

Sustainable Household Economics: A Case of Altering Income of Small- Scale Fishermen in Indonesia

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Abstract. Poor society is still common in almost every developing country, particularly in coastal area. Differences in socio-economic conditions in each country have an impact on people's behavior in dealing with the development of the livelihoods. It is noteworthy that some alternative livelihoods are important ways to raise local economy which caused by decreased production of capture fisheries. The aim of this paper is to compare the economics outputs of two livelihoods activities, namely seaweed farming and capture fisheries. The objective of this study is to compare the economic returns of two different livelihood activities as well as compare the financial returns and costs of each activity. This study was conducted in the South Sulawesi province of Indonesia by administering semi-structured and structured questionnaires to 200 fishermen. Descriptive analysis used to interpret the data. The findings shows, fishermen were interested in seaweed farming as an individual basis to keep their income and livelihoods activity. The number of farmers and farms of seaweed have increased sharply. Finally, fishermen do seaweed farming *Eucheuma cottonii* within floating long line method, together with fishing activity that adopting fishing net around seaweed farm.

Keywords: Seaweed farming, fishing activity and livelihoods development

1. Introduction

Poverty is a wide spread phenomenon in almost all developing countries, thereby making people become incompetent in accessing natural and economic resources. Nevertheless, the coastal environment degradation and resources depletion (mangrove and coral reefs damage), land based marine pollution and over fishing, conflict of utilization of marine space, lack capacity of local government, and lack public participation had influenced to the fisher's livelihoods activities (Laely Nurhidayah, 2010).

One way to reduce poverty and improving livelihoods was the Government of Indonesia (GoI) introduced many types¹ of development projects, which focused on sustainable use of coastal resources and enhancement of fisheries livelihood during the last two decades (Idris, 2004). These projects were usually consisted both environmental and socio-economic aspects (Dahuri et al., 1999; Dudley and Gofar, 2005; Hanson et al., 2003; Idris, 2004; and White et al., 2005). Over fishing were affect to decreased amount of fish catch. Thus, fishermen cannot expect too much to fishing activity and they planting the seaweed as alternative income sources.

Several coastal projects such as Coastal Resource Management Project (CRMP), Coral Reef Rehabilitation and Management Project (COREMAP) and Marine and Coastal Resource Management Project (MCRMP) were implemented in recent 10 years, which aimed to improved economics of poor fishermen. The type of coastal projects was implemented in Indonesia consisted of Marine Resources Evaluation and Planning (MREP), Segara Anakan Conservation and Development Project (SACDP), Those projects was support by international donors agencies.

This paper proposes to compare the economics outputs of two livelihoods activities, namely seaweed farming and capture fisheries. The objectives of this analysis are to compare the economic returns of two

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different livelihood activities as well as compare the financial returns and costs of each activity. In addition, these analyze will used to describe how fishermen's behavior change in recent decade.

2. Methodology

2.1. Study area

This study was conducted in South Sulawesi Province in the eastern part of Indonesia. Two districts, Takalar and Jeneponto, were intentionally selected for sampling. This study covers four villages, one village in Takalar District and three villages in Jeneponto District. These villages are representative of coastal communities on the Laikang Bay with active fishermen. Laikang Bay connects these two districts, which therefore influence one another (Figure 1).



Figure 1. Map of Laikang Bay South Sulawesi Province

South Sulawesi Province, Indonesia is located in the southernmost part of Sulawesi Island (formerly *Celebes*). South Sulawesi is located between S 0°12' – 8' and from E 116°48' up to E 122°36', while Makassar City as the capital city of South Sulawesi Province is located between from S 5° 30' 18" up to S 5° 14' 49" and from E 119° 18' 97" up to E 119° 32' 3". The average temperature in Makassar is between 22°C and 33°C (Provinsi Sulawesi Selatan, 2010).

Takalar District is located at the south side of South Sulawesi Province. This district has a land area of 566.51 km² and is located between S 5°3' and S 5°38' and from E 119°22' up to E 119°39'. It is bounded by Gowa District on the north, Gowa District and Jeneponto District on the east, Flores Sea on the south and Makassar Strait on the west (Dinas Kelautan dan Perikanan Takalar (Takalar Marine and Fisheries Service Office-TMFSO) and Narayana Adicipta Persero, 2007). Interviews and data collection were conducted in Laikang Village, in Managarabombang Sub-district.

Jeneponto District is located in the western part of South Sulawesi Province, and it is also a coastal area that stretches for about 95 km in the southern part, covering an area of 74,979 hectares or 749.79 km². South Sulawesi is located between S 5°16'13" and S 5°39'35" and between E 120°40'19" and E 120°7'51". It is bounded by Gowa District on the north, the Flores Sea on the south, Takalar District on the west and Bantaeng on the east. Jeneponto District consists of 9 districts and 105 villages, and the population in Jeneponto District in 2004 was 324,927, consisting of 158,043 men and 166,884 women. There were 18,943 fishermen, fish farmers and seaweed farmers.

2.2. Data collection and analysis

Data collection was conducted in August and September 2010 from a total sample of 200 farmers who cultivated seaweed. Samples were obtained from four villages with 100 samples from Laikang Village, 40 samples from Garassikang Village, as many as 40 respondents from LP Bahari Village and 20 from Ujunga. The samples were selected randomly. Interviews were conducted by using structured and semi-structured questionnaires, and in-depth, face-to-face interviews were carried out to obtain more detailed information from seaweed farmers and middlemen. Group discussions were also conducted to explore the perceptions of fishermen of the development of seaweed farming, particularly in Laikang Bay.

The data collected was analyzed using simple statistical methods of descriptive statistics to derive percentage, arithmetic mean, number and standard deviation. In addition, comparison between costs and incomes of several fisheries livelihoods activities were used to explain why fishermen conducted those livelihoods.

3. Result and Discussion

3.1. Coastal fishery activities in Laikang Bay

Laikang Village is one of the 12 villages of Mangarabombang Sub-District in Takalar District. It has an area of 19.6 km², equaling about 19.57% of Mangarabombang Sub-District (± 100.14 km²). The village population is approximately 4,139, or 12% of the total population in Mangarabombang Sub-District (35,526 people), and the population density in Laikang Village is about 211 people/km². Administratively, Laikang Village consists of six sub-villages: Laikang, Puntondo, Boddia, Turikale, Pandala, and Ongkoa. Most people in Laikang Village work in fisheries, and some of them work in the agricultural sector. Laikang Village has a concentration of natural resources in fisheries and agriculture, and the tourism sector provides additional support for economic development in the village.

In Laikang Bay, fishermen rely on a variety of livelihood activities, including capture fisheries, seaweed farming, seaweed cultivation combined with fishing, seaweed farming in combination with public services and a combination of seaweed farming with a non-fishing activity. Le Tixerant et al. (2010) stated that human activity in maritime areas depends on the socioeconomic context in which the activity evolved. Some seaweed farmers (46%) conducted seaweed farming as a single activity. Meanwhile, other farmers (37%) combined seaweed farming and fishing, which is possible because the farming (*Eucheuma cottonii*) method does not require much time after planting. The farmers checked the farm 3-4 times a week after fishing was finished. This condition is in accordance with Carneiro (2010), which stated that livelihood interventions are a supplementary form of income that enhances a household's economic resilience.

All seaweed farmers are involved in this study were male (100%) with an average age of 37.04 years. Their level of formal education was low, averaging 2.42 years. In this study, 22.5% of seaweed farmers had never received a formal education. The seaweed farmers in Laikang Bay are of the Makassar ethnic group. Pollack et al. (2008) emphasized that they have divergent opinions, resources and knowledge dependent on the conditions in this area and the groups that exist there.

In case of monthly income, some fishermen (57.5%) earned an income below 500,000 Indonesian rupiah (IDR) per month, whereas others (41.5%) had incomes between 501,000 and 1000,000 IDR per month. These figures represent the total income derived from all livelihood activities of these fishermen. The fishermen using the income to support the family needs. In this study, fishermen has the number of children 1.86 people on average per household. Seaweed farmers in Laikang Bay in both the Takalar and Jeneponto Districts have 1.32 seaweed plots on average, where the size of one plot is equal to 100 meters x 30 meters. Most of the farmers (68.5%) have less than two plots.

3.2. The outputs of fisheries livelihoods

Currently, fishermen cannot depend on the fishing activity alone. They need additional income to fulfill the household needs. Such as the case in this study, referring to the study of the other researchers, seaweed potential in Laikang Bay can be an alternative way to do double strategy². Family members also involved on fishery activities such as preparing seaweed seed or making salted fish. In this study, seaweed culture is still interesting for people to increase their income. Thus, seaweed culture has become main income source besides products from capture fisheries. The result of analysis between several fisheries activities shows that seaweed culture is realistic choice for fishermen to preserve their livelihoods (Table 1).

Table 1. Comparison of main fisheries livelihoods activities in Laikang Bay

Activity	Costs (IDR)	Income (IDR)
Culture fisheries		
- Seaweed farming (<i>Eucheuma cottonii</i>)	13,560,000	4,440,000/month
Capture fisheries based on fishing gear		
- Gillnet	1,000,000	4,00,000/month
- Sero	13,000,000	1,500,000/moth
- Fish trap	625,000	400,000/month
- Cast net	200,000	150,000/month

IDR = Indonesian Rupiah (1 USD = 8,745 IDR) (site from <http://www.bi.go.id> accessed March 8, 2011)

Source: Primary data processed, 2011

Table 1 shows the income and cost of seaweed culture is higher than another four activities in capture fisheries. This cost mainly for initial investment of seaweed culture. In other word, fishermen need many costs for built the farm when they began this activity at first time. One day fishing mostly adopted by fishermen there prior to the expansion of seaweed farming.

At present, fishermen at Laikang Bay do both livelihood activities. Local people become interested in seaweed farming as an individual basis. Thus, the number of farmers and farms of seaweed have increased sharply. The fishing activity also is done by using simple fishing gears, such as mini gillnet and fish/crab trap. Fishers went to the beach around seaweed farm to set up the fishing nets at evening and they took-up these fishing nets in the morning. There are leisure times between set-up and take-up time of fishing nets. Fishermen use this leisure time to do activities related to seaweed farming.

3.3. Future opportunities to develop selected livelihood activity (seaweed farming)

Recently, the most critical problems affecting seaweed development are associated with marketing and breeding. Seaweed farmers have not received many economic benefits from the current marketing of dried seaweed. These marketing problems, allegedly, are associated with institutional problems, network marketing, and a communications gap between producers and consumers when the seaweed is not produced in accordance with standards established by the processing industry and exporters. These problems allow the industry to buy seaweed at low prices. Middlemen can act as an alternative, advantageous way to reduce market frictions (Masters, 2007). The accessibility and risks of the product market depend on market structure, size, expected demand levels and the nature of competition (Roberts and Stekoll, 1993). These problems generally indicate that cooperation among seaweed stakeholders is not strong or well developed. Smith and Renard (2002) suggest that, in order to expand fishers' income-generating activities, they should apply a strategy based on integrated technology, ecology, sociology and economics.

Despite these constraints, fishermen have the capacity to improve their livelihood activities. This study shows that the factors that can strengthen and further develop those activities include decreasing the amount of fish harvested, promoting and benefiting from seaweed cultivation as an alternative source of livelihood, tapping support from local governments and taking advantage of opportunities in the market. These factors are of basic interest to fishermen who engage in seaweed farming as an alternative means of livelihood.

In the future, at least some these factors will represent viable opportunities. First, the demand for raw material has increased year by year, in both domestic and foreign markets. Second, the policies of the national government support the development of seaweed farming. Third, the Government of Indonesia (GoI) encourages private companies and national business agencies to develop seaweed processing. However, climate change, profit-taking, the erosion of the environmental and the lack of standard prices for dried seaweed pose threats to fishermen in their quest to take advantage of these opportunities. According to SWOT analysis, there are several strategies to develop livelihood as well as seaweed farming (*Eucheuma cottonii*) in Laikang Bay (Table 2).

Table 2: SWOT strategy for sustainable seaweed farming in Laikang Bay

The strategies	Explanation
S – O	<ul style="list-style-type: none"> Expand the potential farm area in an optimal and environmentally friendly manner to meet the market demand for seaweed.
S – T	<ul style="list-style-type: none"> Develop alternative models of farming methods to minimize risks Prohibit activities that could reduce the quality of seaweed
W – O	<ul style="list-style-type: none"> Encourage seaweed farmers to improve their knowledge of business management, including aspects of finance, farming methods and post-harvesting processes. Improve knowledge of quality standards as well as of market demand.
W – T	<ul style="list-style-type: none"> Build public understanding and awareness of environmental protection Build a farm utilization model.

S = Strength, W = Weaknesses, O = Opportunities, and T = Threats

Source: primary data processed, 2011

At present, S – O strategy is a reasonable choice to develop seaweed farming in Laikang Bay. However, the Indonesian government should encourage all stakeholders, particularly local governments, to assume greater roles in this realm. The private sector wishes to play a role in diversifying the production of seaweed. Informal leaders can use their power to encourage local people to engage in the management of local resources.

4. Conclusion

Seaweed farming plays an important role in the socioeconomic condition of fishing communities. Such farming increases income and stimulates family and community participation. The dependence of fishing communities on seaweed farming as a primary source of household support has spurred the quick development of seaweed farming. This has led to increasingly vigorous farming activity in the coastal areas.

Fishing has been replaced by seaweed farming as the main source of income, a trend that can be seen in the increasing number of seaweed farms along the coastline of Laikang Bay. In this study, fishermen were selected for seaweed farming because of this activity's low operational costs. They could easily maintain it and the profit is higher than fishing activity. Fishermen have been implemented with seaweed farming *Eucheuma cottonii* within a floating long line method, together with fishing activity that adopts fishing nets around seaweed farms.

Finally, this study concludes that fishermen prefer to do seaweed farming to keep their income and livelihoods activity. Fishermen could expand the potential farm area within an optimal and environmentally friendly as further efforts to meet the market demand for seaweed.

Endnotes

¹ The type of coastal projects implemented in Indonesia consisted of Marine Resources Evaluation and Planning (MREP), Segara Anakan Conservation and Development Project (SACDP), Coastal Resource Management Project (CRMP), Coral Reef Rehabilitation and Management Project (COREMAP) and Marine and Coastal Resource Management Project (MCRMP).

² In this context, double strategy are; 1) Fishermen can do 2 jobs at the same time, they are fishing and seaweed culturing; 2) Fishermen's wife processes the seaweed into a product which can give added value, and they can also help pre-plantation process before seaweed is cultured on the sea.

5. References

- [1] Carneiro, G. Marine management for human development: A review of two decades of scholarly evidence. *Marine Policy*. 2010, 35 (3): 351-363.
- [2] Dahuri, R., M.J. Sitepu and I.M. Dutton (1999). Building Integrated Coastal Management Capacity in Indonesia: the Contribution of MREP. *Proceedings of International Conference of Oceanology (OI 99)*. Singapore. 1999, pp. 223-237.
- [3] Dudley, G.R and A. Gofar. Marine and Coastal Resource Management. Report to the Asian Development Bank, ADB TA 4551-INO. 2005. p.74.
- [4] <http://earth01.net/RGDudley/PDF/MASECSTU.pdf>
- [5] Hanson, A.J., I. Augustine, A.A Courtney, A. Fauzi, S. Gammage and Koesoebiono. Coastal Project: An Assessment of the Coastal Resource Management Project (CRMP) in Indonesia. The Government of Indonesia and USAID. The Coastal Research Center, University of Rhode Island. 2003. p.158.
- [6] Idris., I. *Review Pelaksanaan Pengelolaan Wilayah Pesisir Terpadu di Indonesia dan Aspek Pentingnya Untuk Kawasan Asia*. Review of Implementation Integrated Coastal Zone Management and an Important Aspects for Asian Region. Ministry for Marine Affairs and Fisheries Republic of Indonesia. 2004. Unpublished.
- [7] Laely Nurhidayah. Toward Integrated Coastal Zone Management in Indonesia: Framework Assessment and comparative analysis. *Working paper 28*. United Nations-Japan Foundation. 2010.
- [8] Le Tixerant M., Gourmelon F., Tissot C. & Brosset D. Modelling of human activity development in coastal sea areas. *Journal of Coastal Conservation*. Springer, 2010.
- [9] Masters, A., Middlemen in Search Equilibrium. *International Economic Review*, (48), 1. pp. 343 – 362, 2007.
- [10] Pollack, G., Berghofer, A. and Berghofer, U. Fishing for social realities: challenges to sustainable fisheries management in the Cape Horn biosphere reserve. *Marine Policy*. 2008, 32 (2): 233–242.
- [11] Roberts Jr, W. A. & Stekoll, M S. Commercial Potential of Seaweed from St Lawrence Island, Alaska: evaluation of market opportunity. *Journal of Applied Phycology*. 1993, (5): 167–173.
- [12] Smith, A.H. & Renard, Y., Seaweed Cultivation as a Livelihood in Caribbean Coastal Communities. 2010. Online: <http://www.canari.org/seaweedcultivation.pdf>.
- [13] White, A.T., P Christie, H D'Agnes, K Lowry and N Milne. Designing ICM project for sustainability: Lessons from the Philippines and Indonesia. *Ocean and Coastal Management*. 2005, 48 (3-6): 271-296.