

Current Issues with Fish and Fisheries Sector: Challenges and Solutions

Harshita Singh¹, Devarshi Ranjan^{2*}, Priyanka Verma³, Aditya Kumar Upadhyay⁴, Pramod Kumar⁴ and Anil Singh⁵

¹Dept. of Fisheries, Livestock and Fisheries Coordinator, SPPIF, Government of Odisha, Kalahandi, Odisha (766 110), India

²Dept. of Aquaculture, College of Fisheries, Dr. Rajendra Prasad Central Agricultural University, Dholi, Muzaffarpur, Bihar (843 121), India

³Dept. of Fisheries Resource Management, College of Fisheries, Dr. Rajendra Prasad Central Agricultural University, Dholi, Muzaffarpur, Bihar (843 121), India

⁴Dept. of Aquatic Environment Management, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab (141 004), India

⁵Dept. of Aquaculture, College of Fisheries, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh (224 229), India



Open Access

Corresponding Author

Devarshi Ranjan

✉: devarshiranjan508@gmail.com

Conflict of interests: The author has declared that no conflict of interest exists.

How to cite this article?

Singh *et al.*, 2024. Current Issues with Fish and Fisheries Sector: Challenges and Solutions. *Biotica Research Today* 6(1), 39-45.

Copyright: © 2024 Singh *et al.* This is an open access article that permits unrestricted use, distribution and reproduction in any medium after the author(s) and source are credited.

Abstract

The fish and fisheries sector plays an important role in global food security, employment and economic development. At now, with a total production of 214 million tonnes in fisheries and aquaculture, including 178 million tonnes of aquatic animals and 36 million tonnes of algae, these sectors are making an important contribution to ensuring global food security. Moreover this sector also provides employment to millions of peoples directly or indirectly and also generated higher assets. With 16.24 million tonnes of fish production in India, the sector contributes 1.1% to the Indian economy. Also the sector has become the third largest fish producing country with a contribution of 8% to the global fish production and ranks second in aquaculture production. But in present this sector faces environmental threats (overfishing, habitat destruction and climate change), economic challenges (market fluctuations, IUU fishing and limited access) and social issues (food security, gender inequality and community displacement) around the world. Therefore, to solve these challenges, a holistic approach such as sustainable fisheries management practices, climate change adaptation strategies and collaborative efforts involving governments, the fishing industry, scientists and local communities is required that may be helpful in reducing these problems. This article highlights the interconnected nature of the challenges faced by the fish and fisheries sector and underlines the appropriate step to protect this important resource for food safety, livelihood and environmental protection.

Keywords: Challenges, Economic, Employment, Fish and fisheries, Food security, Holistic approach

Introduction

The fish and fisheries sector is a dynamic industry which not only sustains livelihood but also contributes significantly to the national economy (Chu and Karr, 2017). Ignoring all this, mankind is nowadays over-exploiting natural resources,

due to which the fish and fisheries sector is currently facing various problems, including the decline in fish populations and the possibility of extinction. These issues span the environmental, economic and social spheres, casting a long shadow over the future of fish industry. As we delve into the complexities of these challenges, it becomes clear

Article History

RECEIVED on 30th October 2023

RECEIVED in revised form 23rd January 2024

ACCEPTED in final form 28th January 2024

that they are interconnected; hence a holistic approach is needed to address them effectively. On the environmental front, the threat of overfishing looms, with fish populations declining at an alarming rate due to increasing demand and unsustainable practices. Habitat destruction, driven by coastal development and industrial fishing practices, exacerbates the problem and disrupts fragile marine ecosystems. Climate change has exacerbated these issues, causing warmer waters, ocean acidification and changing migration patterns, posing significant threats to both fish stocks and the communities that depend on them (Akbari et al., 2023). In the economic realm, the fish and fisheries sector face a range of challenges, including market volatility, the scourge of illegal, unreported and unregulated (IUU) fishing and inequitable access to resources. Market fluctuations and consumer preferences can lead to financial instability for fishers and industry stakeholders, while IUU fishing, often driven by profit-seeking entities, undermines conservation efforts and exacerbates resource depletion. Limited access to fishing rights and resources disproportionately affects small-scale fishers and indigenous communities, perpetuating

economic disparities (FAO, 2023). Socially, the sector grapples with issues of food security, gender inequality and the displacement of coastal communities. Reduced fish stocks can trigger food shortages in communities heavily reliant on seafood, while gender disparities persist, with women often facing barriers to resource access and decision-making roles. The looming threats of climate-induced sea-level rise and industrial development have the potential to displace coastal communities, leading to the loss of traditional livelihoods and cultural heritage (Griggs and Reguero, 2021). Therefore, there is an urgent need for a coordinated and multi-pronged approach to effectively deal with these challenges. A strong and resilient population in the wild is necessary for a sustainable fishery. Sustainable fishing practices, improved fisheries management, enhanced enforcement of regulations and equitable resource distribution are essential components of the solution (Pinsky et al., 2013). Additionally, integrating climate adaptation and mitigation strategies is paramount to safeguarding both fish populations and the livelihoods of those who depend on them.

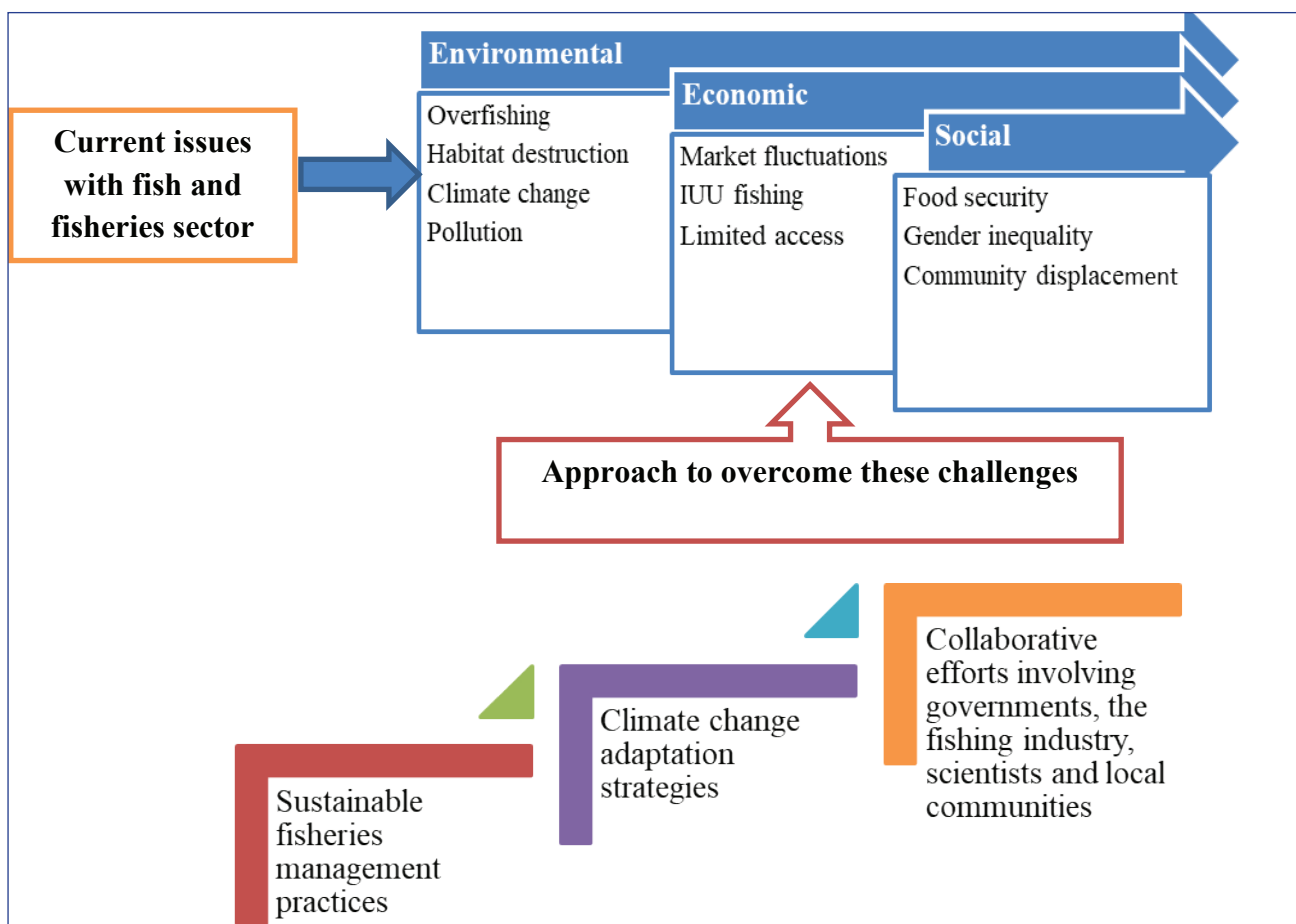


Figure 1: Current issues and approaches in fish and fisheries sector

Current Issues in Fish and Fisheries Sector and Their Solutions

1. Overfishing and Depleted Fish Stocks

Overfishing refers to the excessive harvesting of fish from a specific body of water, surpassing the sustainable levels that allow fish populations to replenish and maintain their natural

balance. This problem has become even more serious due to the increasing global demand for seafood. Overfishing not only threatens the sustainability of fish stocks but also disrupts the balance of marine ecosystems. Fish populations play crucial roles in maintaining the health of oceans by controlling prey species and promoting biodiversity. When these populations decline, it can have cascading effects

throughout the food web (Link and Watson, 2019).

Overfishing is driven by various factors, including increased global demand for seafood, technological advancements in fishing methods and a lack of effective fisheries management. Over time, overfishing has led to the depletion of numerous fish stocks, threatening both the ecological balance of marine ecosystems and the livelihoods of communities reliant on fishing (Link and Watson, 2019). They disrupt marine food chains, leading to imbalances within ecosystems. For example, the decline of certain predator species can result in an explosion of their prey species, which can in turn negatively impact other parts of the food web. Additionally, some overfished species play critical roles in maintaining the health of coral reefs, kelp forests and other habitats (Sumaila and Tai, 2020). Effective solutions to address overfishing include implementing science-based catch limits, enforcing regulations to prevent the capture of undersized fish and reducing bycatch (unintended capture of non-target species). Sustainable fisheries management practices, such as the establishment of marine protected areas and seasonal fishing closures, can also help rebuild fish populations (Sumaila and Tai, 2020).

2. Habitat Destruction and Ecosystem Impacts

Habitat destruction in the fisheries sector often results from activities like coastal development, bottom trawling and the use of destructive fishing practices (Wilson *et al.*, 2010; Ranjan *et al.*, 2023a). These practices harm critical marine habitats such as coral reefs, seagrass beds and mangrove forests. The destruction of these habitats not only diminishes their ecological value but also reduces fish breeding and nursery areas. Healthy marine ecosystems are essential for maintaining fish populations and the overall health of the ocean (Wilson *et al.*, 2010). The destruction of habitats has cascading effects on marine ecosystems. For example, the loss of coral reefs can reduce the availability of shelter and food for various marine species, leading to declines in biodiversity. The degradation of mangrove forests can result in reduced protection from coastal erosion and storm surges. Protecting critical habitats is essential for the long-term health of fisheries. Conservation efforts can include the creation of marine protected areas, zoning regulations that restrict destructive activities and initiatives to restore damaged habitats (Blankespoor *et al.*, 2017).

3. Climate Change

Climate change is altering the dynamics of the world's oceans in ways that profoundly affect fisheries. Due to rising ocean temperatures, fish move to new areas in search of suitable temperatures and cause occurrence of alien species in that area (Ormerod, 2003). This can disrupt established fishing patterns, leading to uncertainty for fishers who rely on predictable fish movements (Muhala *et al.*, 2021). Ocean acidification, caused by increased carbon dioxide absorption by the oceans, affects the ability of marine organisms to build calcium carbonate shells and skeletons. This can harm species like molluscs and corals, with potential ripple effects throughout the food chain (Kroeker *et al.*, 2013; Ranjan *et al.*, 2023b). Adaptation to climate change in the fisheries sector

may involve diversifying catch species, modifying fishing gear or methods and engaging in seasonal fishing to account for changing migration patterns. Mitigation strategies can include reducing greenhouse gas emissions from fishing vessels and supporting policies that address climate change at a broader scale (Kroeker *et al.*, 2013).

4. Pollution

Pollution in the fisheries sector is a multifaceted problem encompassing various forms of contamination, including chemical pollutants, nutrient runoff, plastic debris and other contaminants. The increasing availability of pollutants in aquatic ecosystems has raised concerns about the potential impact on food security and diversity of aquatic life. Even the most important and productive coral reef ecosystems, which sustain a diverse range of marine animals and provide essential ecosystem services to humans, are increasingly being impacted and destroyed (Debnath *et al.*, 2022). The Ganges river dolphin (*Platanista gangetica gangetica*), that is considered an indicator of ecosystem health in river basins, is also being significantly affected by pollution and climate change (Ranjan *et al.*, 2023c; Kelkar *et al.*, 2022). Therefore addressing pollution in the fisheries sector requires comprehensive strategies that involve regulatory measures, sustainable fishing practices and international cooperation. By understanding and mitigating the impacts of pollution, we can strive to ensure the long-term viability of fisheries and the well-being of both marine and freshwater ecosystems and the communities dependent on them.

5. Illegal, Unreported and Unregulated (IUU) Fishing

The term "illegal, unreported and unregulated" (IUU) fishing is broad and encompasses a wide range of fishing practises. In both high seas and regions within national control, unlawful, commercial and recreational fisheries are involved in IUU fishing. IUU fishing refers to fishing activities conducted outside the bounds of national and international regulations. It includes unreported catches, underreported catches and activities conducted without proper authorization. IUU fishing undermines conservation and management efforts, as it often leads to overfishing and the depletion of fish stocks. It also poses economic challenges, as legitimate fishers face unfair competition from IUU operators. Combating IUU fishing requires a multifaceted approach. This includes strengthening enforcement mechanisms, enhancing transparency in seafood supply chains and fostering international cooperation to track and penalize illegal operators (Temple *et al.*, 2022).

6. Economic Challenges in Fisheries

Economic challenges in the fisheries sector result from various factors, including market volatility, subsidies and trade agreements. Fish prices can fluctuate significantly due to factors such as changes in consumer preferences, supply and demand dynamics and geopolitical events. These fluctuations can have a direct impact on the income and financial stability of fishers and industry stakeholders (Akbari *et al.*, 2023). Subsidies provided to the fishing industry can distort market dynamics and encourage overfishing it means "Giving the fishing sector subsidies has

the potential to manipulate market dynamics and promote overfishing". These subsidies may include fuel subsidies, vessel construction grants, or direct payments to fishers. Trade agreements can also affect the economics of fisheries by influencing the flow of seafood products between countries in a simple way. These subsidies could take the form of grants for building vessels, fuel subsidies, or cash rewards to fishermen. Trade agreements can impact the flow of seafood products between nations, which in turn can impact the profitability of fisheries (Ayisi et al., 2023). Addressing economic challenges may involve measures such as diversifying income sources for fishers, promoting sustainable fisheries management and reforming subsidies to align with conservation goals and managing the economy necessitates a holistic approach that takes into account the complex interplay between environmental and economic factors. Encouraging sustainable fisheries management, reforming subsidies to align with conservation goals and providing fishermen with alternative income sources are integral steps toward achieving a more balanced and resilient economy. By embracing these principles, societies can promote the responsible use of marine resources, safeguard the livelihoods of fishing communities and ensure long-term economic prosperity while protecting the environment.

7. Resource Access and Equity

Inequitable access to fishing rights and resources is a significant issue within the fisheries sector. Historically, certain groups, often larger commercial operations, have had preferential access to resources, while small-scale fishers and indigenous communities may face barriers to entry. This inequity can perpetuate poverty and social disparities. Small-scale fishers, who often rely on fishing for their livelihoods, may find themselves marginalized and vulnerable to economic shocks (Furman et al., 2023). Strategies to promote equitable resource access may include implementing community-based fisheries management, redistributing fishing rights and recognizing and respecting indigenous fishing rights. Empowering marginalized groups is essential for achieving a more equitable and sustainable fisheries sector.

8. Social and Cultural Impacts

Fisheries often have deep cultural and social significance for coastal communities. The potential displacement of these communities due to climate change or industrial development can lead to the loss of traditional livelihoods and cultural heritage. This displacement can result in social and economic challenges for affected communities. Displacement can result in the loss of traditional livelihoods, cultural heritage and the disruption of longstanding community ties. It can also lead to challenges related to housing, employment and the preservation of cultural practices (Zamzami et al., 2020). Addressing social and cultural impacts may require measures such as supporting community-led adaptation strategies, providing alternative livelihood options and ensuring that the voices and rights of affected communities are considered in decision-making processes.

9. Food Security and Nutrition

Fish are a crucial source of protein and nutrition for many communities, particularly in regions where alternative protein sources are limited. Reduced fish stocks can lead to food shortages and malnutrition, affecting the health and well-being of populations that rely heavily on seafood as a primary food source. The loss of access to fish can have immediate and long-term consequences for food security, with potential impacts on physical and cognitive development, particularly in children (Belton and Thilsted, 2014). Addressing food security and nutrition challenges involves both short-term measures, such as food aid and nutritional support and long-term strategies aimed at rebuilding fish stocks sustainably and promoting diversified food sources.

10. Gender Equality and Women in Fisheries

Gender disparities persist within the fisheries sector, with women often having limited access to resources and decision-making roles. Empowering women in fisheries is essential for achieving sustainable and equitable outcomes. Strategies may include promoting gender-inclusive policies, training opportunities and support for women's participation in fisheries management. However, women also play crucial roles in fisheries, including in post-harvest processing, marketing and small-scale fishing. Recognizing and empowering women in the sector is not only a matter of gender equality but also a practical strategy for enhancing the sustainability and resilience of fisheries. Strategies to address gender disparities may include promoting women's participation in fisheries management, providing training and capacity-building opportunities and ensuring that women have equal access to resources and benefits (Mangubhai et al., 2022).

Major Actions and Practices to Deal with Current Issues in the Fish and Fisheries Sector

1. Conservation and Sustainable Practices

Conservation and sustainable practices are critical for rebuilding fish stocks and maintaining healthy marine ecosystems. These strategies aim to protect fish populations, preserve ecosystems and promote long-term sustainability (Kenny et al., 2018). Conservation and sustainable practices includes:

- **Marine Protected Areas (MPAs):** Establishing MPAs in key marine habitats to protect critical species and habitats from exploitation.
- **Sustainable Fishing Practices:** Promoting methods that minimize environmental impacts, reduce bycatch and target healthy fish populations.
- **Reducing Bycatch:** Implementing strategies to reduce the accidental capture of non-target species, such as sea turtles, marine mammals and seabirds.
- **Responsible Aquaculture:** Encouraging sustainable practices in aquaculture to reduce pressure on wild fish stocks.
- **Selective Fishing Gear:** Developing and using gear that

minimizes damage to the seabed and reduces bycatch.

- **Ecosystem-based Management:** Taking a holistic approach to fisheries management that considers the interconnections between species and habitats.

2. Adaptation and Mitigation Strategies for Climate Change

Adapting to climate change in the fisheries sector involves adjusting fishing practices and management strategies to cope with changing conditions. For example:

- **Shifts in Target Species:** Fishers may need to adapt by targeting different species that have moved due to changing temperatures and migration patterns.
- **Diversification:** Fishers and communities may diversify their livelihoods to reduce dependence on fishing alone.
- **Ecosystem-based Management:** Recognizing that climate change impacts are not limited to a single species, but can affect entire ecosystems.

Adaptation and mitigation strategies aim to reduce the sector's contribution to climate change. This includes reducing greenhouse gas emissions from fishing vessels, improving energy efficiency and adopting sustainable fuels and practices (Mozumder *et al.*, 2023).

3. Policy and Governance

Effective fisheries management policies and regulations are fundamental to sustainability. This includes:

- **Science-based Management:** Using scientific data to set catch limits and quotas that align with the health of fish populations.
- **Enforcement:** Ensuring that regulations are enforced to prevent illegal activities like overfishing and IUU fishing.
- **Collaboration:** Encouraging collaboration between governments, industry stakeholders and non-governmental organizations to develop and implement effective policies.
- **Adaptive Management:** Continuously evaluating and adjusting policies as new information becomes available.

International agreements and organizations, such as the United Nations' Food and Agriculture Organization (FAO) and regional fisheries management organizations, play a critical role in governing global fisheries. Effective fisheries management policies and regulations are essential for sustainable practices. This topic involves analysing the strengths and weaknesses of existing policies, exploring regulatory frameworks at different levels (local, national, international) and assessing the role of governmental and non-governmental organizations in governance.

4. Technological Advancements and Innovation

Technology can play a significant role in addressing fisheries challenges. Innovations like satellite monitoring, blockchain for traceability and advanced fishing gear can improve transparency, reduce illegal fishing and enhance sustainability in the sector (Fujii *et al.*, 2017). Innovations include:

- **Satellite Monitoring:** Satellite technology can be used to monitor vessel movements, track fishing activities and

enforce fishing regulations.

- **Blockchain and Traceability:** These technologies can improve transparency in seafood supply chains, reducing the risk of IUU fishing and seafood fraud.
- **Advanced Fishing Gear:** Innovation in gear design can minimize environmental impact and reduce bycatch.
- **Data Analytics:** Using data analytics to make informed decisions about when and where to fish, optimizing catch efficiency while minimizing ecological impact.

5. Community Engagement and Stakeholder Collaboration

Successful fisheries management often requires collaboration among various stakeholders, including fishers, scientists, policymakers and NGOs. Engaging communities in decision-making processes can lead to more sustainable and locally relevant solutions. Key aspects of community engagement and collaboration include (Pita *et al.*, 2010):

- **Participatory Management:** Involving local communities in the design and implementation of fisheries management plans.
- **Scientific Collaboration:** Promoting collaboration between scientists and fishers to improve data collection and understanding of local ecosystems.
- **Transparency:** Ensuring that all stakeholders have access to relevant information about fisheries management decisions.
- **Conflict Resolution:** Addressing conflicts that may arise among different stakeholder groups, such as commercial fishers, recreational fishers and conservation organizations.

6. Future Outlook and Solutions

This section summarizes potential solutions and policy recommendations to address the current issues in the fish and fisheries sector. It also considers the long-term outlook for the sector, emphasizing the importance of sustainable practices for its continued viability. The future outlook for the sector depends on:

- **Policy Reform:** Implementing and enforcing policies that prioritize sustainability, equity and the long-term health of fisheries.
- **Technological Advancements:** Harnessing technology to improve monitoring, traceability and sustainability.
- **Climate Resilience:** Developing strategies to adapt to and mitigate the impacts of climate change.
- **Community Empowerment:** Ensuring that local communities have a voice in decisions that affect their fisheries.
- **Global Cooperation:** Collaborating at international levels to manage shared fish stocks and address global challenges like IUU fishing and climate change.

Conclusion

In conclusion, addressing the current issues in the fish and fisheries sector requires a comprehensive and collaborative effort from governments, industries, communities and individuals. Sustainable management practices, technological innovations, community involvement and international cooperation are key components of a successful strategy.

Additionally, recognizing the interconnectedness of climate change, habitat preservation and pollution control is crucial for ensuring the long-term health and viability of the world's fisheries. Continuous monitoring, adaptive management and a commitment to responsible practices are essential for achieving a balance between human needs and the preservation of marine ecosystems.

References

- Akbari, N., Failler, P., Pan, H., Drakeford, B., Forse, A., 2023. The impact of fisheries on the economy: A systematic review on the application of general equilibrium and input-output methods. *Sustainability* 15(7), 60-89. DOI: <https://doi.org/10.3390/su15076089>.
- Ayisi, C.L., Sienso, G., Mensah, G.D., N'souvi, K., Baidoo, K., Alhassan, E.H., Osei, S.A., 2023. Examining the socio-economic characteristics, fishing patterns and challenges of fishermen at James Town in Ghana. *Social Sciences & Humanities Open* 8(1), 100591. DOI: <https://doi.org/10.1016/j.ssaho.2023.100591>.
- Belton, B., Thilsted, S.H., 2014. Fisheries in transition: Food and nutrition security implications for the global South. *Global Food Security* 3(1), 59-66. DOI: <https://doi.org/10.1016/j.gfs.2013.10.001>.
- Blankespoor, B., Dasgupta, S., Lange, G.M., 2017. Mangroves as a protection from storm surges in a changing climate. *Ambio* 46, 478-491. DOI: <https://doi.org/10.1007/s13280-016-0838-x>.
- Chu, E.W., Karr, J.R., 2017. Environmental impact: Concept, consequences, measurement. *Reference Module in Life Sciences* 2017, 1-22. DOI: <https://doi.org/10.1016/B978-0-12-809633-8.02380-3>.
- Debnath, R., Borah, S., Nandi, B., Kumar, J., Yadav, A.K., Prasad, G.S., 2022. Microplastics: An emerging contaminant in aquatic ecosystems. *Biotica Research Today* 4(10), 711-713.
- FAO, 2023. Illegal, Unreported and Unregulated (IUU) fishing. In: *FAO (website)*. Available at: <https://www.fao.org/iuu-fishing/en/>. Accessed on: November 13, 2023.
- Fujii, H., Sakakura, Y., Hagiwara, A., Bostock, J., Soyano, K., Matsushita, Y., 2017. Research and development strategy for fishery technology innovation for sustainable fishery resource management in north-East Asia. *Sustainability* 10(2), 59. DOI: <https://doi.org/10.3390/su10010059>.
- Furman, K.L., Harlan, S.L., Barbieri, L., Scyphers, S.B., 2023. Social equity in shore-based fisheries: Identifying and understanding barriers to access. *Marine Policy* 148, 105355. DOI: <https://doi.org/10.1016/j.marpol.2022.105355>.
- Griggs, G., Reguero, B.G., 2021. Coastal adaptation to climate change and sea-level rise. *Water* 13(16), 2151. DOI: <https://doi.org/10.3390/w13162151>.
- Kelkar, N., Smith, B.D., Alom, M.Z., Dey, S., Paudel, S., Braulik, G.T., 2022. *Platanista gangetica*. In: *The IUCN Red List of Threatened Species 2022*: Available at: <https://www.iucnredlist.org/species/41756/50383346>. Accessed on: September 15, 2022. DOI: <https://doi.org/10.2305/IUCN.UK.2022-1.RLTS.T41756A50383346.en>.
- Kenny, A.J., Campbell, N., Koen-Alonso, M., Pepin, P., Diz, D., 2018. Delivering sustainable fisheries through adoption of a risk-based framework as part of an ecosystem approach to fisheries management. *Marine Policy* 93, 232-240. DOI: <https://doi.org/10.1016/j.marpol.2017.05.018>.
- Kroeker, K.J., Kordas, R.L., Crim, R., Hendriks, I.E., Ramajo, L., Singh, G.S., Duarte, C.M., Gattuso, J.P., 2013. Impacts of ocean acidification on marine organisms: Quantifying sensitivities and interaction with warming. *Global Change Biology* 19(6), 1884-1896. DOI: <https://doi.org/10.1111/gcb.12179>.
- Link, J.S., Watson, R.A., 2019. Global ecosystem overfishing: Clear delineation within real limits to production. *Science Advances* 5(6), eaav0474. DOI: <https://doi.org/10.1126/sciadv.aav0474>.
- Mangubhai, S., Lawless, S., Cowley, A., Mangubhai, J.P., Williams, M.J., 2022. Progressing gender equality in fisheries by building strategic partnerships with development organisations. *World Development* 158, 105975. DOI: <https://doi.org/10.1016/j.worlddev.2022.105975>.
- Mozumder, M.M., Schneider, P., Islam, M.M., Deb, D., Hasan, M., Monzer, Md. A., Nur, A.-A.U., 2023. Climate change adaptation strategies for small-scale hilsa fishers in the coastal area of Bangladesh: Social, economic and Ecological Perspectives. *Frontiers in Marine Science* 10, 1151875. DOI: <https://doi.org/10.3389/fmars.2023.1151875>.
- Muhala, V., Chicombo, T.F., Macate, I.E., Guimarães-Costa, A., Gundana, H., Malichocho, C., Hasimuna, O.J., Remédio, A., Maulu, S., Cuamba, L., Bessa-Silva, A.R., Sampaio, I., 2021. Climate change in fisheries and aquaculture: Analysis of the impact caused by Idai and Kenneth Cyclones in Mozambique. *Frontiers in Sustainable Food Systems* 5, 714187. DOI: <https://doi.org/10.3389/fsufs.2021.714187>.
- Ormerod, S.J., 2003. Current issues with fish and fisheries: Editor's overview and introduction. *Journal of Applied Ecology* 40(2), 204-213. DOI: <https://doi.org/10.1046/j.1365-2664.2003.00824.x>.
- Pinsky, M.L., Kroeker, K.J., Barshis, D.J., Logan, C.A., 2013. Marine conservation in a changing climate. In: *Encyclopedia of Biodiversity*. Second Edition. (Eds.) Levin, S.A. Academic Press. pp. 32-44. DOI: <https://doi.org/10.1016/b978-0-12-384719-5.00336-1>.
- Pita, C., Pierce, G.J., Theodossiou, I., 2010. Stakeholders' participation in the fisheries management decision-making process: Fishers' perceptions of participation. *Marine Policy* 34(5), 1093-1102. DOI: <https://doi.org/10.1016/j.marpol.2010.03.009>.
- Ranjan, D., Verma, P., Kshatri, A.S., Patel, A., Gupta, V., Chaudhary, V., Yadav, B., 2023a. Destructive Fishing Practices and their Impacts on Fisheries. In: *Latest Trends in Fisheries and Aquatic Animal Health*. Volume 5. (Ed.) Gupta, A. AkiNik Publications. pp. 1-12. DOI: <https://doi.org/10.22271/ed.book.2307>.
- Ranjan, D., Chandravanshi, S., Verma, P., Singh, M.B., Verma, D.K., Maurya, P., Upadhyay, A.K., Raghunath, Tiwari,

- A.K., Sahu, K.K., 2023b. Effects of coral reef destruction on humans and the environment. *International Journal of Environment and Climate Change* 13(10), 716-725. DOI: <https://doi.org/10.9734/ijecc/2023/v13i102708>.
- Ranjan, D., Verma, P., Maurya, P., Iqbal, G., Singh, M.B., Upadhyay, A.K., 2023c. Ganges River Dolphin (*Platanista gangetica gangetica*): An indicator of ecosystem health in the river basins. *Uttar Pradesh Journal of Zoology* 44(20), 173-180. DOI: <https://doi.org/10.56557/upjz/2023/v44i203659>.
- Sumaila, U.R., Tai, T.C., 2020. End overfishing and increase the resilience of the ocean to climate change. *Frontiers in Marine Science* 7, 00523. DOI: <https://doi.org/10.3389/fmars.2020.00523>.
- Temple, A.J., Skerritt, D.J., Howarth, P.E.C., Pearce, J., Mangi, S.C., 2022. Illegal, unregulated and unreported fishing impacts: A systematic review of evidence and proposed future agenda. *Marine Policy* 139, 105033. DOI: <https://doi.org/10.1016/j.marpol.2022.105033>.
- Wilson, S.K., Fisher, R., Pratchett, M.S., Graham, N.A.J., Dulvy, N.K., Turner, R.A., Cakacaka, A., Polunin, N.V.C., 2010. Habitat degradation and fishing effects on the size structure of coral reef fish communities. *Ecological Applications* 20(2), 442-451. DOI: <https://doi.org/10.1890/08-2205.1>.
- Zamzami, L., Ermayanti, E., Hendrawati, H., Miko, A., 2020. Socio-cultural impacts of marine conservation areas in Indonesian fishing communities. *IOP Conference Series: Earth and Environmental Science* 430, 012016. DOI: <https://doi.org/10.1088/1755-1315/430/1/012016>.