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MODIFIED STRUCTURES AS APPROPRIATE TECHNOLOGY IN SUPPORTING THE REHABILITATION OF CORAL REEF ECOSYSTEMS IN TUAN ISLAND

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ABSTRAK

This community service program aims to support efforts to rehabilitate coral reef ecosystems on Tuan Island through the application of appropriate technology based on modified structures. Coral reefs are important ecosystems that provide habitat for various marine species, but are currently being damaged by human activities and environmental changes. In this program, we develop and apply artificial structures that have been specifically modified to support optimal coral regeneration and growth. This approach involves environmentally friendly material technology and designs that mimic natural structures, so that they can integrate well into the marine ecosystem. Through collaboration with local communities and direct training in the field, this program is expected to provide a real contribution to accelerating coral reef recovery while increasing public awareness of the importance of maintaining the sustainability of marine ecosystems.

Keywords: Coral Reef Rehabilitation, Modified Structure, Appropriate Technology, Marine Ecosystem, Ecosystem Restoration.

INTRODUCTION

Situation Analysis

Community service in line with the new paradigm implemented by the government are *problem solving*, comprehensive, meaningful, complete, and sustainable *with* multiple targets. Therefore, this service continues the service of previous servants in resolving fisheries problems faced by the fishing community in Lhok Lamteungoh, Peukan Bada District. Efforts to improve the condition of the marine environment as a supporter of fishermen's livelihoods have been carried out in the previous year through the creation of fish house technology as well as *underwater technopark* locations to support tourism, as well as alternative additional livelihoods in the same location. Efforts that will encourage the creation of natural conditions that are getting better day by day. The continuation of the previous service will be continued with the application of appropriate technology in supporting coral rehabilitation while creating new fishing locations or *fishing grounds* that will support fishermen's efforts directly

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and measurably.

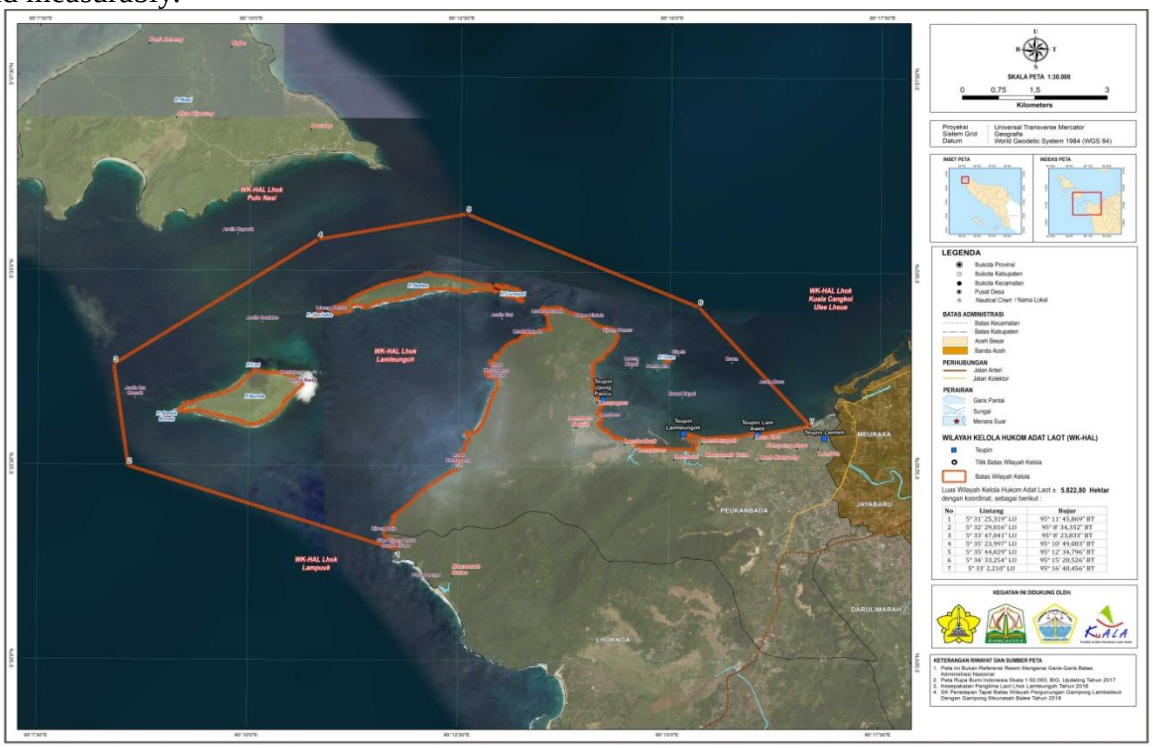

Figure 1. WK-HAL Lhok Lamteungoh Map (Intellectual Property Database, 2022).

Traditional fishing communities in the Lhok Lamteungoh Laot Customary Law Management Area (WK-HAL) in Peukan Bada, consist of traditional fishermen who fish for *one day fishing* , fishing rod fishermen, beach trawl fishermen, oyster hunters, micro-scale fish processing communities and traders of fishery products on a micro-small scale. In general, the income of fishing communities in this area is highly dependent on fish catches and other marine resources, which are directly or indirectly also influenced by changes in seasons and climate as well as changes in the quality of coastal and marine ecosystems.

Figure 2. Fishermen's activities in Peukan Bada

The Lhok Lamteungoh customary law management area has a unique marine nature

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consisting of shallow sea areas with coral reef ecosystems in several places, one of which is on Tuan Island, and several other points in the south-west. The existence of coral reefs that are rich in coral animals, reef fish and other living things that support other ecosystems around them. Coral reef areas are resources that must be preserved and provide income for the surrounding community. Previous community service efforts have shown improvements to the coral reef ecosystem with the growth and presence of a number of new areas overgrown with coral, this is also driven by several non-profit institutions that work together to help the Peukan Bada fishing community.

Figure 3. Location of Tuan Island and its coral reef ecosystem

PKMBP- TTG activities focus on the application of products that can be used to empower and improve the community's economy. The technology to be created is **a simple modified fish house as well as a coral transplantation medium** . A multifunctional technology model so that the multi-target target of PKMBP TTG can be achieved with a model like this. This appropriate technology is created with the consideration of making it at a cheaper price than similar structures, easy to make and easy to install at the desired location.

Fish houses are places where fish associate, where some fish live in nature tend to be in a location with their territorial behavior. The loss of a number of coral reefs in coastal areas that function as fish homes, makes marine resources increasingly reduced in number. Fishing locations are also increasingly limited in existence. Through the application of appropriate technology, it is hoped that the number of fish catches and other fishery products such as octopus, cuttlefish, squid and others will continue to increase.

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Figure 4. Overview of commonly used technologies.

In line with the objectives of the PKMBP-TTG activity in introducing a technology product with economic value that can be used directly. So through this service, an appropriate technology product will be created that is easy to make, inexpensive, easy to install and can be used as an instrument to present fishing grounds for traditional fishing communities. This appropriate technology will increase the value and benefits of USK for the people of Aceh. If the community's income increases from the fishermen's catch due to the existence of a fishing ground (fishing location) it will help create peace and comfort in community life. This technology model will also be easy to implement in the implementation of the USK Real Work Lecture (KKN), if it will be applied. An overview of this technology can be seen in Figure 2 below.

Partner Issues

Based on the results of the discussion and referring to the situation analysis points above, the description of the partner's problems includes:

1. The reduction in fishermen's catches over time.
2. There is irregular unemployment, due to suboptimal fishing activities due to the decreasing number of fishing locations.
3. Many fishing fleets (boats) are not used to go to sea due to increasing costs, while catches are limited.
4. Traditional fishermen need alternative fishing locations that are accessible to increase family income.

The fishing fleet owned by small fishermen often cannot be maximized, due to the existence of fish that are not accessible or the season that is less supportive in fishing. The PKMBP TTG activity focuses on the application of appropriate technology products, in this case it can be used to empower and improve the economy of coastal communities in particular. This PKMBP TTG activity is expected to provide real solutions to the problems above.

PARTNER PRIORITY ISSUES AND THE SOLUTIONS

The problems faced by partners are systematically in accordance with the priority of the problem. The solution that is truly related to the priority problems of partners is the provision of new fishing locations along with environmental improvements. In terms of production, a number of new fishing areas will be produced which will provide more *representative* catches and will have an economic impact on the fishing community. It is very specific to apply appropriate technology for traditional fishermen who catch by fishing or shooting fish, and others. The output will be measured by the amount of increase in catches and direct income of fishermen.

Provision of underwater environmental engineering knowledge and the creation of fish houses with appropriate technology models that function as environmental engineering and engineering of new *fishing ground* locations . Fish habitats can be engineered by creating artificial reefs as permanent replacement habitats. Artificial reefs have long been used as an effort to rehabilitate the environment to improve the quality of fisheries and fisheries management, research, or recreation (Fabi et al, 2015).

The exploitation pressures that have occurred in recent decades have caused environmental quality to decline and reduced fishermen's catches.(Kisworo, 2013). Fish houses will be built

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with concrete construction as a form of environmental engineering to increase fish resources. The use of concrete or concrete for artificial reefs has been known for its strength and suitability to underwater environments that require strong and durable materials. Artificial reefs in various models have been tested and can withstand a number of waves and have different capabilities, but are generally strong enough to be made in areas with waves (Fauzi et al, 2017). According to(Subcommittee, 2004)The advantages of concrete materials for artificial reefs or fish houses include:

a) Concrete materials are very suitable for marine environments.
b) Concrete is very durable, stable and readily available.
c) The flexibility to mold concrete into a variety of shapes makes the material ideal for developing prefabricated units.
d) Concrete provides an excellent surface and habitat for the settlement and growth of crust or fouling organisms, which in turn provide food and shelter for other invertebrates and fish.

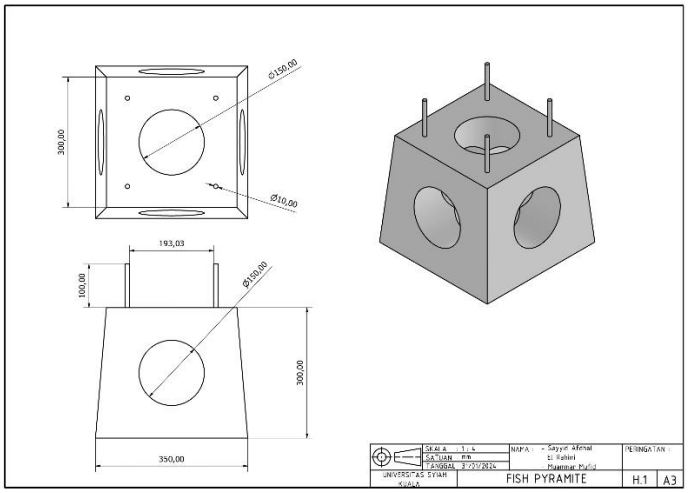

Figure 5. A description of the appropriate technology that will be created by the community service provider

The structure created is expected to be installed by one person with the appropriate weight. Placement or installation can also be done at a water depth of about 3 meters and will function as a fish house and coral transplantation media. Its multi-functional use and easy and cheap manufacture are the advantages of this appropriate technology. This structure is modified in such a way that it is different from the general structure that is usually made with a Single function. This structure is more effective when made and arranged in the form of a grouped colony so that it becomes a more massive structure.

METHOD OF IMPLEMENTATION OF ACTIVITIES

The activity implementation method will explain the stages or steps in implementing the solutions offered to overcome problems that include the following:

Pre-Activity

Pre- activity includes socialization activities to the community that will be involved in the entire process of community service activities. Strengthening a shared vision with the beneficiary community or partners to ensure the success of the program. Socialization of activities and schedules with partners so that a common perception is achieved with the

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community service team. This pre-activity is an important momentum to ensure the success of the PKMBP TTG activities. Socialization is prioritized for stakeholders at the community service location.

Main Activities

The main activity is the main activity which consists of several activities which are made systematically to achieve the goal of devotion. First, survey the location of the fish house placement that will be used as the location for the application of appropriate technology. An ecological approach is important to note regarding water depth, the presence of benthic biota and fish, and the presence of coral reefs at the placement location, as well as a technical approach that supports the ease and benefits of the application of appropriate technology that will be applied. The survey has been conducted and the location is then determined.

Second, strengthening the design and making of modified structures that will be used as fish houses which are the main components in creating a *fishing ground* location . Strengthening the production aspect in this case is the application of appropriate technology products that will become supporting *instruments* for the success of fishermen's fish catches. The making of modified structures is made with the principle of being easy to make, cheap, easy to install. The design has been drawn and selected according to field needs.

Third, the placement of fish house structures that can function as a medium for coral transplantation together with the fishing community so that there is harmony to achieve the desired goals of service. The direct presence of the community can provide input and become a shared learning experience. Directly, the community will be involved in the management aspect which will be implemented through the management of the fishing ground. The placement was carried out on August 18, 2024, after the structure was made within one to two months of preparation.

Along with this process, documentation of activities is also carried out and monitoring is continued from time to time. The importance of monitoring is to see the ecological changes that occur in the fish houses that are made and their great benefits for creating new *fishing grounds* in increasing income for traditional fishermen or small fishing communities. The monitoring process began in September 2024 .

Post Activity

Activity reporting to inform the entire process that has been carried out, and it is hoped that the report can be a source of information and learning material for the future. During the service process, partners together with the service providers will be involved in every planned process. Involvement starts from pre-activity to the end of the service activity. The service location is a location that from time to time is a pilot location for the implementation of service. So, after the activity, monitoring and evaluation of the results of the TTG PKMBP activities will continue to be carried out. Students will be directly involved in the implementation process of the TTG PKMBP. A total of 3 (three) students have been registered to be involved and will receive learning during the implementation of this service process. Student involvement is an important part in supporting one of them, MBKM and is an initial preparation towards the implementation of the final assignment.

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RESULTS OF SERVICE IMPLEMENTATION

Overview of applied science and technology

The modified structure that is made will become a fish house. This structure is known as an artificial structure that is made in such a way that it can become a new habitat for fish and other biota.

Figure 6. Structures made and placed under water.

Description of Activity Implementation

The results of the implementation of community service activities that have been carried out by the Community Service Team. The application of science and technology can be seen systematically supported by supporting images/photos. The stages of implementing community service activities are as follows:

- Socialization and agreement of cooperation between partners with the community at the service location
- Determining the location with partners that will be used for the application of appropriate technology for modified structures or fish houses.
- Preparation of materials has begun since May 2024 with the students involved.
- Create a design image that will be HKI-protected.
- Making concrete molds/molds which will be the appropriate technology for this community service activity.
- Making molds and drying process which takes 1 to 2 months by devotees and students.
- The process of mobilization to the port to then be loaded onto a transport ship.
- Joint placement process with partner communities and students.

The results of the survey of responses/responses/assessment of partner satisfaction with the applied science and technology and the implementation of activities that have been carried out by the Service Team. Partner participation in the implementation of activities and how the Service Team and partners synergize to ensure the sustainability of activities also need to be conveyed clearly.

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Figure 7. *Implementation of PKMBP TTG service*

Impact of Activities

The placement of this artificial structure which is an appropriate technology will directly become a habitat that will bring a number of biota such as fish and other biota that have productive value. The partner community will utilize this technology and make this placement location a fishing ground or location to catch fish.

The catch from this area will be a source of income for fishermen from fishing activities. This area will be a location for direct beheading or a habitat that will support other habitats around it. A mini habitat has been formed of at least 100-200 square meters with the placement of structures in groups and spread across the Tuan Island area. The devotional service's hope can be a solution to the increasing difficulty of getting fish and the destruction of the ecosystem that is increasing day by day.

Obstacles faced

There were no significant obstacles encountered during the service process. The less clear

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underwater environmental conditions made it a little difficult to document the activities.

CONCLUSION AND SUGGESTIONS

Conclusion

This activity has been mostly implemented as well as possible, namely the placement of 82 units of modified structure Appropriate Technology products, which will function to support the rehabilitation of a number of units that have been planned at the beginning. The plan to add units to optimize the results is included in the follow-up plan. The next stage is to continue the follow-up steps as made in the proposal. There have been no obstacles encountered by the service team during this process.

Suggestions

Suggestions regarding improving the implementation of activities to achieve more optimal community empowerment outcomes by integrating with other community service and research programs.

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