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Review Article

MARINE FISHERIES AND ITS IMPACT ON COMMUNITY: AN OVERVIEW

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Abstract *Marine Fishery is the harvesting of fish and other seafood from the ocean for commercial, recreational, and food purposes. Marine fisheries, resources provide animal proteins to billions of people globally. Marine fishery has a vital role in human development and welfare as it provides employment, production, and trade, and has a significant share in the national economy. There are several types of marine fisheries, which provide food security, livelihoods and economic benefits to millions of people especially the coastal communities. Sustainable fisheries of the world, facing many problems, like overfishing, habitat destruction, and climate change resulted in the depletion of fish stock and threat to the marine ecosystem. To get the long- term benefits and to reduce the pressure on marine fishery, conservation efforts i.e. sustainable fishing, marine protected areas establishment and enhancing aquaculture productivity are essential. Coastal area communities around the world usually depend upon the fishing industry for their food, income, and livelihood. Marine fisheries impacted on the communities in both ways i.e. positively and negatively. Economic and ecological impacts of marine fisheries on communities are significant. To mitigate negative impacts and enhance positive impacts of marine fisheries on the communities, the present project is undertaken to highlight those impacts by gathering the data about marine fisheries and its allied subjects from 1980 - 2024. In the end some suggestions are coated, like fisheries management practices, community-based management, and social responsibility initiatives, for better and sustainable fishery industry of the country.*

Keywords: *Marine fishery; seafood; economic; ecological impacts; coastal communities; management; social responsibilities; sustainable fishery*

Introduction

Marine Fishery

The harvesting of fish and other seafood from the ocean for commercial, recreational, or subsistence purposes is called Marine Fishery. This includes the capture of wild fish as well as the cultivation of fish through aquaculture in saltwater environment (Geeksfor Geeks, 2024). Animal protein consumption increased due to increase in population growth globally and seafood from fisheries resources contributing significantly to overcome this demand of the human population (FAO, 2017). Marine fishery is the management and harvesting of fish and other sea foods from the oceans, particularly in coastal areas (Mustafa, et al. 2013). Marine fisheries, resources provide animal proteins to billions of people globally and it also influences the human development and welfare in shape of providing employment, production, and trade, hence playing a significant role in the national economy (Basit, 2020). Employment in the fisheries sector has grown rapidly, especially in Asia, where over 85% of the world's fisherfolk live (Pinzon-Espinosa, 2018). There are several types of marine fisheries, like Demersal fisheries (cod, haddock), Pelagic fisheries (tuna, mackerel), Crustacean fisheries (shrimp, crab), Mollusk fisheries (oysters, mussels), which provide food security, livelihoods and economic benefits to the people especially the coastal communities (Shah, et al. 2018). Nowadays marine fishery is facing a number of challenges such as overfishing, habitat destruction, climate change, and bycatch and discarding which results in the depletion of fish stocks, degradation, ocean acidification and catching non-target species (Basit, 2020). To overcome these challenges marine fisheries, need to formulate management policies and regulations, marine protected areas (MPAs), sustainable fishing practices and international cooperation and agreements under the guidance of Food and Agriculture Organization (FAO), and Regional Fisheries Management Organizations (RFMOs) (FAO, 2024).

Pakistan has a coastline of more than 1000 km long, located in north of the Arabian Sea and from its south-east border, with the Sindh coast, it extends from Iran to India, and in north-west to the Balochistan coast. The inland fish resources are 3,102,408 ha (Shah, et al. 2018) The Exclusive Economic Zone (EEZ) of Pakistan spreads over an

area of 240,000 sq. km (Minton, Kahle, & Kim, 2015). The Jiwani, Gwader, Pasni, Kalmat, Ormara, and Sonmiani bays are the major fish landing areas in Pakistan. Hayat, (1999), FAO, (2017), Shahzad, (2020). Fishing in Pakistan accounts for less than one percent of the GDP which is about 70 % of the total fish export. Fishing sector of the country is playing a crucial role in developing the economy by providing employment to a large number of people residing in poor societies of coastal areas of Balochistan and Sindh (Khan, 2020). During financial year 2023-24, total fish production reached 720.9 m tones (410.9 m tones from marine fisheries and the reminder from inland fisheries) with a sectoral share of 1.30 %, showing an increased growth rate of 0.81 % against 0.60 % during the last year (Economic Survey of Pakistan, 2024). The major threats to sustainability of marine fisheries of the country are overfishing, habitat destruction, climate change, illegal and unreported fishing, overexploitation, coastal pollution, increase in salinity, etc., resulted in the depletion of fish stock and threat to the marine ecosystem (Basit, 2020). For long-term viability and to reduce the pressure on fish population, Fisheries department of the country along with the cooperation of public and private sectors, should take some conservation efforts for the interventions in all weekend areas, such as rules & regulation, technology development, marketing, human resource, sustainable fishing practices, marine protected areas establishment and aquaculture protection (SMEDA, 1999). Therefore, this project is designed to enhance the knowledge and awareness of the public about marine fisheries and its positive and negative impacts on the community by gathering the data about marine fisheries and its related aspects from 1980 -2024.

Materials and methods

Data acquired in this research will be collected from different local and international sources such as research articles, published reports, project reports, scientific reviews etc. In this project data will be gathered by getting information of marine fisheries and its related activities during the period 1980-2024 (Shah, et al. 2018). To mitigate negative impacts and enhance positive impacts, few suggestions for improving, promoting, and extending the sustainable fisheries will also be highlighted (Fisheries, 2022).

Marine fisheries data

Aspects of Marine Fisheries were reviewed by Simon, et al. (2001), Garcia, & Cochrane (2005), Emma Hatfield, (2009), FAO, (2019), Gordon, (2019), IPCC, (2019), William, et al. (2021), Slovene Guggisberg. (2022), & Pitcher, (2024). Brief of aspects, is shown in table. 1

Table. 1 Aspects of Marine Fisheries

Aspect	Description
Biological	To menage fisheries sustainable understanding of fish population, its habitats and ecosystem is essential
Ecological	Impact of fishing on marine ecosystems and biodiversity are studied
Economic	Financial aspects of fish industry, such as revenue, costs, and market trends are analyzed
Social	Examining the human dimensions of fisheries, including community impacts, livelihoods, and food security.
Technological	Developing, improving and implementing fishing gear, vessels, and monitoring systems
Management	Policies, regulations and enforcement to ensure sustainable fishing practices
Conservation	Protecting marine habitats, preventing overfishing, and promoting eco-friendly fishing methods.
International	Addressing global fisheries issues through cooperation, agreements, and organizations
Monitoring and enforcement	Tracking fishing activities, enforcing regulations, and preventing illegal fishing.
Research and development	Continuously improving our understanding of marine fisheries through scientific research and innovation

Source: Simon et al. (2001)

History of Marine Fisheries

The history of marine fisheries highlights the evolution from ancient subsistence fishing to modern industrialized fisheries, sustainable management and conservation. It spans thousands of years, with evidence of ancient methods of harvesting fish and the use of seafood for food, trade, and cultural purposes. Dietrich, & Lundbeck, (1992), Grafton et al. (2010), Garcia et al. (2014), Friedlander, et al. (2015), & Konrad, (2017).

Table 2: Brief history of marine fishery

Period	Duration	Description
Prehistory	10000 – 4000 BCE	Early humans fished for survival, using simple gear like hooks, lines, and nets.
Ancient Civilization	4000 – 500 CE	* Egyptians, Greeks, and Romans fished for food and commerce * Advanced fishing techniques and gear emerged, like trawls and fish traps
Medieval period	500 – 1500 CE	* European fisheries developed, with monasteries and guilds playing key roles

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		* Cod fisheries in North Atlantic became significant
Age of Exploration	1500 – 1700 CE	* European powers established fisheries in new regions, like North America and Asia * Emerging new fishing technologies, like longlines and trawls.
Industrialization	1700 – 1900 CE	* Steam powered vessels and mechanized gear increased fishing efficiency * Fisheries expand globally, with new species targeted
Modern Era	1900 – 1980 CE	* Post-World War II technological advancement led to overfishing and resource depletion. * Fisheries management and conservation efforts began.
Contemporary Era	1980 - Present	* International cooperation and agreements aim to address global fisheries challenges. * Sustainable fishing practices, eco-labelling, and marine protected areas gain prominence

Source: Garcia et al. (2014)

Marine Fisheries in Global Perspective

Marine fishery in the USA is a significant sector, providing food security by supplying protein-rich food to millions of people, and employment to more than 50,000 people who are engaged in fishing and fishing related activities. Economically marine fishery also contributes to the USA's GDP and foreign exchange earnings (NOAA, (2019). The USA has a vast coastline along the Atlantic, Pacific, Gulf of Mexico, and Arctic oceans and produces 2.5 million metric tons of fish annually. Over 20,000 fishing vessels operate in US waters, which act as a home of a diverse range of marine species. (NOAA, (2020). The National Oceanic and Atmospheric Administration (NOAA) control the fish industry by the implementation of the Magnuson-Stevens Fishery Conservation and Management Act. (NOAA, (2007). US marine fisheries face challenges like overfishing, habitat degradation, climate change, bycatch and discarding, quota management and enforcement (NOAA, 2019). To address these challenges, NOAA and regional fisheries management councils have implemented measures such as: catch limits and quotas, marine protected areas (MPAs), fisheries management plans, monitoring and enforcement of fishing rules, and promoting sustainable fishing practices (NOAA, 2019).

In Australia marine fisheries playing a vital role in country's GDP and foreign exchange earnings, it also provides food security by supplying protein rich food and job opportunity to more than 17,000 people. Australia has a vast coastline of about 25760 km and an Exclusive Economic Zone of nearly 11 million km^2 along the Indian, Pacific, and Southern Oceans and produces around 335,000 metric tons of fish annually (Amara, 2020). More than 31000 domestic commercial vessels operating in the Australian water and about 7000 manpower is engaged in it. (AMSA, 2020). Australian marine fisheries are managed by the Australian Fisheries Management Authority Act, (AFMA, 1992). Australian marine fisheries are facing the same issues as the USA, i.e., overfishing, habitat degradation, climate change, bycatch and discarding and quota management and enforcement. To address these challenges, AFMA and regional fisheries management bodies have implemented measures like, catch limits and quotas, marine protected areas (MPAs), fisheries management plans, monitoring and enforcement and promoting sustainable fishing practices. (AFMA, 2018).

In European Union (EU) countries, marine fishery industry provide employment to over 160,000 people, food security to millions of people in shape of fish and fish products, and economically it is also contributing in Europe's GDP and foreign exchange earnings (Eurostat,2024). Europe has a vast coastline along the Atlantic, Mediterranean, and Baltic seas. The longest maritime territory of the world is located in the EU. It has a coastline of about 68000 km long and if the European Economic Area member countries i.e. Norway, Iceland and Turkey are included then it became 185000 km long. It produces around 5 million metric tons of fish annually. More than 70,000 fishing vessels are operating in European waters which serves as shelter to a diverse range of marine species. The European marine fisheries facing the challenges like overfishing, habitat degradation, loss of biological diversity, climate change, discarding and bycatch, quota management and pollution from aquaculture, and tourism in coastal areas. EU countries overcome these challenges by applying a wide range of policies and initiatives under the heading of European Union's Common Fisheries Polices (CFPs) such as Marine Strategy Framework Directive (MSFD), Water Framework Directive (WDF), 2020 Biodiversity Strategy, Common fisheries policy (CFP), Blue Growth, Integrated Maritime Policy, Paris Agreement on Climate Change, Urban Waste Water Treatment Directive (UWWTD), etc. (EEA, 2020).

In India marine fisheries provide food security, employment to 1.5 million people in fishing and

fishing related activities, and it has 1.07 % share in India's GDP and foreign exchange earnings (Soibam, 2020). India has vast coastline of 8129 Km long and an Exclusive Economic Zone about 2.02 million km2, with 9 maritime territories and 4 union councils (Ashish & Singh, (2022). It produces around 5.5 million metric tons of fish annually. Over 200,000 fishing vessels are operating in Indian waters which provide home to a rich variety of marine species, including sharks, rays, croakers, tuna, finfish, prawns, lobsters, crabs, etc. (Pailli & Ganga, 2010). Fisheries management in India has implemented various policies and regulations to manage fisheries sustainability, and other challenges like overfishing, habitat degradation, and climate change etc. (Shyam & Anuja, 2022).

Marine Fisheries in Pakistan

Marine fishery in Pakistan is a vital sector which provides food security and shelter to millions of people. More than 200,000 people are engaged in fishing industry, and it has a share of 1% in the total GDP of the country, and it also take part in foreign exchange earnings (Kiran, et al, (2015), Ahmad, (2017). Pakistan has a coastline of more than 1000 km along the Arabian Sea with an Exclusive Economic Zone (EEZ) of about 240,000 km^2 and producing around 600,000 metric tons of fish annually (FAO,2017). There are more than 29,000 fishing vessels operating in sea waters which provide shelter to a diverse range of marine species, including fish, prawns, lobsters, and crabs (Hayat, 1999). Various policies and regulations are implemented to manage fisheries sustainability in the country by Ministry of Maritime Affairs (M/OMA) and Ministry of Food, Agriculture and Livestock (MINFAL). Some major marine fishery coasts in Pakistan are mentioned by Hayat, (1999), FAO, (2017), Shahzad, (2020) as under:

1. Sindh coast fisheries (Karachi, Koragi, Thatta)
2. Balochistan coast fisheries (Gwadar, Jiwani)
3. Makran coast fisheries (Ormara, Pasni)
4. Rann of Kutch fisheries from Badin to Tharpakar district.

Marine fisheries of the country are facing problems like overfishing, habitat degradation, coastal and marine pollution, climate change, and lack of infrastructure and resources. In addition to these there are other challenges such as, incorporation of small- scale fisheries, lack of technologies, deficiency of institutional development, no infrastructure, insufficient skilled human resource, and least responsiveness among fishing societies, Hayat, (1999), Shazad, (2022). To cope with these challenges, marine fishery departments i.e. Ministry of Maritime Affair and The Ministry of Food, Agriculture and Livestock (MINFAL) along with the collaboration of regional fishery authorities of Pakistan, are trying to enhance fisheries management, promote sustainable fishing practices, invest in fisheries research and development, awareness and training of fishers, improve infrastructure and facilities for fishing and processing, and encourage international cooperation and collaboration (Wasim, 2004).

Impact of marine fisheries on communities

Most of the coastal communities, 37 % of the world population, depend on the fishing and fish industry for food, income and their livelihoods. Women of coastal areas are usually involved in processing and marketing of fish and fish products. With an increase in population and pressure of climate change, sustainable fishing provides an important safeguard to millions of people around the world. Most of fishery workers belong to developing countries, 77% are from Asia, followed by 16% from Africa, 5%from Latin America and the Caribbean, and the remaining 2% spread across North America, Europe and Oceania (UNFAO, SOFIA report 2024). According to Marine Stewardship Council (MSC) Report, 3.2 billion people of the world get their 20% daily animal protein intake from fish, 33 million people are directly involved in the fisheries sector, while 7.3% of the world population depends on fisheries for their livelihood (MSC, 2024). The impact of marine fisheries on communities can be both positive and negative. Marine fisheries impacted positively by providing a source of protein-rich food for millions of people, create jobs and income generating opportunities for fishers, processors, and traders. It contributes to local and national economies through exports and tourism. Fisheries are often an integral part of cultural heritage and identity of coastal communities. Moreover, seafood is a rich source of essential nutrients, improving health and well-being of the people (Shazad, 2022).

Negative impacts of marine fisheries are due to excessive fishing which resulted in declining of fish stocks, threatening to food security and livelihoods. Environmental degradation occurs due to fishing gear and practices that can harm marine habitats and ecosystems. Sometime non-target species are caught and discarded, resulting in wasting of resources and harming the ecosystems. Fisheries can lead to conflicts over resources and displacement of traditional fishing communities and fishers may face health risks from accidents, exposure to elements, and chemical contaminants, Woodhead, et al. (2018), Sanna, et al. (2024).

Overall Impacts

Impact on Environment

Environmental impact from marine fisheries have been described by Gislason, (2003) and Kaiser et al., (2003). They observed that capture fisheries impact specifically on target resources, and when fisheries are poorly controlled, fishing capacity increases

which leads to overfishing that effects the ecosystem socially and economically. Climate change effect the water temperature and pH which impact on the marine fishery's distribution and productivity, Bimal, & Rashid, (2016).

Impact on Marine Ecology

Impact of marine fisheries on ecology was studied by Dayton, et al. (1995), USNRC, (1998) Agardy, (2000), Gislason, (2003), Crowder, et al. (2008), Mustafa, et al. (2013), Eike set, et al. (2014). They described that the fisheries exploitation affects not only the ecological processes, but sometime the entire ecosystems altered. The effects of ecological processes can be better observed in aquatic systems only. The habitats of bottom topography may disturb or destroyed due to the impact of marine fishery. Various human activities such as, aquaculture installations, addition of artificial structures, heavy metals, pesticides, drugs etc., in sea water, may cause harm to the habitat ecology. Some aspects of fisheries like ill managed fishing techniques, pollution of fishing plants, plastic debris, loss of fishing gear, etc., have significant and long-lasting effects on marine ecology. Poorly-managed coastal area mariculture contaminated with food residues, waste and waste products, plastic material, antibiotics, hormones, etc., can damage the coastal ecosystems badly (Zahou, et al. 2010).

Economic impact of Marine fishery

Marine fishery has a major contribution in national economy of a country. It provides jobs to millions of people in fishing, processing, distribution, marketing as well as indirect jobs in boat construction and maintenance companies. This sector also generates revenue by exporting seafoods and other marine resources to the international market and has a significant share in the GDP of a country. By offering an important source of animal protein, marine fishery plays a crucial role in food security of developing countries. The livelihoods of coastal communities and their economic well-being, depends on fishing and its related activities. Efficiency and environmental conservation of marine fisheries can also be promoted by economic investments in new fishing techniques, aquaculture practices and sustainability measures. Vibrant marine fisheries of coastal region attract tourists who participate in recreational fishing, seafood cuisine, and cultural festivals hence raise the income of local community, Nazir, et al. (2015), Ahmad, (2017), WWF, (2019), Akbari, et al. (2023), Salma, (2022).

Impact on Biodiversity

Overfishing depletes the target species which lead to decline in fish population and ultimately extinction may occur. Sometime non-target species are caught and then discarded which contribute to decline in fish population. Fishing gear, damage or destroy the habitats such as coral reefs or seagrass beds. Trophic level change, causes removal of key predators that can alter the food webs and ecosystem dynamics. Introduction of invasive species through fishing gear and vessels can harm the biodiversity. By controlling the herbivore or predator populations, marine fishing can maintain the trophic balance which redistribute the nutrients, benefited for other species, through the ecosystem, USNRC, (1998), Agardy, (2000), Worn, et al. (2006), IPBES, (2019), MSC, (2024).

Impact on health of Human community

Seafood is a rich source of animal protein, essential amino acids, omega-3 fatty acids, vitamins (Vit. A) and minerals like calcium, iron and zinc, Vergis, et al. (2019), Shahzad, (2022). It has been seen that the heart diseases and stroke can be reduced by the use of seafood. Omega-3 fatty acids in seafoods improve the cognitive function and early hood development, maternal health during pregnancy and lactation is also improved by the consumption of fish. Marine fishery not only provide animal protein to millions of people, but it also improves the food security and reduce the malnutrition. Seafood can contain pollutants like mercury, polychlorinated biphenyls (PCBs), and dioxins, which can harm human health. Sometime seafood is contaminated with pathogens like Salmonella, Vibrio, and Norovirus, which causes food borne illnesses. Certain types of seafood cause adverse reactions in allergic or intolerant persons and sometimes cause occupational health risks due to accidents, exposure to elements and chemical contaminants. To ensure that marine fisheries provide a healthy and sustainable source of nutrition to our new generations, we should monitor the pollutant levels in the sea, implement practices for safe handling and storage of seafood, promote sustainable fishing practices, support fisheries management and promote research and educate consumers about seafood safety and nutrition, Woodhead, et al. (2018), Vergis, et al. (2019), MSC, (2024).

Conclusion

Marine waters are very fertile for every type of commercial fishery. Marine fishery is facing number of challenges such as the environment effects, pollution, climate change factors, and the fishing itself. Fisheries overexploitation results in decreasing production of capture fisheries, damaging the ecosystem as a whole. For the maintenance of sustainable fisheries of a country, continued efforts of marine fishery sector are necessary. In Asian countries, some other problems are also faced by fishery management, i.e. limited research on management of sustainable fisheries, qualified human resource in commercial fishery, shortage of training institutions, limited investigation about offshore deep-water fishing, non-availability of technologies to reduce coastal pollution. For sustainable development of fishery sector in the

country and **to** meet such challenges, modern and upgraded aquaculture infrastructure with improved management policies is required.

Recommendations

Impact of marine fisheries can be reduced by sustainable fishing practices and ecosystem-based fisheries management such as catch limits and quotas, marine protected areas, fishing gear innovations, ecosystem monitoring and research, fisheries management plans, eco-labeling and certification, fisheries observer programs, bycatch reduction devices, habitat restoration, climate-smart fisheries management. To ensure that marine fisheries provide a healthy and sustainable source of nutrition to our new generations, few recommended steps are monitor and regulate pollutant levels, implement safe handling and storage practices, promote sustainable fishing practices, support fisheries management and research and educate consumers about seafood safety. The marine fishery authorities should take steps to control the illegal fishing practices, the number of fishing vessels, trawler mesh size of the net, growth of small fish, and improvement of the institutional structure for marine fisheries. Fishery management should control the entry of wasteful deployment of capital, labor, and equipment in marine fisheries. For sustainable fisheries in the country, marine fishery research institutes should improve their systems of data collection, analysis procedures, and distribution for making policy decisions. The public sector should ban the illegal fishing in the spawning seasons and also ensure the reduction of bycatch or discard fish problems. A comprehensive national program may be launched that determines the habitats suitable for fish reproduction, their growth and how they can be protected.

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