monsoon ban" is a mandatory conservation measure implemented by the Government of India to protect fish during their peak spawning period and ensure the long-term sustainability of marine resources (Ministry of Fisheries, 2024) [9]. Compliance with these regulations is vital for the recovery of stressed stocks and aligns with the National Policy on Marine Fisheries, which seeks to balance economic output with ecological resilience (PIB, 2025).

Trip Duration and Catch per Unit Effort (CPUE)

The duration of fishing trips ranged from 17 to 22 days, a timeframe characteristic of the "long-voyage" multi-day trawling sector operating out of Gujarat's major harbors. Boat 8 undertook relatively longer trips, likely due to its higher ice and fuel capacity, which allow for greater endurance in distant fishing grounds. The Catch Per Unit Effort (CPUE) varied between 500 and 800 kg per trip, with Boat 9 and Boat 7 recording comparatively higher catch ranges.

Variations in CPUE were influenced by a synergistic combination of technical and operational factors, including gear type, engine power, specific fishing coordinates, and trip duration. High-power vessels like Boat 7 (215 HP) are capable of maintaining higher towing speeds and using larger net spreads, which can significantly enhance catch rates compared to lower-powered counterparts (Pillai *et al*., 2024) [10]. Furthermore, the spatial choice of fishing location—specifically targeting high-productivity upwelling zones or deeper shelf edges—remains a critical determinant of fishing efficiency and economic return for the mechanized fleet.

Catch composition

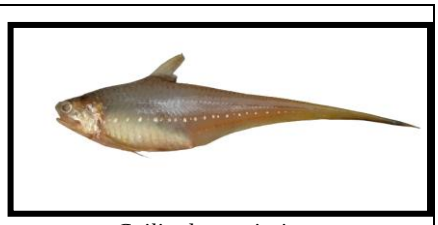
Rathod Hitanshi *et al*. (2021) [13] conducted a study at Veraval Fishing Harbour, Gujarat, during the period from February to March 2021, in which a total of 14 marine species were recorded from the fishery. Subsequently, K. Kuhada *et al.* (2025) [8] documented the fish catch composition at Veraval Harbour, closely associated with Bhidiya Harbour, during November 2021 to April 2022. The recorded catch was categorized into finfishes, crustaceans, cephalopods, and miscellaneous groups, comprising a total of 75 species belonging to 20 orders and 50 families. During the present survey, several species reported in these earlier studies were also observed. The species documented in the present study are presented in Table 2, with corresponding photographs provided in Annexure 1.

Table 1: species composition

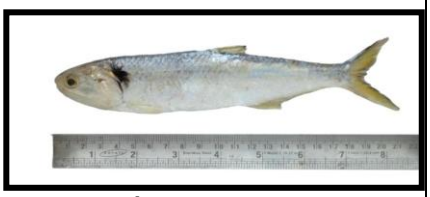
Sr. No.	Species Name
1	*Thryssa dussumieri*
2	*Coilia dussumieri*
3	*Thryssa mystax*
4	*Chirocentrus nudus*
5	*Ilisha filigera*
6	*Pampus argenteus*
7	*Johnius dussumieri*
8	*Epinephelus coioides*
9	*Lutjanus johnii*
10	*Lepturacanthus savala*
11	*Trichiurus lepturus*
12	*Rastrelliger kanagurta*
13	*Arius arius*
14	*Plicofollis dussumieri*
15	*Plotosus lineatus*
16	*Scoliodon laticaudus*
17	*Rhizoprionodon oligolinx*
18	*Himantura* sp.
19	*Rhynchobatus djiddensis*
20	*Parapenaeopsis stylifera*
21	*Penaeus indicus*
22	*Metapenaeus* sp.
23	*Penaeus monodon*
24	*Acetes* sp.
25	*Solenocera* sp.
26	*Panulirus polyphagus*

Table 2: Species composition

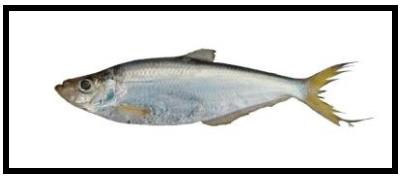
Thryssa dussumieri



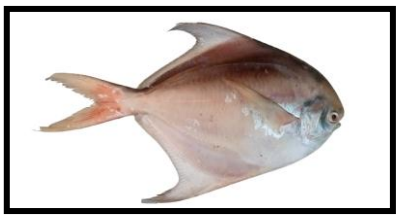
Coilia dussumieri



Thryssa mystax



Ilisha filigera



Pampus argenteus

Johnius dussumieri

Epinephelus coioides

Lutjanus johnii

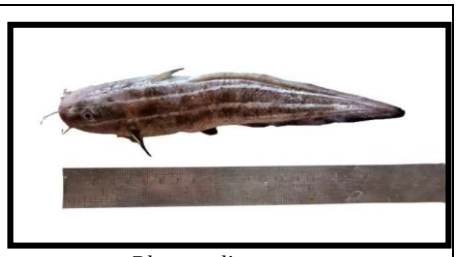
Lepturacanthus savala

Trichiurus lepturus

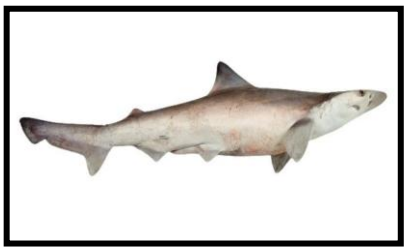
Rastrelliger kanagurta

Arius arius

Plicofollis dussumieri



Plotosus lineatus



Scoliodon laticaudus

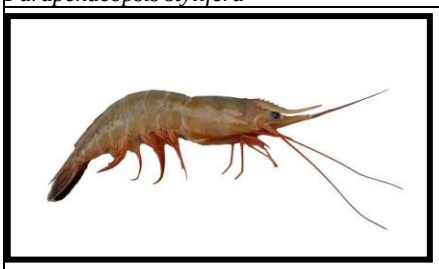
Rhizoprionodon oligolinx

Himantura sp.

Rhynchobatus djiddensis

Parapenaeopsis stylifera

Penaeus indicus



Metapenaeus sp.

Penaeus monodon

Acetes sp.

Solenocera sp.

Conclusion

The present study provides a comprehensive assessment of the craft and gear characteristics of mechanized trawlers operating from Bhidiya Fishing Harbour, Gujarat, based on a detailed survey of nine selected fishing crafts. The findings indicate that trawl fisheries in the region are dominated by medium-sized mechanized vessels (LOA 15.41-15.49 m) with standardized dimensions and uniform crew strength.

Variations in engine power (180-215 HP), fuel capacity, and trip duration were found to be the primary drivers of fishing performance. The observed differences in Catch Per Unit Effort (CPUE), ranging from 500 to 800 kg per trip, suggest that higher horsepower and fuel endurance allow for a strategic advantage in accessing distant, higher-productivity fishing grounds. While the predominance of trawl nets with a uniform 40 mm mesh size indicates consistent regional practices, the inherent risks of bycatch and the reliance on multi-species harvests emphasize the need for adopting Square Mesh Codends and other Bycatch Reduction Devices (BRDs) to protect juvenile stocks.

The uniform observance of the 75-day monsoon ban (1st June to 15th August) demonstrates a high level of regulatory compliance and awareness among the fishing community regarding the necessity of spawning closures (Ministry of Fisheries, 2024) [9]. However, the wide spatial coverage—extending from Gujarat to Maharashtra waters—underscores the importance of cross-border management and adaptive strategies that account for migratory fish patterns. Overall, this study generates vital baseline information to support fisheries planning and gear regulation. These results serve as a critical reference for policymakers and researchers aiming to harmonize the economic viability of the Gujarat trawl fleet with the long-term sustainability of marine resources.

References

1. Boopendranath MR, Hameed MS. Gross energy requirement in fish harvesting systems. Fish Technology. 2013;50(1):27-33.
2. CMFRI-DoF. Marine fisheries census 2016 - Gujarat. Kochi: Central Marine Fisheries Research Institute, ICAR; Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India; 2020. p. 188.
3. Commissioner of Fisheries. Fisheries statistics of Gujarat state. Gandhinagar: Government of Gujarat; 2024.
4. FAO. The state of world fisheries and aquaculture 2024: blue transformation in action. Rome: Food and Agriculture Organization of the United Nations; 2024.
5. Fischer W, Bianchi G. FAO species identification sheets for fishery purposes: Western Indian Ocean (Fishing Area 51). Updated digital ed. Rome: Food and Agriculture Organization of the United Nations; 2024.
6. FRAD, CMFRI. Marine fish landings in India 2023. CMFRI Booklet Series. 2024;33:1. Kochi: ICAR-Central Marine Fisheries Research Institute.
7. He P, Chopin F, Suuronen P, Ferro RST, Lansley J. Classification and illustrated definition of fishing gears. FAO Fisheries and Aquaculture Technical Paper. 2021;(672):1-94.
8. Kuhada JK, Dave TH, Tandel NA, Janbandhu S, Mer J, *et al*. Catch composition analysis of trawl fishery at Veraval Harbour, Gujarat, India. Journal of Advances in Biology and Biotechnology. 2025;28(10):1743-1756.
9. Ministry of Fisheries, Animal Husbandry and Dairying. Order on uniform ban on fishing in the Indian Exclusive Economic Zone (EEZ) for 2024. New Delhi: Government of India; 2024.
10. Pillai SL, Thirumalu C, Rao GS. Energy audit and carbon footprint of the mechanized fishing fleet in Gujarat, India. Marine Pollution Bulletin. 2024;198:115124.
11. Press Information Bureau. India's fisheries on the rise: achievements from 2004 to 2024. New Delhi: Ministry of Fisheries, Animal Husbandry and Dairying, Government of India; 2025 Feb 15.
12. Press Information Bureau. Strengthening marine resources and livelihoods: India celebrates World Fisheries Day 2025. New Delhi: Ministry of Fisheries, Animal Husbandry and Dairying, Government of India; 2025 Nov 20.
13. Rathod H, Vagh R, Chaudhari P, Varma R. Catch composition survey of trawlers operating from Veraval fishing harbour, Gujarat. Pharma Innovation Journal. 2021;10(11S):1962-1964.
14. Seafish. Types of fishing gear: static, encircling, and towed gear. Seafish Fishing Gear Database. 2024.