

Baseline strategy to manage a Marine Conservation Area through community evaluation approach

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Abstract. This research was carried out in October 2019 in the Marine Protected Area (MPA) of Raja Ampat, Indonesia. At 2007 appointed as an MPA, the Raja Ampat marine area was perceived as having a good condition. However, 15 years later, there is a need to be reevaluated. This study aimed to evaluate its condition by the approach of Pressure State Response (PSR) analysis, based on collected secondary and primary data. The primary data was in the form of the community perception toward the influence of the MPA on fish resources, ecosystem, and socio-economic condition. This research used purposive sampling through questionnaires and interviews, with a percentage answer scale. Secondary data was collected from socio-cultural conditions. The results showed pressures in Raja Ampat MPA in the form of livelihood relying on capture fishery, low welfare of community, illegal fishing and other destructive activities, development of marine tourism, and the issue of planning on mining at sea. The state is that the marine area is in a fairly good condition, while the fishing cost, the total number of fishermen and boats, as well as the price of fish increased. The conditions of mangroves and coral reefs are good, the welfare increased, and the MPA is rated well. The fish existence has also increased and makes fishing activities easier. The response was establishing regulations at the level of village or regency to maintain the coastal ecosystems, fish resources and community welfare. Furthermore, the results of this study can be used as a baseline strategy to manage Raja Ampat MPA.

Key Words: community perception, pressure state response, regency of Raja Ampat.

Introduction. Raja Ampat Regency is mostly a seawater area, with only 15% of land (RAFS 2021). It is an archipelago consisting of 1325 large and small islands with the total area of 67380 km². It has a population of 61141 people and almost all of them live on the coast, where mostly ($\pm 90\%$) work as fishermen (CSARAR 2021). Various species of fish exist in Raja Ampat waters, mainly pelagic and reef fish. However, there are shrimp, lobster and shellfish as well. Destructive fishing habits are also found in this area, such as the use of explosives, drill roots, cyanide poisoning and others that threaten the existence of fish, or illegal fishing by migrants, although within controlled limits (RAFS 2018).

The Regent of Raja Ampat stipulates Regulation No. 66 of 2007 to protect the marine waters from damage due to over exploitation. The substance of this regulation is that a part of Raja Ampat's marine waters is designated as a Marine Protected Area (MPA), which covers an area of more than one million ha. Subsequently, the Minister of Marine Affairs and Fisheries has also determined a conservation area of 60000 ha to be a National Water Conservation Area, the Nature Reserve of Raja Ampat Archipelago Waters. This determination is in accordance with the Decree of the Minister of Marine Affairs and Fisheries Number KEP.64/MEN/2009 (KONWCA 2021).

Raja Ampat MPA has been managed for 15 years since it was established by the Regent of Raja Ampat in 2007 and, of course, it has an effect on the fish resources, coastal ecosystems, and community socio-economy. Therefore, it needs to be evaluated. In the beginning of its creation in 2008, an evaluation was carried out for dissertation data (Haryani 2010), but an in-depth analysis has not been conducted. At that time, the Minister of Marine Affairs and Fisheries had not designated it as a National Water

Conservation Area, i.e. the Nature Reserve of Raja Ampat Archipelago Waters. Only in 2009 it was established by the Minister. In the 2008 evaluation, it was stated that the Raja Ampat MPA had not been managed properly and the region had not developed as it is today as a popular marine tourism destination for people from foreign countries.

Overall, the evaluation of the Raja Ampat MPA has not been discussed based on its latest condition. Therefore, in order to have sustainable fish resources and to keep the development of MPA in line with the socio-economic development of the community, this research was conducted. It is expected that the condition of coastal ecosystems, communities and MPA in Raja Ampat can be evaluated according to the perceptions of the local community. This study aims to know the pressure, state, and response (PSR) of the MPA and the surrounding waters. The PSR information can be used for further analysis, like bioeconomic analysis or economic evaluation (Haryani & Fauzi 2019).

PSR analysis is often used to determine the causes and consequences of an existing problem. For example, Wijaya & Mutia (2016), apply it to a comprehensive analysis of the development of small and home industries in terms of various factors. PSR analysis is simple, but can be applied to a relatively complex MPA evaluation, which is influenced by various factors. Thus, the research using PSR analysis is important for evaluating the condition of Raja Ampat MPA. It is carried out using the approach of community perception (in % of respondents) of the influence of an MPA existence related to fish catching activities, the changes in the size, type and price of fish, as well as the changes in the water conditions, the balance of coastal ecosystems, community welfare, tourism sector and the prevention of natural disasters.

Material and Method

Description of the study sites and time period. Data collection was carried out in the area of Raja Ampat MPA and its surroundings in West Papua Province, Indonesia (Figure 1), in October 2019. There has been a change in the management of Raja Ampat waters by stipulating a part of its area as an MPA, either by the Regional Government of Raja Ampat Regency, or by the Central Government (Ministry of Marine Affairs and Fisheries). The purpose of establishing the MPA is to be an instrument for sustainable fisheries management. The existence of an MPA in Raja Ampat waters is expected to produce sustainability. This is because in Raja Ampat waters the biodiversity is high, with 1150 species of marine fish, 699 of molluscs and 537 of corals (KONWCA 2021).

Method of collecting data. The data analyzed consisted of primary and secondary data. Primary data was collected by filling out a questionnaire, followed by interviews. In addition, observations were also made in the area around the MPA to meet the community and determine the physical condition of the waters inside the MPA. The research method used was descriptive qualitative, emphasizing the primary data supplemented by secondary data. Questionnaires and interviews were used to determine the community perceptions of the condition of fish catching activities, the changes and effects of MPAs, the changes in water conditions, the changes in coastal ecosystems, the changes in the size and type of fish, community welfare, tourism sector and the prevention of natural disasters (Haryani & Fauzi 2019).

Questionnaires were filled out and interviews were conducted at the study site with the respondents from relevant stakeholders, including fishermen, community leaders, activists, local policy makers from relevant agencies and tourists. Using purposive sampling technique, the selected respondents reached a total of 100 people. The respondents were determined according to the characteristics of the population, represented by the coastal communities living around the MPA (Sugiyono 2020). The main respondents were fishermen (90%) who live in 4 villages, namely Yanbekwan, Sawingrai, Kapisawur and Saporkren. The rest of 10% were activists, local community leaders, tourists, and policy makers from related agencies.

Secondary data supported the data obtained from the relevant agencies/institutions at the research site, including the Central Bureau of Statistics, the Fisheries Service Office, fish landing centers, fish auction sites, non-governmental

organizations, and others. The secondary data included, among others, local demographic, geographic and socio-cultural conditions.

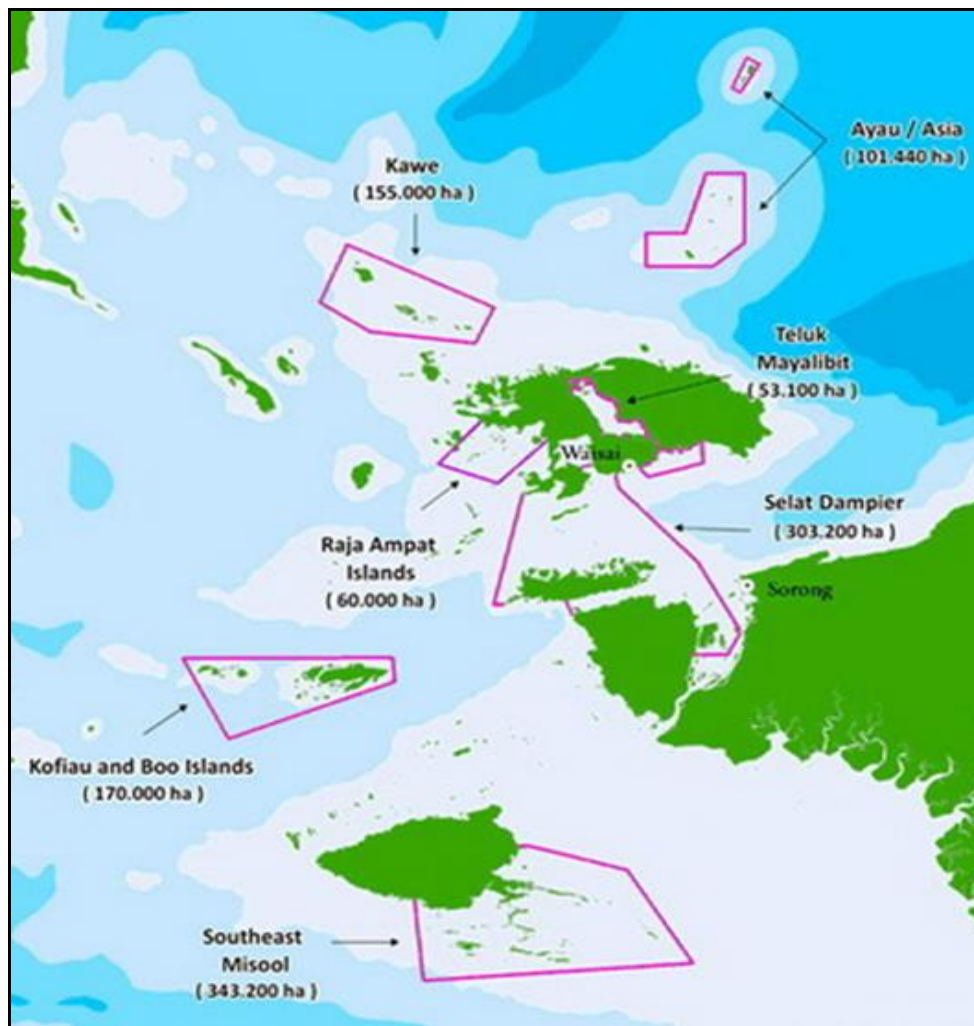


Figure 1. Boxes in pink color show the area of Raja Ampat MPA in West Papua Province, Indonesia. Source: <https://indopacificimages.com/indonesia/diving-indonesia-the-marine-protected-areas-mpas-of-raja-ampat/>.

Data analysis. The primary data was analyzed using a simple approach of pressure, state, response (PSR) to assess the condition of Raja Ampat MPA (Haryani & Fauzi 2019). This PSR analysis model consists of 3 approaches, namely: (1) pressure as the main factor or force, which is the answer to the question of why problems occur and are considered as the starting point of environmental and socio-economic issues; (2) state (the existing conditions) explains the current condition of the environment; it is an environmental condition due to pressure; for example, the conditions of pollution and coastal damage, which have an impact on the community welfare; (3) response is an action to find a solution for the problem by involving related stakeholders. For example, conserving natural resources, rehabilitating damaged environments, formulating new regulations, or implementing new strategies in the environment management. Furthermore, the PSR approach model can help determine solutions and policy interventions (Wijaya & Mutia 2016; Haryani & Fauzi 2019).

Results and Discussion

Pressure at Raja Ampat MPA. The pressure that occurs in Raja Ampat MPA is not heavy. This is different from other MPAs in Indonesia. This MPA location is far from the

center of crowds or human activities, lessening the existing pressure. It is isolated and difficult to reach due to the unavailability of public transportation access. Significant socio-economic problems produce pressure, for example the low welfare of the local community. In addition, fishing is the only alternative livelihood for the local community (Haryani & Fauzi 2019; Haryani 2022). The local community is a traditional society. To fulfill their daily needs, they use available natural resources. However, negative activities have been occurring, although they are under control. If performed continuously, these can degrade the fish resources, undermining the sustainability of the MPA. On the other hand, illegal fishing by migrant fishermen, the continued development of marine tourism, as well as the potential mining resources exploration are high pressures for the MPA and have high risks (RAFS 2018).

The establishment of an MPA by the Regional Government of Raja Ampat Regency and the Nature Reserve of Raja Ampat Archipelago Waters by the Ministry of Marine Affairs and Fisheries has improved the management of Raja Ampat marine area in terms of sustainability. The low education level of the local population, growing population, and difficulty to find employment opportunities seem to be of no pressure for Raja Ampat MPA. The existing fish resources do not experience a heavy pressure because the input for exploiting fish and other marine biota is at an efficient scale (Haryani & Fauzi 2019; Haryani 2022).

State at Raja Ampat MPA. The perception of community in Raja Ampat waters toward the fishing activities was good. 55% of the respondents perceived that Raja Ampat fishermen were increasing in number, while 30% stated that the number remained the same and 15% stated it was decreasing. Concerning the number of fishing vessels, 75% of the respondents said it was increasing, 18% said it was constant and 7% said it was decreasing. This explains that the input of the number of ships and the input of the number of fishermen continues to increase every year and that the fishermen continue to carry out fishing activities in the local area (Haryani & Fauzi 2019; Haryani 2022).

The community perception that the existence of an MPA was actually to catch fish had faded away. However, 55% of the respondents stated that the number of fish caught had increased. As many as 25% of the respondents said it was constant and 20% others said it had reduced. Such a condition is favorable for sustainable fisheries management, but caution must be applied to avoid over fishing (Haryani & Fauzi 2019; Haryani 2022).

Furthermore, as many as 55% of the respondents stated that the conditions of Raja Ampat waters were getting better; no dangerous water pollution was resulted from human activities as the impact of domestic waste, ports and tourism, or others. As many as 33% of the respondents said the water conditions remained stable and 12% said the waters were getting worse. This condition is beneficial for the MPA management to support sustainable fisheries because it can ensure the sustainability of human resources, keeping the environment maintained and the fish abundant (Haryani & Fauzi 2019; Haryani 2022).

The degradation of natural resources in the waters of Raja Ampat was not detrimental to fish resources, mangroves, coral reefs and seagrass beds (Supriyadi et al 2018). 62% of the respondents perceived that the coral reefs were in a better condition, 23% said they were in the same condition and 15% said the coral reefs were degrading. In addition, 56% of the respondents said that the area of coral reefs was increasing, 32% said that the area was the same, and 12% said that the area was decreasing. This is in line with the results of Yuanike et al (2020), where coral reefs condition in the waters of Raja Ampat is categorized as good with an average value of hard coral cover of 64.24%.

73% of the respondents said that the conditions were getting better for the mangrove ecosystem, 20% said they were constant and 7% thought that the mangroves and their ecosystems were getting worse. 68% of the community perceived that the area of the mangrove ecosystem had increased, 24% said it remained the same, and 8% considered that it decreased. This community perception was partly due to the increasing public understanding of the sustainability of human resources and environment (Sutono et al 2020).

Based on the community perception, the conditions of the mangroves and their ecosystem in Raja Ampat are good. So far, the coral reefs destruction through mining for building materials, the use of bombs during fishing, or the use of mangrove wood for firewood and building materials has not been at a disturbing stage and is currently reasonable. However, the destruction caused by the use of explosives for fishing must be controlled properly (Supriyadi et al 2018).

The community perception of the conditions of coral reefs and mangroves is reasonable. Based on various data, the waters of Raja Ampat are well preserved due to the local community's high awareness of the importance of preserving natural resources and their ecosystems (Haryani & Fauzi 2019; Haryani 2022). A potential threat is the increasing ship traffic due to the development of marine tourism. There have been several ship accidents hitting and destroying coral reefs, detrimental to the area of Raja Ampat MPA (Witomo et al 2017). It should be remembered that coral reef ecosystems and mangroves in the sea are important also for their role of natural coastal protectors of beaches from damage due to abrasion and sedimentation, and even tsunamis (Haryani et al 2021).

55% of respondents perceived that the size of the fish in the waters of Raja Ampat was increasing. Meanwhile, 30% of the respondents said that the size of the fish was constant and 15% said that it decreased. The impact of the MPA was in improving the conditions of the Raja Ampat waters prevent degradation. This was the basis for the community opinion as mentioned above (Haryani & Fauzi 2019; Haryani 2022). The better water conditions had resulted in more fish species, meaning that they were diverse, as stated by 58% of the respondents. However, 32% of the respondents said the diversity of fish species remained the same and 10% said that it decreased. This is in line with Sala et al (2018), who noted that the selectivity of fishing gear is improving and various types of fish are easier to catch. A variety of new fish species might have migrated in the area due to better ecosystem conditions. The waters of Raja Ampat are fish migration routes and their balance is maintained (Bawole & Megawanto 2017).

Response at Raja Ampat MPA. The various existing conditions and pressures are determined were used to analyze the appropriate response for the development of the Raja Ampat MPA. There are 5 main steps of response in the Raja Ampat MPA: (1) improving various policies according to the latest conditions; (2) updating the fishing system regarding the inputs for fishing; (3) developing a group of local fishermen; (4) repairing the existing environmental damage; (5) making fish resource conservation efforts (RAFS 2021).

Through the grouping of responses, 21% of the respondents said it was important to form a fishing group. The existence of fishing groups would become a forum for channeling the aspirations of the community. 19% of the respondents agreed that there should be village-scale or local government-scale regulations, with the aim of protecting human resources. Regulations must be improved continuously and adapted to the demands of existing changes. Even the regulations for managing and developing the Raja Ampat MPA must always be agreed upon by all levels of the local community, so that the new applied regulations are truly a response to the existing pressures and state. This is intended to maintain the sustainability of natural resources and the preservation of marine resources diversity. Another 15% of respondents said they would carry out fish resources conservation. In terms of environmental improvement, 10% of the respondents agreed. 2% of the respondents said that coral reef transplantation efforts were important to preserve coral reef ecosystems and support the sustainability of fish resources. The low percentage of environmental improvement and coral transplantation was understandable because the local community considered the sea conditions in Raja Ampat relatively balanced and fish resource abundant. Local wisdom in conserving natural resources such as Sasi or others is always obeyed by the local community. There was even a ban for catching fish and eating rare fish, and the community complied with it and has continued to maintain it (Sombo et al 2017).

In terms of sea trips, 7% of the respondents said they would increase the distance of their trips, and 7% said that they would have more trips. It is suspected that the

respondents take advantage of this condition to catch fish with no difficulties, because the frequency and quantity of catch were considered low (Haryani & Fauzi 2019; Haryani 2022). To increase the input to fishing, 4% of the respondents brought along their families to catch fish, so that the input of labor increased. With this condition, although there were fewer long distance sea trips, the catching results would be better (Haryani & Fauzi 2019; Haryani 2022). Furthermore, 15% of the respondents replaced their fishing gear as a response to fishing inputs.

People remain in their settlements and remain fishermen. They also have not tried to make FADs due to the abundant fish resources and good catching results. The local people did not have skills other than being fishermen. Only a few were able to provide tourism services. Moreover, the Raja Ampat area was isolated, making their life practically depend only on fishing, being difficult for them to move their domicile outside Raja Ampat.

The community avoids activities that damage the environment, such as catching fish by using bombs or poison. Locals even expel migrant fishermen who damage or fish illegally. They are aware of the importance of preserving natural resources and are accustomed to living a peaceful life (Haryani & Fauzi 2019; Haryani 2022). The communities did not reduce their fishing trips, change the boat size, use bycatch as bait, rehabilitate mangrove ecosystems or government protests, because such efforts were not considered effective responses for MPA development and welfare.

From the PSR analysis discussed above, it can be known that Raja Ampat MPA has not been under pressure of damage in terms of natural resources and ecosystem. The pressuring problems are in the form of unfavorable conditions, namely the low quality of human resources, low welfare and the isolated location of residential areas from the MPA. This condition makes the community depend on fishing activities in the sea around the MPA as its livelihood. With the condition relatively safe from environmental damage and pollution, the sustainability of fish resources in Raja Ampat MPA is in a good state, and the MPA can develop effectively (Haryani & Fauzi 2019; Haryani 2022).

Based on the response explained above, there is a positive perception of the existence of the MPA. Village-level regulations or those issued by local governments are very important to maintain the sustainability of the natural and marine resources. Thus, the management of MPA becomes clear and the stakeholders can play their roles according to these regulations. It is important to develop community or fishermen groups to facilitate coordination and cooperation, to guarantee the availability of human resources and community welfare. A spillover effect of the MPA management is that it can increase the results of fish catching. Therefore, better fishing gear is needed to improve fishermen welfare (Haryani & Fauzi 2019; Haryani 2022). A complete description of the results of the PSR analysis can be seen in Table 1.

PSR in relation with the economic value of fish resources. From the PSR approach, 50% of the respondents said that the fish price had increased. 35% of the respondents said the price remained the same, and the remaining 15% said the price was decreasing. It is suspected that the increase in fish prices is an effect of the increasing purchasing power of local residents and of the availability of higher quality fish.

90% of the respondents said that there was an increase in the cost of fishing, and the rest of 10% said it remained the same. The increase in fishing costs is thought to be due to fishing farther away since the designation of parts of Raja Ampat waters as MPA. However, the community also said that the establishment of the MPA had increased the fish catching results, even though the fishing locations are further away (Haryani & Fauzi 2019; Haryani 2022). Furthermore, 63% of the respondents said that their income had increased with the presence of the MPA, 23% said it was constant and the remaining 14% said their income had decreased. It is suspected that the increase in income was caused by the increased fishing efforts, like a more efficient fishing system (Haryani & Fauzi 2019; Haryani 2022). In addition, the increase in income is caused by the rising fish prices and increasing public consumption of fish, in line with the increasing population growth. The increase in tourist arrivals and the increasing number of human transportation to Raja Ampat also make the fish supply in the market in higher demand.

Table 1

The results of the evaluation of Raja Ampat Marine Protected Area (MPA) using the Pressure State Response (PSR) approach

<i>Pressure</i>	<i>State</i>	<i>Response</i>
<ul style="list-style-type: none"> • In the area around the MPA, the community welfare is relatively low • Fishing is the only skill of the community around the MPA • Potential overfishing by people living outside Raja Ampat (immigrants) <ul style="list-style-type: none"> • Continuous encouragement for marine tourism development • Mining exploitation planned by the private sector in the marine waters of Raja Ampat • Ships hitting coral reefs in the MPA area 	<ul style="list-style-type: none"> • Fish catching in Raja Ampat is good, with increasing catches • The number of ships increases, the selling price of fish is better, and the number of fishermen increases; on the other hand, the cost of fishing trips increases <ul style="list-style-type: none"> • Environmental conditions, mangrove and coral reefs around the MPA are improving • The conditions of Raja Ampat waters are improving, pollution has not become a threat yet <ul style="list-style-type: none"> • The degradation of natural resources is low, not affecting the fish, mangroves, seagrass and coral reefs • Larger fish have a better price, and more diverse species increase the income <ul style="list-style-type: none"> • The MPA acts as a step to conserve ecosystems and increase fishing yields, although the fishing area is far away, as it has to be outside the MPA • The MPA is good, because the community believes that their welfare will increase and they will become prosperous 	<ul style="list-style-type: none"> • In order to protect the sustainability of fish resources, the community made some village/regency regulations for clearer MPA management <ul style="list-style-type: none"> • Conservation of fish resources was done in better ways • The community formed fishing groups to facilitate coordination and cooperation in the preservation and capture of fish resources <ul style="list-style-type: none"> • To support the conservation of natural resources, the community tried coral reef transplantation and improvement of the aquatic environment • For higher fish production, the community increased its input to fishing by inviting family members, using better fishing gear, and increasing fishing trips <ul style="list-style-type: none"> • Catching more fish with longer distances

PSR in connection with the existence of an MPA. 65% of the respondents said the MPA development was good because the fishing results increased, whereas 25% said it the results remained constant and 10% said they did not know. 75% of respondents said that there was an obstacle to fishing due in the MPA, making long distance trips, 20% said there was no difficulty, and 5% did not know the impact on the fishing distance. The ban on fishing in MPA waters makes the distance for fish catching farther. The waters inside the well managed MPA cause a spillover effect, increasing the volume of fish catching in the waters just outside the Raja Ampat MPA.

80% of the respondents said that the level of community welfare has increased as a result of the MPA development. 10% of the respondents said that the MPA did not increase welfare, and the remaining 10% said they did not know what the relationship between MPAs and local community welfare was. People welfare increases in line with their positive perception. MPAs have a good impact and make their lives easier. Furthermore, community welfare can also be achieved by empowering local people with the existing local resources (Haryani et al 2022).

76% of the respondents said that the MPA had a good impact on maintaining the balance of fish resources and the Raja Ampat marine ecosystem. However, 12% of the respondents said developing part of the marine area as an MPA was not related to the preservation of fish resources and ecosystem around the MPA. The remaining 12% of the respondents said they did not know the impact of the MPA. 85% of the respondents stated that MPA was useful for more than tourism, 5% said it was useful only for tourism

and 10% said they did not know. In terms of its benefits for natural disaster management, 75% stated that the MPA was also useful for natural disaster management, 20% stated that it had no relation with natural disaster management and 5% stated that they did not know.

Community perceptions related to the increased catches, increasingly distant fishing barriers, improved welfare, sustainability of aquatic ecosystems, influence on the tourism sector and benefits to natural disaster prevention can certainly be influenced by the development of the MPA. The MPA was developed as an instrument for sustainable fish resources management to enable the fishermen to catch fish in better ways and to be prosperous (Bawole & Megawanto 2017). The marine ecosystem of Raja Ampat is improving and the community is more prosperous. It is presumably because the fish catching has increased as the result of increased fishing efforts and efficient fishing systems. After being classified by range, respondents had a good perception of the MPA of 50-90%, and a bad perception was in the proportion of 0-20%.

Conclusions. In general, it can be concluded that the conditions of waters around Raja Ampat MPA are good, and the MPA development is considered positive by the local community, because various fish species are available in higher numbers, enabling increased captures, prices and income, which in turn lead to better welfare. The research approach with PSR analysis is an appropriate approach because the results are useful as an underlying baseline and cross-checking for bioeconomic analysis, economic valuation, or other analyses. As for policy implication, it is suggested that the responses in the form of village regulations or informal rules should be formulated in the form of regional regulations (regency level), so that they have a stronger power. It is also necessary to immediately set up a strategy for Raja Ampat MPA development, completed with bioeconomic analysis and economic valuation.

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Conflict of Interest. The author declares that there is no conflict of interest.

References

- Bawole R., Megawanto R., 2017 [Establishing of Aquatic Protected Areas (APAS) network in Papua's Bird Head's Seascape (BHS): Species migration and genetic connectivity]. *Coastal and Ocean Journal* 1(2):189-200. [In Indonesian].
- Haryani E. B. S., 2010 [Hybrid bioeconomic modeling for the development of Marine Protected Areas in small islands]. *Strata-3 Dissertation*, Bogor Agricultural University, Bogor, Indonesia, 231 p. [In Indonesian].
- Haryani E. B. S., 2022 [Evaluation of Marine Protected Areas using Pressure State Response approach]. *Grouper: Scientific Journal the Faculty of Fisheries of Lamongan Islamic University* 13(1):50-61. [In Indonesian].
- Haryani E. B. S., Adi C. P., Pranoto A. K., Panjaitan P. S., Tanjung A., 2022 [Community empowerment in watershed through development of catfish (*Pangasius* sp.) cultivation business]. *Journal Airaha* 11(1):1-13. [In Indonesian].
- Haryani E. B. S., Fauzi A., 2019 The management of marine protected area of Raja Ampat Regency, West Papua Province through bioeconomic model approach. *IOP Conference Series: Earth and Environmental Science* 278(1):012033.
- Haryani E. B. S., Pasaribu R., Soeprijadi L., Djari A. A., Pattirane C. P., 2021 Development of coastal protection structure in Karawang coastal area of Indonesia. *International Journal of Research and Innovation in Applied Science* 6(11):14-22.
- Sala R., Simbolon D., Wisudo S. H., Haluan J., Yusfiandayani R., 2018 [Suitability of types of fishing equipment in Misool traditional use zone, Raja Ampat]. *Journal of Marine Fisheries Technology and Management: Marine Fisheries* 9(1):25-38.

- Sombo H., Kamal M. M., Wardiatno Y., 2017 [Conditions and priorities for controlling the utilization of Napoleon fish (*Cheilinus undulatus*, Rüppell, 1835) in Raja Ampat Regency]. Indonesian Journal of Fisheries Research 23(3):181-191. [In Indonesian].
- Sugiyono, 2020 [Qualitative quantitative research methods and R & D]. 2nd Edition. Alfabeta, 443 p. [In Indonesian].
- Supriyadi I. H., Cappenberg H. A., Souhuka J., Makatipu P. C., Hafizt M., 2018 [Condition of coral reefs, seagrasses and mangroves in water nature reserves, Raja Ampat Regency, West Papua Province]. Indonesian Journal of Fisheries Research 23(4):241-252. [In Indonesian].
- Sutono D., Perangim-angin R., Mustasim, 2020 [Coral reef ecosystem of Arborek Island, Raja Ampat, West Papua]. Airaha Journal 9(1):63-70. [In Indonesian].
- Wijaya N., Mutia M. A. A., 2016 [Analysis of the development of small and home industries using the DPSIR approach: A case study in Ciparay District, Bandung Regency]. Tataloka Journal 18(3):172-182. [In Indonesian].
- Witomo C. M., Firdaus M., Soejarwo P. A., Muawanah U., Ramadhan, Pramoda R., Koeshendrajana S., 2017 [Estimated economic losses from damage to coral reefs due to the Caledonian sky ship collision in Raja Ampat]. Journal of the Scientific Bulletin "MARINA" Socio-Economic Marine and Fisheries 3(1):7-19. [In Indonesian].
- Yuanike, Yulianda F., Bengen D. G., Dahuri R., 2020 [Marine ecotourism integrated management model in the Raja Ampat Water Conservation Area]. Strata-3 Dissertation, IPB University, Bogor, Indonesia, 245 p. [In Indonesian].
- *** CSARAR (Central Statistics Agency for Raja Ampat Regency), 2021 [Raja Ampat Regency in Figures]. [In Indonesian].
- *** <https://indopacificimages.com>
- *** KONWCA (Kupang Office of National Water Conservation Area), 2021 [Raja Ampat SAP area]. Available at: <https://kkp.go.id/djprl/bkkpknkupang/page/391-profil-sap-raja-ampat>. [In Indonesian].
- *** RAFS (Raja Ampat Fisheries Service), 2018 [Profile of marine and fisheries resources of Raja Ampat Regency]. [In Indonesian].
- *** RAFS (Raja Ampat Fisheries Service), 2021 [Marine and fisheries information for Raja Ampat Regency]. [In Indonesian].
- *** RRA (Regent of Raja Ampat), 2007 [The Regent of Raja Ampat stipulates Regulation No. 66 of 2007 to protect the marine waters from damage due to over exploitation]. [In Indonesian].

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