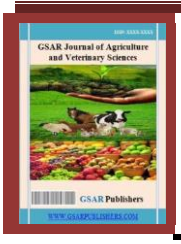

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EFFECTS OF IUU AND OTHER ILLEGAL FISHING ACTIVITIES ON AQUATIC BIODIVERSITY: THE REVIEW

By

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Abstract

Aquatic ecosystems play a vital role in maintaining the balance of our planet, providing us with food, oxygen, and supporting a rich biodiversity of life. However, these ecosystems are facing a significant threat, especially the aquatic ecosystems from illegal, unreported, and unregulated (IUU) and other illegal fishing activities. This review will explore the devastating effects of these practices on aquatic biodiversity, highlighting the urgency for stronger regulations and enforcement measures. Our oceans and waterways harbor a vast and diverse array of marine life, playing a crucial role in the health of our planet. However, this delicate ecosystem faces numerous threats, with illegal fishing activities posing a significant and growing danger. IUU fishing and other illegal practices undermine legitimate fishing operations, deplete fish stocks, and contribute to the destruction of critical marine habitats. Understanding the damaging impacts of these activities is essential to developing effective conservation strategies and securing the long-term sustainability of aquatic biodiversity as stated by the Brundtland Commission on sustainable development 1987. Aquatic biodiversity is essential for maintaining healthy and functioning ecosystems. It provides food and resources for millions of people, supports tourism and recreation industries, and plays a crucial role in regulating climate and water quality. However, aquatic biodiversity is facing numerous threats, including pollution, habitat loss, and overfishing. Among the most significant threats are IUU and other illegal fishing activities. IUU and other illegal fishing activities pose a major threat to the health of our oceans and the future of aquatic biodiversity; by recognizing the devastating impacts of these practices and taking decisive action, we can protect our aquatic ecosystems and ensure the continued availability of vital resources for generations to come. This requires a collective effort from governments, industries, consumers, fishers education and conservation organizations to work together towards a sustainable future for our oceans.

KEYWORDS: *Illegal Fishing, Aquatic Biodiversity, Overfishing, Biomagnification, Fisheries Management and Conservation, Climate Change*

1.0 INTRODUCTION

Bodies of water are home to large numbers of living organisms. Marine life has the most biological diversity on the planet (Baird, 2006) and is, therefore, an important source of food. Fisheries are defined as locations where living resources from water and its surfaces are obtained. These stocks are important for marine ecosystems and are naturally renewed through reproduction. Humans have used fish wealth from time immemorial as an important food supply (Baird, 2006). However, Palma *et al*. (2010) stated that illegal, unreported and unregulated (IUU) fishing poses one of the greatest threats to marine ecosystems. It undermines the conservation of marine biodiversity and national and regional efforts to manage fisheries sustainably; IUU fishing has escalated over the past 20 years, particularly in high seas fisheries. However,

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it is dynamic; adaptive, and its confidential nature prevents direct assessment of its effects.

Illegal, unreported, and unregulated fishing remains one of the greatest threats to marine ecosystems due to its potent ability to undermine national and regional efforts to manage fisheries sustainably as well as endeavours to conserve marine biodiversity. IUU fishing takes advantage of corrupt administrations and exploits weak management regimes, in particular those of developing countries lacking the capacity and resources for effective monitoring, control, and surveillance (MCS). It is found in all types and dimensions of fisheries, it occurs both on the high seas and in areas under national jurisdiction; it concerns all aspects and stages of the capture and utilisation of fish, and may sometimes be associated with organized crime. Fisheries resources available to bona fide fishers are poached in a ruthless manner by IUU fishing, often leading to the collapse of local fisheries, with small-scale fisheries in developing countries proving particularly vulnerable products derived from IUU fishing which find their way into overseas trade markets, thus throttling local food supply. IUU fishing, therefore threatens livelihoods, exacerbates poverty, and augments food insecurity. It is well known that IUU fishing has escalated in the past 20 years, especially in high seas fisheries. Unfortunately the dynamic, adaptable, highly mobile, and clandestine nature of IUU fishing prevents a straightforward estimation of its impact. The global scale of IUU fishing is estimated at about 11– 26 million tons, which is about a $10– 23.5 billion loss annually (MRAG, 2008). Some scientists suggest, that if current rates of depletion persist, most large predatory fish stocks will have collapsed by 2048 (Worm et al., 2006). Illegal fishing vessels frequently use destructive fishing methods, and this harms crucial components of the marine ecosystem (FAO, 2007).

Examples of these methods include blast bombing and cyanide fishing. Blast bombing has led to the loss of over 50% of the coral reef system in South East Asia (Caldwell and Fox, 2006), and has reduced the productive capacity of coral reefs to one fifth of their original capacity (White et al., 2000). The poisonous substance of cyanide fishing kills coral polyps, and the damage of these polyps leads to the discoloration of coral colonies (Mak *et al*., 2015).

Illegal, unreported and unregulated fishing is a global phenomenon occurring across all fishery types, sectors and geographies. In order to successfully address IUU fishing, fisheries policies, regulations, and management strategies, as well as subsequent monitoring, control and surveillance activities, must be supported by an appropriate evidence base at relevant spatial-temporal scales (Andrew *et al* 2022).

Illegal, unreported and unregulated fishing is a significant transnational crime problem that costs developing nations from $2 to $15 billion in economic losses annually. Perpetrators include established organized crime groups and commercial fishers, while the incidence of IUU fishing is often shaped by public corruption. Various economic drivers, such as the exceptionally high value of some species, and the Flag of Convenience (FOC) system of vessel registration contribute to the significance of the problem. Negative environmental impacts involve the depletion of fish stocks, damage to coral reefs, and stress on marine mammals and birds. Social and economic impacts are severe as well, and are most especially prevalent in developing nations.

Theoretically, IUU fishing may be viewed as arising and proliferating due to " criminogenic asymmetries," especially evident in the uneven patchwork of international laws governing the world' s oceans. A broad range of public and private responses have thus far generated limited success in thwarting IUU fishing (Don Liddick 2004). Illegal, unreported and unregulated (IUU) fishing is a significant problem that affects the marine ecosystem and those who depend on it for survival. Research and theory in criminology can shed light on the problem and suggest policy instruments to reduce IUU fishing. These findings demonstrate the utility of thinking about illegal fishing through the lens of criminology, which is equipped with practical tools to address the problem. Findings suggest a dialogue between criminologists and conservationists to work together to address similar problems affecting the environment (Gohar, 2015). IUU fishing poses serious threats for the sustainable fishing. IUU fishing is connected to ghost fishing, by-catch, depletion of the fishing stocks, destruction of the benthic ecosystem (Öztürk, 2015). Findings suggest that curbing the problem of IUU fishing requires a dialogue between criminologists and conservationists to work together to address similar problems affecting the environment (Gohar, 2015).

IUU fishing significantly undermines the sustainability of the world' s oceans. According to the United Nations Food and Agriculture Organization estimates (FAO, 2006), 52% of the major marine fish stocks or species are fully exploited, 17% are overexploited, and 6% are depleted, and IUU fishing is one of the major contributors to this problem (EFTEC, 2008).

Humans depend extensively on fish as a significant source of animal protein in their daily lives, even though future global food security is a major issue. The demand for fish protein is still increasing owing to the massive expansion of the global population; however, many of the world' s fish populations are already degraded and unable to provide maximum sustainable production (FAO. 2007; Agnew et al., 2009). In contrast to the rate of population growth, the consumption of fish as a food source has increased worldwide in the last six decades. The average annual increase in total fish consumption from 1961 to 2017 was 3.1%, exceeding the annual growth rate of the population, which was approximately 1.6% (FAO. 2020).

According to estimates, 179 million tons of fish were produced globally in 2018, of which 156 million tons were used for human consumption (approximately 20.5 kg per person annually). In 2017 globally, fish accounted for 20% of the average per capita intake of animal proteins consumed by more than 3.3 billion people, reaching 50% or more in nations like Bangladesh, Cambodia, the Gambia, Ghana, Indonesia, Sierra Leone, Sri Lanka, and several small island developing

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States (FAO. 2020). However, it is a matter of great concern that global fishery sectors are facing a potential threat due to such surging demand and continued illegal, unreported, and unregulated fishing during the last few decades.

Fishing activities that contravene or disregard national, regional, or international fisheries' legal frameworks are referred to as IUU fishing. This can also refer to a lack of regulation or control n fisheries (DoF.2019). According to the US National Intelligence Council (NIC. 2016), illegal fishing refers to " fishing activities by vessels from one country in the jurisdiction of another country without permission or other activities of fishing vessels that contravene fisheries laws." Unreported fishing refers to " activities that are unreported or deliberately misreported to proper authorities." In addition, unregulated fishing refers to " fishing activities in areas with no practical conservation or management measures, such as outside any country' s Exclusive Economic Zone (EEZ) and not under the jurisdiction of Regional Fisheries Management Organizations (RFMOs)" .

Many studies have highlighted IUU fishing as a significant threat to global fishing worldwide because it threatens legitimate fishing livelihoods and operations, jeopardizes food and financial prosperity, aids international crime, skews markets, encourages human trafficking, and prevents efforts to implement sustainable fishery management practices (NIC. 2016). It also hampers marine biodiversity, natural fish stocks, and sustainable fishery management (Donlan *et al*., 2020). It is difficult to quantify the actual extent of IUU fishing. However, according to the most recent estimates, between 11 and 26 million tons of fish are harvested annually illegally and unreported worldwide, with a market worth $10– $23 billion (Widjaja *et al*., 2020). Moreover, owing to the increasing number of fleets, fish stocks are facing a record level of overfishing (Watson et al., 2013). Nevertheless, these fleets are up to 2– 3 times larger than those generally needed to harvest fish, which the ocean can supply substantially (Joseph et al., 2010). Most importantly, modern fish detection systems and fishing equipment have made fishing boats more efficient, allowing them to accelerate the overexploitation of global fishery resources (Knauss, 2005). Concerns have been raised in the international community since the 1950s. Any action that jeopardizes efforts to manage and rebuild fish stocks, such as IUU fishing, is no longer regarded as politically or economically acceptable from this perspective (Le Gallic and Cox, 2006).

The Convention on the Conservation of Antarctic Marine Living Resources first formally used this term in a report published in 1997, highlighting the rising risk of fish overexploitation in the Southern Ocean. Since then, efforts to combat IUU fishing have gained international momentum (NIC. 2016). Many RFMOs, such as the North East Atlantic Fisheries Commission, Northwest Atlantic Fisheries Organization, South East Atlantic Fisheries Organization, South Indian Ocean Fisheries Agreement, South Pacific Regional Fisheries Management Organization, and General Fisheries Commission for the Mediterranean have been established over time by various groups to manage fishery resources (NIC, 2016) collectively. Nevertheless, at the global level, the first major international initiative to deter and eliminate IUU fishing, the Food and Agriculture Organization of the United Nations (FAO), developed the first International Plan of Action (IPOA) in 2001 to prevent and counter IUU fishing (FAO. 2001; Le Gallic and Cox, 2006). Moreover, the IPOA-IUU has supported many countries worldwide in adopting this plan at the national level, known as the National Plan of Action to Prevent, Deter, and Eliminate IUU Fishing, or, in short, the NPOA-IUU (Widjaja *et al*., 2020). Similarly, many regions have developed a Regional Plan of Action (RPOA), such as the RPOA-IUU of South Asia, under the IPOA-IUU, to control and properly manage fish stock (Fujii et al., 2021).

Concerns regarding IUU fishing are not new to the waters of the Indian Ocean, especially in the Bay of Bengal (BoB). Similar to many other developing countries in Southeast Asia, BD has been experiencing this issue to a greater extent for years. Despite having a large number of marine fish species (511, including shrimp) and a maritime zone in the BoB covering an area of approximately 118,813 square kilometers, including the 200 nautical miles-long EEZ and 354 nautical miles of the continental shelf, BD' s marine fisheries account for a small portion of the country' s overall catch (Shamsuzzaman and Islam, 2018). The fishery industry provides 2.06% of the total export revenue, 3.69% of the GDP, approximately 23% of the overall agricultural production, and 60% of the nation' s total consumption of animal protein (Islam *et al*., 2017).

Nevertheless, this sector is crucial because it supports the livelihoods of millions of people and ensures national nutrition and food security. However, the fishing sectors in BD experience many challenges because the stocks of several fish species, including shrimp, are decreasing. Consequently, the catch per unit effort is declining in coastal fisheries due to inadequate fish protection regulations, lack of knowledge, indiscriminate killing of juveniles, pollution, disease issues, and other factors (Kuperan and Jahan, 2010; Murshed-e-Jahan *et al*., 2014 ; Islam *et al*., 2017; Shamsuzzaman and Islam, 2018).

1.2 Aim and Objectives of the Review

1.2.1 Aim of the Review

This review is aimed at discussing the effects of IUU and other illegal fishing activities on aquatic biodiversity

1.2.2 Objectives of the Review

The specific objectives of this review are to:

i. Investigate the impact of IUU fishing and other illegal fishing activities on aquatic biodiversity, including fish stocks, marine ecosystems, and coastal communities.
ii. Assess the effectiveness of current laws and regulations in addressing IUU fishing and other illegal fishing activities.
iii. Propose measures to reduce the negative impacts of IUU fishing and other illegal fishing activities on aquatic biodiversity.

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1.3 Global Statistics of IUU Fishing Activities

Agnew et.al (2009) stated that illegal, unreported and unregulated fishing is harmful to the environment which contributes to the over-exploitation of fish stocks in marine life. It contributes significantly to the rapid decrease of fish in marine ecosystems. Through the authors' review and review of the situation in 54 countries and on the high seas, the minimum and upper estimates of the total value of current illegal and unreported fishing losses worldwide were between $ 10 billion and $ 23.5 billion per year. The disadvantage of UUI and its negative impacts of it on the aquatic environment that hinders the large number of fish in nature, in addition to the economic losses of countries due to these illegal activities (Agnew et.al 2009).

Thus, it is possible in the coming years that there will be a lack of food security in the world, especially fish resources and the instability of the economy among countries, due to the increasing population worldwide (Agnew et.al 2009). The rapid population growth contributes to inadequate food supplies for the population of various regions, threatening famine, directly affecting the overall health status of the population, declining physical strength, vulnerability, wasting and diseases associated with undernourishment; Such as anemia and rickets, and food shortages have hit many regions of the world (Moutopoulos et al 2017). Not only that, poor African countries and third world nations have the highest rate of growth in the world, placing them at increased risk of food crises in those regions (Doumbouya et al 2017).

1.4 The Environmental Impact of IUU Fishing on Marine Life

Illegal fishing has considerable direct and indirect impact on marine life and on the diversity, structure, and productivity of benthic ecosystems. These effects are easily recognized and last longer in areas with rare natural disorders. Fishing in an incomplete system leads to drastic changes in the structure of the fish community (Jennings and Kaiser, 1998). As fishing intensifies continuously, the natural decline in the abundance of fodder fish is accelerated and amplified, reducing the success of breeding and the abundance of marine birds and mammals and contributing to the disruption of marine ecosystems (Jennings and Kaiser, 1998). However, the authors explain that these donor-dominated dynamics are less pronounced in food webs where fish are the most important predators, as their nutrition strategies are more than those of most birds and mammals. Unregistered fishermen tend to target rare species of fish, and a large number of them are invested in the development of fisheries, leading to changes in the composition of marine communities over time (Jennings and Kaiser, 1998). In addition, all forms of fishing, and illegal fishing especially, have a negative impact on the function of marine ecosystems, whether by reducing the major predators, such as sharks, or fishing with equipment that destroys the habitat. The exploitation of fragile ecosystems irreparably destroys wildlife on the seabed. In particular, deep seabed fishing can eliminate sponges that take decades, if not centuries, to grow (Australian Marine Conservation Society).

1.5 Potential Causes of IUU Fishing Activities

Moutopoulos et al (2017), state that reducing illegal fishing is critical to the sustainability of fisheries worldwide. It is important that the nations focus on violations of fisheries by analysing official questionnaires answered by local fishermen to determine the real effectiveness of control efforts, which represent a concrete sample of fishermen in general. This is a valuable case study to identify illegal fishing practices, control status, and effectiveness of regulations (Moutopoulos et al 2017). The data indicate that the considerable contribution to registered violations is due to the lack of licenses for fishermen and ships. Fines are not commensurate with this type of illegal activity, as there are no strict deterrent decisions for fishermen (Pronto 2016). The number of recorded violations represents a very small percentage of the estimated number of fishing days by professional fishermen and persons without a fishing license or vessel (Pronto 2016). The results indicated that some States did not have adequate records and information, which weakens any possibility of assessing the status of fisheries and resources and severely impairs any definition of useful thresholds for sustainable management (Moutopoulos et al 2017).

Additionally, many fishermen noted that IUU fishing is intriguing due to its ability to avoid taxes and fees while increasing their income. In many regions around the world, it can often be practiced with impunity because it occurs at sea, a naturally vast area. Irregularities also occur in fishing without punishment because of poor control in developing countries. Studies indicate that IUU fishing is practiced mainly in countries with typical symptoms of faulty governance: widespread corruption, contradictory legislation, lack of will or capacity to enforce existing national legislation (The World Ocean Review, 2013).

1.6 Community Issues on IUU Fishing Activities

Lampert (2017) stressed that seafood markets worldwide have a common problem; often, the product listed is not actually what is being offered. This phenomenon - known as cheating in seafood - is associated with IUU fishing practices and threatens the continuity of the oceans, poses health risks to consumers, and forces customers to pay a heavy price for a cheap product. Previous domestic and international efforts to combat this issue have failed for a number of reasons, including the global nature of the industry, the Byzantine supply chain, the large number of entities responsible for combating this issue, the lack of resources provided to these entities, and the difficulty of identifying and distinguishing species of seafood (Lampert 2017). Recent efforts, such as the Action Plan of the Presidential Task Force on Combating Illegal, Unreported, and Unregulated Fraud and Seafood Fraud, are promising to reduce this issue, but they are not enough.

It is urgent to stop the sale of any illegal seafood in markets. Lampert argues that illegal seafood makes economic gains by illegal fishing without punishment (Mariani et al 2014). Many fishermen practice illegal fishing for extra income without regard to marine life. When fishermen try to illegally obtain a scarce, endangered species, ignoring all laws that prohibit

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such activity, it adversely affects the marine environment, contributing to the extinction of various aquatic life. Such actions should be punishable by law (Mariani et al 2014).

1.7 THE IUU CRISIS ACROSS THE GLOBE

Illegal, unreported and unregulated (IUU) fishing poses a serious threat to the conservation of fish populations in the Caspian Sea and puts them on the brink of extinction (Aghilinejhad, et al 2018). This is because of overfishing in the area, which fishermen practice overfishing in various forms and degrees in coastal waters, or on the high seas in the Caspian region, which the lobbies operating in this unorganized sector, which generates hundreds of thousands of dollars annually to private accounts that do not the nations benefit from them.. It also reflects on the social conditions of seafarers, as many of them are frustrated by these illegal activities that contribute to the exclusion of honest competition for fish trade. (Aghilinejhad *et al*., 2018).

In spite of the legal procedures, legislative measures, implementation mechanisms and monitoring produced by the Antarctic region in recent years to address illegal, unregulated and unauthorized fishing, the phenomenon is still active in a number of areas in crooked ways, making a significant contribution to the depletion of fisheries and the forced infringement of laws (Bacalso and Wolf, 2014). The estimate of illegal fishing for the area covered by the Convention for the Conservation of Antarctic Marine Living Resources was 938 tons for 2008-09 (Baird, 2006). This is less than the illegal catch in 2007-08 1,169 tons, and substantially less than that caught in 2006-07 3,615 tons and 2005-06 3,420 tones (Baird, 2006). From the coldest Antarctica to Philippines, Bacalso and Wolff (2014) the mixed trophic impacts MTI has provided an analysis that related to the role of illegal and destructive fishing operations in influencing ecosystem structure and dynamics of marine life. Moreover, the estimated annual estimated annual harvest of illegal fisheries is equivalent to approximately a quarter of the total municipal fisheries in the region. Thus, the numbers of illegal fisheries constitute a dangerous proportion, which threatens to benefit from the future fisheries.

The illegal fishing crisis goes beyond the problematic decreasing of fish populations, having far deeper effects on marine life in many areas, such as Cuba. Alzugaray et al. (2018) note that spinal lobster is the main source of fish feed for Cuba and show a significant decline the lobsters' numbers due to illegal fishing. This contributes significantly to the decreasing fish population in the area, as the main feed resource becomes scarcer. The region has seen a decline in this type of habitat, which has made fish numbers fall dramatically. All this contributes to the ecosystem' s dysfunction.

1.7.1 IUU in Australia

It is estimated that Australian fisheries are the best managed and most sustainable in the world traps (Flothmann *et al*., 2010). However, this does not mean that all the fisheries are lawful, as many illegal traps are used in the area traps (Australian Marine Conservation Society 2018). Although Australia has the third largest marine economic zone exclusive to the ocean, its water is very low in nutrients and does not contain a large abundance of fish. Many illegal fisheries have spread in this area, reducing the region's fish diversity and creating a significant loss of fish wealth traps (Flothmann *et al*., 2010). This indicates that Australian fisheries must maintain optimal locations and keep away from illegal traps (Australian Marine Conservation Society, 2018).

AFMA (2016) states that Australia' s clean waters and well-managed fisheries lure in foreign fishers who plan to utilize illegal practices for the purpose of doubling profit, targeting primarily high-value species, such as the sea cucumber (also known as the Beach of Mer or Tribang) The Giant Clams (AFMA 2016). One particularly notable case dealing with these creatures involved four illegal boats carrying hundreds of giant oysters and sea cucumbers in northern Australia, leading to disorder in the nearby marine ecosystems (AFMA. 2016). Sea turtles are also particularly vulnerable, as both bycatch and illegal fishing are problematic for the endangered species in Australia. Worldwide, there are only seven species of sea turtle, and six of these live in Australian waters (Australian Bureau of Statistics, 2013). Illegal fishing aims to catch the most valuable resources without any consideration of endangered species; such practices not only decrease the population, but may threaten it with extinction (Australian Bureau of Statistics, 2013). These factors provide strong indications that illegal fishing is one of the most serious threats to the health of the world's fisheries and oceans. It has many negative impacts, such as sharply increased difficulty of maintaining fish stocks and managing fisheries at sea. It also greatly affects the ecosystem, particularly regarding the bycatch of vulnerable species like sea turtles, seabirds, and sharks (Australian Bureau of Statistics, 2013).

1.8 International Framework to combat IUU fishing

A framework of international instruments has been developing over the last decades and, together, a powerful suite of tools which can be used to combat IUU fishing:

United Nations Convention on the Law of the Sea (1982) defines the rights and responsibilities of nations with respect to their use of the world' s oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources; FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, (1993) aims to prevent the " re-flagging" of vessels fishing on the high seas under the flags of States that are unable or unwilling to enforce international fisheries conservation and management measures. The maintenance of records of fishing vessels, international cooperation, are covered extensively by the provisions of the Agreement, UN Fish Stocks Agreement (1995) aims to ensure the long-term conservation and sustainable use of straddling and highly migratory fish stocks within the framework of UNCLOS. The Agreement also spells out the duties of flag States including those related to registration and records of vessels, authorisations, MCS and compliance and enforcement. Cooperation in international,

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regional and sub-regional enforcement is also addessed, along with boarding and inspection procedures and port State measures.

FAO Code of Conduct for Responsible Fisheries (1995) comprises principles and international standards of behaviour for responsible fishing practices and aquaculture development. It serves as a reference for national and international efforts, including for policies and institutional frameworks and instruments, to ensure sustainable exploitation of aquatic living resources in harmony with the environment. It also promotes, inter alia, responsible trade of fish and fishery products. It includes provisions on the duties of all States, flag States, port States and market States, and the role of RFMOs; International Plan of Action to prevent, deter and eliminate Illegal, Unreported and Unregulated Fishing (2001), is a toolbox to combat IUU fishing, for use by all States, in general, flag States, coastal States, market States, port States and RFMOs. The IPOA-IUU calls upon all countries to develop and implement a consistent National Plan of Action and to review it periodically. Implementation of flag State responsibilities, as well as coastal State, port State, and market-related measures, are core elements of the IPOA-IUUFAO Agreement on Port State Measures to Prevent, Deter and Eliminate, Illegal, Unreported and Unregulated Fishing (2009), aims to prevent vessels engaged in IUU fishing from using ports and landing their catches, thereby reducing the incentive of such vessels to continue to operate and blocking fishery products derived from IUU fishing from reaching national and international markets. The Agreement also covers the role of flag States and RFMOs in the implementation of port State measures.

Voluntary Guidelines for Flag State Performance (2014), provides guidance to strengthen and monitor compliance by flag States with their international duties and obligations regarding the flagging and control of fishing vessels. It covers the relevant responsibilities of flag States on the basis of elements contained in international law, including binding and non- binding international fisheries instruments. Fisheries management, registration and records of vessels, authorizations, MCS and cooperation between flag States and coastal States are among the central components of the Guidelines. RFMOs should play a role in using the Guidelines to strengthen flag State performance. FAO and global initiatives to combat IUU fishing.

1.9 Voluntary Guidelines on Catch Documentation Schemes

A number of importing countries have begun to implement Catch Documentation Schemes (CDS) in their fight against IUU activities in an attempt to tackle the problem from a market and trade perspective. In order to ensure that these schemes do not constitute an unnecessary barrier to trade, the UN General Assembly Resolution on Sustainable Fisheries in December 2013 requested member countries to assist FAO in elaborating guidelines and other relevant criteria relating to catch documentation schemes. It was stipulated that these should be in conformity with the provisions of relevant international law, not create unnecessary barriers to trade, follow the principle of equivalence and be risk- based. The assessment of schemes and formats includes cost-benefit considerations and take into account catch documentation schemes already existing in certain member states, member organisations, and in the context of RFMOs. The proposed draft Voluntary Guidelines on Catch Documentation Schemes are currently undergoing technical consultation and could be adopted by the 40th session of the FAO Conference in July 2017.

The Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels (Global Record). The Global Record is a voluntary, phased and collaborative global initiative intending to make information available on vessel identification and other relevant data with the aim of providing a reliable and rapid way to contrast the level damage to fisheries biodiversity.

1.10 Other Illegal Fishing Activities on Aquatic Biodiversity

It is a common knowledge that illegal fishing which includes use of wrong gears, explosives, excessive exploitation of choice stocks, enhancement and stocking of water body and pollution has devastating effects on the critical biomass of fish biodiversity and livelihood activities associated with fishing.

When doing illegal fishing, several fishing methods are used by those performing it. Some of the common ones include:

1.10.1 Bottom Trawling:

Bottom Trawling is one of the most damaging methods of fishing. It is an industrial technique that uses huge nets weighed down with weighty ballast that gets dragged down the sea bed, collecting and squashing everything on the way, from fish to aquatic plants. Many species, including those at the risk of extinction, get caught accidentally, and when returned to the sea, they are normally dead. Such collateral damage, sometimes called discards, can go up to 80% or 90%. When using this method, big parts of the seafloor, the territories where fish live and look for food, get compressed during the process. That' s because the large nets used in bottom trawling have a big mouth, leaving scars on the seafloor that sometimes can extend up to 4 kilometers in length or even beyond. In fact, the harm to the ecosystem due to this method may be permanent in some cases. Still on the downside, bottom trawling also stirs up sediment that may be poisonous, at times creating muddy water that gives aquatic species a difficult time surviving. Of course, that' s without ignoring the fact that this method of fishing destroys the natural features of the environment where plants and fish would typically live, relax, and even hide. The floor of water bodies consists of extraordinary biodiversity, which is what bottom trawling interferes with. In the past two decades, for example, researchers have discovered a lot of marine areas that are deeper than 400 meters to 2000 meters, with hundreds to thousands of creatures. The technique is mostly used by industrial boats in the high seas, at times regulated in protected waters. Bottom trawling has been blamed for contributing largely to overfishing and is often used for fishing in prohibited marine areas.

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1.10.2 Bycatch

Bycatch means accidentally catching numerous types of aquatic life while catching other fish. It can include catching the wrong size of the intended fish, other creatures that do not get eaten or the ones which are not in demand, or the endangered species, including particular birds, aquatic mammals, and turtles. On other occasions, some fish get thrown back because the fishing boat has not been licensed or lacks enough space, and sometimes the captain could change his or her mind on catching some particular fish. The large quantity of bycatch amounting to millions of tons annually gets thrown back into the water bodies, injured or dead.

1.10.3 Using Explosives or Blast Fishing

Using explosives for blasting fish is a method that has been used for years. Explosions can create very big craters ranging from 10 to 20 square meters of the sea bed. One downside of this method is that apart from killing the intended fish, it also kills the neighboring species and sometimes the coral reefs; which restructuring may take years. Explosives are commonly used because they can be easily and cheaply accessed, such as dynamite or homemade bombs made from locally available materials. Also, their regulation comes from construction and mining companies. Other explosives can be retrieved from old munitions and past and present wars. In other places, fishermen get access to the explosives through illegal trading.

1.10.4 Ghost fishing

It is the deliberate or unintentional leaving of fishing objects in a water body. The fishing nets still continue to catch fish and other creatures big and small, and the fish eventually die from overtiredness or suffocation after a long struggle to get to the top to breathe. The act of abandoning or losing fishing nets at sea has been intensified by rising fishing goings-on and the introduction of synthetic fishing nets that are very durable.

1.10.5 Cyanide Fishing

It involves divers crushing cyanide tablets into plastic quirt bottles of water and puffing the concoction to confound, and confine live fish in the coral reefs. The method is mostly practiced all over Southeast Asia regardless of being illegal in many nations in the area. The method was initially used in the 1960s in the Philippines so as to obtain live fish for sale to aquarium owners in other countries, a market that has tremendously grown. Currently, the method is used in supplying fish for Hong Kong and Singapore restaurants. The cyanide method is very harmful to the creatures that gulp it down. In fact, research shows that aquarium fish that have ingested cyanide grow cancer within a year of being bought. It is also said that one square meter of the coral reef is destroyed for every fish caught with the cyanide technique. The consumer of cyanide caught are at risk of cyanide poisoning through biomagnification at the long run.

1.10.6 Muro-ami

This illegal fishing method is mostly used in Southeast Asia. It involves using a huge encircling net with a number of pounding tools, normally weighty stones or cement blocks attached to the surface, to pound fish out of coral reefs. Fishermen pound the coral reefs with the cement blocks, scaring the fish out. Normally, the fish do not get scared, but the stones and blocks crash the coral reefs leaving the fish with no place to hide and getting caught. The continuous crashing of the coral reefs destroys the bottom sea aquatic ecosystem, which takes years to restore. The worst-case scenario is that they never grow back. Nonstop use of the Muro-ami technique could lead to the total eradication of coral reef ecosystems in Southeast Asia in the next decade, as it is reported that reefs affected by Muro-ami fishing take hundreds of years to recover which endangers aquatic biodiversity.

1.10.7 Kayakas

It is also known as bahan, bahiglukay, lukayan, gill net, ring net, or bahan. This method is the local smaller version of the " Muro-ami" with bamboo or tree trunks, coconut leaves, or other materials as scare-lines to drive the fish out of the coral reefs to be caught by the fishers with the idea of nonselective fish species harvesting.

1.10.8 Overfishing

When more fish are caught than can be naturally reproduced by the remaining population, it is called overfishing. There are recreational and commercial " bag limits" to ensure proper management of various fish species. Recreational anglers contribute to overfishing by keeping more fish than state or federal laws legally allow. Overfishing has a negative impact on aquatic biodiversity because every living organism plays a special role in keeping the balance of an ecosystem.

1.10.9 Electro-fishing

Using electricity generated by dry-cell batteries, electric generators, or other sources to aid in catching fish at a minimal voltage of electricity. This illegal method kills, stupefies, disables, or renders unconscious fish and other aquatic animals. Possessing any of the above shall constitute a presumption that the same was used for fishing.

10. Obnoxious or Poisonous Substances

Plant extracts, chemicals (such as cyanide), and other substances, raw or processed, are used in this method to kill, stupefy, disable, or render unconscious fish and other aquatic animals. Using plant extracts to eradicate predators in fishponds must be within acceptable limits, and that must not cause poisoning in neighboring waters. Synthetic pesticides (Brestan, Aquatin as well as Paraquat/Aquat) are also not allowed in fish ponds.

1.10.10 Keeping Undersized or Oversized Fish

Length limits ensure that a smaller population of fish is eligible for harvest. This reduces pressure on juveniles and larger spawning-size fish needed to repopulate.

1.11 Causes of Illegal Fishing That Affects Aquatic Biodiversity

Illegal fishing is highly propelled by the lack of proper fishing zone management as well as the lax fishing policies. Below are some of the reasons for illegal fishing:

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1.11.1 Lax Regulatory Systems in The Issuance of Fishing Permits

When there are no serious penalties, the idea of IUU fishing is very profitable. It is argued that not so many nations have implemented levels of regulations that are effective in deterring illegal fishing. Implementing rules such as forfeiting catches and fishing boats will effectively reduce such cases. Moreover, there are a lot of fishermen using counterfeit operating companies, and their names keep on changing so as to avoid penalties when they get in trouble.

1.11.2 Lack of Enough Funds or Resources for Surveillance and Tracking

Financially weak states set other priorities other than marine fishing surveillance. Those with illegal fishing policies tend to pay their staff very low wages, encouraging vessel owners to take advantage. Financially weak states also have poorly maintained marine patrol boats and aircraft, leaving room for illegal fishers to do as they please.

1.11.3 Economic and Social Circumstances

Research shows that many fishermen involved in illegal fishing are mostly from developing nations with a slow-growing economy and poor living conditions. The same scenario is also registered in developed nations. What is more, individuals from poor financial and social circumstances get provided with work where illegal fishing takes place; they are misused and do not even have social protection. This cycle of unending poverty and the need to have a source of livelihood encourages illegal fishing in continents such as Asia, Latin America, and Africa.

1.11.4 Lack of Proper Supervising, Control and Surveillance Activities

As you would have thought, the amount of supervising, control, and surveillance initiatives have the ability to have considerable control of illegal fishing. It gives helpful indicators to lawful fishing operators and dispiriting probable rebelliousness. Some of the notable aspects under this category include: Lack of knowledge regarding fish populations and quotas in a universal standard, There are little to no rules regarding fishing practices, which encourages fishing fleets to bypass areas that do have regulations. This is the case in most international waters, Problems with customs and importation clearance bodies where the provenance of fish is not questioned.

1.11.5 High Demand for IUU Fish

When fish prices rise, so do the need to get them illegally and the financial gains from IUU fishing, searching for the creatures that go for high prices. For instance, the cumulative money lost from IUU fishing of Patagonian tooth-fish was estimated to be about $ 518 million between the years 1996 and 2000.

1.11.6 Low Risk and High Return

Historically, illegal fishing has been a low-risk, high-return activity. That is, the chances of being caught are relatively low, as are the costs of fines and prosecution, particularly when compared to the huge profits that can be made by selling the fish. Some fishers skirt the law in pursuit of higher catch, taking advantage of patchy regulation of the commercial fishing industry and poor enforcement regimes at sea. The risks are worth taking because the rewards are huge, and the chances of being caught are small.

1.11.7 Supervision Is Costly

The purchase, maintenance, and operational costs of patrol boats and aircraft are very high. They must spend sufficient time at sea or in the air for effective control. However, even though they are available in some states, they are not operational because of the logistical problems of lack of fuel, proper maintenance regime, etc.

1.11.8 Authorities Lack Interest

There is an absence of sufficient and adequately trained personnel in the relevant authorities. The authorities' motivation to invest in relevant personnel is poor. Also, financially weak states pursue other priorities. Salaries are low, and vessel owners take advantage of this situation and pay irregularly to observers/fisheries administrators to cover up their activities.

1.12 CONCLUSION

Illegal, unreported and unregulated fishing is a broad term that captures a wide variety of fishing activity. IUU fishing is found in all types and dimensions of fisheries; it occurs both on the high seas and in areas within national jurisdiction. It concerns all aspects and stages of the capture and utilization of fish, and it may sometimes be associated with organized crime. IUU fishing undermines national and regional efforts to conserve and manage fish stocks and, as a consequence, inhibits progress towards achieving the goals of long-term sustainability and responsibility. Moreover, IUU fishing greatly disadvantages and discriminates against those fishers that act responsibly, honestly and in accordance with the terms of their fishing authorizations. If IUU fishers target vulnerable stocks that are subject to strict management controls or moratoria, efforts to rebuild those stocks to healthy levels will not be achieved, threatening marine biodiversity, food security for communities who rely on fisheries resources for protein and the livelihoods of those involved in the sector. Fishing may be illegal due to restrictions placed on fishing in certain territorial waters by specific nations or it may be illegal to hunt certain fish species at specific times of the year or in numbers greater than the legal quotas. IUU fishing activities could be seen in the context of; fishing without a license or quota for certain species, failing to report catches or making false reports, keeping undersized fish or fish that are otherwise protected by regulations, fishing in closed areas or during closed seasons, and using prohibited fishing gear.

In this review, it is notable that the marine environment is identical to other systems, such as deserts and forests, in what it needs to thrive. The pivotal element of any sound ecosystem is balance. Maintaining this balance between its individual components leads to the continuation of that system as we know it. An imbalance in the system signifies the emergence of negative symptoms and its eventual deterioration. These problems can arise due to natural factors, such as climate change, or as a result of human intervention, creating effects

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that range from transitory to irreversible. These considerations contribute to the impact of illegal fishing on marine life, which has made States intervene and impose immediate solutions that lead to the sustainability of these marine ecosystems.

Therefore, this article covers the most important points regarding the illegal fishing impacts on marine life. It is comprehensive, containing statistics from different geographical areas, lending the data an authority that makes it an important reference for other studies. The pivotal point made by different authors is that illegal fishing represents a legitimate disaster for the entire world. Moreover, the literature illustrates the impact of cheating in seafood markets, can lead to catastrophic outcomes on marine life.

1.13 RECOMMENDATIONS

This review recommends providing policy to countries to create a clearer picture of the consequences of violating fishing laws which can significantly mitigate the illegal fishing worldwide. One of the effective solutions to stop IUU by utilizing blockchain as advanced technique to follow any illegal activities from a specific individuals and groups. Any violation of the law that should expose people to severe penalties additionally, further studies should be undertaken to examine pollutants released from illegal fishermen, such as the dumping of numerous nets into the sea, which may cause a considerable threat to the lives of birds and marine organisms.

Hence, FAO should provide technical support for implementation of the IPOA-IUU and should keep the issue of IUU fishing under review. FAO should report to its members every two years on progress being made with the implementation of the IPOA-IUU. These reports should be based on information provided to FAO by its members. Governments should encourage fishers to comply with fishing rules through positive actions, including: community education and other outreach to fishers; ensuring that stakeholders participate in the development of fishery rules; fostering peer pressure in favour of compliance, and creating systems for collecting information that are easy for fishers to use.

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