



Sustaining Purse Seine Fisheries along the Karnataka Coast: The Nets, the Fish, and the Future

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Along Karnataka's coast, purse seine fishing is more than a method of catching fish it is part of a coastal economy shaped by generations of fishing knowledge, changing marine conditions and growing technological capability. The fishery is particularly important for schooling pelagic resources such as Indian oil sardine (*Sardinella longiceps*) and Indian mackerel (*Rastrelliger kanagurta*), which support fishers, traders, processors and consumers. Yet the future of purse seine fishing depends on maintaining a balance between fishing efficiency, livelihoods and the productive capacity of marine resources. This article explores the development and operation of purse seine fishing along the Karnataka coast, its contribution to fisheries and livelihoods, changing catch patterns and environmental influences, and the challenges associated with fishing pressure. It also examines how echosounders can complement fisher knowledge by improving fish-school detection and supporting more informed fishing decisions.

Keywords: Purse seine fisheries; Karnataka coast; Indian oil sardine; Indian mackerel; fishing livelihoods; sustainable fisheries; echosounder

Introduction: Where the Nets Meet the Sea

Before sunrise, fishing harbours along the Karnataka coast come alive with activity. Boats prepare to leave, nets are carefully arranged, engines roar into life, and crews head towards the open sea. For thousands of coastal families, this daily journey is more than a livelihood it is a way of life shaped by generations of knowledge, experience and dependence on marine resources. Among the various fishing methods practiced in the region, purse seining has become one of the most important techniques for harvesting schooling pelagic fishes such as Indian oil sardine (*Sardinella longiceps*), Indian mackerel (*Rastrelliger kanagurta*), anchovies and other small pelagic species. These fishes are vital not only for food security but also for supporting the incomes of fishers, traders, processors and numerous stakeholders connected to the fisheries value chain.

Karnataka's coastline stretches for about 300 km from Majali in the north to Talapady in the south and supports an active marine fishing sector across the districts of Uttara Kannada, Udupi and Dakshina Kannada. According to CMFRI, about 1.7 lakh fisherfolk living in 144 marine fishing villages depend on marine fisheries for their livelihoods. Marine fish landings reached approximately 5.29 lakh tonnes in 2016, with Dakshina Kannada and Udupi each contributing around 38% of the catch and Uttara Kannada contributing 24%. Mangaluru and Malpe serve as the state's principal fishery harbours (Kuriakose & Paul, 2017). This local story reflects a broader global challenge. The Food and Agriculture Organization reported that global capture fisheries produced 92.3 million tonnes in 2022, including 81 million tonnes from marine waters. However, only 62.3% of assessed marine fish stocks were being exploited within biologically sustainable limits in 2021, emphasizing the need to improve fishing efficiency while ensuring the long-term sustainability of marine resources (FAO, 2024).

The Net That Changed Fishing

Purse seine fishing became commercially important along the Karnataka coast during the 1970s. Historical records from the Mangaluru region show that purse seiners were introduced around 1975, contributing to a rapid increase in marine fish production during the latter half of the decade (Dhulkhed *et al.*, 1982). A later study reported that purse seines were introduced commercially in Dakshina Kannada primarily to harvest pelagic fish resources beyond the reach of many traditional fishing gears. The impact was immediate: oil sardine landings increased from 6,129 tonnes in 1976–77 to 32,629 tonnes in 1979–80 (Dhulkhed & Bhat, 1985). The arrival of purse seines marked a major shift in fishing operations along the Karnataka coast. For generations, fishers had depended on gears such as shore seines, gillnets and cast nets, often operating close to shore. Purse seining, combined with mechanisation, enabled vessels to search larger areas and efficiently harvest dense schools of pelagic fish. This increased fishing capacity and helped transform the region into one of India's most productive small-pelagic fishing grounds. A purse seine is a large wall of netting designed to surround an entire school of fish. Floats keep the upper edge at the surface, while the lower edge is fitted with rings through which a purse line passes. Once the school is encircled, the purse line is tightened, closing the bottom of the net like a drawstring purse and preventing the fish from escaping downward (FAO, 2002). However, even the most efficient net is useful only when fish can be found. For purse seine fishers, understanding where and when fish schools occur is often as important as the gear itself.

Following the Fish

The success of a purse seine operation begins long before the net is set. Pelagic fish are constantly on the move, responding to changes in season, food availability, ocean temperature, currents and other environmental conditions. Over time, fishers develop a deep understanding of these patterns through experience and observation. The Karnataka coast is part of the Malabar upwelling system of the southeastern Arabian Sea. During July to September, nutrient-rich waters rise towards the surface, increasing productivity and creating favourable conditions for pelagic fishes. As a result, nearly 70% of the pelagic fish catch along the Mangaluru coast is landed during September–December, during or immediately after the upwelling season (Krishnakumar *et al.*, 2008). This seasonal cycle strongly influences the availability of key resources such as Indian oil sardine and Indian mackerel, two of the most important pelagic fishes along the Karnataka coast. Their abundance can vary considerably from year to year depending on environmental conditions. The importance of these species is reflected in the purse seine fishery. Between 1990 and 2014, purse seines accounted for about 75% of Karnataka's oil sardine catch and 65% of its Indian mackerel catch. The study also showed that catches were influenced by environmental factors such as sea-surface temperature, upwelling, rainfall and chlorophyll-*a* concentrations (Supraba *et al.*, 2016).

A Fishery That Supports More Than Fishers

When a purse seiner returns to harbour, the story does not end with the landing. Fish move from the boat to the landing centre, where they may be sorted, auctioned, iced, transported, processed and sold. Behind every landing are networks of workers and businesses boat owners, crew members, auctioneers, traders, transporters, ice suppliers, processors, vendors and consumers. The fishery therefore supports a much wider coastal economy. In 2016, Karnataka recorded about 5.29 lakh tonnes of marine fish landings, with Indian mackerel contributing 88,219 tonnes and oil sardine 62,609 tonnes among the major resources reported by CMFRI. Dakshina Kannada and Udupi each accounted for approximately 38% of the state's marine landings (Kuriakose & Paul, 2017). But fisheries do not produce the same amount every year. CMFRI estimated Karnataka's marine fish landings at 400,270 tonnes in 2024. In 2025, CMFRI reported that Karnataka experienced a 44% increase in marine fish landings compared with the previous year, following the steep decline in 2024. The institute attributed the recovery partly to favourable environmental conditions and regulated fishing pressure that provided time

and space for small pelagic stocks to recover (ICAR-CMFRI, 2026). Such year-to-year variation is a reminder that a fishery is a dynamic system.

When the Sea Changes, the Catch Changes

For a fisher, environmental variability is not an abstract scientific concept. It can mean the difference between returning with a full hold and returning with a disappointing catch. A familiar fishing ground may produce fewer fish than expected. A species that was abundant in one season may be less available in another. At other times, favourable conditions can result in unusually productive fishing. Scientific observations from the Mangaluru region demonstrate how strongly ocean conditions can influence pelagic fisheries. Krishnakumar *et al.*, (2008) documented seasonal upwelling and its relationship with pelagic fish production. Their study also described major fluctuations in mackerel and oil sardine abundance, including periods when one species became more dominant as the other declined. This variability matters increasingly in a changing climate. Fish respond to their physical and biological environment, and changes in temperature, productivity and ocean circulation can influence their distribution and availability. For purse seine fishers, this creates a practical challenge: the fish may not always be where they were yesterday or even where they were last season. That makes good information increasingly valuable.

The Other Side of a Successful Catch

Purse seine fishing can be highly effective when a large school of fish is located. That efficiency is one of the reasons the gear became important along the Karnataka coast. But efficiency also creates a management challenge. Historical research from South Karnataka provides an early example. Following the introduction of purse seines, oil sardine landings increased dramatically during the late 1970s. However, the subsequent decline in landings and catch rates, alongside increasing fishing effort, led researchers to raise concerns about fishing mortality and the removal of gravid fish (Dhulkhed & Bhat, 1985). This historical experience illustrates a broader fisheries principle: A highly productive fishing method still needs to operate within the productive capacity of the fish population. The challenge is not to portray purse seine fishing simply as a problem. It is an important fishing method that provides food and livelihoods. The challenge is to ensure that fishing effort, gear characteristics, seasonality and resource availability remain compatible with long-term sustainability. The issue is therefore one of balance. Too little fishing can affect food supply and livelihoods. Too much pressure can reduce the capacity of fish populations to replenish themselves. Sustainable fisheries management must consider both.

From Experience to Information

Fishers have always searched for clues before setting a net. Birds feeding at the surface, changes in water colour, fish activity, dolphins and other observations may provide signs of fish schools. These observations are part of the knowledge accumulated through years at sea. Modern fishing adds another source of information: technology. One of the most important tools is the echosounder. An echosounder sends sound pulses into the water and measures the returning echoes. When these sound waves encounter fish or other objects, some of the energy is reflected back towards the instrument. The resulting signal can provide information about the presence, depth and relative strength of fish aggregations. This principle has been used in fisheries science for decades. Acoustic surveys use fish target strength and echo measurements to investigate fish distribution and estimate abundance (Foote, 1987). For purse seine fishing, the attraction is obvious: if fish can be detected beneath the surface, fishers can make more informed decisions about where to set the net. FAO guidance on responsible fisheries describes hydro-acoustic equipment as widely used in modern purse seine fisheries for locating fish schools and monitoring their position relative to the fishing gear (FAO, 2002).

Fishing Smarter, Not Simply Harder

Imagine a vessel searching for a school of fish. Surface signs may suggest fish are nearby, but the school could be deeper or moving in a different direction. Setting a large purse seine without

enough information can waste time, fuel and effort. An echosounder helps by providing a view beneath the surface. It does not replace the fisher's knowledge; instead, it adds useful information for making better fishing decisions. However, echosounders do not identify every species or guarantee a successful catch. Acoustic signals vary with fish species, size, behaviour and depth, so interpreting them requires experience. Studies from tropical tuna purse seine fisheries show both the benefits and limitations of this technology. Wain *et al.* (2021) reported that echosounder-equipped fish-aggregating devices increased catch per set by about 10% in the French Indian Ocean tuna fleet. However, the study also noted that improvements in fishing efficiency must be considered in stock assessments and management decisions. For Karnataka's purse seine fishery, the value of echosounders lies not simply in catching more fish, but in improving catch precision and reducing unnecessary searching time and fuel consumption.

Sustainability Begins Before the Net Is Set

The future of purse seine fisheries will not depend on one technology. Sustainability begins with knowing the resource. Regular monitoring of catch, fishing effort, species composition and fish size helps scientists understand how a fishery is changing. Oceanographic observations help explain environmental influences. Fishers provide local knowledge about fishing grounds, seasons and fish behaviour. Echosounders can provide additional information about what is happening beneath the surface. Together, these sources create a more complete picture. Responsible purse seine fishing also requires compliance with fisheries regulations, appropriate gear and mesh sizes, attention to fish size and reproductive periods, and measures to reduce unnecessary fishing pressure. The need for such measures is recognised in fisheries policy. CMFRI has provided guidance on minimum legal sizes for commercially important marine fishes in Karnataka, with the broader aim of reducing the capture of juvenile fish and improving the long-term productivity of fisheries. At the national level, fisheries researchers have also highlighted the importance of managing purse seine fishing capacity. Sathianandan *et al.*, (2016) assessed India's purse seine fishery and estimated an optimum fleet size substantially below the fleet size then reported, illustrating the broader challenge of matching fishing capacity with available resources. However, sustainability cannot be achieved through regulations alone. Fishers must be part of the process. For people whose income depends directly on fishing, management measures have real economic consequences. Effective fisheries governance therefore requires communication between fishers, scientists, managers and other stakeholders. The goal should not be to prevent people from fishing. The goal should be to keep fishing possible into the future.

The Road Ahead for Karnataka's Purse Seine Fisheries

Karnataka's purse seine fishery is moving towards a future where traditional fisher knowledge and modern technology work hand in hand. Better use of catch records, oceanographic data, satellite information, echosounders and stock assessments can help improve fishing decisions and resource management. At the same time, sustainable fisheries require more than technology alone. Fish stocks must be harvested responsibly to ensure that resources remain available for future generations. The strong recovery in Karnataka's marine fish landings in 2025, following the decline in 2024, shows how fisheries can respond to favourable environmental conditions and appropriate fishing pressure. Balancing fishing efficiency with sustainability will remain key to the future of Karnataka's purse seine fisheries.

The Nets, the Fish, and the Future

A purse seine may appear to be simply a large fishing net. Along Karnataka's coast, however, it represents much more. It represents the skill of a crew working together at sea. It represents the movement of sardines, mackerel and other schooling fishes through changing waters. It represents harbours, auctions, markets and processing centres. And it represents the livelihoods of families whose lives are closely connected with the sea. It also represents a responsibility. The history of purse seine fishing demonstrates how technological development can transform fishing efficiency. The history of catches shows that fish populations can fluctuate

dramatically. The experience of coastal communities reminds us that fisheries management is ultimately about people as well as fish. The next chapter can therefore be about precision rather than simply greater effort. Echosounders can help fishers look beneath the surface. Scientific surveys can help identify changes in fish populations. Oceanographic observations can explain why fish appear where they do. And the knowledge of fishers can connect these measurements with what is actually happening on the water. None of these tools works alone. The sustainable future of purse seine fisheries along the Karnataka coast will depend on bringing them together the experience of fishers, evidence from science, possibilities offered by technology, and responsible fisheries management. The goal is not to keep the nets full at any cost. It is to ensure that there are still fish in the sea, livelihoods on the shore, and a reason for the next generation to look towards the horizon and go fishing. Ultimately, the future of Karnataka's purse seine fisheries will depend on keeping three things in balance: the nets that catch the fish, the fish that sustain the ecosystem, and the people whose lives are tied to both.

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