



Activities of fisheries co-operative societies in India to boost up and optimise the resources and economy of farmers: a review

Tanmay Sanyal¹ • Alope Saha² • Pronoy Mukherjee³

¹ Department of Zoology, Krishnagar Government College, Krishnagar, West Bengal, India

² Department of Zoology, University of Kalyani, Kalyani, Nadia, West Bengal, India

³ Department of Zoology, Rishi Bankim Chandra College, Naihati, West Bengal, India

Correspondence

Tanmay Sanyal; Department of Zoology, Krishnagar Government College, Krishnagar, West Bengal, India

✉ tanmaysanyal@gmail.com

Manuscript history

Received 3 September 2022 | Accepted 8 June 2023 | Published online 27 August 2023

Citation

Sanyal T, Saha A, Mukherjee P (2023) Activities of fisheries co-operative societies in India to boost up and optimise the resources and economy of farmers: a review. *Journal of Fisheries* 11(2): 112301. DOI: 10.17017/j.fish.487

Abstract

Fisheries within India have significant financial, nutritional and socio-economic development prospects. The country has a diversified natural fishery resource. Fishermen have continuously undertaken fisheries activity throughout the country over decades and fisheries co-operatives have now been developed for cumulative production and effective regulation of fishery activities. It was observed that there have been many inconsistencies, mostly in the management of fisheries co-operatives; a few were effectively handled under active supervision and government backing, whereas many co-operatives are facing various problems for their existence. Effective administration of fisherman's co-operatives is critical for increasing fishing productivity and the socio-economic growth of fishermen. Co-operatives can help fishermen develop their skills and gather information about technology, marketing, and management. Co-operatives can improve productivity, processing, storing and transportation capabilities while also meeting financial demands. As a result, co-operative organisations may contend with multinational corporations by integrating competent management abilities with co-operative power. To do this, a nationwide research project focusing on different elements of fisheries co-operatives is recommended. The need for appropriate policy implications for such sustainable management of fisheries co-operatives in accordance with current technical advancements in the sector of aquaculture, environmental degradation and global warming has been highlighted.

Keywords: fishermen; fishery co-operatives; Indian fishery; socio-economic development; sustainable development

1 | INTRODUCTION

Ecosystems play a great role in the economy and different biotic agents in an ecosystem act as different factors of the economy. Fish production is one of the most important economic factors. If economic growth is the destination, then the fish production industry is a vehicle to reach the destiny and fisherman's communities act as drivers to steer the vehicle on the right path (Curtis *et al.* 2017; Watson *et al.* 2021). In 2018, approximately 179 million tonnes of fish can be produced globally, with aquaculture accounting for 46% of total production and

catchment fishery accounting for 54% (Maulu *et al.* 2021). Nearly 50% of the total fish production is achieved by small-scale fisheries (SSF) and in the case of catchment fisheries in developing countries, most of the people depend on SSF (Franz *et al.* 2017). In sustainable development, SSF play a significant role in different aspects such as hunger, economic growth, poverty, women's empowerment and livelihood (Harper *et al.* 2013; Mukherjee *et al.* 2022). In India, the majority of fishermen (those who

make their living from fishing) come from low-income families (Karuppusamy and Karthikeyan 2017). Co-operatives protect the vulnerable, and in India, fishermen are one of the most vulnerable members of society. Significant problems include illiteracy and unemployment, as well as inadequate knowledge about current fishing technologies (Anwar *et al.* 2020). This deadly loop is complicated by the absence of adequate infrastructure, both in terms of logistics and funds. As a result, fishermen are being exploited by intermediaries who function as money lenders, dealers and subcontractors (Ahsan *et al.* 2016). India has extensive fishing reserves with promising prospects for developing the fishing industry and boosting fishermen's socioeconomic conditions (Ekka *et al.* 2012; Bhendarkar *et al.* 2017). Despite possessing great potentiality in aquaculture, the fisherman could not really exploit it to significantly improve their socio-economic condition owing to the absence of organisational assistance such as infrastructure and funding (Ghosh *et al.* 2015). As a result, fishery co-operatives appear to be a more suitable institution to enhance the socio-economic position of fishermen throughout India (Jaini 2021; Ranicki 2012). According to FAO (2002), about 5.8 million fishermen belong below the poverty line. So-called fish co-operatives and SSF guidelines should focus on achieving zero hunger and poverty (Wilson *et al.* 2015). According to SSF guidelines, local fishermen can form organisations (known as co-operatives) to eliminate poverty (Kurien 2014). Some people believe that the fishery industry is facing critical threats and risks as a result of anthropological activities such as overfishing, which destroys aquatic ecosystems (Zeng *et al.* 2022). Another group believes that underdevelopment management is a major threat to the fishery industry (Karim *et al.* 2020). A top-down strategy can help maintain the resources of the fishery industry in most developing countries (Samian *et al.* 2017). This strategy mainly focuses on imposing different rules by the government on the fishery industry, but it is unable to prevent the overexploitation of fish resources (Hollup 2020). The World Bank (2006) introduced a new concept known as co-management, in which responsibilities are shared between government and fish resource users for managing the fishery industry (Samian *et al.* 2017).

The Indian fishing industry is presently recognised as a rising star in terms of the nation's economic growth. With the participation of advanced technologies as well as the usage of massive fishery ecosystems, Indian fishery has recently been turned into a big commercial industry. This industry has already played a significant role in the socio-economic development of the weaker communities (Ayyappan and Diwan 2006). Fisheries have the capacity to contribute to gross domestic product, food production, job prospects, progressive goals and exporting profits. The Indian fisheries industry is crucial since it employs and sustains approximately 16 million of individuals di-

rectly and plenty more informally (Agrawal *et al.* 2016). Throughout India, this industry has transformed from a subsistence farming sector to a fully grown, multifaceted, huge corporation with enormous development opportunities (Vasisht 2009; Suresh and Parappurathu 2018; Bureau 2019).

Indian fishery has evolved from a solely traditional activity to a significant commercial sector with huge opportunities. The fishery industry is currently one of our country's biggest providers of export revenues (Ahmed and Ahmed 2022). India is presently one of the world's biggest fishery exporters. India possesses rich and diversified fishery resources spanning from ocean waters to wetlands, marshes, and streams, accounting for even more than 10% of the overall world biodiversity in regards to freshwater and marine fish varieties (Rajeev and Bhandarkar 2022). India has a wide coastline (8118 km), 2.2 million square kilometres of exclusive economic zone (EEZ) and 0.53 million square kilometres of continental shelf region, which are home to abundant marine fishing sources (Desai *et al.* 1990; Ngasotter *et al.* 2020). Streams and channels, riverbank ponds, pools and tanks, basins, salt water, highly salinity-impacted regions and so on are examples of freshwater resources. Underused and neglected, this huge and diverse freshwater resource provides excellent prospects for socioeconomic improvement and productivity expansion (Ayyappan and Krishnan 2004).

Fishermen recognised that co-operatives may protect members from extortion while also improving their socioeconomic situation (Harper *et al.* 2013). Initiatives in this manner have generated positive outcomes in certain places, but the general image of fisheries co-operatives remains unfavourable. The fishing industry has experienced considerable growth in recent years (Lynch *et al.* 2016). Fishing farm development agencies have now been established in the inland fisheries industry and the inland fishing industry has expanded (Elliott *et al.* 2022). Landing and anchorage services have been expanded and ongoing attempts to enhance infrastructure and encourage exporting are now being made (Ranicki 2012). In this review, we investigate the development of Indian fisheries co-operatives and the issues that are affecting India's co-operative fishery industry.

2 | THE DEFINITION AND CONCEPT OF FISHERY CO-OPERATIVE

Co-operatives help to achieve social, cultural and economic needs through their democratic and self-governing associations (Anbumani 2007). The significance of co-operatives, mostly in the goal of economic improvement for one of India's oldest oppressed communities, especially fishermen, is widely recognised. Because most fishermen are from lower-income families, they need the essential financial means, technical capabilities and organi-

sational ability for improved capture fisheries, stockpiling, handling and commercialisation (Lynch *et al.* 2016). Because of their poor income, they generally take out loans at exorbitant interest rates from fish traders. As a result, there is indeed a continuous cycle of debt that promotes victimisation. Fisheries co-operative societies may resolve most of these challenges and fishermen in various states have chosen the collaborative method of working to enhance their fisheries in general and also their socio-economic situations (Mahanayak and Panigrahi 2021). The Indian Fisheries Cooperative Programme was established to provide economic support to fishermen. Fishery co-operative organisations are governed by a different set of laws designed to channel support from the government associated with self-help and management and control. In India, the fishery co-operatives system is roughly three layered, with a basic co-operative for a regional or local level and another two that are basically district and state level federations (Chandrashekar 2014; Wasave *et al.* 2020).

Research undertaken by India's Council for Social Development proved the usefulness of fisheries co-operatives as more than just a strategy for improving fishermen's welfare (Mishra 1997). The research also emphasised the importance of integrating proactive fishermen into the co-operative as well as developing and motivating fisherman co-operative societies to fulfil multi-functional roles and encourage social rights for all individuals. The report proposed that "multi-functional primary fishermen co-operatives can be retained" to enable the establishment of a very well-developed and strong architecture of fisheries co-operatives in India (Mishra 1997).

3 | INDIA'S FISHERY SCENARIO

India is the world's second largest fishing country, with significant potential in the fisheries and aquaculture sectors, producing about 14.16 million metric tonnes of fish in the year 2019–20 (Meena 2022). Nevertheless, considering its incredible natural wealth, India possesses unrealized potential as well as the ability to become a leading nation. Recognising the industry's possibilities, the government remains committed to a nationwide goal of increasing fish output to 22 million metric tonnes by 2024–2025, which would benefit 28 million fishermen and producers and nearly twice that amount across fish-related economic activities (Meena 2022).

The EEZ's marine resources in India include prawns, lobster, crustaceans, mackerel, jellyfish, pomfret and many other fish species. Inside the inland region, India possesses almost 27000 km of rivers, a 145000-km long network of waterways, reservoirs and lakes comprising 29 lakh hectares and freshwater reservoirs spanning approximately 1.5 million ha (Roonwal 1997). Recently, India has initiated a massive effort to enhance brackish water fish-

eries (Vohra 2020). Once fully completed, this might span a range of around 1 million ha. During the previous decade, this field has seen a tremendous increase in fisheries output. Apart from the local marketplace, the fisheries sector has made a significant contribution to India's export revenues (Mahanayak and Panigrahi 2021).

According to Livemint [www.livemint.com], the government has offered economic assistance via many programmes in order to fulfil the goals such as the blue revolution with sustainable development, huge fishery exports, branding of the fishery industry and disease monitoring (Bhaskar *et al.* 2020). The Fisheries and Aquaculture Infrastructure Development Fund (FIDF) was established with a total asset value of 911.28 million USD to encourage the implementation of fishery infrastructure development in both the inland and marine sectors as well as to increase fishing output. In addition, the Pradhan Mantri Matsya Sampada Yojana (PMMSY) was inaugurated with a budget of 2429 million USD, the largest major expenditure there in the fishery sector. The PMMSY will be introduced throughout all states and union territories during a five-year period, between the financial years 2020–21 and 2024–25. Since around January 2022, projects amounting to 634 million USD have been approved, benefiting approximately 11.6 million people (Bhaskar *et al.* 2020).

4 | HISTORY OF FISHERY CO-OPERATIVE SOCIETIES IN INDIA

The concept of a fishery co-operative was mainly that fishermen would be organised at the community level for resolving their common problems and uplifting of socio-economic status by incorporating easy and steady finance, marketing, communication with government and private partners, modern technology incorporation and storage and transport development. This thought process led to the formation of fisheries co-operative societies. The traditional co-operative organisation seems to have had its beginning in 1844 in England (Birchall 2004). In India, in the year 1913, the first fish farmers' society named 'Karla Machhimar Co-operative Society' in Maharashtra started running (Tyagi *et al.* 2013). West Bengal was indeed the second state to establish co-operative societies in the fisheries sector in 1918 (Mahanayak *et al.* 2017). Tamil Nadu established one fishery co-operative association that year (Mahanayak *et al.* 2017). Though the fisheries co-operative movement in India began in 1913, development of co-operatives remained moderate there in the pre-independence period. Later in 1946, the Co-operative Planning Committee recommended state aid for the development of the fishery sector through co-operative societies (Mahanayak *et al.* 2017). Then later, the 'Five-Year Plan' made in 1950–51 by the erstwhile Planning Commission of India gave focus to the co-operative system's finances and other issues. In India,

there has been a phenomenal improvement in the performance of all tiers of co-operative groups (Rao 1973).

According to the data retrieved from the National Federation of Fishermen Cooperatives (FISHCOOPFED), there are a total of 21 state-level co-operative societies and seven regional-level co-operative societies (Mahanayak and Panigrahi 2021). The number of fishery co-operatives at the district level is around 132, and at the primary level, it is around 21741 in number (Mahanayak and Panigrahi 2021). Currently, around 3353115 members are directly associated with the fishery co-operatives in India, and there are almost 3.3 million fishermen in India (Ranicki 2012). Fisheries co-operative organisations in West Bengal are organised into three strata. Benfish is a state-level apex organisation. At the district level, there are Central Fishermen Co-operative Societies (CFCS), while at the local level, there are Primary Fishermen Co-operative Societies (PFCS). At present, West Bengal has 19 CFCS, 1162 PFCS, and 16 apex institutions (Mahanayak and Panigrahi 2021). According to the Department of Fisheries of West Bengal, the population of fishermen in West Bengal is almost 32362 (Mahanayak and Panigrahi 2021).

Efforts to establish a substantial proportion of co-operatives in the fisheries and aquaculture sectors have achieved positive outcomes in certain places, but the actual quality of fisheries co-operatives remains unimpressive. Only a few co-operative organisations are effective and capable of meeting their shareholders' requirements. Most of the fishing co-operatives are still ineffective or dormant due to organisational, administrative and functional shortcomings (Kumar *et al.* 2008). In a broad sense, fishery management co-operatives have not yet achieved the desired threshold due to poor planning, a dearth of specialised training mechanisms, depressing productivity and performance patterns, a dearth of infrastructural development, troublesome funding and financial management and poor interconnections with relevant organisations (Prakash 2000; Kumar *et al.* 2008; Upadhyay *et al.* 2013).

5 | NATIONAL ORGANIZATIONS AND THEIR EFFORTS IN STRENGTHENING OF FISHERY CO-OPERATIVES IN INDIA

5.1 National Co-operative Development Corporation (NCDC)

The NCDC was established in 1968 and its headquarters are situated in New Delhi, India. NCDC played an important role in developing fishery co-operatives by assisting members in increasing their shareholding, establishing maintenance and repair centres for sailboats, establishing packing plants, fish oils and meals factories, net manufacturing plants, constructing warehouses and drying grounds and so on (Sundararajan 1991).

To aid in the growth of fisheries co-operatives, the NCDC has developed an integrated strategy for giving support to fisheries co-operatives for a number of reasons, including helping in the purchase of fishing equipment (boats, nets, etc.), creation of infrastructure for marketing, establishment of processing facilities, such as ice factories and cold storage facilities, improvement of freshwater fisheries, seed farms, as well as hatcheries, preparation of feasibility studies, appointment of experts under technical and promotional cell schemes and integrated fisheries project development (marine, inland, and brackish water) (Sapovadia 2007).

5.2 National Fisheries Development Board (NFDB)

The NFDB was established in 2006 whose headquarter is situated in Hyderabad, India (Ayyappan and Diwan 2007). Its main functions are to promote the underdeveloped fisheries sector, develop the processing and marketing infrastructure, conduct research and development on fish production and give special care to women and the weaker section (also less developed) of fish farmers.

5.3 National Federation of Fishers Co-operatives Limited (FISHCOFED)

It was established in the year 1980 as the All India Federation of Fishermen Cooperatives, and later in 1982 it was renamed the National Federation of Fishery Co-operatives Limited. Its headquarters are situated in Haryana, India (Sapovadia 2007). Its main functions are: bringing the fishermen under insurance; helping with training and education for fish farmers; surveying and creating a database of nationwide primary fishery co-operatives; and promoting publications, workshops, seminars, etc. (Nair *et al.* 2010).

5.4 National Bank for Agricultural & Rural Development (NABARD)

The NFDB was established in 1982 and its headquarters are situated in Mumbai, India (Shah and Soni 2022). Its primary functions are to provide an easy loan facility for co-operatives, to boost rural areas and to help meet long-term development goals.

6 | STRUCTURE OF FISHERY CO-OPERATIVES IN INDIA AND THEIR FUNCTIONS

Co-operatives are bound by the seventh schedule under Indian constitutional law. The organisational structure of co-operatives differs by state. Co-operatives are typically organised into four-layer structures: the National Federation of Fishermen's Cooperatives, the State Federation of Fishermen's Cooperatives, Central Fishermen's Cooperative Societies, and Primary Fishermen's Cooperative Societies. The primary activities of fisheries co-operatives at

various organisational levels are listed here (Sapovadia 2004; Sapovadia 2007).

6.1 National Federation of Fishermen's Cooperative Limited

The main functions of the National Federation of Fishermen's Cooperative Limited are to manage the distribution of fishery materials and tools, to promote innovation among fishermen through co-operatives, ensuring safety for fishermen, acquire ponds or reservoirs on a rental basis for developing fish breeds, selling fish at a fair price, offer consulting assistance for people of fisheries co-operatives, putting together the instructional and demonstration sections, commercialising fish seed as well as facilitating trade fisheries cooperation, development and consultation, publications, collaboration and partnership with the government and other co-operative organisations and international co-operatives (Mahanayak and Panigrahi 2021).

6.2 State Federation of Fishermen's Co-operatives

The main functions are to support and establish state-wide fishery co-operatives; collect funds through the sale of stock, investments and term loans; acquire and distribute necessary fisheries materials and apparatus; sell fish at affordable prices; engage in the packaging and exporting of fishery products; and provide technical advice and collaborate with both the government and other organisations (Sapovadia 2004).

6.3 Central Fisherman's Co-operative Societies

Main functions are to encourage fisherman to develop co-operatives, gather fish from members, offer a good platform or market for fish selling, supply fish larvae, fingerlings and nets, as well as other necessary materials and apparatus and provide technical assistance to members (Sapovadia 2004).

7 | COMMON TYPES OF FISHERY CO-OPERATIVES IN INDIA

According to their functional aspects, the Indian Fishery Co-operatives can be classified into the following types: producer co-operatives, consumer co-operatives, credit co-operatives, marketing co-operatives, insurance co-operatives, transport co-operatives and storage co-operatives (Chidambaram and Dabhi 1964). Producer co-operatives deal with the production of fish crops with proper utilisation of labour and allied production-related issues, if any. Consumer co-operatives include some stores that purchase fish at wholesale rates and sell it to common consumers. Credit co-operatives are beneficial to low-capital-bearing fishermen. They can access quick and low-interest credit for their fish farming and business. They buy the fishing crafts and gears this way (Dubey *et*

al. 2009). Marketing co-operatives minimises the intervention of middlemen in the dealing of fish, and in that way, it helps obtain maximum profit for the fish farmer itself. Insurance co-operatives help minimise the life risks of fishermen while catching fish in the deep sea and rivers by providing the facility to include them under insurance (Zheng *et al.* 2018; Wei *et al.* 2021). These help them cover their big boats and trawlers under insurance so that, in case of damage, they get protection (Parappurathu *et al.* 2017). Transport co-operatives generally help the fishermen transport the fish to areas where demand is high. Fast transport helps to retain the good freshness quality of the fish for longer (Smith and Basurto 2019). Storage co-operatives generally help to build up or ease up the process of storing catch fish in the form of cold storage or other storage units (Lakshmi Devi 2012).

8 | ROLES OF FISHERY CO-OPERATIVES IN GROWTH OF FISHERY IN INDIA

The basic fisheries co-operatives are intended to serve as a multipurpose organisation, giving loans, equipment, assistance, monitoring and debt utilisation, as well as gathering and shipping fish to marketing hubs, whereas central societies provide equipment and services, processing and market research (Sapovadia 2007). The apex authority is also meant to act as a bridge between the government and society. Furthermore, it is discovered that there has been significant overlap in the duties of various groups, with no clear delineation or appropriate interconnection (Nair *et al.* 2010; Jeyanthi *et al.* 2018; Nazir *et al.* 2018).

8.1 Low interest loan for fishing craft and gear

The fishermen of India are mostly from the poorer section of society. They lack the funds needed to buy several costly crafts and gears for fishing and some of the crafts are so costly that they need to share buyers (Sakib *et al.* 2020). The poor fishermen generally take loans from local people, which are mostly unauthorised (Sapovadia 2007). The high interest rate and conditions create problems in their profession. But due to the formation of fishery co-operatives, they are able to take out loans at a very low interest rate and without any prior complex conditions (Smith and Basurto 2019). The co-operatives also form a well-organised group of fishermen, which leads to the simplicity of share purchases of some necessary things (like big fishing boats, trawlers, big seine nets, etc.) for their needs (Nazir *et al.* 2018).

8.2 Self-reliance to women

Fish co-operative societies can play an important role in promoting self-reliance among women in fishing communities (Freeman and Svelds 2022). By providing women with access to training, resources and support networks,

co-operatives can help them build the skills and confidence needed to participate more fully in the industry (Sapovadia 2007). This can include training in fishing techniques, business management and financial planning, as well as access to loans and other financial services (Haqiqiansyah and Sugiharto 2018). By empowering women in this way, fish co-operatives can help to create more equitable and inclusive fishing communities, where women are valued and respected for their contributions (McDougall *et al.* 2022). This can also help to promote the long-term sustainability of the industry by ensuring that all members of the community have a stake in its success (Gopal *et al.* 2020).

8.3 High quality fish seed availability

In the case of India, the fishery is being practised by people who generally lack the touch of academics. Due to this reason, farming often includes unscientific methods, which generally hampers production in a very drastic way (Sapovadia 2007). But the fishery co-operatives play a vital role in being facilitators and allowing the fish farmers to have regular or frequent meetings with district fish departments (Shoko *et al.* 2023). The fishery department always tries to boost production by promoting the inclusion of several high-producing fish seeds, disease-resistant varieties and others (Nyimbili and Musuka 2017). The co-operative being a constant partner between the fish farmers and government authorities makes it easy for the farmers to include the needed one for fish farmers (Thakur 2018; Roy 2019).

8.4 Modern technology orientation project

The fishery co-operatives always try to help the fish farmers accommodate new technologies. The fish farmers sometimes get allured by advertisements for chemical fertilisers and pesticides promising high production (Pathak *et al.* 2022). The co-operative always monitors and guides them with the help of the district fisheries department. The government officials and scientists then always break the misunderstandings of the fish farmers and make them enlightened about bioaccumulation and biomagnification and make them aware of the long-term perishes of soil like decreasing soil fertility of the water body (Damalas and Eleftherohorinos 2011; Pathak *et al.* 2022). These restraints prevent the fishery from using chemical fertilisers and pesticides and they use alternative bio-fertilisers and bio-pesticides, which are equally effective for the growth of their production (Nandan 2017).

8.5 Storage capacity and procurement centre building

The Indian fishery is capable enough to produce the fish wealth more than is needed to feed India and also to export. But the Indian fishery is related to the problem of fish storage. Many parts generally get damaged due to

not having any nearby high-capacity cold storage units (Ps *et al.* 2022). This generally decreases the profit share of the fish farmers and sometimes it even causes losses. The Indian fishery also lacks the point-based procurement centre for catching fish, which generally speeds up fish spoilage (Getu and Misganaw 2015; Sampels 2015). The fishery co-operatives help the fish farmers by approaching the government in a systematic way to facilitate easy, available transport mechanisms for fish transport and the setting up of government or private sector investments in setting up cold storages or fish processing centres in the prospecting areas (Tsoukalas *et al.* 2022). The majority of the co-operatives have ice plants and cold storages for fisheries preservation. Selling of fish has become a critical function of societies, with the majority of cultures involved in promotion (Sapovadia 2004; Nair *et al.* 2010).

8.6 Procurement of ice, petrol, ropes, as well as other fishing necessities

Fish co-operative societies play a critical role in the procurement of ice, petrol, ropes and other fishing necessities for their members. By pooling their resources and purchasing these items in bulk, co-operative societies can negotiate better prices and secure reliable access to these essential supplies (Yapanto *et al.* 2020). This enables fishers to operate more efficiently and effectively, reducing their operating costs and increasing their profits. In addition to the procurement of fishing necessities, co-operative societies can also provide their members with access to financing, training and marketing support, helping them to improve their livelihoods and build more sustainable fishing businesses (Nair *et al.* 2010).

8.7 Insurance for equipment and life, as well as assistance from the Distress Charitable Foundation

Fish co-operative societies also play a critical role in providing insurance for equipment and life, as well as assistance from the Distress Charitable Foundation for their members. Insurance for fishing equipment and vessels is essential for protecting the livelihoods of fishers, who often face significant financial risks due to damage or loss of their equipment (Parappurathu *et al.* 2017). Similarly, life insurance provides a safety net for the families of fishers in case of accidents or fatalities at sea (Mumford *et al.* 2009). The Distress Charitable Foundation provides emergency assistance to fishers and their families in times of crisis, such as natural disasters, accidents or illness (Zheng *et al.* 2018). By providing these essential services, co-operative societies can help to protect the well-being and financial security of their members, supporting the sustainability of fishing communities (Wei *et al.* 2021). Considering the potential and volatility in the industry, the National Federation of Fishermen's Cooperatives Ltd. (FISHCOPFED) has developed a group accident scheme, sponsored by the central government, and is being

adopted by almost all of the co-operative societies (Nair *et al.* 2010).

8.8 Supply of consumption items through the stores of society

A fish co-operative society is an organisation owned and operated by fishers who work together to market and sell their catch. The society can provide a range of services, including buying and selling fish, providing financial assistance to its members and advocating for the interests of fishers (Samian *et al.* 2017). In addition to fish, some co-operatives also supply other consumption items through their stores, such as groceries, household items and even fuel. This can provide a convenient and affordable option for community members who may have limited access to these goods otherwise (Samian *et al.* 2017). By working together, fish co-operative societies can help support the livelihoods of fishers and contribute to the local economy (Nair *et al.* 2010).

8.9 Organising workshops

In addition to their core activities of marketing and selling fish, fish co-operative societies can also organise workshops for their members. These workshops can cover a range of topics, such as fishing techniques, safety practices and business management (Sajesh *et al.* 2021). By providing these educational opportunities, the society can help its members improve their skills and increase their profitability. Workshops can also provide an opportunity for members to network and share knowledge with one another (Tan *et al.* 2023). Overall, organising workshops can be a valuable way for fish co-operative societies to support the growth and success of their members, while also promoting the sustainable use of fisheries resources (Turgeon *et al.* 2018). Most co-operatives provide six months of fisherman training for their participants at regional Fisheries Training Institutes (Bradley *et al.* 2019). Cooperative Training Institutes provide management training to a small number of co-operative members, including board members and workers (Nair *et al.* 2010).

8.10 Revenue sharing among members

One of the key benefits of participating in a fish co-operative society is the opportunity for revenue sharing among members. When the society sells fish or other products, the profits are distributed among members according to a predetermined formula (Cashion *et al.* 2018). This can help to ensure that all members receive a fair share of the benefits of their collective work, regardless of their individual contributions (Kasperski and Holland 2013). Revenue sharing can also provide an incentive for members to work together and support one another, as everyone benefits when the society is successful (Ashrafi *et al.* 2021). By distributing profits in a fair and transparent way, fish co-operative societies can help to build

trust and promote the long-term sustainability of their operations (Hendrik *et al.* 2020). Many co-operatives in India generate a huge amount of revenue, and those profit-making co-operatives usually share the dividend among the members, and the percentage of the dividend varies according to the net profit earned (Nair *et al.* 2010).

8.11 Fishery co-operative society and Sustainable Development Goal (SDG)

Fish co-operative societies can contribute significantly to the achievement of Sustainable Development Goal (SDG) 17, which is focused on strengthening the means of implementation and revitalising the global partnership for sustainable development (Lynch *et al.* 2020). This goal emphasizes the importance of collaboration, partnership and cooperation between countries, stakeholders and different sectors of society.

Fish co-operative societies can contribute to the achievement of SDG 17 in various ways. Fish co-operative societies can facilitate partnerships and collaborations between fishers, fishing communities, private sector actors, governments and other stakeholders (Contreras Loeira and Zulawska 2013). This can lead to the development of sustainable fisheries management practices, access to financing and technology and the establishment of markets for fish and fishery products (Bradley *et al.* 2019).

It can also promote sustainable economic growth by providing economic opportunities to fishing communities, creating jobs and generating income (Habib and Jan 2021). This can help to reduce poverty, increase food security, and promote economic development (Mary and Kailasam 2015). Fish co-operative societies can provide capacity building opportunities for their members, including training and education on sustainable fishing practices, resource management and entrepreneurship. This can enhance the skills of fishers and fishing communities and promote the development of sustainable fishing practices (Sajesh *et al.* 2021).

Fish co-operative societies can mobilise resources from different sources to support sustainable fishing practices, including financing from development partners, private sector investments and government funding. Fish co-operative societies can promote knowledge sharing and learning between fishing communities, scientists and other stakeholders. This can help to improve understanding of the marine environment, fisheries management and sustainable fishing practices. Fish co-operative societies can contribute significantly to the achievement of SDG 17 by facilitating partnerships, promoting sustainable economic growth, providing capacity building, mobilising resources and promoting knowledge sharing (Elliott *et al.* 2022). These efforts can help to promote sustainable fisheries management practices, reduce poverty and support economic development.

9 | ROLE OF FISHERY CO-OPERATIVES IN SOCIO-ECONOMIC DEVELOPMENT

Fishermen and fish farmers are the foundation of the Indian fishery sector. Fishermen belong to a lower socioeconomic class; they are typically behind us in terms of economics, politics, literacy and socialisation (Das *et al.* 2022). They are established as inhabitants in the riverine areas while using fishing as their traditional occupation to earn an income (Ayyappan and Krishnan 2004). Fishermen have scarce resources and they are very unfamiliar with technologies. Local resident fishermen aggregated their resources with assistance from the government as well as other public organisations to create a reciprocal consideration co-operative (Johnson and Van Densen 2007). According to research done by the National Cooperative Union of India (NCUI), just 4% of fishermen completed their education up to the undergraduate level (Junare 1999; Tewary 2001; Sapovadia 2004).

Fishery co-operatives and integrated fish farming can play an important role in women's empowerment by providing women with access to economic opportunities and financial independence (Torre *et al.* 2019). Fishery co-operatives are collective enterprises owned and managed by a group of fishermen who work together to improve their livelihoods (Freeman and Svets 2022). Women who are engaged in fishing, fish processing and marketing can join these co-operatives and benefit from shared resources and knowledge (Adam and Njogu 2023). On the other hand, integrated fish farming involves combining different aquaculture activities such as fish farming, shrimp farming and crab farming with agriculture activities such as vegetable farming and rice cultivation, along with poultry, piggery, apiary, goat and dairy farming (Geburu 2021). This provides extra opportunities for women to engage in multiple income-generating activities, as they can participate in both aquaculture and agriculture activities (Gonzalez Parrao *et al.* 2021). Women can benefit from fishery co-operatives and integrated fish farming in several ways (Haqiqiansyah and Sugiharto 2018). Co-operatives can provide women with access to credit and other financial services, which can help them to invest in their businesses and improve their income (Dadabhau and Kisan 2013). Co-operatives and integrated fish farming provide women with training and knowledge on best practises in fish farming, processing, and marketing. This can help women improve their productivity and the quality of their products (Haqiqiansyah and Sugiharto 2018). Women who join co-operatives can benefit from increased bargaining power, as they can negotiate better prices for their products and access to markets (Kumar 2018). Women who are engaged in fishery co-operatives and integrated fish farming can improve their social status within their communities as they become more economically independent and contribute to the local economy (Soni *et al.* 2014; Chaubey *et al.* 2018). Overall, fish-

ery co-operatives and integrated fish farming can provide women with opportunities for economic empowerment, skills development and social status improvement, making them an important tool for women's empowerment in the fisheries sector (Al Mamun *et al.* 2012; McDougall *et al.* 2022).

Fishermen's co-operatives are more than just a source of income; most of them are involved in community fields such as education, healthcare, public distribution, cultural change and charities in both normal and abnormal times, such as catastrophic or man-made disasters (Figure 1). Outside the gross revenue earned per each calendar year, most of the co-operatives spend money on charity and philanthropic activities such as weddings, youth centre construction and so on (Nandan 2017; Samian *et al.* 2017). The Veessava Fisheries Cooperative is a socioeconomic reformation and humanitarian group that has implemented initiatives for superstitions removal, schooling, healthcare and other community programmes (Junare 1999; Tewary 2001).

India is among the few nations on earth with massive resources and a suitable agro-climate for fisheries management operations (Ngasotter *et al.* 2020). Notwithstanding its plentiful resources, the fishing industry contributes little to total gross domestic product development. As a result, the fishing industry is anticipated to contribute more towards economic growth (NCBA Clusa 2015).

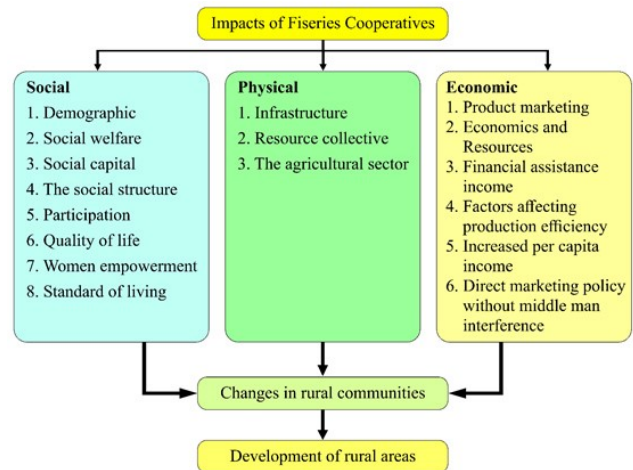


FIGURE 1 The role of co-operative fisheries in socio-economic development.

10 | FISHCOPFED DATABASE

The National Federation of Fishers Cooperatives Ltd. (NFFC or FISHCOPFED) published some statistical data regarding fisheries co-operatives in their website (www.fishcopfed.in) which are presented in Figures 2–4.

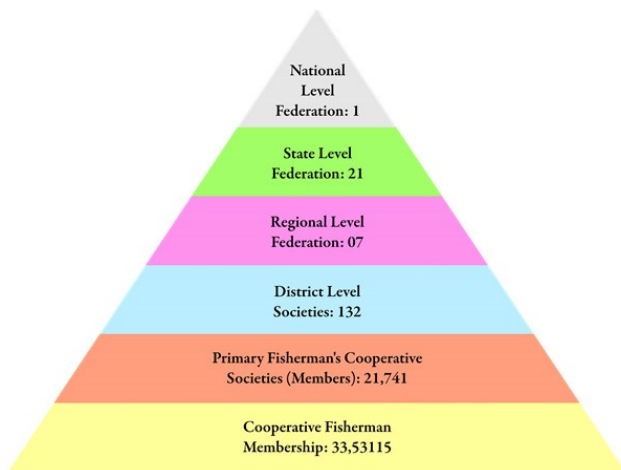


FIGURE 2 Hierarchy of fishermen's co-operatives according to their numbers (source: Mahanayak and Panigrahi 2021).

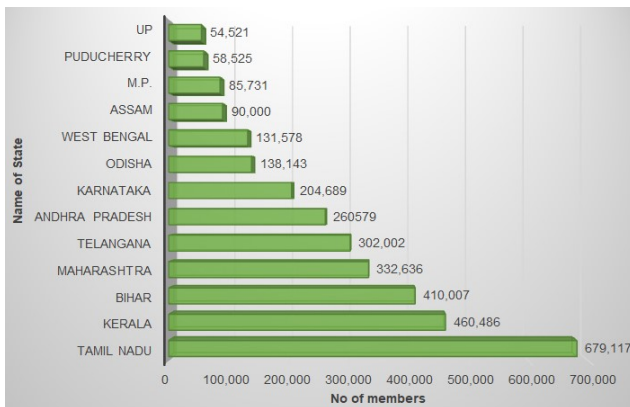


FIGURE 3 State-wise, the number of Primary Fishermen Co-operative Societies (PFSC) in India ranges from 50000 to 700000 (source: Mahanayak and Panigrahi 2021).

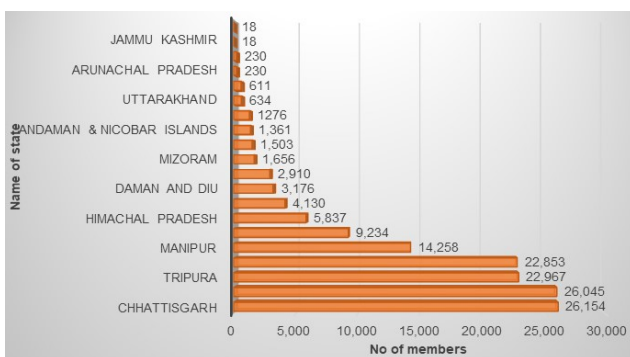


FIGURE 4 State-wise number of the Primary Fishermen Co-operative Societies (PFSC) in India is between the range of below 100 and below 50000 (source: Mahanayak and Panigrahi 2021).

11 | CONSTRAINTS OR ISSUES ENCOUNTERED BY INDIAN FISHERIES CO-OPERATIVES

Pandya and Patel (2002) investigated the barriers to the growth of entrepreneurship in the fisheries sector. They stated that the main barriers to such growth of entrepre-

neurship in the fishing sector were the lack of accessibility of credit from banking sectors, the absence of sufficient training centres, the inadequacy of timely proper support, etc. According to the survey, the key restrictions faced by fisherman co-operatives comprised an underdeveloped selling system, insufficient distribution networks, late delivery of seedlings, a high intensity of fish thievery, insufficient water depth inside the water body during the winter and summer seasons, etc.

Bhaumik *et al.* (2005) investigated the obstacles faced by fisheries co-operatives in boosting fish productivity. According to the research, the main obstacles confronted by the co-operative societies seemed to be increased levels of contamination, mainly in urban regions due to the arrival of contaminants into waterways from inadequately treated municipal wastewater canals, and in rural locations due to the entry of contaminants in the form of agrochemicals, outbreaks of fish pathogens, illegal fishing or overexploitation, the unavailability of funding from government agencies, and the high intensity of invasive alien species of weeds.

De and Saha (2006) investigated various obstacles affecting co-operative fisheries. Their research observed that the primary restrictions of co-operative fisheries were always the predominance of several persons in making choices or policies in general, as well as the lack of public engagement and co-operative collaboration. Researchers further found restrictions such as disagreements over benefit sharing between shareholders of fisheries co-operatives, inadequate technological ability of fishers and the existence of trade middlemen.

ONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTION

TS Design & conceptualisation, secondary data collection, checklist preparation, manuscript editing; AS manuscript writing, manuscript formatting, framework preparation; PM framework preparation, reference & in-text citation formatting.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

REFERENCES

- Adam R, Njogu L (2023) [A review of gender inequality and women's empowerment in aquaculture using the reach-benefit-empower-transform framework approach: a case study of Nigeria](#). *Frontiers in Aquaculture* 1: 1052097.
- Agrawal R, Darapuneni RR, VLN Rao B, Nanda SK, Bhattacharya S (2016) [Assessment of employment potential for fisheries professionals in India](#). *Indian*

- Journal of Fisheries 63(2): 102–109.
- Ahmed H, Ahmed I (2022) [Current status of fisheries resource of India: present status and future prospective](#). *Bangladesh Journal of Fisheries* 34(1): 119–130.
- Ahsan MK, Runa NS, Ghosh SK, Hasan MM, Kamal M (2016) [Socio-economic condition of fishermen and intermediaries involved in marine fish marketing chain in Coxs Bazar area, Bangladesh](#). *Asian Journal of Medical and Biological Research* 2(1): 67–73.
- Al Mamun S, Nasrat F, Debi MR (2012) [Integrated farming system: prospects in Bangladesh](#). *Journal of Environmental Science and Natural Resources* 4(2): 127–136.
- Anbumani K (2007) International marketing conference on marketing and society, 8-10 April, 2007, Indian Institute of Management, Kozhikode 2007.
- Anwar WA, Mostafa NS, Hakim SA, Sos DG, Abozaid DA, Osborne RH (2020) [Health literacy strengths and limitations among rural fishing communities in Egypt using the Health Literacy Questionnaire \(HLq\)](#). *PLOS ONE* 15(7): e0235550.
- Ashrafi TA, Syed S, Eide A (2021) [Individual quotas and revenue risk of fishing portfolio in the trawl fishery](#). *Fisheries Research* 241: 105990.
- Ayyappan S, Diwan AD (2006) Fisheries research and development in India. *Fishing Chimes* 26: 19–23.
- Ayyappan S, Diwan AD (2007) National fisheries development board and fisheries policy. In: *Indian fisheries: a progressive outlook*. CMFRI, Cochin. pp. 1–11
- Ayyappan S, Krishnan M (2004) Fisheries sector in India: dimensions of development 59: 391–412.
- Bhaumik U, Mittal IC, Das P, Paria T (2005) Constraints in enhancing fish production. *Indian Journal of Extension Education* 41: 88–90.
- Bhendarkar MP, Sarang N, Bhosale M, Laxmi RH, Vardia HK (2017) [A study on profile of socio-economic condition of fishermen in selected village in Kabirdham district, Chhattisgarh State, India](#). *International Journal of Educational Science and Research* 7(6): 49–56.
- Birchall J (2004) Cooperatives and the millennium development goals. International Labour Organization, International Labour Office, Geneva, Switzerland.
- Bradley D, Merrifield M, Miller KM, Lomonico S, Wilson JR, Gleason MG (2019) [Opportunities to improve fisheries management through innovative technology and advanced data systems](#). *Fish and Fisheries* 20(3): 564–583.
- Bureau ET (2019) [Fisheries sector registered more than double growth in past 5 years; emerged largest group in agri export](#). *The Economic Times*, accessed on 10 June 2022.
- Cashion T, De La Puente S, Belhabib D, Pauly D, Zeller D, Sumaila UR (2018) [Establishing company level fishing revenue and profit losses from fisheries: A bottom-up approach](#). *PLOS ONE* 13(11): e0207768.
- Chandrashekar BS (2014) Fishery co-operative societies in India: problems and prospects. *Global Journal for Research Analysis* 3: 92–94
- Chaubey D, Prakash V, Yadav TC, Singh G (2018) [Doubling of farmers' income through integrated farming system approaches in Bihar- a review](#). *International Journal of Current Microbiology and Applied Sciences* 7(12): 1602–1613.
- Chidambaram K, Dabhi RG (1964) Fisheries co-operatives and their role in marketing of fish in India, with special reference to Gujrat. *Proceedings of the Indo-Pacific Fisheries Council* 11: 292–307.
- Contreras Loera MR and Zulawska U (2013) [Fisheries co-operative organization and sustainable development in the rural community](#). *Journal of Intercultural Management* 5(1): 19–28.
- Curtis J, Breen B, O'Reilly P, O'Donoghue C (2017) [The economic contribution of a recreational fishery in a remote rural economy](#). *Water Resources and Rural Development* 10: 14–21.
- Dadabhau AS, Kisan WS (2013) [Sustainable rural livelihood security through integrated farming systems -A review](#). *Agricultural Reviews* 34(3): 207.
- Damalas CA, Eleftherohorinos IG (2011) [Pesticide exposure, safety issues, and risk assessment indicators](#). *International Journal of Environmental Research and Public Health* 8(5): 1402–1419.
- Das BK, Roy A, Som S, Chandra G, Kumari S, ... Pandit A (2022) [Impact of COVID-19 lockdown on small-scale fishers \(SSF\) engaged in floodplain wetland fisheries: Evidences from three states in India](#). *Environmental Science and Pollution Research* 29(6): 8452–8463.
- De HK, Saha GS (2006) Constraints to community-based aquaculture research. *Indian Journal of Extension Education* 42: 66–68.
- Desai BN, Bhargava RMS, Sarupria JS (1990) [Estimates of fishery potentials of the EEZ of India](#). *Estuarine, Coastal and Shelf Science* 30(6): 635–639.
- Dubey AK, Singh AK, Singh RK, Singh L, Pathak M, Dubey VK (2009) Cooperative societies for sustaining rural livelihood: a case study. *Society of Extension Education, Agra* 9(1): 43–46.
- Ekka A, Katiha P, Pandit A, Nagesh Barik, Balasubramanian GK (2012) [Socio-economic status of fishers' of reservoirs in India](#). *Journal of the Inland Fisheries Society of India* 44(2): 79–87.
- Elliott V, Araya CC, Aura CM, Bice C, Cole J, ... Shultz A (2022) [Inland fisheries management—Exploitation and livelihoods](#). In: *Encyclopedia of inland waters* (pp. 318–330). Elsevier, Netherlands.
- Elliott VL, Lynch AJ, Phang SC, Cooke SJ, Cowx IG, ... Stokes GL (2022) [A future for the inland fish and fisheries hidden within the sustainable development goals](#). *Frontiers in Environmental Science* 10:

- 756045.
- FAO (2002) [The State of World Fisheries and Aquaculture 2002](#). Rome.
- Franz N, Poulain F, Westlund L (2017) Towards the implementation of the SSF guidelines in South Asia. Proceedings of the South Asia FAO-BOBLME Regional Consultation on the implementation of the voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication, Colombo, Sri Lanka, 23 – 26 November, 2015. FAO Fisheries and Aquaculture Proceedings 57, FAO, Rome.
- Freeman R, Svets K (2022) [Women's empowerment in small-scale fisheries: the impact of fisheries local action groups](#). *Marine Policy* 136: 104907.
- Gebru T (2021) [Integrated aquaculture with special reference to fish integration with animal husbandry to enhance production and productivity](#). *Journal of Agriculture and Aquaculture* 3(2): 1–6.
- Getu A, Misganaw K (2015) [Post-harvesting and major related problems of fish production](#). *Fisheries and Aquaculture Journal* 6(4): 1–6.
- Ghosh SK, Ahmmmed MK, Ahmed SI, Ahsan MK, Kamal M (2015) [Study on the socio-economic conditions of the fishermen in Teknaf](#). *Research in Agriculture Livestock and Fisheries* 2(3): 483–489.
- Gonzalez Parrao C, Shisler S, Moratti M, Yavuz C, Acharya A, ... Snilstveit B (2021) [Aquaculture for improving productivity, income, nutrition and women's empowerment in low- and middle-income countries: a systematic review and meta-analysis](#). *Campbell Systematic Reviews* 17(4): 1–95.
- Gopal N, Hapke HM, Kusakabe K, Rajaratnam S, Williams MJ (2020) [Expanding the horizons for women in fisheries and aquaculture](#). *Gender, Technology and Development* 24: 1–9.
- Habib N, Jan S (2021) [Socio-economic status of fishermen community of Wular Lake in district Bandipora of Jammu and Kashmir](#). *Journal of Fisheries* 9(3): 93205.
- Haqiqiansyah G, Sugiharto E (2018) [Coastal women empowerment in improving enterprise of fish product processing in Sanga-Sanga districts](#). IOP Conference Series: Earth and Environmental Science 144: 012054.
- Harper S, Zeller D, Hauzer M, Pauly D, Sumaila UR (2013) [Women and fisheries: Contribution to food security and local economies](#). *Marine Policy* 39: 56–63.
- Hendrik H, Hamid H, Alvionita D, Alfrendo A (2020) [Wage system and profit sharing in fish catching business using lift net in ocean fishing port of Belawan](#). IOP Conference Series: Earth and Environmental Science 430(1): 012017.
- Hollup O (2000) Structural and sociocultural constraints for user-group participation in fisheries management in Mauritius. *Marine Policy* 24(5): 407–421.
- Jaini M (2021) [India's fisheries: past, present, and future](#). India Development Review. IDRonline, Bandra West, India.
- Jeyanthi P, Chandrasekar V, Ashok A, Nair VR, Thomas KJ, ... Gopal N (2018) Institutional development and efficiency of fishermen cooperatives in marine fisheries: a case study from Kerala. *Fishery Technology* 55: 79–85.
- Johnson TR, Van Densen WLT (2007) [Benefits and organization of cooperative research for fisheries management](#). *ICES Journal of Marine Science* 64(4): 834–840.
- Junare SO (1999) A glorious era of Vesava Cooperative Fishery Society. *Tamilnadu Journal of Cooperatives, India*. pp. 39–41.
- Karim MS, Techera E, Arif AA (2020) [Ecosystem-based fisheries management and the precautionary approach in the Indian Ocean regional fisheries management organisations](#). *Marine Pollution Bulletin* 159: 111438.
- Karuppusamy D, Karthikeyan K (2017) [A study on socio-economic and cultural profile of fishermen in Puducherry region, India](#). *International Journal of Advanced Research* 5: 1752–1761.
- Kasperski S, Holland D S (2013) [Income diversification and risk for fishermen](#). *Proceedings of the National Academy of Sciences* 110(6): 2076–2081.
- Kumar BG, Datta KK, Joshi PK, Katiha PK, Suresh R, ... Menon M (2008) [Domestic fish marketing in India-changing structure, conduct, performance and policies](#). *Agricultural Economics Research Review* 21: 345–354.
- Kumar SS (2018) [Livelihood improvement through integrated farming system interventions to resource poor farmers](#). *Journal of AgriSearch* 5(1): 19–24.
- Kurien J (2014) Collective action and organisations in small-scale fisheries (pp. 41–104). In: Kalikoski DC, Franz N (Eds) *Strengthening organizations and collective action in fisheries: a way forward in implementing the international guidelines for securing sustainable small-scale fisheries*. 18–20 March 2013, FAO Fisheries and Aquaculture Proceedings No. 32. Rome, Italy.
- Lakshmi Devi NB (2012) [A study on existing fisheries management system and the problems faced by the fishers in Loktak lake of Manipur](#). *IOSR Journal of Agriculture and Veterinary Science* 1(5): 22–28.
- Lynch AJ, Cooke SJ, Deines AM, Bower SD, Bunnell DB, ... Beard TD (2016) [The social, economic, and environmental importance of inland fish and fisheries](#). *Environmental Reviews* 24(2): 115–121.
- Lynch AJ, Elliott V, Phang SC, Claussen JE, Harrison I, ... Stokes GL (2020) [Inland fish and fisheries integral to achieving the Sustainable Development Goals](#). Na-

- ture Sustainability 3(8): 579–587.
- Mahanayak B, Chakraborty S, Panigrahi A (2017) Preliminary survey on the primary fishermen co-operative societies (PFCS) of Murshidabad district of West Bengal. *Indian Journal of Biology* 4: 142–145.
- Mahanayak B, Panigrahi AK (2021) Sustainable management of the aquatic ecosystem and the fishermen cooperative societies in India: a brief review. *Uttar Pradesh Journal of Zoology* 42: 28–35.
- Mary MD, Kailasam S (2015) [Socio economic status of fisher folks engaged in mussel fishery at Kanyakumari district of Tamil Nadu, India](#). *Journal of Marine Science: Research & Development* 5(3): 1–5.
- Maulu S, Hasimuna OJ, Haambiya LH, Monde C, Musuka CG, ... Nsekanabo JD (2021) Climate change effects on aquaculture production: sustainability implications, mitigation, and adaptations. *Frontiers in Sustainable Food Systems* 5: 1–16.
- McDougall C, Kruijssen F, Sproule K, Serfilippi E, Rajaratnam S, ... Adam R (2022) [Women's empowerment in fisheries and aquaculture index \(Wefi\): Guidance notes](#). Worldfish, Penang, Malaysia.
- Meena S (2022) [India continues to maintain its position as the world's second-largest fish producer](#). *Krishi Jagran*, India.
- Mishra BK (1997) Fisheries cooperatives in India. *International Cooperative Alliance, Co-op Dialogue* 7: 28–31.
- Mukherjee P, Saha A, Sen K, Erfani H, Madhu NR, Sanyal T (2022) [Conservation and prospects of Indian Lacustrine fisheries to reach the Sustainable Developmental Goals \(SDG 17\)](#). In: A basic overview of environment and sustainable development. International Academic Publishing House (IAPH) Kolkata, India. pp. 98–116.
- Mumford JD, Leach AW, Levontin P, Kell LT (2009) [Insurance mechanisms to mediate economic risks in marine fisheries](#). *ICES Journal of Marine Science* 66(5): 950–959.
- Nair SR, Pandey SK, Sharma A, Shyam SS (2010) Performance of fisheries cooperatives in India- an evaluation of primary societies in Thane district of Maharashtra. *Journal of Fisheries Economics and Development* 11 (2): 16–27.
- Nandan MJ (2017) [Skill development and training requirements of the aquaculture sector in Andhra Pradesh, India: - a need for sustainable economic growth](#). *Oceanography & Fisheries Open Access Journal* 1: 71–72.
- Nazir I, Chauhan RS, Khati A, Arya P (2018) Role of credit for the upliftment of the fisheries sector. *International Journal of Fisheries and Aquatic Studies* 6: 1–4.
- NCBA Clusa (2015) [How a fishermen's co-op lives the 7 cooperative principles](#). NCBA CLUSA. National Cooperative Business Association CLUSA International, Washington DC, USA.
- Ngasotter S, Panda SP, Mohanty U, Akter S, Mukherjee S, ... Devi LS (2020) [Current scenario of fisheries and aquaculture in India with special reference to odisha: A review on its status, issues and prospects for sustainable development](#). *International Journal of Bio-Resource and Stress Management* 11(4): 370–380.
- Nyimbili B, Musuka CG (2017) [Fish seed availability, quality, quantity and its significance to aquaculture development in Zambia](#). *Innovative Techniques in Agriculture* 1(4): 162–173.
- Pandya RD, Patel BM (2002) Constraints in development of inland fish entrepreneurship. Paper published in Abstract brought out on national Seminar on Entrepreneurship Development in Agriculture 65.
- Parappurathu S, Ramachandran C, Gopalakrishnan A, Kumar D, Poddar MK, ... Sunil P V (2017) [What ails fisheries insurance in India? An assessment of issues, challenges and future potential](#). *Marine Policy* 86: 144–155.
- Pathak VM, Verma VK, Rawat BS, Kaur B, Babu N, ... Cunill JM (2022) [Current status of pesticide effects on environment, human health and it's eco-friendly management as bioremediation: a comprehensive review](#). *Frontiers in Microbiology* 13: 962619.
- Prakash M (2000) Role of fisheries cooperatives. *Fish co-ops* 14: 195–198.
- Ps K, Gopan S, Rajabudeen R, Fathima R, Shibu K, ... Gb S (2022) [Post-harvest losses in the fisheries sector-facts, figures, challenges and strategies](#). *International Journal of Fisheries and Aquatic Studies* 10(4): 101–108.
- Rajeev M, Bhandarkar S (2022) [Fisheries sector in India—an overview \(pp. 47–59\)](#). In: Rajeev M, Bhandarkar S (Eds) *Unravelling supply chain networks of fisheries in India*. Springer Nature Singapore, Singapore.
- Ranicki C (2012) [Uniting India's fishing cooperatives](#). *StoriesCoop*, India.
- Rao PS (1973) Problems of management of fish marketing and co-operatives. FAO/ SIDA course on the management of fishermen's co-operative in collaboration with the Govt. of India and the International Cooperative Alliance (ICA) Bombay, FIE/MFC 10: 1–8.
- Roonwal GS (1997) Marine mineral potential in India's exclusive economic zone: some issues before exploitation. *Marine Georesources & Geotechnology* 15(1): 21–32.
- Roy K (2019) [Technicalities to be considered for culture fisheries development in Indian inland waters: seed and feed policy review](#). *Environment, Development and Sustainability* 21: 281–302.
- Sajesh VK, Suresh A, Mohanty AK, Singh V, Ravishankar CN (2021) [Skill development in marine fisheries:](#)

- Some reflections on the issues and way outs. The Indian Journal of Animal Sciences 91(7): 518–524.
- Sakib MN, Hasan MR, Ullah MA (2020) [Fishing gears and crafts used in Gumti river of Muradnagar upazila, Bangladesh](#). Asian Journal of Medical and Biological Research 6(3): 469–474.
- Samian M, Saadi H, Asadi M, Mirzaei K, Ansari E, ... Soleymani A (2017) [The role of fishing cooperatives on social – economic and cultural development of rural areas of Bord Khun city of Bushehr, Iran](#). Journal of the Saudi Society of Agricultural Sciences 16: 178–183.
- Sampels S (2015) The effects of storage and preservation technologies on the quality of fish products: a review: fish preservation. Journal of Food Processing and Preservation 39(6): 1206–1215.
- Sapovadia V (2004) Fishermen cooperatives: a tool for socio-economic development. IIFET 2004 Japan Proceedings Tokyo, Japan. pp. 1–11.
- Sapovadia VK (2007) [A comparative study on financial performance appraisal of Indian cooperative sector and USA based cooperative sector](#). SSRN Electronic Journal 2007: 1–288.
- Shah B, Soni R (2022) A study on role of NABARD and financial initiatives taken in promoting rural finance in India. Journal of Positive School Psychology 6(2): 4542–4550.
- Shoko AP, Limbu SM, Ulotu EE, Shayo SD, Silas MO, ... Tamatamah RA (2023) [Fish seed and feed value chains analysis and their critical factors for aquaculture development in Tanzania](#). Aquaculture, Fish and Fisheries 3(1): 35–50.
- Smith H, Basurto X (2019) [Defining small-scale fisheries and examining the role of science in shaping perceptions of who and what counts: a systematic review](#). Frontiers in Marine Science 6: 236.
- Soni RP, Katoch M, Ladolia R (2014) [Integrated farming systems - a review](#). IOSR Journal of Agriculture and Veterinary Science 7(10): 36–42.
- Sundararajan S (1991) Dimensions of co-operative management, 1st edition. Mittal Publications, New Delhi, India.
- Suresh A, Parappurathu S (2018) [Capital formation in fisheries sector in India: Trends, compositional changes and potential implications for sustainable development](#). Agricultural Economics Research Review 31: 111.
- Tan FW, Nesti L, Yonnedi EY, Ridwan ER (2023) [Strategy to improve economic condition of fishermen living in the coastal area in Kabupaten Pesisir Selatan](#). Journal of Business and Socio-Economic Development 3(1): 69–85.
- Tewary MM (2001) Revitalization of Non-Viable and Weak Cooperatives with Special Reference to Fishermen Cooperatives. 14th Indian Cooperative Congress Souvenir, India. pp. 103–107.
- Thakur A (2018) Assessment of status of the fishery cooperatives, SHGs and fishermen groups in Bastar district of Chhattisgarh: a review. Journal of Pharmacognosy and Phytochemistry 7: 1748–754.
- Torre J, Hernandez-Velasco A, Rivera-Melo FF, Lopez J, Espinosa-Romero MJ (2019) [Women’s empowerment, collective actions, and sustainable fisheries: Lessons from Mexico](#). Maritime Studies 18(3): 373–384.
- Tsoukalas D, Kendler S, Lerfall J, Jakobsen AN (2022) [The effect of fishing season and storage conditions on the quality of European plaice \(*Pleuronectes platessa*\)](#). LWT 170: 114083.
- Turgeon K, Hawkshaw SCF, Dinning KM, Quinn BK, Edwards DN, ... Mombourquette D (2018) [Enhancing fisheries education and research through the Canadian Fisheries Research Network: a student perspective on interdisciplinarity, collaboration and inclusivity](#). FACETS 3(1): 963–980.
- Tyagi LK, Bisht AS, Pal A, Lal KK (2013) Functioning of fishing cooperative societies in selected states of India. Journal of Community Mobilization and Sustainable Development 8: 90–93.
- Upadhyay AD, Sinha M, Roy AK, Dhanze JR, Pandey DK (2013) [Evaluation of performance of primary fisheries cooperative societies \(Mss\) of Tripura](#). Economic Affairs 58: 271.
- Vasisht A (2009) [An Analysis of Capital Formation in Fisheries Sector in India](#). Asian Fisheries Science 22: 823–837.
- Vohra S (2020) Draft national fisheries policy seeks big growth but ignores fishers. Mongabay, India.
- Wasave S, Sharma A, Wasave S (2020) Organizational roles performed by marine fisheries cooperatives of Maharashtra state, India. Journal of Experimental Zoology India 23: 781–786.
- Watson B, Reimer MN, Guettabi M, Haynie A (2021) [Commercial fisheries & local economies](#). Journal of Environmental Economics and Management 106: 102419.
- Wei X, Hu Q, and Ma J (2021) [Evaluation on the effect of fishery insurance policy: evidence based on text mining](#). Fishes 6(3): 41.
- Wilson M, Payton F, Cox M (2015) FAO, voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication. Oceanography 87: 338–346.
- Yapanto L M, Musa DT, Tanipu F, Paramata AR, Tuli M (2020) The effectiveness of fishery cooperative institutions. PalArch’s Journal of Archaeology of Egypt / Egyptology 17(4): 1329–1338.
- Zeng C, Wen Y, Liu X, Yu J, Jin B, Li D (2022) [Impact of anthropogenic activities on changes of ichthyofauna in the middle and lower Xiang River](#). Aquaculture and


Fisheries 7(6): 693–702.

Zheng H, Mu H, Zhao X (2018) [Evaluating the demand for aquaculture insurance: An investigation of fish farmers' willingness to pay in central coastal areas in China](#). *Marine Policy* 96: 152–162.



T Sanyal  <https://orcid.org/0000-0002-0046-1080>

A Saha  <https://orcid.org/0000-0001-9985-3481>

P Mukherjee  <https://orcid.org/0000-0002-4901-0141>