

How Overfishing Aggravates Marginal Fishers Poverty: Southeast Asia

Grace Chen^{1, a, †}, Wenxi Deng^{2, b, †} and Jiarun Liu^{3, c, †}

¹Chongqing BI Academy, Chongqing, 401147 China

²University of Macao, Macao, 999078 China

³University of Colorado, Denver, CO 80204 USA

*Corresponding

author: ^agrace.chen@biacademy.cn, ^bbb70146@connect.um.edu.mo, ^cjiarun.liu@ucdenver.edu

These authors contributed equally

Keywords: Overfishing, poverty, small-scale fisheries, Southeast Asia

Abstract: Overfishing is happening severely in Southeast Asia fishing grounds. It is noteworthy that overfishing hurts not only the marine resources and biodiversity of ocean species but also the fisher groups themselves. Furthermore, the poverty of these fisher groups is aggravated in a vicious circle between overfishing and privation. This review is to find out the reason and the solutions to the problem of overfishing and also the poverty problem among marginal groups. This review used an advanced harvest function as the primary method combining data from geographic information system (GIS) resources and graphs, Southeast Asia countries' official national database, and several secondary research with their surveys and interviews to present. Overfishing, throughout the literature review, is found to be more damaging to marginal poor fishers. Poor and marginal fisher groups are always more vulnerable to various conditions, including climate and the competition from robust fisher communities who are wealthier. With better policies and regulations by local government and efficient industrial transformation and upgrading, it is promising to help poor marginal fishers get out from the poverty-overfishing loop. Since fishers tend to have more people under the poverty line, this review is to help them get out from poverty and reduce overfishing activities among Southeast Asia marine areas.

1. Introduction

1.1 Research Background

The whole Southeast Asia marine area is one of the most crucial seafood producers in the world. More capture and production can create more benefit at the beginning in the short term, but this fishing process will deplete the marine resources. On one side, such overfishing activities are detrimental to the environment, especially the biodiversity of marine lives. But on the other side, overfishing is also counterproductive to fishers. Since Southeast Asia is known for its long coastline and abundance of fishing areas, fishing activities and fisher groups are vital to these countries overall benefit and economic level. From an economic point of view, fishers would devote too many resources and efforts into fishing but earn less and less, causing a diminishing return in the long term. For poor fishers who are more vulnerable to risks, like low savings and climate change issues, this process leads to an even worse vicious circle: poor fishers get even more deficient, and overfishing is also more severe. However, governments' policies and regulations are far from enough for poor fishers, and the whole industry also undergoes an unsustainable development. It is expected to have more and more fishers slip back into poverty in the long term, which is going to destroy the industry and many fishers life.

1.2 Research Significance

Many pieces of research and reviews of marine biodiversity problem with overfishing in Southeast Asia, but poor marginal fishers who have to increase their capture level, one main reason for the

overfishing problem, did not get enough attention. The consideration of poverty is not considered as significant as other features like low-level management or improper method of fishing. As for those papers that mentioned the poor fishers, they did not provide enough information on the overfishing issue or have no clear and complete analysis for the relationship between overfishing and poverty. By analyzing the fishing industry in Southeast Asia, this review is to draw the attention of the government and the international communities and provide several reasonable methods to solve the problem. Among many different industries in Southeast Asia, the proportion of poor people is high for fisher groups. For example, in Indonesia, up to 11.34% of the people in Indonesia's fisheries were classified as poor by 2017. And this percentage is relatively higher than sectors like restaurant services (5.6%) and building construction (9.9%), according to the National Social Economic Survey for Indonesia in 2017. Such a big scale of the population could influence the industry and the overfishing problem in the long term. Therefore, by using our advanced harvest function and secondary data result, this review managed to prove that poorer fishers would make overfishing worse. This paper concludes years of research and presents several new methods to the overfishing and poverty issue for poor fishers. Solving poor fishers' problems, however, would show a significant improvement in overfishing in Southeast Asia.

1.3 Paper Organization

This paper has three parts. The first part is an advanced long-term harvest function and GIS data to help discuss and to show the importance of overfishing toward poverty. Recollection and conclusion of nowadays research and reviews presents the problem. There are finally policies and solutions for the governments and international organizations to help Southeast Asia fishers.

2. Methodology

This paper used an adjusted fishery harvest function to include all the historical data and models collected. The basic one is

$$H(E,X)=qEX \quad (1)$$

It is usually for short-term analysis. In this one, q is the catchability parameter that includes factors like technology and equipment level, E is the effort, and X is the fish stock. H is the harvest for fishers. However, it is not suited for the benefit-costs analysis for long-term situations, including the market. It is not clear enough for various other factors like climate conditions and policy change, for example. Thus the upgraded version is selected to support the review, including the market price that promised with a long-term equilibrium condition as in

$$TR(E)=pH=pqKE(1-\frac{qE}{r}) \quad (2)$$

The p is price indicating the local market in most cases, and H is the harvest from fishing. K is the carrying capacity, and r is the maximum relative growth rate or the intrinsic growth rate for marine living resources. One important thing for these three countries examples of small-scale poor fishers is that they generally have a local fishing ground with limited resources. Therefore, K and r are fixed in the short run but would eventually change in the long run.

In this paper, this function is applied to the intrinsic relationship analysis of overfishing, climate, and how the low total revenue leads to poverty. Climate change in Southeast Asia will cause negative change to K and r in the long-term, and all other factors would change due to overfishing and poverty issues. It is called the vicious cycle of overfishing and poverty.

3. Overfishing Problem in Southeast Asia

3.1 Definition and Causes of Overfishing

A time series of Thailand's fisheries production from 1995 to 2015 shows a significant decline in wild fish and shellfish from marine and freshwater environments, from about 3.0 million tons in 1995

to 1.5 million tons in 2015 [1]. As one of the essential industries in Southeast Asia, the fishery has made a great contribution to the economic development in Thailand. But the massive fishing of wild fish has undoubtedly caused damage to the ecological environment, and the amount of fish caught has dramatically exceeded the rate of fish reproduction and exceeded its maximum sustainable yield.

In addition, the total capture and aquaculture (see Fig. 1) in Indonesia had rapidly risen from 1980 to 2015 [2]. In the Philippines, the index catch-per-unit-effort illustrates the declining trend.

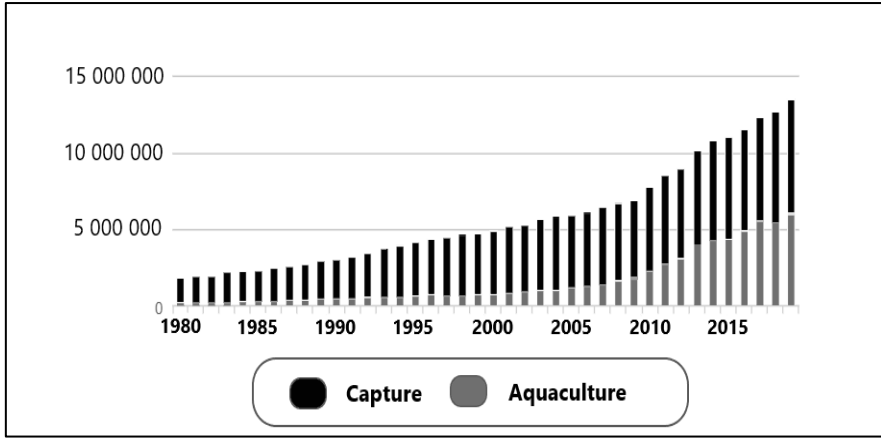


Fig 1. Total capture and aquaculture production in Indonesia (tonnes).

One cause of overfishing is population growth. In Indonesia, economic expansion and population growth have expanded the use of the coastal region without enough attention and consideration of environmental sustainability. Overpopulation has put great pressure on fisheries and marine ecology, leading to the overuse of marine resources.

The growing fishery market in Southeast Asia is also one of the reasons for overfishing. Southeast Asia, as one of the richer fishing regions, can be an important source of fish for other parts of the world. In this way, to meet the great demand from local and worldwide areas, the fishers in Southeast Asia may do some illegal fishing. There are a variety of variables that contribute to these breaches, including a lack of understanding of the law and care for the marine ecology, as well as a low frequency of field monitoring efforts.

3.2 The biology view of overfishing

Overfishing can be defined as a fishing effort that exceeds the biological limits of aquaculture resources. Immature fish stock that is below age or size on reproduction were caught in the Philippines, which directly caused the imbalance of the ecosystem. Specifically, the ecosystem became less productive and functional since some species were out of amount or disappeared. Therefore, the maximum sustainable yield (MSY) (see Fig. 2) moves to the left side, which implies the maximum harvest level is decreasing by using (1) [3].

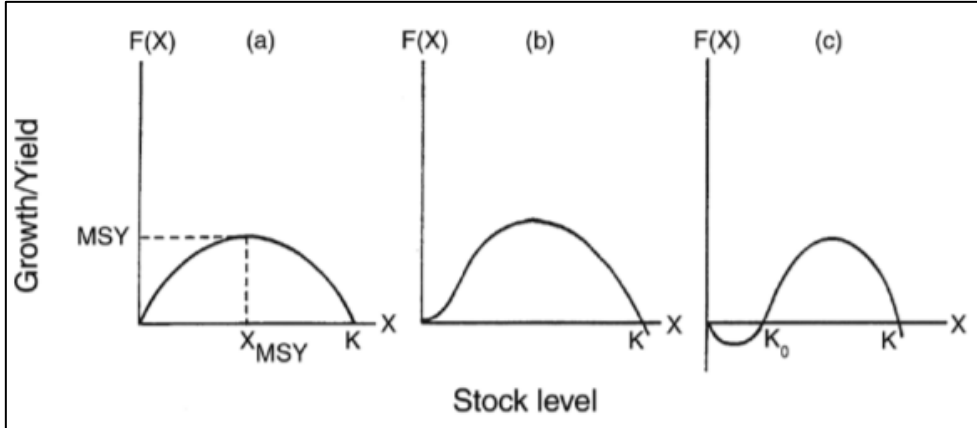


Fig 2. Growth curves with three procedures stock level as compensation, depensation, and critical depensation.

In the main harvest function model, overfishing is going to cause a decline in fish stocks. Overfishing will also reduce the carrying capacity and the stock growth rate in the long run. Since the overfishing issue is getting worse and worse, there would be few marine life resources to support the carrying capacity, and the intrinsic growth rate would decline due to a shortage of juveniles.

4. Poverty problem and Marginal Small-Scale Fishers

4.1 Poverty in Southeast Asia

Although Southeast Asia has a huge fishery market, some fishers, especially marginal fishers, are not benefiting from the profit brought by fishing. According to a survey, 25.1 million Indonesians still live below the poverty line (2015), and more than 11% of Indonesian fishers are poor, and this rate is much lower than other sectors like [4]. The fishers have a large population, and the 11% suggests that those poor fishers are taking up a large portion of the whole poor population. Since the poverty issue is important for the countries overall well-being, solving fisher’s poverty can contribute to the whole improvement of the poverty issue in Indonesia.

Excessive dependence on commodities, over-exploitation of natural resources, and significant inequality of opportunity were recognized as major roadblocks to poverty reduction and shared prosperity in the 2015 Sustainable Development Report (SCD) [5]. Considering fishers position that they need to fight for marine public resources to get revenue and also to provide marine products to the market, they have to face these exploitation problems, and it is even harder for poor fishers since that poverty issue would increase their level of overfishing.

Fishers also averagely have bad living conditions. All the poverty issues mentioned leading to a result that they need to devote any margin profit into the enhancement of q , as well as the catchability, and then the change in this would reduce what they can spend on their families’ living conditions. Such bad living conditions could save money, but it can also gradually reduce the effort fishers can put into the fishing activity. In the long-term, such a negative production process then will only decrease the profit of fishers instead of solving their poverty problem.

4.2 Marginal Small-Scale Fishers in Thailand, Philippines, and Indonesia

There are 2.5 million Indonesian households engaged in small-scale fisheries production, but these households are characterized by high poverty rates and will become more vulnerable in the face of declining ecosystem health and climate change [6]. Small-scale fisheries make up a certain percentage of the world's fishing industry and help keep a huge number of coastal families around the world afloat. However, with limited fishery resources, only large-scale fishers with better equipment and more labor can gain more benefits and more opportunities. Marginal fishers, such as cottage industry workers, find it difficult to compete with other fishers in this situation.

Specifically for small-scale fishers of Thailand, there was a survey that covered municipalities in Thailand cities like Krabi and Trang [7]. The result showed that half of the respondents have decreased fish catch and lower total incomes since 2013. Although Trang’s got higher fishing incomes than those in Krabi, the reason is that they used a higher shard for their consumption and have other agricultural opportunities. In Philippines, their research covered Tanza Municipality in Cavite Province and Barotac Viejo in Iloilo Province. There were problems like water shortage, lower incomes, and also illegal fishing, and lower catch in their top-list (see Table 1).

Table 1. Top Perceived Problems in the Survey.

B.V. (Ph)	Tanza (Ph)	Krabi (Th)	Trang (Th)
Water shortage	Illegal fishing	Unpredictable weather	Water shortage
Bad roads	Typhoons	Lower incomes	Landlessness
Lower incomes	Low fish catch	–	Drugs

There was another research, and its survey focused on Indonesia, which mainly covered two Sama Bajo village communities: Bukori and Saponda Laut [8]. From their result, it has been found that those poor households in these two communities are more likely to have characteristics like inadequate food security, poor quality housing, poor equipment such as better boats, and also low savings. These features help create the standards, and they mostly tell how these small-scale fishers life would be under poverty issues. Wealthy fishers have been found that most do not have these features.

4.3 Intrinsic Relationship between Overfishing and Poverty

Since small-scale fishers in Southeast Asia always tend to have lower incomes and poor levels of equipment, the intrinsic relationship is considered in the model. Total revenue is regarded as the most important factor, and the harvest function implies that a lower level of equipment and poor living condition would lead to an even worse harvest. Using (2), we can see that q , as well as the catchability, is significantly affected by how advanced the technology the fishers use. With no credits or low bank savings, it is impossible to upgrade their equipment, and therefore not enough catchability.

In addition to that, the poor living conditions would also lead to a lower effort to devote to fishing. Small-scale fishers, unlike professional fishing companies or united fishing communities that can ensure better effort, catch fish mostly in family units. More family members, however, will then also be the cost of living. Thus, it is hard for small-scale fishers to put more effort into fishing activities. When combining all these factors together, it is easy to see that those who used to be poor fishers would be poorer in the future. Their TR , the total revenue, would keep declining until they have significant improvement with either catchability or effort using (2). It should be considered that this is still even under an optimistic assumption that the carrying capacity and the growth rate of their fishing area would not change. But this would be different when referring to reasons like climate change in Southeast Asia.

5. Climate Reasons

5.1 Climate in Southeast-Asia

One vital difference between Southeast Asia and other important fishing areas is that this area is closer to the equator, and they are suffering more negative effects from climate change and global warming these days. The equatorial rainfall climate and tropical monsoon climate of Southeast Asia are mainly attributed to tropical locations. The variable environment in Southeast Asia can lead to natural disasters such as exceptional warm periods, smoke haze, and flooding, which can cause dramatic changes in fish habitat in the short term. [9]. The temperature, oxygen content, and other factors of the region influence to some extent the reproduction and survival of fish, thus fluctuating the development of the fishery. And thus finally, all these climate problems would lead to destructive influences on fishers

In Indonesia, climate change caused by greenhouse gases such as Carbon dioxide (CO_2) has a significant impact on fisheries. Climate change phenomena such as global warming can lead to heat waves, typhoons, flooding, and other problems. This is because global warming increases the temperature of the water in the oceans and rivers, and the expanding volume of water causes the sea level to rise, affecting the reproduction of fish. Also, CO_2 emissions have been on the rise from 1980 to 2004 due to modern industrial processes such as excessive logging and factory operations (see Fig. 3) [10]. Thus, the problem of climate change and natural disasters in the Indonesian region has not been solved.

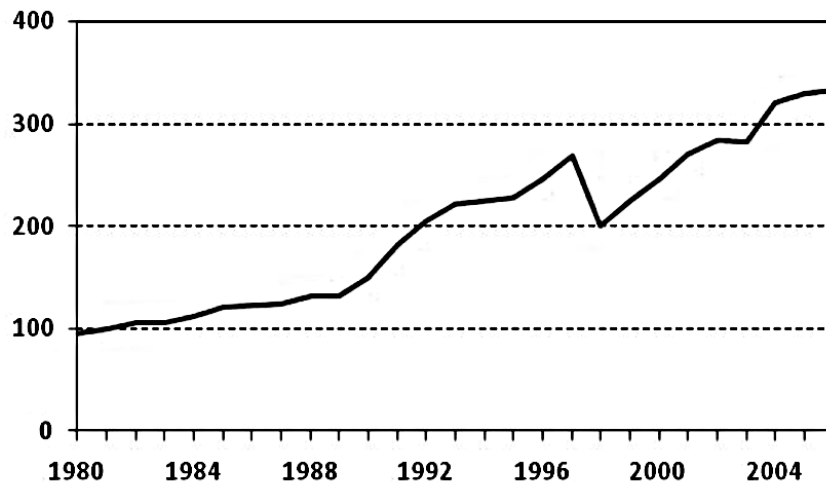


Fig 3. Indonesia CO2 emissions from 1980-2006 (millions of metric tons).

The Philippines and Thailand have a similar situation of fish stock affected by climate changes, including water temperature in the ocean, PH value, abnormal ocean current, and extreme weather, which are all related to global warming to a certain degree. Significantly, water temperature is the most impact threat to fish stock since these two countries are both near the equator, having some of the warmest water areas around the world.

In the Philippines, six typical species were studied by the University of San Carlos [11]. The study measured the suitable and tolerable temperature at different levels. The test result indicated that the highest tolerable level of temperature was 35°C. In the range of 40°C to 35°C, these organisms showed symptoms of sub-health and reproductive difficulty.

In Thailand, another study from Maejo University showed that low levels of dissolved oxygen in the warm water is the leading cause of decreasing fish stock, especially for the commercial and integrated culture areas where are riskier on insufficient oxygen level than subsistence areas [12]. These outcomes are caused by climate change these days, and they are never good news for any fishers in Southeast Asia.

5.2 Climate, Overfishing, and Poverty

Although it is assumed that K and r , as well as the carrying capacity and growth rate of fish stock, would be stable for those small-scale marginal fishers since they generally only dominate a small area of fishing, the climate is not a regional phenomenon. Still, it must be widespread throughout the whole fishing area. With only one disaster like typhoon or flooding, it would hurt every fisher in the area, and therefore, it breaks the balance and difference between small-scale fishers and other business fishers.

Unlike professional fishers or business fishers, those small-scale fishers do not have enough support and also insurance for them. Taking Indonesia Sama Bajo fishing activity as an example, they have to suffer from the southeast monsoon blowing out of Australia. Its strong winds and high seas would then block all the fishing activity for those poor households who have low-level fishing equipment. Just like this paper mentioned earlier (Table 1), it is evident from the survey that unpredictable weather and typhoons are also the main reasons for their problem with poverty. The carrying capacity and the maximum relative growth rate would cause both to decline to a lower level. Since the fishing stock is also decreasing, fishers' total revenue would also decrease together when it is assumed that other factors can stay the same.

The main problem behind this is that poor and marginal fishers are more vulnerable to climate change as same as they get hurt from overfishing. A simple comparison can be a richer fisher and a poorer fisher in the same community by using (2). Then poor fishers would have lower catchability and effort, for which they cannot upgrade them easily and quickly. Therefore, with even lower carrying capacity and intrinsic growth rate due to the climate issues, there has nothing left for these poor fishers

to get revenue. Overfishing is the only way for them. However, for other fishers, no matter richer fishers or professional fishers, they have the financial capacity to improve other factors like better technology or even just put more effort into the fishing activity. Lower capital investments, lower savings, and no insurances are the main reasons why these small-scale fishers can be easily destroyed by the climate.

6. Suggestions

6.1 Government and Collaborations

The lack of regulation and supervision from the government leads to the arms race on boats, and gear technology, the collapse of fish stock and degradation of a coastal area, and the increasing demand of fish market cannot be satisfied.

Thus, the national government and local governments are all responsible for fisheries management. Since our three cases: Indonesia, Thailand, and the Philippines all have legal codes to control the overfishing issues. For example, the Philippines has a code that asks local government units to implement fishery laws, rules, and regulations [13]. It is even more important for small-scale fishers' waters. The government also has the responsibility with municipal and city legislative councils, so creating laws and ensuring these laws are enforced should be enhanced and placed more emphasis on it.

For governments, it is vital to connect and collaborate with international groups. The United States Agency for International Development Sustainable Ecosystem Advanced (USAID SEA) project effectively supported Indonesia from two aspects of capital and environment. Also, with the aid of the USAID SEA project, marine ecosystems, marine spatial planning, small-scale fisheries management, and maritime law enforcement were improved or strengthened [14]. From a financial perspective, around \$80,000 was donated to local fishers in the name of sustainable initiatives. From the environmental perspective, supervision and legislation related to critical marine habitats were strengthened, and international cooperation is strongly recommended in the fishery industry, let alone its impacts on marginal fishers.

6.2 Leading Fishers to Alternative Industry

With limited fish resources, reducing the number of fishers is an effective solution to the problems of overfishing and poverty. It was shown through a survey that over half of the municipal fishers in the 16 fishing communities studied since 1976 (Philippines) showed readiness to change their jobs, while another 30% of participants stated willingness to relocate [15]. Thus, the mobility of fishers can match this solution. Furthermore, tourism should be a feasible alternative to start the industrial transformation. These three countries mentioned above have abundant coastline resources with distinguishing features based on their corresponding culture. Therefore, the potential of transformation success is high under correct guidance and support from the government.

By guiding fishers to transform their industries, the competitive pressures on fisheries can be effectively reduced, and it can offer more people chances to get rid of poverty. Governments just need to help them get started and provide relevant support policies. Compared the examples of disincentives include restrictions on the sorts of individuals who use the boats or the type, restricted seasons, or other limited forms. Incentives, on the other hand, include the creation of additional revenue streams that are more appealing to lure fishers away from fishing. In addition, the government should also help small-scale fishers with specific financial capabilities form groups to not only ensure their capacity with risks to return to poverty but also better regulation with groups instead of individuals.

6.3 Monitoring Fishing with Spatial Data System

One main problem of this review paper is that there has little data and sources for those marginal fishers even though they are equally crucial for the whole fishing industry and overfishing management. Without a spatial data system, it is impossible for government units and researchers to speculate the marine resources, which would lead to an unhealthy research environment for the overfishing issue.

The government should play a vital role in overfishing: the protection of marine resources and the regulation of fisheries. An online GIS prototype, for instance, was created to display illegal fishing occurrences, and it was built to use illegal fishing data as essential inputs to map unlawful fishing occurrences [16]. To better monitor fisheries and reduce illegal fishing, a complete monitoring geographic system is necessary. At the same time, to ensure the effective use of this system, the government should develop policies to ensure the proper functioning of the system and subsequent related processing based on the data.

Of course, many Southeast Asian countries are already experimenting with systems to collect fisheries data. However, throughout time, fisheries statistics have been gathered without a defined goal in mind, and in most cases, they encompass a wide range of data. As a result, the quality of fisheries statistics is insufferable. This vicious cycle of poor fishery data must be stopped, which can only be done if the goals of fisheries management are clearly defined. Fisheries data must not only be collected but also analyzed and reported to help improve the fisheries situation in the future. Therefore, human resource development for fishery statistics is equally important.

6.4 Forming Decentralized Communities

Most Southeast Asian countries now nationalize their marine resources and manage them in a centralized manner. The critical problem with the centralized management policy is that when all marine resources are nationalized and opened for use, the responsibility for monitoring and protecting the oceans rests entirely with the government. Thus, one of the reasons that led fishers to start fishing illegally was the lack of awareness and responsibility of fishers to protect fishery resources, which could be mitigated by the decentralization of fisheries management. At the same time, the scattered ports and multiple types of fishing forms in coastal areas (Thailand) can increase the difficulty factor of fisheries management. The expenses of effective monitoring and enforcement are considerable, and the government may not cover them [17]. The efficiency of community-based marine resource management system bottom-up planning and co-management of coastal fisheries this participatory approach empowers local domain management, which leads to their increased awareness of resource management, which is the reason for sustainability. It not only increases the effectiveness and motivation of fisheries management but also ensures a democratic fisheries market.

7. Conclusion

This review focuses on the marginal fishers as a group and explores in-depth overfishing and poverty. By showing long-term equilibrium harvest functions, GIS resources, databases, as well as historical researches and surveys and interviews, this paper indicates that overfishing has a great impact on fishers, mainly marginal, small-scale poor fishers. The article also identifies that in Southeast Asia, there is a positive correlation between fishers' poverty and overfishing, meaning that overfishing does contribute to fishers' poverty. This review paper proposes three practical ways to help poor marginal fishers get out of the "poverty-overfishing cycle" as well: industry transformation, spatial system establishment, and decentralized management. This research is primarily aimed at helping marginal fishers escape poverty while improving overfishing in Southeast Asia. By combining and analyzing overfishing and small-scale poor fishers poverty, it can help provide a new scope of both environmental and development economics. This paper also includes climate change and the natural environment pressure on small-scale fishers to help analyze their vulnerability to climate. Compared to researches on similar topics, this review paper combines several countries in Southeast Asia and discusses the group of marginal fishers, and it is generally a diversified and integrated analysis toward the Southeast Asia small-scale poor fishers. When the governments and related institutions offer more help, the policies suggested in this paper can be implemented. It is also essential to have more data to use the spatial system effectively. Thus, this area of the overfishing and poverty issue still needs more collaboration and effort of government units and other pieces of research in the future.

References

- [1] Sampantamit, T., Ho, L., Lachat, C., Sutummawong, N., Sorgeloos, P., & Goethals, P. (2020). Aquaculture production and its environmental sustainability in Thailand: Challenges and potential solutions. *Sustainability*, 12(5), 2010.
- [2] FAO. 2021. Fishery and Aquaculture Country Profiles-The Republic of Indonesia. Food and Agriculture Organization of the United Nations.
- [3] Flaaten, Ola. 2011. Fisheries economics and management. University of Tromsø, 50-72.
- [4] Badan Pusat Statistik. (2017). "Survei Sosial Ekonomi Nasional (Susenas), 2017 Kor" Harvard Dataverse.
- [5] World Bank. 2020. Indonesia Systematic Country Diagnostic Update. Washington, DC. pp. 9-14.
- [6] Stacey, N., Gibson, E., Loneragan, N. R., Warren, C., Wiryawan, B., Adhuri, D. S. ... & Fitriana, R. (2021). Developing sustainable small-scale fisheries livelihoods in Indonesia: Trends, enabling and constraining factors, and future opportunities. *Marine Policy*, 132, 104654.
- [7] Andriessse, E., Kittitornkool, J., Saguin, K., & Kongkaew, C. (2021). Can fishing communities escape marginalisation? Comparing overfishing, environmental pressures and adaptation in Thailand and the Philippines. *Asia Pacific Viewpoint*, 62(1), 72-85.
- [8] McWilliam, A. R., Wianti, N. I., & Taufik, Y. (2021). Poverty and prosperity among Sama Bajo fishing communities (Southeast Sulawesi, Indonesia). *Singapore Journal of Tropical Geography*, 42(1), 132-148.
- [9] Brander, K. (2010). Impacts of climate change on fisheries. *Journal of Marine Systems*, 79(3-4), 389-402.
- [10] Measey, M. (2010). Indonesia: a vulnerable country in the face of climate change. *Global Majority. E-Journal*, 1(1), 31-45.
- [11] Ubaldo, J. P., Uy, F. A., & Dy, D. T. (2007). Temperature tolerance of some species of Philippine intertidal echinoderms. *Philippine Scientist*, 44, 105-119.
- [12] Sriyasak, P., Chitmanat, C., Whangchai, N., Promya, J., & Lebel, L. (2013). Effects of temperature upon water turnover in fish ponds in northern Thailand. *International Journal of Geosciences*, 4(5), 18-23.
- [13] Green, S., White, A., Flores, J., Careon, M., & Sia, A. (2003). Philippines fisheries in crisis: A framework for management.
- [14] Andina, Swiny. 2021. United States and Indonesia Celebrate Shared Successes in Marine Conservation and Sustainable Fisheries: Press Release: Indonesia. U.S. Agency for International Development.
- [15] Smith, I. R. (1980). Traditional fisheries development in the Philippines.
- [16] Wicaksono, D., & Seminar, K. B. (2009). Development of web GIS for fisheries surveillance in fisheries management zone of Indonesia.
- [17] Tokrisna, R., Boonchuwong, P., & Janekarnkij, P. (1997). A review on fisheries and coastal community-based management regime in Thailand. Fisheries Co-management Project Working Paper. ICLARM, Manila, 26.