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REVIEW

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Navigating the Depths of the Global Marine Fisheries Crisis: A Brief Review

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Conflict of Interest

The authors declare that the manuscript was formulated in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors Contribution

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Abstract

The global fisheries industry faces a critical challenge with annual catches exceeding sustainable levels, leading to overexploitation. Establishing precise global limits is difficult, highlighting the need for immediate action, particularly due to severe overcapacity. Managing fisheries is complicated by uncertainties, requiring safety margins, risk management, and transparent institutional arrangements. Indiscriminate fishing methods like gill nets and traps pose ecological threats, capturing targeted species while endangering non-commercial marine species and disrupting marine ecosystems. Effects of COVID-19 on fisheries include changes in food consumption, supply chain disruptions, and socio-economic instability. Overfishing, driven by increased demand and technological advancements, has depleted fish stocks, impacting ecosystems and food security. Climate change worsens these challenges through ocean acidification, sea level rise, and habitat alterations. Proposed solutions involve restoring fish populations, enhancing carbon storage, and reducing CO2 emissions. Sustainable fisheries management requires recovery measures, improved monitoring, and ecosystem-focused scientific advice, including fishing bans, habitat restoration, and promoting sustainable practices. Immediate comprehensive measures are needed to address overfishing, mitigate climate change impacts, and ensure long-term global fisheries sustainability.

KEYWORDS

Climate change, Overfishing, Sustainable Fisheries, Management

INTRODUCTION

The annual global fishery catches, estimated to be between 130 and 190 million tonnes, closely align with predicted sustainable catch levels. However, a substantial proportion of fisheries are currently either fully or overexploited. (Rögnvaldur and Hannesson, 2015) Despite the inherent uncertainty in establishing global limits, it is crucial not to dismiss the imminent risks. Consequently, an urgent response is warranted through the implementation of fishing effort control measures. Unfortunately, this endeavour faces significant challenges due to the pervasive issue of severe global overcapacity, constituting a fundamental structural problem that demands attention.

The majority of fisheries are either completely or overexploited, despite the fact that worldwide fishery harvests are in line with sustainable projections. This highlights the necessity to manage the risks related to uncertainty in global limits. Maintaining healthy fisheries and regulating fishing activity depend heavily on managing the extreme overcapacity of the world. Safety margins in fishing targets, open institutional structures, reversible actions, and safe management techniques are critical to overcoming these obstacles. In order to deal with uncertainty and guarantee the long-term sustainability of fisheries, it is essential to identify and create sustainable resource management systems. Most fisheries are either completely or overexploited, despite the fact that worldwide fishery harvests are in line with sustainable projections. This highlights the necessity to manage the risks related to uncertainty in global limits. Maintaining healthy fisheries and regulating fishing activity depend heavily on managing the extreme overcapacity of the world. Safety margins in fishing targets, open institutional structures, reversible actions, and safe management techniques are critical to overcoming these obstacles. In order to deal with uncertainty and guarantee the long-term sustainability of fisheries, it is essential to identify and create sustainable resource management systems.

FISHERIES DECLINE

Indiscriminate Fishing Methods

Within the sphere of marine resource management, indiscriminate fishing methods present a pressing concern, marked by the deployment of non-selective gear such as gill nets and traps. While these methods demonstrate efficiency in capturing targeted species, they simultaneously pose a significant threat to non-commercial marine species, namely parrot fish, tarpon, permit, bone fish, and sharks (Eric et al., 2023). The ecological repercussions of indiscriminate fishing manifest in multifaceted ways, encompassing unintended captures, bycatch, and disturbance of the delicate balance within marine ecosystems. Existing literature consistently highlights the adverse effects of such practices, underscoring the necessity for a comprehensive examination of the ecological ramifications associated with the systematic removal of non-commercial species. As marine biodiversity confronts escalating anthropogenic pressures, cultivating a nuanced understanding of the impacts of indiscriminate fishing methods becomes imperative. This understanding serves as a foundation to inform the development of sustainable resource management strategies, thereby fostering the preservation of marine ecosystems for the benefit of future generations.

Fishing Nurseries

Fishing nurseries, recognized as critical habitats for the early life stages of numerous marine species, serve as pivotal contributors to the ecology and sustainability of marine ecosystems. These

habitats, including coastal areas, estuaries, and other shallow waters, function as nurseries for juvenile fish and other marine organisms, providing essential elements such as shelter, foraging grounds, and optimal conditions for growth and development. Beyond their local implications, these areas play a substantial role in the recruitment of adult populations, exerting influence on the overall abundance and diversity of marine species. The intricate interplay between environmental factors and the presence of fishing nurseries emphasizes the necessity for a comprehensive understanding of these ecosystems to guide effective conservation and management strategies. Moreover, given the escalating anthropogenic pressures on coastal habitats, an investigation into the resilience and adaptability of fishing nurseries becomes imperative for the sustainable stewardship of marine resources and the preservation of biodiversity (Giulio et al., 2021). Near shore habitats such as mangroves and seagrass beds serve as nurseries for many juvenile fish species. Catching juvenile fish with nets, traps or spearfishing removes them from the marine environment before they had a chance to reproduce and replenish populations.

Fishing Spawning Aggregations

Fishing spawning aggregations, recognized as gatherings of reproductive individuals of a specific fish species during their reproductive period, constitute a critical ecological phenomenon with far-reaching implications for fisheries Conservation and Management efforts. These aggregations function as focal points for the reproductive activities of diverse marine species, offering a concentrated area for the release and fertilization of eggs. The study of fishing spawning aggregations is integral to comprehending the reproductive dynamics and life history traits of targeted species, forming the foundation for the development of effective fisheries management strategies that ensure the sustainable exploitation and conservation of fish populations. Additionally, the predictable nature of fishing spawning aggregations renders them vulnerable to over-exploitation, susceptible to intensive fishing pressures. Consequently, a thorough exploration of the ecological roles, behaviours, and vulnerabilities associated with fishing spawning aggregations is imperative for informed decision-making and the formulation of conservation measures aimed at preserving the resilience and integrity of marine ecosystems. (Christopher et al., 2021) Many fish species gather in large numbers at specific times and sites to mate and reproduce. At this time fish are vulnerable and fishing at spawning aggregations will lead to overfishing.

Fishing Oversized

Within marine ecosystems, the practice of fishing oversized individuals has become a prominent concern, prompting an in-depth examination in the realm of fisheries management and conservation. Targeting oversized individuals, often identified by sizes surpassing the reproductive maturity threshold, holds the potential to yield profound ecological consequences for fish populations and their associated ecosystems. Oversized individuals, owing to their size and reproductive status, assume crucial roles in maintaining population resilience and significantly contribute to reproductive potential and genetic diversity (Raquel et al., 2003). The systematic removal of such individuals through fishing activities has the capacity to disrupt population dynamics, impede reproductive success, and pose a risk to the long-term sustainability of fisheries resources. Moreover, the ecological ramifications extend beyond direct population effects, influencing community structure and the overall functioning of marine ecosystems. Hence, cultivating a nuanced understanding of the ecological implications

of fishing oversized individuals is imperative for the development of effective fisheries management strategies. (Lyndsie et al., 2022) These strategies should strive to achieve a delicate balance between the sustainable exploitation of marine resources and the preservation of ecosystem integrity and biodiversity. Large fish produce greater number of eggs than younger fish. Fishing too many large fish may lead to reduced number over time.

Marine Debris

Ghost fishing, a critical aspect of anthropogenic impact on marine ecosystems within the broader spectrum of marine debris, occurs when abandoned, lost, or discarded fishing gear, including nets, traps, and lines, continues to trap and ensnare marine organisms, resulting in unintended and often wasteful captures. The persistence of ghost fishing presents significant ecological challenges, leading to alterations in population dynamics, ecosystem structure, and biodiversity. The entanglement of marine species, spanning from invertebrates to large vertebrates, not only causes direct mortality but also impedes natural behaviours and contributes to the degradation of sensitive habitats. Given the intricate nature of ghost fishing, a multifaceted approach is imperative, involving research efforts to comprehend the extent and ecological implications of this phenomenon. Additionally, the development of mitigation strategies and policies addressing the root causes of ghost fishing is crucial. Effective intervention mandates collaboration between the scientific community, policymakers, and stakeholders to mitigate the ecological consequences of ghost fishing and contribute to the broader goal of marine ecosystem conservation. Ghost nets and abandoned traps can continue catching and killing fish indiscriminately.

Illegal Fishing

Exerting detrimental impacts on marine ecosystems and biodiversity, illegal fishing poses a complex and pervasive challenge to the sustainable management of global fisheries. This illicit activity encompasses a spectrum of practices, such as unreported and unregulated fishing, overfishing, and the use of prohibited gear, often motivated by economic considerations. The consequences of illegal fishing transcend mere resource depletion, involving the disruption of marine food webs, habitat degradation, and compromised resilience of target species (Geoffrey and Landis, 2023). The widespread prevalence of this phenomenon presents significant hurdles to effective fisheries management and conservation efforts. To address illegal fishing, a holistic approach is necessary, integrating robust enforcement mechanisms, international collaboration, and community engagement. Paramount to this effort

is the implementation of rigorous monitoring and surveillance, coupled with stringent regulations and deterrent measures. These strategies are essential for curbing the detrimental effects of illegal fishing and promoting the sustainable stewardship of marine resources on a global scale. Fishing out of season, undersized or prohibited species can drastically reduce population numbers. Considering Capture fisheries of World fish production, the total fish production in capture fisheries for 2016 was 78.3 million tonnes, in 2017 it was 81.2 million tonnes and for 2018 it was 84.5 million tonnes. during 2019 it was recorded about 80.1 million tonnes Whereas in 2020 it was lowest at 78.8 million tonnes. (Covid-19 Period) Source: SOFIA, 2021

Fish Consumption

Globally speaking, the amount of fish consumed per person for food has increased significantly,

rising from 9.0 kg in 1961 to 20.2 kg in 2020, at an average yearly growth rate of almost 1.5 percent. This data includes consumption of main seafood commodities, such as crustaceans, cephalopods, and other mollusk species, as well as consumption of different types of fish. With a large amount of 87.3 kg, the Maldives emerged as the nation with the highest per capita intake of fish among the assessed nations. South Africa, on the other hand, had the lowest per capita consumption of fish (6.52 kg). (Source: The Aquaculture and Fisheries Status Worldwide, 2022).

IMPACT OF COVID-19 ON GLOBAL FISHERIES

- Changes in food consumption and challenges in reaching customers are having a big effect on costs and demand.
- Reduced labor mobility within the supply chain and the requirement for additional health and safety precautions have an impact on production capacity and prices.
- The possible effects on livelihoods and global food security necessitate prompt but thoughtful responses from governments and business.
- Impact on Fishers include Sudden decrease in the income leading to Social, economic instability for fishers, Vendors, women, migrant labors. forced Unemployment- Impacting services as ice-plants, diesel transportation, maintenance of nets, crafts, gears.

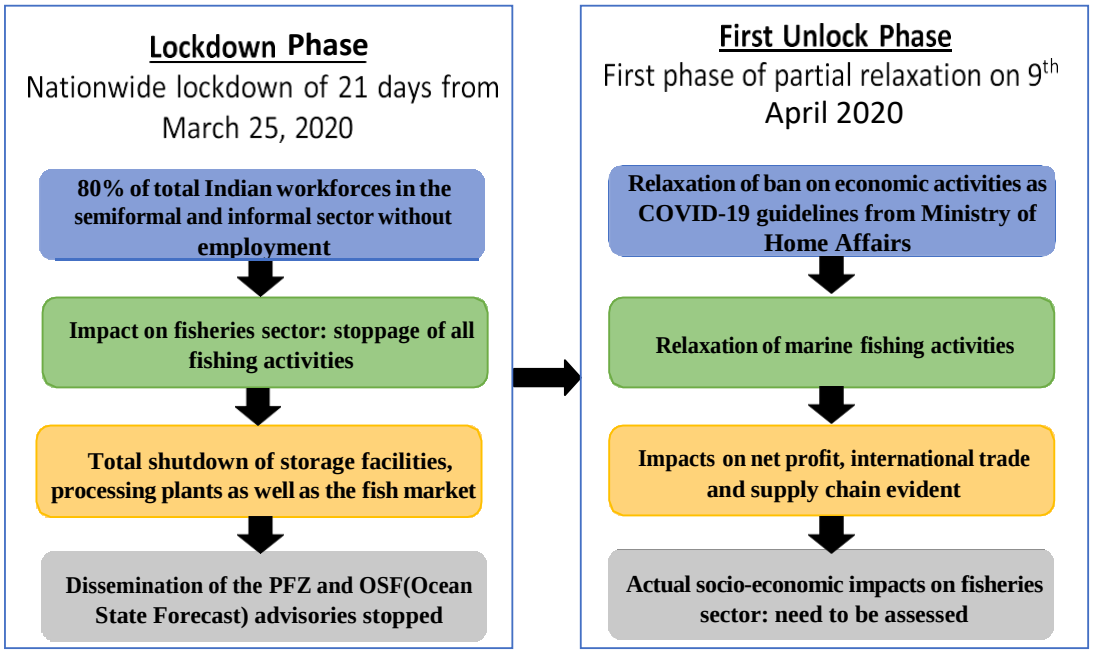

Fig. 1: Flowchart of nation-wide developments in India in response to the COVID-19 highlighting the impacts on the marine fishery industry (Kundu & Santhanam, 2021)

- Impacts on fishing includes Decline in supply of fishes due to low market demands, depreciation in market prices. Lesser availability of storage facilities - selling at lower price or discard, destroy precious goods. Also having multiplicative effects as Loss of diverse spring Catches followed by loss due to fish Ban Period. (Kundu & Santhanam, 2021)

IMPACT OF CLIMATE CHANGE ON GLOBAL FISHERIES

Sea levels are rising, sea ice is melting, glaciers are retreating, and natural catastrophes like floods and cyclones are getting worse due to climate change, all of which have an immediate effect on the fisheries environment. Deforestation, industrial agriculture, and the burning of fossil fuels all

contribute to the atmospheric release of gases that trap heat, such as carbon dioxide (CO_2), which causes global warming. Over 90% of the extra heat and about 25% of the CO2 have been absorbed by the ocean, which has acted as a mitigating factor, but at the expense of serious devastation to marine ecosystems. Increased CO2 levels cause a 90% increase in temperature, which makes water supplies warmer, more acidic, and depleted of oxygen. Wetland ecosystems will eventually be flooded, and coastal populations will experience more frequent flooding as a result of climate change's acceleration of sea level rise. Bleaching is a serious danger to marine biodiversity and warm-water coral reefs hotspots that may disappear if global warming increases by 2°C (3.6°F). The health of fish, birds, marine animals, and even humans is being negatively impacted by the spread of toxic algae, which is typified by bigger and more frequent blooms. Reduced oxygen levels are causing marine species to suffocate and shrink their habitats, which is causing a general loss of habitat and disturbances to migration. El Nino reduces the normal cold-water upwelling, which lowers the nutritional content of the area. When La Nina is present, the trade winds are stronger, which results in warmer water reaching Asia. Cold water with lots of nutrients rises to the surface due to increased upwelling off the US west coast. La Nina may also produce hurricanes. (Source: The University of British Columbia's Nereus Program for the Oceans and Fisheries)

Additionally, species that create shells, like corals, clams, and oysters, are negatively impacted by ocean acidification, which is caused by increasingly acidic water. When taken as a whole, these fishery disturbances have implications for the marine food chain, regional economies, and world food security.

GLOBAL OCEAN TEMPERATURE EFFECT

Fish and their communities will be impacted by climate change. Increased temperatures will affect wild fish populations' numbers, migratory patterns, and death rates. They will also dictate which species may be farmed in certain areas. (Xu et al., 2021)

A study project carried out in the Scottish Sea. Initially, they examined the average annual growth rate of many fish species. The first set of analysis measured the mean annual body length of the species at places across their ranges in relation to the annual mean sea surface temperature (SST). The change in body size of 40% for every 1°C in place and time, respectively. This size was compared to the average annual temperature of the ocean surface in the locations where these fish reside. (Ikpewe et al., 2021) Fish in warming Scottish seas grow faster but reach a smaller size juvenile fish are getting bigger and maturing early, as well as confirming that adult fish are getting smaller as sea temperatures rise. cod, haddock, whiting.

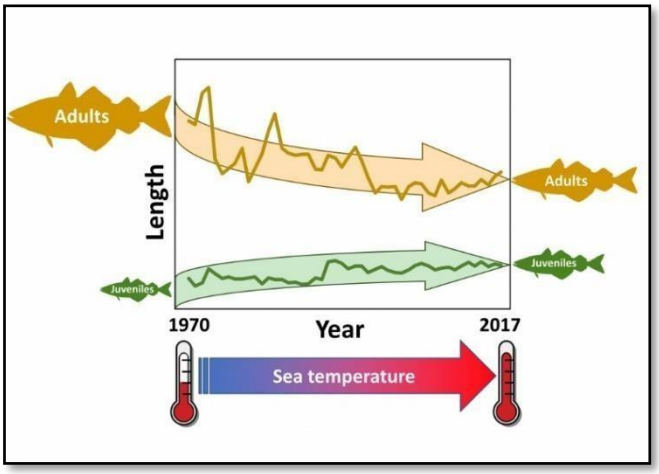

Fig. 2: Size reduction in Fish (Ikpewe et al. 2021)

OVERFISHING

When too many fish are taken at once due to overfishing, the spawning stock is too diminished to recover. A stock cannot be sustained if it is overfished. Ecosystem collapse from this might have detrimental effects on those who depend on a healthy ocean. The live marine resources of the planet are being overfished overall. Not only fisheries ecosystem but also coral reef ecosystem, seagrass ecosystem, aquatic plants, marine mammals, like dugongs, manatees, and turtles. When too many fish in a certain stock are taken and there aren't enough adults to spawn and maintain a healthy population, this is known as overfishing. Overfishing has increased in the last several decades, and there are already three times as many overfished stocks as there were in 1970. Between 1990 and 2018, there was a 122% rise in fish consumption worldwide. Scientific results published in the peer-reviewed journal Marine Policy suggest that 100 million sharks are killed annually in commercial fisheries, with estimates ranging from 63 million to 273 million. resulting in a 70% decline in shark populations worldwide. The demand for fins, overfishing, bycatch in fisheries, loss of habitat and prey, and disturbance by humans are some of the factors endangering sharks and rays. (Source: https://saveourseas.com). Solution to Prevent Global Fisheries Crisis

- Restore fish population
- Boost marine carbon storage, coastal protection & increase resilience by restoring valuable habitats
- Reduce CO2 emission by removing fuel tax subsidies
- Recognize ending destructive overfishing as climate action
- Restore Ocean Ecosystem Health
- Incorporate scientific advice for ecosystem and climate indicators
- Implement recovery measure for collapsed fish populations
- Drastically improve monitoring & control of all fishing

it means taking steps to help those fish populations grow back to healthy levels by Restocking, fishing ban in particular area for few years Habitat Restoration, we must watch and manage the fishing in the ocean very carefully. We must keep track of how many fish are being caught, where, and when. (Sumaila and Tai, 2020)

SUSTAINABLE FISHERIES

Sustainable fishing entails preserving ecosystems and endangered species while harvesting enough fish to last for future generations in the ocean. People whose livelihoods depend on fishing can continue to do so by protecting the oceans. Spearfishing and cast-net fishing are popular among native Hawaiians. All around the world, including South America, Africa, Australia, and Asia, spearfishing is a modern sport. The Tagbanua people of the Philippines have long used fishing techniques that both sustain and exploit fish stocks. According to the Worldwide Fund for Nature (WWF)'s 2018 Living Planet report, since 1950, humans have taken about 6 billion tons of fish and other invertebrates out of the ocean, making fishing the biggest danger to marine life. The biggest lagoon system in Southeast Asia is the Cau Hai Lagoon in Vietnam. Following Sustainable fishing practices by building Good leadership withing fishing associations, Co-operation among fishers, Secure financing for fishing associations, efficient Support from local Government, raising knowledge about value of Conservation from grass-root level.

CONCLUSION

Not only can irresponsible fishing methods cause a decline in fish populations, but they also drastically change ecosystems and upend the food chain. Fisheries management has historically placed a strong emphasis on individual fish populations; however, effective management is hampered by a lack of basic information about these stocks' true state, how they respond to fishing pressure, and how they affect other species and ecosystems. The global fish capture production fell as a result of the COVID-19 pandemic in 2021, underscoring the industry's susceptibility to outside shocks. The majority of fisheries are either completely or overexploited, despite the fact that worldwide fishery harvests are in line with sustainable projections. This highlights the necessity to manage the risks related to uncertainty in global limits. Maintaining healthy fisheries and regulating fishing activity depend heavily on managing the extreme overcapacity of the world. Safety margins in fishing targets, open institutional structures, reversible actions, and safe management techniques are critical to overcoming these obstacles. In order to deal with uncertainty and guarantee the long-term sustainability of fisheries, it is essential to identify and create sustainable resource management systems.

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