EMPOWERING WOMEN THROUGH IMPLEMENTING HORIZONTAL NET INNOVATION FOR SEAWEED CULTIVATION IN NORTH BUTON REGENCY

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***Abstract*— Seaweed cultivation is an important activity in most coastal villages in Indonesia. Most of the seaweed cultivation activities are carried out by men. This is because the longline cultivation method requires a lot of effort. Women only help in small processes such as tying and drying. One of the severe problems disturbing seaweed cultivators is the existence of fish pests that attack seaweed. This community service activity aims to implement seaweed cultivation innovations to increase seaweed production as well as the role of women in cultivation. Horizontal net innovation can prevent seaweed from being attacked by fish pests in seaweed cultivation. This community service activity was carried out in one of the coastal villages in Kulisusu District in North Buton Regency. This service activity is carried out through training and operational assistance using the horizontal net tool. As a result of the implementation of the activity, it was found that the community, especially women, was very enthusiastic about participating in the training. This activity was attended by 20 women consisting of representatives of seaweed cultivators around the waters of the Ereke sub- district. Output This activity is to provide increased knowledge and skills in operating the horizontal net, especially in empowering the role of women. It is easier for female seaweed cultivators to catch material and can immediately implement horizontal nets. The operation ofthis horizontal net tool is easy because the method used is very simple and does not require a lot of energy to operate. The increase in seaweed production is not determined by who the actor is cultivating but by using good and correct methods.**

Keywords*— *community service, farmers, seaweed, production

I. INTRODUCTION

North Buton Regency is one of the regencies with a long coastline among the 12 regencies/cities in Southeast Sulawesi. The topography of the area consists of islands with a sea area of up to60% of the total area. One of the main commodities in the marine and fisheries sector is seaweed. Since 2018, this area has continued to develop seaweed development center locations [1]. Seaweed cultivation is a very strategic effort to improve the welfare of coastal communities in North Buton Regency. Most coastal communities make seaweed cultivation their main livelihood. The dried seaweed trading industry is not far from the capital city of North Buton Regency, so this condition urgently requires supplies of dried seaweed raw materials. The supply of seaweed is highly dependent on the yields of seaweed farming communities. Seaweed production is currently not well developed due to the many problems it faces. One of the serious problems is the method of cultivating seaweed with a long rope system [2,3]. The Longline method is a free method and is often attacked by pests including herbivorous fish, sea turtles and some herbivorous animals [3,4]. This problem is exacerbated by the frequent emergence of ice- ice disease which is the main enemy of seaweed farmers [5]. The attacks usually occur in July – September each year. The attack was carried out by the juveniles and adult fish Siganus sp.which eats the new thallus (shoots) of seaweed and leaves the main thallus which turns white andsometimes dies. This pest attack can reduce seaweed production by up to 60% of the total community production [6]. Another problem is the large amount of seaweed that breaks and is carried away by sea currents.

The phenomenon of pest attacks by herbivore fish is very widespread and occurs in almost all seaweed cultivation areas in Indonesia [2]. In India, especially on Krusadai Island, seaweed cultivation, such as Euchuema cottoni and E. denticulatum, has experienced a decline in production starting from 10% of its growth due to attacks by predatory pests [7]. Some seaweed entrepreneurs are very concerned about this serious problem and recommend the maintenance of Kappaphycus alverazii seaweed using cultivation methods protected from attacks by fish and turtle pests. The method that is often recommended is confinement which can prevent seaweed from being attacked by herbivorous animals [6]. In Indonesia, seaweed production has decreased to 60% of the community's total seaweed production. [3,4]. Several countries such as the Philippines and Brazil have begun to make efforts to maintain seaweed which can protectseaweed from pest attacks by using nets which are still very traditional [8,9,10].

The problem of seaweed pest attacks occurs very often in North Buton Regency. Herbivorous fish, especially Siganus sp. continues throughout the year and increases drastically from early August to early October every year [6]. The attack by herbivorous fish pests occurs because the cultivation method in this area uses longlines which provide opportunities for fish to eat seaweed [11]. The longline method used by the community is a method of tying seaweed on a long rope and letting it grow. This method is open and without any

protection at all [12]. The problem of herbivorous fish pests is very serious and produces quite low production results. This herbivorousfish pest attack has also reduced the number of seaweed farmers due to the resulting losses [11,13]. Several cultivation areas are the main habitat for herbivorous fish, thereby providing access to natural food for Siganus sp. [14]. Another problem is that the longine method is irregular and produces a lot of used bottle waste.

Wandaka Village, Kulisusu District, North Buton Regency, Southeast Sulawesi Province is a strategic location where the majority of the population farms seaweed. This area also employs women as assistants in seaweed cultivation. This village has topography and water quality that is good enough for the development of seaweed. However, various problems continue to occur, including the need for seeds and low production due to fish pest attacks. This problem continues to be experienced by the community, for this reason, some intelligent efforts are needed to beable to help with the problem in order to increase the income of the community, especially women seaweed cultivators. Another serious problem is the absence of seaweed nurseries that are able to support the availability of seaweed seeds in sufficient quantities. The issue of the absence of seaweed nurseries is a major problem in seaweed cultivation development centers in this area. A strategic solution is needed that can change the cultivation method from an open method (longline) to a protected method [15,16,17]. Changing cultivation methods from those that are open and vulnerable to pest attacks to methods that are protected, beautiful and neat [18]. Apart from that, this change in method will provide added value for increasing production and new employment opportunities for coastal women. For this reason, it is very strategic to make this location a center for seaweed nurseries. The priority target for service activities that can occur in the next three years is to increase seaweed production driven by female cultivators so that the rawmaterial needs of the seaweed industry located in North Buton can be met.

II. THE SOLUTION TO THE PROBLEM AT HAND

Many methods have been created to avoid attacks by herbivore pests, but they do not cover a very wide scale in waters [7,9]. One thing used is a seaweed pest repellent tool [10,11]. However, this effort has not developed well and really needs better development. The development of seaweed cultivation methods is currently still very slow, seaweed farmers in Southeast Asia in general and in Indonesia in particular still continue to use longline cultivation methods [12]. Several countries such as the Philippines and Brazil have started to carry out seaweed maintenance efforts that can protect seaweed from pest attacks using traditional ropes [13,14]. Several regions in Indonesia are starting to use floating cages for seaweed cultivation [15]. Various efforts can continue to be made to minimize fish pest attacks, especially boronangfish (Siganus sp) and turtles in seaweed cultivation areas. Until now, cultivation has been carried out using confinement technology [16,17]. The use of cages has been successful in protecting seaweed from fish pest attacks [15]. However, the use of floating cages requiresquite a large investment if used in very large areas. The use of cages is currently only used for rearing seaweed seeds [3,18]. Maintaining seaweed seeds does not require a large area. The seedling area is quite narrow and therefore floating cages are only effective for cultivating seaweed seeds [19]. The serious problem faced is the cultivation of seaweed in large areas usingthe longline method. The use of longlines is quite cheap so that some people in Indonesia and the world still stick with the longline method [16]. This is a challenge and a good opportunity. The development of an underwater sound emitter as a seaweed pest repellent tool can be used invery large areas while still using the longline method, which is why this tool functions to repel herbivorous fish pests [20]. Efforts to get a tool that works effectively is the goal of this research.

The main problem in seaweed cultivation activities in North Buton Regency is the declinein production at the farmer level due to the intensity of pest attacks from herbivorous fish and turtles that eat seaweed. Cultivation areas in Buton Regency from July to October are the peak season for seaweed planting. However, these months also see an increase in the population of herbivorous fish (*Siganid* sp.) and turtle pest attacks so that most farmers experience losses. Nearly 60% of the community's seaweed production has decreased dramatically at each harvest due to this pest attack. The attack pattern is that small fish (Siganid sp.) will eat the skin of the seaweed, leaving the seaweed peeling and eventually dying. Meanwhile, large fish will eat the tops of the seaweed until the growth of the seaweed is seriously disturbed. Another serious problem that plagues seaweed cultivation activities in Buton Regency is the limited availability of seaweed seeds which occurs every year. Every year farmers are faced with the problem of limited availability of seeds because there is no seaweed nursery in their location. Many of the cultivating workers have to utilize female labor in the seaweed cultivation business. Although itis realized that cultivation work is quite heavy for women. It is very important to develop pilot seed gardens as a good solution to the limited number of seeds

in several seaweed industry centers in Buton Regency. The use of Horizontal Net for pilot seaweed nurseries will have a very good impact, especially on the availability of large-scale seeds [19]. This horizontal net innovation is very simple, so it will be easier for women as seaweed workers to do it [18]. This regional-based service activity will be a national model, especially in the use of horizontal net innovation and the development of seaweed nurseries which will employ women because of the ease and simplicity of using this innovation [19]. Seaweed seeds will be maintained, and the guarantee of sustainability is very high. The existence of a nursery with Horizontal Net innovation (Figure 1) will have a big influence on increasing seaweed production for female farmers and, furthermore, the national seaweed industry. The method that can be done is to create and develop a seaweed nursery by implementing the Horizontal net variant. The location of the nursery will be in Wandaka Village, Kulisusu District, North Buton Regency, which is one of the seaweed development centers in Southeast Sulawesi.

FIGURE 1. HORIZONTAL NET FOR SEAWEED CULTIVATION

III. METHODS FOR IMPLEMENTING COMMUNITY SERVICE ACTIVITIES

The location of regional community service activities is carried out in Wandaka Village, Kulisusu District, North Buton Regency, Southeast Sulawesi Province. This location is one ofthe centers for seaweed development in Southeast Sulawesi. The location for seaweed cultivation is on a protected bay beach and the bottom topography is sloping and quite wide.

Community service activities are carried out in the following stages:

1. Preparation for activities in the form of team coordination and coordination with local government and community groups. Coordination to determine the location point for installing the Horizontal Net which will be managed by the Seaweed Cultivator Group in Wandaka Village.
2. Procurement of Horizontal Net tools and materials. Procurement of tools and materials will take into account the ease of sending the tools to the Regional-based community service location. The tools and materials provided are in the form of paralon pipes and nets as well as ropes and all supporting equipment for making a Horizontal Net.
3. Pre-assembly for samples and training pilots to be carried out at the location of this activity. Pre-assembly is the assembly of tools on certain parts to make it easier for training participants to understand the design and shape of the horizontal net as well as tomake it easier to assemble and make training efficient in the field. Pre-assembly iscarried out by teams and students who are members of this community service activity. Itis hoped that later students will be able to provide a better understanding to the group of lat grass cultivators as well as provide field assistance in the process of assembling and maintaining equipment in the field.
4. Training, mentoring and field technical guidance regarding the manufacture of tools on site. The theme of the training given is how to assemble and maintain Horizontal Net. The training model is carried out by direct practice of Horizontal Net by participants consisting of female seaweed cultivators. The training participants are seaweed cultivators, especially women, consisting of a maximum of 20 participants per group so that the total number of participants is 40 people. The training time is carried out in one full day followed by field assistance which is carried out during the activity. Implementing the activities are the team leader and team members, North Buton Regency BAPPEDA Partners as well as field staff consisting of final project students who are included in the field assistant team.
5. Assembling the tools to be carried out by cultivators accompanied by the implementing team. The assembly was carried out by community members, especially women, and several male participants who had received training in making and assembling tools. However, assistance will still be provided because the process of installing the equipment requires serious care so that the equipment can last a long time in the process of use. This activity will be carried out by cultivators as participants who are directed by Team Members and Final Project Students as field workers.

6. Preparation for lowering the equipment to the placement location in the waters. The reduction process will be carried out by the seaweed cultivators themselves in order to facilitate understanding and knowledge regarding the operation of the equipment. The seaweed cultivator group is dominated by women and several men will be accompanied by team members and final project students as field workers.
7. Controlling the function of the tool at the location of the activity. The control process will be carried out by cultivator group members and assisted by team members. Each tool definitely has problems when used in the field. To minimize errors that may occur and damage that may occur, community members will continue to control the function of the tool, which is carried out in turn by group members. To ensure the implementation of control, the team's field staff will work together with members of the seaweed cultivator group to carry out the control function. This activity will be fully carried out by members of the cultivator group and field workers.

FIGURE 2. TEAM AND PARTICIPANTS IN COMMUNITY SERVICES ACTIVITIES

8. Setting up a neat layout of tools as a place for developing a nursery. This arrangement is carried out in a cultivation area which is located not far from the location of the community village. The shape of the layout is adapted to the topography of the coast and provides opportunities for farmers to be able to observe the seaweed cultivation process.
9. Monitoring and evaluating the implementation of activities. Monitoring and evaluation is carried out by the LPPM-UHO Team and accompanied by the head of the implementing team.

IV. ACHIEVED RESULTS AND OUTCOMES

A. Procurement of Tools and Materials

Horizontal net materials and tools are procured by purchasing pipe and net equipment and other equipment. The pipe purchased complies with the horizontal net specifications. Another method is a net with a diameter of 1 cm. Purchase of equipment is carried out completely and continues with assembly of the equipment. The assembly of the tool is carried out by cutting the pipe and assembling the pipe, then installing the net so that it forms a long rectangular box covered by the net.

B. Initial Assembly

Initial assembly is intended as part of the process of procuring tools that willfacilitate the training process at the community level. The initial assembly process will be carried out by the team and assisted by students so that examples of tools can be made and become examples for training participants. The process of procuring tools will be carried out by students so that it will facilitate the field assistance process by students later. Students will be able to directly provide direction for the training process and field assistance later.

C. Pre-Training and ToT for selected female farmers.

Pre-training was carried out to provide initial understanding and at the same time guidance to several women and women's group members. This activity is intended to provide knowledge to several female cultivators, including the group leader and several group members. With the knowledge and skills possessed by the group leader and several group members, it is hoped that they will be able to provide training and assistance to other group members in the tool assembly process. This pre-training process was carried out in Wandaka village, Kulisusu District, North Butn Regency, which was attended by 6 leaders and selectedgroup members. The pre-training process is carried out by explaining the function of the tool, design and benefits of using a horizontal net to the cultivator. Knowledge about how easy it isto assemble and maintain so that female farmers will play more of a role in the seaweed cultivation process.

D. Net Horizontal Assembly Training

Training activities are carried out in the following sequence of activities; (1) Training preparation. Training preparation activities are carried out at the activity location by completing all the equipment and materials used in the training process. (2) The training process will be provided with provisions that are relevant to Horizontal net design. (3) Training activities by providing material and continued with demonstrations and practice of horizontal net design. The demo and training process was made in a structured way with a round sitting model and the demonstration was carried out in the middle of the group. Next, practice is carried out by group members. Practice is carried out by each group to facilitate assembly and to further understand each group regarding the design and function of each existing design.

FIGURE 3. TRAINING PROCESS TO INCREASING KNOWLEDGE OF FEMALE FARMERS

Each group will assemble the horizontal net tool together so that it seems that all group members will work optimally and understanding the design and function of the tool can be understood more easily, more completely and more quickly. Each group of 4 people will be responsible for making 4 Horinet designs and at the same time assembling the main buoys which will be used to tie up each Horinet in the field later.

E. Finalization of assembly and demolition of tools in the field.

The field assembly finalization activity was carried out in the seaweed cultivation area of one of the female cultivators in the middle of the sea, in the middle of the seaweedcultivation site which was attended by all the training participants. This activity is carried out directly by women with the material they have obtained during the training activities. Field assembly finalization activities are carried out to improve skills in assembling tools in the field.The unloading of tools in the field is carried out by female cultivators to provide an understanding that these tools are very easy for women to operate. After finalizing the assembly, it is completed with the equipment being dropped off in the field. The tool lowering process is a demonstration of tool use in the field carried out by group members. Each group is responsible for each unit of equipment provided and each unit of equipment is filled with seaweed seeds which will be maintained using horizontal nets. Before dropping the seeds, check the quality of the seeds that will be dropped. This is to provide reinforcement regarding the quality of the seeds and will later influence the growth of the tools used.

V. CONCLUSION

In the process of this service activity, it was found that the group's enthusiasm for getting out of problems in seaweed cultivation was very well established. Women cultivators will increase their role in cultivation while increasing seaweed production because the main problems in the form of fish pest attacks and a reduction in the amount of harvest due to broken seaweed and being washed down by the currents will no longer occur.

Collaboration with North Bappeda of Buton Regency and women's cultivator groups is going well and will continue to be improved through other women's capacity building programs.

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