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Effect of Barbed Hooks Used in the Longline Fishing Operations Operated along the Panambur Coast off Mangaluru

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ABSTRACT

The study was conducted during August, 2024–September, 2025 at Panambur coast off Mangaluru, Karnataka, India to investigate the operational efficiency, hooking ability and economic viability of barbed hooks used in longline fishing operations along the Panambur coast off Mangaluru, Karnataka. The primary objective was to evaluate the performance of barbed hooks in terms of catch composition, species selectivity, fuel consumption, and profitability under real world fishing conditions. Field trials were conducted over a 255-day period using a fiber-reinforced plastic longliner powered by a 9.9 hp outboard engine. The fishing gear comprised a two hundred meter nylon monofilament mainline with one hundred branch lines, each fitted with stainless steel barbed hooks and baited with live fish. Fishing operations were carried out at a depth of approximately 30 m, with catch data, fuel usage and operational parameters meticulously recorded. The results demonstrated that barbed hooks achieved an average hooking efficiency of 0.52, with peak performance observed on the 19th day. The catch composition was dominated by Skipjack Tuna, followed by King Mackerel and Barracuda, indicating high selectivity for commercially valuable species. Fuel consumption averaged seventy l trip^{-1}, reflecting cost-effective operations. The study highlighted the effectiveness of barbed hooks in enhancing catch rates while maintaining economic and ecological sustainability. These findings supported the continued use of barbed hooks in small-scale longline fisheries and provided a scientific basis for gear standardization and policy recommendations aimed at improving resource utilization and fisher livelihoods along the Indian coast.

KEYWORDS: Longline fishing, barbed hooks, hooking efficiency, economic viability

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1. INTRODUCTION

Marine fisheries are vital to global food security, employment, and the economic growth of coastal communities. India, with over 11,000 km of coastline, has one of the world's largest marine fisheries sectors. The west coast, from Gujarat to Kerala, is highly productive and supports diverse fishing practices. Karnataka, with 343 km of coastline, contributes significantly to national landings, where mechanised and motorised fishing dominate. Panambur, near Mangaluru in Dakshina Kannada district, is a critical hub for artisanal and industrial fishing, supporting livelihoods and supplying high-value seafood (Zacharia et al., 2025). Industrial pelagic fishing uses a range of methods that involve the use of nets (e.g., purse seines, drift nets), and hooks and line (e.g., drifting longline, pole and line) to catch highly migratory tunas, billfishes and sharks (Crespo and Dunn, 2017). Over recent decades, Indian fisheries have transitioned from traditional gears like shore seines, gillnets, and hook-and-line methods to advanced mechanised operations. Among these, longline fishing has gained prominence due to its ability to selectively target valuable pelagic and demersal species such as Tuna, Seerfish, Snapper, Grouper, and Billfishes. This method involves deploying a long mainline fitted with numerous baited hooks on branch lines, which can be set at different depths depending on the target species. Longlines are considered more selective and environmentally sustainable than trawls, as fish are hauled individually, resulting in higher-quality catch and reduced seabed impact (Gilman et al., 2017). Despite these advantages, concerns about bycatch and fish welfare have led to increased scrutiny of hook design (Kennelly and Broadhurst, 2021). The hook is the most critical component of longline gear, influencing catch rates, hooking location, fish injury, and post-release survival of non-target species (Varghese et al., 2025). Barbed hooks remain the most widely used design in commercial longlining. A small backward-pointing projection near the hook tip prevents it from slipping out once embedded, improving retention rates. This design reduces bait loss and escapement, enhancing catch unit[1] effort (Scott et al., 2022). The live baits are used during the study period preferably *Rastrelliger kanagurta* and *Carangoides coeruleopinnatus*. Live bait of native species produced in a closed recirculation system is a desirable activity from a social and economic point of view, as artisanal fishermen and small rural producers can become suppliers of live baits, contributing to the generation of employment and income (Henriques et al., 2022). According to Sulikowski et al. (2020). Although bycatch is often discarded, capture and handling can often lead to death (Gallagher et al., 2014). The coupling of life history traits such as late maturity and slow growth limits the resiliency of this group of fishes to recover from these anthropogenic pressures (Musyl and Gilman, 2019) on a global scale. However, fishing practices and gears that minimize hook injury, handling, and air exposure can considerably improve fitness and survival in released fish (Holden et al., 2021). For commercial fishers along the Panambur coast, this efficiency translates directly into higher profitability. While extensive global research exists on longline fisheries, including hook selectivity, bycatch, and efficiency (Swimmer et al., 2011; Coelho et al., 2012), limited work has focused on the Indian context, especially on barbed hooks. The Panambur coast, an important longline fishing ground, offers an ideal site to address this gap. Understanding the effectiveness of barbed hooks in terms of hooking efficiency, catch composition, and economic returns is essential for recommending gear practices that balance fisher livelihoods with sustainable resource use. The primary objective of this study was to evaluate the performance of barbed hooks under real-world fishing conditions, focusing on catch composition, species selectivity, fuel consumption, and profitability.

2. MATERIALS AND METHODS

2.1. Sampling area of the study

The study was conducted during August, 2024 –September, 2025 at Panambur Coast Off Mangaluru. The Panambur coast off Mangaluru, Karnataka was selected as the study site due to its significance as a popular tourist destination and its prominent Longline fishing activities, featuring a diverse range of hook designs. Throughout the study period, this region experienced intense fishing operations. Sampling was conducted between two stations Station 1 (lat. 12.947475 N, long. 74.341098E) and Station 2 (lat.12.9437312 N, long. 74.6843686 E) at a depth of 30 meters (Figure 1). The fishing ground's depth was assessed using an echosounder.

2.2. Longline fishing gear and its accessories

The Longline gear used in the study consisted of a Nylon monofilament mainline with a diameter of 0.6 mm and a total length of 200 m. The branch lines were also made of nylon monofilament material measured 3 to 5 m in length

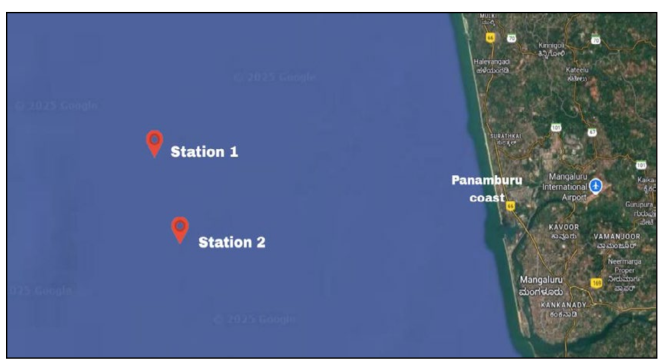

Figure 1: Locations of fishing ground at the Panambur coast off Mangaluru

with a diameter of 0.3 mm. For the terminal gear, stainless steel hooks of 0.4 mm diameter and 40 mm length were employed. Stainless steel barbed hooks of 0.4 mm diameter and 40 mm length were employed to evaluate their efficiency and performance. The fishing gear employed in the study was fitted with100 plastic floats and 100 iron sinkers. The floats were designed in a doughnut shape, each measuring 8 cm in size and weighing 150 g. In contrast, the sinkers were barrel-shaped, with a size of 3 cm and an individual weight of 250 g. This combination of floats and sinkers ensured proper buoyancy and stability of the gear during operation.

2.3. *Fishing vessel*

Experimental fishing activities were carried out along the Panambur coast off Mangaluru in Karnataka using a privately operated Longliner. As part of the physical survey, key structural elements of the fishing vessel were recorded. The vessel named SHREE RAM was constructed with a FRP (Fiber Reinforced Plastic) and was powered by a YAMAHA engine delivering 9.9 hp. It has an overall length (LOA) of 10 m, a depth of 1.280 m, and a breadth of 2.500 m. The vessel cruises comfortably at speeds ranging from 6 to 10 knots. For navigation and underwater detection, it was equipped with GPS and an Echo-sounder acoustic device.

2.4. *Live baits used during study period*

The hooks of length 2 cm were used to catch the Live baits these were the made up of Stainless steel. The Live baits were caught at the depth of 5 to 10 m. These hooks were attached with artificial attractants to attract small pelagic fish such as Mackerel (*Rastrelliger kanagurta)* and Coastal Trevally (*Carangoides coeruleopinnatus)*. The Hooks were attached to the Nylon monofilament handline operated by the fishermen onboard the vessel. The catch from the Handline were carefully removed from hook and fish were stored in Live bait storage installed in the vessel.

2.5. *Fishing voyage*

The duration of each fishing expedition was the total time a vessel spends from departure to return, encompassing all activities between consecutive trips. This included the transit to and from the fishing grounds, active fishing efforts, idle time spent waiting for favourable conditions or catch opportunities, and other logistical activities like unloading the haul at the harbour. The unplanned delays due to rough weather or sea state conditions were considered. These temporary aspects were carefully tracked and assessed using the field data collected throughout the study, offering a clearer understanding of operational timelines and their impact on efficiency.

2.6. *Statistical analysis*

The study evaluated the catch composition of longline fishing gear equipped with barbed hooks to assess their relative hooking ability during actual fishing operations. The fieldwork was conducted using a 9.9 HP outboard engine powered Longliner off the Panambur coast off Mangaluru, running at a depth of approximately 30 m. The aim was to determine whether the design of the hook significantly influenced catch rates and species selectivity under consistent environmental and operational conditions.

3. RESULTS AND DISCUSSION

Longline fishing, a passive and selective method, was employed along the Panambur coast off Mangaluru to target demersal and pelagic species such as *Katsuwonus pelamis*, *Scomberomorus commerson* and other commercially important species. It is important to understand the deployment of pelagic longline gear for reducing non-target species interactions, and increasing fishing efficiency (Song et al., 2015). The gear consisted of a 200 m nylon monofilament mainline with high specific gravity, to which 100 branch lines were attached at 2 m intervals. Catch rates of swordfish were not significantly affected by leader material. Nylon leaders showed lower at-haulback mortality for most bony fishes, except swordfish (Floats were spaced every 5 mto maintain buoyancy and prevent tangling. Fishing operations were conducted using a 33-foot FRP vessel powered by a 9.9 hp Yamaha outboard motor, equipped with GPS and echosounders for precise navigation and fish detection The collection of accurate fisheries catch data is critical to ensuring sustainable management of tuna fisheries, mitigating their environmental impacts and for managing transboundary fish stocks (Brown et al., 2021). Live baits such as *Rastrelliger kanagurta* and *Carangoides coeruleopinnatus* are used during the study period. Using live baits Using fish as bait resulted in lower retention rates of sea turtles, highlighting that option as an additional measure to further mitigate sea turtle bycatch (Santos et al., 2024).

3.1. *Hook design and deployment*

Barbed hooks with a 0.2 cm downward-facing barb were used throughout the study. Fifty hooks were baited with live fish such as *Rastrelliger kanagurta* and *Carangoides coeruleopinnatus* and deployed at depths of approximately 30 m. The design of the longlines can vary in the types of hooks, length of the snoods, thickness and material of the different lines used, intervals at which the snoods are placed along the mainline, and where they are used in reference to the seabed. All of these parameters vary depending on the target species, and they may influence the fishing efficiency of the gear. The gear was soaked for 30 min to 1 h before retrieval. Gear modification, such as the use of circle hooks instead of conventional J-hooks, has been identified as an effective bycatch reduction strategy in different pelagic longline fisheries around the world (Lima et al., 2024). The study aimed to evaluate the impact of hook design on catch efficiency, fuel consumption, and economic viability. Circle and octopus hooks reduced hooking depth in Channel Catfish compared with J-hooks and tended to reduce postcapture bleeding as well. Postholding physiological results showed no effect of hook type on blood lactate or glucose levels, and reflex impairment was very rare (Hintz et al., 2024). Lennox et al. (2015) suggests both deep hooking and capture of bluegill are significantly affected by both hook types and hook-set techniques.

3.2. Hooking ability

To evaluate the performance of barbed hooks in longline fishing operations, a series of trials were conducted over a span of 255 days along the Panambur coast off Mangaluru. During each trial, 50 barbed hooks were deployed and monitored for their hooking efficiency. Hooks are designed to exploit differences in size of target (e.g. tuna, swordfish) and non-target (e.g. large odontocetes) species in pelagic longline fisheries (McLellan et al., 2015). The results revealed considerable variation in hooking ability across different days, ranging from a minimum of 0.36 on day 30 to a maximum of 0.72 on day 90, where 36 out of 50 hooks successfully caught fish. Other notable efficiencies included 0.66 on day 45, 0.62 on days 15 and 135, and 0.58 on days 120 and 240 (Figure 2) Standardizing CPUE from baited longline gear has the additional complexity that the probability of catching a fish, and thus catchability, depends on volitional (foraging) behavior that is affected by gear configuration and environmental variables (Monnahan et al., 2018). The lowest recorded hooking ability was 0.36, with only 18 hooks yielding catch. Despite these fluctuations, the overall average hooking ability across all trials was calculated to be 0.52, indicating that barbed hooks consistently demonstrated moderate to high efficiency in capturing target species. These findings affirmed the reliability of barbed hooks in longline fishing and provided a quantitative basis for their continued use in commercial operations along the Panambur coast. These findings aligned with previous studies, which reported that barbed hooks tended to retain fish more effectively and result in higher catch rates (Sulikowski et al., 2020; Schaeffer and Hoffman, 2002).

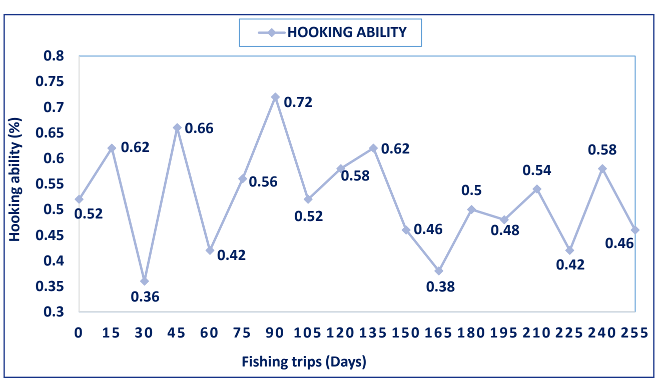

Figure 2: Hooking ability of Barbed Hooks used during study period along Panambur coast off Mangaluru

3.3. Species composition

During the longline fishing operations conducted along the Panambur coast off Mangaluru, a total catch of 7150 kg was recorded using the barbed hook, comprising a diverse array of commercially important marine species. The catch composition was significantly influenced by habitat type, behavior, trophic level, year, site, water transparency, month, and sea surface temperature; bioecological variables provided the greatest contribution to explain the variability in catch composition. The dominant species in the catch was *Katsuwonus pelamis* (Skipjack Tuna), which accounted for 4578.30 kg, representing 64.03% of the total catch. The smallest unit of data for recorded for longline fisheries is the catch on an individual set (This was followed by *Scomberomorus commerson* (King Mackerel) with 1290.60 kg, contributing 18.05%, and *Sphyraena barracuda* (Barracuda) with 759.00 kg, making up 10.61%. Other notable species included *Coryphaena hippurus* (Mahi-mahi) at 216.28 kg (3.02%) and *Epinephelus* spp. (Groupers) at 205.52 kg (2.87%). Additionally, a miscellaneous group comprising squid, small sharks, flying fish, and other species contributed 100.30 kg, accounting for 1.40% of the total catch (Table 1) Catch rates of species that survive being hooked (e.g. blue shark) increase with soak time. In contrast, skipjack tuna and seabirds are usually dead at the time of retrieval. Their catch rates decline with time, perhaps because scavengers can easily remove hooked animals that are dead (ward et al., 2004). These results highlighted the ecological richness and economic significance of the region's fishery resources, with Skipjack Tuna emerging as the most targeted and abundant species during the study period.

3.4. Catch composition

The catch composition recorded using barbed hooks

Table 1: Catch and percentage composition of various species caught using barbed hooks in longline fishing operations

Sl. No.	Species	Total catch (kg)	Percentage composition (%)
1.	*Katsuwonus pelamis*	4578.30	64.03
2.	*Scomberomorus commerson*	1290.60	18.05
3.	*Sphyraena barracuda*	759.00	10.61
4.	*Coryphaena hippurus*	216.28	3.02
5.	*Epinephelus* spp	205.52	2.87
6.	Miscellaneous	100.30	1.40
	Total	7150	100

during the study period exhibited notable fluctuations across fishing trips, reflecting the dynamic nature of pelagic fish availability and environmental conditions along the Panambur coast. Midwater longlining systems (MLS) have become a preferred fishing method for targeting large pelagic sharks while reducing bycatch compared to gillnets and bottom trawling (Raut et al., 2023). Catches ranged from a minimum of 310 kg on the 105th day to a peak of 540 kg on the 90th day, with an overall mean of 397.22±59.70 kg. Initial trips yielded 410 kg, followed by a decline to approximately 345–350 kg. A sharp increase was observed on the 45th day (530 kg), and the highest catch was recorded on the 90th day. Catch rates with circle hooks were greater for 11 species, including four tuna species, six shark species and one Istiophorid billfish (Reinhardt et al., 2018). Subsequent trips showed variable yields between 310 kg and 435 kg, with relatively low catches on the 105th (310 kg) and 165th (325 kg) days. In the latter phase, catched stabilized between 340 and 420 kg before slightly declining to 390 kg on the final trip (255th day) (Figure 3). These fluctuations suggested that while barbed hooks maintained moderate consistency in catch rates, temporal factors such as seasonal fish movement, water temperature, and bait interaction likely influenced catch variability. Baiting pattern has also been reported to affect the catch rates significantly (Kumar et al., 2016). By suspending baited hooks at specific depths, MLS enhances selectivity and minimizes the unintended capture of non-target species, making it a more sustainable alternative to other fishing methods (Sasipriyan et al., 2024). Similar observations were reported by Hazin et al. (2005) and Campbell et al. (2012), who emphasized the role of environmental and gear deployment factors in shaping catch outcomes in pelagic longline fisheries. The present findings reinforced the operational reliability of barbed hooks in maintaining catch stability across variable fishing conditions.

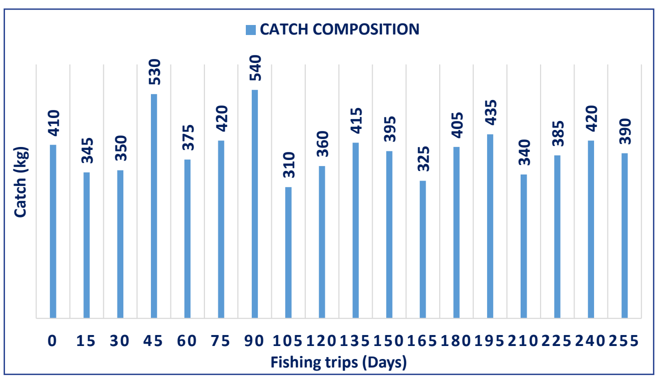

Figure 3: Catch composition obtained using barbed hooks along the Panambur coast of Mangaluru

3.5. Fuel consumption and operational efficiency

Fuel consumption during longline fishing operations was a critical parameter in evaluating the economic viability of the vessel and gear configuration. A global challenge for capture fisheries is to promote fishing practices that minimize their environmental impacts while maximizing the societal value generated (Bastardie et al., 2022). The study recorded an average fuel usage of 70 l trip^{-1}, comprising 35 l of petrol and 35 l of kerosene for the FRP vessel equipped with a 9.9 hp Yamaha Outboard Motor (OBM) (Table 2). This translated to an average consumption rate of 15 l h^{-1}, aligning with the operational demands of twelve-hour fishing voyages along the Panambur coast. longline fishing is characterised by low energy consumption, low bycatch of non-target species and high catch quality, bycatch of undersized fish has been found to be a problem in some fisheries (These findings were consistent with earlier observations by Benjamin et al. (2003), who reported similar fuel usage patterns for OBM-powered vessels, though the present study demonstrated improved cost-efficiency. Energy use has been of great concern within fisheries,because this economic activity sector is highly dependent on fossil fuels for energy needs, especially in fish catching activities (Bastos et al., 2021). The vessel's cruising speed of 8–12 knots facilitated timely access to fishing grounds and efficient gear deployment at depths of approximately 30 m. As highlighted by Valdemarsen (2001), high-speed OBMs enhance operational performance and catch freshness, while fuel remained a significant cost factor in small-scale fisheries. A significant advantage that longliners have over trawlers is the relatively low fuel consumption per unit of catch (Ingólfsson et al., 2017). The integration of passive gear like longlines, which required lower fuel kg^{-1} of catch compared to active gears, further supported sustainable fishing practices. Fishing practices and gears vary widely in their environmental impacts and fuel efficiency but, in general, the impacts of passive fishing gears such as pots, traps, and hooks are considered to be less severe, and the amounts of fuel required per kg of catch smaller, than for towed gears such as beam trawls, dredges and the many types of bottom trawls (Suuronen et al., 2012). Moreover, optimizing hook design-particularly the use of barbed hooks with higher catch efficiency contributed to reduced fuel consumption unit^{-1} catch, reinforcing the link between gear selectivity and economic sustainability (Arunkumar et al., 2025). Income distribution among the

Table 2: Average fuel consumption of 9.9 HP outboard motor engine used for Barbed and Barbless hooks used during fishing operations along the Panambur coast off Mangaluru

Fuel	Fuel consumption l h^{-1}	Fuel consumption l trip^{-1}
Petrol	03.00	35.00
Kerosene	15.00	35.00

crew followed a share system, implemented after deducting operational costs such as fuel. Additional expenses included vehicle hire for transporting crew between their village and the harbour. According to Sathianandan (2009), such share systems ensured equitable income distribution in small-scale fisheries. Post-auction, approximately 7% of the proceeds were allocated to various fees, including the auctioneer's commission, cooperative society contributions, and apex cooperative organization shares. A portion was also deducted as a beneficiary share, which was distributed annually to members through the cooperative society.

4. CONCLUSION

Barbed hooks used in longline fishing along the Panambur coast demonstrated superior hooking efficiency, consistent catch composition, and economic viability. With an average hooking rate of 0.52 and dominant catches of *Katsuwonus pelamis*, the gear proved effective under varied conditions. Fuel consumption remained cost efficient, supporting sustainable operations. These findings affirmed the suitability of barbed hooks for enhancing catch rates and profitability in small scale fisheries, while promoting responsible resource utilization and operational efficiency.

5. FURTHER RESEARCH

Further research may carry out to Investigate the performance of alternative hook under similar operational conditions to assess differences in catch efficiency, species selectivity, and bycatch reduction.

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7. REFERENCES

Arunkumar, K., Muthupandi, G., 2025. Technology and community interventions for food security and waste reduction. In: 2025 International Conference on Data Science, Agents & Artificial Intelligence (ICDSAAI). IEEE, 1–6. DOI: 10.1109/ICDSAAI65575.2025.11011650.

Bastardie, F., Hornborg, S., Ziegler, F., Gislason, H., Eigaard, O.R., 2022. Reducing the fuel use intensity of fisheries through efficient fishing techniques and recovered fish stocks. Frontiers in Marine Science 9, 817335. DOI: 10.3389/fmars.2022.817335.

Bastos, R.F., Branco, D.A.C., Arouca, M.C., 2021. Potential of diesel electric system for fuel saving in fishing vessels: a case study on a bottom longline fleet of Brazil. Journal of Marine Engineering & Technology 20(1), 1–16. DOI: 10.1080/20464177.2018.1507445.

Benjamin, D., Kurup, B.M., 2012. Stock assessment of dolphinfish, *Coryphaena hippurus* (Linnaeus, 1758) off southwest coast of India. Journal of the Marine Biological Association of India 54(1), 1–96. DOI:10.6024/jmbai.2012.54.1.01675-12.

Brown, C.J., Desbiens, A., Campbell, M.D., Game, E.T., Gilman, E., Hamilton, R.J., Heberer, C., Itano, D., Pollock, K., 2021. Electronic monitoring for improved accountability in western Pacific tuna longline fisheries. Marine Policy 132, 104664. DOI:10.1016/j.marpol.2021.104664.

Campbell, R.A., Young, J.W., 2012. Monitoring the behaviour of longline gears and the depth and time of fish capture in the Australian Eastern Tuna and Billfish Fishery. Fisheries Research 119, 48–65. DOI:10.1016/j.fishres.2011.12.006.

Coelho, R., Fernandez-Carvalho, J., Santos, M.N., 2012. Effects of hook and bait on target and bycatch species in the pelagic longline fishery of the Atlantic Ocean. Bulletin of Marine Science 88(3), 449–467. DOI:10.5343/bms.2011.1064.

Crespo, O.G., Dunn, D.C., 2017. A review of the impacts of fisheries on open-ocean ecosystems. ICES Journal of Marine Science 74(9), 2283–2297. DOI:10.1093/icesjms/fsx084.

Deshpande, S.D., Rama Rao, S.V.S., Sivan, T.M., 1970. On the results of preliminary fishing trials with shark long lines in Veraval waters. Fishery Technology 7(2), 150–157. DOI:10.56093/ft.v7i2.60916.

Gilman, E., Huang, H.W., 2017. Review of effects of pelagic longline hook and bait type on sea turtle catch rate, anatomical hooking position and at-vessel mortality rate. Reviews in Fish Biology and Fisheries 27(1), 43–52. DOI:10.1007/s11160-016-9447-9.

Goodyear, C.P., Schirripa, M., Forrestal, F., 2017. Longline data simulation: a paradigm for improving CPUE standardization. Collective Volume of Scientific Papers ICCAT 74(2), 379–390. https://iccat.int/Documents/CVSP/CV074_2017/n_2/CV074020379.pdf.

Hazin, F., Travassos, P.E.P.F., Carvalho, F.C., Erzini, K., 2007. Fishing strategy and target species of the Brazilian tuna longline fishery from 1978 to 2005 inferred from cluster analysis. Collective Volume of Scientific Papers ICCAT 60(6), 2029–2038. https://

www.researchgate.net/profile/Humberto-Hazin/publication/268252432_Fishing_strategy_and_target_species_of_the_Brazilian_tuna_longline_fishery_from_1978_to_2005_inferred_from_cluster_analysis/links/563ca42408ae405111aa3572/Fishing-strategy-and-target-species-of-the-Brazilian-tuna-longline-fishery-from-1978-to-2005-inferred-from-cluster-analysis.pdf.

Henriques, M.B., de Araujo Nunes, F.A., de Souza, M.R., Castilho-Barros, L., Barbieri, E., 2022. Live bait or artificial bait? Efficiency in recreational fishing for sea bass (*Centropomus parallelus*). Ocean & Coastal Management 216, 105976. DOI: 10.1016/j.ocecoaman.2021.105976.

Herrmann, B., Sistiaga, M., Rindahl, L., Tatone, I., 2017. Estimation of the effect of gear design changes on catch efficiency: methodology and a case study for a Spanish longline fishery targeting hake (*Merluccius merluccius*). Fisheries Research 185, 153–160. DOI: 10.1016/j.fishres.2016.09.013.

Hintz, K.J., Qualich, J.M., Brunais, B.E., Louison, M.J., 2024. Impact of hook choice, fish size, and water temperature on hooking depth, injury and postcapture physiology in channel catfish. Transactions of the American Fisheries Society 153(4), 463–473. DOI:10.1002/tafs.10473.

Holden, H.E., Whalen, B.K., Gude, A.G., Allen, M.S., 2021. Testing a bite-shortened hook to minimize fish handling in a recreational fishery. Fisheries 46(7), 321–328. DOI: 10.1002/fsh.10608.

Ingolfsson, O.A., Einarsson, H.A., Lokkeborg, S., 2017. The effects of hook and bait sizes on size selectivity and capture efficiency in Icelandic longline fisheries. Fisheries Research 191, 10–16. DOI:10.1016/j.fishres.2017.02.017.

Kennelly, S.J., Broadhurst, M.K., 2021. A review of bycatch reduction in demersal fish trawls. Reviews in Fish Biology and Fisheries 31(2), 289–318. DOI: 10.1007/s11160-021-09644-0.

Kumar, K.A., Pravin, P., Meenakumari, B., 2016. Bait, bait loss, and depredation in pelagic longline fisheries-a review. Reviews in Fisheries Science & Aquaculture 24(4), 295–304. DOI: 10.1080/23308249.2016.1162134.

Lennox, R., Whoriskey, K., Crossin, G.T., Cooke, S.J., 2015. Influence of angler hook-set behaviour relative to hook type on capture success and incidences of deep hooking and injury in a teleost fish. Fisheries Research 164, 201–205. DOI: 10.1016/j.fishres.2014.11.015.

Lima, F.D., Parra, H., Alves, R.B., Santos, MAR, Bjorndal, K.A., 2024. Correction: Effects of gear modifications in a North Atlantic pelagic longline fishery: A multiyear study. PLOS ONE 19(12), e0315684. https://doi.org/10.1371/journal.pone.0315684.

McLellan, W.A., Arthur, L.H., Mallette, S.D., Thornton, S.W., McAlarney, R.J., Read, A.J., Pabst, D.A., 2015. Longline hook testing in the mouths of pelagic odontocetes. ICES Journal of Marine Science 72(5), 1706–1713. DOI: 10.1093/icesjms/fsu181.

Monnahan, C.C., Stewart, I.J., 2018. The effect of hook spacing on longline catch rates: implications for catch rate standardization. Fisheries Research 198, 150–158. DOI: 10.1016/j.fishres.2017.10.004.

Musyl, M.K., Gilman, E.L., 2019. Meta-analysis of post-release fishing mortality in apex predatory pelagic sharks and white marlin. Fish and Fisheries 20(3), 466–500. DOI: 10.1111/faf.12358.

Niella, Y.V., Hazin, F.H., Afonso, A.S., 2017. Detecting multispecific patterns in the catch composition of a fisheries-independent longline survey. Marine and Coastal Fisheries 9(1), 388–395. DOI: 10.1080/19425120.2017.1347115.

Raut, S., Prakash, S., Kumar, A., 2023. Assessing artisanal fishers attitude and perception towards electric rays conservation along the Indian coast. Mar. Policy Elsevier, 149, 105777. https://doi.org/10.1016/j.marpol.2023.105826.

Reinhardt, J.F., Weaver, J., Latham, P.J., Dell'Apa, A., Serafy, J.E., Browder, J.A., Christman, M., Foster, D.G., Blankinship, D.R., 2018. Catch rate and at-vessel mortality of circle hooks versus J-hooks in pelagic longline fisheries: A global meta-analysis. Fish and Fisheries 19(3), 413–430. DOI: 10.1111/faf.12260.

Santos, C.C., Rosa, D., Gonçalves, J.M., Coelho, R., 2024. A review of reported effects of pelagic longline fishing gear configurations on target, bycatch and vulnerable species. Aquatic Conservation: Marine and Freshwater Ecosystems 34(1), 4027. DOI: 10.1002/aqc.4027.

Santos, M., Lino, P., Coelho, R., 2017. Effects of leader material on catches of shallow pelagic longline fisheries in the southwest Indian Ocean. Fishery Bulletin 115(2), 219-232. Avialable at: https://spo.nmfs.noaa.gov/content/fishery-bulletin/effects-leader-material-catches-shallow-pelagic-longline-fisheries.

Sasipriyan, P., Shameer, T.T., Manimozhi, A., 2024. Species recovery plan with a focus on marine species: Project completion report. Tamil Nadu Biodiversity Conservation and Research Institute, 1–50. Available at: https://www.aiwc.res.in/admin-assets/uploads/handbook/69554.pdf.

Sathianandan, T.V., Jayasankar, J., 2009. Simulation model for evaluating the response of management options on the demersal resources of Tamil Nadu coast. Asian Fisheries Science 22(2), 681–690. Available at: http://eprints.cmfri.org.in/id/eprint/5722.

Schaeffer, J.S., Hoffman, E.M., 2002. Performance of barbed and barbless hooks in a marine recreational fishery. North American Journal of Fisheries Management 22(1), 229–235. DOI: 10.1577/1548-8675(2002)022<0229:POBABH>2.0.CO;2.

Scott, M., Cardona, E., Scidmore-Rossing, K., Royer, M., Stahl, J., Hutchinson, M., 2022. What's the catch? Examining optimal longline fishing gear configurations to minimize negative impacts on non-target species. Marine Policy 143, 105186. DOI: 10.1016/j.marpol.2022.105186.

Shea, B.D., Gallagher, A.J., Bomgardner, L.K., Ferretti, F., 2023. Quantifying longline bycatch mortality for pelagic sharks in western Pacific shark sanctuaries. Science Advances 9(33), 3527. DOI: 10.1126/sciadv.adg3527.

Song, L., Li, J., Xu, W., Zhang, X., 2015. The dynamic simulation of the pelagic longline deployment. Fisheries Research 167, 280–292. DOI: 10.1016/j.fishres.2015.03.005.

Sreedhar, U., 2019. Design, operation of long lines for resource and energy conservation. ICAR Winter School: Responsible Fishing: Recent Advances in Resource and Energy Conservation 21, 261–286. Available at: https://courseware.cutm.ac.in/wp-content/uploads/2020/06/Design-Operation-of-Long-lines.pdf.

Sulikowski, J.A., Golet, W., Hoffmayer, E.R., Driggers III, W.B., Natanson, L.J., Carlson, A., Sweezey, B.B., 2020. Observing post-release mortality for dusky sharks, Carcharhinus obscurus, captured in the US pelagic longline fishery. Fisheries Research 221, 105341. DOI: 10.1016/j.fishres.2019.105341.

Suuronen, P., Chopin, F., Glass, C., Løkkeborg, S., Matsushita, Y., Queirolo, D., Rihan, D., 2012. Low impact and fuel efficient fishing-Looking beyond the horizon. Fisheries Research 119, 135–146. DOI: 10.1016/j.fishres.2011.12.009.

Swimmer, Y., Zollett, E.A., Gutierrez, A., 2020. Bycatch mitigation of protected and threatened species in tuna purse seine and longline fisheries. Endangered Species Research 43, 517–542. DOI: 10.3354/esr01069.

Valdemarsen, J.W., 2001. Technological trends in capture fisheries. Ocean & Coastal Management 44(9–10), 635–651. DOI: 10.1016/S0964-5691(01)00073-4.

Varghese, M.D., George, V.C., Gopalakrishna Pillai, A.G., Radhalakshmi, K., 2025. Properties and performance of fishing hooks. Fishery Technology 34(1). Available at: https://epubs.icar.org.in/index.php/FT/article/view/23510.

Ward, P., Myers, R.A., Blanchard, W., 2004. Fish lost at sea: the effect of soak time on pelagic longline catches. Fishery Bulletin 102(1), 179–195. Available at: https://www.researchgate.net/profile/Peter-Ward-11/publication/228782966_Fish_lost_at_sea_The_effect_of_soak_time_on_pelagic_longline_catches/links/5c81eb4c458515831f8f3db3/Fish-lost-at-sea-The-effect-of-soak-time-on-pelagic-longline-catches.pdf.

Zacharia, P.U., Ninan, R.G., Wilson, L., 2025. Indian marine fisheries: present status and future challenges. In: Marine and Coastal Resources of India: Selected Case Studies, 347–371. DOI: 10.1007/978-3-031-81276-7_20.