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Legal Development in the Overcoming Overfishing in Indonesian Coastal Areas

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ABSTRACT

Indonesia, as a vast island state surrounded by extensive seas, holds a strategic advantage in the maritime sector. The coastal areas, rich in resources, play an indispensable role in the lives of numerous Indonesians. Despite the abundance of resources, the well-being of the population faces uncertainties attributed to management challenges. A prominent issue exacerbating the decline in the coastal ecosystem and diminishing productivity is the phenomenon of overfishing. Characterized by the excessive extraction of fish beyond their capacity to replenish, overfishing poses a severe threat to coastal areas. This unsustainable practice is rooted in legal ambiguities, conflicts in authority, and the bio-geophysical degradation of

resources within coastal zones. The detrimental consequences of overfishing necessitate immediate attention and intervention to preserve coastal ecosystems and secure the livelihoods of those reliant on them. Addressing these challenges, the focus of this research is on preventing the widespread occurrence of overfishing in coastal areas and mitigating the impacts of existing overfishing activities. The primary strategy proposed involves the development of a robust legal framework for the management of coastal areas. Through the establishment of clear legal guidelines, resolution of uncertainties, and mitigation of conflicts in authority, this research aims to lay the groundwork for sustainable and responsible practices in coastal resource management. The research aims to provide valuable insights that contribute to the enhancement of coastal area management, ultimately fostering ecological sustainability and improving the welfare of communities dependent on these vital resources. By delving into the complexities of coastal resource management, this study seeks to enrich the discourse surrounding sustainable practices, thereby facilitating informed decision-making and policy development in the quest for a harmonious coexistence between human communities and coastal ecosystems in Indonesia.

Keywords: Overfishing, Coastal Area, Law Enforcement

INTRODUCTION

Indonesia is conceived as the largest archipelagic states in world. The status is recognition under the United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982) making Indonesia as an archipelagic state. As referred to Article 46 of UNCLOS 1982, the archipelagic state consist of one or more archipelagos and can include other islands

having an island cluster, including the parts of island, interconnecting waters between and other closely interrelated natural manifestations and thereby those islands, waters, and other natural manifestations interrelated closely are an essential geographic, economic, and political unity, or the historical aspect has regarded as such.[1] Indonesia's geographic landscape consisting of 17,504 Islands in which 16,056 have been submitted to the UN covers the vast waters in different jurisdiction. The data obtained show that Indonesia's sea water area breadth is more than 75% of total area with 5.8 million square kilometers and 81,000 km-long coastal line making Indonesians to have advantages in their geographical potentials, particularly in maritime sector.[2]

Indonesia's geographical circumstances along with very broad sea water area, of course, influence significantly its people daily life and needs. Products generated from sea are one of fundamental life and economic sources to the people, particularly those living in coastal area and in that sense, all coastal areas of Indonesian offer potentials to explore. The potentials not only on natural resources but also human resources.[3] Coastal areas, certainly, make significant contribution to Indonesian economic development for the reason that those have provided abundant natural resources. It goes into further consideration that socio-economically about 50% of Indonesians live in coastal area with the mean growth rate of 2% per year and most of cities and regencies are located in coastal areas. In addition, another

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1 United Nations, "United Nations Convention on the Law of the Sea" (1982), Article 46.

2 Fahrudi Ahwan Ikhsan, "Wawasan Letak Geografi Indonesia Dalam Perspektif Kebijakan Pendidikan Kemaritiman Dan Kurikulum Nasional," *Prosiding Seminar Nasional (Pendidikan Geografi, FISH UNESA)*, no. 2006 (2017): 179.

3 Rahmat Datau and Hairan Hairan, "Aspek Hukum Dalam Pengelolaan Wilayah Pesisir Dalam Perspektif Otonomi Daerah," *Gorontalo Law Review* 2, no. 2 (2019): 82, https://doi.org/10.32662/golrev.v2i2.700.

important aspect is that biophysically Indonesian coastal and sea areas have long coast line where a large number of biodiversity live.[4]

Coastal area is a transition area connecting land to sea ecosystem, then it becomes the transition between land and sea, and thus to provide economic value and improve social-economic development activities. [5] The area also has highly potential development including renewable resources like mangrove forest, coral reef, seagrass, seaweed, and marine fishery resources. Moreover, non-renewable resources such as mineral and geological resources, environmental services, tourism, transportation and energy source are also in existence.[6]

Plentiful natural resources and varied biodiversity in coastal do not automatically ensure that the people working as fishermen will secure their prosperity. The average household income of small fishermen (small scale fisheries) since 1997/1998 in 10 provinces in Indonesia still below the regional minimum wage determined by the government in the same year.[7] The natural resources potential should be able to make the fishermen and the coastal people prosperous, but

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4 M. Kristiyanti, "Pemberdayaan Masyarakat Pesisir Pantai Melalui Pebdekatan ICZM (Integrated Coastal Zone Management)," *Seminar Nasional Multi Disiplin Ilmu*, no. 180 (2016): 752–53, http://www.unisbank.ac.id/ojs/index.php/sendi_u/article/view/4264/1270.

5 Luhur Akbar Devianto Syifa Saputra, Edward Ngii, Muhammad Chaerul, Dewi Alima Nostalia Suseno, La Ode Muhammad Magribi, Marzuki Sinambela, Moch Saad, Reza Yesica, *Pengelolaan Wilayah Pesisir Yang Terpadu Untuk Ketahanan Nasional* (Yayasan Kita Menulis, 2020), 29–30.

6 Kurniawati Hapsari Ekosafitri, Ernan Rustiadi, and Fredinan Yulianda, "Pengembangan Wilayah Pesisir Pantai Utara Jawa Tengah Berdasarkan Infrastruktur Daerah: Studi Kasus Kabupaten Jepara," *Journal of Regional and Rural Development Planning* 1, no. 2 (2017): 147, https://doi.org/10.29244/jp2wd.2017.1.2.145-157.

7 Prihandoko S et al., "Kondisi Sosial Ekonomi Nelayan Artisanal Di Pantai Utara Provinsi Jawa Barat," *Jurnal Penyuluhan* 8, no. 1 (2015): 82, https://doi.org/10.25015/penyuluhan.v8i1.9896.

in fact their life is instead identical with poverty.[8] Such condition is due to some problems occurring in coastal area having impact on the income of people living there, particularly those working as fishermen. Coastal area is an important but vulnerable-to-disturbance area. The area also can change easily, either temporally or spatially.[9]

One of important problems affecting the welfare of people around coastal area and on which this research focuses on is overfishing (often called excessive fishing). Overfishing is a status given to water area, the fish resources of which has encountered overfished. It occurs when the fishing rate is in fact beyond the fish resource's recovering ability.[10] Overfishing leads the fish population to experience a decline consistently and even the it is more than the fish population's growth rate, in which can result their extinction.[11]

Overfishing has occurred in some coastal areas in Indonesian waters such as Malacca Strait, Java North Beach, Bali Strait, and Sulawesi South Beach due to the fishing rate surpassing the potential fish stock. [12] This marine environmental problem results to the damaged sea/coastal ecosystem leading to low productivity.[13] There

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[8] Anak Agung Istri Ari Atu Dewi, "Model Pengelolaan Wilayah Pesisir Berbasis Masyarakat," *Jurnal Penelitian Hukum* 18, no. 2 (2018): 165.

[9] Burhan Bungin Kismartini, *Wilayah Pesisir Indonesia: Narasi Kebijakan Publik Masalah Pesisir Dan Pulau-Pulau Kecil Di Indonesia* (Jakarta: Kencana, 2019), 2.

[10] Duto Atmaja, Suherman Banon Sadhotomo, Bambang Nugroho, "Overfishing Pada Perikanan Pukat Cincin Semi Industri," *Jurnal Kebijakan Perikanan Indonesia* 1, no. 021 (2011): 52.

[11] Ulrike Hilborn Ray Hilborn, *Overfishing: What Everyone Needs to Know* (New York: Oxford University Press, 2012), 3.

[12] PPPHN Kemenkumham, "Laporan Analisis Dan Evaluasi Hukum Tentang Pengelolaan Wilayah Pesisir Dan Pulau-Pulau Kecil," 2015, 17, https://www.bphn.go.id/data/documents/ae_tentang_pengelolaan_wilayah_pesisir_dan_pulau-pulau_kecil.pdf.

[13] E. W. H. Herwindya, A. Y dan Susilo, "Analisis Manfaat Mangrove Dan Terumbu Karang Terhadap Lingkungan Pesisir Serta Implikasinya Pada Pendapatan Nelayan (Studi Emperik Pesisir Pantai Demak)," *Jurnal Ekonomi Manajemen Akuntansi* 21, no. 36 (2014): 2.

are some indicators that can be the reference to a coastal area encountering overfishing, those are, the total catch volume which is higher than the Maximum Sustainable Yield of fish resources, decreased catch, smaller size of fish caught, and farther or deeper fish catching area.[14] A coastal area having indicated overfishing will affect significantly the fishermen who rely on their life in the area to fulfill their life needs and welfare.

As aforementioned, overfishing creates legal and institutional problems related to the management of coastal area. There are 21 laws and 6 international conventions (either ratified or serving as soft law only) mandating some development sectors to conserve and mange resources in coastal area. In their implementation, the regulations result in the emerging conflict of interest amongst institutions in managing resources in coastal area. This is also due to regional autonomy policy requiring the regional government to develop its regulation based on the interest in improving local own-source revenue. This finding generates legal uncertainty in coastal resource development and management, leading to the damaged resources and environment. Legal problem occurring in the management of coastal areas is related to the conflict between laws, conflict between laws and customary law, and legal gaps. These problems end up in legal uncertainty, conflict of authority, and damaged bio-geophysical resources in coastal areas.[15] Coastal area as common property and open access will, of course, involve many elements interested in the

[14] Nobel Aqualdo Ria Pika Wati, Syapsan, "Dampak Kelebihan Tangkap (Overfishing) Terhadap Pendapatan Nelayan Di Kabupaten Rokan Hilir," *JOM.Fekon* 1, no. 2 (2014): 7–8, https://jom.unri.ac.id/index.php/JOMFEKON/article/view/5827.

[15] PPPHN Kemenkumham, "Laporan Analisis Dan Evaluasi Hukum Tentang Pengelolaan Wilayah Pesisir Dan Pulau-Pulau Kecil," 24–25.

area management.[16] Then, highly potential coastal resources, various dynamics, and exploitation activities occurring in the coastal area need appropriate policy and management.[17]

This research has the objective to prevent the overfishing from spreading to other coastal areas and to recover the coastal areas that have encountered overfishing. This paper offers the recommendation to develop legal frameworks in the attempt of compensating the gap of law to achieve the certainty in terms of resource management in the coastal area. The legal development is also intended to overcome overfishing and to manage coastal resources to benefit actually the welfare of people living in the area and the state development.

This research focuses on legal development as an action or an activity to create better and more conducive legal mechanism.[18] Legal development is an attempt of developing new law to reform positive law (substituting new law for the old one).[19] Legal development can be done in some attempts; the attempt to be done in this research is, among others, to formulate the legal material reform by considering the legal order enacted and the effect of globalization as an attempt of improving law certainty and protection.[20]

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[16] Dwi Maulidatuz Zakiyah Aris Subagiyo, Wawargita Permata Wijayanti, *Pengelolaan Wilayah Pesisir Dan Pulau-Pulau Kecil* (Malang: Universitas Brawijaya Press, 2017), 43.

[17] Dyah Ayu Widowati and Muchammad Chanif Chamdani, "Dinamika Hukum Pengelolaan Pesisir Pasca Reformasi Di Indonesia," *Majalah Hukum Nasional* 48, no. 2 (2018): 27, https://doi.org/10.33331/mhn.v48i2.102.

[18] Badan Pembinaan Hukum Nasional Kementerian Hukum and Hak Asasi Manusia Republik Indonesia (BPHN), "Perencanaan Pembangunan Hukum Nasional 2005-2025," *Jakarta: Badan Pembinaan Hukum Nasional Kementerian Hukum Dan Hak Asasi Manusia Republik Indonesia* 1945 (2014): 1.

[19] Achmad Irwan Hamzani, Mukhidin, and D. Prapti Rahayu, "Pembangunan Hukum Nasional Sebagai Implementasi Tujuan Nasional," *Prosiding SENDI_U* 1, no. 3 (2018): 366.

[20] BPHN, "Perencanaan Pembangunan Hukum Nasional 2005-2025," 3–4.

In this research, the legal development will be elaborated comprehensively to solve overfishing. The legal development strategy is implemented in the legal substance component to address legal uncertainty in the attempt of overcoming the problem. The early step is taken by mapping both international and national regulations related to the management of coastal area. The identified regulations are then harmonized and synchronized into an integrated regulation system. The integrated legal material and substance is then identified comprehensively to find out which one has been irrelevant, or which one has resulted in the gap of law and thereby led to overfishing in coastal areas. Following the identification and the finding of substance or law leading to unsolvable overfishing phenomenon, the formulation of law is done to construct legal substance or material in the scope of coastal management to solve overfishing problem and to improve the welfare of coastal people. This research becomes relevant and substantial as it is a process of yielding solution to the problem of coastal management.

OVERFISHING UNVEILED: TRACING ITS HISTORY, UNRAVELING IMPACT, AND EXPOSING THE CAUSES

I. History of Overfishing: The Global Practices

In the intricate realm of overfishing, scientists grappled with perplexities well into the turn of the 20th century. The quagmire of questions surrounding this issue has stirred curiosity and debate: When does overfishing truly occur? What are the discernible markers

for identifying overfishing? Does it manifest in various forms? And, perhaps most crucially, how can we effectively overcome the challenges posed by overfishing? These lingering uncertainties beckon us to explore, question, and ultimately rally for comprehensive solutions in our shared commitment to safeguarding the delicate balance of our aquatic ecosystems.[21] Long before, in the context of marine fisheries, the term "used-up natural resource" still became a topic of debate, although there is a specified limitation in the debate in the term of the extraction of renewable resources such as forest, whale population, and lake fishery.[22] Overfishing was debated firstly in England in 1854, in which some fishermen complaining about the arrival of trawler fishermen and then they asked the Official Commissions of Enquiry into Sea Fisheries for conducting early investigation. In late 1870s, the owners of trawler saw by themselves their decreased catch and they wanted the local government take some measure to face the phenomenon.[23]

The term overfishing was coined firstly by Cleghorn in 1854, but the term is not defined in detail. Cleghorn argued by associating overfishing with the non-sustainable extraction that can reduce population in such a way that makes the population extinct economically and the activity will inherently restrict the use of it by

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[21] Gregory Ferguson-Cradler, "The Overfishing Problem: Natural and Social Categories in Early Twentieth-Century Fisheries Science," *Journal of the History of Biology* 54, no. 4 (2021): 719, https://doi.org/10.1007/s10739-021-09655-4.

[22] D. R. Goethel, S. X. Cadrin, and B. J. Rothschild, "Reconsidering Historical Definitions of Overfishing and the Balance between Sustainable Use and Overexploitation," *ICES ASC Bergen 2012*, no. February 2015 (2012): 5, www.vliz.be/imisdocs/publications/247565.pdf.

[23] Jens Smed and John Ramster, "Overfishing, Science, and Politics: The Background in the 1890s to the Foundation of the International Council for the Exploration of the Sea," *ICES Marine Science Symposia* 215 (2002): 16, https://doi.org/https://doi.org/10.17895/ices.pub.8084.

the future generation.[24] This argumentation is, of course, criticized by some scientists, despite the support from some others. Friedrich Heincke is a German biologist in his article in 1894 defining overfishing as a condition in which there is sufficiently strong pressure against fish population so that the new fish production decreases and leads to the constantly decreasing population. Meanwhile, C.G. Johannes Petersen, as the head of Danish Biology Station, states that in 1903 that overfishing is the reduction of fish population due to human activities. Furthermore, in 1905 a Dutch fishery scientist and a senior figure in European fishery research, P.P.C. Hoek, defines overfishing as catching too many fish at once it means that the number of fish taken is more than that replaceable through natural production. Some terms explained in some periods of time do not affect significantly because fisheries scientists more often discuss overfishing broadly with a general assumption and note contradiction between meaning and its implication.[25]

Historically, in the context of discussion on overfishing, the researchers have studied various data sources including modern ecological notes. The data sources also include historical information collected on the fishing activities since 15th century, archeological recording about human settlement in coastal areas coming from 10,000 years ago, and paleo-ecological data coming from 125,000 years ago. Recalling anything having ever been done by human beings to the sea historically, overfishing is the main cause of ecosystem collapse. An investigation is also conducted on the change of seas throughout world, from Chesapeake bay to Caribbean coral reef and Australia coastal bays. The result shows that throughout world

[24] Goethel, Cadrin, and Rothschild, "Reconsidering Historical Definitions of Overfishing and the Balance between Sustainable Use and Overexploitation," 5.

[25] Ferguson-Cradler, "The Overfishing Problem: Natural and Social Categories in Early Twentieth-Century Fisheries Science," 720.

human's early hunt for sea animal on the peak of food chain such as shark, turtle, or whale, affects significantly the animals existing in the bottom of food chain.[26]

Historically, overfishing has ever occurred in Norway and then affected the fisheries and the coastal people. It was because the collapse of "Norwegian spring-spawning herring' fish stock in late 1960s and overfishing affecting adversely the stock of big fish in Barents, Norwegian, and North seas.[27] Long before, the collapse of spawning herring fish has occurred in western Baltic Sea in the end of 16th century as a result of overfishing and climate change combination. The research team reconstructs the spawning herring catching level in Baltic Sea in 1200-1650. The fisheries for spawning herring fish are so far most important in the case of overfishing. It is because the fish collapse in short time without recovery until today.[28] In late 1970s, the researchers have concluded that the species collapse was due to overfishing. It is in line with a report on resource published by Institute for Marine Research in 1977. This report explains in detail that the collapse was due to fish catching done by human beings. The stock of fish caught excessively (literally meaning

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[26] Sarah Graham, "Historical Overfishing Started the Problems Marine Ecosystems Now Face," Scientific American, 2001, https://www.scientificamerican.com/article/historical-overfishing-st/.

[27] Peter; Asgeir Aglen; Asmund Bjordal; Geir Blom; Sverre Johansen; Jørn Krog; Ole Arve Misund; Ingolf Røttingen. Gullestad, "Changing Attitudes 1970–2012: Evolution of the Norwegian Management Framework to Prevent Overfishing and to Secure Long-Term Sustainability," *ICES Journal of Marine Science* 71, no. 2 (2014): 173, https://doi.org/10.1093/icesjms/fst094.

[28] Kiel University, "Climatic Changes and Overfishing Depleted Baltic Herring Long before Industrialization," phys.org, 2021, https://phys.org/news/2021-12-climatic-overfishing-depleted-baltic-herring.html.

caught until the end), particularly the small fat herrings that have been overexploited up to 90%.[29]

Another historical information related to overfishing has occurred since 14th and 15th centuries. European fishermen began to see the adverse effect of overfishing done for centuries on local fisheries in East Atlantic Sea. The populations of halibut and cod fish abundant previously in East Atlantic Sea began to depreciate quickly and led to the small number of catch.[30] In 1947, history has recorded a period when a navigator named John Cabot went back from Newfoundland to England while reporting that the fish there was very abundant and sometimes made his ship stopped. This resulted in the exploitation of marine resource around Newfoundland and the information on "New World" quickly became public news to European people. Then, in 16th Century, the competition was begun by fishermen, sailors, and European dwellers to claim and to take advantage from the valuable "new" region. It indicated the beginning of marine resource exploitation due to overfishing in the water areas.[31]

There is a challenge to achieve the target mentioned in the sustainable development goals (SDGs) in the sea. Overfishing is one of problems that has drained and disturbed marine ecosystem, and therefore endangering economic, social, and environmental benefits. The threat against the sea is no longer in doubt in the presence of more pressure against marine resource.[32] The researchers have suggested

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[29] Gregory Ferguson-Cradler, "Fisheries' Collapse and the Making of a Global Event, 1950s-1970s," *Journal of Global History* 13, no. 3 (2018): 405, https://doi.org/10.1017/S1740022818000219.

[30] Christopher D. Lampart, "What Are the Effects of Overfishing on Marine Ecosystems in the Northwest Atlantic Ocean?," Panic in The North Atlantic, n.d., https://panicinthenorthatlantic.weebly.com/final-research-paper.html.

[31] Lampart.

[32] Jane Lubchenco et al., "The Right Incentives Enable Ocean Sustainability Successes and Provide Hope for the Future," *Proceedings of the National Academy*

that overfishing is an important challenge today, but policy makers and ecologists are often inhibited by the inadequate empirical data available concerning fisheries before the mid of 20th century.[33] To overcome the overfishing having occurred and to occur, the policy makers should be able to formulate a policy that can save the sea along with its resource from the threat. The policy makers can learn from a long historical experience for centuries about the incidence of overfishing that damage and endangers the sustainability of sea and its resources.

II. Overfishing Unleashed: Unmasking the Devastating Impact

Apprehension arises due to the global excessive fishery exploitation. Despite the information that global fish production and fishery product increase continuously, the harvest aspect of capture fishery is stagnant in some decades. Fish stock and species have decreased in quantity and even disappeared today. It, of course, requires tight management and even protected region development.[34] In the case of fish scarcity or extinction in the area where fish catching activity is done, overfishing is usually the first marine environmental issue to come up followed by other factors such as pollution and eutrophication, mechanic habitat damage, introduced species, and climate change. Overfishing makes the fish stock irrecoverable and it

of Sciences of the United States of America 113, no. 51 (2016): 14507, https://doi.org/10.1073/pnas.1604982113.

[33] The University of New Orleans, "This Historical Fish Tale Can Guide Future Conservation Policy, UNO Researchers Say," The University of New Orleans, 2021, https://www.uno.edu/news/2021-08-17/historical-fish-tale-can-guide-future-conservation-policy-uno-researchers-say.

[34] J. David Allan et al., "Overfishing of Inland Waters," *BioScience* 55, no. 12 (2005): 1041, https://doi.org/10.1641/0006-3568(2005)055[1041:OOIW]2.0.CO;2.

is because most capture fisheries rely on natural stock reproduction and then do overfishing. The fisheries will be caught in their biological limit and the main threatening factor is extinct habitat and environmental degradation.[35] The severe overfishing will lead species to ecological extinction, because the population caught excessively will no longer be able to interact significantly with other species in its community.[36]

Overfishing is a factor affecting significantly the decrease of fish species and type. There are two basic types of overfishing: intensive fish catching with the targeted species leading to the decrease of catch per unit and the size of fish caught, and overfishing in colony or ecosystem.[37] In addition to the decrease of fish species and type, overfishing also can affect the coral reef's ability of recovering from destruction leading to degradation. It is because the fish catching activity is undertaken on the coral reef and then the coral reef will be taken excessively particularly in the area close to human settlement.[38] In some cases, overfishing is due to the combination of low productivity and sustainable fish catching, and thereby will lead to the increase of exploitation mortality.[39] Just like eutrophication, excessive fish catch is the main anthropogenic cause that can result in global-scale change in estuary and coastal system. There are many

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[35] Allan et al., 1043.

[36] J. B.C. Jackson et al., "Historical Overfishing and the Recent Collapse of Coastal Ecosystems," *Science* 293, no. 5530 (2001): 629, https://doi.org/10.1126/science.1059199.

[37] Allan et al., "Overfishing of Inland Waters," 1045.

[38] Alina M. Szmant, "Nutrient Enrichment on Coral Reefs: Is It a Major Cause of Coral Reef Decline?," *Nutrient Effects on Coral Reefs* 25, no. 4b (2002): 748, https://doi.org/10.3938/jkps.65.243.

[39] Georgi M. Daskalov et al., "Trophic Cascades Triggered by Overfishing Reveal Possible Mechanisms of Ecosystem Regime Shifts," *Proceedings of the National Academy of Sciences of the United States of America* 104, no. 25 (2007): 10520, https://doi.org/10.1073/pnas.0701100104.

estuaries previously providing large fish harvest but now having been exploited excessively with some nearly extinct fisheries. The high-valued species is the first one used up and leaving some unexpected forms to be exploited. Similarly, in United States of America, out of 28 estuaries assigned to be the National Estuary Program Site in US, there is a decrease in the number of fish and wild life populations, considered as high- or medium-priority problem in the 22 estuaries.[40]

III. Decoding its Roots & Causes in Overfishing Practices

Overfishing, particularly in coastal area may be caused by the population density in the area. It can be seen in the case occurring in Hawaii Island. Hawaii Island is very populous and urban in which coral reef in the area provides most protein to Hawaiian people in the previous years. However, currently the use of coral reef resource is done consumptively involving commercial, recreational, and subsistence activities. Coastal fishery in Hawaii Islands encounters excessive exploitation, and thereby productivity decreases, particularly in the more populous areas likely constituting the cumulative outcome of overfishing for many years.[41] Furthermore, overfishing also occurs in the north of New Zealand. The fishery product in Hauraki Gulf increased gradually since 1800 through 1970

[40] Michael J. Kennish, "Environmental Threats and Environmental Future of Estuaries," *Environmental Conservation* 29, no. 1 (2002): 97–98, https://doi.org/10.1017/S0376892902000061.

[41] Alan M. Friedlander and Edward E. DeMartini, "Contrasts in Density, Size, and Biomass of Reef Fishes between the Northwestern and the Main Hawaiian Islands: The Effects of Fishing down Apex Predators," *Marine Ecology Progress Series* 230 (2002): 255, https://doi.org/10.3354/meps230253.

when Pair Trawls catching tool is introduced. Then, in 1980 the annual catch began to decrease by 87% and indicated the signs of overfishing.[42] It is understandable that even the technical detail of fishing gears can be the factor generating overfishing that then has an impact on damaged marine environment and decreased fish catch. In Indonesia the fishing gear like Pair Trawls has been prohibited since 2016 based on Minister of Marine and Fisheries Regulation Number 71 of 2016, because this equipment contributes to damaging marine environment.

Marine and fisheries experts have admitted that overfishing damages the marine environment. In 1989 about 90 million ton (metric ton) of fish catch has been taken from the sea and then the fishing industry has achieved the most productive, and since then the catch decreased and became stagnant.[43] Overfishing occurs when the stock decreases quickly with overcapacity in slow process or the increasing attempt of catching fish (e.g. using bigger technology) due to the fishery management's incapability of predicting or adapting quickly to the change of fish stock.[44] A previous study conducted in Cape Code (a cape geographically extending from the south east corner of Massachusetts in the North Eastern United States of America to Atlantic Ocean) found that overfishing (including fishing for recreational purpose) has serious impact. Marine resources

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[42] Lorenz Hauser et al., "Loss of Microsatellite Diversity and Low Effective Population Size in an Overexploited Population of New Zealand Snapper (Pagrus Auratus)," *Proceedings of the National Academy of Sciences of the United States of America* 99, no. 18 (2002): 11742, https://doi.org/10.1073/pnas.172242899.

[43] Yuanyang Du, Jiale Sun, and Guoyun Zhang, "The Impact of Overfishing on Environmental Resources and the Evaluation of Current Policies and Future Guideline," *Proceedings of the 2021 International Conference on Public Relations and Social Sciences (ICPRSS 2021)* 586, no. Icprss (2021): 1121, https://doi.org/10.2991/assehr.k.211020.316.

[44] Daskalov et al., "Trophic Cascades Triggered by Overfishing Reveal Possible Mechanisms of Ecosystem Regime Shifts," 10521.

existing in the area, particularly fishery, develop very rapidly and codfish has been the main menu of American and European people for many years. Millions pound of codfish, mackerel, and other seafood have been sent to all over the world. This case study in Cape Cod found that if predator populations have been caught excessively, the coastal flora will diminish more quickly. Overfishing done over the fish on the top food chain by fishermen leads to the significant increase in the number of *Sesarma*. *Sesarma* can proliferate and eat freely without predator, and thereby result in damaged coastline. The phenomenon occurring in Cape Cod is a real example that can reveal some bigger problems related to overfishing.[45]

Overfishing will result in very big and may potentially irrecoverable loss in the future.[46] Therefore a comprehensive action should be taken to save marine ecosystem that encounters overfishing. During the restriction of fishery access through quota system that can be transferred individually (e.g. in the states like Canada, Island, and New Zealand) or total moratorium in fishery harvest (e.g. strip bass fishery in central Atlantic states of United States of America during 1985-1990), the recovery of fishery stock could be seen. However, to most states, the trend related to the decreased fishery stock due to overfishing happens continuously. Many countries, particularly developing countries, do not have effective management program and generally fishermen will resist the policies restricting the fishing attempt.[47]

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[45] Du, Sun, and Zhang, "The Impact of Overfishing on Environmental Resources and the Evaluation of Current Policies and Future Guideline," 1121.

[46] Jeremy B.C. Jackson, "Ecological Extinction and Evolution in the Brave New Ocean," *Proceedings of the National Academy of Sciences of the United States of America* 105, no. SUPPL. 1 (2008): 11458, https://doi.org/10.1073/pnas.0802812105.

[47] Kennish, "Environmental Threats and Environmental Future of Estuaries," 98.

OVERFISHING IN THE JAVA SEA

Overfishing is a threat against marine biodiversity. It is encouraged with overcapacity or overproduction then leading to publicly opened access to a state's policy in the term of fisheries management. The management recently is not only limited to the fulfillment of commercial fishery industry, but also required to accommodate various economic and social benefits including food tenacity and economic growth. Therefore, a sound and reliable fisheries management is so important that appropriate institutional structure and legal framework are required in resource management. The broad participation of stakeholders in the resource management will be important in achieving the successful implementation of better fishery management strategy. Decentralization system involving local people at higher level in decision making will result in more flexible management system. Thus, the regulation can be formulated and enforced more possibly according to the local fishery need.[48]

The Report on Legal Analysis and Evaluation on the Management of Coastal Areas and Small islands in 2015 by National Legal Development Planning Center of National Legal Building Agency of RI's Ministry of Law and Human Rights mentions that there are some Indonesian sea regions beginning to show the existence of overfishing one of which is Java Sea. Java Sea is the one with 20-m Isodepth criteria located in the distance up to ten miles from high seas. Java Sea is located between Kalimantan, Java, Sumatera, and Sulawesi Islands in Indonesian archipelago. The geographical limit of Java Sea can be found in the President Regulation Number 3 of 2022 on the Java Sea Interregional Zoning

[48] Allan et al., "Overfishing of Inland Waters," 1049.

Plan.[49] The boundary in the President Regulation adopts the world's limit oceans and seas published by the International Hydrographic Office.[50] The stream in Java Sea spreads widely throughout its waters and has fairly crowded cruise line.[51] Java Sea is a relatively narrow with about 300-km width and 1000-km length surrounded by Java Island in the South, Sumatera Island in the West, Kalimantan Island in the North and Sulawesi Island in the North East.[52] Java Sea has various potential living and non-living resources. As the crowded cruise line, an understanding is required on the natural phenomenon occurring in the waters. It will be useful to support the attempt of utilizing marine resource and various activities existing in the waters.[53]

Generally, the 12-mile area of Java Sea is no longer used for the fishing activity, because the marine resources have decreased in the area, in which the number and the size of fish are getting smaller. Thus, the fishermen should sail farther (about 60 miles) to fish. The factor resulting in damaged sea resource in the 12-mile area is, among others, the use of fishing instruments now prohibited by Indonesian

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[49] Indonesia, "Peraturan Presiden Republik Indonesia Nomor 3 Tahun 2022 Tentang Rencana Zonasi Kawasan Antarwilayah Laut Jawa" (2022), n. Article 2 and Annex 1.

[50] The International Hydrographic Organization, "Limits of the Oceans and Seas," *Special Edition Number 23 (3rd Edition)*, 1953.

[51] Nandia Meitayusni Nabila, Bandi Sasmito, and Abdi Sukmono, "Studi Karakteristik Gelombang Perairan Laut Jawa Menggunakan Satelit Altimetri Tahun 2016-2018 (Studi Kasus : Perairan Laut Utara Jawa)," *Jurnal Geodesi Undip* 9, no. 1 (2020): 67.

[52] Wahyu Budi and Aditya Pamungkas, "Perbandingan Karakteristik Oseanografi Pesisir Utara dan Selatan Pulau Jawa: Pasang-Surut, Arus, Dan Gelombang," *Prosiding Seminar Nasional Kelautan Dan Perikanan*, no. September (2017): 191.

[53] Andyra Yahya Nugraha Putra and Danar Guruh Pratomo, "Pengembangan Co-Tidal Charts Untuk Analisis Karakteristik Pasang Surut Perairan Laut Jawa," *Jurnal Teknik ITS* 6, no. 2 (2017): 204, https://doi.org/10.12962/j23373539.v6i2.25241.

legislation, *cantrang* and *cotok* (micro trawl). The gear is still used to fish by the irresponsible fishermen until today and thereby can lead to make the marine environment destructed. One of the issues in its connection to overfishing is the substitution of fishing gears by the fisherman. While they are accustomed to use certain fishing gears with fairly significant catch, it can include the smallest fish and damage coral reef.[54]

Indicator of overfishing such as number of fishing volume in Java Sea can be observed from the statistical data of the Ministry of Marine and Fisheries that can be accessed in the website statistik-kkp. The data used is related to the analysis of overfishing phenomenon in the website statistik-kkp, including the data in 2018, 2019, and 2020. Meanwhile, the data of 2021 is not used as it is still provisional in nature, related to the volume of fishery production beginning to decrease or even not found in Java Sea of Central Java province including *Bawal* (pomfret), *Cucut* (swordfish), *Gabus* (snakehead fish), *Rajungan* (small crab), *Setuhuk* (marlin), *Tenggiri* (mackerel), *Tongkol* (mackerel tuna), and *Udang* (shrimp). The data collected is presented in the table below:

TABLE 1 Data of Maritime and Fishery Production

Business Type	Province	Types of Fish	Years	Production Volume (Ton)	Production Value (Rp. 1.000,-)
Sea Fishing	Central Java	*Bawal*	2018	16.257,18	751.046.443
Sea Fishing	Central Java	*Bawal*	2019	9.036,22	489.138.893
Sea Fishing	Central Java	*Bawal*	2020	2.739,80	157.817.557
Sea Fishing	Central Java	*Bawal*	2021	2.640,61	126.040.916

[54] Kholis; Rahayu; Peni Susetyorini; Arnanda Yusliwidaka Roisah, "Data Confirmation Using Interview Method, Informants from Maritime and Fishery Resource Supervision Unit of Pati, Work Areas of PSDKP Tasik Agung, PSDKP Jobokuto – Jepara, PSDKP Morodemak, Fishery Port of Tasik Agung Beach, Rembang on August 15-16, 2022.," 2022.

Business Type	Province	Types of Fish	Years	Production Volume (Ton)	Production Value (Rp. 1.000,-)
Sea Fishing	Central Java	*Cucut*	2018	665,59	30.686.316
Sea Fishing	Central Java	*Cucut*	2019	1.537,45	50.900.502
Sea Fishing	Central Java	*Gabus*	2018	32,42	475.310
Sea Fishing	Central Java	*Gabus*	2019	351,23	4.109.601
Sea Fishing	Central Java	*Gabus*	2020	7,81	136.624
Sea Fishing	Central Java	*Gabus*	2021	4,00	64.474
Sea Fishing	Central Java	*Rajungan*	2018	9.759,16	777.680.247
Sea Fishing	Central Java	*Rajungan*	2019	8.619,63	537.944.572
Sea Fishing	Central Java	*Rajungan*	2020	2.002,86	71.611.540
Sea Fishing	Central Java	*Rajungan*	2021	1.167,09	88.324.510
Sea Fishing	Central Java	*Setuhuk*	2018	119,82	5.677.254
Sea Fishing	Central Java	*Setuhuk*	2019	1.031,82	32.519.526
Sea Fishing	Central Java	*Tenggiri*	2018	5.775,85	299.864.717
Sea Fishing	Central Java	*Tenggiri*	2019	2.805,84	144.356.580
Sea Fishing	Central Java	*Tenggiri*	2020	2.237,32	88.219.868
Sea Fishing	Central Java	*Tenggiri*	2021	2.910,66	113.897.492
Sea Fishing	Central Java	*Tongkol*	2018	17.686,34	432.646.644
Sea Fishing	Central Java	*Tongkol*	2019	10.797,75	222.816.097
Sea Fishing	Central Java	*Tongkol*	2020	6.456,26	113.195.733
Sea Fishing	Central Java	*Tongkol*	2021	7.258,67	119.955.127
Sea Fishing	Central Java	*Udang*	2018	7.013,91	450.118.348
Sea Fishing	Central Java	*Udang*	2019	8.926,74	273.370.097
Sea Fishing	Central Java	*Udang*	2020	5.427,39	145.544.090
Sea Fishing	Central Java	*Udang*	2021	4.757,28	152.122.314

Source: https://statistik.kkp.go.id/home.php (Navigation: Fishery Production; Keywords of Data Searching: Type of Marine Capture Business; Years 2018, 2019, 2020; Type of Fishes: pomfret, swordfish, snakehead fish, small crab, marlin, mackerel, mackerel tuna, and shrimp; Central Java).[55]

From above data, it can be drawn that some fish such as *Bawal* (pomfret), *Rajungan* (small crab), *Tenggiri* (mackerel), and *Tongkol*

[55] Kementerian Kelautan dan Perikanan, "Statistik-KKP," accessed September 19, 2022, https://statistik.kkp.go.id/home.php.

(mackerel tuna) experience consistent decrease in production volume from 2018 to 2020, while the production volume of *Gabus* (snakehead fish) and *Udang* (shrimp) has ever increased in 2019 but decreased significantly in 2020. In addition to the decrease of production volume, some types of fish are not found in 2020: swordfish and marlin. It should be considered specifically recalling that an indicator of overfishing is the decrease of catch or production volume. Suman et al. supported this finding and observed that pelagic fishing in Jepara waters within Fisheries Management Area 712 (Java Sea) was overfished due to the declined production of purse seiners operated.[56] This situation suggests ecosystem overfishing in the Java Sea due to the declining catch of major fish types listed above.[57]

PREVENTION & MITIGATION OF OVERFISHING: A LEGAL PERSPECTIVE

In relation to legal aspect, the prevention and the settlement of overfishing in Indonesian coastal areas can be studied firstly from international law, UNCLOS 1982. It is important recalling that Indonesia is a state party of UNCLOS 1982. Thus, there is a stipulation on the state's rights and obligations enacted under international legal framework. Chapter XII UNCLOS 1982 has regulated sea protection

[56] Ali Suman et al., "Status Stok Sumber Daya Ikan Tahun 2016 Di Wilayah Pengelolaan Perikanan Negara Republik Indonesia (WPP NRI) Dan Alternatif Pengelolaannya," *Jurnal Kebijakan Perikanan Indonesia* 10, no. 2 (2018): 107–28, https://doi.org/10.15578/jkpi.10.2.2018.107-128.

[57] Jason S. Link and Reg A. Watson, "Global Ecosystem Overfishing: Clear Delineation within Real Limits to Production," *Science Advances* 5, no. 6 (2019): n. For a general overview of ecosystem overfishing, https://doi.org/10.1126/sciadv.aav0474.

and preservation that can function to prevent and to overcome the overfishing. Article 192 provides the obligation for the state to protect and to preserve sea environment.[58] Furthermore, Article 193 mentions that the State is entitled to exploit its natural resource sovereignly, but the implementation should be based on the environmental policy according to its duty to protect and to preserve sea environment.[59] The state is obliged to develop some necessary measures to protect and to preserve the scarce and fragile ecosystem, the used-up, endangered and almost extinct species habitat, and other sea life forms according to Article 194 clause (5).[60] The stipulation can be explained further that the states, including Indonesia, are authorized to develop appropriate measures and programs in the attempt of protecting and preserving sea ecosystem based on environmental policy.

Indonesia, in managing coastal area management, has adopted some laws and regulations: Law Number 27 of 2007 about the Management of Coastal area and Small Islands, Law Number 1 of 2014 concerning the Amendment to the Law Number 27 of 2007 concerning the Management of Coastal Areas and Small Islands, and Law Number 6 of 2023 concerning Job Creation. Article 4 letter (a) Law Number 27 of 2007 explains that in managing coastal area and small islands is conducted aiming to protect, conserve, rehabilitate, utilize, and enrich coastal and small island resources and their ecological system sustainably.[61] This stipulation then underlies the development of technical measures in protecting and conserving ecosystem in coastal areas.

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[58] Nations, United Nations Convention on the Law of the Sea, Article 192.

[59] Nations, Article 193.

[60] Nations, Article 194.

[61] Indonesia, "Undang-Undang Republik Indonesia Nomor 27 Tahun 2007 Tentang Pengelolaan Wilayah Pesisir Dan Pulau-Pulau Kecil" (2007), Article 4.

Technical measures have been taken by Directoral General of Marine and Fisheries Resource Surveillance in the attempt of protecting and conserving coastal area through supervising the fishing and sea resource utilizing activities. The supervision is also conducted by publishing SLO (*Surat Laik Operasi* or Operational Seaworthiness License) by checking ship trips and ship specifications. If the two elements are compatible, SLO will be published, conversely in the case they are not been compatible, clarification will be made. In addition, there are technical measures involving community element generally in the attempt of doing supervision to achieve ecosystem protection and conservation of the marine environment, through Pokmaswas (*Kelompok Masyarakat Pengawas Perikanan*/Fisheries Surveillance Community) program.[62]

Regulation in the form of legislation has existed and technical measures have been formulated and implemented, but some violations are still found, for example, in the use of prohibited fishing gears leading to the damaged marine ecosystem and overfishing. The problem factually is dominated by one day fishing system, catching thousands fish and illegal system. Economic factor is the main background of problem and thereby need special attention in to address this problem.[63] A legal development is needed to deal with the damaged marine ecosystem leading to overfishing.

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[62] Roisah, "Data Confirmation Using Interview Method, Informants from Maritime and Fishery Resource Supervision Unit of Pati, Work Areas of PSDKP Tasik Agung, PSDKP Jobokuto – Jepara, PSDKP Morodemak, Fishery Port of Tasik Agung Beach, Rembang on August 15-16, 2022."

[63] Roisah. *See also* Muhammad Insan Tarigan, "Implementation of Countermeasures Effort of Illegal Fishing in Indonesia (Case Study on Sinking the FV Viking Vessel)." *Journal of Indonesian Legal Studies* 3, no. 1 (2018): 131-146; Yanti Amelia Lewerissa, "Impersonating Fishermen: Illegal Fishing and the Entry of Illegal Immigrants as Transnational Crime." *Journal of Indonesian Legal Studies* 3, no. 2 (2018): 273-290; Aldhanalia Pramesti Salsabila, "Optimization of Task Force 115 with the Coordination Model of Central and Regional Task

Firstly, legal substance is required to regulate the substitution of new fishing tool for the previously prohibited fishing instrument or tool, in which the new fishing tool has some conveniences and can yield the catch at least similar to the previous catch. It becomes important due to the use of old fishing tool that can damage ecosystem such as *cantrang* and *cotok* (micro trawl) that can be used easily and even can catch the smallest size of fish. Thus, the volume of catch seems to be the one with the largest volume of catch. Meanwhile, the issue is very much worrying to sea ecosystem, recalling that the smallest fish is the regeneration its species.

Secondly, a legal substance is required to govern tightly the fishers still using "one day fishing" system. It is because many ships used illegally and unmonitored due to their very large number and thereby the specification of ship and fishing tool cannot monitor optimally. Thirdly, in formulating a regulation regulating maritime, fishery, coastal area and small island development, and fishermen, economic aspect should be taken into account, in addition to environmental aspect, particularly to "one day fishing" fishermen.

Fourthly, a framework is needed at technical level in the attempt of protecting and conserving sea ecosystem. This technical context of framework is needed to facilitate the technical implementers or the people (members of community) to do their duty to protect and to conserve marine ecosystem. Comparatively, it is just like what is done in European sea waters and coastal area, including North Sea and Baltic Sea constituting the sea area used most intensively in the world. These waters are used in some ways with ever increasing intensity, e.g. for fishing or sailing and recreational

Forces as a Form of Illegal Transshipment Prevention in Indonesia [Pengoptimalan Satgas 115 dengan Model Koordinasi Satgas Pusat dan Daerah Sebagai Bentuk Pencegahan Illegal Transhipment di Indonesia]." *Lex Scientia Law Review* 2, no. 1 (2018): 5-20.

purposes. Such use has an impact on sea environment, thus the EU Marine Strategy Framework Directive was published in 2009. The Framework requires the member states of European Units to achieve or to maintain "Good Environmental Status" (GES) in sea environment in 2020. The direction decides the framework for the community action in sea environmental policy. To achieve or to maintain GES, the maritime strategy contains action program that should be developed and implemented obligatorily to protect and to conserve sea environment, to prevent its destruction, or to recover sea environment in the areas that has been affected negatively.[64]

Indonesian government, in this case the Ministry of Marine Affairs and Fisheries formulates a concept of Quota-based Fishing that today has arrived at the stage of developing regulatory frameworks. Main principles of this policy have been adopted in Government Regulation Number 11 Year 2023 concerning Controlled Fishing and its implementing regulation, Minister Regulation Number 28 of 2023. The concept of this fishing approach is a fishing activity conducted based on output control (quota per ship) by utilizing the potential fish resources existing. The quota obtained by every ship will be reviewed for 1 year. If a ship cannot achieve the given quota, it will affect the quota in the next year. It will, of course, be a part of analysis in the attempt examining the factor causing the quota unfulfilled, including whether or not overfishing occurs, or it may come from the fishermen factor.

According to the Regulation, quota-based fishing is controlled based on fishing quotas in six predetermined zones. This system aims to preserve fish resources and the environment and equalize national economic growth. The amount of catch allocation is determined based

[64] Christine Bertram et al., "Cost-Benefit Analysis in the Context of the EU Marine Strategy Framework Directive: The Case of Germany," *Marine Policy* 43 (2014): 307–8, https://doi.org/10.1016/j.marpol.2013.06.016.

on the potential and amount of allowable catch derived from the recommendations of the National Commission for Fish Stock Assessment established by the Minister of Maritime Affairs and Fisheries as well as quotas in the Regional Fisheries Management Organization (RFMO) for tuna and skipjack.

The quota for the measured fishing zone is adjusted to the availability of fish resource allocation. A quota system in fishing will limit the number of vessels fishing at sea. The vessel registration system will facilitate the recording and data collection of catches through mobile applications monitored at the Ministry of Maritime Affairs and Fisheries command centre. A simple fishery logistic chain will maintain the quality of fisheries products. It also facilitates the process of traceability of fishery products.

The concept of quota-based fishing can be optimistically a solution to the effect on the damaged marine environment and overfishing.[65] Quota systems have been used in hundreds of fisheries management practices worldwide from early 1980 to 2000 and have yielded positive results.[66] The fishing with quota-based determination has been introduction in Cape Cod (United States). The overfishing practices makes the cod fish stock almost used up. It comes into the National Oceanic and Atmospheric consideration that the fishing border or quota method is taken to prevent the total destruction of fish resources along with their environment.[67] Specifically, in the

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[65] Kholis; Rahayu; Peni Susetyorini; Arnanda Yusliwidaka Roisah, "Data Confirmation Using Interview Method, Informants from Legal Bureau Ministry of Marine Affairs and Fisheries Republic of Indonesia on September 7, 2022.," 2022.

[66] A. Hatcher et al., "Future Options for UK Fish Quota Management : A Report to the Deparment for the Environment, Food and Rural Affairs," *University of Portsmouth*, no. 58 (2002): 54.

[67] Du, Sun, and Zhang, "The Impact of Overfishing on Environmental Resources and the Evaluation of Current Policies and Future Guideline," 1122.

mechanism of dealing with the areas indicating overfishing, a formulation of legal substance in Indonesia is required to govern the reconstruction of resources and sea environment experiencing overfishing. It is in line with what has been done in United States of America, in which there is a Sustainable Fishery Law prohibiting overfishing and requiring the reconstruction of stock caught excessively. [68] Furthermore, the attempt of preventing and overcoming overfishing in protecting and conserving environment can be taken using theory for design of no-take reserves. This theory is conceptualized with the no-take reserves (the reserves prohibited from being caught or taken) that can give guarantee of protection from overfishing and improve the fishery surrounding. The no-take reserves will potentially achieve two main objectives in fisheries management; initially, it provides a kind of insurance concerning the decrease of species that cannot be maintained due to overfishing and later it increases fish species production in the fishing zones. The Final goal is maintaining or improving the marine environment as well as preventing it from degradation.

Those functions come from varying recruitment and connectivity constituting the characteristics of sea populations. The recruitment of fishery population is usually very varying, either temporally or spatially. It will lead to the strong recruitment event that can survive for many years and become very important in long term. The small population caught excessively in the context of variable recruitment will be very vulnerable to damage or even local extinction. Therefore, this reserve prohibited from being caught will tend to maintain the population density at higher level and can

[68] Michael M. Sissenwine, Pamela M. Mace, and Hans J. Lassen, "Preventing Overfishing: Evolving Approaches and Emerging Challenges," *ICES Journal of Marine Science* 71, no. 2 (2014): 153, https://doi.org/10.1093/icesjms/fst236.

provide an effective buffer to the excessive exploitation.[69] This theory then can be formulated into a policy that governs the management of coastal areas indicating the overfishing, with an expectation that the concept can be the answer to prevent and overcome the overfishing.

CONCLUSION

This research concluded that overfishing has manifested in the Java Sea and other marine regions falling within the jurisdiction of Indonesia. The primary causal factor is the utilization of prohibited fishing implements, notably *cantrang* and *cotok* (micro trawl), which indiscriminately scrape the sea's resources down to its seabed. The continuous application of these tools poses a substantial threat to the marine ecosystem, impeding resource regeneration. Despite the present prohibition of these gears, a persistent practice known as "*one day fishing*" persists, primarily driven by economic considerations. Furthermore, mitigating this issue necessitates a multifaceted approach, prominently featuring legal development interventions aimed at rectifying the overfished areas and preventing potential sites from succumbing to further degradation. This can be achieved through the replacement of fishing gears, stringent enforcement of regulations concerning "*one day fishing*," legal frameworks incorporating economic considerations for the fishing community, and the formulation of a comprehensive technical framework to augment and fortify legal measures. Moreover, the realization of these objectives aligns with the concept of preventing and mitigating overfishing within the policy domain, drawing on theoretical

[69] Peter F. Sale et al., "Critical Science Gaps Impede Use of No-Take Fishery Reserves," *Trends in Ecology and Evolution* 20, no. 2 (2005): 75, https://doi.org/10.1016/j.tree.2004.11.007.

foundations akin to the design of no-take reserves. This approach underscores a holistic strategy that integrates legal, economic, and ecological dimensions, acknowledging the intricate interplay of factors contributing to overfishing. In adopting a theoretical framework derived from the design of no-take reserves, policymakers can structure interventions that promote sustainable resource management and conservation, thus establishing a robust foundation for the preservation of marine ecosystems within Indonesian waters.

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