

Overview of the Externalities Between Optimization and Overfishing of Fisheries

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ABSTRACT

The externalities are conditions or side effects that arise due to economic activities. The externalities can bring positive and also negative impact for ecosystems, one of which is the marine ecosystem. Moreover, the government plays an important role in controlling economic activities so as not to cause damage to the marine ecosystem that is related to the optimization and overfishing of the fisheries sector. As we know that the marine environment is one of the important economic factors as providers of food for human. Therefore, human is carrying out exploitation in the sea and the coastal areas of the sea to fulfil their needs. The method used in this research is phenomenological with an ecological approach. Based on the results of research on externalities in the fisheries sector, there are several factors that are caused by overfishing. There are 6 forms of overfishing that occur. First, growth overfishing, overfishing, biological overfishing, economic overfishing, ecosystem overfishing, and overfishing recruitment. The implications are expected to provide an in-depth understanding of all parties concerned about the importance of maintaining marine ecosystems.

Keywords: *Externalities, overfishing, government, fishery, marine sustainability*

1. INTRODUCTION

The growth in economy and development by humans can have both positive and negative impacts. These conditions in economic terms is called externalities. Some theories related to externalities are put forward by several experts. According to Katz & Rosen [1], the externalities occur when a person's activities have an impact on others outside the market mechanism. Similarly, Hackett & Dissanayake [2] says externalities are positive and negative impacts arising from the production process. Cullis et al. [3] believe externalities occur when individual utilities do not only depend on the goods and services consumed by the individual concerned but are also influenced by other individual activities. Other opinions such as Hyman [4] states that externalities are the costs or benefits of market transactions that are not reflected in prices. Furthermore, Meade [5] says economic externalities act as an event that gives considerable benefits (gives substantial losses) to some people who do not participate fully in decision making. Fisher [6] added that an externality occurs when an economic activity (both production and consumption) affects the welfare of other economic actors and events that occur outside the market mechanism. Based on the

explanation of the theory, it can be explained that the externality from a theoretical perspective is the impact caused by the economic activities of individuals and companies that result in costly consequences. Externalities are unexpected so that externalities themselves can cause market failure or inefficiency, regardless of the positive or negative impacts caused to third parties who are not directly involved in economic activities.

Overfishing is one form of externalities in the fisheries sector. Overfishing is a condition where there are activities of fishermen who catch fish excessively without considering the age of the fish. It will bring impacts on the survival of fish due to the depletion of seed availability. Overfishing occurs due to the activity of fishermen who take fish faster than the breeding stock of these species to produce a replacement. Overfishing in Zhou et al. [7] is divided into several types namely:

1. Growth overfishing, i.e., catching any fish without paying attention to the age of the fish. If the caught fish are still in its growing age, consequently it may disturb the fish community. To maximized the number of fish, it should be caught at a certain age according the fishing rule.

2. Recruiting overfishing, that is overcoming the management of the parent fish so that it has an impact on fish regeneration.
3. Ecosystem overfishing, which is a form of over-harvesting fish that impacts on the ecosystem of the catchment area. Ecosystem damage can result in the loss of several types of potential and high-value fish species

Overfishing occurs due to efforts to optimize the fulfillment of increased demand. Optimization is the result achieved as desired. On the other hand, optimization is an effort by maximizing activities so that the desired profit is achieved.

The fisheries sector is one of the sectors that are very vulnerable to externalities. These include pollution, waste pollution, damage to coral reefs due to fishing activities and the effects of maritime-based ecotourism activities. A dilemma like this will arise because on the one hand human faced with the problem of needs and demands and still have to concern with the survival of natural resources that underpin economic activity. Seeing this condition, the government needs to take an active role in preventing externalities in the fisheries sector. This is due to the imbalance of the positive impact of activities in the fisheries sector with the consequences of the resulting losses. In the worst case, the activities even lead to the creation of sustainable losses which will certainly have an impact on moral responsibility for users and natural resource manager. It will occurs in the form of the budget allocation to repair and rehabilitate the resources in high cost.

The government should put more attention to regulations related to fisheries by providing tight monitoring and supervision of fishing efforts in the form of licensing and processing of marine products. This action should also by supporting system such as the security forces, in this case, the marine police by providing anticipation of illegal fishing, destruction of marine life with fishing gear, or fish bombs. Of all these efforts, cooperation and awareness of all parties need to be built starting from the community, business actors, government, and security forces. All of these can be achieved through education related to marine affairs.

Related to marine education issues, Sulistiono et al. [8] conducted activities in East Halmahera in the form of counseling, monitoring, and evaluation related to issues of empowerment and conservation education by involving the government and related parties in maintaining the preservation of marine ecosystems. There are also other activities such as initiating the development of the marine product market, improving the quality of products and diversification of marine products, managing community empowerment, making efforts to certify processed products, and developing joint venture institutions into cooperatives.

The implication of the research is the achievement of environmental sustainability by preventing environmental damage due to hazardous waste to create

sustainable fishing activities. Raicevich et al. [9] stated that the rule of law in coastal fisheries management consists of a number of concerns. These include the involvement of traditional institutions, informal leaders, and local institutions, as well as the importance of paying attention to the factors that influence the existence of traditional systems. These factors are beliefs, community structures, the form of regulations, the intensity and technology of fish catching, the structure of village governance, and commodity prices. It should focus more on welfare issues especially those of the fisheries sector, Mirza et al. [10] in their research in the Riau Islands shows that the role of the government has not been maximal in terms of using its authority in alleviating poverty. The role of government is very necessary for the implementation of government policies related to marine resource conservation programs in supporting fisheries activities.

Sinjai Regency is one of the districts in South Sulawesi that has quite prominent economic activity in the fisheries sector. This can be seen through the data presented by the Bureau of Statistics (Sinjai, 2017) in 2016-2017 showing the volume and value of fish production in TPI Lappa Sinjai for the year 2016 reached 2,509.14 tons with a value of Rp 17,626,388,000. There is an increase of production in 2017 that volume reached 4109.14 tons with a value of Rp 30,487,994,000. The increase in the fisheries sector have significant influences on the gross regional domestic product of Sinjai Regency. Moreover, some market segments of fishery products from the Sinjai Regency are marketed outside Sinjai Regency. Some fish species are exported through vendors located in Makassar. The government has been put several programs to improve TPI facilities such as the addition of areas and the arrangement of places to be more orderly and hygienic to support sustainability and productivity in the fisheries sector.

Increased economic activity in the marine fisheries sector, especially the fishermen in Sinjai district, have a positive impact on supporting the economy of local community. However, it also harms marine ecosystems in fishing and marine areas. Bureau of Statistics in 2018, Sinjai District together with the marine police released data that there were many environmental problems due to exploration fish in the sea such as damage to coral reefs due to the use of fish bombs, theft of sea corals, and the use of fishing gear that is not under the standards of the Indonesian Ministry of Maritime Affairs.

The damage of marine biota due to exploitation that violates state rules done by fishermen, in the long run, will affect the decline in the population of fish species at sea. Therefore, the government needs to intervene and take decisive action against all violations that occur. Based on this description, the formulation of the problem in this study will investigate the externality between the optimization and overfishing of fisheries in Sinjai Regency. The objectives of this study are described as follows:

1. To find out the causes of externalities due to activities by fishermen in Sinjai District
2. To find out the impact of externality problems due to the optimization and overfishing of fisheries by Sinjai fishermen.
3. To provide solutions to the externality conditions of optimization and overfishing in the Sinjai District fisheries sector.

2. RESEARCH METHODS

This study uses a qualitative approach in the form case study research. Creswell & Creswell [11] stated that the study conducted as an exploration of related systems (bound systems) or cases, while Patton [12] stated case studies are studies of the specificity or complexity of a single case and try to understand the case in context, time and situation. The approach used in this case study research is a situational analysis. According to Gillham [13], a case study with a situational analysis is trying to analyze the situation against certain events or events. Data collection was carried out by interview and survey techniques. In addition supporting documentation studies were carried out to supplement information related to the issue under study. The research instrument used was interview guidelines and research related documents. Documentation is in the form of taking pictures or videos and sound recordings. After all, data has been collected during the study, and data analysis will then be performed.

The selection of informants were done by using nonprobability sampling techniques by sampling quota. According to Creswell [14], quota sampling is determining the sample of the population that has certain characteristics until it reached the desired amount. Direct data were collected in the sampling unit, and if the quota is fulfilled then the data collection is stopped. The intended information is collected from fishermen groups, business groups, community leaders, social institutions linked to research, government, marine police/security forces, and community users/consumers. Data analysis were carried out using data reduction, data presentation, and then conclusion.

3. RESULTS AND DISCUSSION

3.1. The causes of externalities are caused by fishermen in Sinjai District

Analysis of the causes of externalities by fishermen in Sinjai district is generally caused by seeking maximum profit. This is done by fishermen with the reason to cover costs in this case fuel/diesel fuel and the cost of preserving fish/ice blocks. These loads or costs in the sea for one day is high enough that they need to catch more fish to cover it. The other cause is the increasing number of competitors that it cause several types/commodities of fish prices to fluctuate. From interview, it showed that the fishermen take a short step to catch fish, such as using

fish bombs, trawlers, poisons and other prohibited fishing gear to overcome those problems. In line with the discussion, a strategy is needed to deal with the conditions experienced by Sinjai fishermen. As stated by Kenny et al. [15], ecosystem-based fisheries management is needed. Fisheries management should be based on science so that production goals can be achieved effectively. One of the concerns is how the impact of fisheries activities on other marine species and ecosystems that are not being targeted.

The role of government is also very much needed in terms of fishermen's activities. In Lester et al. [16], it is stated that based on the results of research the government attention to marine issues is still minimal. Reforms in the marine sector still trigger pros and cons and result in the difficulty of making strict regulations to protect the sea from adverse impacts. Overfishing issues not only cover production issues but also other issues such as safety at the sea. It is not uncommon to find fishermen abandoning their fishing gear. This issue was raised by Richardson et al. [17], that found many ghost nets or stray at sea along the North Sea Australia originating that is suspected from Asian fishermen. The cooperation between security and the government is also cracking down on illegal fishing perpetrators.

3.2. The impact of externalities due to optimization and overfishing of fisheries

Analysis of externalities that occur due to overfishing for fishermen is generally resulted as there were the formation of fluctuating prices and increased operational costs due to the shifting of fishing areas under forced conditions. From interview, it was found that sometimes fishermen in this area must first owe money to go for fishing. The damage to marine life and ecosystem may causes the loss of several fish species so that it will have a direct impact on the availability of fish stocks. This is in line with the discussion put forward by Froese et al. [18] that overfishing has an impact on marine ecosystems. In Wear [19], coral reefs as a place to live for fish in some oceans have been damaged and will directly affect the availability of fish. The depletion of fish stocks will certainly affect the profitability of fishermen. The government, as the manager of the sea, in this case, the ministry of maritime affairs and fisheries, can adopt a program as stated by Islam et al. [20]. The ministry can offer conservation programs by providing incentives for fishermen who act as examples of sustainable fisheries management. The task of this government is in line with what was stated in the study Heenan et al. [21]. They believed that the problem of fisheries in developing countries is not only a matter of how to build food security but also helps in overcoming habitat degradation due to overfishing that can reduce fisheries productivity. Positive impact if the marine conservation program runs effectively as stated by Sala et al. [22] that there will be new benefits gained by fishermen aside from the catch of the fish such as in

tourism sector. This sector can create new jobs where fishermen are made as a manager or shareholder.

4. CONCLUSION

1. Externalities that occur in the activities of fishermen in Sinjai Regency are generally negative, such as the occurrence of damage to marine life in this case sea corals as a place to live sea fish. From an economic standpoint, overfishing activities also have an impact on fish prices, which have become volatile at fish auctions. The impact also makes fishermen lazy to operate due to high fishing costs. This happens due to technology supporting fishermen activities that are still conventional which resulted in increasing operational costs in fishing.
2. It is encouraged for fishermen to stop fishing method that may damage marine biota.
3. Encourage the government and all related parties, security forces, academics to actively conduct counseling programs related to the preservation of the marine environment. They can assist fishermen in the process of fishing using technology and abandon conventional methods so that the catch is more leverage without damaging the marine ecosystem.
4. The subsidized funding program for traditional fishermen is very important to help sea fishing activities.

REFERENCES

- [1] M. L. Katz and H. S. Rosen, "Microeconomics, MacGraw-Hill," Inc. Bost., 1998.
- [2] S. Hackett and S. T. M. Dissanayake, *Environmental and natural resources economics: Theory, policy, and the sustainable society*. Routledge, 2014.
- [3] J. Cullis, P. Jones, and P. R. Jones, *Public finance and public choice: analytical perspectives*. Oxford University Press, 2009.
- [4] N. D. Hyman, "Public Finance: A Contemporary Application of Theory to Policy (6. Baski)," Dryden Press, 1999.
- [5] C. Richard and S. Todd, "The theory of externalities, public goods, and club goods." Cambridge University Press, 1986.
- [6] R. C. Fisher, *State, and local public finance*. Routledge, 2018.
- [7] S. Zhou, A. D. M. Smith, and E. E. Knudsen, "Ending overfishing while catching more fish," *Fish Fish.*, vol. 16, no. 4, pp. 716–722, 2015.
- [8] S. Sulistiono, Z. Zulkarnaen, and T. Nugroho, "Edukasi pelestarian sumberdaya dan lingkungan pantai pada nelayan perikanan bagan," *JPPM (Jurnal Pendidik. dan Pemberdaya. Masyarakat)*, vol. 5, no. 2, pp. 181–192, 2018.
- [9] Raicevich, S., Alegret, J. L., Frangoudes, K., Giovanardi, O., & Fortibuoni, T. (2018). Community-based management of the Mediterranean coastal fisheries: Historical reminiscence or the root for new fisheries governance?. *Regional Studies in Marine Science*, 21, 86-93.
- [10] A. C. Mirza, R. A. R. Anggraini, and I. R. Soetijono, "Implementasi Pengelolaan Sumber Daya Laut Nasional Terhadap Kebijakan Pemerintah Provinsi Kepulauan Riau," *Lentera Huk.*, vol. 4, no. 2, pp. 79–94, 2017.
- [11] J. W. Creswell and J. D. Creswell, *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications, 2017.
- [12] M. Q. Patton, "Qualitative research," *Encycl. Stat. Behav. Sci.*, 2005.
- [13] B. Gillham, *Case study research methods*. Bloomsbury Publishing, 2000.
- [14] J. Creswell, "Research design," *Qual. Quant. Approach*. Thousand Oaks SagePublications, 2009.
- [15] A. J. Kenny, N. Campbell, M. Koen-Alonso, P. Pepin, and D. Diz, "Delivering sustainable fisheries through adoption of a risk-based framework as part of an ecosystem approach to fisheries management," *Mar. Policy*, vol. 93, pp. 232–240, 2018.
- [16] S. E. Lester, E. O. Ruff, K. Mayall, and J. McHenry, "Exploring stakeholder perceptions of marine management in Bermuda," *Mar. Policy*, vol. 84, pp. 235–243, 2017.
- [17] K. Richardson, R. Gunn, C. Wilcox, and B. D. Hardesty, "Understanding causes of gear loss provides a sound basis for fisheries management," *Mar. Policy*, vol. 96, pp. 278–284, 2018.
- [18] R. Froese et al., "Status and rebuilding of European fisheries," *Mar. Policy*, vol. 93, pp. 159–170, 2018.
- [19] S. L. Wear, "Missing the boat: Critical threats to coral reefs are neglected at global scale," *Mar. Policy*, vol. 74, pp. 153–157, 2016.
- [20] M. M. Islam, E. Y. Mohammed, and L. Ali, "Economic incentives for sustainable hilsa fishing in Bangladesh: An analysis of the legal and institutional framework," *Mar. policy*, vol. 68, pp. 8–22, 2016.
- [21] A. Heenan et al., "A climate-informed, ecosystem approach to fisheries management," *Mar. Policy*, vol. 57, pp. 182–192, 2015.
- [22] E. Sala et al., "Fish banks: An economic model to scale marine conservation," *Mar. Policy*, vol. 73, pp. 154–161, 2016.