Doctoral Thesis

Livelihood Development and Resource Management towards Social Resilience in Coastal Areas of Indonesia

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Graduate School of Biosphere Science

Hiroshima University

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ABSTRACT

Livelihood development strategies in fishing communities of Indonesia are implemented to encourage and improve participation of fishing communities to diversify livelihoods. This study aims "to assess the development livelihood strategies and resource management in fishing communities towards resilience in Indonesian coastal areas." Livelihood strategy here focuses on diversification of livelihood through developing seaweed farming in fishing community and other livelihoods outside fisheries. Resource management would concern the management of marine resources through the zoning system in coastal areas harnessing the productivity of each area including mangrove, pond culture, coral reef, seaweed, fishing, and marine protected area (MPA). Evaluation of fisheries management policies is also included in the analysis and discussion of this study.

This study has five specific objectives: 1) to explore the impact of depleted capture fisheries on livelihood activities of fishing communities, 2) to evaluate the livelihood strategies to adapt the decline of fisheries resource impacts, 3) to assess the constraints and opportunities of seaweed farming development in sustaining fisheries resource and fisheries livelihoods, 4) to evaluate the impact of marketing system of fisheries resources on livelihood activity in coastal areas, and 5) to provide recommendations for enhancing resilience in fishing communities. The first objective would be discussed in detail in Chapter 4, and describe in other chapters. The second objective would be explained mainly in Chapter 5, and refer to Chapter 4. The third objective would be discussed in Chapter 6, and the fourth objective to be answered in Chapter 7. The conclusions and recommendations would be described in Chapter 8.

A series of studies were conducted in the eastern part of Indonesia, namely: 1) Laikang Village in Takalar District; 2) Village of Garassikang, LP. Bahari and Ujunga in Jeneponto District, South Sulawesi Province; 3) Pengambengan Village in Jembrana District, Bali Province. Data collection was conducted during three periods: August to September 2010, February to March 2011, and November 2011. Interviews were conducted by using structured and semi-structured questionnaires, by using qualitative and quantitative questions. In South Sulawesi, respondents were covered fishermen/seaweed farmers, fishermen's wives, seaweed traders/collectors, seaweed exporters, seaweed processing companies, and local fisheries officers. In Bali, the target of respondents were fishermen, fish collectors, owners of purse seine boats, fish traders, and fish processing companies. Some key informants from marine and fisheries offices of Bali Province and Jembrana District, The villages and local NGOs were also interviewed. The analysis tools adopted consist of: 1) descriptive analysis, 2) a likert type scale analysis, 3) benefit-cost analysis, 4)

SWOT analysis, 5) comparative analysis, and 6) qualitative contents analysis.

The fishermen in Jembrana have experienced first-hand the various impacts of overfishing of Bali Strait in their daily, monthly or annual activities during the "fish crisis" such as on 2010 to 2011. This condition has affected to not only fishermen but also processing companies and fish traders. Both boat owners and crew members did not have any option to perform alternative activities outside of the fisheries to meet their daily requirements because the "crisis" is longer than as the period of off-fishing. To adapt this situation, some crew fishermen often worked as construction workers in other cities in Bali or Java, and some worked as agricultural laborers in other villages. The boat owners and captains/fishing masters sold their assets to survive their life and maintain of other assets during the "fish crisis". In fisheries management, establishing joint governors decree (JGD) that manage the operating permits of purse seine boats, mesh size of purse seine nets, zoning, and fishing grounds were not effective yet to control fishing in the Bali Strait. Hence, management body is urgently needed to tackling management in Bali Strait with including community surveillance as part of whole management system.

In case of South Sulawesi coastal areas, small-scale natural resource management (SNRM) project is one of the successful coastal projects to improve household economy of fishermen by encouraging the prospective fisheries activities, such as seaweed culture and fish peddling. Most of respondent (77% of total respondent) planted the seaweed with long line floating method after participate in SNRM. At present, seaweed farming plays an important role in the socio economic condition of fishing communities as the main income source, besides fishing activity. Income of 87% respondent increased to the range IDR. 0.5 Million – 1 Million, because seaweed farming gave them additional income that led their income increased. However, they could not fulfill the financial requirement in planting season due to the lack of financial management. To adapt with two monsoon seasons, fishermen change farm (plots) location to Jeneponto during May to November, and they moved to Takalar side during December to April. However, some factors such as changes monsoon seasons, marketing channel, quality of seaweed seed, farm ownerships and commercial price need more attention for improving the quality of seaweed and environment. All of these considerations would be as factors to sustaining seaweed farming in South Sulawesi particularly.

Seaweed (*Eucheuma cottonii*) farming has become the main livelihood for fishermen in the studied areas, with providing the major source of income. Capture fisheries have been replaced by the seaweed farming. Yet another obstacles were predatory behavior and imperfections in post-harvest methods. However, farmers have made much effort to overcome these obstacles. Positive factors are related to domestic and export market demand of dried seaweed, and supported national policy could be a great opportunity for

developing seaweed farming, beside high profit resulted from seaweed farming compared with other fishing activities. Thereby encourage participation of family labor and community in pre to post harvest of seaweed farming. Moreover, local stakeholder had set up coastal zones based on local and scientific knowledge to sustaining coastal environment and livelihood activities. They divided Laikang coastal area into 4 main zones; mangrove zone, seaweed farming zone, sea grass and coral reef, and brackish fish pond. Boat track and tourism area were outside of these main zones under consideration of coastal management.

The marketing system of seaweed (*Eucheuma cottonii*) has provided benefits, such as speedily supplying investment and daily operational funds without interest, to seaweed farmers through the efforts of middlemen. However, such an exclusive link between fishermen and middlemen has created a heavy dependency on middlemen and, consequently, brought a monopoly in marketing. The existence of middlemen is crucial in the dried seaweed supply chain, as long as the local/central government could not implement a better and effective market chain for seaweeds at local level. This traditionally disadvantageous relationship between middlemen and seaweed farmers would be maintained in the absence of government intervention and big industry players that could offer more equitable business terms to further encourage seaweed farming. Fishermen sold the dried-raw seaweed to middlemen at village. The middlemen sold dried seaweed to wholesaler at district after the stock was enough for shipping. The wholesaler could sell the dried seaweed for two possibilities to exporters and/or processing company at province. These products are used for domestic supply to foods, cosmetics, and health industries. For this case, market demand of domestic and export is become main factor to determine seaweed production. It would encourage fishermen to improve not only the production volume, but also value-added product and expanding farm area.

It is clear that the results of this study showed “fish crisis” was the cause of “collapse” of livelihood in fishing communities, and affected to all parts of the supply chain including fishermen, traders, processing plant and factory and have ceased their economic activities. Seaweed farming is could be a double strategy of income sources to sustain livelihood activity and household economy in small-scale fisheries, but it could not be generate to all types of fisheries. Recommendations and suggestions generated from this study; first, encouraging self-monitoring of coastal and marine resources uses with collaborated work among all stakeholders to perform one management body. Second, livelihood diversification on fisheries and non-fisheries products and improving alternative fishing technology are better choices against the capture fishery resource depletion. Third, sustaining seaweed farming by expanding the potential farm area in an optimal and environmentally friendly way to meet the market demand for seaweed, improving farmers’

knowledge about production technique, quality control, business management and marketing practices, environmental protection and farming technique. Lastly, improve existing market channels by giving participation opportunities to coastal communities and develop the cold chain system for fish product. On the other hand, shortening the market channels of seaweed by formalizing the “seaweed cooperative” at the local level, besides maintaining existing market channels is advisable. Modification and creating alternative marketing channels is needed to address the stable price at the farm level.

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CHAPTER I

INTRODUCTION

1.1. Background of study

Indonesia has a large maritime zone, about 5.8 Km^2 consisting of archipelagic waters, territorial seas, and Exclusive Economic Zones (EEZ). Its coastline is more than 81,000 km long. Its sustainable fisheries (MSY) of all kinds are about 6.4 million tons a year while its total allowable catch (TAC) is estimated at 80% amounting to about 5.12 million tons annually. In addition, there are also great potentials for aquaculture, inland open water fisheries as well as the development of marine biotechnology (MMAF and JICA, 2010).

Capture fisheries

Indonesia marine capture fisheries production in year 2009 was about 4.81 million tons. In which the bigger production were Eastern little tunas (0.40 million tons), Skipjack tunas (0.34 million tons) and Tunas (0.20 million tons). Indonesian inland open water capture fisheries production in year 2009 was about 0.30 million tonnes of which the bigger production were snakehead murrel (27.9 thousand tons), shrimp (16.7 thousand tons), mozambique tilapia (10.7 thousand tons) and common carp (6.4 thousand tons) (Appendix 9) (MMAF and JICA, 2010).

Aquaculture fisheries

In Indonesia the extent of areas with aquaculture potential is around 11.81 million hectares, consisting of 2.22 million hectares with potential for freshwater culture, 1.22 million hectares with potential for brackish water culture and 8.36 million hectares with marine culture potential. Currently, exploitation of this potential has only reached 18.01 % for freshwater culture, 55.77 % for brackish water culture and only 0.51 % for marine culture. The bigger aquaculture productions in 2009 were seaweed (2.96 million tons), second is shrimp (0.34 million tons), milk fish (0.33 million tons), nile tilapia (0.32 million tons), common carp (0.25 million tons), clarias cat fishes (0.14 million tons), pangasius cat fishes (0.11 million tons), giant gourami (0.05 million tons) and shells (0.02 million tons) (Appendix 9) (MMAF and JICA, 2010).

1.1.1. National development planning in fisheries in Indonesia

The most important challenges of the Asian Developing Outlook 2011 are eliminating poverty and tackling rising consumer price. In terms of rising food price, the poor have been the most vulnerable. However, developing countries in Asia show social resilience in the face of tremendous external shock.

Indonesia has approximately 17,480 islands with coastlines 95,181 km long. The total population is approximately 219 million with a population density of 117.6 persons per square km in 2005. The Gross National Product (GNP) of Indonesia was US$ 707 Billion in 2010, with 1144 US$ per capita. Indonesia was recorded as a lower-middle income country at rank 155 in the world in 2011 (World Bank, 2012 and UNCTAD, 2011).

To improve capacity building and strengthen the economic competitiveness in Indonesia, the central government set up the National Medium Term Development Plan (RPJMN) 2010 – 2014. It pursued 11 priority agenda: 1) reforming of the bureaucracy and governance, 2) education, 3) health, 4) poverty reduction, 5) food security, 6) infrastructure, 7) investment and business climate, 8) energy, 9) environment and disaster, 10) under-developed regions, foremost, outmost and post-conflict, 11) culture, creativity and technological innovation. Marine and Fisheries development focuses on five of these priorities, such as 1) bureaucratic reform and governance, 2) poverty reduction, 3) food security, 4) environment and disaster management, 5) under-developed regions, foremost, outmost and post-conflict.

Bureaucratic reform and governance mean strengthening for better governance, integrity, accountability, respect to legal authority and transparency. **Poverty reduction** covers decreasing the level of poverty, improving the income distribution, community empowerment, economic development for low-income communities. **Food security** means improving agricultural GDP's growth rate (3.7 % per year) and fish farmer exchange rate (FER)[1] (115-120 per year) by 2014. **Environment and disaster management** means conservation of the environment to support economic growth and sustainable prosperity (MMAF and JICA, 2010) (Figure I-1).

[1] FER or *nilai Tukar Nelayan (NTN)* is exchange rate that used to consider all the revenue and all expenses of fishermen family and is measure of ability fishermen family to meet the need of their subsistence.

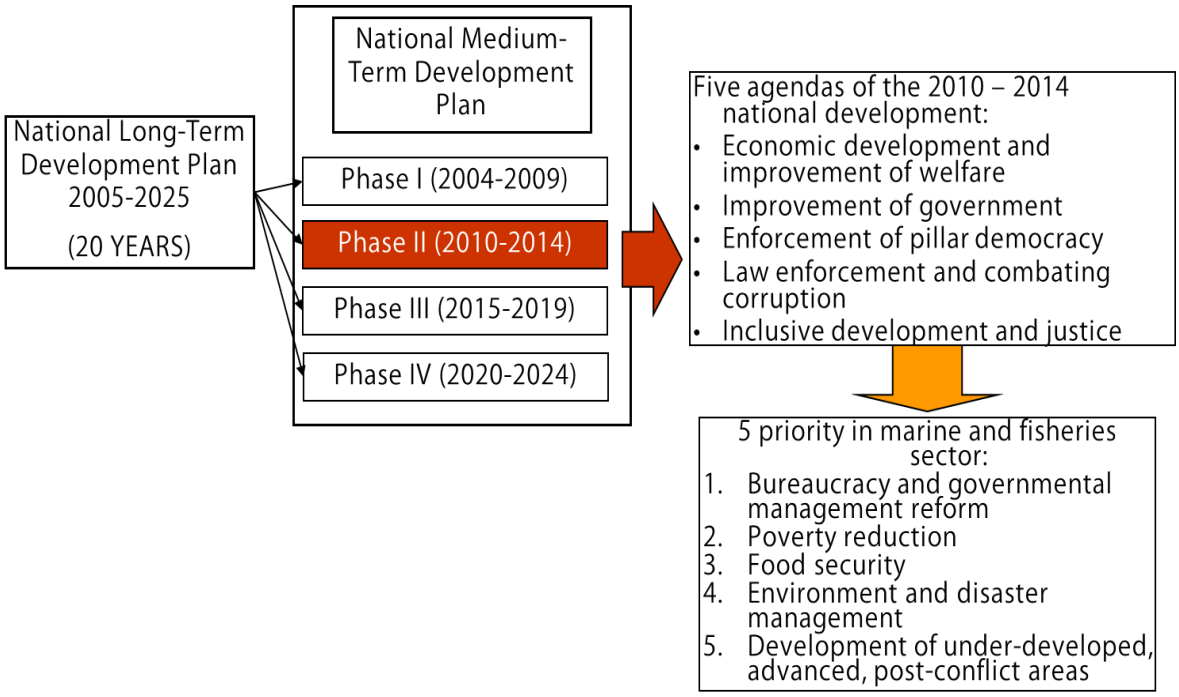


Figure I-1. National strategic plan of Indonesia

The development of marine and fisheries covered the natural resource and environment. It is very important for providers of raw materials to support living systems. The strategies implemented through several directions: 1) *Minapolitan*, 2) entrepreneurships, 3) networking, 4) technology and innovation, 5) empowering, and 6) the institutional strengthening of community groups. The latest program in the fisheries sector that develops fisheries production is the *minapolitan*[2] which is an accelerated effort to develop marine and fisheries production over the last 3 years. This program aims to increase fish production as well as encourage business productivity, develop the economic growth in the region, and increase the income of fishermen, fish farmers and processors in an equitable way. However, this program focused on developing the aquaculture sector, through revitalizing deserted shrimp ponds, improving inland fishpond, and developing seaweed culture/farming, and so on. It does not mean that the government pays little attention to capture fisheries, but it encourages fishermen/private to improve activity at an offshore area by using more high technology of capture fisheries. It is as anticipate steps to reduce fishing activity and overcome over-fishing in shore area.

[2] *Minapolitan* is an accelerate effort to develop marine and fisheries production in Indonesia

1.1.2. Fisheries policies and community based management

In Indonesia, fisheries management has rapidly and widely developed since the Government of Indonesia (GoI) ratified the United Nations Convention on the Law of the Sea (UNCLOS) in 1982, which is stated in the Law No. 7/1985. Following this, the Indonesian parliament approved "Indonesia's Economic Exclusive Zone of the sea (IEEZ) through the Law No. 5/1983 one year after UNCLOS, Law No. 9/1985 about fisheries (2 years after UNCLOS) and Law No. 5/1990 on ecosystems and natural resources conservation, and Law No. 6/1996 is related with Indonesian waters. The recent regulation related to fisheries established in Law No. 31/2004 about fisheries, Law No. 32/2004 about local government decentralization, and Law No. 27/ 2007 about coastal zone and small island management. The Law No. 32/2004 with the provincial marine and fisheries as representative of the national government at the local level and connecting central government and local government. Both national government budget[3] (called: *APBN*) and local government budget[4] (called: *APBD*) have been supporting many fisheries program conducted by the central government as well as local government which was provided in the master plan of national programs (Table I-1).

Table I-1. Evolution of regulations related to marine and fisheries management of Indonesia

No	Regulation	Year	Rules
1	Ordinance (Ducts indies era)	1939	The width of territorial sea area was 3 nautical miles (NM)
2	Djuanda Declaration	December 13, 1957	The width or territorial sea area was 12 NM
3	United Nations Convention on the Law of the Sea I (UNCLOS I)	1958	Established 2 sea areas: territorial sea and high sea
4	Minister of agriculture decree no. 607	1976	Established three fishing lines: I: 3 NM II: 4 Nm from lines 1 III: 5 NM from lines 2
5	United Nations Convention on the Law of the Sea I (UNCLOS I)	1982	Indonesian region is integral part of land, sea and air
6	Law no. 5	1983	Indonesian economic exclusive zone (IEEZ)

[3] The budget of APBN is provide by central government.
[4] The budget of APBD is provide by provincial and district governments.

7	Government regulation No. 15	1984	Natural resource management in Indonesian Economic Exclusive Zone (IEEZ)
8	Law No. 5	1990	Ecosystems and natural resources conservation
9	Law no. 9	1985	Fisheries all Dutch ordinances that conflict with fishery law were declared invalid
10	Indonesian archipelagic sea lanes (*ALKI*)	1995	1: Malaka Strait-Natuna Sea-South China Sea 2: Sunda Strait-Karimata Strait-South China Sea/Singapore Sea 3: Lombok Strait-Makassar Strait-Sulawesi Sea 4: Maluku Sea-Seram Sea-Banda Sea-Ombai Sea-Sawu Sea/Timor Sea/Arafura Sea
11	Law No. 6	1996	Indonesian waters
12	Law No. 31	2004	Fisheries Law no. 9/1985 were declared invalid
13	Law No. 27	2007	Coastal zone and small island management

Source: MMAF, 2010

At the national level, fisheries policy was stated as Government Regulation (*PP*) No. 25/2004 that concerns to the National Development Planning System (NDPS). The Ministry of Marine Affairs and Fisheries (MMAF) then established the Strategic Plan (RENSTRA) of marine and fisheries development 2010-2014, which determines the long-term 2005-2025 (refer to the Law No. 17/2007), medium-term 2009-2014 (refer to President decree No. 5/2005) and short-term of development in marine and fisheries sector.

Since 1999, decentralization has begun in Indonesia with the establishment of the Law 22/1999 that called for local autonomy. Decentralization means that local government is given the authority to manage the local resources and regulate users' behavior on resource utilization. Fisheries agencies, being responsible for development and management of fisheries industry, has a strategic role, particularly because of the reformation of government system (from centralized to decentralized system) and local autonomy era. The roles and responsibility of each agency can be summarized in Table I-2.

Table I-2. Roles and responsibility of institutions for developing marine and fisheries in Indonesia

Agency	Role	Authority	Output
MMAF (Ministry for Marine and Fisheries of Indonesia)	Set up planning and implement the programs of marine and fisheries at national level Set up the marine and fisheries regulation at national level. Prepare per sector budget to national parliament (DPR)	Perform the national program based on official budget location. Implement national policies of marine and fisheries. Allocate fisheries budget to provincial office to implement the national programs.	National marine and fisheries policies. National marine and fisheries programs. National marine and fisheries budgets.
Provincial Marine and Fisheries Office (MFO)	Set up planning and implementation of provincial programs Representative of MMAF at province to implement the programs Propose fisheries budget to provincial parliament (DPRD-province)	Perform national program of marine and fisheries at provincial level Implement the marine and fisheries based on approved budget allocation.	Provincial marine and fisheries programs
District Marine and Fisheries Office	Set up and implement marine and fisheries program at district level. Propose the budget to district parliament (DPRD-district/city)	Perform the marine and fisheries program at district level based on approved budget allocated.	The programs of marine and fisheries.

It is generally acknowledged that an effective socio-economic response to decreased fisheries resource is to provide alternative jobs. At one and the same time, conventional fisheries policy have been revitalized such as Law No. 31/2004 (fisheries) and Law No. 27/ 2007 (coastal zone and small island management). Moreover, ministry regulations have been established to accelerate particular fisheries programs to achieve the target of production and poverty alleviation (Table I-3).

Table I-3. Marine and Fisheries Minister Regulation of MMAF to improve production and poverty alleviation in Indonesia

Regulations	Topics
Regulation 13/MEN/2012	Certification of fish caught
Regulation 12/MEN/2012	Capture fisheries in high seas
Regulation 08/MEN/2012	Fisheries port
Regulation 07/MEN/2012	Guidelines for Implementation of the National Program for Community Empowerment Marine and Fisheries in 2012
Regulation 05/MEN/2012	Fishing Line and Fishing Gears Placement and Tools Fishing in Regional Fisheries Management of the Republic of Indonesia
Regulation 01/MEN/2009	Fisheries management areas of Indonesia
Regulation 08/MEN/2008	Utilization of Gillnet in the Indonesian Economic Exclusive Zone
Regulation 04/MEN/2008	Quality control system and safety of fishery products

Source: www.kkp.go.id

The Asian Development Bank (ADB) also promoted marine culture development and other activities to reduce fishermen's dependence on capture fisheries as a main job. The existing fisheries national policies that are managed through provincial, district and all level of governance were promulgated for the benefits of national fisheries management. The important issue of the centralized policy is that all water areas are classified as *de facto* open access. It caused varied effects on the diversity and large ecosystems of marine and fisheries resources, while the management ability of central government is limited. It impacted on the rise of the management cost. In another way, traditional fisheries management in some parts of Indonesia became important to solve the problems in fisheries resource depletion. Traditional systems such as *Sasi*[5] in Maluku and Irian Jaya, *Awig-awig*[6] in West Nusa Tenggara and Bali present an opportunity for those traditional systems to perform a part of the community based management plans.

Generally, Indonesia has large territorial sea areas, and Indonesia Exclusive Economic Zones (IEEZ). It has among the top three longest coastlines in the world with more than 81,000 km. This potential marine area has brought a huge volume of fisheries production at 6.4 million tons a year (MSY). This does not include the potentials from aquaculture, inland open water fisheries and marine biotechnology. National fisheries production

[5] *Sasi* is a traditional agreement about utilization of coastal resource composed by people and legalized through custom structural mechanism in village level (Nikijuluw, 1994).

[6] *Awig-awig* is a custom regulation at Bali, West Lombok and East Lombok that regulate management of coastal fisheries resources appointed by government in village level, custom institution and elite figure of religion or custom (Kusumastanto et al, 2004).

increased at a 9.92% of annual growth rate, from 6.12 million tons in 2004 to 9.82 million tons in 2009. The production of capture fisheries increased 1.91%, aquaculture increased 26.64%, export also increased 0.91%, and import increased 0.16%. Viewing these trends with rather constant amounts of import and export, it should be interpreted that the domestic consumption of fisheries product has increased year after year. Total national fish supply for consumption in 2009 was around 7.65 million tons, being around 33.51 kg/capita/year (Marine and Fisheries in Figures 2010, MMAF).

Historically, since the 1970s, Indonesia has evolved the efforts of poverty reduction. The complexity of poverty has resulted to poor human resources, lack of social infrastructure and the many problems in resource management (UNEP)[7]. There are five basic-needs for people's survival such as food, health, water and sanitation, education, and shelter. In 1993, the guideline of national policy transformed new approaches that developed human resources simultaneously with the economy. This development was aimed to enhance policy effectiveness at a local level, improve performance of public and private providers and enforce accountability.

The poverty rate of Indonesia decreased from 23.4% (1999) to 12.5% (2011). Since 2009 to 2011, the Indonesia's economy has seen to regain strong power. However, the vulnerability still exists in parts of Indonesia's population. One remarkable indicator showing vulnerability is the monthly expenditure for consumption, being IDR 233,000 per month (US$ 27) in 2011. Most of the populations have been just above the poverty line, whereas 24% live below the official near-poverty line, 38% below the poverty line and almost equally vulnerable (World Bank, 2012).

Poverty reduction is one of the target measurements of the Millennium Development Goals (MDGs) besides other 7 goals for combating hunger, illiteracy, disease, discrimination against women, and environment degradation. Poverty reduction of the marine and fishery sector will contribute to reducing the national absolute poverty from 14.1 % in 2009 to 8 – 10 % in 2014. However, SMERU (2011) argued that if the total population is over 240 million, this means that more than 31 million people are still living under the poverty line. It is supposed that 32 % of the coastal communities are among the poorest.

[7] Sited from http://www.unep.ch/etb/publications/FINALIndonesianReport.pdf

1.1.3. Livelihood development and community empowerment

Livelihood development strategies established by the government in coastal communities are supposed to encourage and improve participation of coastal communities in diversified fisheries livelihood activities. These livelihood development and community empowerment activities are assisting to determine the success or failure of poverty reduction effort in the coastal areas.

Since 2001, a systematic effort to transform and improve coastal community's well-being has been undertaken via a national program called economic empowerment for coastal community *Pemberdayaan Ekonomi Masyarakat Pesisir* (PEMP) or Coastal Community Economic Empowerment Program. The *PEMP* Program had been carried out in three phases of empowerment during 2001-2008. The first phase *PEMP* is called as "Initiation Period", when coastal community groups set up micro finance institutions for economic empowerment (LEPP-M3: *Lembaga Ekonomi Pemberdayaan Pesisir Mikro Mitra Mina*). The LEPP-M3 managed natural resources for coastal community economic empowerment. The second phase is "Institutionalization Period" which was indicated by the formalization of LEPP-M3 into becoming fisheries cooperatives. The third phase is called as "Diversification Period", in which the fisheries cooperatives diversified their business units into micro enterprises (Kusnadi et al., 2006). Since 2009, community empowerment programs in marine and fisheries are integrated into the National Program for Community Empowerment in Marine and Fisheries (*PNPMM-KP*) mechanism. Coastal communities and people are involved in this program to get support for improving their fishing activity and aquaculture, including milkfish, shrimp culture and seaweed farming.

The programs of livelihood development are also attached to other coastal projects that were implemented by the GoI, to name a few, Marine Resources Evaluation and Planning (MREP), Segara Anakan Conservation and Development Project (SACDP), Integrated Coral Reef Management Project (INTECOREEF), Coastal Resource Management Project (CRMP), Coral Reef Rehabilitation and Management Project (COREMAP) and Marine and Coastal Resource Management Project (MCRMP). These projects have been supported by international donor agencies. The MCRMP aimed to sustain livelihood, improve management, conservation of the environment by developing seaweed farming as main livelihood activity in fishery communities. Livelihood development was promoted by the policy for marine and fisheries (pro-poor, pro-job, pro-growth, and pro-sustainability) to achieve resilience.

1.2. Statement of the problems

Based on the issues on livelihood development and coastal resource management, the main problems focused hereafter have been summarized as follows:

Decreasing the poverty level is expected about 4 % to 6 % during 5 years (2009-2014) and improved the income distribution, community empowerment and the expansion economic opportunities[8] of low-income communities will support the GoI to accelerate national economic development in the next 5 years. Many efforts have been done by the GoI to reduce the poverty during last two decades. In term of developing coastal area and community development, the GoI focused on the sustainable use of coastal resources and the enhancement of fisheries livelihood for fishing communities. However, 32 % of 16.4 million people who live in coastal areas are living under the poverty line (Kusnadi et al., 2006) and is considered as very high rate.

Fish resources in Indonesian waters tend to degrade in the last decade, particularly those located in inland waters and coastal waters (MMAF, 2010). The causes are associated with destructive fishing activities, illegal fishing activities and human activities, which accelerated the degradation of the coastal environment and fish resources. Moreover, the small-scale fishing fleets are dominant, increased production costs/operational costs of fishing activity have caused low-productivity of the fishermen. Declining volume of fisheries production of about 20 % during 2009 – 2010 has been threatening the livelihood activities of coastal communities. These consequently caused the fishermen to have difficulties in exiting the poverty trap.

The coastal communities and fishermen are affected by the climate change. The effects include changes in tides, accelerating abrasion, unpredictable monsoon seasons, and declining fish yields (Kompas, 2009). At present, the fishermen could not predict the weather. In olden times, their ancestors could do so by examining the sky and stars[9]. Impact of climate change resulted in unpredictable monsoon seasons which have influenced the productivity of fisheries. Recently, the period of two monsoon seasons in Indonesia could not fix the time exactly.

[8] The expansion economic opportunities mean to provide any activities inside and outside fishery that could gain for the income for fishermen.

[9] They read the position of the southern constellation (shaped like a sting-ray) so they could tell the start of the west and east monsoon seasons. At present, the fishermen still continue this way to predict the weather, but the climates have already changed. They have difficulties to determine monsoon seasons.

Overall, the number of marine fishing boats activity decreased to 3.31% during 2009 to 2010. In this period, the number of non-powered boat decreased to 10.78%, the number of outboard motor decreased to 2.24%, but the number of inboard motor increased to 4.17% and fish net increased to 75.79%. Rapid growth of using highly productive fishing technology caused destructive resource use with rate about 37%-70% in 2009-2010 (MMAF, 2010).

In Indonesia, fluctuation and instability of oil price exerted big pressure to almost all sectors of development, particularly the fisheries sector. It became the trigger to increasing the production and operation costs of fishing activity. Under these conditions, the small-scale fishermen with low-income were faced big obstacles to improve or at least maintain their productivity. On the other hand, an increase in operational costs was not followed by an increase of production volume. At the same time, the GoI has limited financial subsidies to support the operational costs of fishermen, such that a sharp rise of fuel price has caused a decrease in fish production and fishermen's income.

Poverty prevents people from accessing the resources. It also causes low quality of human resources, low income and productivity. The problem that fishers face in some parts of Indonesia is unstable social-economic conditions such as poverty, social discrepancy, lack of access capital, technology and market (Kusnadi, 2004). Social discrepancy still exists between fishermen, owner and trader despite various coastal development projects for improving livelihood. This is related with income, access to information, access to financial capital, and assets ownership.

The major impact of these practices in coastal and marine areas of Indonesia is related with long-term off-fishing (*paceklik*), then called "fish crisis". Fishermen keep depending on fishing activity even during the off-fishing season. The alternative livelihoods in both fishery and non-fishery in villages have not yet been developed, even in recent years. This condition of difficulties experienced by fishermen to adopt livelihood activities outside of fishery was also seen by other researchers (Kusnadi 2001, 2004, 2006; Satria 2009; Suyanto 2004).

1.3. Research questions

Most of the problems above are classical but they still remain, particularly in the fishing communities. Alternative livelihoods development in fishing communities may have starting point under the whole economic development in the region, which is needed to pay serious attention as a main point. At the same time, improving coastal environment should be carried out continuously and comprehensively. There have been drastic changes in the last decade. In this situation, fishing communities are also required to improve their motivation and effort to adapt to any changeable environment that may negatively impact on society and the economy, especially for small-scale fishermen who will get the direct impact the most. Therefore, this study focused on some questions below addressed to some of the problems faced by fishing communities regarding the current condition of fishery resources, development of alternative livelihoods in order to establish better coastal communities.

[1] How is overpressure of capture fisheries affecting the socioeconomic environment of fishing communities?

[2] How do fishermen adapt to the impact of declining capture fisheries resources?

[3] What are the impacts of seaweed farming development on the resource management system and livelihood in fishing communities?

[4] What are the impacts of the marketing system of fishery resources on sustainable livelihood of fishing communities?

[5] How do resource management and livelihood development contribute to social resilience of fishing communities in Indonesian coastal areas?

1.4. Purpose

To answer the study questions, this study was arranged to address the five specific objectives. One specific objective will be discussed and explained in each chapter that constitutes this dissertation.

Overall, this study aimed “to assess the development livelihood strategies and resource management in fishing communities towards social resilience in Indonesian coastal areas”. Livelihood strategies here focused on the diversification of livelihood activity of fishermen through developing seaweed farming in fishing community as well as livelihood activities outside fisheries which is part of alternative livelihood strategies in fishing communities. Resource management would concern on the management of coastal uses through zoning

system in coastal areas based on the productivity of each area including mangrove, pond culture, coral reef, seaweed, fishing, and Marine Protected Area (MPA). Evaluation of fisheries management policies is also included in the analysis and discussion of this study.

1.5. Specific objectives

This study has five specific objectives. The fifth objective will be answer to the questions that are described in each chapter. The answers are found in Chapter 4, Chapter 5, Chapter 6, Chapter 7 and Chapter 8 as the last chapter comprising conclusions and suggestions. Chapter 4 will answer the first question related to the impact of overpressure on capture fisheries to livelihood activities of fishing communities. Chapter 5 is to find out the livelihood strategies of fishermen against the declining fisheries resources. This chapter showed two different cases of fishing communities in South Sulawesi and Bali. Chapter 6 will show the finding related to the constraints and opportunities of seaweed farming on sustaining livelihood activities and fisheries resource uses. Chapter 7 will answer the fourth question. This chapter will show the impact of marketing system of different fisheries products namely fish and seaweed, where both fisheries products have different characteristics in marketing. Chapter 8 will answer all questions by providing the conclusions and recommendation to give problem solving for five selected problems in this study.

The specific objectives of this study therefore were:

[1] To explore the impact of overpressure of capture fisheries on socio economics environment of coastal communities.

[2] To evaluate the livelihoods adaptation pattern to the declining fisheries resource in fishing communities.

[3] To assess the constraints and opportunities of seaweed farming development in sustaining fisheries resource and livelihood activity.

[4] To evaluate the impact of marketing system of fisheries resources on livelihood activity in coastal areas

[5] To provide recommendation for enhancing social resilience in fishing communities of coastal areas

1.6. Conceptual framework of study

The development of fishing technology over the last two decades has presented a negative impact to the coastal resources such as overpressure of the fish resources. In addition, destructive fishing practices such as using the bombs for catching fish has seriously damaged the environment and deplete the resource. Climate change phenomenon in recent years has led to extreme changes in environmental conditions and biological circulation of fish, resulting in the migration of fish to other fishing grounds and often causing stunted fish growth.

These environmental degradation and overfishing have negative impacts on people's livelihoods in coastal community, not only fishermen but also to those who engage in all fisheries related businesses, such as trading and processing. These businesses would be expected to give long-term impact and cause changes in the complex socio-economic structure of coastal communities. This condition can exacerbate the poverty which has led to the low resilience in coastal communities.

To overcome these problems, both national and local governments have made much effort to implement a number of government-sponsored projects, policy packages in long, medium and short term, and encourage the development of community based management that has already existed in society in improving livelihoods and coastal communities. This study will assess and analyze the impact of the livelihood development, resource management and formulation of strategies to improve the resilience of coastal communities against the problems that arise in the coastal areas (Figure I-2).

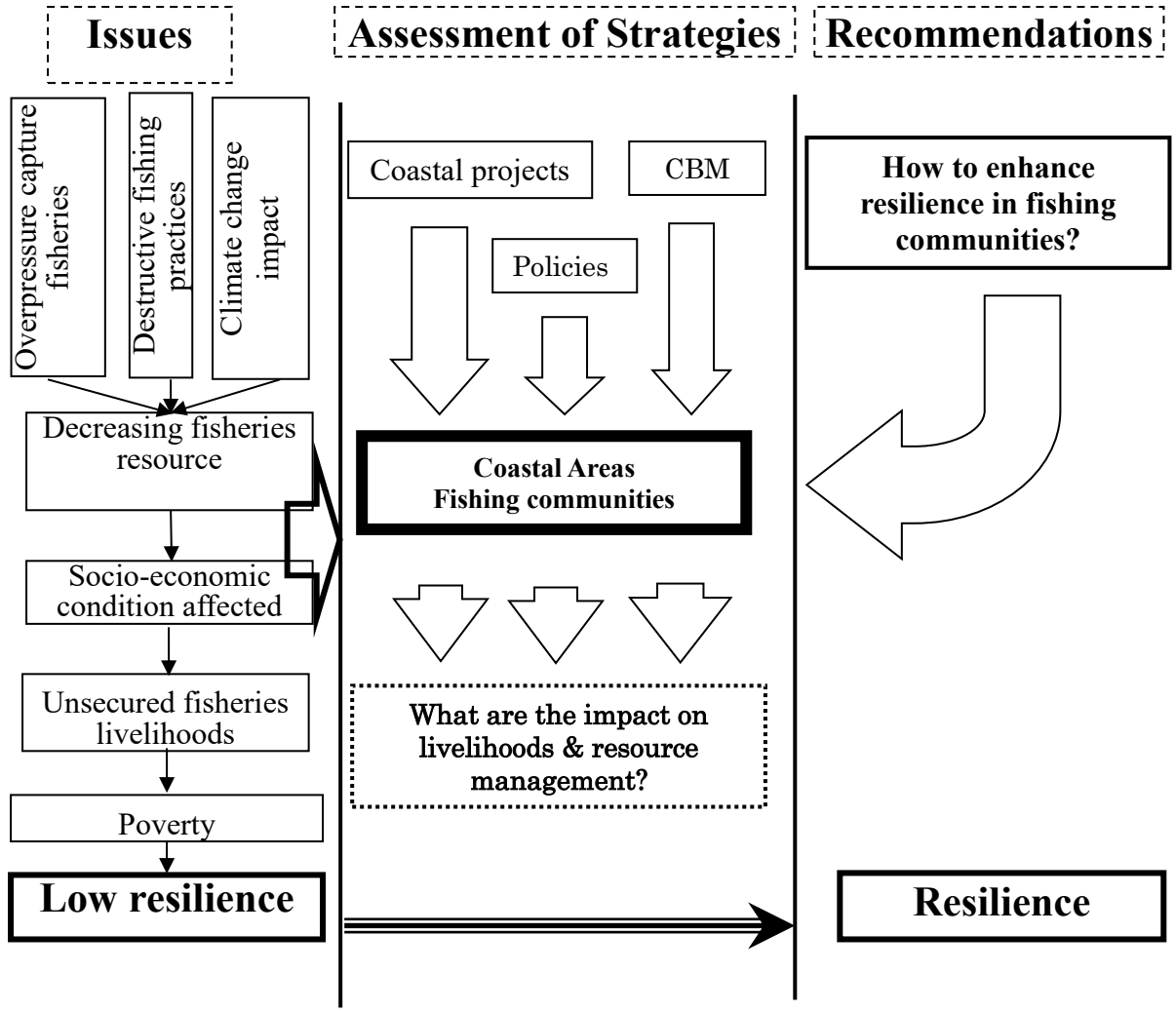


Figure I-2. Conceptual framework of study

To manage the three main stages of study, this report would be organized into eight chapters. Chapter 1 is the introduction, consisting of background of study, problem statement, research questions, objectives and conceptual framework. Chapter 2 is the methodology, which includes study area, survey procedure, data collection and data analysis. Chapter 3 is the theoretical review. This will review theoretical issues and concept that have been used in livelihood development, common-pool resource management and resilience. This chapter will also show the link between livelihood and common-pool resource management towards social resilience in fishing communities. It would be used as reference to link between livelihood diversification and coastal resource management towards social resilience in fishing communities in Indonesia. Chapter 4 focuses on the socio-economic impact of overpressure of Indonesian capture fisheries: case study in Bali Strait. Chapter 5 is explaining developing livelihood strategies of fishing

communities in Indonesian coastal areas. Chapter 6 describes an assessment of opportunities and constraints of seaweed farming in sustaining livelihood and fisheries resources. Chapter 7 concerns the impact of the marketing system of fisheries resources on livelihood activity in coastal areas. As a conclusion, Chapter 8 consists of the conclusion and recommendation (Figure I-3).

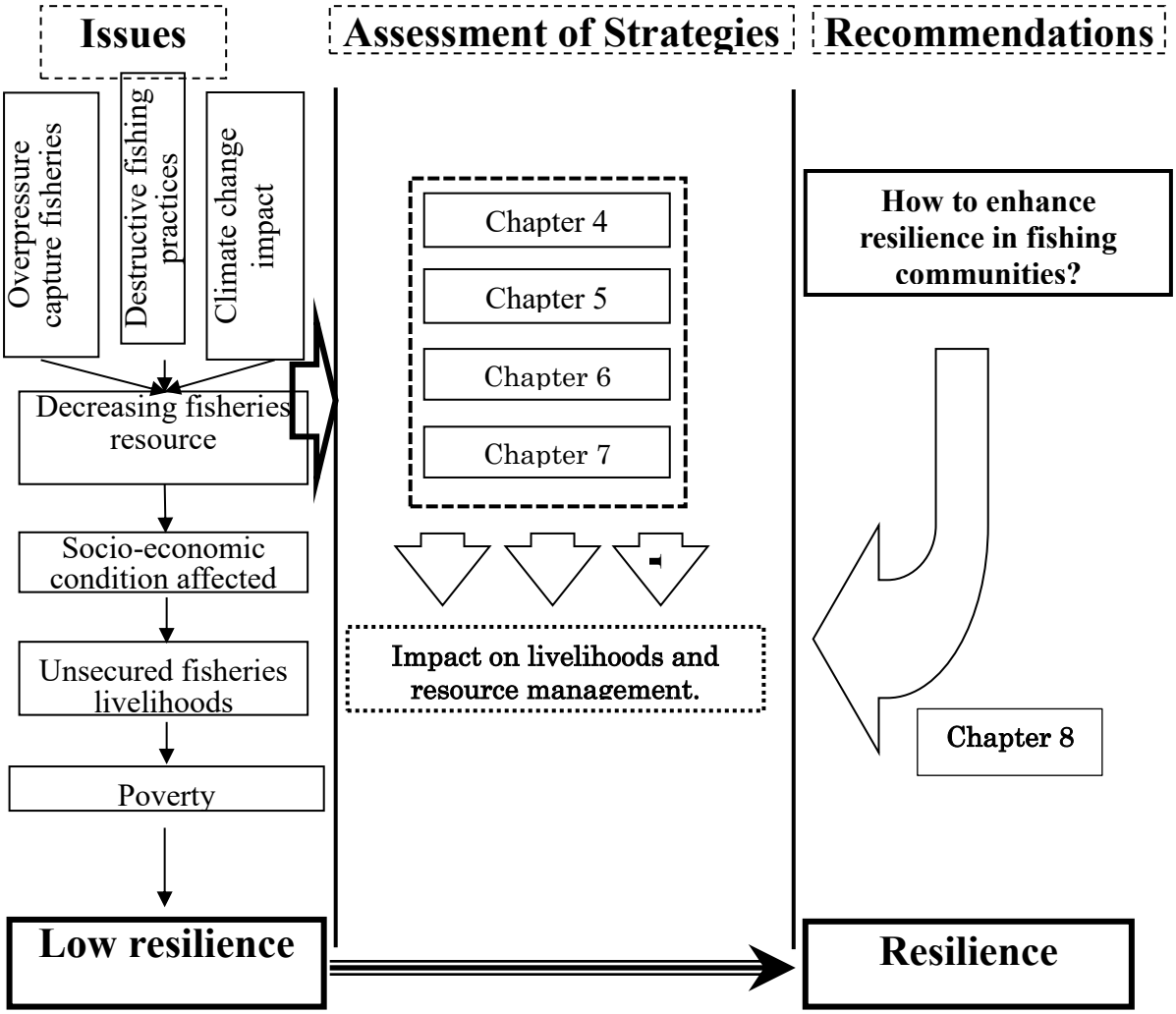


Figure I-3. Conceptual framework of dissertation

1.7. Structure of dissertation

As has been described, this dissertation consists of 8 chapters:

Chapter 1 introduces the national development plan of Indonesia which has 5 priorities in marine and fisheries sector. They are 1) bureaucratic reform and governance, 2) poverty reduction, 3) food security, 4) environment and disaster management, and 5) under-develop regions, foremost, outmost and post-conflict. This chapter also describes fisheries policies and community based management approach, trend of fisheries resources and coastal poverty, livelihood development and community empowerment. In this chapter, the problem statements, research questions, and specific objectives are described in detail. The chapter is to provide the explanation of conceptual framework of the study and dissertation.

Chapter 2 is the theoretical review used and referred to support the findings of this study. Several theories are reviewed such as common-pool resource management, developing alternative livelihood strategies and adaptation strategies of fishermen. Common-pool resource management was firstly described together with its concept, problems and alternative solutions in fisheries management. Developing livelihood strategies for sustainable fishermen's economy, adaptation strategies of fishermen to achieve resilience and environmental sustainability have been discussed in this chapter.

Chapter 3 presents detailed information of the research field on the geographical and socio-economic aspects. Primary data collected are firstly described and methodology adopted here will be discussed in depth, referring to secondary information of the study areas in two provinces (South Sulawesi Province and Bali Province). In this study, the survey was conducted during three times. The first survey was conducted during August to September 2010. The second survey was been done on February to March 2011. The last survey was carried out in November 2011 in the two provinces (Bali and south Sulawesi) of Indonesia. Data analysis explains the type of data collected (primary and secondary) and its methods. Six data analysis tools were used in this study, i.e., 1) Descriptive analysis, 2) a Likert type scale analysis, 3) benefit-cost analysis, 4) SWOT analysis, 5) comparative analysis, and 6) qualitative contents analysis.

Chapter 4 will analyze fisheries activity and fisheries management in Bali Strait. Multiplier effects of "fish-crisis" and fluctuated fish production would be explained in this chapter. Economic activities in fishery that almost stopped during 2010 to 2011 would be

described here. This chapter will focus on the current status of *SL* fishery in Bali Strait and fisherman's socio-economic, adaptation against this situation and policy action.

Chapter 5 will compare the economic outputs of two livelihoods activities, namely seaweed farming and capture fisheries. The objective of this study is to compare the economic returns of different livelihood activities as well as compare the financial returns and costs of each activity. In addition, these analyses were used to describe the livelihood adaptation pattern to the declining fisheries resources in fishing communities.

Chapter 6 will discuss the opportunities and constraints of seaweed farming in sustaining livelihood and fisheries resources. The development of Indonesian seaweed farming is affected by various factors, including the availability of socio-economic, resources, public policy, and technology. Developing policies and programs to enhance sustainable coastal management requires an assessment of the constraints and opportunities that characterize the situation of coastal communities. The objective of this chapter is to assess the constraints and opportunities associated with the development of seaweed farming. This chapter also provides recommendations for increasing the sustainability of seaweed farming activity and, thereby, for improving sustainable coastal management in Indonesia.

Chapter 7 focuses mainly on the impact of the marketing system of fisheries resources on livelihood activity in coastal areas particularly for seaweed product. In the seaweed business, fishermen or seaweed farmers have used various ways to address the problem of financial capital. Besides formal financial institutions that are rarely tapped, fishermen usually borrow money from the family, relatives, friends and brokers (middlemen) in the village. This financial problem often happens because small-scale fishers still have problems in accessing capital from formal financial institutions such as commercial banks. The patron-client relationship in seaweed farming is often referred to as *punggawa* (middleman) – *sawi* (farmer) system. This chapter shows the important role of middlemen in sustaining local seaweed cultivation activities; the pattern of the local seaweed procurement chain toward sustainable livelihood development in fishing community.

Chapter 8 provides a summary of conclusions, limitations and recommendations for improving policies related to livelihood development and coastal management toward social resilience in coastal areas of Indonesia.

CHAPTER II

THEORETICAL REVIEW

2.1. Introduction

Common-pool resource management is an important component in the interrelated challenges of poverty reduction, resource utilization, livelihood improvement, community resilience and environmental sustainability. Many resource managers are known in managing common-pool resource with holistic approach, but there is less understanding about how to adapt holistic approach to the social, economic, political and environmental changes. Due to this fact, many projects and programs provided by the government and other organizations have frequently failed to improve the social, economic and environmental conditions. Therefore, livelihood development strategies would emphasize and must be linked in implementing coastal resources management particularly in Indonesia. This chapter will discuss interrelated common-pool resource management in fisheries, livelihood development and its development toward community-self resilience and environmental sustainability, as long as these are concerned with the purpose and specific objectives of this paper.

2.2. Common-pool resource management: concept, problems and alternative solutions in fisheries management

2.2.1. Concept and theory of common-pool resource

Common-pool resources (CPRs) can be understood as a natural resource sufficiently large and it is costly to exclude users from obtaining sub-tractable resource units (Honneland, 1999). Ostrom (2008) defined common as referring to systems, in which it is difficult to limit access, but one person does not subtract a finite quantity from another's use. Ostrom explains the concept of common-pool resources (CPRs) for better understandable purpose. Ostrom separates the concept related to resource systems from those concerning property rights. She used the CPRs to refer to resource systems and property right involved. CPRs include natural and human constructed resources in which exclusion of beneficiaries through physical and institutional means is especially costly and exploitation by one user reduces resource availability for others (Ostrom et al. 1994). Common-pool resources include fisheries, wildlife, surface and ground water, range and forests (National Research Council, 1986). In 1985 and 1990, Garret Hardin had argued that users of a commons are caught in an inevitable process that leads to destruction of the resources on which they depend (Berkes, 2005). Hardin's idea had examples from many parts of the world. Then,

Berkes (1989) and Feeny et al. (1990) defined two characteristics of common-pool resources: a) exclusion or the control of access of potential users was difficult, and b) each user was capable of subtracting from the welfare of all other users.

Berkes (1989) defined common-pool resources as a class of resources for which exclusion is difficult and joint use involves subtractability. Furthermore, Berkes (2005) defined four types of common property rights: a) open access means access to the resources is free and open to all resource users; b) private property refers to the situation of individual or corporation having the right to exclude others and regulate utilization of the resources; c) state property, refers to the right exclusively controlled by government and regulate resource use; d) common property, refers to an identifiable community who can exclude others and regulate use. Due to these definitions, common-pool resources may be governed and managed by various institutional arrangement that can be roughly grouped as government, private or community ownership. In practice, the resources are usually held in mixed combinations of property right regimes. Berkes (2005) stated that no particular regime is superior to other regimes, but one may fit a particular circumstance better than other regimes. He mentioned that common property is not the same as open-access. If the property is social relationship, then it can lead to problems and the formulation of practical rules in use (Berkes, 2005 and Ostrom, 1990).

There are two characteristics of common-pool resources: 1) excludability or control of access, referring to the physical nature of the resource such that controlling access by potential user may be costly and virtual impossible. 2) subtractability means that each user is capable of subtracting from the welfare of other users (Berkes, 2005).

2.2.2. Classical and contemporary issues in commons fisheries

2.2.2.1. Classical issues of the commons fisheries

The “tragedy of the commons” is often a starting point in discussions of the common theory. The user faces a decision about how much they use the resource, and if all users restrain themselves, then the resource can be sustained, but if one limits the use of the resource and one’s neighbors do not, then the resource still collapses and one has lost the short-term benefit of taking one’s share (Hardin, 1968). Hardin mentioned that the “tragedy of the commons” is a central concept in human ecology and the study of the environment. The simple type commons is the resources such as oceanic ecosystem, the global atmosphere and forest as a common-pool resource to which a large number of

people have access. The key is the ability of a community using common resources to limit the access of outsiders, and to self-regulate its own harvest. However, this "key" has caused conflict among users in resource use in recent years. However, Fenny at al. (1990) argued that the logic of the tragedy of the commons should not observe sustainable management of common-pool resources and the exclusion of some uses or users, under regime other than private or state property. Meanwhile, private or state ownership is not always sufficient to provide for exclusion.

Ostrom et al. (1999) explain, to solve CPR problems, there are two elements that should be considered; restricting access and creating incentives (usually by assigning individual rights to shares the resources) for users to invest in the resource instead of overexploitation. In terms of migratory marine resource, Berkes (2005) explained that the management has tried to pursue progressively more sophisticated technical solutions. Moreover, management has fallen back on the use of precautionary approach, dealing with uncertainty and other complex systems problems through such principles as the Code of Conduct for Responsible Fisheries (CCRFS)[10].

Community-based resource management can solve the exclusion problem (and subtractability problem. Exclusion means the ability to exclude people other than the members of a defined group. Subtractability refers to the ability of social groups to design a variety of mechanism to regulate resource use among members. However, it does not mean that the solution of communal property is necessary sustainable, any more than private property solutions are sustainable (Berkes, 2005). In many cases, resource users have been able to avoid Hardin's tragedy by devising self-governing rules, monitoring mechanisms, and sanctions that rely neither on government control nor on private property right.

2.2.2.2. Contemporary issues of the commons fisheries

Southeast Asians is a big producer of fishes which is a primary source of dietary protein and income generation (Pomeroy, 2012), and overcapacity of fish production becoming a key issue in fisheries management. Overcapacity is referring to the fact that fishing

[10] CCRF is the Code that sets out principles and international standards of behavior for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code recognizes the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all those concerned with the fishery sector. The Code takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users (available at: ftp://ftp.fao.org/docrep/fao/005/v9878e/v9878e00.pdf accessed on October 18, 2012)

capacity is greater than some optimal or desired level. The key issue for coastal fisheries in Asia is the depletion of the resources. In the region's countries with sufficient time series of data, total biomass has declined to < 10% of "baseline" estimates in some areas, the average decline was down to 22% of the earlier estimates (Stobutzki et al., 2006). The drastic declines in coastal resources are linked intimately to poverty issue among fishing communities. Poverty is regarded as pervasive in small-scale fisheries and small-scale fishing is often cited as an income of last option for the poorest of the poor (Bene, 2003). The demarcation of fishing zones has been another approach to managing access to the coastal resource. The EEZ of most countries is divided into several zones, based on depth or distance from shore, where particular gear and/or vessels can be used (Garces et al. 2006).

Hardin and Baden (1977) suggest that to avoid the tragedy, the commons could be privatized or kept as public property to which rights to entry and use could be allocated. Privatization of resource management as part of decentralization is very effective for managing the small-scale natural resource because it will be focused on. On the other side, privatization cannot be applied to all levels of society. Privatization is more applicable to the community, which has the same level of abilities (i.e., knowledge, financial, access etc.). In Indonesia, the issue of privatization in the commons has been refused by the people. They expected that they would have limited access to the resources when the private sector occupies the common resources. Such a situation has led to the chapter about governing coastal management in the law of coastal zone and small island No.27/2007 amended by the constitutional court of the Republic of Indonesia.

The theory of the commons is now sufficiently developed to enable prediction, but they only focus on single resource or/and a small number or homogeneous users. Thus, commons governance becomes complex when scale is increased (Berkes, 2005). In case of migratory fisheries resources, the problem of the scale is crucial. The stocks may be harvested through coastal and offshore fisheries by small and large-scale users. Another problem is when the stock moves to another area, it would be difficult to deal with problems. This kind of problem occurred in migratory fisheries resources in Indonesia, such as *Sardinella lemuru (SL)*, tuna and tuna-like species, etc. In case of *Sardinella lemuru*, movement always happens every year in the Bali Strait, Indonesia. It has caused sharp fluctuation of *Sardinella* since the last decade. Fishermen or government could not predict the peak season and low season of *SL*. Many authors expect that this is as

consequence of fishing resources as common pool resource (CPR) (Hardin, 1968; Gordon, 1954 and Schaefer, 1957).

Recently, the impact of migratory resources is not only on the stock of the resource but also spreading to the problem of social, economic, livelihoods, poverty and resilience in the coastal communities particularly purse seine fishery. This condition is part of the challenge facing fishers, resource managers and national decision makers in Southeast Asia Region, and they are in the process to find out the alternative governance and public policy mechanism to manage resource sustainability and economic feasibility (Pomeroy et al. 2007). The scale of problems has been increased and needs collaborated effort to solve this problem. Uncertainties in migration and other biological characteristics of *Sardinella* create further management problems. The problem continues even if the regulation or policies are set up by two local governments collaboratively to limit the access of Bali strait to catch the Bali *Sardinella*. However, OECD (1999) and McCay (1995) state that limiting access alone can fail if resource users compete for shares and the resource can become depleted unless incentives or regulation prevent overexploitation.

Research in commons considers the self-organization and self-regulation capability of community of resource users to solve the problem of the commons (Ostrom et al. 1999). Locally evolved institutional arrangements governed by stable communities and buffered from outside forces have sustained resources successfully for centuries, although they often fail when rapid change occurs (Dietz et al., 2003). Another theory argued that community-based resource management can solve the exclusion problem and the subtractability problem. Moreover, the key is the ability of a community using a common resource to limit the access and self-regulate its harvest. This statement is contrary to which Hardin claims that there are only two state-established institutional arrangements; centralized government and private property which could sustain commons over the long run (Constanza, 1987), but he neglects the point that many social groups have struggled successfully against threats of resource degradation by developing and maintaining self-governing institutions (McCay and Acheson, 1987; NRC, 1986; Balland and Platteu, 1996 and Ostrom, 1990).

Research in commons issues has often sought the simplicity of community-based resource management cases to develop theory (Berkes, 2005). Ostrom (1990) expresses that her strategy has been useful for small-scale common property because self-organization and self-governance are easier to observe in this situation. In the commons science, the

important key to manage commons is not only the ability of a fishing community to manage own resources, but also capacity building by the resource manager. The changing philosophies of the fisheries development process are reflected in changing approaches to fisheries resources management (Berkes et al. 2001). Traditional and customary fisheries management regimes are typical management systems before colonialism (Ruddle et al. 1992). Governance of fisheries resources was transferred from communities to local and national government bodies during the colonial period (Pomeroy and Pido, 1995).

Fisheries management is scientifically, socio-economically and politically complex "wicked" problem in policy studies (Jentoft and Chuenpagdee. 2009 and Browman et al., 2005). To improve management, Gibbs (2008) suggested fisheries management could be thought of as a governance network, given large space for participation of informed stakeholders in the fisheries process. Governance networks are self-organizing, non-hierarchical, yet contain leaders and managers within the network (Agranoff, 2007). However, Hartley (2010) argued that network structures enable or inhibit various groups and individual functions. Moreover, an individual positioning in a network and the communication links can be indicator of information flow and their access to decision-makers.

Since over two decades, fisheries management has shifted away from conventional production based management to conservation and ecosystem-based management (Berkes et al., 2001). Furthermore, fisheries governance is shifting centralized system to market regulation, community-based management and co-management. It was used to address the problems in centralized fisheries management such as lack of participation and conflicts in coastal utilizations.

Stakeholder's participation is involved in resource management used to control access of the resources. Policies have shifted from open and free access, fisheries policy, command and control instruments and top-down approach to limited entry, user rights and user fees, coastal zone inter-sectoral policy, command and control and macro-economic instruments, participatory and precautionary approaches (Garcia, 1994). It has shifted from the traditional top down management approach to bottom up approach (Pauly et al. 1998; Agrawal 1999; Brown and Pomeroy 1999). In many countries, fisheries management has applied in the direction of devolution, deregulation, decentralization and co-management (Berkes, 1994).

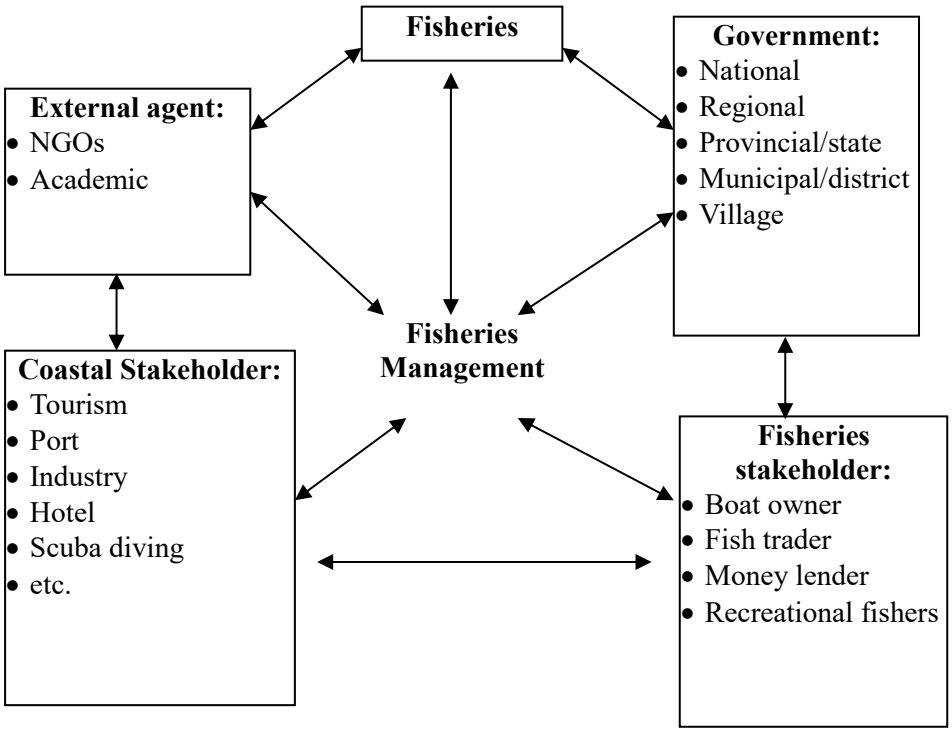


Figure II-1. Fisheries co-management is a partnership (Berkes et al. 2001)

As governance of fisheries resources, fisheries management in Indonesia has different types of customs and traditions, norms, cultures and social values in each region because of a wide variety of natural resource management in this country. It is clear that natural resource management needs to pay attention to the local society and culture as regards both subjects and object of development. A wide variety of community based management in marine and coastal resources have developed differently from long experiences in several areas of Indonesia.

2.3. Community based management experiences in Indonesia

Community based resource management is one of the concepts of co-management. Charter (1996) gives a definition of community based resource management (CBRM) as a strategy to achieve development which centers in human resource, where the center of decision making about utilization of resource continuously in an area depends on people's organizations in that area. The people have a responsibility to manage their resource. They define need, aim and decision-making by themselves.

Indonesia has various kinds of culture in all areas and provinces. A wide variety of community based management in marine and coastal resources has developed differently from long time ago from one region to another. *Sasi* (Moluccas) is a traditional agreement

about utilization of coastal resource composed by people and legalized through custom structural mechanism in the village level (Nikijuluw, 1994). *Hak ulayat laut* in North Sulawesi (Sea tenure-North Sulawesi) divides local fishing ground into 3 areas; 1) waters area called "*nyare*"; 2) waters area called "*inahe*"; and 3) waters area called "*elie*" (Kusumastanto et al, 2004). *Hak ulayat lau*t in Papua (Sea tenure - Jayapura, Papua) regulates utilization of fishing grounds, fishing gears and punishment for violations. This regulation is led by three elements, they are; local government, custom leader and church leader (Kusumastanto et al, 2004). Another example is the *Ladang berpindah* tradition of *Bajo* ethnic (migratory-tradition). *Bajo* people cut the trees in the forest to open new agriculture land. They have migrated from one place to another continually. They leave the old place after the planting process is complete. Then, they move to a new place and do cultivation, and finally they come back to their first place. They repeat the same process again. *Awig-awig* in Balinese, West Lombok and East Lombok is a custom regulation in Bali, West Lombok and East Lombok that regulates the management of coastal fisheries resources appointed by government at the village level, custom institution and elite figure of religion or custom (Kusumastanto et al, 2004). *Panglima laot* in Nangroe Aceh Darussalam, NAD) is a person who leads custom and habit valid in capture fisheries and quarrel resolution (Kusumastanto et al., 2004).

1) *Ladang berpindah* tradition of *Bajo* ethnic (migration).

Bajo peoples have cutting the trees in the forest to open new agriculture land. They have migrated from one place to another place continually. Detail explanation as follow; they left the old place after the planting process is complete. Then, they went to another new place and doing the same and finally they came back to their first place. Then, they repeat the same process again.

2) *Sasi* (Moluccas)

Sasi is a traditional agreement about utilization of coastal resource composed by people and legalized through custom structural mechanism in village level (Nikijuluw, 1994).

3) *Panglima laot* (Nangroe Aceh Darussalam, NAD),

Panglima Laot is a person who leads custom, habitual that valid in capture fisheries and quarrel completion (Kusumastanto et al, 2004).

4) *Awig-awig* (Balinese, West Lombok and East Lombok)

Awig-awig is a custom regulation at Bali, West Lombok and East Lombok that regulate management of coastal fisheries resources appointed by government in village level, custom institution and elite figure of religion or custom (Kusumastanto et al, 2004).

5) *Hak ulayat laut* -North Sulawesi (Sea tenure-North Sulawesi)

This regulation divides local fishing ground into 3 areas; that are; 1) waters area called *"nyare"*; 2) waters area called *"inahe"*; and 3) waters area called *"elie"* (Kusumastanto et al, 2004).

6) *Hak ulayat laut* -Papua (Sea tenure -Jayapura, Papua)

This regulation regulates utilization of fishing ground, fishing gear and punishment towards violations. This regulation is led by three elements, they are; local government, custom leader and church leader (Kusumastanto et al, 2004).

2.4. Decentralized coastal management in Indonesia

The Government of Indonesia (GoI) started developing knowledge about marine and coastal resources through capacity-building programs starting from theLong-Term Development II (*PJP II*) supported by foreign donors. Marine resource and planning (MREP) project, Coral Reef Rehabilitation and Management Program (COREMAP), coastal resource management project (CRMP), collaborative research and education programs were some of the coastal projects applied in coastal area of Indonesia. They have assisted the change in coastal management system in Indonesia to become better, although there are still a lot of weak points that need to be improved (Dahuri and Dutton, 2000).

Decentralized fisheries management in Indonesia has begun since the Government of Indonesia (GoI) promulgated the Law No. 22/1999 then revised Law No.32/2004, which called the local autonomy law (Satria, 2004). In terminology, local autonomy is the authority to regulate and manage the interests of the local community based on community participation in accordance with legislation. Indonesia has four levels of government system. The levels of government consist of: a) central government, b) provincial government, c) local (district or cities) and d) village (*desa*) (Law No.32/2004). They act as key administrative units, being responsible for providing most government services. Although local governments have broad functions and receive substantial inter-governmental transfers, they have limited revenue generating authority (Siry, 2007). Dudley and Gofar (2005) explain that, in the philosophy of decentralization, the districts would work together with local stakeholders to ensure that their purposes are heard at the higher levels. In Indonesia, cooperation between local government and local stakeholder in marine affairs and fisheries can be facilitated by the marine affairs and fisheries service office in provincial and district levels. Nevertheless, the limited number of marine and

fisheries officers in local government is still an obstacle to bridge relationship intensively between local governments and stakeholders.

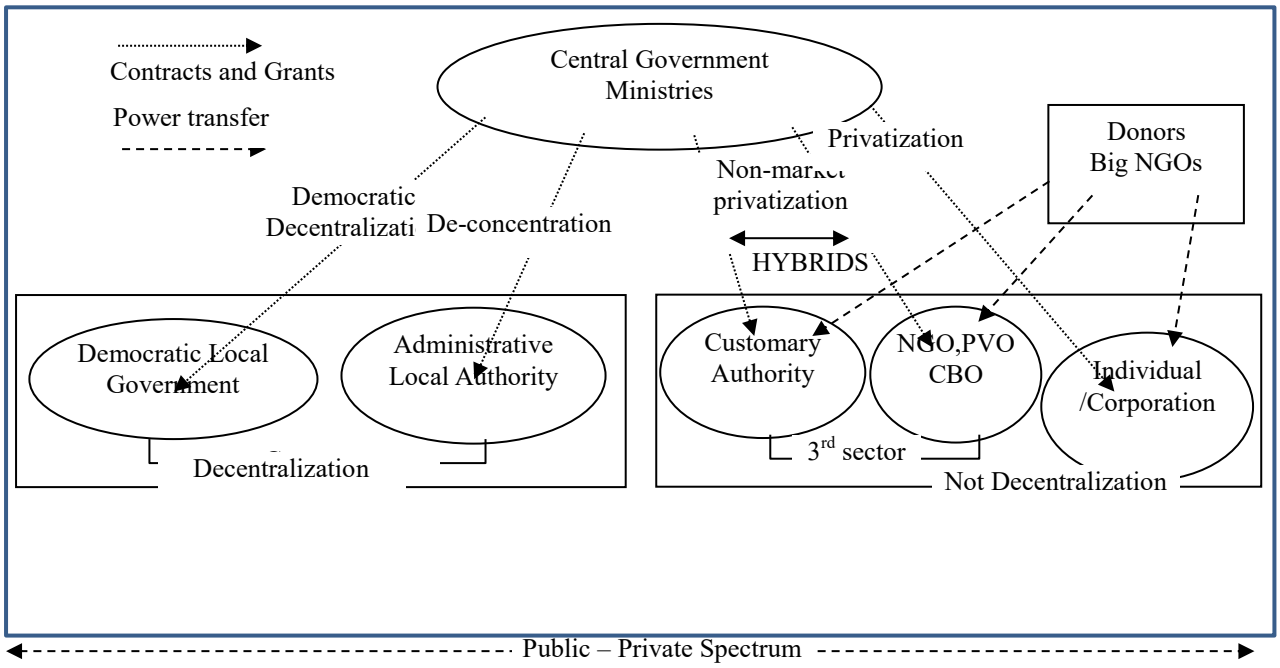


Figure II-2. Formal definitions: decentralization and centralized government systems (Ribot, 2004)

Law No.32/2004, article 18 of chapter 3 defines Indonesian water territory within 12 nautical miles as belonging to the authority of a province as regards the management of marine and fisheries. District government has authority over marine area from seashore up to 4 nautical miles. The authorities as mentioned by Law No. 32/2004 are tasked for: 1) exploitation, exploration, conservation and resource management 2) administration management 3) zone management 4) law enforcement, not only regulation from local government but also regulation from central government given to the local government 5) participation in security 6) participation in sovereignty (article 18).

As an archipelagic state, Indonesia could gain much by effectively utilizing coastal and small island resources. In other considerations, Law No. 27/2007 on the management of coastal zones and small islands, article 5 in Chapter III of Law No. 27/2007 explained that coastal zone and small islands management consists of the planning, exploitation, controlling and management of community activities. This serves as a guide for community activity in the exploitation of coastal zone and small islands resource and done in a sustainable way, towards enhancing the community's prosperity and in

guarding the unitary state of the Republic of Indonesia. However, fisheries management has to address the social context and the benefits and costs, not only for individual fishing boats and fishing fleets, but also for fishing communities as well (Jentoft 2000). Management requires a broader understanding of human behavior and how people use and misuse marine commons (Ostrom *et al*. 1999).

2.5. Developing livelihood strategies for sustainable fishermen's economy

2.5.1. Concept and definition of livelihood

Chambers and Conway (1992) define livelihood as comprising the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. Then, Ellis (2000) extended such a definition by more explicitly considering the claims and access issues, "A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household". It is clear that the concept of livelihood is to highlight the critical factors that affect the vulnerability of individual of family survival strategies.

2.5.2. Typology of livelihood strategies

Livelihood strategies are composed of various activities undertaken by households to generate livelihood, generally adaptive over time, responding to opportunities and changing constraints (DFID, 1999). Devereaux (1993) and Davies (1996) make the distinction between survivals, coping, adaptive and accumulative in household strategies (Table II-1). Cumulative strategy is identical with increased consumption and stocks. Adaptive strategy seeks to spread the risk of consumption that may occur through diversification of activity. Coping is to absorb the impact of an adverse shock by reducing consumption and assets. Survival strategy is dramatically reducing assets, consumption, etc.

Table II-1. Typology of different livelihood strategies

Type of livelihood strategies	Internal livelihood system		
	Change to assets	**Strategies and activities**	**Consumption outcomes**
Accumulative	- Increased stock of assets - *Diversified activity*	As for adaptive	More income, improved nutrition, increased security, *improve livelihoods*
Adaptive	- Change in mix of	- Intensification	- Income and

	assets, precautionary saving of financial and other assets. - *Developing alternative livelihood*	(cultivation of more land), on farm & off-farm diversification, intensification of cash cropping, investments in social capital, migration. *-Doing activities outside fisheries* *- Keep fisheries activity*	consumption smoothing, risk reduction, risk spreading, labor smoothing. - *Improve household income* *- Improve family participation*
Coping	- Intensified sale of livestock, calling down informal claims. - *Extensive seaweed farm* *- re-evaluate fisheries policy* *- Development community-based management*	- Piecework, agriculture labor, temporary migration, withdrawing children from school. *- adding seaweed plot in prospective area* *- reduce the number of purse seine boat and gear* *- Developing community surveillance*	- Reduced frequency, quantity and quality of meals, use where available of relief food, social and ceremonial obligation reduced *- Increased seaweed production volume* *- Normalize production of fish* *- Reduce violations*
Survival	- Sell of productive assets, sale of household effects. *- Keep maintain relationship with middleman*	- Illegal activities, begging, permanent out-migration. *- borrowing money to middleman* *- Sell the boat and gear*	- Starvation and destitution. *- Sustained livelihood activity* *- Sustained household economy*

Source: Modified from Devereaux (1993); Davies (1996); field survey (2010, 2011, 2012)

At present, fishers need new appropriate technology to improve the quality of products and increase their market value, since the price of dried seaweed has increased. Diversification of livelihood activities has reduced destructive fishing practices, and make finding fishing ground with abundant resources easier, decreasing operational cost and increasing fish catch. Allison and Ellis (2001) emphasized that diversification gave some benefits, such as 1) reduces the risks of livelihood failure by spreading it across more than one income, 2) overcome the uneven use of assets caused by seasonality, 3) reduce vulnerability, and 4) generate financial resources in the absence of markets. In fact, alternative livelihoods, which are introduced to poor or small-scale fishers, should bring more economic benefit by making their products more marketable. Livelihood diversification might be combined with other resources (Seavanen *et al*. 2005). However, fishermen cannot be easily persuaded to go into such a diversification of their livelihood. They need some kind of technical and financial assistance until the products will have been accepted by the market continuously. In the case of a newly introduced livelihood that is considerably

capital-intensive, the small-scale fishers could hardly start without any support. These businesses can be developed through joint ventures between fishermen to solve the problem of initial capital. They cooperate with other fishermen to solve problems on limited financial capital (Zamroni and Yamao, 2011b).

2.5.3. Livelihood strategy of Indonesian fishing community

Poor society in almost all developing countries suffers from low quality of human resources, low income and productivity. They have unable to fully benefit from natural and economic sources. In Indonesia, approximately 32% or 16.4 million people live in coastal areas and under the poverty line (Kusnadi *et al*. 2006). Farrington *et al* (1999) argued that poverty is not only equated with inadequacy and dissatisfaction with income and consumption, but also characterized as the situation that is insecurity or vulnerability, and inability in households, communities or governance systems. The GoI has designed many types of coastal projects and implemented for poverty alleviation. It has focused on sustainable use of coastal resources and enhancement of fisheries livelihood (Idris, 2004; Dahuri *et al*. 1999; Dudley and Gofar 2005; Hanson *et al*. 2003; and White *et al*. 2005).

2.5.3.1. Generating new livelihoods in coastal communities

Among the implemented projects, the GoI has developed various kinds of sustainable, environmentally-friendly aquaculture, such as seaweed farming. Seaweed farming can play a significant role in nutrient recycling (Sorgeloos, 2000) as well as increase local biodiversity and food security for coastal and island communities (Kinch *et al*.,, 2003). An additional advantage of seaweed farming is its beneficial effect on the environment and climate change mitigation. Mariculture is often described as “blue revolution” that has the potential to contribute to food security, economic growth and poverty alleviation (Irz *et al*. 2007).

Seaweed farming is crucial to the implementation of a system of sustainable ecosystem management (Alder *et al*., 1994). This is confirmed by Salayo *et al*. (2012) that mariculture qualifies as an economic enterprise and livelihood option for diversifying income sources in the context of sustainable livelihood approach (SLA) to fisheries management. Besides, aquaculture and capture fisheries might provide alternative livelihood options for fishermen (Pomeroy 2006). In the realm of social policy, seaweed farming is a sustainable form of aquaculture that has particularly benefited women and has contributed to government-sponsored poverty alleviation programs (Bryceson, 2002).

Extensive culture-based fisheries have also been associated with the mitigation of poverty (Sheriff *et al*. 2008).

2.5.3.2. Seaweed farming as an alternative way

Since the 1980s, the development of seaweed farming in Indonesia has supported the change of the mindset of coastal communities from the unsustainable exploitation of natural resource uses to productive seaweed mariculture that is both friendly to the environment and economically empowering (Zamroni et al. 2011). It is expressed by one study that seaweed farming in most developing countries is frequently suggested not only to improve economic conditions but also to reduce fishing pressure (Crowford, 2006; Salayo *et al*. 2012; Sievanen *et al*. 2005). This opinion is supported by the study of Zamroni and Yamao (2011a), showing that the development of seaweed farming in Indonesia has led to radical changes in the socio-economic structure, particularly in the livelihood economic activities of traditional coastal communities. Furthermore, seaweed cultivation can also be used to complement or even support the income of fishermen during off-fishing with times of low fish catch.

2.5.3.3. Starting a new livelihood: patron-client relationship in fisheries activities

Patronage relationships have an important role in sustaining livelihood activities of fishermen. Patrons or *punggawa* had support clients by providing initial capital to start or re-start livelihood activities. The client has the commitment to sell the fisheries product to the patron, besides returning the money that was loaned to the patron without any interest. The patron-client relationship is based more on practical consideration rather than on loyalty. A client will commit to another patron if the previous relationship does not benefit or satisfy him. Pelras (2000) mentioned that as long as client is in debt, the commitment cannot be broken. In seaweed farming of Indonesia, the patron-client system can be found among fishermen and/or seaweed farmers and traders serving as financial and production link between them. The lenders (patrons) intend to let the debt stay, because they want to keep the patron-client relationship with seaweed farmers (Zamroni and Yamao, 2011b). Moreover, this relationship gave both positive and negative impacts. The positive impact is the quick process of available fund with no interest and collateral, but client farmers are to sell their products exclusively to their patrons. As a result, on the negative side, the farmers can neither determine the price of seaweed nor sell their product to any other traders (who might offer better prices) as long as they have financially indebted with a particular patron. Traders, collectors or middlemen mainly function as providers of capital lent out to

particular seaweed farmers and as buyer of raw dried seaweed from them. However, there is a difference as regards "patron- client" system in fishing activity as can be seen in Table II-2.

Table II-2. Patron-client relationship in capture fisheries activities

Instruments	Fishing activity	
	***Punggawa*-owner (patron)**	***Sawi*-fishermen (client)**
Role	Owner of fishing equipment	Worker
Products or service provided	Fuel, boat, fishing gears	Manpower
Benefits	Profit from business/activity	Receives a salary
Organizational form	Group	Group

Source: Field observation 2010 supported by Arif (2007) (unpublished).

2.6. Adaptation strategies of fishermen for achieving resilience

According to Cooke (1984), the collapse of fishery is defined as a sustained period of very low catch value occurring after a period of high catch value. Depletion of marine fish stocks because of over exploitation can jeopardize the future of marine fisheries (Baum *et al*. 2003; Myers and Worm 2003). Overfishing is one of the most critical concerns for the conservation of marine ecosystems, particularly of specific species (Pinsky *et al*. 2011). In Southeast Asia, most of the near-shore fisheries are overfished and overcapacity is one of the leading causes of overfishing (Burke e*t al*. 2002; Berkes *et al*. 2001). Small pelagic species have rapid growth rate, highly catchable and therefore susceptible to overfishing (Beverton, 1990). However, Mullon *et al*. (2005) have different opinion that not all collapsed fisheries are associated with resource depletion, but also few fisheries collapse are the result of purely economic or administrative reasons. Rice and Garcia (2011) mentioned that the efforts of fisheries conservation do not come without costs. The effort expected for better marine and fisheries to improve the aquaculture and recovery of marine fisheries has different directions.

2.6.1. Building capacity of coastal community

Capacity building is widely recognized as a central dogma of Integrated Coastal Zone Management (ICZM). Kay and Alder (1999) defined capacity building as the process of increasing the capacity of those charged with managing the coast to make sound planning and management decisions. In coastal management, capacity building is increasing and is of increasing crucial importance (Smith, 2002). Hartoto et al. (2009) explained it more clearly by saying that capacity building can include: 1) dissemination of information; 2)

training to develop knowledge, skills and attitudes; 3) development of networks through information exchange and learning of the experiences from other people; 4) facilitation by experienced external organizations.

Increased community capacity can potentially empower local communities with the ability to tackle the impacts of socio-economic change (Barker, 2005). Community capacity building intends to enhance a moral sense of duty (Fletcher, 2003). Furthermore, coastal resource users have a natural right to determine how local resources are used and should be engaged at the earliest possible stage of coastal management. The process of capacity building is dependent on existing civil society[11] and social capital[12] (Atterton, 2001).

In coastal communities, fishing is not only for income generation and source of employment but also as a way of life and livelihood that could produce the food for the household (Pollnac and Poggie, 1988). Fishing may be a seasonal activity where small-scale fishermen are dependent on coastal resources for their livelihoods (Allison and Ellis, 2001). The building capacity of coastal community is important in recent years. This aims to improve capability and ability of coastal community to response to depleting coastal fishery resources and uncertainty. Capacity building aims to improve community participation in coastal management. Improved capacity can help coastal communities tackle adverse socio-economic pressures. These pressures are related to population instability, economic decline, unemployment and deprivation (Barker, 2005). Inter-community linkages should be encouraged and developed at the outset as this will result in more resilient local capacity (Wiber *et al*. 2009).

2.6.2. Adaptive capacity of coastal community

According to the definition of capacity mentioned above, it is an important step for fishermen or coastal communities to adapt to uncertainties such as Armitage (2005) and Olson *et al*., (2004) mentioned in term of adaptive capacity which is the ability of social or ecological systems to adapt to any changes and to respond to disruption. Walker *et al*., (2002) argued that adaptive capacity is an aspect of resilience that reflects learning, flexibility to experiment and adopt solutions and development of generalized responses to broad classes of challenges. Learning how to deal with uncertainty and adapt to changing conditions is becoming essential where people play a major role in global scales (Falkowski *et al*. 2000; Folke *et al*. 2002; Palumbi 2002).

[11] Civil society refers to social relations as individual, group and institution/organization
[12] Social capital refers to the nature of relations, networks, norms and trusts.

The concept of adaptive capacity and the implication for community based resource management are given attention on the social process and institutions that influence opportunities for adaptation complex and uncertainty (Armitage, 2005). Successful adaptive approaches for resource management under uncertainty need to (1) build knowledge and understanding of resource and ecosystem dynamics (2) develop practices that interpret and respond to ecological feedback, and (3) support flexible institutions and organizations and adaptive management processes (Berkes and Folke, 1998).

2.6.3. Coastal community empowerment

Coastal communities and stakeholder change over time require an adaptive approach of fisheries management, not only to ecological fluctuations but also to shifts in social values, perceptions and to interests (Alpizal, 2006). Participatory approaches to management of resources came particularly effective in small-scale fisheries management (Jentoft, 2003; Wilson, 2003; Hauck and Sowman, 2003). The method is based on the support of public participation at the local level and the empowerment of coastal communities or stakeholders, and active in policy design and implementation (Berkes *et al*. 2001; Jentoft *et al*. 1998). In Indonesia, community empowerment in marine and fisheries involves an effort to provide the facilities, encouragement or assistance to the society in order to determine the best choice in exploring marine and fisheries resource for independence and prosperity (MMAF and JICA, 2010).

In theory, Jentoft (2005) defines that empowerment as partly psychological and partly social; the former emphasizing emotional qualities, the latter the importance of social interpersonal relations. Issues of overcapacity and sustainable resource use cannot be isolated from poverty, unemployment and declining quality of life in fishing communities (Pomeroy, 2012). It affects the social and economic condition of the people who are dependent directly or indirectly on fishing activity. Due to this situation, they need to encourage and empower their lives with or without support from other institutions or the government. People are empowered when they are allowed to do something from which they are previously barred, when institutions are established that facilitate participation and secure right. Moreover, control information and improved organization link to outside support, gaining the access to resources that are the key elements of community empowerment (Petersen, 1994).

Livelihood options have given chance for fishermen or families to choose the activities in order to support leaving from the fishery and reduce the dependence of household

economy on fishery. A household livelihood strategy is taken to provide broader range of livelihood options. Fishermen need to improve basic services of coastal household and communities. Women have long history of involvement in natural resource management. In many fisheries, they have traditionally participated in the pre and post-harvest sector, processing and marketing (Bennet, 2005). Moreover, traditionally, their focus has been less on the resource base and more on the down-stream aspects of the resource (processing, marketing, etc.).

As regards livelihood development in Indonesia, the involvement of women has provided an overview of the importance of economic improvement in the framework of coastal management in the local setting (Zamroni and Yamao, 2012). In their study, women in different age group are very active in seaweed farming rather than men. It is not only in pre-production/planting but also in marketing too. It would represent a change for women to open other economic relationship with outside parties in term of extending their business. As regard to this condition, Aldon (2011) emphasized that the smooth relationships of women with the outside community make them a stronger social and economic network than their husbands. This is proving that women have an important role in the diversification of fisheries activity, in order to improve household economy supported by effective communications. Weber *et al*. (2009) stresses, that the true communication and collaboration among communities are important factors to drive integrated management as a holistic activity.

A community empowerment program in Indonesia has been proposed by the central government to integrate such projects in different ministries and institutions under the umbrella of the "national program of the community empowerment" (PNPM). This is prepared for implementation in poor districts and sub-districts, which is not new in Indonesia. In the past, Indonesia had projects under the President's instruction intended for poor villages (IDT), village infrastructure program (P3DT), empowerment of the regions to overcome the impact of the economic crisis (PDM-DKE), sub-district development program (PPK), urban poverty program (P2KP), farmer and fisher's increasing income project (P4K) and economic empowerment for coastal community (PEMP). PPK is the forerunner for developing PNPM in rural area, while P2KP is for developing PNPM in urban area. The ministries which implement PNPM should coordinate with governors and heads of district/sub district during actual implementation.

Table II-3. Evolution of the national program for the community empowerment of Indonesia

No	Name of the program	Focused of activity	Period	Funding source
1	President instruction for poor village-*"Inpres Desa Tertinggal" (IDT)*	Poverty reduction	1993-1996	Central government
2	Village infrastructure program-*"Program Pembangunan Prasarana Pendukung Desa Tertinggal" (P3DT)*	Developed village infrastructure such as sanitation, bridge, clean fresh water and environment	1995-997	The Overseas Economic Coorperation Fund (OECF) Japan and World Bank.
3	Empowerment of the regions to overcome the impact of the economic crisis-"*Pemberdayaan Daerah dalam Mengatasi Dampak Krisis Ekonomi*"(PDM-DKE)	Social Safety nets for poor people from the economic crisis	1997-1999	Agency of National Development Planning (*BAPPENAS)*
4	Sub-district development program-"*program pengembangan kecamatan"* (PPK)	Poverty reduction, local government (sub-district) improvement	1998-2008	World Bank
5	Urban poverty Project-"*Proyek Penanggulangan Kemiskinan di Perkotaan* (P2KP)	Poverty reduction of urban society	1999-2008	Government of Indonesia (GoI) – World Bank
6	Farmer and fisher's increasing income project (P4K)	Income generating program for marginal farmers and fishermen	1990-1996	International Fund for Agricultural Development (IFAD), Bank of Indonesia (BI), the United Nations Development Programme (UNDP) and the Dutch government
7	Economic empowerment for coastal community (PEMP)	SMEs development, institutional strengthen, community empowerment and product diversification	2001-2006	Ministry for Marine Affairs and Fisheries of Indonesia (MMAF of Indonesia)
8	"National program of the community empowerment"	Poverty reduction, capacity building,	2006-2015	World Bank

(PNPM).	community empowerment	

Source: compiled from Bappenas, 1997; 2009; PEMP report, 2007; National plan of PNPM 2006.

Since the last two decades, many types of development projects have been designed and implemented for poverty alleviation, focusing on the sustainable use of coastal resources and enhancement of fisheries livelihood (Idris, 2004), usually consisting of 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). The projects such as 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) have been supported by international donor agencies. Since 2001-2009, there was a special program to empower the economy of coastal communities namely "*Pemberdayaan ekonomi masyarakat pesisir* – the program of coastal community economic empowerment (PEMP)" in Indonesian marine and fisheries during 2001-2009 (Kusnadi *et al*., 2006). Since 2009, GoI through MMAF has promoted PNPM in marine and fisheries sector. This program provides three clusters of poverty alleviation; social protection, community empowerment and small-middle scale enterprise (SMEs) empowerment. These three clusters were seen as previous community empowerment programs. This is indicate the strong commitment of GoI to empower poor people, not only in marine and fisheries sector but also in other sectors and reduce poverty in Indonesia as mandated by the Millennium Development Goals (MDGs).

Table II-4. National program for the community empowerment in marine and fisheries sector of Indonesia

No	Name of the program	Focused of activity	Period	Funding source
1	Marine Resources Evaluation and Planning (MREP)	Improve coastal zone management capacity by using Geographical Information Syatem (GIS)	1993/94–1998/99)	Asian Developme nt Bank (ADB)
2	Segara Anakan Conservation and Development Project (SACDP)	Sustainable fish catches within the Segara Anakan Lagoon	1996	Asian Developme nt Bank (ADB)
3	Coastal Resource Management Project (CRMP)	Decentralize and strengthen coastal resources management in Indonesia	1997-2003	USAID and *BAPPENAS*

4	Coral Reef Rehabilitation and Management Project (COREMAP)	Rehabilitation and conservation of coral reef and related ecosystem	1999-2014	AusAid, GEF, World Bank and ADB
5	Marine and Coastal Resource Management Project (MCRMP)	Management capacity improvement of marine and coastal resource management	2001-2006	ADB
6	"National program of the community empowerment" (PNPM).	Poverty reduction, capacity building, community empowerment	2006-2015	World Bank

Source: compiled from CRMP report 2006; COREMAP, 2010; MCMRP report 2007, ADB, 1999; PNPM fisheries, 2010.

2.6.4. Resilience of coastal communities

Under the context of vulnerability, people pursue their livelihoods with focus on the trends, shocks and seasonal fluctuations in prices, production, health and employment opportunities. The vulnerability of poor people's livelihoods is usually influenced by external factors outside their direct control and is dependent on wider policies, institutions and processes. To support the people in order for them to be more resilient to the negative effects, policy-makers and practitioners can support people's access to assets and ensure responsive policy to their needs (Alinovi *et al*, 2010).

The final goal of various efforts in improving coastal communities is toward "resilience". The simple meaning of resilience is to come back to the previous level of people's condition after being subjected to pressures. However, there are many arguments about resilience from many scientists. For instance, Holling (1973) argued that resilience is originally conceived in the ecological literature, which was re-defined as the relative persistence in complex dynamic systems such as socio-economic systems (Levin *et al*. 1988). There are two options of resilience's concept; first called "engineering" is the ability of the system to return to the equilibrium after agitation (Tilman and Downing, 1994). The other option referring to "ecological" resilience is the magnitude of disturbance that can be absorbed before the system re-defines its structure by changing the variables and processes that control behavior (Walker *et al*., 1969 and Holling, 1973).

There were many scholars also defined resilience in social, economy and ecology. Walker *et al*. (2004) argued that resilience is the capacity of a system to absorb disturbance and re-organize while undergoing change, so it will still retain essentially the same function, structure, identify and feedback. Exactly, community resilience is the capacity of a

community to adapt to, and influence the course of environmental, social, and economic changes. Resilient communities need to be aware of their relation with and dependence on coastal resources and to what extent the degradation of coastal resources puts them at risk. It is an aim for minimizing the loss and maximizing the protection for future uses and benefit (U.S. Indian Ocean Tsunami Warning System Program. 2007).

In fact, there has been many ways conducted as individual, group or institution comeback to the resilience. In Indonesian fishing communities, the fluctuation of fisheries stocks, shifting fishing seasons, and climate change challenges the coastal communities to response to them continuously. Improving coastal livelihoods and coastal management are approaches to achieve resilience in the fishing communities of Indonesia. Diversifying livelihood activities includes diversifying fisheries activities particularly for women or family members and non-fishing activities. Diversification of fisheries activities could improve by developing for example seaweed farming, drying fishes, process value added product based on fishes or other fisheries material. Engaging in the fisheries marketing activity can be an alternative solution in improving livelihoods. During the period of resource decline or off-fishing, not all fishermen could survive in their community. Some of them try to find another job in the city to secure their monthly income. Migration of fishermen to urban areas is usually temporary. They will come back to the fishing community when off-fishing is over.

2.7. Linking between livelihood, common-pool resource management and social resilience

Common-pool resources in many parts in the world provide a critical support to the human and natural life in sustainable way. The countries which based are natural resources exploitation and fisheries have played an important role for economic development in rural and coastal areas. If coastal areas have been managed well, then the coastal resources can contribute to long-term development of local economy as well as national economic growth and to the resilience of livelihoods and food production systems. In contrast, if the coastal resources are degraded to the irreversible point to sustain coastal and fishery livelihoods, fishing communities which have heavy dependence on coastal resources are systematically denied access or displaced. These conditions can also cause horizontal conflict among coastal resource users. “Tragedy of the commons” is the real effect of malpractice in resource management which has been forecasted by many scientists in many years, not only coastal and fishery resources but also for other natural resources. However,

people have not learnt from previous bitter experiences in coastal resource management and some of them still continue to exploit the resources without better control.

Due to the phenomena above, many countries including Indonesia have improved the policy and regulation framework for community-based management of fisheries and coastal management. This is not an instantaneous work to change human behavior into environmentally friendly ones in coastal resources uses. Production demand, poverty, low level of education, law enforcement is some of the major constraints to set up long-term resilience of ecosystems and the economy. Over decades, Indonesia has tried to implement better management in coastal resources. However, they still have problems with commitment and consistency of human behavior in implementing the policy and regulations.

A return to community based management system is the best alternative to manage coastal resources. Successful experiences of community based management in Indonesia can be an example as to how people with traditional ways succeed to manage the resources even in the small-scale. Its existence does not interfere with modernization of fisheries. However, establishment of decentralization policy has the support in improving community based management system and spread to different levels and areas of the country. The collaboration system between community based management and decentralization systems have the power to become good governance in coastal management as long as there is strong commitment among stakeholders.

Besides that, livelihoods strategy can be added into management system as a tool to improve community participation and capacity building of the fishing society. Coastal resource management cannot leave the economic matters of people. Developing alternative livelihood can use local resources. In the fishing community, culture fishery can be an alternative when fishing production has been decreased, or collaboration between two activities, for examples culture fisheries and capture fisheries, fisheries activities and non-fisheries activities etc. This is namely double strategy as part of adaptive strategies of fishermen to sustain their household economic and livelihood activities.

CHAPTER III

METHODOLOGY

Detailed geographical information on the research field, primary and secondary data collected are firstly described below, and methodology adopted in this dissertation will be discussed in depth.

3.1. Study area

A series of studies were conducted in the eastern part of Indonesia (Figure III-1), namely: Takalar District and Jeneponto District in South Sulawesi Province, and Jembrana District in Bali Province. One village was selected from Takalar District, while three villages were selected from Jeneponto District. In Bali, one village namely Pengambengan Village was selected from Jembrana District.

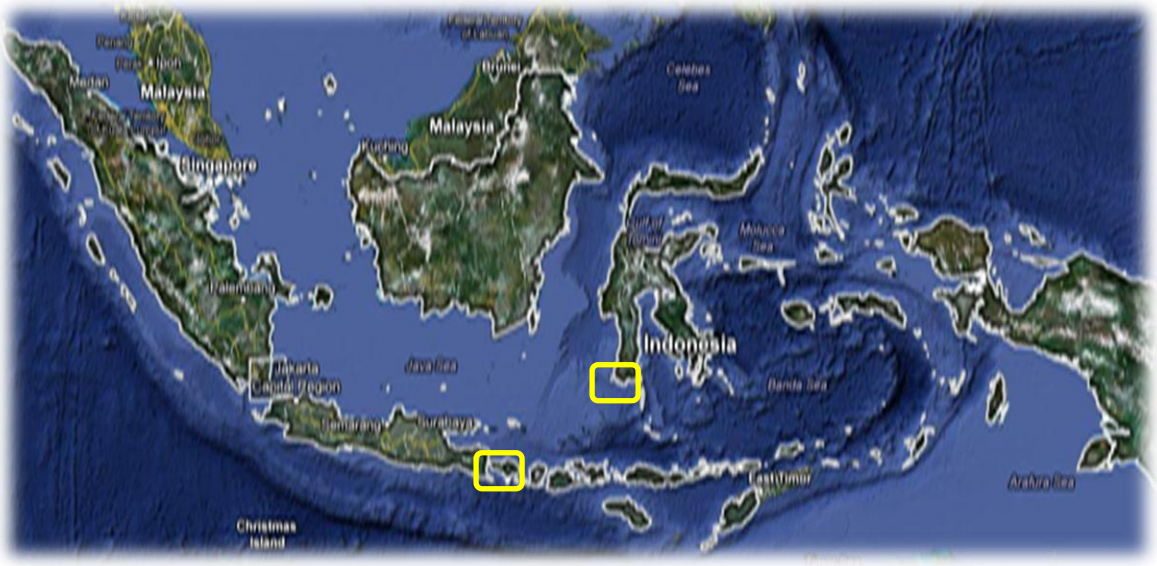


Figure III-1. Map of Indonesia with two study areas
Source: www.maps.google.com

3.1.1. Study area in South Sulawesi Province

A survey was conducted in South Sulawesi Province in the eastern part of Indonesia, in order to provide data for the study. Two districts, Takalar and Jeneponto, were chosen for sampling. The survey covered four villages, one village in Takalar District and three villages in Jeneponto District. These villages are representative of coastal communities in Laikang Bay that host active fishermen. Laikang Bay connects these two districts, which influence one another (Figure III-2).

Figure III-2. Study location at South Sulawesi Province

Source: www.maps.google.com

South Sulawesi Province is located in the southernmost part of Sulawesi Island between S $0^{o}12'$ – 8' and from E $116^{o}48'$ up to E $122^{o}36'$. Makassar City is the capital city of South Sulawesi Province. The average daily temperature in Makassar fluctuates between $22^{o}C$ and $33^{o}C$. Takalar District is located on the south side of South Sulawesi Province. This district has a land area of 566.51 km^2, which is bounded by Gowa District (N), Gowa District and Jeneponto District (E), Flores Sea (S) and Makassar Strait (W) (Marine and fisheries office of Takalar-(DKP) and Narayana Adicipta Persero, 2007, unpublished).

Interviews were planned and conducted in Laikang Village which is located in Mangarabombang Sub-District. Laikang village has an area of 19.6 km^2 with a population of 4,139 or 12% of the total population of the sub-district (35,526 people). Its population density is about 211 people / km^2. Most of the people work in fisheries, and some work in agriculture. Laikang village is rich in natural resources like fisheries, agriculture and tourism sectors which largely contribute to the economic development of the village. However, lack of development of fisheries infrastructure and public transportation hampered the economic development of the coastal villages.

Jeneponto District is the second study area which is located in the western part of South Sulawesi Province with area 749.79 km^2. It is bounded by Gowa District (N), the Flores

Sea (S), Takalar District (W) and Bantaeng (E). The population of 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.

There are several reasons to select these study locations. First, South Sulawesi Province is the largest producer of seaweed (wet/dry) in Indonesia. Second, Takalar and Jeneponto Districts in South Sulawesi were selected purposively due to their linkages to fisheries activities at Laikang Bay area. Third, both districts are included for development of seaweed farming. Fourth, the fishermen cultivate same species of seaweed (*Eucheuma cottonii*) in both Takalar and Jeneponto Districts. Fifth, there are different environmental characteristics that can supplement each other in planting time during two monsoon seasons of the year.

3.1.2. Study area in Jembrana district, Bali Province

Jembrana District consists of 5 districts, namely: Melaya Sub-District (19.719 Ha), Negara Sub-District (12.650 Ha), Jembrana Sub-District (9.397 Ha) Mendoyo Sub-District (29.449 Ha) and Pekutatan Sub-District (12.965 Ha). The total area is 841.80 km^2 with the population density reaching 310.81 persons/km^2 and Negara District is the most densely populated with 615 persons/km^2. The number of family unit is 72,710 with an average of 3 to 4 persons per family unit. During 2000 - 2010, the rate of population growth in Jembrana was 1.22%. The district is located in 8^o09'30"- 8^o28'02" S and 114^o25'53"-114^o56'38" and north border is Buleleng; south border is the Indian Ocean; west border is the Bali Strait and the east border is Tabanan Regency (BPS Jembrana District, 2010a). Jembrana District has the authority to manage about 604, 24 km^2 sea area.

This study was conducted at Pangembengan Village, Negara sub-district, Jembrana District in the Province of Bali. This is due to the multiplier effects of fisheries activity in Bali Strait to Pengambengan Village. Besides Muncar (East Java), Pangembengan is also the landing site of the fishermen using purse seine with Lemuru as their main catch. The catch landed at Pangembengan is also aimed to supply the fishery industry with *Sardinella lemuru* as one of the products (Figure III-3).

Table III-1. Number of population, density and family units in the coastal village of Negara Sub District, 2010

Village	Area (km^2)	Population	Total of households	Density per km^2	Average per household
Cupel	6.40	3,692	1,020	393	4
Tegal Badeng Barat	4.02	4,574	1,225	254	4
Tegal Badeng Timur	6.01	3,577	986	347	4
Pengambengan	***10.30***	***10,251***	***3,208***	***995***	***3***
Loloan Barat	1.47	3,684	1,080	94	3
Lelateng	6.29	8,416	2,792	1,315	3
Banjar Tengah	4.98	4,073	1,070	386	4
Baluk	10.55	5,989	1,712	997	3
Banyu Biru	9.39	7,304	2,135	4,969	3
Kaliakah	17.99	7,564	2,050	1,203	4
Berangbang	39.13	6,192	1,774	1,540	3
Baler Bale Agung	9.97	10,263	2,707	1,029	4

Source: BPS Jembrana District, 2010

Figure III-3. Study location at Pengambengan Village, Jembrana district, Bali Province (Source: www.maps.google.com)

There are three main reasons to select Jembrana district as a study site; 1) the fish production (catch) has significantly decreased, 2) small-scale fishermen with low-income continuously dominate the fishing community, 3) fishing effort alone in Bali is hardly able to sustain economic activities in the near future. Based on the above reasons, identification of the success/failure factors in developing fisheries livelihood is needed to achieve sustainable development of coastal areas. Table III-2 below shows the characteristics of three study areas in South Sulawesi and Bali, Indonesia.

Table III-2. Summary of study areas characteristics and information

Description	Study areas		
	Takalar	Jeneponto	Jembrana
Geographic	5°3' - 5°38' S and 119°22' up to 119°39' E.	$5^0$16'13" – $5^0$39'35" S and $12^0$40'19" up to $12^0$7'51" E.	08°23'46" S and 114o34'47" E
Area	566.51 Km^2	749.79 Km^2	995 km^2
Population	252,270	324,928	10,251
Fishermen	- 56.43 %	50.98%	56.1 %
Employment	- Agriculture, fisheries, processing industry, mining, and public services	Agriculture, Fisheries, Forestry/farm, trade and public services	34% of total population work in the fisheries
Rainfall	896 mm/yr.	1000 – 1250 mm/yr.	1750 mm/yr.
RGDP	223,379.35 USD	247,119.56 USD	1,494.772 USD
Temperature (°C)	22 – 34	25 – 32	20 – 39

Source: BPS of South Sulawesi, 2010; DKP of South Sulawesi, 2010.

3.2. Survey procedure

Data collection was conducted during three periods: August to September 2010, February to March 2011, and November 2011. Two provinces were covered as study sites during these periods. Interviews were conducted by using structured and semi-structured questionnaires, by using qualitative and quantitative questions including open and close ones. In South Sulawesi, fishermen/seaweed farmers, fishermen's wife, seaweed trader/collector, seaweed exporter, seaweed processing company, local fisheries officers were included as respondents. Meanwhile, the respondents in Bali Province were fishermen, fish collector, owner of purse seine boat, fish trader, and fish processing. Staffs of marine and fisheries office Bali Province and Jembrana District, head of village and selected local NGOs were interviewed as key informants. Pre-test questionnaires have been applied to several fishermen before the real interview.

Survey in Bali Strait was aimed to assess the impact of fisheries resource depletion particularly for *Sardinella lemuru* (*SL*) or Bali *sardinella* as a native resource of this area. Adaptation pattern of fishermen who engaged in purse seine against the fish crisis has been investigated in Takalar District (South Sulawesi province). Possible solutions are expected to be found from the cross-cases of these two study areas.

3.3. Data Collection

3.3.1. Primary data

Interviews were conducted basically using in-depth and face-to-face interviews, and additionally email, phone and online networks were used to obtain more detailed information. Group discussions were also designed and implemented to explore the perceptions of fishermen of the development of seaweed farming and other fishery activities. In Takalar and Jeneponto, the total samples were collected from 200 fishermen/seaweed farmers; 20 respondents from local fisheries officers, collector/seaweed traders, exporters, processing companies; coastal woman/fishermen's wife. Representatives of 11 different stakeholders were interviewed too.

Random sampling method was adopted. In Jembrana District of Bali Province, the samples were collected from 30 fishermen (13 crews, 2 boat drivers, 2 engineers, 4 haul porters, fishing masters, 3 fish traders, and 3 boat owners), 7 local fisheries officers and fish collectors.

3.3.2. Secondary data

At the central government level, secondary data were collected mainly from the Ministry for Marine and Fisheries (MMAF), Republic of Indonesia. At the local level, the data were collected from the Marine Affairs and Fisheries service office of Province (DKP-province) and the Marine Affairs and Fisheries service offices of the district (DKP-district) both Bali province and South Sulawesi Province, village offices and research institutes, and universities. Statistics data, published books, scientific journals and other resources which were related to the research topic were also collected. The pictures were taken by camera to provide documentation of the survey activities such as observation, interview, figure of village environment, fisher's activity and so on.

3.4. Data analysis tools

This study adopted several types of analysis tools: 1) descriptive analysis, 2) Likert type scale analysis, 3) benefit-cost analysis, 4) SWOT analysis, 5) comparative analysis, and 6) qualitative contents analysis.

3.4.1. Descriptive analysis

Descriptive analysis will focus on socio economic condition of respondents and the research locations, participation of community and livelihood. Descriptive statistics is the

branch of statistics that focuses on collecting, summarizing and presenting a set of data (Levine and Stephan, 2005). Descriptive statistics essentially aimed to provide a better understanding of how frequent the data value is, and of how much variability there is around a typical value in the data (Fernandes, 2009). The results obtained from field observation, key informants opinions, and informal investigations were used to support the analysis.

Descriptive analysis includes frequency distribution, mean, and standard of deviation. Mean is a number equal to the sum of the data values for a variable, divided by the number of data values that were summed. Frequency distribution is a summary of the frequency of individual values or ranges of values for a variable.

3.4.2. A Likert type scale analysis

A Likert type scale analysis is a psychometric response scale primarily used in questionnaires to obtain participant's preferences or degree of agreement with a statement or set of statements. Likert scales are a non-comparative scaling technique and are one-dimensional (only measure a single trait) in nature. Respondents are asked to indicate their level of agreement with a given statement by way of an ordinal scale.

A Likert type scale analysis is used to analyze perception of fishermen of seaweed farming development, to analyze the level of obstacles in developing seaweed farming, and to analyze participation of multi-stakeholders at local level in developing seaweed farming.

3.4.3. Cost- Benefit analysis (CBA)

Cost- Benefit Analysis (CBA) is an economic technique used to evaluate a project of investment over time. This technique also compares the characteristics of set of projects. CBA is conducted by comparing economic benefits of an activity with economic costs of an activity. As a tool for economic analysis, CBA seeks to examine potential actions for increasing well-being. It is also seeking an activity or use that provides greater benefit than cost or among competitors. Although CBA cannot make decisions of the projects alone, but can be used for providing information on economic features of projects activities. CBA is used to analyze the economics of selected fisheries activities. This study focuses on the cost components and revenues of selected activities.

3.4.4. SWOT analysis

SWOT analysis is used to identify Strengths (S) and Weaknesses (W), and for examining the Opportunities (O) and Threats (T) that may be present. The SWOT analysis stands for the analysis of internal strengths and weaknesses of an operation and external opportunities and threats to the operation. Strengths are the first element of a SWOT analysis describing the strengths of an operation. These strengths include what an operation does well, and should be viewed from both points of view.

Weaknesses are the other internal element of the SWOT analysis describing the weaknesses of an operation. Examining weaknesses include identifying what an operation does not do well. With reference to the strengths, weaknesses should be examined from both perspectives and from the perspectives of those outside the operation. It is also possible for weaknesses to be obvious such as a limitation of resources or be more of a perspective issue. Opportunities are the external factor of SWOT that includes any favorable situation. Threats are the final factor of SWOT analysis that an operation faces (Chapman, 2007). In this study, SWOT analysis is used to formulize the strategies for developing livelihood activities such as seaweed farming and selected capture fisheries activity.

3.4.5. Comparative analysis

In this study, comparative analysis is used to compare between cost and income of several fisheries livelihoods activities particularly capture fisheries using different fishing gears and seaweed culture. Comparative analysis is also used to compare adaptation pattern of coastal communities in Bali and South Sulawesi against the fish crisis situation and decreasing production of fishes.

3.4.6. Qualitative contents analysis

Content analysis is a research method for making replicable and valid inferences from data to their context, with the purpose of providing knowledge, new insights, a representation of facts and practical guide to action (Krippendorff, 1980). Elo and Kyngas (2007) defined it as a method that may be used with either qualitative or quantitative data and in an inductive or deductive way. Deductive content analysis is used when the structure of analysis is operationalized on the basis of previous knowledge for the theory being tested (Kyngas and Vanhanen, 1999). Inductive content analysis is based on data movements from the specific to the general, and then particular instances are observed and then

combined into a larger whole of general statement (Chinn and Kramer, 1999). Content analysis does not proceed in a linear method and is more complex and difficult than quantitative analysis because it is less standardized and systematic (Polit and Beck, 2004).

Qualitative contents analysis is used to analyze the contents of policy for fisheries management in Bali Strait. Joint agreements between East Java Province and Bali Province have changed five times after its inception. The essence of these policies would be picked up and discussed by using this analytical tool.

CHAPTER IV

EXPLORING SOCIO-ECONOMIC IMPACT OF OVERPRESSURE OF INDONESIAN CAPTURE FISHERIES:

Case study of Purse seine fishery in Bali Strait

4.1. Introduction

The water of the Bali Strait provided 70% of the total national production of *Sardinella Lemuru* (*SL*). Most of the communities in Bali (Pengambengan) and East Java (Muncar) derived their main income from fishery resources. However, the production decreased drastically from 2010 to mid-2011. At that time, purse seine boats could no longer operate because the stock of *SL* was depleted from the waters of the Bali Strait. Consequently, fishermen, boat owners, captains, fish traders and fish processing industries relying on Bali Strait resources were forced to stop their activities during this period. Fishing boats with purse seine gear operating in the Bali Strait employed advanced technology which required a large capital. According to Berkes et al. (2001), the fish resources became rapidly depleted when the fishing units that used high technology entered the open-access fisheries. Therefore, the economic activities associated with fisheries have nearly stopped.

SL is the main product of capture fisheries in the Jembrana District on Bali Island. The production of *SL* has been highly fluctuating and unpredictable in the previous 35 years (1974-2009). Data showed that the lowest landed production was 5,000 tons and the highest production was 80,000 tons with an annual average of approximately 35,000 tons (Jaya, 2011). During 2000-2004, there were migratory fishermen from outside the Bali Strait, such as Tuban (another district in East Java), who employed purse seine gear. Johnson and Orbach (1990) mention economic and occupational opportunities as among the main reasons for migrating to other coastal areas. Since 2000-2004, fishing gear and boats became more uncontrolled and affected the status of *SL* in the fishing grounds. In 2008, the catch of *SL* continued to decline and completely disappeared from the waters of the Bali Strait. The fishermen did not know when *SL* would return to the Bali Strait. This situation upset not only the economic fishing activity but also the businesses related to fish canning or boiled fish in Pengembangan.

The fishing industry of the Bali Strait has attracted the attention of many researchers since 1971 who conducted various studies related to fish biology, fisheries management,

acoustic surveys, TAC (total available catch), and fish population dynamics and problems. A purse seine fishery in the Bali Strait has been regulated by a joint governor decree (JGD) between the Governors of the Provinces of East Java and Bali and has been amended four times. Based on the decrees no. 238/1992 and 674/1992, the purse seine vessel quota for the Bali region is established at 83 and 190 units for the East Java region. However, the current conditions show that the number of purse seine fishing catches landed in the Pengambengan Fishery Nusantara Port (PFNP) has exceeded the capacity established by the decree (Setyohadi, unpublished). Previous studies have recommended that fishing in the Bali Strait should be controlled by regulating the fishing net mesh size and reducing the number of purse seine vessels. Currently, it has been difficult to implement the JGD issued by the East Java and Bali governors.

The fish resource crisis in the Bali Strait appears to continue over time and there is an urgent necessity for more serious efforts to solve the problem. It was emphasized by Roughgarden and Smith (1996) that the collapse of resources, such as fisheries, can lead to an ecologically unstable and costly management. Based on these reasons, this study had several aims: (1) to analyze the socio-economic conditions of fishermen during the "crisis" and their adaptation efforts, (2) to evaluate the effectiveness of fishery management policies in the Bali Strait as reflected by the current conditions, and (3) to identify the problems in controlling and managing the fish resources of the Bali Strait.

4.2. Methodology

4.2.1. Research location

This study was conducted in the Pengembengan Village, Negara sub-district, Jembrana district in the province of Bali. This village was chosen because it is directly affected by the changing fishery industry in the Bali Strait. Moreover, “Muncar and Pengembengan” are major landing sites for fishermen using purse seine with *SL* as their main catch.

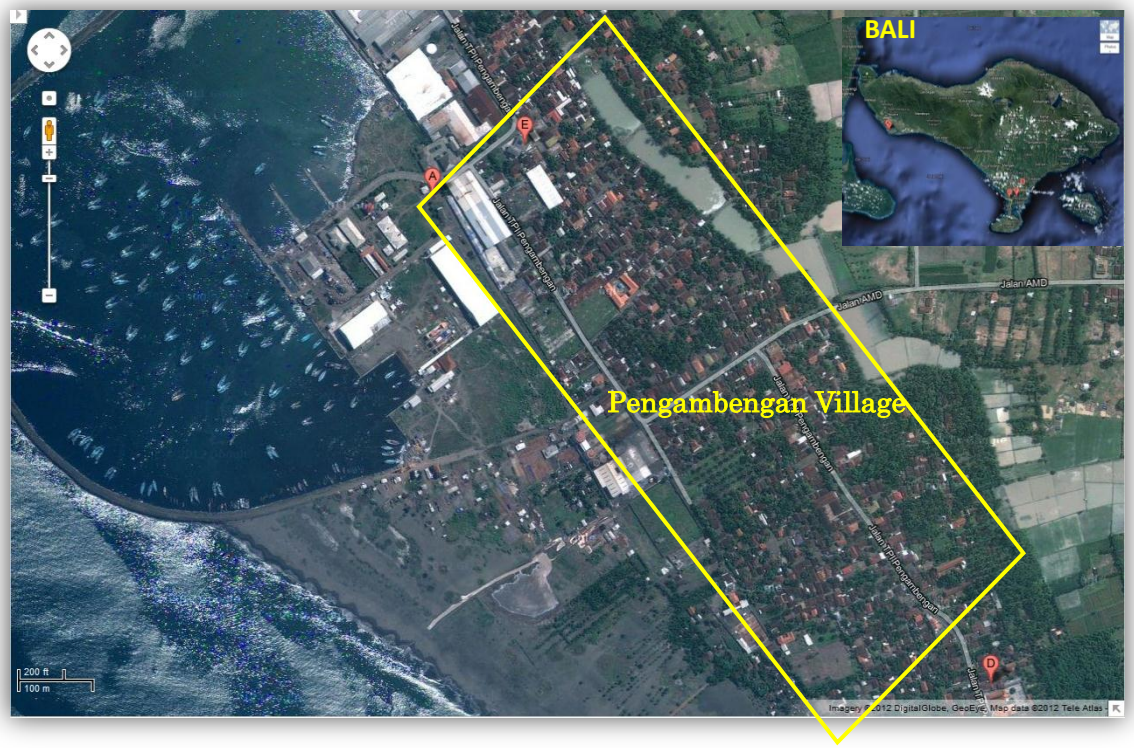


Figure IV-1. A map of Pengambengan village in the Jembrana district.

Source: www.maps.google.com

The Jembrana district consists of 5 sub-districts: Melaya sub-district (197.19 km^2), Negara sub-district (126.50 km^2), Jembrana sub-district (93.97 km^2), Mendoyo sub-district (294.49 km^2) and Pekutatan sub-district (129.65 km^2). The total area is 841.80 km^2 with a population density of 310.81 persons/km^2. The Negara sub-district is the most densely populated with 615 persons/km^2. The number of family units is 72.710 with an average of 3 to 4 people per family unit. During 2000-2010, the rate of population growth in Jembrana was 1.22%. The district is located between 8°09'30"- 8°28'02" S and 114°25'53"-114°56'38" E. Buleleng is on the north, the Indonesian Ocean is on the south, the Bali Strait is on the west and the Tabanan Regency is on the east (BPS Jembrana District, 2010a). The Jembrana district has jurisdiction over approximately 604. 24 km^2 of sea area and is responsible for the implementation of fishery and marine conservation laws.

The study site is Pengambengan village located at 08°23'46" S and 114°34'47" E with a land area of 10.30 km^2. The population is 10,251 and 3,208 family units with a population density of 995 per km^2 and an average of 3 members per family unit. Altogether, 34% (3,490) of the total population works in the field of fisheries, whereas others work on farms, plantations, in trade, industry, government, etc. Pengambengan is one of the villages in the

Negara district, which is located 0-125 m above sea level and has approximately 179.5 mm rainfall for 11 days/month. In the north, Pengambengan borders with Tegal Badeng Village, the eastern area borders with Perancak Village, the western area borders with Tegal Badeng Village and the southern area borders with the Bali Strait (BPS Jembrana District, 2010b).

Table IV-1. The population, density and family units in the coastal village of the Negara sub district, 2010.

Village	Area (km^2)	Population	Total of households	Density per km^2	Average per household
Cupel	6.40	3,692	1,020	393	4
Tegal Badeng Barat	4.02	4,574	1,225	254	4
Tegal Badeng Timur	6.01	3,577	986	347	4
Pengambengan	**10.30**	**10,251**	**3,208**	**995**	**3**
Loloan Barat	1.47	3,684	1,080	94	3
Lelateng	6.29	8,416	2,792	1,315	3
Banjar Tengah	4.98	4,073	1,070	386	4
Baluk	10.55	5,989	1,712	997	3
Banyu Biru	9.39	7,304	2,135	4,969	3
Kaliakah	17.99	7,564	2,050	1,203	4
Berangbang	39.13	6,192	1,774	1,540	3
Baler Bale Agung	9.97	10,263	2,707	1,029	4

Source: BPS Jembrana District, 2010b

Pengambengan is the site for the *SL* fishery in the Jembrana district and has the densest population of fishermen. Therefore, the interview was focused in this village.

4.2.2. Data collection

Data were collected by using a socio-economic survey method. Interviews with the fishermen were performed with using structured and semi-structured questionnaires. The respondents were obtained from among the crews of purse seine vessels because they were the individuals who caused the highest effect because of the decline of fish resources in the Bali Strait. Some boat owners were also interviewed to determine the condition of their company and the company's efforts in overcoming problems. The captain or fishing master and fish traders was also interviewed. This study involved 30 respondents: thirteen purse seine boat crews, two captains, two engineers, four haul porters, three fishing masters, three merchants and three ship owners.

Secondary data were also collected in this study, including statistical data and the results of previous studies, which provided preliminary information and the data obtained from fish production in the Pengambengan Nusantara Fishery Port (PNFP).

4.2.3. Data analysis

The data were analyzed by descriptive statistics to describe the frequencies, means and standard deviations. Content analyses were used to analyze the changes of fishery management policies for the Bali Strait. The data were analyzed by using descriptive analysis, comparative analysis and qualitative contents analysis were used to describe the structure of the fishermen, their adaptation strategies and other fishery actors in the fisheries' activities toward resilience.

4.3. Results and Discussions

4.3.1 Fishermen activity in purse seine fisheries

Currently, the number of fishermen in Pengambengan is approximately 2114, consist of 71 are the owners of purse seine boats and categorized into 240 units of purse seine boat or 120 boat pairs. The fishermen working on the purse seine boats, particularly in Pengambengan, are divided into several levels: captain or fishing master, engineer, towing weights, buoy pullers and towing nets. The crews who carried the fish from fishing boat to fish auction and the crews who in charge of drained fish tanks were included as fishermen on board. Fishermen in Jembrana are divided into 3 types: full-time fishermen, part-time fishermen (major) and part-time fishermen (minor) (Figure IV-2). In addition, there is a steward or organizer who is responsible for preparing all of the requirements and maintenance of the purse seine nets and boats (Figure IV-3).

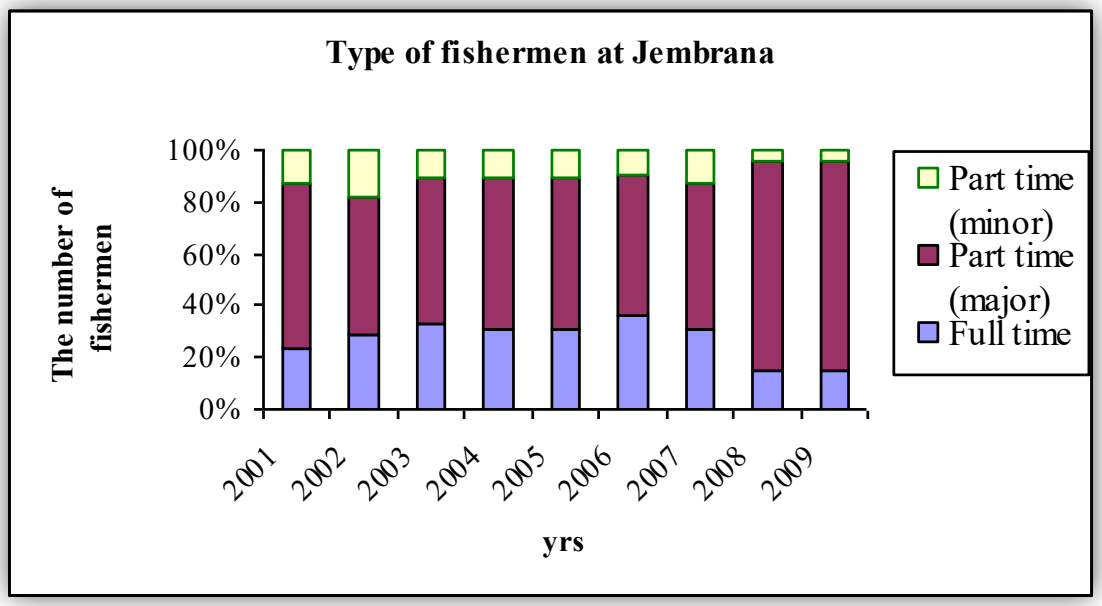


Figure IV-2. The number of three fishermen types (crew) at Pengambengan.

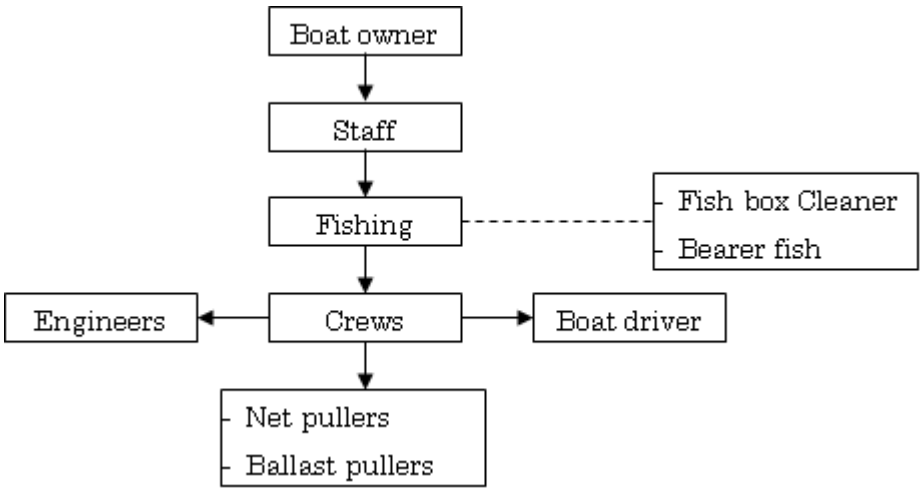


Figure IV-3. The organizational structure of purse seine fishery

Organizational structure of purse seine fishery structure has been influenced by the profit-sharing system. Based on the results of interviews with ship owners and managers, the catch of fish (production) is reduced by the operational cost expenses and is then divided into 2 equal portions. The first portion is given to the owner of the boat, and the remaining portion was given to the crew including the captain. The fish caught is divided among each crew member based on their job level. The fishing master receives three points; the storage tank drainers receive one point; the boat driver receives two points; the engineer receives two points; the towing tin (ballast) receives two points, and the towing

buoys and regular crew receive one point. Beside the division of the profits or catch, each crew member receives fish (approximately 25 kg) to take home for family meals. The fishermen do not usually bring home all the fish, and there are those individuals that sell back to the trader or collector.

The above division automatically determines the income for each crew member. The harvest season (peak season) and low season (off season) also affects the amount of income for the fishermen (Table IV-2).

Table IV-2. The income of the fishermen in two fishing seasons[13].

Status of fishermen	Monthly income (sharing-benefit) (USD)	
	Peak season	Low season
Owners	75,057.7 to 92,378.7	28,868.4 to 57,736.7
Fishing master/captain	7,794.5	6,772.5
Boat driver	360.8	73.6
Engineer	288.7	58.9
Net puller	216.5	44.2
Ballast puller	288.7	58.9
Ordinary crew	144.3	26.0
Fish box cleaner	144.3	26.0
Bearer fish	389.7	338.6

Source: Primary data processed, 2011

The income of the ordinary crews is small. There is a large difference between the income of the fishing master and ordinary crew. The "gap" is caused by granting higher salaries because the boat owner has difficulty in hiring a captain or fishing master. The absence of a fishing master has led fishermen with high capabilities to demand higher salaries. This shortage occurs because the purse seine boats grow and produce rapidly, while the number of fishing master is limited at local fishing community. Simultaneously, the captain is also responsible for recruiting fishermen as boat crew. The captain uses this reasoning as leverage to demand a higher salary from the boat owner.

A purse seine net is a pelagic fishing trap operated during a cloudy moon by circling schools of fish with or without a torch. In normal conditions, the purse seine boats operate approximately 21-23 days per month or 255 days per year within a one-day fishing trip. The major fishing gear used in the Bali Strait is the purse seine nets with the boat approximately 5-30 gross ton (GT). Other fishing gear is the *payang* for the boat 10-15 GT and gillnet for the boat 2-3 GT. Fishing activity with purse seine nets uses the "active

[13] The interview data in the table above are from purse-seiners, such as the boat owner, crews, fishing master and crew, with particular tasks. The data averages are then obtained in the current condition.

method" (local name called: *gadangan*) in which the fishing operations are performed by a two boat system and one-day trip system. The boats typically travel to the fishing ground at approximately 1 p.m. and return to the port at 4 a.m. The first boat is called a 'purse seine boat' and the second is called an 'encircle'. In Pengambengan, the first boat has an average size of 9.18 m long, 4.71 m wide and a depth of 1.65 m with a 69.1 HP engine. The second boat is an average of 20.3 m long, 5.17 wide and 1.81 m in depth with a 115.9 HP engine. Figure IV-4 shows the two coupled purse seine boats in Pengambengan.

Figure IV-4. Two couples of purse seine boats in Pengambengan.

The purse seine nets in Pengambengan are between 190 and 500 m in size and between 60 and 75 m deep. The net has a mesh size of 1 to 0.75 inches and a net loss for the shaped bag (bunt)[14]. The one-unit purse seine boats (2 boats) required 39 to 42 fishing crew members (Figure IV-5).

The adoption of purse seine nets in the Bali Strait in 1974 not only increased the number of boat ownerships but also increased the utilization of the purse seine. There are two kinds of fishing techniques using the purse seine net in Pengambengan, namely 'active method' (local name called: *gadangan*) and 'passive method' (local name called: *Tangkauan*). The first technique involves fishing boats that actively look for schools of fish. The second technique (passive) is fishing using light tools (torch) to attract or collect fish. In the second technique, 4-6 lights bulbs are required for a small boat. The net is deployed near the water

[14] Purse seine nets constructed of nylon multifilament PA. The wing nets use yarn number PA 210 D/6 and 210/D9, the net body uses thread and 210/D12 210/D9 PA numbered, the part numbered bag uses yarn 210/D12 PA, 210/D14 and 210/D15.

surface while the boat waits until the fish approach. The net is then dropped down to trap the schools of fish, and the string is pulled until the opening is covered by the fisherman (Figure IV-6).

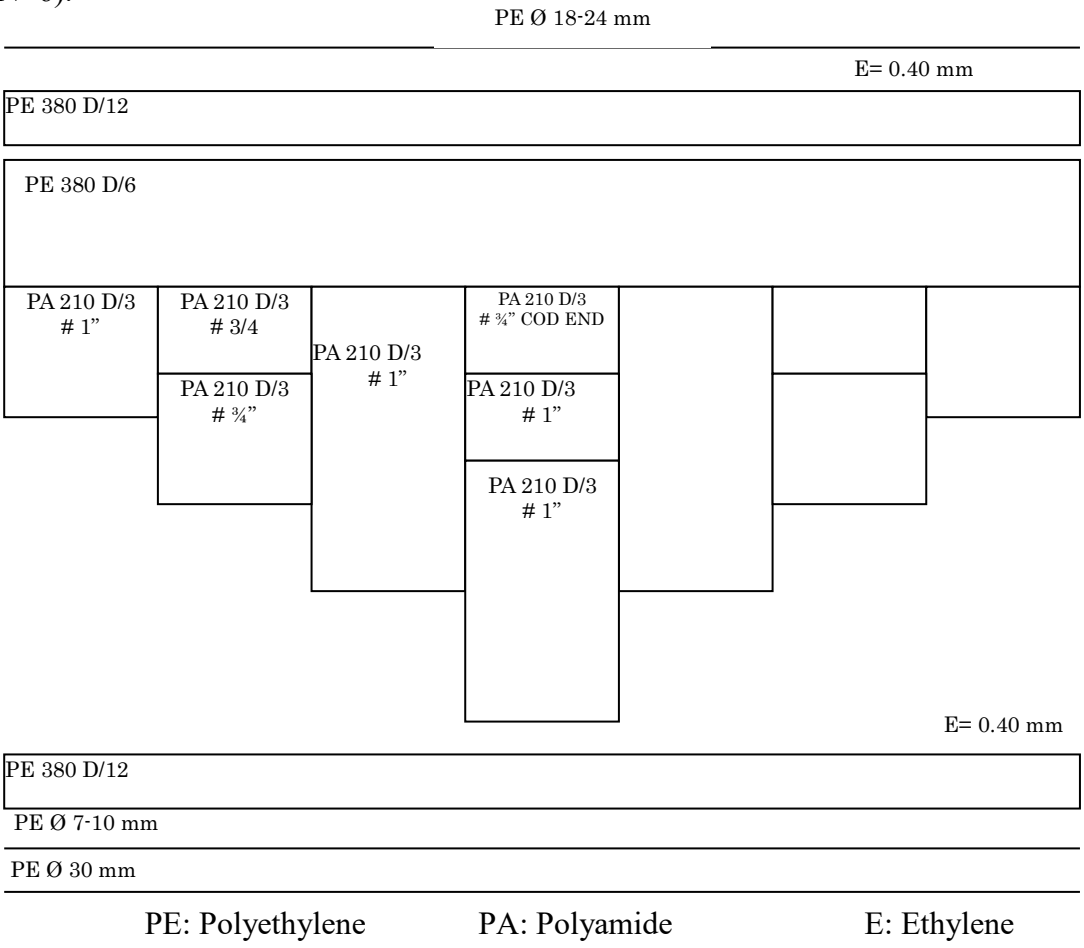


Figure IV-5. The structure of purse seine net operated in Pengambengan

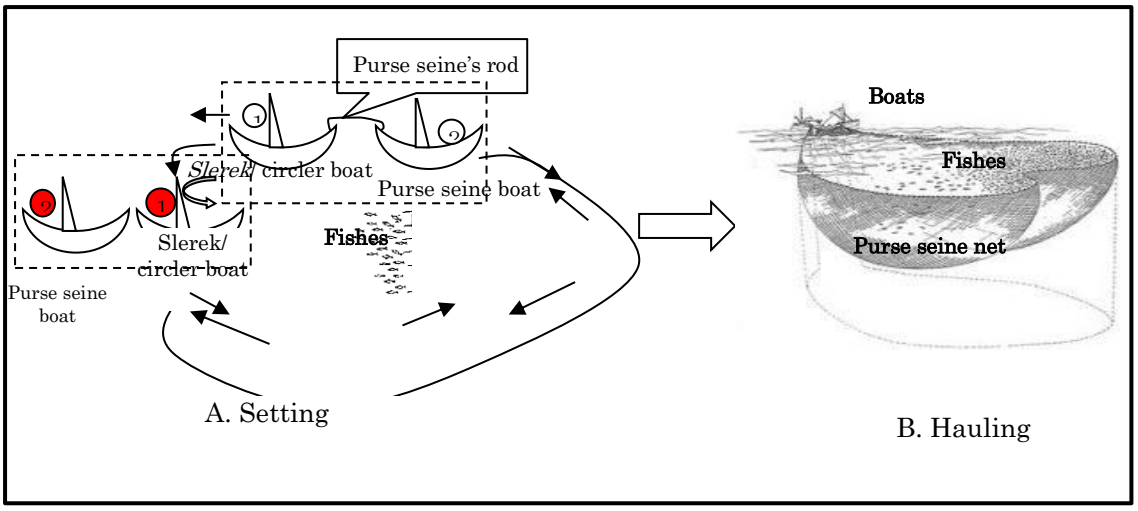


Figure IV-6. The operational method of purse seine by using two boats on board.

4.3.2 The current status of the resources in the Bali Strait and their effect.

Fishing activity for *SL* in the Bali Strait has developed rapidly after the purse seine fishing gear was introduced in 1974 to the fishermen in the Bali Strait and the fishermen of Banyuwangi (Java side) and Pengambengan (Bali side) (Mertha *et al*. 2000). *SL* is the dominant species caught in Pengambengan, and other species include the fringed scale sardinella, fimbriated sardine, scads, Indo-Pacific mackerel, pony slip mouth fishes, eastern little buds, hair tails, and little buds (Table IV-3).

Table IV-3. Species of fishes caught in the Bali Strait.

No	Local Name	Common Name	Selling Name	Species
1	*Teri*	*Lemuru*	Indian oil sardinella	*Clupea longlcesp (C.V) Sardinella longiceps Sardinella lemuru*
2	*Teri tanjan*	*Tembang*	Fringe scale sardinella Fimbriated sardine	*Sardinella fimriata (Val.) Spratella fimbriata Clupea perforate*
3	*Layang*		Scads	*Decapterus russell! (Rupp) Decapterus macrosoma*
4	*Medahi, lemaren, kembung*	*Kembung*	Indo pacific mackerel	*Rastrelliger neglectus*
5	*Petek, Perek, polipo*	*Petek*	Pony fishes Slip mouths	*Leiognathus insidiotor (Bloch) Ctenops vittatus (C.V)*
6	*Tongkol*	*Tongkol*	Eastern little tunas	*Euthynnus pelamys (L) Euthynnus affinis (Cantor)*
7	*Layur*	*Layur*	Hair tails	*Trichiurus savala (Cuv) Trichiurus haumela (Forsk) Trichiurus mutikus (C.V)*
8	*Selar*	*Selar*	Travallies	*Selar spp Sefaroides spp*
9	*Slengseng*	*Slengseng*	Little tunas	*Euthynnus spp.*
10	*Golok-golok*	*Golok-golok*	Wolf herring	*Chiroectrus dorab (Forsk)*

Source: MMAF, 2004

The *SL* production in the Bali Strait is divided into three areas: the Badung district (Bali), Jembrana district (Bali) and Muncar district (East Java). During 1999-2004, the Jembrana and Muncar districts were the biggest producers of *SL* with an average production of 49% (13,576.91 ton) and 47% (13,099.65 ton), respectively, of the total catch. However, the *SL* production in the Bali Strait fluctuates annually, particularly in the Jembrana District (Figure IV-7).

Sardinella lemuru

Scad

Longtail tuna

Striped bonito

Figure IV-7. Main species of fishes landed at Pengambengan fishing port

The fishing activity in the Bali Strait is characterized as a multi-species and multi-gear activity. For instance, *SL* is caught using multi-fishing gear; therefore, one gear can catch more than one type of fish. Some fishing gears used in the Bali Strait include the purse seine, payang, beach seine, gillnet and bagan. According to Mertha (1992), *SL* is divided into 3 groups according to their size: the total length <5 cm (*sempenit*), TL 5-12 cm (*protolan*) and TL>12 cm (*kucing*).

Open-access and common property are characteristics of the ocean that require special measures for regulated access (Costanza, 1999). The fishing ground in the Bali Strait is divided into the East Java and Bali regions. The Java region includes Banyuwangi, which start from the ferry port south of Banyuwangi, where the Muncar fish landing base is located. This region includes the village of Senggrong, Klosot, and Karangente. The Bali region is covering the southern section of the Bali water area until Jembrana with a fish landing based at Pengambengan. This region consists of Pengambengan, Seseh, Tabanan, Jimbaran and Uluwatu. The names of the areas were given by the fishermen for generations based on the names of the nearest landmarks such as headlands, bays or other markers (Figure IV-8).

According to Branch (2008), the fisheries may never have collapsed and they may have recovered from collapse. In the case of fisheries in the Bali Strait, *SL* appears to have disappeared from the Bali Strait water area from 2010 to mid-2011. This disappearance has

affected the production and marketing of fish activity, particularly for *SL*, as the main source of raw material for the fish processing plants in Pengambengan and Muncar. These conditions also occurred in 1976 - 1983, 1984 - 1986, and 1991 – 2006, in which a decline in production occurred. It was assumed to have occurred because of the climate change from El Nino and La Nina phenomena (Ghofar *et al*., 2000 and Merta *et al*, 2000).

Wudianto (unpublished) argues that the decline in *SL* production in the Bali Strait is caused by the migration of *SL* to deeper water and out of the reach of fishermen. In 2011, it was reported that the number of mackerel scad, Indian mackerel, spotted chub mackerel, and eastern little tuna are more than Bali *sardinella*. Worm *et al*. (2006) also argued that rates of the resource collapse increased and potential, stability and water quality decreased sharply with declining biodiversity. In the Bali Strait, the decline in SL is an anomaly because the Bali *sardinella* or *SL* is more prevalent. Varjopuro *et al*. (2008) stated that the crises in the stock and negative reputation of the ecosystem have caused society more concern for the ecosystem. Recently, stakeholders of Bali *Sardinella* showed more concern toward the Bali ecosystem by looking for causes as to why *Sardinella* occasionally disappeared.

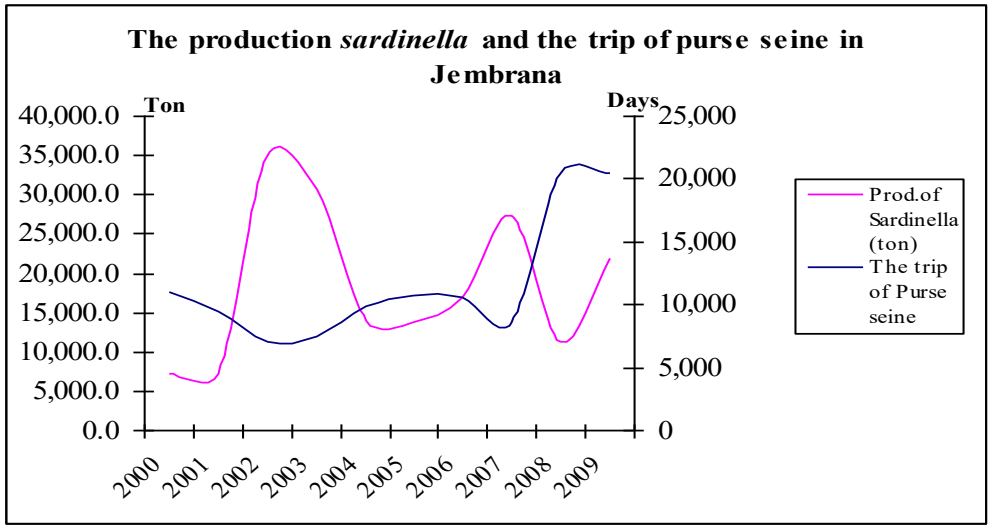


Figure IV-8. The production trend of *SL* and a fishing trip in Pengambengan, the Jembrana district, Bali.

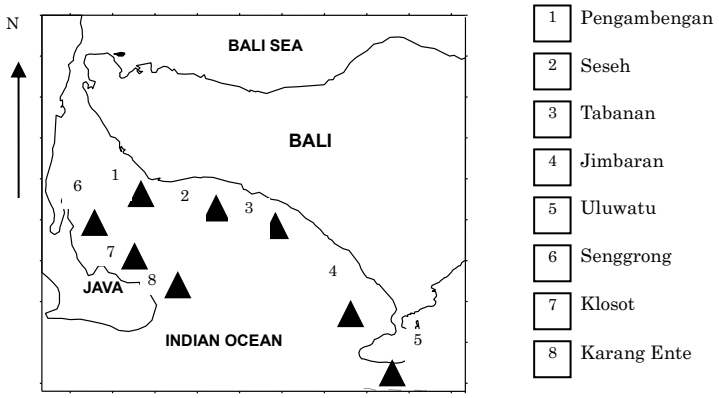


Figure IV-9. The fishing ground of *SL* in the Bali Strait.

Source: Bali Marine and Fisheries Agency, 2009; 2010 and Setyohadi, 2010

The fishing season in the Bali Strait is influenced by two monsoon seasons, namely east and west monsoon seasons. The east monsoon season occurs from April to December, in which the fish are crowded about 2 feet under the water surface. In this season, the fishermen use "*gadangan"* techniques (not using the light). The average catch is more than 10 to 50 tons per trip. However, in the west monsoon season, the fishermen use lights to catch the fish because the fish are in deeper waters. This season lasts from January to March, and average catch per trip rages between 5 and 10 tons. The volume of monthly production during the period from 2003 - 2011 can be observed in Figure IV-10. The data from 2011 were updated until August.

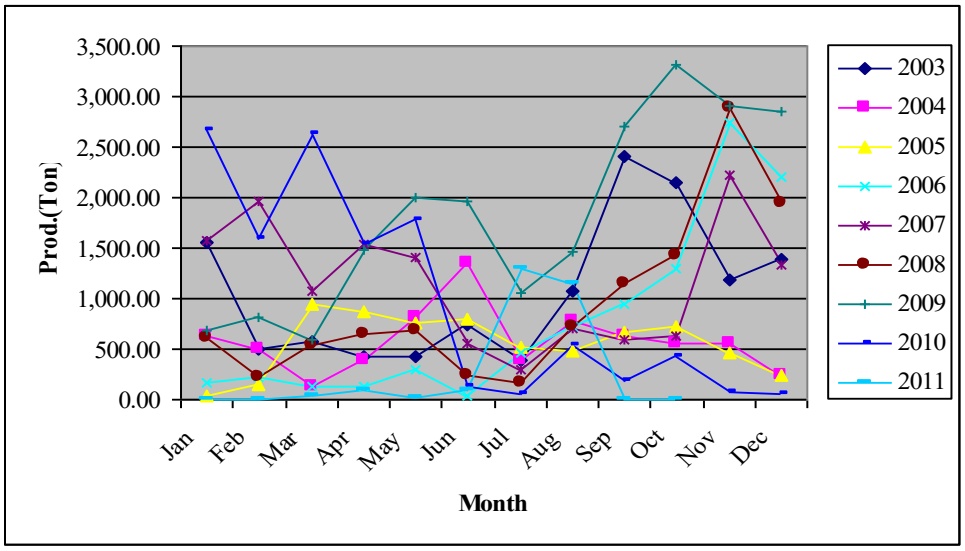


Figure IV-10. Trend of monthly production of fishes landed at Pengambengan fishery port

Source: Pengambengan fish landing, 2011

Generally, the price of fish during the west monsoon season in Pengambengan is more expensive than the price of fish during the east monsoon season. The price differences of the

main fishes in Pengambengan can be observed in Table IV-5, and the average monthly prices of fish for five years can be observed in Figure IV-11.

Table IV-4. Trend of the number of fishing gear in Jembrana

Year	Fishing boat		Total	Fishing Gear		Total
	NPB	PB		NPS	PS	
1976	2,630	98	2,728	2,699	29	2,728
1980	4,823	526	5,349	5,319	30	5,349
1984	4,930	735	5,665	5,628	37	5,665
1988	2,410	761	3,171	3,087	84	3,171
1992	2,086	594	2,680	2,433	247	2,680
1996	2,430	1,091	3,521	3,483	38	3,521
2000	2,523	7,364	9,887	4,894	99	4,993
2004	1,379	6,243	7,622	41,455	174	41,629
2008	1,826	1,491	3,317	31,992	141	32,133

NPS: Non-purse seine, PS: Purse seine; NPB: Non-powered boat, PB: Powered boat
Source: Bali Marine and Fisheries Agency, 2009; 2010 and Setyohadi, 2010

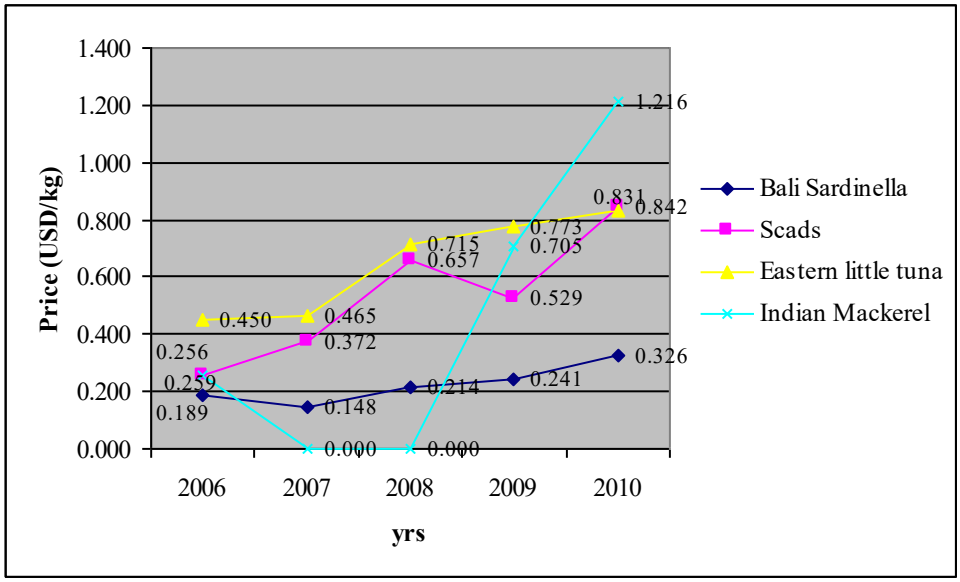


Figure IV-11. Average price of fishes landed at Pengambengan Fishing Port
Source: Statistic of capture fisheries of Jembrana District, 2010

Table IV-5. The price of main fishes caught in Pengambengan fishing port

Types of Fish	The Price during east monsoon season (Rp/kg)	The Price during west monsoon season (Rp/kg)
Bali sardinella	5,000 – 6,000	5,000 – 6000
Mackerel scad	3,000 – 4,000	8,000
Eastern little tuna	5,000	9,000

Source: Field interview, 2011

Table 5 shows that the price of fishes in the second fishing season is relatively identical and even a little expensive during the west monsoon season. This price has not much fluctuated because of the intimate connection between the fishermen and buyers (fish processing plant). The prices of *SL* are relatively lower than the prices of other fish. Because *SL* is the dominant fish caught in the Strait of Bali, it makes the price of the fish low. However, scads, eastern little tuna and Indian mackerel are seasonal fish with relatively high prices. The price of *SL* sold to the fish-powder factories is 50% lower than the price at the fish canning, because the quality of the fish is lower (rejected quality) than the ones sold to the canning factory. The distribution of fishes begins at auction, in which they are then distributed to the fish processing plant, the boiled fish company and cold storage. Fishes are sold through the auctions and some are sold through weighing. The distribution of fish in general can be observed in Figure IV-12.

SL and mackerel scads are distributed to the fish processing plant (canning) in Muncar (East Java) and Pengambengan (Bali). These fish are not obtained through the auction process, since there is an agreement between the boat owners and factory. Therefore, the fish must only be weighed. This process aims to maintain the quality of the fish for keeping quality to be exported. However, the fish sold to the boiled fish factory and cold storage should pass through the auction at Pengambengan. Boiled fish products are marketed to Java and Borneo Island. The lowest quality of fish or rejected fish was sold to the fish-meal factory lower prices. However, traders sell to cold storage if there is an oversupply of fish in Pengambengan when the canning and boiled fish factories are not able to accommodate these catches as raw materials.

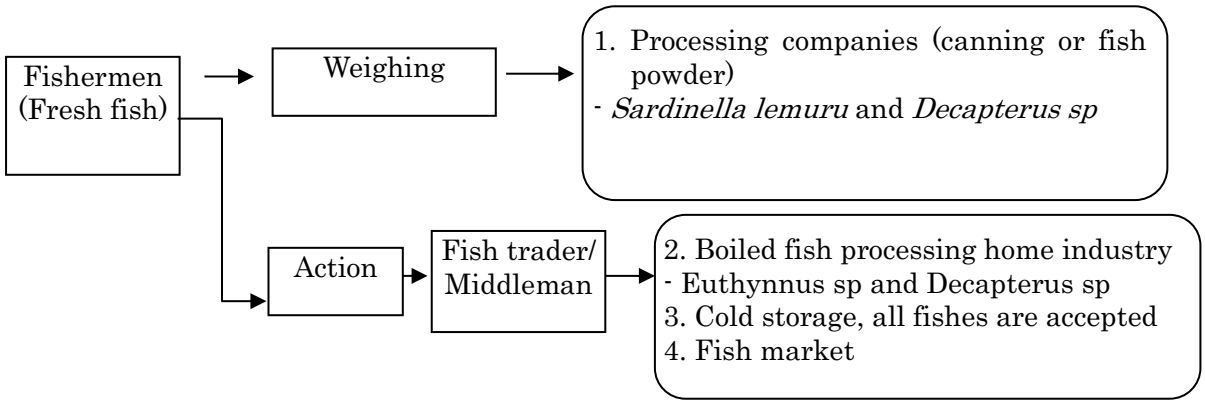


Figure IV-12. Distribution of fishes from Pengambengan Fishing Port

4.3.3. The fishermen's adaptation to the "fish crisis"

Most fishermen in Jembrana work as crew on purse seine boats. Wives are usually wait at home and do not work. Only small number of wives was work as a fish collector or middleman. They both the fish from the fishermen or crew of purse seine vessels. The collectors were both the fish from the fishermen who obtain fish as a share from fishing activity. The fishes, which belong to the fishermen sold to a collector (local name called: *belantik*). The buyers (collector) sell the fish to the boiled fish factories or directly sell them to the direct market (traditional market/wet market). Other wives were also employed at the fish processing plants.

Normally, fishermen go fishing for 15-20 days (one-day trips) per month. The remaining days are spared for repairing nets or boats. From 2010 until mid-2011, 80% of the fishermen did not have any fishing activities on purse seine boats, neither did the purse seine vessel owners nor the fish traders. This is chiefly because target species had disappeared in their immediate fishing grounds. This disappearance may be a consequence of purse seine fisheries equipped with high technology which is not easy to control the demand and resource threatening (Garcia *et al*., 1999). The crew members no longer worked on the boats and attempt to find other jobs. Some fishermen fish using a fishing rod on board 5 GT and smaller boats. These conditions are similar with fishermen in South Sulawesi in adapted to the uncertainty conditions of capture fisheries. Although the fishermen diversified their livelihood activities, they stayed close to the fishery areas (Zamroni and Yamao, 2011a). However, most of the fishermen prefer to going to Denpasar or other urban areas, in order to get construction work for additional income to meet their daily requirements. Small fishermen in South Sulawesi planted seaweed instead of capture fisheries as livelihood activity (Zamroni and Yamao, 2011b). However, fish traders still sell by purchasing fish from other areas in Java and then sell in Bali. There are also some fishermen who can keep supplying raw materials to a boiled fish factories and fish processing factory (canned). The fish processing plants in Jembrana were maintained production by importing raw materials from overseas countries such as India.

The crew of purse seine boats (ordinary crew) work every day, and obtain the following wages: {daily wages + additional wages (local name called: *gacokan* + food allowance (local name called: *lawuhan*) = total income per person}. This wage is a minimum for survival when their main job is stagnant. The boat owners are able to survive but their income is drastically reduced. From 2010 to mid-2011, some boat owners could not gain

any income from the operation of purse seine vessels. They sold their valuable items, such as motorcycles, cars, boats or gold, to fulfill their daily necessities. The crews also sold their assets such as motorcycles or gold. The crews will then buy things as normal during the fishing season. "Selling and buying" assets normally occurs in coastal communities, particularly among poor fishermen. However, in 2010, this happened in not only fishermen but also owners, traders and other community members.

Table IV-6. The income values and income sources of fishermen in the periods of fish crisis and non-crisis.

Status of fishermen	Monthly income (sharing-benefit) (USD)		Income source
	Before "fish crisis"	"fish crisis"	
Owners	28,868.4 to 57,736.7	0	Sell the assets, withdraw the saving
Fishing master/captain	6,772.5	0	Sell the assets, withdraw saving, borrow money from boat owner
Boat driver	73.6	69.3	Construction, fishing with small boat, borrow money from captain
Engineer	58.9	46.2	Construction, fishing with small boat, borrow money from captain
Net puller	44.2	37.5	Construction, agriculture, fishing with small boat, borrow money from captain
Ballast puller	58.9	46.2	Construction, agriculture, fishing with small boat, borrow money from captain
Ordinary crew	26.0	40.4	Construction, agriculture, fishing with small boat, borrow money from captain
Fish box cleaner	26.0	34.6	Construction, agriculture, fishing with small boat, borrow money from captain
Bearer fish	338.6	37.5	Construction, agriculture, fishing with small boat, borrow money from captain

* The income above shows the income before "fish crisis" during low season.

Source: Primary data processed, 2011

4.3.4. The collaborative fisheries management of the Bali Strait

Pomeroy et al. (2007) stated that a challenge facing fishermen, resource managers and national decision makers in the Southeast Asian region is to identify the appropriate governance and public policy mechanisms to manage resource sustainability and economic feasibility. The fisheries management of the Bali Strait began in 1977 with the issuance of the Joint Governor Decree (JGD) between Bali and East Java Provinces No.

EK/I/39/1977-EK/Ie/52/77 on May 20, 1977. The agreement regulates two main activities within the established zone, including fishing, by setting the number of purse seine fishing gears allowed, which were 50 units for each, and restricting the number of ships. The government facilitates such agreements through the Directorate General of Fisheries under the Department of Agriculture. In 1978, the agreement was revised by the joint decree No. EK/Ie/146/1978. This JGD established the number of purse seine fishing gears allowed, which was 73 units for the East Java Province and 60 units for the Bali Province. In 1983, the agreement was again revised in decree No. 126/1983 and 236/1983. The decrees allowed 125 units of purse seine boats operated for the East Java Province and 75 units for the Bali Province. The JGD has allowed an increase in purse seine fishing boats in 1985 through the JGD No. 7/1985 and No. 4/1985. There are 190 units allowed for the East Java Province and 83 for the Bali Province. In 1992, a revision of the previous decree was implemented affected through a meeting between the two provinces launched under JGD No. 238/1992-674/1992 on November 24th, 1992. There are three important points in these regulations: to restrict the capacity of boats to less than 30 gross tones (GT); to set the size of purse seines to a minimum mesh size of 1 inch (2.54 cm), a maximum length of 300 meters and a depth of 60 meters. A restricted number of purse seine nets were 190 units for the East Java Province and 83 for the Province of Bali; and the Bali Strait area is divided into 2 zones, zones I and II. Zone I is allocated to traditional fishing activity, whereas zone II is designated for large-scale fishing activity such as purse seines (Figure IV-13). In addition to the existing regulations, it would be better to follow the argument of Suarez de Vivero et al. (2008) that the greater effectiveness, capacity and legitimacy in the implementation of the decisions that affect both the sector and livelihoods that depend on the fishery sector remain to be achieved. This argument is reasonable considering the Bali Strait is managed by different provinces (East Java and Bali) and exploited by the populations of these provinces.

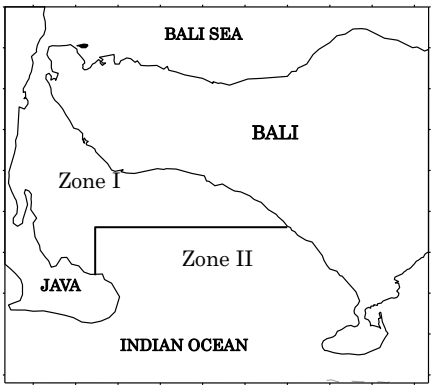


Figure IV-13. Zoning for fishing operation in Bali Strait

The Bali Strait is not a large fishing area. Fishing can be easily conducted through one-day fishing and surveillance in these waters. A surveillance system in the Bali Strait remains under the responsibility of the Committee for Marine Safety and Security (CMSS or *Bakorkamla*) that involves cross-security agencies, such as representatives of the custom office, immigration units, the harbormaster, the Ministry for Marine Affairs and Fisheries (MMAF), marine police, and navy are in charge for monitoring, controlling and surveillance (MCS). Moreover, MCS system also have a community supervision system performed by the fishing community at Pengambengan, particularly against the fishermen committing violations at sea, which are then reported to the security forces at checkpoints in the Pengambengan fishing port. These entities become a governance network and require collaboration and interaction. However, the governance network is likely to erode the traditional command and control authority of the formal government and increases the transaction costs (Gibbs, 2008; Grafton, 2007).

People are an integral portion of ecosystems, and intervention management to an ecosystem usually affects human lives (Carneiro, 2011). Bali and the East Java Province are collaboratively responsible for the management of *SL* to control its use and exploitation in the Bali Strait. In fact, the most important tasks from both governments are to stop or prohibit the manufacturing of new boats and not to give new licenses for the operation of fishing boats and purse seine fishing gear. Jentoft (2007) emphasized that fisheries and coastal governance must be concerned with the relationship between the governing system and the system to be governed. The institutions involved in the management of fisheries in the Bali Strait have been established and community supervision is ready to assist the monitoring and prevention of conflict. Dietz *et al*. (2003) stated that in resource management, locally evolved institutional arrangements governed by interested parties

have sustained resources. However, there remains an absence of coordination between interested parties and the consequences for violations. In addition, the fishermen still manufacture purse seine boats, whereas the joint agreement between the two provinces has explicitly reduced the number of boats. The stakeholders involved in the Bali Strait do not directly precede the violations. This condition continues to progress so that boat manufacturing grows and eventually a "workforce crisis" occurs. This result is due to the owner or captains have difficulties in finding or recruiting crew from Jembrana and the surrounding areas. These factors have an effect on the cost of production.

4.4. Summary

The fishermen in Jembrana can address this condition in their daily, monthly or annual activities. Under normal conditions, the fishermen usually use their time to repair purse seine nets and boats, catch fishes with small boats or rest until the peak-season arrives. The fishermen do not work or perform any activities outside of their main job (fishing). This resulted in contrast during the off-fishing (local name called: *paceklik*) condition from 2010 to mid-2011. The fishermen from all levels, from the owner to the regular crew members, did not have the option to perform any activities outside of the fisheries to meet their daily requirements because of the “crisis” is longer than as normal time of off-fishing. The fishermen have different ways to adapt to the situation. In this case, ordinary fishermen or crew members usually work as construction workers in Denpasar or other cities in Java, and others work as agricultural laborers in other villages in Jembrana. During this time, the boat owner and captain/fishing master also stop their fishing activities. The boat owners and captains/fishing masters sold their assets to keep survive during the “fish crisis”.

The Joint Governor Decree (JGD) between the Governor of East Java and the Governor of Bali has been changed five times since its initiation in 1977. The agreements related to the operating permits of purse seine boats, mesh size of purse seine nets, zoning, and fishing grounds were considered sufficient to control fishing in the Bali Strait. However, the agreements have not yet been completely implemented. One example is when the community continues manufacturing purse seine boats although this manufacturing has not been allowed. The acceleration of the legal operation in the form of "document management of fisheries in the Bali Strait" is one of the alternative solutions. Surveillance by local fishermen is an appropriate step to overcome the limitation of the facilities owned by the security officers. Therefore, a communication and cooperation system between the

fishermen and security officers must be improved. One possible way is to train the fishermen in handling the violations and conflicts that occur at sea.

The fishermen have been highly dependent on the capture fishery activities for a long time and possibly into the future. The alternative livelihoods in both fisheries and non-fisheries have not yet been developed in Pengambengan, so that the fishermen depend on fishing activity even during the off-fishing season or “fish crisis” of 2010-2011. The implementation of both provincial governments (East Java and Bali) in regulating the fisheries in the Bali Strait is not yet satisfactory, and Monitoring, Controlling and Surveillance (MCS) action even with traditional way against people who violate the rules is necessary. The benefits of fish resources in the Bali Strait are large and broadly influence other fisheries. Subsequently, the management body must be developed in the future. The idea can be included into the document of Bali Strait management, which is now under a process of discussion.

CHAPTER V

EVALUATION OF LIVELIHOOD DEVELOPMENT STRATEGIES ON FISHING COMMUNITIES IN SOUTH SULAWESI COASTAL AREAS

5.1. Introduction

Poverty is a wide spread phenomenon in almost all developing countries, thereby making people become incompetent in accessing natural and economic resources. The coastal environment degradation and resources depletion (mangrove and coral reefs damage), land based marine pollution and over fishing, conflict of marine uses, 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 that the Government of Indonesia (GoI) introduced many types 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 affects decrease in amount of fish catch. Thus, fishermen cannot expect to rely on income from fishing activity and they planting the seaweed as an alternative income source.

In Indonesia, the land area with aquaculture potential is estimated to be around 11.81 million ha, of which 8.36 million ha have marine culture potential (MMAF and JICA, 2009). Aquaculture production showed a growth rate of 20.14% within 5 years from 2001 to 2005[15] (Nurdjana, 2006). The production of farmed seaweed in Indonesia gradually increased every year reaching 1,728,475 tonnes in 2007 (Dahuri, 2004; MMAF and JICA, 2009). According to Mira *et al*. (2006), there are many benefits realizable from seaweed farming such as: 1) being an environmentally friendly activity, 2) opening job opportunities, 3) improvement of fishermen's income and 4) contributing to foreign exchange revenue.

The Indonesian manufacturing industry can benefit enormously from the industrialization of carrageenan which is the principal chemical extract obtained from the farmed seaweed, *Eucheuma cottonii* (Tjahjana, 2010). The development of a viable seaweed industry can

[15] The production volume increased from 1,076,750 tons in 2001 to 2,163,674 tons in 2005.

support the national program for job creation, reducing unemployment and contributing to national economic growth. Development could focus on the various types of seaweed available locally which in turn could support the production of carrageenan, agar and alginate. The local carrageenan industry producing semi-refined carrageenan products grew rapidly after 1990. However, it declined due to lack of raw materials. This could be attributed to the fact that the manufacturing industry could not compete with exporters of dried unprocessed seaweed in the purchase of raw materials.

Several coastal projects such as 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) had implemented in recent 10 years, which aimed to improved economics of poor fishermen. Those projects were supported by international donors agencies.

This chapter intends to compare the economic outputs of two livelihoods activities, namely seaweed farming and capture fisheries. The objectives of this analysis are to compare the economic returns of different livelihood activities, and to compare the financial returns and costs of each activity. In addition, these analyses will compare the livelihood adaptation pattern to the declining of fisheries resources in fishing communities.

5.2. Results and Discussion

5.2.1. Successful experience of livelihood project in improving fishermen's income

Small-scale Natural Resource Management (SNRM) Project (2006-2007) was one of the projects implemented in the Takalar District (Laikang Village). This project came from the central government, whose main purpose was to restore the coastal environment that provides economic capacity building program in fisheries. Coastal management under the SNRM is limited to the aspects of coastal environmental improvements which evaluate the rules (non-formal) at the local level as a reference in managing coastal areas at the village level (village regulations). This local rule was made to minimize conflicts of interest in the exploitation of coastal areas or bay area (Laikang Bay) by setting the rules in the use of the bay area with control on users, fishery activities, retribution and punishment. All users are obliged to obey the regulations both as a group or an individual.

Laikang Village was selected as study site because they have various potentials of coastal resources that can be further developed. A village has an 8 km coastline, which has the

potential for the development of seaweed farming, fishing and the cultivation of crab and other fisheries. In addition, the implementation of SNRM projects in the Laikang, Mangarabombang Sub-District and Takalar District is considered successful in improving the household economy of fishermen. An effort to improve fishing activity was done by providing soft loans that are packaged in a revolving fund to improve seaweed farming. Seaweed (*Eucheuma cottonii*) is one of the fishery commodities in the province of South Sulawesi deemed particularly important for increasing fish production and improving the economy of coastal communities since the last decade. This condition has changed the role of capture fisheries and other aquaculture business to contribute to household income of fishermen (Figure V-1).

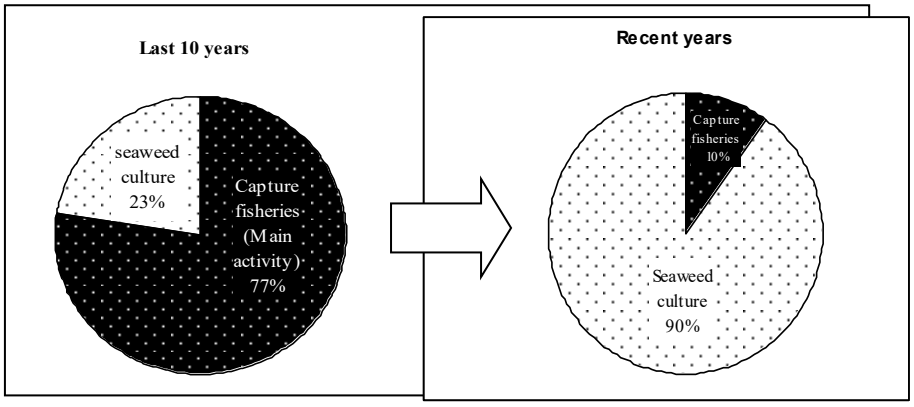


Figure V-1. Change of main income source during the last decade

In this study, there was an observed shift in main livelihoods activity from capture fisheries to seaweed culture activity. However, many fishermen still conduct fishing activities as additional income of household economy. In Laikang Village, 77% of respondents did not change their main business activity. All respondents in Laikang Village shifted their main income generating activities (IGA) to culturing the economic seaweed *Eucheuma cottonii*. As a result, they could gain double income sources. Small-scale natural resource management (SNRM) program successfully encouraged all respondents to adopt seaweed culture as the main job, while capture fisheries became the second job in Laikang Village. In this study area, fishers lacked post-harvest and processing activities. Allison and Horemans (2006) stated that reduce the fishing-dependent without increasing fishing effort high be helped solve the problem in small-scale fishery. Allison and Ellis (2001) suggested that encouraging alternative livelihoods within the fishing community with a complementary or substituting non- fishery activity would have better results. Livelihood diversification might be combined with other resources (Seavanen *et al*. 2005). However,

fishers cannot be easily persuaded to go into such a diversification of their livelihood. They need some kind of technical and financial assistance until the products will have been accepted by the market continuously.

5.2.2. The factors influenced on changes of fishermen's livelihood activities

According to the field survey, there were some reasons why the respondents change or do not change their jobs. Most of respondents answered that they did not change activities because of: 1) the main job was still productive, producing a lot of profit with a little amount of capital: 2) they were worried about the risks caused by switching to a new job. Meanwhile, those respondents who changed their activities gave the reasons as follow: 1) a new business needs low operational cost: 2) it makes lots of profit: 3) many fishers have been successful in doing alternative new businesses. “Greater profit” and “better business opportunity” were the major causes to stimulate fishers to involve alternative livelihoods. They felt that their previous income was not enough for their daily needs, and some just followed successful cases of others.

With the production of seaweed (*Eucheuma cottonii*) by adopting long line floating method, fishermen income has increased 50%, especially after or during the implementation of the SNRM project (Figure V-2). Analysis of costs and benefits for the cultivation *Eucheuma cottonii* can be seen in Table V-1.

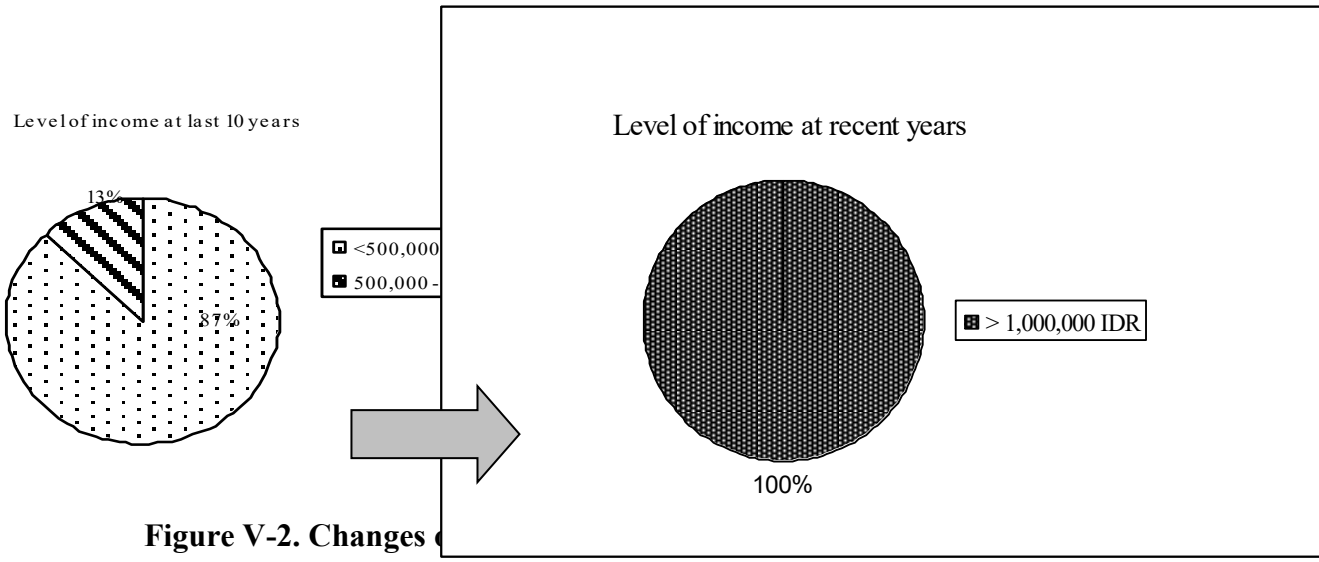


Figure V-2. Changes

Up to the present, seaweed farming remains the main option of most coastal people Takalar District, and surrounding districts such as Jeneponto District, and Bulukumba District. Changes in the main livelihood of fishermen do not necessarily abandon fishing activities that have been done for many decades. They still catch fishes and crabs every day by using

gillnet, push net, cast net and palisade trap. They conduct fishing around the coast and around seaweed farms.

Table V-1. Benefit-Cost analysis of seaweed farming by using floating long line method

Material	Number	Cost per unit (IDR)	Useful life (years)	Annual depreciation	Total
Size of farm (100 m x 30 m)					
Initial investment:					
Main ropes for frame line (8 mm) (kg)	30	1,050,000	5	210,000	31,500,000
Ropes for tying anchor (7 mm) (kg)	20	700,000	5	140,000	14,000,000
Ropes for seaweed lines (3 mm) (roll)	75	2,500,000	5	500,000	187,500,000
Tie-tie (1,5 mm) (ball)	35	1,600,000	4	400,000	56,000,000
Anchors (woods) (stick)	200	150,000	5	30,000	30,000,000
main floaters (Styrofoam/empty bottles 1-3 liters) (units)	30	100,000	3	33,333	3,000,000
Small floaters (empty bottles 250 ml) (units)	150	400,000	3	133,333	60,000,000
Frame construction (unit)	1	200,000	5	40,000	200,000
Boat construction and engine (unit)	1	5,000,000	5	1,000,000	5,000,000
Boat maintenance (unit)	1	150,000	1	150,000	150,000
Tarps (size: 6 m x 8 m) (sheets)	2	200,000	3	66,667	400,000
Drying rack (unit)	1	600,000	3	200,000	600,000
Sack (sheets)	30	100,000	2	50,000	3,000,000
Total				2,953,333	391,350,000
Fixed cost					0
Depreciation				2,953,333	2,953,333
Variable cost					0
Tying seed (lines)	300	1,200			360,000
Planting (lines)	300	500			150,000
Farm maintenance (day)	30	-			50,000
Harvesting (lines)	300	800			240,000
Drying (lines)	300	-			10,000
Total					810,000

Production/revenue					
Dried seaweed (kg)	2000	9,000		18,000,000	18,000,000
Income	R-C				14,236,667

1 USD = IDR. 9,490 (www.bi.go.id. Access on August 14, 2012)

Source: Primary data analysis, 2011

How to raise operational funds is usually a great obstacle for fishers to change their livelihood. They have hardly accumulated own capital for investment in a new livelihood. Another constraint for altering livelihood is a lack of market information. In the survey, respondents expected that their present business was profitable enough to continue it; however, those respondents who anticipated a good prospect of their present business for development. A lack of capital was not always regarded as a main obstacle to affect the sustainability of livelihood activities, according to the survey results in two selected villages. Like other livelihood assistance projects, SNRM provided a source of financial capital for those fishers who would develop their present livelihood or adopt alternative ones. However, Suyanto (2004) argued that the financial capital given to such fishers does not always ensure better living conditions.

Alternative livelihoods, which are introduced to poor or small-scale fishers, should bring more economic benefit by making their products more marketable. In fact, however, in cases where a newly introduced livelihood is considerably capital-intensive, the small-scale fishers could hardly start without any support. These businesses can be developed through joint ventures between fishermen. They cooperate with other fishermen to solve problems on limited financial capital.

5.2.3. Fishermen and their activities in Laikang Bay

5.2.3.1. Two main livelihood activities at Laikang Bay

Capture fisheries and seaweed farming are two main livelihood activities at Laikang Bay. Prior to the expansion of seaweed farming, most fishermen had been engaged in one day fishing by using mini gillnet, *sero* (set net), fish trap and cast net. Then, they began to implement seaweed farming with floating long line method, while they continued to do fishing activity by adopting fishing nets around seaweed farms.

A series of the surveys show that most seaweed farmers in Laikang Village are 26 – 40 years old. Size of their family is between 2 and 5 persons. Most of them graduated only from elementary school, having a poor level of education. The income of respondents came from two main activities, capture fisheries and seaweed farming. Both activities were

conducted by respondents in Laikang, Garassikang, LP. Bahari and Ujunga Villages. Those fishers who got more profit from seaweed farming compared with capture fisheries naturally preferred to give a higher priority to seaweed culture as their main income source. Most of respondents (70.5%) had income less than one-million Indonesian Rupiah (IDR) per month (Table V-2).

Table V-2. Socio economic data of seaweed farmers in Laikang Bay.

Variable	Frequency (n= 200)	%	Mean	S.D
Age (years)			37.04	9.6
≤ 25	17	8.5		
26 - 40	115	57.6		
41 - 60	68	34		
Gender (male/female)			1	0
Male	200	100		
Female	0	0		
Education			2.42	2
Elementary school	105	52.5		
Junior high school	41	20.5		
Senior high school	9	4.5		
None	45	22.5		
Marital status			2	0
Single	0	0		
Married	200	100		
Widow	0	0		
Ethnicity			2	0
Bugis	0	0		
Makassar	200	100		
Javanese	0	0		
Main Income Generating Activity			4.02	2.9
Seaweed culture	92	46		
Seaweed culture + capture fishing	74	37		
Seaweed culture + public officer	4	2		
Seaweed culture + non-fishing	30	15		
Number of family member (persons)			1.86	0.34
≤ 2	27	13.5		
3 - 5	173	86.5		
Income value per month			1.44	0.5
≤ 500,000	115	57.5		
501,000 - 1000,000	83	41.5		
>1000,000	2	1		

Source: Primary data processed 2010

Table V-2 above shows that fishermen rely on a wide variety of livelihood activities, including capture fisheries, seaweed farming, seaweed farming 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 condition under which the activity evolved. Seaweed farmers (46%) conducted seaweed farming as a single activity and 37% combined seaweed farming and fishing activity. It is possible for many fishermen to conduct the both, because the farming of *Eucheuma cottonii* does not require much time after planting. The farmers checked the farm 3-4 times a week after fishing was finished. These combinations of some livelihood activities as income source could be achieve a resilient of household economic.

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 1,000,000 IDR per month. These figures represent the total income derived from all livelihood activities of these fishermen. The fishermen are using the income to support the family needs. In this study, fishermen have 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 3000 m2 (100 meters x 30 meters). Most of the farmers (68.5%) have less than two plots.

The support of public participation at local level and the empowerment of coastal communities or stakeholders, then they were an active in management policy design and implementation (Berkes *et al*. 2001; Jentoft *et al*. 1998). Coastal communities and stakeholder change over time and this requires fisheries management approach to be adaptive, not only to ecological fluctuations but also to shifts in social values, perceptions and to interests (Alpizal, 2006). Kay and Alder (1999) defined capacity building as the process of increasing the capacity of those charged with managing the coast to make sound planning and management decisions. In addition, Fletcher (2003) argued that the community based capacity-building serves to enhance a moral sense of duty.

Nowadays, fishermen at Laikang Bay do both livelihood activities. Local people become interested in seaweed farming as an individual basis. Therefore, the number of farmers and farms of seaweed have increased sharply. The fishing activities are also conducted by using simple fishing gears, such as fish net and crab net. Fishers go to the beach around seaweed farm to set up the fishing nets at evening and they pick-up them in the morning. Fishermen use this leisure time to do activities related to seaweed farming (Table V-3).

Table V-3. Daily schedule of fishermen's activities

Hours/ activity	AM												PM											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
A																								
B																								
C																								
D																								

Source: Field survey, 2010

One of the reasons of fishermen conducted seaweed farming was as the household income source. Firstly, the government design and implement government projects that aimed to improve the economy of coastal communities. Secondly, relatively small operational costs attract a large number of fishermen to engage in seaweed farming. Thirdly, it was easy for them to maintain seaweed farming. Finally, they could get more profit from this farming activity. Satria (2009) argued that double strategy could be solved of fisher's household income problem. This strategy means that fisher together with family should be done in both fisheries activity and alternative jobs outside fisheries. In this study, almost all the seaweed farmers (97.5%) agreed that the benefit of seaweed farming is better than catching fish. The indication was 77.5% farmers stated that the number of seaweed farm was increased. However, 71.5% farmers are still using old seed, which has long strain. Therefore, 77% of farmers express to make breeding hatchery to create a new strain of seaweed.

Fishermen have a various livelihood activities such as capture fisheries, seaweed farming, and seaweed cultivation combined with fishing, seaweed farming with a combination of public services. There are some seaweed farmers (46%) conducted seaweed farming as a single activity. Meanwhile, others (37%) combined seaweed farming and fishing activities. In this study, most fishermen still have low income. Some fishermen (57.5%) had income below the 500,000 rupiah (IDR) per month, while others (41.5%) had incomes between 501,000 to 1,000,000 rupiah (IDR) per month. This amount represents the total income derived from all livelihood activities of fishermen. This income was used to support the family needs that each person has a child 1.86 on average (Table V-2).

Fishermen use their incomes for mostly for social and cultural ceremonies and other ritual, remains for foods and the school of their children. This condition was affected to fishermen who face the problem with lack of financial capital when they re-start to do

seaweed farming. Because of this, fishermen really need to change the priority to be the school, foods and capitals at first, then others (Figure V-3).

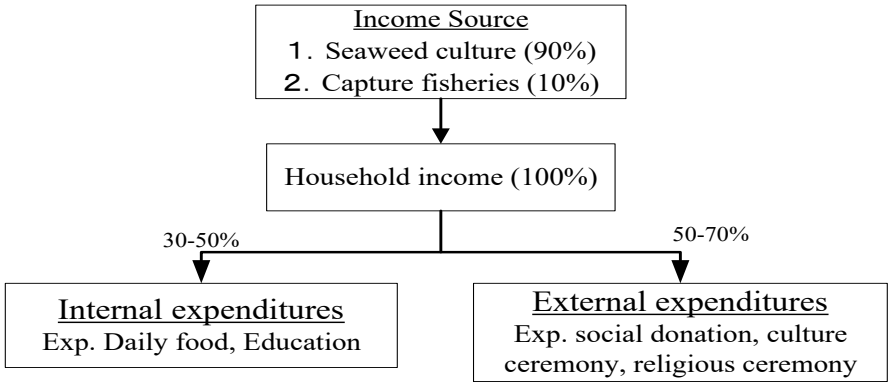
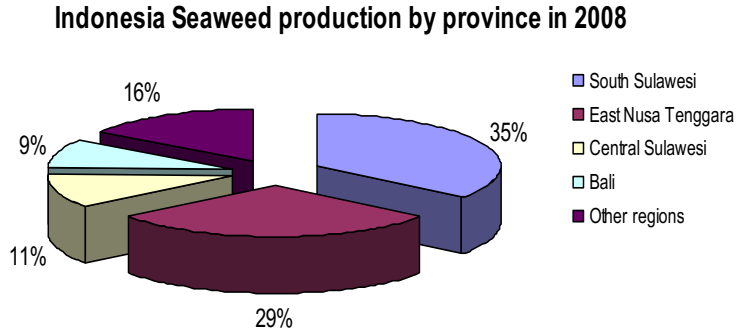


Figure V-3. Income utilization of fishermen at Laikang Bay

5.2.3.2. Seaweed farming as main livelihood activity

South Sulawesi is highest producer of dried seaweed (35%), followed by East Nusa Tenggara, Central Sulawesi and Bali (Figure V-4).



Seaweed farming in South Sulawesi is spread throughout the west coast (Makassar Strait) and the east coast (Gulf of Bone). Small financial system, small production and traditional technology are characteristics of the farmers. These activities had been done by fishermen as household economy activities at least for last 10 years. In this study, the planting process, maintenance and harvesting done by the husband (head of household) and sometimes assisted by the children. Meanwhile, wife and daughters could support in the process of breeding. Seedling and planting activities are done by the fishermen for 45 days by using floating long line method (Figure V-5). They used the services of labor in the planting process. After the planting is finished, the next step is maintenance. They were checked to the farm plots 2-4 times a week. Almost all the seaweed farmers argued that the

benefit of seaweed farming is better than catching fish. It could indicate that the number of seaweed farm has increased.

The state of coastal resources is a significant factor affecting livelihood prospects for poor coastal communities (Glavovic, 2007). At present, seaweed cultivation has become a major source of livelihood for fishing communities along the coast of Laikang Bay. Capture fisheries cannot be carried out throughout the year, because it depends on the condition and situation of local waters for fishing activity (Karubaba *et al*., 2001). At present, the farmers are adopted the old seed, which has long strain and they express local or central government facilitate to set up breeding hatchery to create a new strain of seaweed seed (Figure V-6).

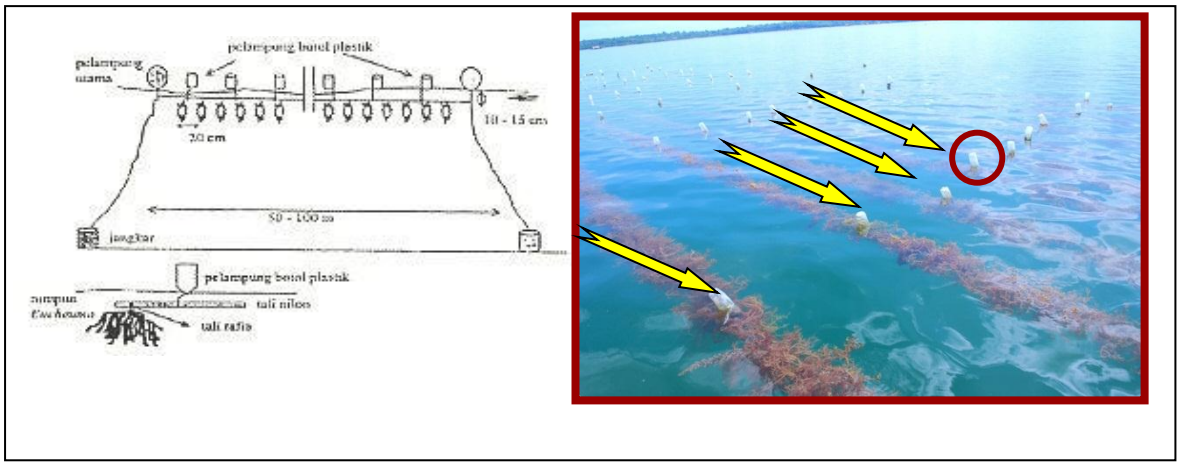


Figure V-5. Floating long line method used by respondent on cultivating seaweed *Eucheuma cottonii*

Figure V-6. Tying the seaweed seed in pre-farming proses

In Takalar, high productivity occurs during December to April, because this area is protected from big waves and has a low salinity. In Jeneponto, highest productivity occurs during May to November. At that time, the area is protected from big waves and has a supply of fresh

water from the Allu River. According to these conditions, some fishermen moved to those places following the environmental condition and productivity.

During May to November, usually farming activity of some fishermen moved from Takalar to Jeneponto. Meanwhile, during December to April, they moved to Takalar to do the same activity. However, not all the fishermen transfer their farms to highest productivity area (Figure V-7).

According to respondents (81.5%), environmental condition in Laikang Bay is still to be developed for cultivate the seaweed. At present, respondents (82.5%) argued that the farm area is already dense. Therefore, most of them (89%) stated they need re-arrangement of farm/plot of seaweed and identify farm ownership. According to observation, some farm/plot had not been used for long time, and the other hand there are some farmers who want to use these plots.

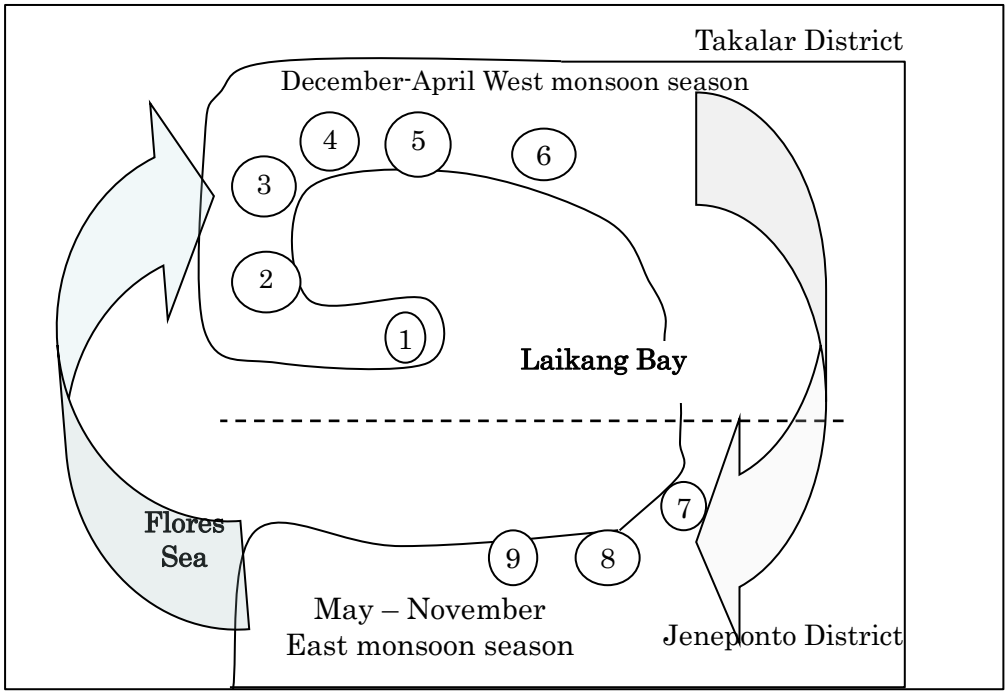


Figure V-7. Production pattern regarding the seasonal calendar of seaweed farming at Laikang Bay

Public awareness to coastal environmental is still low. There are deferent between fishermen each other. Some farmers stated that the environmental condition is still suitable for planting the seaweed, but some argued that there is need to rearrange their farms. There was inconsistence in answer of fishermen due to the simple minds of fishermen. They

might expect that as long as the environment is capable for producing seaweed, they will continue to expanding their farm.

Idle seaweed farm over several years may have caused the problems in the environment. It can be seen with equipment such as main ropes and anchors in the farm structure become dirty and disorganized. Many cases like this usually occur if the owners of farm are no longer cultivating seaweed. They often went out the village or look for other jobs in the cities. Some of them did not have enough capital to do the cultivation of seaweed. On the other hand, there are some fishermen who want to invest their capital/money in planting the seaweed.

Traditionally, fishermen dried seaweed under sunshine. They used the bamboo racks for drying the wet seaweed (Figure V-8). The problems were that seaweed could not dry well on the rainy season and it takes more times. The respondents stated that they have suffered many losses during the rainy season because they could not make perfect dried product. Seaweed is not commercially produced yet to be value added product. In Laikang Bay, 25% farmers stated that some seaweed made into traditional products such as a toffee (lunkhead), candy, jelly etc.

Figure V-8. Drying seaweed using the bamboo rack at near the beach

The fishermen kept dried seaweed before sold to middlemen. The farmers do not directly sell seaweed at each harvest. They sell dried seaweed after 2 to 3 harvested times. The farmers feel that seaweed market channels are still long and they people stated the price is still acceptable even some fluctuated. However, they still able to tolerate as long as they still produce the seaweed.

5.3. 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 strategy. 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 V-4).

Table V-4. Comparison of main fisheries livelihoods activities in Laikang Bay

Activity	Costs (IDR)	Income (IDR)
Culture fisheries		
- Seaweed farming (*Eucheuma cottonii*)	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: Field survey, 2011

Table V-4 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 much cost for building the farm when they began this activity at first time. One day fishing is 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.

5.4. Summary

SNRM applied a comprehensive approach for the sustainability of coastal resource management and improvement of livelihoods. The main findings show that the household economy of respondents joining SNRM improved. The respondent's income increased and it was used for buying the equipment (strings, fish basket and motorcycle) for the prospective fishery businesses, such as seaweed culture and fish peddling. Some changed their main business to others, which provided a wide variety of opportunities whereby they could increase household net income. On the other hand, some did not change their main jobs because they still obtained enough amount of income. Although fishers always pay much attention to how to increase economic benefit, some perceive how importantly they should conserve coastal environment by participating in a management group of mangrove trees. The group is responsible for preserving mangrove ecosystem that SNRM had rehabilitated and replanted mangrove trees. Nevertheless, not all activities of SNRM have been sustained after the project was terminated. Government of Indonesia should encourage all stakeholders, especially local government to realize the importance of its roles. Local government should provide the technical assistance and control to the project activities in project sites. Private sectors, such as fisheries industries related to food, processing and fishing can actively participate in developing fisheries products, and contributing to the growth of local economy. Meanwhile, central government still provides the roles as a partner in funding, concept and supervision.

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 was selected seaweed farming because of this activity have low operational costs. They could easy maintenance and the profit is higher than fishing activity. Fishermen have been implemented seaweed farming *Eucheuma cottonii* within floating long line method, together with fishing activity adopting fishing net around seaweed farm. 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.

Poor management of income could not well manage for productive activity in livelihoods, even their income was increase. Most of fishermen used their income for social matter such as cultural events and ceremonies and etc. Fishermen still have high expectation to seaweed farming development at Laikang Bay although there are various limitations such as lack of post-harvest technology, low price of dried seaweed, and complicated market channel, beside suitable environmental condition. Integrated management still as a problem in managing Laikang Bay, even stakeholders can communicate between each other. In term of improving livelihoods activities in Laikang Bay, some factors should pay attention, particularly; changes monsoon seasons[16], marketing channel, quality of seaweed seed, farm ownerships and commercial price. High demand of raw material from domestic and export market, and national policy can be opportunities for future development of seaweed farming and can be expect to improve livelihood of fishermen in Indonesia.

[16] Change monsoon seasons here mean that change the period of monsoon season every year.

CHAPTER VI

AN ASSESSMENT OF OPPORTUNITIES AND CONSTRAINTS OF SEAWEED FARMING IN SUSTAINING LIVELIHOODS AND FISHERIES RESOURCES

6.1. Introduction

Indonesia's coastal zones constitute one of the major ecosystems of the area's biosphere and are important for their biodiversity (Sukardjo, 2002). Nevertheless, these coastal zones have experienced several stresses that affect their sustainability. These stresses stem from environment degradation and resource depletion in coastal regions (e.g., mangrove and coral reef damage), overfishing, and conflict of marine uses.

Since the 1980s, Government of Indonesia (GoI) has implemented a range of policies and projects aimed at sustaining coastal zones. Among these projects are efforts to develop various kinds of sustainable, environmentally-friendly aquaculture, such as seaweed farming. According to Sorgeloos, P. (2000), seaweed farming can play a significant role in nutrient recycling, as well as increase local biodiversity and food security for coastal and island communities (Kinch, J. *et al*. 2003). An additional advantage of seaweed farming is its beneficial effect on ecology and climate change. By trapping carbon, seaweed farming could be a tool in the carbon credit system that is being developed. Seaweed farming also removes nitrogen and phosphorus nutrients from local waters, and could therefore also be eligible for nutrient in an eutrophication-reduction system (Neish, 2007**)**. In the realm of social policy, seaweed farming is a sustainable form of aquaculture that has particularly benefited women and has contributed to government-sponsored poverty alleviation programs (Bryceson, 2002). As an alternative means of livelihood, seaweed farming is crucial to the implementation of a system of sustainable ecosystem management (Alder *et al*., 1994).

However, the development of Indonesian seaweed farming is affected by various factors, including the availability of socio-economic, resources, public policy, and technology. Developing policies and programs to enhance sustainable coastal management requires an assessment of the constraints and opportunities that characterize the situation of coastal communities. The objectives of this chapter are to assess the constraints and opportunities associated with the development of seaweed farming. This chapter will also provide

recommendations for increasing the sustainability of this farming activity and, thereby, for improving sustainable coastal management in Indonesia.

6.2. Results and Discussions

6.2.1. Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis for sustainable seaweed farming in Laikang Bay

6.2.1.1. Current problems and constraints in developing seaweed farming as livelihood activity

Changes in the monsoon season and its cycles are, at this time, a major problem in the development of seaweed cultivation. Long market channels and income distribution continue to remain major obstacles in Laikang Bay's seaweed business. A lack of financial capital is the most difficulty that often experienced by fishermen, especially when they begin planting. Seaweed farmers use various tactics to resolve such a financial problem. Instead of formal financial institutions, fishermen usually borrow money from the family, relatives, friends and middlemen in the village. This type of borrowing occurs because small-scale fishers still find a great difficulty in accessing financial capital from formal financial institutions, such as commercial banks. Yet other problems are the availability of seaweed seedlings, the quality of the seed, land tenure, a disease that attacks the seaweed plant and the post-harvest process. Price fluctuation is now perceived as a minor problem.

Recently, the most critical problems affecting seaweed development are associated with the aspect of marketing and breeding. Seaweed farmers have not received many economic benefits from the current marketing system of dried seaweed. The marketing problems, allegedly, are associated with institutional marketing, information of marketing network, and a communications gap between some farmers and some exporters when the seaweed is not produced in accordance with (international or domestic) standards established by the processing industry and exporters. Due to such problems, the industry can buy seaweed at low prices.

6.2.1.2. Improving seaweed farming and development of opportunities

In this part, SWOT analysis will focus on analyzing factors of strengthens weaknesses, opportunities and threats of seaweed farming development. This is including all aspects of farming, processing, marketing, environment and policy in developing seaweed farming at local level of South Sulawesi. Firstly, listing the internal factors (strengthens and weaknesses) and external factors (opportunities and threats), and then scoring (0 to 1) and rating to those items in each factor. Secondly, multiply the score value between strengthens

and threats (S-T), weakness and opportunities (W-O), strengthens and opportunities (S-O) and weaknesses and threats (W-T). This step is important to determine the strategies of ST, WO, SO, and WT. Lastly, showing all selected factors includes external and internal factors and strategies factors based on the rating values. This chapter shows a summary all the process of SWOT analysis.

In the fact, there are some problems faced by fishermen doing livelihood activities. It would be as weaknesses to develop fishermen livelihood activities. Finding shows that changes monsoon season and it cycles is the major problem in the development of seaweed cultivation at this time. Long market channel and income distribution are still major problem both in the business of seaweed in Laikang Bay. Financial capital is the next problem is felt most often experienced by fishermen especially when they start planting. In addition, the availability of seaweed seedlings, quality of seed, land tenure seaweed, a disease that attacks the plant seaweed and the post harvested process. Fluctuation of seaweed price is feeling as a minor problem.

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 of 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 (Table VI-1). Therefore, 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.

Table VI-1 Matrix of SWOT for sustainable seaweed farming in Laikang Bay

Internal / **External**	**Strengths:** Farming activity: - Carrying capacity of the coastal environment still supports farming activity - Farming methods (investment and costs) are still affordable for fishermen. Production/harvesting: - Production of seaweed tends to increase annually. Fishermen's preference: Self-motivation of fishermen to cultivate seaweed. Income source: - Seaweed farming is the main source of income supporting fishermen's expenditures.	**Weaknesses:** Farming activity: - Diseases, such as ice-ice[17] - Farming patterns depend on the monsoon seasons - Changes/shifts in the monsoon seasons - Seed availability and quality. - Farm ownership Post-harvest: - Post-harvest process Financial source: - Lack of capital for developing seaweed farming Marketing: - Long market chain - The price of dried seaweed fluctuates Income management: - Lack of income management
Opportunities: Policy: - National policies support seaweed farming as an alternative livelihood - Local government policies support seaweed as a leading product - National business agency and private companies encourage the development of seaweed processing. Demand: - Establishment of a seaweed processing company Market opportunity: - The demand for dried seaweed has increased Market opportunities	**S – O strategy** • Expand the potential farm area in an optimal and environmentally friendly manner to meet the market demand for seaweed	**W – O strategy** • 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 and of market demand.

[17] "Ice-ice" disease triggered by bacteria could take place when slow water movement in the cultivation ground, the cultivation ground is close to freshwater sources, temperature is high (Largo, D.B. 2002).

Threats: Environment: - Climate change, - Decreasing environmental quality Market and price: - Profit-taking actions - No standard price for dried seaweed	S – T strategy • Develop alternative models of farming methods to minimize risks • Prohibit activities that could reduce the quality of seaweed	W – T strategy • Build public understanding and awareness of environmental protection • Build a farm utilization model

Field survey, 2010

6.2.2. Involvement of woman as a tool in coastal management

Fishermen tried to diversify their household income by engaging in an alternative fishery activity. Allison and Ellis (2001) state that diversification is use to reduce losses due to failure of livelihoods or alleviating lack of income by doing more than one livelihood activities. At present, fishermen engage in two fisheries activities do so without much conflict in schedule. Fishermen do perform activities related to seaweed farming such as harvesting, cultivation and maintenance in the rest time of fishing activity. The fishes caught are then sold to collectors, to neighbors or held household consumption depending on the situation at that time. Proceeds are used for daily food, buy cigarettes and other foodstuffs.

Women participate in activities in food processing by using raw material from seaweed materials as well as fish and participate in some parts of seaweed farming activity. The role of women in the cultivation of seaweed includes 1) preparing the rope used to tie the seed as well as in construction, 2) tying seaweed seeds for re-planting, 3) drying the seaweed, and 4) cleaning up the rope (construction) after harvesting for re-planting preparation. Since the development of seaweed farming, coastal women were more productive in farming activities as well as in income generating activities. Seaweed farming is easily done by women of all age levels (children to adults) (Table VI-2) Additional income from the women's activities has pushed down the number of fishermen who have to go to urban areas to work outside the fisheries sector during off-fishing season.

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Table VI-2. The roles of women in the process of seaweed farming

Activity	Age	Burden sharing
Prepare the main lines	Adults	40% woman (men cut the big rope and women prepare for "ring line"). This means that 40% of work was done by women.
Set up the frame line	10 years old - adults	90% of work was done by women
Tie the seaweed seed	7 years old – adults	100% of work was done by women
Carrying seed to boat	Adults	Women together with men
Transport seaweed from the boat drying rack	Adults	Women together with men
Drying process	10 years old - adults	75% of work was done by women
Transport dried seaweed from the drying rack to storage	Adults	40% of work was done by women
Cleaning the ropes	10 years old - adults	75% of work was done by women
Separation and re-streamlining the rope	7 years old - adults	75% of work was done by women

Source: Field survey 2011

Table VI-2 shows that women in different age groups have an important support role in seaweed farming activity. Although men are also involved in seaweed farming (seedling to sales), women have more workload compared to men. Some young women also occasionally participate in tying the seeds (seedling). Women also do the work of men such as bringing the seaweed seedlings from the seedling storage to the boat then brought to the farm; carry the seaweed from the boat to the drying rack. In fisheries, Bennett (2005) also states that women play various roles, particularly in pre and post-harvest, processing and marketing. This means, women have double roles in daily life: first, the role in taking care of the family (domestic role) and the role in productive or income-generating activity.

6.2.3. Stakeholders' involvement in coastal management

Coastal resource management requires participation of all stakeholders at all levels on individual, group or institution basis. Functional relationship between them would contribute to sustainable development. In this study, the roles of women in fisheries activities have positive contribution to household and economic improvement and fisheries resources management. The stakeholders consists of 11 different groups which come from

local and central government sectors (marine and fisheries officers, head of village, MMAF), non-government organizations (NGOs) and local customs, academe (research center and university), small business entrepreneurs (middlemen, fishermen group and traders).

Almost all (90.9%) of the stakeholders performed roles and responsibilities to support fishermen to develop alternative livelihoods. Findings showed that 45.5% perceived the current management scheme as prone to horizontal conflict. In addition, 63.6% of stakeholders stated that there is no integrated management concept formulated by the two districts for arranging the seaweed farm in Laikang Bay (Table VI-3).

Table VI-3. Participation of multi-stakeholders at local level

Likert-scale statements n= 11	% responses			Mean (± SD)
	Agree	Neutral	Disagree	
Management prone to horizontal conflict in the current farming area	45.5	0	54.5	1.55 (0.522)
Respondents can communicate with other stakeholders	63.6	9.1	27.3	1.45 (0.688)
Some fishermen still doing illegal fishing practice	36.3	18.2	45.5	1.82 (0.751)
Stakeholders do their responsibility	90.9	0	9.1	1.09 (0.302)
Stakeholders need communication among themselves	90.9	9.1	0	1.18 (0.603)
No integrated management concept in the two districts	63.6	27.3	9.1	1.64 (0.924)

Source: Primary data processed, 2011

Those stakeholders who perceived continuing illegal fishing practices were 36.3% of the total, but 45.5% stated there are no illegal fishing practices. Therefore, they set up an informal agreement among all seaweed stakeholders including fishermen who are also seaweed farmers and full-time seaweed farmers. This agreement aims to prevent conflicts, to control coastal utilization around the beach, and to optimize the yield from farming and fishing. The Table VI-3 show that 63.6% of respondents can communicate well with other stakeholders. Therefore, almost all stakeholders (90.1%) want to encourage more productive and effective communication among existing stakeholders.

The increased attention and awareness is partly a product of the emphasis made on participatory and democratic governance and civil society participation within international institutions since the early 1980's (Wilson, 2003). There are many failed experiences of livelihood projects in coastal areas of Indonesia. The failures were caused by lack of

internal coordination, cooperation and communication among stakeholders such as project participants, local and central government, local government and fishing community. Cooperation among all stakeholders is needed. This condition was also emphasized by Mangi (2008) that complex marine ecosystems should have a simple system of sharing for all stakeholders, as well as representatives of many interested bodies of stakeholders (Pita *et al*. 2010). Cooperation from local stakeholders should provide greater role and real actions towards developing coastal areas. Central government will play a role as a partner of local governments in developing any livelihood activities. Local government is expected to gradually reduce its dependence on the central government particularly in funding sources.

6.2.4. Coastal zone utilizations of Laikang Bay coastal area

6.2.4.1. Zoning for economic activities

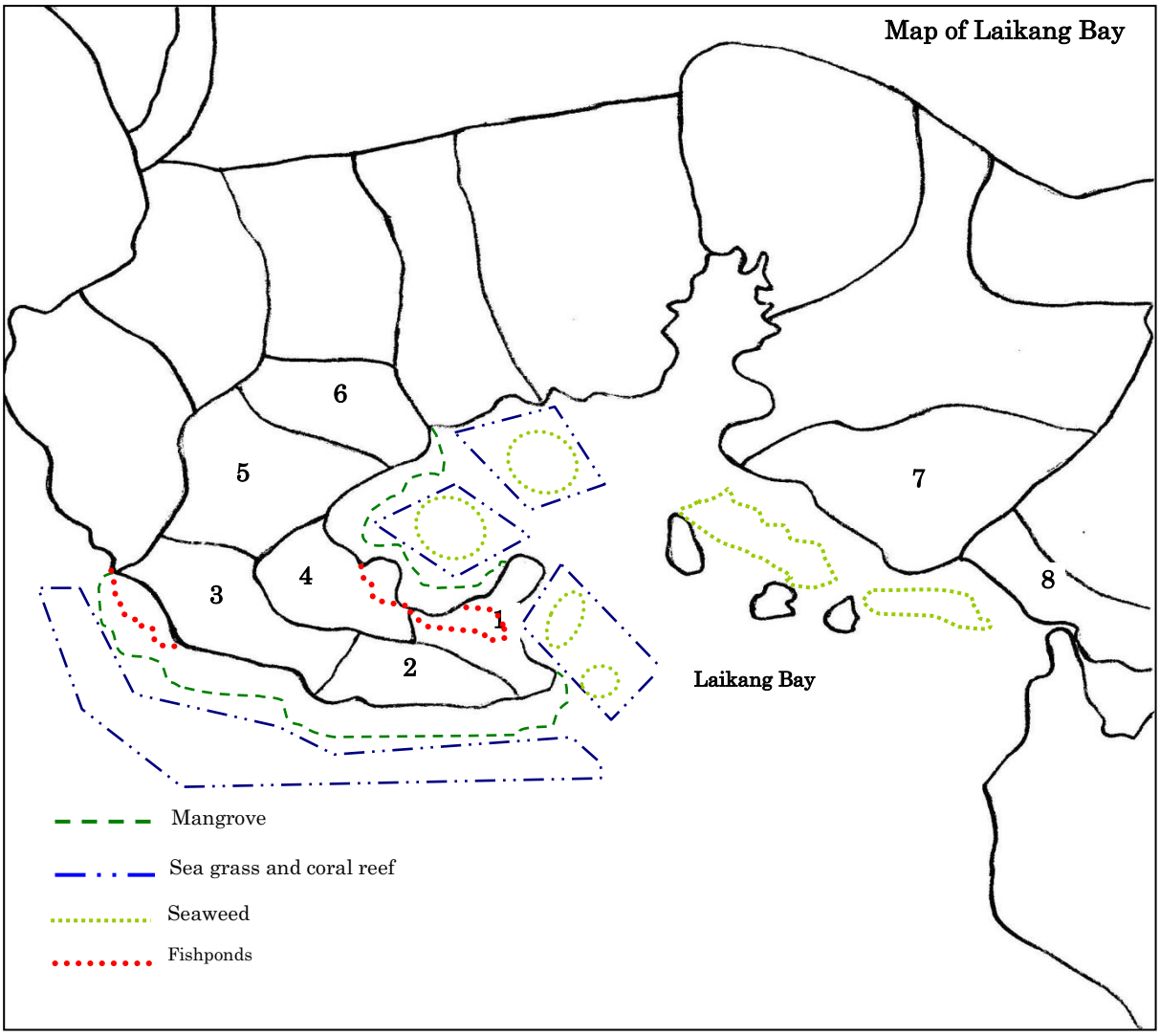
Activities in the coastal area of Laikang Bay are varied, which consist of seaweed farming, fishpond, capture fisheries, marine transportation, marine tourism, research and conservation. Some activities have generated income to the village as service charges. Most income came from seaweed farmers, crab collectors, fish farmers, and fish traders. Remuneration from seaweeds only applied to a collector because of certain considerations. First, it could protect the actual seaweed farmers engaged in production. Second, it was assumed that the seaweed collector get more economic benefits from selling the dried seaweed. The calculation of remuneration is based on the frequency or purchasing volume.

Integrated coastal management regulations were included into the village rules with the cooperation and concurrence among existing stakeholders such as groups of fisheries and other marine producers, non-governmental organizations in Laikang village, donors or partners, community groups and small-scale business people. Meanwhile, retributions are imposed upon people who commit violations. Punishments include warnings, expulsion from Laikang Village, fines, revocation of business license, confiscation of fishing gear and litigation.

6.2.4.2. Zoning for environmental conservation

Mangrove rehabilitation is also included among the regulations of the village because the mangrove ecosystem is important for restore degraded mangrove forest by transplanting mangrove trees and expanded mangrove area along coastline of Laikang Bay by planting mangrove trees. The mangrove ecosystem is vulnerable to land conversion. The regulation

specified that the mangrove ecosystem can only be used for capture fisheries and aquaculture without cutting the mangrove trees. If there is a conversion of the function of the mangrove ecosystem to other purposes, then it should be under the control of the village leader and mangrove management group (MMG) in Laikang Village. Mangrove rehabilitation is determined on levels of vulnerability of the area that is determined by the MMG and replanted together with the help of the coastal community. Since the community also has the responsibility to maintain ecosystem, community-based approach to rehabilitation and planting of mangroves is emphasized. Destructive practices are logging, destructive fishing practices, transplanting other kinds of commercial trees.



Remarks: 1: Puntondo Sub-Village (*dusun*) 2: Bodia Sub-Village 3: Laikang Sub-Village 4: Turikale Sub-Village 5: Pandala Sub-Village 6: Ongkoa Sub-Village 7: Garassikang Sub-Village 8: Pantai Bahari Sub-Village

Figure VI-1. Zoning of Laikang Bay coastal area

Zoning of the coastal area has been created through the SNRM project. Zoning in Laikang Village coastal area consists of: 1) conservation of erosion area, 2) mangrove forest conservation, 3) sea grass protection, 4) coral reef protection, 5) fish cage, 6) tourism, 7) seaweed, 8) fish pond and 9) boat track. Zoning the coastal land could serve 1) to protect the coastal environment from human activities that may damage the ecosystem, 2) to prevent conflicts of interest from various parties that utilize the coastal area, 3) to educate coastal communities about the coastal areas that open or restricted for human activity (Figure VI-1). Economic pressure can lead to coastal communities to unregulated exploitation to gain greater economic advantage, even if it would destroy the environment.

6.2.4.3. Institutional arrangement

Coastal management in Laikang Bay includes at least four aspects of social, economic, environmental and institutional strengthening. These aspects have been designed and implemented in an integrated manner. However, in reality, Laikang Village focuses on the socio-economic aspects and institutional strengthening rather than other two aspects. Economic improvement of coastal communities in Laikang Village remains a central issue in coastal management. Coastal communities are not free from the economic pressures particularly since 2007 the national economic crisis in Indonesia. Close collaboration between social and natural scientists and practitioners will contribute to the advancement of integrated coastal management (Cheong 2008).

Institutional strengthening is more emphasized towards capacity building of the human resource in coastal environment and community development. This is necessary particularly because there is limitation of general knowledge among coastal communities about environmental management and organizational management among them is still weak, while their capabilities are indispensable in managing the natural resources. Institutional strengthening under the SNRM in Laikang Village is to set up management groups such as MMG and fish cage management group, financial institutions for lending funds and village regulation formulators group.

People in coastal areas are highly vulnerable to the changing of natural resources exploitation patterns and environmental changes. Limited ability of the people in managing natural resources and the dynamics of environmental changes are still the main obstacle for them. Most significant form of degradation of habitat is the destruction of mangrove forests and coral reefs. Mangrove forest damage was caused by the conversion of mangrove areas into fishponds and large waves due to extreme weather. Meanwhile,

damage of coral reefs can be due to destructive fishing practices such as dynamites and poisons used to catch the fishes. These problems occur as a result of economic and political pressures. Consequently, policies are more concerned to production rather than sustainable use of coastal resource (Bailey 1988). Some fishermen are interested to help protect resources that they have depended on for their livelihoods (Aldon 2011).

6.2.5. Fishermen's perceptions on seaweed farming development

The eastern parts of Indonesia like South Sulawesi, Bali, Nusa Tenggara, Maluku and Papua, with their extensive coral reefs and clean water, are promising areas for developing the cultivation of seaweed, abalone, fish, coral and pearl oysters (Nurdjana, 2006). As such, it is important to ascertain the fishermen's perceptions in order to prevent any unwanted changes in these conditions. Cinner *et al*. (2010) stated that 'people who live in coastal communities have multiple levels of knowledge about the marine activities that evolved there'. Rochet et al. (2008) emphasized that fishermen's perceptions have great potential to serve as early warning signals of recent changes in the environment. In this study, the perceptions of fishermen and seaweed farmers in Laikang Bay are divided into four categories: 1) perception of farming activity, 2) perception of environmental management, 3) perception of harvesting and 4) marketing activity (Table VI-4, Table VI-5, Table VI-6 and Table VI-7).

6.2.5.1.Perception on farming activity

Indonesian mariculture involves the cultivation of seaweed, grouper, lobster and abalone. *Eucheuma*, as one of the most established species of seaweed, is recognized as a strategic commodity (Suastika *et al*., 2006). Seaweed farming in South Sulawesi is spread throughout the west coast (Makassar Strait) and the east coast (Gulf of Bone). Low income, low production level and traditional technology are characteristic of these farmers.

Essentially, seaweed farming in Laikang is distributed into two places in the Laikang Bay side (60%) to the west and the Flores Sea side (40%) to the south. Seaweed cultivation has become a major source of income for fishing communities along the coast of Laikang Bay, improving the household economy of fishermen for at least the last 10 years and which may have contributed towards a stable and sustainable way of life. Gaillard et al. (2009) stated that the concept of sustainability implies that basic needs are met on a quotidian basis. On the other hand, production scarcity influences the way in which people adopt alternative opportunities (Perez-Sanches and Muir, 2003). In this study, the processes of

planting, maintaining and harvesting were conducted mainly by the husbands or heads of household, who was sometimes assisted by the children. Meanwhile, the wife and daughters provided support in the process of seeding. The labor contributions of women and family were found to be key factors in the success of seaweed farming (Cooke, 2004).

The entire process of seeding and planting including maintenance is done by the fishermen (76%) for 45 days. Most of the fishermen (71%) employ extra labor in the planting process obviously the most laborious portion of seaweed farming. After the planting is finished, the next step is maintenance. In this study, fishermen (91%) checked their farm plots 2-4 times per week (Table VI-4). Many times, seaweed lines are detached by strong waves and currents, or floating debris get entangled in the lines causing significant crop losses.

Table VI-4. Fishermen's perception in farming activities

Factor/Statement	Perceptions (n=200)			Mean	S.D
	Agree	Disagree	Neutral		
Seaweed Farming Activities					
Benefits of seaweed farming are better than those of capture fisheries	195 (97.5)	2 (1)	3 (1.5)	1.04	0.26
The number of seaweed farms has increased	155 (77.5)	23 (11.5)	22 (11)	1.34	0.667
The seaweed farmer uses the old type of seed	143(71.5)	53 (26.5)	4 (2)	1.3	0.503
The seaweed seed could be obtained from another farmer easily	191(95.5)	7 (3.5)	2 (1)	1.06	0.269
Breeding plots are needed to produce new generations of seaweed	154 (77)	35 (17.5)	11 (5.5)	1.28	0.562
Checking The farm every day	32 (16)	162 (81)	6 (3)	1.87	0.417
Checking time to the farm is checked 2-4 times per week	182 (91)	8 (4)	10 (5)	1.14	0.471
The harvesting time is 45 days of growth	152 (76)	20 (10)	28 (14)	1.38	0.72
Laborers are involved in farming activities	142 (71)	39 (19.5)	19 (9.5)	1.38	0.655

Source: Primary data analyzed 2010

One of the reasons fishermen choose seaweed farming as an alternative livelihood is its introduction by the government through livelihood and income augmentation projects that aim to improve the general economies of coastal communities. Secondly, seaweed farming involves relatively low operational costs. Thirdly, seaweed farming requires only easy maintenance that will allow some time to engage in other income generating activity. Lastly, farmers can realize more profit from farming than from fishing. Almost all the seaweed farmers interviewed (97.5%) agreed that seaweed farming provided more economic benefits than catching fish alone, and 77.5% of farmers believed that seaweed farming is on an increasing trend in their communities. However, 71.5% of the farmers still use old seaweed seed stock, which is becoming an undesirably inferior strain. Because of

this, 77% of farmers expressed their desire to construct a breeding hatchery for creating new and improved seaweed strain without realizing the technological complexities that go into seed stock selection. Clearly, government intervention is needed here to accomplish this goal.

There are several methods of seaweed farming as explained by Salayao *et al*. (1991). Various submerged and floating methods are already in use in countries like the Philippines and Indonesia. The method used by seaweed farmers in Laikang Bay is the long line floating system. This method is used for several reasons, including suitability to dynamic water conditions, easily maintenance and monitoring, low investment and operational cost requirements, durability and repeated use of infrastructure. The number of lines in this method varies depending on the availability of seeds and farmland, spacing between each line, spacing between seedling attachment points and the economic status of the farmer.

6.2.5.2.Perception on environmental management

For seaweed farming as well as other food production systems, carrying capacity is an important factor for maintaining the sustainability of the activity. According to MMAF (2008), there are some techniques to optimize the carrying capacity of seaweed farm. Among these techniques are setting enough buffer space between farms, reducing the number of farms in dense cultivation areas, and using the right cultivation method that is suitable to the environmental conditions of a given area. Risk factors such as security, conflicts of interest, accessibility and environmental concerns also deserve serious attention. Ariza (2010) emphasized that 'planning for an integrated management approach is an influential factor and attractive for coastal areas'.

According to the respondents (81.5%), environmental conditions in Laikang Bay still need to be further developed for optimizing seaweed culture. The fishermen/farmers (82.5%) reported that the current farming areas are already crowded, and most of them (89%) stated that they need to reconfigure their seaweed plots and to identify farm ownership in a more judicious way. Some plots had been abandoned for a long time, and meanwhile there are farmers who want to use these plots (Table VI-5).

The environmental conditions of Laikang Bay are always changing because of the seasons. Unfortunately, public awareness of the importance of environmental quality is still low among the respondents. Table VI-5 shows that while environmental awareness is low, there is a growing but vague awareness of the link between environment and seaweed growth.

One condition is their continued argument that seaweed farms in the area are too dense and the situation requires a reordering of seaweed farms in Laikang Bay. There are inconsistencies in fishermen's answers when addressing environmental conditions and capabilities. Farmers' outlooks are often short-term. As long as the seas are capable of producing seaweed, farmers will continue to add plots as dictated by their economic capabilities. Fishermen who have identified or planted in ideal of fertile areas usually do not want to move to other less fertile areas, even if their farms have been left idle for a long time adding to the already worsening crowded farm problem.

Table VI-5. Fishermen's perception in environmental management

Factor/Statement	Perceptions (n=200)			Mean	S.D
	Agree	Disagree	Neutral		
Environmental Management					
Conflict has occurred in farm management	45 (22.5)	140 (70)	15 (7.5)	1.85	0.528
Environment of the coastal area is still suitable for seaweed farming	163 (81.5)	15 (7.5)	22 (11)	1.3	0.656
The coastal area for seaweed farming is already populated	165 (82.5)	30 (15)	5 (2.5)	1.2	0.459
Farm areas need to be rearranged	178 (89)	19 (9.5)	3 (1.5)	1.12	0.374
Marine pollution has increased due to seaweed farming	85 (42.5)	113 (56.5)	2 (1)	1.58	0.514

Source: Primary data analyzed 2010

Idle seaweed farms are also expected to add to the problems in the environment over several years. Their negative effects can be seen when equipment like rope and anchors become dirty and disorganized. Many cases of idle seaweed farms are observed if the owner gives up seaweed farming and goes into town to look for other jobs, or if the owner no longer have enough capital to continue cultivating seaweed. However, there are also other fishermen who want to use their capital to start planting seaweed but do not have available planting area. From the above, it is clear that a more defined system of marine farm tenure is needed to avoid conflicts as well as to maximize productivity.

6.2.5.3. Perception on harvesting activity

Seaweed age and weather conditions are two major considerations for timing seaweed harvest. Seaweed age is a "key" because it is associated with the quality of the product, including its *carrageenan* content. Big waves and continuous heavy rainfall also need to be considered in the harvesting decision. Strong wave causes seaweed lines to break a way, or even whole plots to be carried away incurring significant losses. On the other hand,

dilution of the seawater with rainwater affects seaweed growth and quality especially in areas near river mouths where freshwater influence is more pronounced. Under these situations, fishermen/farmers will harvest the seaweed even if the seaweed has not reached harvestable size and age.

It was found that seaweed was harvested following several steps. The process started by removing each line of seaweed and bringing it to the beach. Then, the seaweed was cut free from the main rope. The next process involved drying the seaweed under sunshine. In one farming operation, people use bamboo racks for drying the wet seaweed. The seaweed does not dry well during the rainy season, and requiring more time to dry, thereby affecting the quality of the dried seaweed and its water content ranges from 30-35% (MMAF, 2005). At this level, the content of carrageenan could be expected to decrease. Therefore, the respondent declared that they have suffered many losses during the rainy season.

At research sites, seaweed is not yet used to produce value added goods. Local and central governments have launched projects such as small-scale natural resources management (SNRM), economics of coastal community empowerment project (PEMP), IFC's (International Finance Cooperation)-PENSA (Program for Eastern Indonesia Small-Medium Enterprise Assistance) and even a coral reef rehabilitation and management program (COREMAP) that included some training for the processing of seaweed products by fishermen's wives and young women. In this study, 25% of the farmers stated that they incorporated some seaweed into traditional products such as toffee (lunkhead), candy and jelly. The seaweed production is increasing every year, and some fishermen/ farmers (1.2) wanted the appropriate technology to process the dried seaweed into value added goods (Table VI-6).

Table VI-6. Fishermen's perceptions of harvesting activity

Factor/Statement	Perceptions (n=200)			Mean	S.D
	Agree	Disagree	Neutral		
Harvesting					
Seaweed is dried by using a rack	124 (62)	68 (34)	8 (4)	1.42	0.57
Some seaweed was used to produce value-added products	50 (25)	138 (69)	12 (6)	1.81	0.525
The value-added technology is needed	167 (83.5)	26 (13)	7 (3.5)	1.2	0.481
Seaweed farmers take significant losses during rainy seasons	191 (95)	8 (4)	1 (0.5)	1.05	0.24

Source: Primary data analyzed 2010

However, the dried seaweed products processed by farmers do not meet the standards. Lack of quality control mechanisms is one of the problems causing the poor product quality. Moreover, farming areas that are scattered in many different areas had different harvesting times, and lack of cooperation among the districts is still a major obstacle towards developing seaweed farming. At this time, traders or middlemen[18] buy all types of seaweed products, and do not pay much attention to product quality. They buy seaweed generally based on price and according to the quality of dried seaweed.

6.2.5.4. Perception on marketing activity

The market chain of dried seaweed, which extends from producers to consumers, is still a long one. These systems provide employment opportunities at every step for the communities and facilitate marketing for producers, but the producers mostly receive low prices. Market channels at the local level start with seaweed farmers and then go on to include traders, wholesalers, warehouse/exporters and the factory and processing industries.

Dried raw-material seaweed and hydrocolloids such as agar, alginate and carrageenan are widely traded in the international market (Pawiro, 2006). Seaweed farmers in Laikang Bay mostly sell in the form of dried seaweed. They store their dried seaweed before selling to middlemen after two to three harvests. The farmers do not directly sell the seaweed after each harvest, which allows them to wait for favorable pricing to some degree (Mullikin and Petty, 2011). The price of seaweed shows some fluctuations within one year depending on different market price (Hikmayani et. al., 2007). The price decreases 10% during the peak season (January-April (Takalar) and May to August (Jeneponto)), increases 20% in the low season (August – October (Takalar) and January – April (Jeneponto)) and is usually stable during the medium season (May-July (Takalar) and September – December (Jeneponto)). According to Ju et al., 2010, these prices serve as the high and low boundaries for the asking and bidding prices of middlemen when capacity cost is sufficiently high

However, seaweed farmers argued that the market prices have been in accordance with their wishes and are acceptable to them. At the farm level, traders have a strong influence on price. Market participants such as seaweed farmers, traders/middlemen, wholesalers and processing companies/warehouses have close relationships. These ties are due to the presence of debt, kinship and friendship relations between the parties. However,

[18] Middleman is person who buys the dried seaweed from fishermen and sells to wholesalers or exporters or seaweed processing industries.

Perez-Sanches and Muir (2003) argued that 'although organization has an important effect on the local market, middlemen frequently tend to monopolize the market' and exert a dominant force (Table VI-7).

Table VI-7. Fishermen's perceptions of marketing activity

Factor/Statement	Perceptions (n=200)			Mean	S.D
	Agree	Disagree	Neutral		
Marketing					
The dried seaweed is storage before sold	163 (81.5)	33 (16.5)	4 (2)	1.2	0.452
The price of dried seaweed conforms with the expectations of farmers	139 (69.5)	56 (28.5)	5 (2.5)	1.33	0.522
The marketing system for dried seaweed is still useful	130 (65)	57 (28.5)	13 (6.5)	1.42	0.612
The price of dried seaweed is fluctuated	138 (69)	25 (12.5)	37 (18.5)	1.5	0.789

Source: Primary data analyzed 2010

Table VI-8. Compare mean between four dimensions of perception on seaweed farming development

T test		Sum of Squares	df	Mean Square	F	Sig.
T-farming	Between Groups	0.230	3	0.077	1.344	0.261
	Within Groups	11.185	196	0.057		
	Total	11.415	199			
T-environment	Between Groups	0.382	3	0.127	1.877	0.135
	Within Groups	13.313	196	0.068		
	Total	13.696	199			
T-harvest	Between Groups	0.066	3	0.022	.297	0.828
	Within Groups	14.429	196	0.074		
	Total	14.495	199			
T-market	Between Groups	1.044	3	0.348	3.059	0.029
	Within Groups	22.293	196	0.114		
	Total	23.337	199			

The mean difference is significant at the 0.05 level

Table VI-8 shows that perception of seaweed farmers is different in every dimension of seaweed farming activity such as farming activity, environmental management, harvesting activity and marketing activity. Respondent who conducted seaweed farming have a different perception in marketing and different with respondents who have activity in both seaweed farming and fishing activity; and seaweed farming with other activity outside fishery.

Table VI-9. Compare mean of multiple comparisons between four perception's dimension and personality of respondents

	T-test (Sig.)			
Factors	**T-farming**	**T-environment**	**T-harvest**	**T-market**
Family member	0.232	0.237	0.083	0.015
Age	0.294	0.678	0.254	0.044
Livelihood activity	0.261	0.135	0.828	0.029
Number of plots	0.729	0.323	0.805	0.004
Income	0.056	0.149	0.876	0.023

The mean difference is significant at the 0.05 level

Source: Primary data analyzed, 2012

According to Table VI-9, respondent who have different occupation have a different perception in marketing. Respondents who have different number of family members are different perception in marketing. Respondent who have different age have different perception in marketing. The age between 26-40 years old have different perception in marketing with respondent between 41 – 60 years old. Respondents who have different number of plot are different of perception in marketing. Personality (age, family member, livelihood activity and number of seaweed plot) have different perception in marketing.

6.2.6. The constraints of developing seaweed *E. cottonii* at farm level.

Areas of seaweed growth that stretch across the Indonesian maritime region provide not only opportunities for the development of seaweed cultivation but also the great challenge of developing sustainable seaweed cultivation. Gelcich et al. (2009) stated that this could be achieved if the local community became involved in the management process. The absence of spatial planning is the main problem in the development of seaweed culture. Currently, the factors influencing the development of seaweed cultivation include the technical aspects of aquaculture such as the aquatic environment and seeds, in addition to social, economic, marketing, managerial, and human resource capabilities.

Findings have shown that the changing monsoon season is the biggest problem in the development of seaweed cultivation. Badjeck et al. (2010) predicted that climate change will bring new challenges to fisheries in the coming decades, and the local communities should promptly adapt to this situation. The long market chain (4.22) is still a major problem in the seaweed business in Laikang Bay. Financial capital is another problem that is felt most often by seaweed farmers (3.72), especially at the start of the planting season.

In addition, the availability of seaweed seedlings (3.16), the quality of the seed (3.3), the land tenure of seaweed (3.5), diseases that attack the plant (2.84), harvesting and post-harvest processing (2.98) are considered moderate cultivation problems. The seaweed farmers expressed, to some extent, dissatisfaction with the fluctuating prices of dried seaweed (2.37), but this is manageable if there is no immediate solution (Table VI-10). Instead, the IFC's study stated that the important problems in seaweed farming are more on limited access to credit sources and the small number of buyers. Farming methods were not found to present a problem in seaweed cultivation (IFC, 2006). Presently, farmers are still propagating seaweed using cuttings, setting aside the cultivated *thallus*, but the few seaweed nursery centers in Indonesia have created difficulty for farmers trying to optimize crop yields.

Furthermore, all stakeholders in seaweed farming anticipate a rise in farm ownership issues. In the field, the head of the village has the authority to determine the location of seaweed farms. This judgment is based on several factors, such as economic means that a farmer possesses, the current location of seaweed farms and his/ her experience and condition of the coastal environment including currents, tides and depth. The economic means of fishermen is a decisive factor because there are differences in production costs between locations in the shallows and those in the deeper areas. According to the respondents, areas located in deeper water entail greater production costs, though these areas have a richer environment compared with shallower locations. Considering these factors helps to ensure equitable farm distribution and to maintain a balance while accommodating the interests of the fishermen who conduct fishing and other activities in Laikang Bay.

It often happen that seaweed does not meet the quality standards specified by the processing industry in the country because there is a lack of quality control over the product since farmers do not pay much attention. On the other hand, buyers tend to pay attention to standards in terms of quantity rather than quality. Profit taking on the part of seaweed farmers has contributed to the lack of attention to the quality of the product, a situation caused by a larger demand for seaweed than supply. Finally, seaweed of any quality would be accepted and bought by the middlemen further contributing to the overall low quality of products.

The price of dried seaweed has rose compared to prices 5-10 years ago. Nonetheless, farmers feel that low price is a significant problem in their seaweed production despite its fluctuations. Seaweed farmers argued that the market channels of dried seaweed in South

Sulawesi is long. This is assumed that the long market chain influences prices at the farm level and that farmers will earn more benefits if the market chain of dried seaweed can be shorter. However, a comprehensive effort is necessary for the creation of simple market channels that are free from conflict and fosters an effective alternative marketing process.

Table VI-10. Obstacles to develop seaweed farming in Laikang bay

Factor/Statement	Rating scales (n=200)					Mean	S.D
	1	2	3	4	5		
Changes in the two monsoon seasons	0 (0.0)	0 (0.0)	5 (2.5)	8 (3.9)	187 (91.7)	4.91	0.364
Seed availability at the farm level	0 (0.0)	0 (0.0)	179 (87.7)	11 (5.4)	10 (4.9)	3.16	0.482
The quality of seaweed seeds	0 (0.0)	0 (0.0)	166 (81.4)	7 (3.4)	27 (13.2)	3.3	0.696
Occupation of seaweed farms by farmers	0 (0.0)	0 (0.0)	112 (54.9)	77 (37.7)	11 (5.4)	3.5	0.601
Development of coastal areas	145 (71.1)	33 (16.2)	18 (8.8)	4 (2.0)	0 (0.0)	1.4	0.737
Predators and/or diseases	16 (7.8)	22 (10.8)	141 (69.1)	21 (10.3)	0 (0.0)	2.84	0.714
Financial capital	0 (0.0)	2 (1.0)	59 (28.9)	133 (65.2)	6 (2.9)	3.72	0.534
Farming method	172 (84.3)	15 (7.4)	13 (6.4)	0 (0.0)	0 (0.0)	1.2	0.543
Post-harvest processing	4 (2.0)	25 (12.3)	141 (69.1)	30 (14.7)	0 (0.0)	2.98	0.597
The price of dried seaweed	9 (4.4)	122 (59.8)	52 (25.5)	17 (8.3)	0 (0.0)	2.38	0.707
Marketing channel for dried seaweed	0 (0.0)	0 (0.0)	17 (8.3)	123 (60.3)	60 (29.4)	4.22	0.584

1: No obstacle 2: Slight obstacle 3: Moderate obstacle 4: Significant obstacle 5: Extreme obstacle
Source : Primary data analyzed, 2010

Table VI-11. Compare mean of multiple comparisons between average obstacles and personality of respondents

	T-test (Sig.)			
Factors	**Number of plots**	**No. of family member**	**Livelihood activity**	**Income**
Aobstacle	0.05	0.059	No sig.	No Sig.

The mean difference is significant at the 0.05 level
Source: Primary data analyzed, 2012

According to Table VI-11, respondent who have different number of seaweed plot, they might think have different obstacle scale. In this case, the respondent who have less than or equal two plots had extremely obstacle in seaweed development rather than respondent who have more than three plots of seaweed farm. Respondent who have small number of family members or less than or equal two members had extremely obstacles rather than

respondent who have a big family member (between 3 to 5 members). Respondent who concerned in improving economy, they have to concerned in developing seaweed farming. Finally, it can be conclude that seaweed farming is one of alternative way to improve the fishermen's economy.

6.3. Summary

The results of this study show that seaweed farming, mainly of the species *Eucheuma cottonii*, has become the main livelihood for fishers in the studied area. 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. As a result, destructive fishing has declined considerably and awareness has increased regarding the need to preserve the mangrove areas that protect the coastal ecosystem from degradation. Seaweed farming plays an important role in the socioeconomic condition of fishing communities. Such farming increases income and stimulates family and community participation, particularly that of women. However, some constraints hinder the development of this activity, such as disease, post-harvest difficulties, farm ownership, shifts in the monsoon season, and marketing constraints. In addition, the availability and quality of seaweed seeds, issues surrounding farm ownership, predatory behavior and imperfections in post-harvest methods are also obstacles. However, farmers can overcome these obstacles. Positive factors include the lack of restrictions on the development of coastal areas, the availability of successful farming methods and the price of dried seaweed.

In Laikang Village, revolving fund stimulus given to fishermen through government projects was effective in increasing economic capacity of fishermen. The funds are primarily to support the development of fishermen activities and livelihood diversification. Seaweed farming (*Eucheuma cottonii*) as a product measure of diversification efforts has improved the economic situation of fishermen in recent years. The success of fishermen in livelihood diversification has not only given a positive impact on the fishermen themselves, but also provided benefits to his wife and other family members. The fishermen's wives are involved in production actively. Fishermen in coastal area of Laikang Bay together with other stakeholders set up zone for coastal uses in the bay area. Although still tentative and formal legal status is still weak, stakeholders in the village level set up the zoning policy of temporary nature.

Fishermen can adapt to changes during the monsoon season and then plant seaweed during the year as an alternative activity. Awareness among fishermen of environmental

productivity is still low. Rich farm locations tend to be under more pressure because of the increase in new plots and farms that are built surrounding these locations. New drying technologies are needed during the rainy season, when there is an abundance of seaweed production. Nonetheless, seaweed farmers can still accept the low prices and long marketing chain of dried seaweed despite these problematic factors. To explore solutions to these problems, there should be a more open interaction involving not only farmers, fishermen, local leaders, local government and traders, but also representatives of other sectors. Finally, the study concludes that the development of seaweed farming can promote the sustainability of the fishery sector and coastal areas and make the livelihood of fishermen more stable and secure.

CHAPTER VII

IMPACT ASSESSMENT OF MARKETING SYSTEM OF DRIED SEAWEED ON SUSTAINABLE LIVELIHOOD ACTIVITIES IN FISHING COMMUNITY

7.1. Introduction

In the cultivation of seaweed, fishermen in the research sites have used various ways to address the problem of financial capital. Besides formal financial institutions that are rarely tapped, fishermen usually borrow money from the family, relatives, friends and even traders in the village. This frequently happens because small-scale fishers still have problems in accessing capital from formal financial institutions such as commercial banks. The patron-client relationship within seaweed farming scheme is often referred to as *punggawa* (middlemen) – *sawi* (farmer) system. In this study, a patron is called middleman, who can be defined as the person who provides the capital and lending to fishermen/seaweed farmers to produce seaweed. Meanwhile, a client is a person/fisher producing the seaweed, who is called as seaweed farmer.

This chapter seeks to identify the socio-economic characteristics of seaweed farmers in Laikang Bay; to assess the role of middlemen in sustaining local seaweed cultivation activities and to describe the pattern of the local seaweed supply chain.

7.2. Results and Discussions

7.2.1. Market channels of dried seaweed at local level

The survey results reveal that the existing marketing system for seaweed farming plays an important role in sustaining fisheries livelihood activities in surrounding coastal area of Laikang Bay. In Takalar Village, seaweed farmers sell seaweed in dried form to middlemen at the village level. These traders then sell the product to middlemen at the district level, who, in turn, sell it to wholesalers who have warehouses in Makassar/Ujung Pandang, or to a processing company there. The usual age of harvestable seaweed is 45 days. However, seaweed farmers may harvest seaweed at 20 days, 25 days and 30 days, or even at 15 days. This is mainly because of avoiding the spread of disease. Such earlier harvesting is undertaken when disease spread among the seaweed, which will lead to the damage of harvesting, or the death of those plants. Diseased seaweed can still be sold, but at lower-than-normal prices.

Wholesalers receive shipments of seaweed from traders who have become frequent partners. Bulk shipment of seaweed out of the villages is done about once a month, or when the accumulated seaweed volume attains 15 to 20 tons in order to maximize the benefits from transportation costs. Wholesalers receive seaweed from the same traders who have become frequent and reliable suppliers over time thus reinforcing the strong ties between wholesalers and traders. Personal trust among seaweed farmers, middlemen, wholesalers and processing company plays an important role in the success of the seaweed business. According to the survey, wholesalers required technical specifications of dried seaweed when they would buy. Water content of seaweed is less than 37% and pH less than 12. In some cases such as rainy season, disease attack and extreme environmental changes was caused farmers could not fulfill those quality standard. In such cases, the seaweed will either be rejected or be bought at discounted prices by wholesalers. The trust factor is important between wholesalers and traders with strong business ties. Wholesalers exist because they are able to provide a more effective and efficient distribution system than any other participants in the market (Rosenbloom, 2007). The marketing structure of seaweed in Takalar is illustrated in figure VII-1 below.

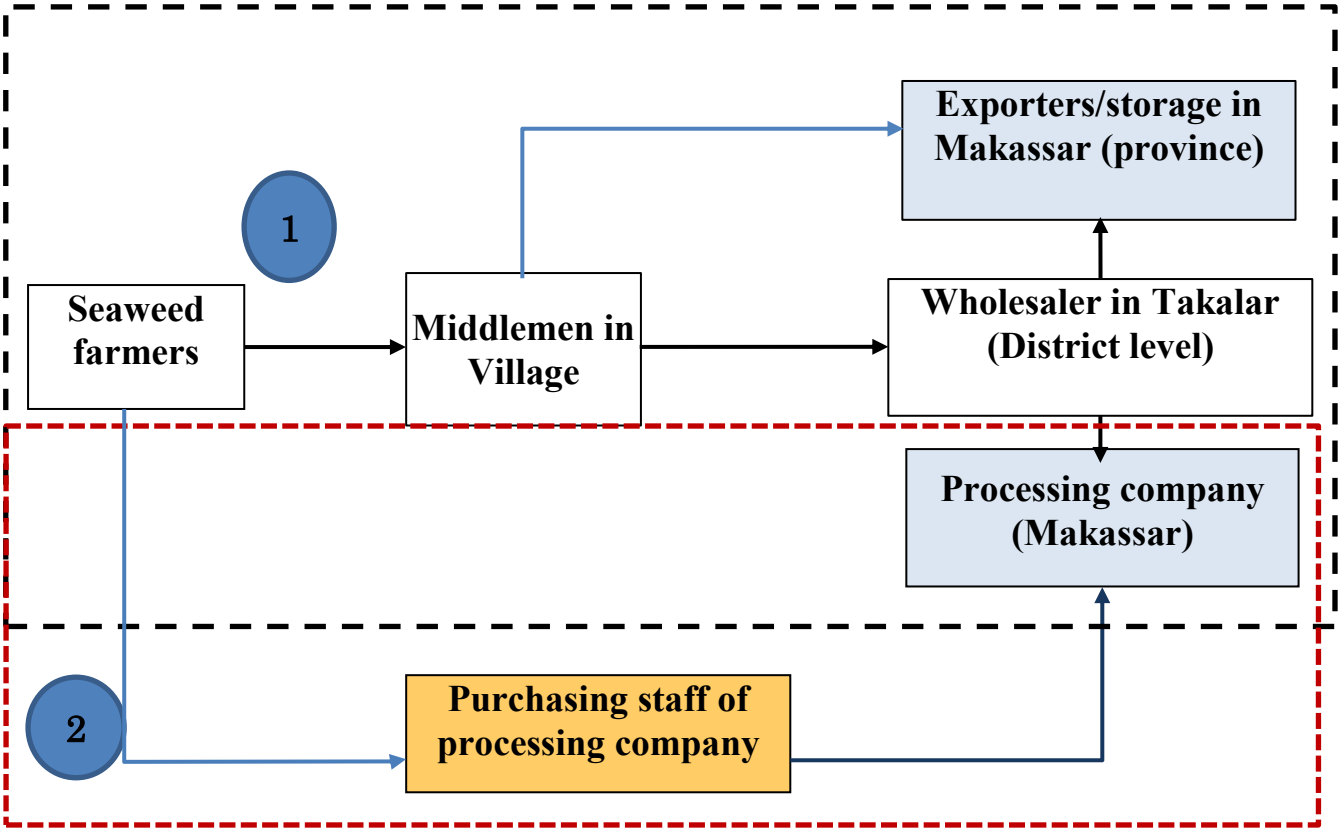


Figure VII-1. The two major patterns of market channel for dried seaweed at South Sulawesi

Fishermen have been adopted these two major market channels that showed in Figure VII-1 above. The price of dried seaweed always fluctuates. Generally speaking, the price of dried seaweed can be distinguished based on quality of dried seaweed. However, lenght of market channels have also influence the price formation of dried seaweed at farm level. According to the survey, the price of dried seaweed in first level (farmer to middlemen) is IDR[19]. 7000 – 8000/kg, the price at second level (middlemen to wholesaler) is IDR. 8000 – 9000/kg, and the price at third (wholesaler to exporter/processing company) is IDR. 9000 to 10,000/kg. In the last level, pricing is depend on the buyer who is an exporter of processing company. The price in exporter is higher than the price in processing company with considering the quality of dried seaweed. In practice, the first market channel (Figure VII-1) is the most adopted in South Sulawesi since about last two decades. This is due to the decisive role of middlemen , as has been already mentioned. Fishermen at the village level who cultivate seaweed can also serve as middlemen.

Processing company's agent found in the marketing chain is not an employee of a processing company or an exporter, but some agents are appointed by the company to purchase raw materials (Figure VII-2). Some exporters are also engaged in seaweed processing aside from being exporters of dried seaweed.

Figure VII-2. Packaging process of dried seaweed by the exporter's staffs

There are particular exporters such as Semi Refined Carrageenan (SRC) and Alkali Treated Cottonii (ATC) producing value-added products (Figure VII-3). The pattern of seaweed

[19] 1 USD = 9,735 IDR (2012/12/25) www.bi.go.id

marketing in Takalar, as described above, is similar to that in Gorontalo, Southeast Sulawesi. In Gorontalo, dried seaweed is sold to a local trader, who then sells it to a wholesaler, processing company, or exporter (Neish, 2007). Roy (2000) emphasizes that, in order to expand the market, each part of the chain may need information on the seaweed's characteristics and on consumer preferences.

Figure VII-3. Processing product of Seaweed in South Sulawesi

7.2.2. The Role of middlemen in sustaining seaweed farming activity.

According to Ju et al. (2010), intermediaries begin by choosing the best goods, then buy the goods from producers and sell them to consumers. In the current study, middlemen were described as buying dried seaweed from farmers containing a moisture content of 60%. The purchase price for dried seaweed is 4000 IDR/kg (Figure VII-4). Middlemen located in farming areas, and traders in some areas are members of the seaweed farmers' group; some even serve as heads of groups.

Figure VII-4. Middleman weighing seaweed obtained from fishermen

After a significant amount of seaweed is collected, it is then sold to middlemen who live in the district and then sold to the warehousing or processing enterprises in Makassar. This procedure was confirmed by Gadde and Snehota (2001), who argue that middlemen bridge a production-consumption gap. This study finds that some seaweed farmers are closely affiliated with particular middleman. Consequently, they sell their produce to those middlemen (Figure VII-5).

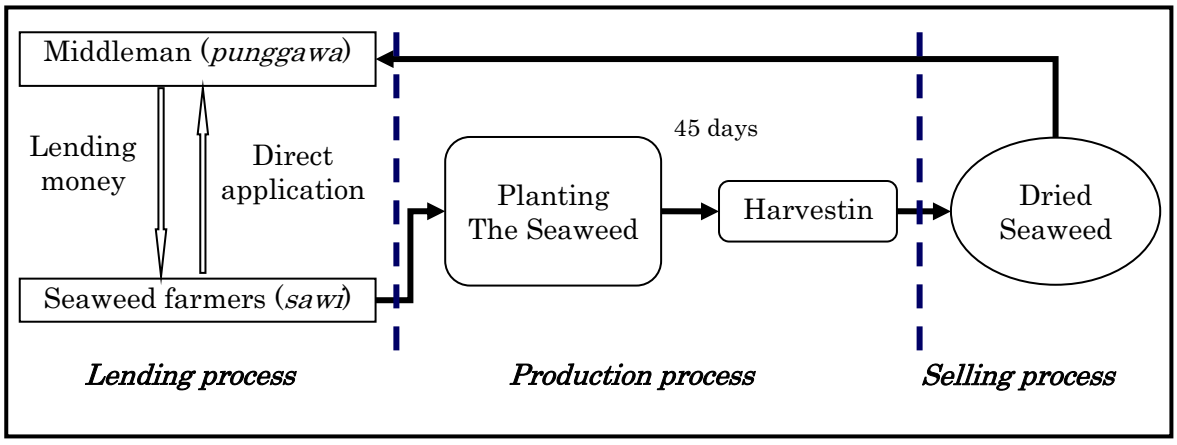


Figure VII-5. Relationship pattern between middlemen and seaweed farmers toward sustainable seaweed farming

Figure VII-5 above shows that seaweed farmers go directly to a particular middleman to borrow money. These funds are used for restarting the planting cycle and are allocated either for seaweed seed stock or for equipment needed to repair the seaweed farm. This loan is extended without any collateral. In return, seaweed farmers must sell their product exclusively to the middleman who extended the loan. Normally, middlemen do not fix a

time limit for repayment of debt. Seaweed farmers do derive some benefits from this relationship: 1) seaweed farmers can quickly obtain loans, 2) there is no interest charge on loans, 3) the farmers get the assurance that they will be able to sell their harvest, and 4) the farmers get cash payments. This is quite similar to the situation in Kenya, wherein middlemen act both as direct links to the external market and as the source of credit for fishermen (Crona, et al. 2010**)**.

In this study, the relationship between a particular middleman and seaweed farmer is based on the viability of the seaweed business. The double roles that middlemen play cannot alone guarantee a sustainable business, although they are assured of the availability of dried seaweed from the farmers who borrow capital from him. This means that middlemen and seaweed farmers are implicitly "tied" to one another in a mutually beneficial relationship. Day (2000) emphasizes the value of such relationship building when there are only a few valuable customers who engage in large transactions. However, the relationship between middlemen and fishermen/seaweed farmers is being transformed, in the long term, into a trade with an exclusive relationship at the local level. The middlemen's financial sources are independently different from regular institutional sources. The same "patron-client" relationship (local name called: *punggawa-sawi*) relationship exists in the traditional fishery system but it is different from that in the seaweed farming system. Table VII-1 compares the two different patron-client systems in capture fisheries and seaweed farming activities.

Table VII-1. The two patron-client systems in capture fisheries and seaweed farming activities

Instruments	**Fishing activity**		**Seaweed farming**	
	Punggawa-middlemen (patron)	*Sawi*-fishermen (client)	Middlemen (patron)	Seaweed Farmer (client)
Role	Owner of fishing equipment	Worker	- Moneylender - Buyer	- Farmer - Borrower
Products or service provided	Fuel, boat, fishing gears	Manpower	- Funds/money	- Dried seaweed
Benefits	Profit from business/activity	Receives a salary	- Easy to get dried seaweed products	- Get capital money - Easy to sell dried seaweed
Organizational form	Group	Group	- Individual	- Individual

Source: Field survey, 2010 and Arif (2007) (unpublished).

The present study has found that the observed positive impact on the relationship between seaweed farmers and middlemen can be explained in several points; 1) seaweed farmers could get loans through quicker process, 2) there was no interest collected on loans, 3) the farmers were assured of selling their harvest and 4) the farmers got cash payment for their produce which actually represents additional debt. Middlemen may not be the best buyers, but they can provide some social benefits in the long run (Masters, 2008) by seeking the best market prices whose profits can sometimes be passed on to the farmers (Ju *et al*., 2010; Rust and Hall, 2003; Shevchenko, 2004; Li, 1998). Indeed, middlemen have two essential roles as direct links to the external market and as provider of credit to fishermen (Crona *et al*., 2010). Characteristics of seaweed marketing in Takalar seem typical of the trends seen in this part of Indonesia. In Gorontalo southeast Sulawesi, dried seaweeds were sold to a local trader, then purchased by wholesalers/processing company (Neish, 2007).

According to Ju *et al*. (2010), intermediaries begin by making capacity choice then buy goods from producers and sell them to consumers effectively bridging the production-consumption gap (Gadde and Snehota, 2001). Johri and Leach (2002) and Vesala (2008) argued that the adverse selection problems in the trade of goods of different quality may be alleviated through a middleman. Middlemen can act as an alternative and advantageous way to reduce market frictions (Masters, 2007). Meanwhile, wholesalers made the products available, bringing an assortment of conveniences essential for bulk-breaking, providing credit and finance, performing customer service functions, as well as providing advice and technical support (Samali and El-Ansary, 2007). The accessibility and risks of the product market depend on market structure, size of the products, expected demand levels and the nature of competition (Roberts and Stekoll, 1993**)**. These constraints generally indicate that cooperation among seaweed stakeholders is not strong or well developed. Smith and Renard (2010) suggest that, in order to expand fishers' income-generating activities, they have to apply a strategy based on integrated technology, ecology, sociology and economics.

7.3. Summary

The marketing system has provided benefits, such as speedily supplying investment and daily operational funds, without interest, to seaweed farmers through the efforts of middlemen. Middlemen are perceived to be very important to sustaining seaweed farming. However, this situation has created a heavy dependency on middlemen and, consequently, also created an exclusive relationship. Nevertheless, the activities of middlemen are

necessary to the operation of the dried seaweed supply chain in Laikang Bay as long as the local and central governments cannot facilitate the creation of an effective alternative market chain at the local level.

The existence of middlemen is crucial in the dried seaweed supply chain, as long as the local/central government could not implement a better and effective market chain for seaweeds at the local level. The farmers have borrowed from middlemen eliminates the need for financial institutions which require complicated documentation and strict repayment schemes. Middlemen can offer more flexible repayment terms in kind or goods. This works better for farmers because of the flexibility it offers and assured disposal of their dried products even if some respondents perceive the middlemen-farmer relationship as exploitative and unfair. This is because the seaweed buying price is mostly set by middlemen and most farmers usually cannot sell to other traders who may be offering higher buying prices. Indeed, this traditionally disadvantageous relationship will be maintained in the absence of government intervention and big industry players that can offer more equitable business terms to further encourage seaweed farming. The acute supply of raw materials these days should prompt processors to set up more vigorous procurement efforts by putting up buying programs characterized by higher prices and easier credit extension.

The growing dependence of many fishing communities to seaweed farming as a main income source will allow seaweed farming more quickly and potentially resulting to greater prosperity in the coastal areas. However, the density of seaweed plots and the unclear definition of farm ownerships are prone to lead to conflicting claim among interested parties. The issues about foreshore claims should be addressed by village and government leadership to avert a socio-economic crisis in the future. Furthermore, ecological studies should be conducted on the carrying capacity of the coastal environment in Laikang Bay and how seaweed farming can influence the environment in an effort to strike a balance of social acceptability and positive ecological effects of this particular activity.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations are provided to explain four specific objectives: 1) to explore the impact of overpressure from capture fisheries on the livelihood activities of fishing communities; 2) to evaluate the livelihood adaptation pattern in response to declining fisheries resources in fishing communities: 3) to assess the constraints and opportunities of seaweed farming development in sustaining fisheries resource and livelihood activities: 4) to evaluate the impact of marketing of fisheries resource on livelihood activities in fishing communities. The result of analysis in this study will hopefully be able to support and giving contribution to developing a diversification strategy of livelihood and coastal resource management toward achieving social resilience in fishing communities of Indonesian coastal areas. This chapter offers some recommendation that will solve the problems in coastal areas particularly in fishing community and contribute for poverty alleviation in Indonesia. The recommendations based on the findings of field surveys to find out livelihood development strategies, developing livelihood activity in fishery and outside fishery, better marketing systems for fisheries products for achieve better life of fishermen in Indonesia.

8.1. Conclusions

8.1.1. The impact of overpressure from capture fisheries on the livelihood activities of fishing communities.

This chapter would answer for the first question and the first objective of this study. Fishermen are highly dependent on capture fisheries for many years. As a case study of purse seine fishery in Bali strait, fish production has decreased or fluctuated in both quantity and quantity in recent years. An ever-increasing and uncontrolled exploitation and management malpractices have caused a reduction of fisheries resource. Beside, introduction of modern fishing gears such as purse seine, modern motor boat and destructive fishing practices in some areas has increased pressure to fisheries resource in Bali Strait.

The major impact of these practices in coastal and marine areas of Indonesia is related with long-term off-fishing (*paceklik*), then called “fish crisis”. Moreover, this caused “collapse” of livelihood in fishing communities, because all parts of the supply chain including fishermen, traders, processing plant and factory have been stopped or nearly collapsed in

their economic activities. On the other hand, small-scale fishermen and their family do not have many other accesses to alternative income sources. Meanwhile, the central government (GoI) through the local government equipped with existing regulations is still experiencing difficulty to continuously find a surefire way to implement policies to address depleting fish production through time.

8.1.2. The livelihood adaptation strategy in response to declining fisheries resource in fishing communities.

This part would answer for the second question and the second objective of this study. There are different adaptation patterns for those fishermen who work at small-scale fishing activity in South Sulawesi and large-scale fishing activity in Bali. They keep depending on fishing activity even during the off-fishing season. They do not migrate temporarily or do any activities outside their main job (fishing). The alternative livelihoods in both fishery and non-fishery in villages have not yet been explored. To adapt the strategies in response to fisheries resources depletion, the fishermen use different ways to adapt to changeable situation. In case of large scale fisheries such as purse seine fishery in Jembrana (Bali), ordinary fishermen or crew usually work as construction workers in the city of province (Denpasar) and some city in Java, working as agricultural laborers in other villages in the district (Jembrana). The owners of boats and the captain/fishing master also take off from their fishing activities. They sell some assets such as boat, gold, motorcycle, car to survive during off-fishing. Some fish traders maintain buying and selling activities by providing fresh fishes obtained from some fishing area of Java. In any cases where there is less alternative resource available and job opportunities, which is the reason for fishermen, boat owners, captains sell their assets to adequate daily expenditures and maintain another asset (for boat owners).

In case of small-scale fishermen such as those in Takalar and Jeneponto Districts, they reduced their activity on fishing and concentrate in seaweed culture activity. These activities are conducted together by fishermen as a double strategy to sustain their household income. This is one type of adaptation pattern in response to decreased fish production. At present, in case of this study, seaweed culture becomes the “prime mover” for household economy rather than capture fisheries. As long as the coastal environment is conducive for developing seaweed culture, this adaptation pattern can be used by fishermen and expanded to another coastal area. This is assuming that demand for dried seaweed *E. cottonii* has a good market.

8.1.3. The constraints and opportunities of seaweed farming development in sustaining fisheries resource and livelihood activity.

The constraints of developing seaweed farming in coastal area of Indonesia can be divided into 4 major factors that related to: 1) farming activity, which includes pre-farming, planting, harvesting and drying:2) marketing including market channels and prices:3) financial management; and 4) environmental changes. Changes in the period of monsoon seasons, attached disease, drying method have resulted in low quality of seaweed. However, even such a low quality product is accepted in the market at a low price. Due to the high demand for dried seaweed, government policies fully support and promote the seaweed business to local people as main economic driver in coastal areas of Indonesia. Moreover, this needs to be supplemented with fishermen's ability to manage their income for sustainable business.

Some fishermen might think that the constraint of seaweed farming is dependent on the number of seaweed farms (plots). Finally, fishermen showed concern to improving local economy as well as individual economic condition by developing seaweed farming in surrounding coastal areas. Livelihood diversification through seaweed farming succeeded to improve household economy as well as family member participation in income generating activities. These explanations above are answering for third question and objective of this study.

8.1.4. The impact of marketing system of fisheries resources on livelihood activity in coastal areas.

Marketing system of fishery products (fish and seaweed) in Indonesia shows typical "labor-intensive" pattern. There are many types of market channels. In case of fish marketing in Jembrana (Bali), people who showed interest in participating in any channels of marketing systems have increased, even just in the small part. They would sell some products and get the benefits from particular marketing activities of fisheries products. Meanwhile, in case of seaweed marketing, a middleman has an important role in marketing of seaweed products, particularly to sustain the supply chain because he buys the products directly from fishermen. Meanwhile, the middleman has another important role in sustaining the fishermen's business. Middleman always provides a certain amount of capital when client-fishermen need for their reinvestment. Good performance of the microfinance institution's roles to support small and medium scale entrepreneur of

fishermen will reduce the dominance or hegemony of middleman in supply chain and pricing of dried seaweed at the local level.

Overall, marketing system of fish product as well as dried seaweed gives positive impact to encourage people participate in maintaining fisheries livelihood sustainable. In term of local economic development point of view, fish marketing system is appropriate to maintain for short-term project (5-10 years), because fishermen can explore several types of market channels without adding any costs to the marketing system. The new market players can sell individually, cooperate with others, they process to be value added product and then sell to the market. These modifications of marketing system can be improved by themselves according to market opportunities. This evaluation is different with marketing system in seaweed business.

At present, market channels of seaweed product such explained in Chapter 7 is exclusive relationship. This is due to the fact that the seaweed (*E.cottonii*) is not for the main food product in Indonesia, but for industrial purposes and export. Product diversification from seaweed for human food is not yet develops in Indonesia. This is the reason that marketing system of seaweed cannot be equated with fish marketing system. However, as a mentioned at Chapter 7, the number of channels in seaweed marketing felt still long. This long channel should be reducing to increase the seaweed price at the farm level. Modification and creating alternative marketing channels is needed to address the stable price at the farm level.

8.2. Recommendations

8.2.1. Coastal management for sustainable fisheries and livelihood activities.

Central government (GoI) and local governments (provincial and district) through the technical staff in the field need more strength in enforcing existing fisheries regulations. Self-monitoring of coastal and marine uses needs the support of all fishery stakeholders by encouraging performing existing system namely “community surveillance system” collaborated with water police and coast guard. Stakeholders particularly fishermen on the sea will report to security guard or “management body” when they show any violation in the sea, for example the violation related with fishing ground, destructive fishing practices etc. In the small-scale fishery, local government needs more active participation in marine and coastal management at village levels by encouraging staffs to visit frequently the villages and identify the problems and opportunity in the village as well as fishermen’s

economy problems, coastal management and social matters. To ensure that the policies are implemented properly, the "management body" as ad hoc organization needs to be performing to control the utilization of coastal and fishery resources of Bali Strait. The "management body" can performed by two provincial governments (East Java and Bali) which responsible for implement and control policies, research, monitoring for water area including physics, biology, environment, fish stock management etc. Limit the quota of purse seine and daily catch amount, enlarge meze size can be alternative choice for recover the condition of fish resource in Bali Strait.

8.2.2 Adaptation of fishery resources depletion.

Livelihood diversification is a better choice to support the fishermen adapting from the impact of decreased resource. Local government should provide some assistance such as training for alternative livelihoods, capacity building for fishermen, institutional strengthening and social capital strengthening. Improving alternative fishing technologies which are environmentally friendly and economic beneficiaries can be developed in fishing communities as one of the ways to reduce the impact of declining fish catches. Developing livelihood activities other than fishery in fishing communities is needed to give alternative choices to fishermen and their wives for improving their economic situation. Developing value added product processing by producing "food product" with seaweed or fish as raw material is another choice to reduce dependence on fishing activity. In this case, women (fishermen's wives) could get more chance to actively participate in improving livelihood activities by producing some food product based on seaweed as raw material (Appendix 10).

8.2.3. Sustaining seaweed farming by minimizing constraint and maximizing opportunity

According to the SWOT analysis, there are four strategies to develop seaweed farming. These four strategies are interdependent with each factor of SWOT; 1) Strengthen – opportunity (S-O) strategies, 2) weakness-opportunity (W-O) strategies, 3) strengthen-threat (S-T) strategy, and 4) weakness-threat (W-T) strategy. In this study, the first strategy (for fishermen) is proposed to expand the potential farm area in an optimal and environmentally friendly way to meet the market demand for seaweed. The second strategy consists of two choices (for government side): a) encourage seaweed farmers to improve their knowledge of business management, including aspects of finance, farming, methods and post-harvesting process; b) improve knowledge of quality standards and

market demand. The third strategy covers two choices (for local stakeholder): a) develop alternative models of farming methods to minimize the risks, such as reducing farm size (50 m x 15 m) and using the baskets to protect seaweed plat from predators, and b) prohibit activities which could reduce the quality of seaweed, such as collecting farm's waste and improving implementation and evaluate existing village regulations. The fourth strategy also consists of two factors (for local stakeholder): a) building public understanding and awareness of environmental protection; b) build a farm utilization model. The development of seaweed farming can promote the sustainability of the fishery sector and coastal areas and make the livelihood sources of fishermen more stable and secure.

8.2.4. Marketing system of fishery products

Fish product

For middle and large scale fisheries such as purse seine fisheries

There is a possibility to maintain existing marketing system for fish products. This is due to the cooperative relationship between fisherman and traders, fishermen with processing companies and trader with processing company. As such, the fish from boats is quickly distributed to processing companies considering the fragile nature of fish.

For the small-scale fishery

Provide greater opportunities to the people who are interested in fisheries marketing system as an alternative choice. They usually know where the fish should be sold. It also provides alternative livelihood options other than fishing.

National government and local government should strengthen further cooperation to promote the "cold chain system" in the marketing of fish product. This is very important step to maintain the quality of fishes, safety and hygiene of fish products.

Seaweed

For a short term strategy

The existence of middlemen in the farm level is important to sustain the seaweed business. This means that government could maintain this existing marketing system.

For a mid-term strategy

Re-arrange market channels of dried seaweed. There will be some requirements needed, firstly, encouraging the spirit of the fishing community to set up “seaweed cooperative”. In the future, seaweed cooperative could be replacing the dominant-role of middlemen. This means that a cooperative will provide the capital investment for fishermen and buying the seaweed from fishermen. Secondly, brainstorming between fishermen, the staffs of village, local NGOs, middlemen and custom figure are needed to find out a better strategy to improve value chain of seaweed product. However, the socialization or dissemination of this idea is needed to get the response and support of the coastal society particularly fishing community.

In practice, some practical recommendation can apply for developing local economic and environmental management such as reducing the size of farm from 100 m x 30 m to 50 m x 15 m, using the baskets to protect seaweed plant from predators, collecting farm’s waste and improving implementation and evaluate existing village regulations about marine and coastal management, mangrove ecosystem management, loan and micro credit, and marine protecting area (MPA), which established since 2007.

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Appendix 1. Questionnaires

A. Questionnaire for assessing livelihood development and coastal management in Laikang Bay, South Sulawesi

PART I. DEMOGRAPHICS INFORMATION

Information of respondents

1. Name or respondent:
2. Gender ✓

Male	
Female	

3. Age (Yrs.) ✓

18 – 24	
25 – 34	
35 – 44	
45 – 59	
≥ 60	

The number of family member ✓

≤ 2	
3 – 5	
≥ 6	

4. Education ✓

Incomplete elementary	
Elementary	
Incomplete junior high school	
Junior high school	
Incomplete senior high school	
Senior high school	
Incomplete college	

5. Occupation in fisheries ✓

Fishing activity	
Fish culture	
Seaweed culture	
Fisheries processing	
Others (please specify)	

6. Monthly income (Indonesian Rupiah/IDR) ✓

≤ 500,000	
500,001 – 1000,000	
1000,001 – 2000,000	
2000,001 – 3000,000	
> 3000,000	

7. What proportion of household income come from seaweed culture? ✓

≤ 25%	
26% - 50%	
51% - 75%	
75% - 100%	

8. Distribution of income (%)

School fee of children	
Daily food	
Health fee	
Social purposes	
Saving	
Other purposes (please specify)	

Loan information ✓

9. Do you have indebtedness? Y☐ No ☐

10. Source of indebtedness:

Bank	
Family	
Neighbor house	
Middleman	
Informal moneylender	
UPKMP	
Other sources (please specify)	

11. What is the ethnic group you are?

Makassar	
Bugis	
Buton	
Java	
Others	

12. Classification of respondents, according to the seaweed planting experience

≤ 5 years	
6 – 10 years	
> 10 years	

Woman activity

1	Types of woman activities	✓	Period of started (yrs)		
			≤ 5	6-10	>10
	Internal activities (household)				
	Post harvesting (fish processing, food processing etc)				
	Pre-production (fishing activity, farming activity etc)				
	Production activity (fishing and farming)				
	Marketing (fisheries and non-fisheries)				
	Social activity				

2. Who is introducing the present activity to you?

Local government	
Local Gov. through the project	
The project activities	
It self-initiative	

3. How much your income

Activity	Per week (IDR)	Per month (IDR)
1.		
2.		

4. If they have activity, their used the benefit is for?

Support the household need	
Saving	
Private purposes	
Other purposes	

5. Participation in decision making of household matter

Yes	
No	

6. Who is dominant in decision making in household

Husband	
Wife	

7. Did you participate in some projects activities, which implemented in this village?

Yes	
No	

8. If “yes”, did you continue your activities?

Yes	
No	

9. If "no", please answer the question: why?

Lack of the financial capital	
Raw material is limited	
Other reasons	

PART II. BENEFIT-COST ANALYSIS (BCA)

Seaweed culture activity

1. How many plots (units) of seaweed you have now? (1 plot = ……m X……m) or ……lines

1	
2 – 5	
6 – 10	
10 – 15	
≥ 16	

2. Status of seaweed plots ownerships

Private ownerships	
Share ownerships	
Tenants	
Rent	

3. Production (in average)

	Ton/month	Ton/yr
Wet		
Dried		

4. Cultivation method

Off-Bottom plots	
Floating lines plots	
Raft	
Long line	

5. Input-output information

- Initial investment cost

Material	Quantity	Cost per unit (IDR)	Useful life (Yrs(
Frame (.mX…m)			
Frame line (…mm) (roll or kg)			
Anchor line (…mm) (roll or kg)			
Seaweed line (…mm) (roll or kg)			
Anchor			
Floater			
Frame construction			
Boat			
Boat maintenance			
Tarps			
Drying rack			
Sack			

- Investment source/financial capital

Bank	
Family	
Neighbor house	
Middleman	
Informal moneylender	
UPKMP	

Other sources (please specify)	

- Annual labor cost

Activity	Number of labor	Hours per laborer	Wage per hour	Total cost
Tying seed: - Family labor - Hired labor				
Planting				
Farm management				
Harvesting: - Family labor - Hired labor				
Carrying to dry				
Packaging				

- Revenue (IDR)

Wet: (1 ton= IDR) - per harvest	
- per year	
Dried: (1 ton= IDR) - per harvest - per year	

6. Type of disease, which destroyed the seaweed

Ice-ice		
Predator		
Small fish		
Others (please specify)		

7. Why crop was failure or production was decreased

Quality of seed is low	
Predators	
Disease	
Strong wave	
Environmental condition is low	
Natural disaster	
Planting method	
Others	

8. Planting season

Seasons/month	1	2	3	4	5	6	7	8	9	10	11	12
Pick												
Middle												
Low												

9. Production of seaweed by season in average

Seasons	Amount	Status of amount ✓			
		Decrease	Increase	Normal	%
Pick (ton)					
Middle (ton)					
Low (ton)					

10. What are the problems and constrains in developing seaweed culture in this village?

Shifting the seasons	
Supply of seaweed seed	
Quality of the seed	
Land tenure	
Coastal environment	
Predators/disease	
Financial capital	
Planting method	
Post harvested process	
Price of product	
Marketing channel	

Carrying capacity	

11. What are the roles of woman in seaweed culture activity?

Preparing the seed	
Maintenance of seaweed plant/plot	
Harvesting	
Drying	

12. what are motivation to cultivate the seaweed?

Fish production is decrease	
To get more income	
By project from government	
Just try and following other people	

Fishing activity

13. Do you own the boat you are using? Yes ☐ No ☐
14. Fishing gear used: ☐ Net ☐ Hand-line ☐ Hunting ☐ Gathering ☐ Other

If net, Mesh size:

Net size:

Fishing Technique:

15. What year did you buy your boat?
16. What is the size of boat: length: m, width: m, deep: m
17. What type of engines do you have? Nil/outboard/inboard
18. How much money do you spend each month for maintenance and repair of your boat and equipment?
19. How much money was spent on each item on your last trip?

Fuel	
Food	
Gear	
Others	

20. Number of people on the boat:
21. Did the crew share these trip expenses?
22. How far did you travel on your last trip?
23. Location - where did you fish?
24. Do fishermen from outside your area also catch fish here?
25. Main fished species (decreasing order)
26. Month when fishing occurs:✓

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec

27. Evolution of the quantity of fish caught since 2006:

Species	Situation 2010					Evolution/2006		Evolution/2008	
	Combination fishing site/gear	Nb fishing trip/week	Nb month	Qty	Size	Qty	Size	Qty	Size
All Fish									
Seaweed									
Eucheuma									
Grasillaria									

Marketing activity

28. Where you sell your seaweed/fish?

	Seaweed	**Fish**
Middleman		
Industry through the agent		
Directly to exporters		
Neighbor		
Others (please specify)		

28. What type of seaweed have been sold?

	Seaweed	**Fish**
Wet product		
Dried product		
Others (please specify)		

30. What is the payment system?

	Seaweed	**Fish**
Cash payment		
Delay payment		
Other (please specify)		

31. What price of your seaweed/fish?

Type of products	**Seaweed**			**Fish**		
	Seasons			Seasons		
	Pick	Middle	Low	Pick	Middle	Low
Wet product (IDR/kwintal)						
Dried product (IDR/kwintal)						

- Status of price following the seasons

Seasons	Price status of Seaweed				Price status of fish			
	Decrease	Increase	Constant	%	Decrease	Increase	Constant	%
Pick								
Middle								
Low								

32. Marketing channel (please give the serial number based on the sequence from seaweed farmer)

Seaweed farmer	
Middleman/local collector in village	
Collector in sub-district	
Collector in district	
Processing industry through agent	
Exporter	

33. How many middleman/trader in the village?

34. How many agent of Seaweed Company in the village?

35. Where did you get the market information? ✓

Middleman	
Agent	
Family/colleague	
Local government	
NGOs	
The staffs of village	
Others	

36. Who have the power to decide the price of product in primary level/village level?

Seaweed farmer	
Middleman	
Agent	
Agreement/share	
Other	

PART III. RESPONDENTS' PERCEPTION

1. Description of fisheries activities (fishing and seaweed culture)

Questions	Fishing	Seaweed
1. How would you describe your usual fishing gear/farming method?		
2. Is this the same gear/method were using before the closed area was established?	Yes ☐ No ☐	Yes ☐ No ☐
3. How long have you been using this particular type of gear/method?	Years	Years
4. Is this your preferred type of gear/method?	Yes ☐ No ☐	Yes ☐ No ☐
5. Please name the port/place where you usually land your catch/planted		
6. Are there other landing ports/place that you use?	Yes ☐ No ☐ If yes, please name	Yes ☐ No ☐ If yes, please name
7. Do you own the vessel/plots you use?	Yes ☐ No ☐	Yes ☐ No ☐
8. How long is your vessel	M	M
9. Do you own any other boats?	Yes ☐ No ☐ If yes, what are the lengths?	Yes ☐ No ☐ If yes, what are the lengths?
10. How long have you been a fisherman/seaweed farmer?	Years	Years
11. How many years have you been fishing/farming in Laikang Bay	Years	Years
12. on average, how many days did you spend fishing in one month/per harvested	In 2008: days In 2009: days In 2010: days	In 2008: days In 2009: days In 2010: days
13. How many crews do you have in your boat/farm?		
14. What percentage of the year do you employ your crew?	%	%
15. Do you share your earnings with your crew?	Yes ☐ No ☐ If yes, what % does each one get?	Yes ☐ No ☐ If yes, what % does each one get?
INCOME		
16. What are your main target species?		
17. Approximately, what is your average catch/harvested per fishing trip/harvested?		
18. Is this more or less what you caught/harvested in 2010	More ☐ Less ☐ Same ☐	More ☐ Less ☐ Same ☐
19. Following question 18, if it is either increased or decreased, can you please briefly explain what are the reasons for this change		
20. Approximately, what is the average daily value of your catch?		-
21. In your view, has your income from fishing increased, remained stable or decreased in the last year?	Increased ☐Decreased remained stable ☐	☐creased ☐Decreased remained stable ☐
22. If it is increased or decreased, can you please briefly explain what are the reasons for this change		
23. Do you have any other additional income?	Yes ☐ No ☐	Yes ☐ No ☐
24. on average, what is your income net monthly income from following activities	IDR	IDR
25. What percentage of your income comes from sources other than fishing?	%	%
26. Based on total monthly income you have made	%	%

from fishery, approximately what percentage has been due to you fishing/seaweed in Laikang Bay?		
COST		
27. Approximately, what has been the average cost per day of your fishing trips/farming in Laikang Bay in this year?	IDR	IDR
How have the following changed for following activities since 2008:		
28. Total cost	Increase ☐ Decreased ☐ Stayed the same ☐	Increase ☐ Decreased ☐ Stayed the same ☐
Is the change due to the establishment of the closed area or the result of other factors?		
29. Travel time to fishing site	Increase ☐ Decreased ☐ Stayed the same ☐	
Is the change due to the establishment of the closed area or the result of other factors?		
30. Average fishing/farming duration?	Increase ☐ Decreased ☐ Stayed the same ☐	Increase ☐ Decreased ☐ Stayed the same ☐
Is the change due to the establishment of the closed area or the result of other factors?		
31. The fishing/farming sites you use?	Change ☐ Stayed the same ☐	Change ☐ Stayed the same ☐
Is the change due to the establishment of the closed area or the result of other factors?		
32. The gear/farming equipment you use?	Change ☐ Stayed the same ☐	Change ☐ Stayed the same ☐
Is the change due to the establishment of the closed area or the result of other factors?		
33. Other changes		
Are the change due to the establishment of the closed area or the result of other factors?		
34. On a scale of 1-5, where 1 no effect and 5 a large effect, how much has the closure affected your decision to fish/plant in Laikang Bay?	1 ☐2 ☐3 ☐ ☐ ☐	1 ☐2 ☐3 ☐ ☐ ☐
35. On a scale of 1-5, where 1 no effect and 5 a large effect, how much has the closure affected your decision as to where you fish/plant in Laikang Bay?	1 ☐2 ☐3 ☐ ☐ ☐	1 ☐2 ☐3 ☐ ☐ ☐
36. On a scale of 1-5, where 1 strongly against and 5 strongly support, to what extent do you support the closed area policy in Laikang Bay?	1 ☐ ☐ ☐ ☐4 ☐5	1 ☐2 ☐3 ☐ ☐ ☐

2. People's perception about developing seaweed culture

Please tell me weather in general you agree or disagree with the following statements:

No	Statements	Agree	Disagree	Neutral
1	**Seaweed culture activity**			
	Seaweed culture give more benefit than fishing activity			
	I expanded seaweed plots from selling result of seaweed			
	I used old seed for planting the seaweed			
	The present planting method is still useful for increasing production			
	Current price of seaweed is adjusted with farmer's wishes			
	Environment is still good for culturing the seaweed			
	Seaweed plot is already dense			
	I got the seed easily from other			
	The plots for the seed now is needed in this village			
	Rearrangement for plots location is urgently needed			

	Currently, change the monsoons affected to the seaweed production			
	The plots was checked in everyday			
	The plot was check in 2 – 4 times a week			
2	**Harvesting and Post-harvest**			
	Harvest of seaweed is always at the 45 days age			
	But, sometimes I harvest on less than 45 days			
	The bamboo rack were used for drying the seaweed			
	The net used for drying seaweed in the ground			
	I need the technology/equipment for drying in rainy season			
	I need the technology for process the seaweed			
	I use some seaweed to make process product			
	I need less than 1 week for drying seaweed in normal sunshine.			
	I need more than 1 week for drying in rainy season.			
	I keep the dried seaweed in my home before selling			
	I am losing a lot of benefit on a rainy season, because of bad quality of seaweed and price decreased.			
3	**Marketing**			
	I feel happy with current marketing system in this village			
	However, these system need to be evaluate			
	The price of seaweed is suitable for farmers			
	We need more marketing player to make market become more competitive.			
	The farmer's cooperative (*koperasi*) institution is needed now			
4	**Seaweed farming activity link to the coastal management**			
	Seaweed farming activity have been disturbed other ecosystem (such as mangrove, coral reef, sea grass and etc.			
	Seaweed farming has causing the conflict among coastal users (fisherman, transportation sector and etc)			
	Plots arrangement has been in the right track as part of coastal zone management			
	Seaweed farming contributed to preserve coastal environment			
	Seaweed farming contributed to maintain the survival of mangrove trees			
	The rubbish on the beach has increased since fishers planting the seaweed			

3. Seaweed farmer's perception about stakeholder participation in developing seaweed agribusiness

No	Statements	Agree	Disagree	Neutral
1	Local government (*dinas perikanan*) always give assistance to the farmers			
2	Head of village/staffs has been facilitate in agribusiness of seaweed in the village			
3	The marketing process has been facilitating by cooperation/fishers cooperation.			
4	Middleman is the central of agribusiness in the village			
5				

Post-catch activities of seaweed farmer and their family

4. On plated during the past 12 months what did you usually do with your seaweed? (Tick the best answer)

All of the seaweed was sold	
Some of the seaweed was sold	
Some of the seaweed was taken home to eat	
All of the seaweed was taken home to eat	
Some of the seaweed was given to the crew	
Some of the seaweed was given to family and friends	

5. Do you dry your seaweed when you harvested them? Yes ☐ No ☐

6. How do you pay your labors?

% share of gross revenue	
% share of net revenue	
% share of catch	
Bonus/incentive	

7. After expenses, what percentage of your family income comes from fishing? %
8. How many people are involved in the drying of seaweed?

Family labor	People
Children	
Wife	
Labor (local residents/neighbor house)	

9. How much time is taken up with drying seaweed activities? days

PART IV. QUESTIONNAIRE FOR STAKEHOLDERS

1. According to you, what are the 5 main goals of seaweed area management?
2. According to you, what are the 5 main ways in which the community takes advantage of the seaweed area management system?
3. Could you rate results incurred thank to the work from coastal manager group for the following issues (give a number between 0 – 5)

Issues	**Rate**	**Comments**
To redevelop traditional cultural practices		
To decrease mangrove exploitation		
To decrease over fishing		
To find alternative income to decrease fishing pressure		
To decrease live rock harvest		
To decrease fishing from outsiders		
To develop awareness on over fishing in the community		
To eliminate poaching		
To eliminate the use of illegal fishing gear		

4. What is your global satisfaction of the fishing ground management system (give a number between 0-5)?
5. Could your rate the following resource parameters change since ……

(Give a number between negative 5 and positive 5, 0 means no change)

Parameters	**Rate**	**Comments**

<u>Semi directive interview</u>

Reference system (values and references of the participant):

6. Who are you?
7. What are your duties within the seaweed area management?
8. Why do you think a resources management system is important?
9. What are the issues to be addressed by seaweed area management?

Preference system (participant's role: aspiration and fear):

10. What are you expectations of the management plan?
11. What have you gained from management mode so far?
12. Are there some things you feel are still missing?
13. What are you fears/reservations about the present mode of management?

Coordination system (how the participant describe the coordination process):

14. What are the important steps of the establishment of the present mode of management?
15. Can you list the different groups concerned with the seaweed area management? What are the roles of these participants? Please rate from 0-5 the importance of each participant within the management system.
16. Do you thing that all the participants are in attendance and well represented?

Interaction system (relation of the participant with others):

17. Are you in contact with the other participants? Where and how do you keep in touch?
18. Are there some participants with whom dialogue is more difficult?
19. What do you think are the others' aspirations/fears?
20. Sociogram: could you draw up on a sheet of paper the different participants involved in the management of the coastal management and show the links between them?

Prospective system (what is the future system?, from the participant's point of view):

21. How would the seaweed evolve if the necessary measure were not taken?
22. How would you like to see the territory in the future?
23. Is the current management plan able to fulfill your expectations?
24. If not, what do you think is necessary to ensure that the future of the territory is as you wish it?
25. What are you prepared to do to make it happen?
26. In your opinion, what are or will be the changes responsible for the system evolution?
27. Finally, can you give three factors you think are essential for the good management of the territory?

PART V. SEMI STRUCTURE QUESTIONNAIRE FOR INSTITUTIONS

Directorat General of Aquaculture-MMAF

1. What are the policies or regulations for developing seaweed production?
2. How are the progresses of these policies?
3. Is there any program or project for developing seaweed production?
4. What are the species of seaweed that developed in Indonesia?
5. What are the important roles of seaweed in fisheries economics of Indonesia?
6. Where is the economic position of seaweed in fisheries sector?
7. Can you tell the history about industrialization of seaweed?
8. How distribution of roles between DG in MMAF related industrialization of seaweed?
9. Where is position of DGA of MMAF?
10. Can you mention how many stakeholders are involved in developing seaweed in Indonesia?
11. How DGA coordinated with seaweed's stakeholders?
12. May I know distribution of seaweed farm/culture in Indonesia?

Directorate General of Processing, Marketing of Fisheries Product

1. May I know the progress of export-import of seaweed product? What is the trend?
2. What kind the products made from seaweed?

3. May I know the number of exporter and importer of seaweed, processing industry in Indonesia?
4. May I know about distribution of seaweed industry in Indonesia?
5. What are the policies or regulation for developing seaweed industry?

Indonesian Seaweed Association (ISA)

1. What are the roles of this association in case of seaweed development in Indonesia?
2. Where is the position of this association in coordination lines among stakeholders, especially with MMAF?
3. What are the main annual programs of this association related the seaweed development?

Indonesian Seaweed Society (ISS)

1. What are the roles of this association in case of seaweed development in Indonesia?
2. Where is the position of this association in coordination lines among stakeholders, especially with MMAF?
3. What are the main annual programs of this association related the seaweed development?

Research Center for Marine and Fisheries Socio-Economics

1. What kind of the topic of research related the seaweed?
2. What are your experiences for research of seaweed and what are your comments or suggestions?
3. What is your recommendation for the future research related with seaweed development?

***Dinas perikanan* (fisheries office at province or district):**

1. How is the growth trend of seaweed production during last decade?
2. What are the local government policies to support seaweed culture development and coastal management?
3. May I know the existed program and past program related seaweed development?
4. What is your real action for building capacity in seaweed development?

Exporters

1. What are the types of seaweed product that you export?
2. Can you tell me where are the export destination?
3. Can you tell me about export capacity per year? What is the trend?
4. According your experience, what are your comments about seaweed business in South Sulawesi or Indonesia? what is your hopes and suggestions to the government?

PART VI. WOMAN ACTIVITY IN BALI STRAIT FISHING ACTIVITY

1. What types of woman activity before and during "fish crisis" in Bali Strait?

Types of woman activities	✓	**Period of "fish crisis"**	
		Before	**During**
Internal activities (household)			
Post harvesting (fish processing, food processing etc)			
Pre-production (fishing activity, farming activity etc)			
Production activity (fishing and farming)			
Marketing (fisheries and non-fisheries)			
Social activity			
-			

2. Why you conduct that activity?

To assist husband	
To get additional income	
To get self-income	

3. How much your income per day? 1 month= work days

Activity	IDR
1.	
2.	

4. How you allocate your income?

Support the household needs	
Saving	
Private purposes	
Other purposes	

5. How is important your role in household economics?

A	100% support for household economics
B	75% support for household economics
C	50% support for household economics
D	25% support for household economics

6. Who is most dominant in supporting household economics?

Before "fish crisis"		**During "fish crisis"**	
Husband		Husband	
Wife		Wife	
Adult children (Son or Daughter)		Adult children (Son or Daughter)	

7. Please, explain your own daily schedule **before** "fish crisis":

Activity	**AM**												**PM**											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Cooking																								
Take care the children and family																								
Working:																								
Take a rest																								

Please, explain your own daily schedule **during** "fish crisis" to **present**:

Activity	**AM**												**PM**											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Cooking																								
Take care the children and family																								
Working:																								
Take a rest																								

B. Questionnaire for assessment of purse seine fishery at Bali Strait

Demographics information

1. Information of respondents

No	Name	Gender (M/F)	Age	Fam. Memb.	Edctn.	Occpt.	Monthly Income (IDR)	Status in Purse seine	Inc.from Capt.fish (%)	Ethnic	Income dist.(%)	Debt. (Y/N)	Debt source
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

2. Please, explain your own daily activities **before** "fish crisis":

Resp.	Activity	Before "fish crisis"																							Before "fish crisis"																							
		AM												PM											AM												PM											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1																																																
2																																																
3																																																
4																																																
5																																																
6																																																

7																																																	
8																																																	
9																																																	
10																																																	
11																																																	

3. Historical information of fisheries activity in Jembrana

Resp.	Stat.(O/C)	Start PS	Intr. (Who&When)	Gears before PS	Use PS (Reasons)	Reduce&stpped PS act.(when)	Why reduce?	Condt. Of Fishmn After PS stopped	HH needs after PS stopped	Use diff.gears (Y/N)
1										
2										
3										
4										
5										
6										
7										
8										
9										

4. The questions for owner:

Resp.	Fin. source	The num. of business	2 boat(IDR)	PS (IDR)	Type of FGs	Size of FGs	Num. of FGs	Size of boat	Engine cap.	Crew/ 2 boat	Dif./E as. recruit	Crew source	Salary sys.	F.trip/ (a D,W, M)	L.based-FG (hours)
1															
2															
3															
4															
5															
…..															

5. How much you expense your cost and benefit you get for one trip.

Fishing gear	Cost components	IDR (*rupiah*)	Benefit (IDR)	Allocation of benefit
1. purse seine	- food		Fish= tones	
	- fuel		Fish= IDR	
	- fresh water			
	- Ice			
	-			

6. How many hours do you need to find fishing ground form landing based?

a. before “fish crisis” : hours

b. during “fish crisis” to present: hours

7. The size of fish caught before “fish crisis” is bigger than present size (a. Yes, b. No)
   - What activities done by fishermen (crew) during crisis?
   - How did you fulfill daily needs during the crisis?
   - What did you do to response this fish crisis?
8. Fishermen’s group
   - How many fishermen group here? How many members per group?
   - What are fishermen’s roles in fishing community generally?
   - What are the roles of fishermen group to response fish crisis?
   - How is leaders/group to their members to response fish crisis?
9. Fishing activity
   - Where is the fishing ground?
   - How distance between fishing port to fishing ground?
   - How many trip per day?
   - How many work-days per month?
   - How many work months per year?
   - Peak season: month: to month: ton per trip:
   - Mid-season: month: to month: ton per trip:
   - Low season: month: to month: ton per trip:
   - How much income per month before and after fish crisis? Ton. And how is present condition? Ton.
   - Where is your income source before and after fish crisis and present condition?
   - What a fishermen did when fish crisis ocurred in SB?
10. Managemnt of Bali Strait (BS):
    - Who are involved in management of BS?
    - What are exist policies to manage BS?
    - When management of BS started?
    - What are the roles of *dinas perikanan* instead of local government?
    - How is responsible to coordinate management of BS?
    - How is the surveillance system in BS?
11. The problems: What are the problems occurred in BS related with;

    1. Quality of water environment and water pollution 2. Trend of fish production 3.Management system 4.Livelihoods activity 5.Conflict 6.Illegal fishing practices

Appendix 2. The pictures of field survey

A. The figures of field survey in South Sulawesi

Seedling of seaweed before plantation

Seaweed farm with long line floating method

Harvesting seaweed *E.cottonii*

Drying seaweed on the bamboo rack

Dried seaweed stock for export at exporter's warehouse

1. Alkali Treatment Chips (ATC)
2. Semi Refine Carragenan (SRC)

Mangrove transplantation

Coral reef conservation area

Sea grass area

Women groups existed for seedling

B. The figures of field survey at Pengambengan, Bali Strait

Fishing boats with purse seine gear

Fishermen repaired the purse seine

Boat engines

Fish collector collected the fish from crews

Carrying fish from the boat to fish auction

Auction and Weighing

Carrying fish from auction to processing factory

Fish auction

Carrying fish by fish traders

Pengambengan Fish landing site in the morning (06.00 AM)

Appendix 3. Statistical analysis for seaweed farming

A. T- test for number of seaweed plot

Group Statistics

	Number of Seaweed Plots	N	Mean	Std. Deviation	Std. Error Mean
T-farming	<=2	137	1.3066	.22162	.01893
	>=3	63	1.3192	.27615	.03479
T-environment	<=2	137	1.3985	.23577	.02014
	>=3	63	1.4381	.31286	.03942
T-harvest	<=2	137	1.3668	.26089	.02229
	>=3	63	1.3770	.29055	.03661
T-market	<=2	137	1.3139	.30773	.02629
	>=3	63	1.4643	.39107	.04927

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
T-farming	Equal variances assumed	.088	.767	-.346	198	.729	-.01265	.03654	-.08471	.05940
	Equal variances not assumed			-.319	100.157	.750	-.01265	.03961	-.09124	.06593
T-environment	Equal variances assumed	1.998	.159	-.990	198	.323	-.03956	.03994	-.11831	.03920
	Equal variances not assumed			-.894	95.638	.374	-.03956	.04427	-.12742	.04831

T-harvest	Equal variances assumed	.363	.548	-.248	198	.805	-.01020	.04118	-.09140	.07101
	Equal variances not assumed			-.238	109.625	.812	-.01020	.04286	-.09513	.07474
T-market	Equal variances assumed	2.833	.094	-2.940	198	.004	-.15042	.05116	-.25130	-.04954
	Equal variances not assumed			-2.693	98.686	.008	-.15042	.05585	-.26123	-.03960

B. T test for number of family member

Group Statistics

	Number of family member	n	Mean	Std. Deviation	Std. Error Mean
T-farming	<=2	27	1.2593	.19245	.03704
	3-5	173	1.3186	.24554	.01867
T-environment	<=2	27	1.4667	.18397	.03541
	3-5	173	1.4023	.27193	.02067
T-harvest	<=2	27	1.4537	.26887	.05174
	3-5	173	1.3569	.26847	.02041
T-market	<=2	27	1.5093	.22448	.04320
	3-5	173	1.3382	.35226	.02678

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
T-farming	Equal variances assumed	.395	.531	-1.198	198	.232	-.05930	.04950	-.15693	.03832
	Equal variances not assumed			-1.430	40.494	.160	-.05930	.04148	-.14310	.02449
T-environment	Equal variances assumed	2.115	.147	1.187	198	.237	.06435	.05423	-.04259	.17130
	Equal variances not assumed			1.570	45.947	.123	.06435	.04100	-.01818	.14689
T-harvest	Equal variances assumed	.050	.823	1.742	198	.083	.09677	.05556	-.01280	.20634
	Equal variances not assumed			1.740	34.594	.091	.09677	.05563	-.01620	.20974
T-market	Equal variances assumed	16.655	.000	2.445	198	.015	.17111	.06999	.03308	.30913
	Equal variances not assumed			3.366	48.737	.001	.17111	.05083	.06895	.27327

C. Analysis of livelihood activities with one way Anova

Descriptives

		n	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
T-farming	Seaweed culture	92	1.3466	.21020	.02192	1.3031	1.3901	1.00	2.00
	seaweed and fishing	74	1.2853	.29084	.03381	1.2179	1.3527	1.00	2.89
	Seaweed and governmental officer	4	1.2500	.18976	.09488	.9481	1.5519	1.00	1.44
	Seaweed and others (outsides of fishery)	30	1.2704	.17430	.03182	1.2053	1.3355	1.00	1.67
	Total	200	1.3106	.23950	.01694	1.2772	1.3440	1.00	2.89
T-environment	Seaweed culture	92	1.3957	.23342	.02434	1.3473	1.4440	1.00	2.40
	seaweed and fishing	74	1.4595	.30651	.03563	1.3884	1.5305	1.00	2.60
	Seaweed and governmental officer	4	1.4500	.19149	.09574	1.1453	1.7547	1.20	1.60
	Seaweed and others (outsides of fishery)	30	1.3333	.21867	.03992	1.2517	1.4150	1.00	1.80
	Total	200	1.4110	.26234	.01855	1.3744	1.4476	1.00	2.60
T-harvest	Seaweed culture	92	1.3859	.24976	.02604	1.3341	1.4376	1.00	2.00
	seaweed and fishing	74	1.3649	.31566	.03669	1.2917	1.4380	1.00	2.50
	Seaweed and governmental officer	4	1.3750	.25000	.12500	.9772	1.7728	1.00	1.50

	Seaweed and others (outsides of fishery)	30	1.3333	.21105	.03853	1.2545	1.4121	1.00	1.75
	Total	200	1.3700	.26989	.01908	1.3324	1.4076	1.00	2.50
T-market	Seaweed culture	92	1.2880	.31434	.03277	1.2229	1.3531	1.00	2.25
	seaweed and fishing	74	1.4257	.36717	.04268	1.3406	1.5107	1.00	2.50
	Seaweed and governmental officer	4	1.2500	.20412	.10206	.9252	1.5748	1.00	1.50
	Seaweed and others (outsides of fishery)	30	1.4417	.33914	.06192	1.3150	1.5683	1.00	2.25
	Total	200	1.3613	.34245	.02421	1.3135	1.4090	1.00	2.50

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
T-farming	Between Groups	.230	3	.077	1.344	.261
	Within Groups	11.185	196	.057		
	Total	11.415	199			
T-environment	Between Groups	.382	3	.127	1.877	.135
	Within Groups	13.313	196	.068		
	Total	13.696	199			
T-harvest	Between Groups	.066	3	.022	.297	.828
	Within Groups	14.429	196	.074		
	Total	14.495	199			
T-market	Between Groups	1.044	3	.348	3.059	.029
	Within Groups	22.293	196	.114		
	Total	23.337	199			

Multiple Comparisons

LSD

Dependent Variable	(I) Livelihood activities	(J) Livelihood activities	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
T-farming	Seaweed culture	seaweed and fishing	.06133	.03730	.102	-.0122	.1349
		Seaweed and governmental officer	.09662	.12201	.429	-.1440	.3372
		Seaweed and others (outsides of fishery)	.07625	.05022	.131	-.0228	.1753
	seaweed and fishing	Seaweed culture	-.06133	.03730	.102	-.1349	.0122
		Seaweed and governmental officer	.03529	.12263	.774	-.2066	.2771
		Seaweed and others (outsides of fishery)	.01491	.05170	.773	-.0871	.1169
	Seaweed and governmental officer	Seaweed culture	-.09662	.12201	.429	-.3372	.1440
		seaweed and fishing	-.03529	.12263	.774	-.2771	.2066
		Seaweed and others (outsides of fishery)	-.02037	.12716	.873	-.2711	.2304
	Seaweed and others (outsides of fishery)	Seaweed culture	-.07625	.05022	.131	-.1753	.0228
		seaweed and fishing	-.01491	.05170	.773	-.1169	.0871
		Seaweed and governmental officer	.02037	.12716	.873	-.2304	.2711

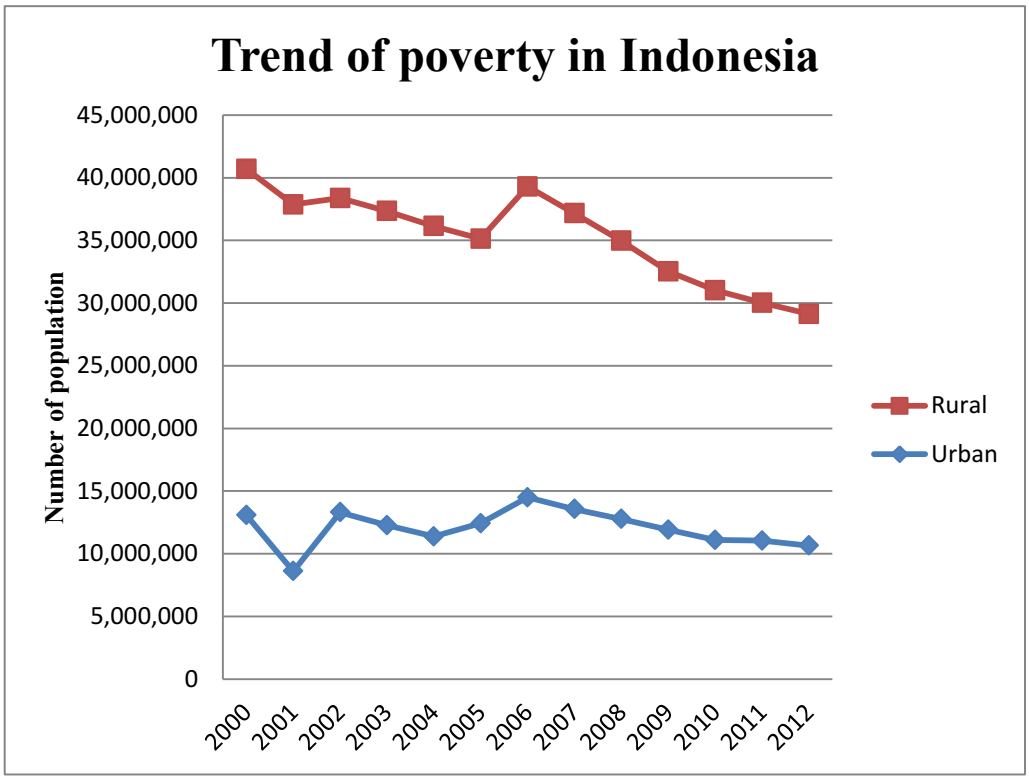
	Seaweed culture	seaweed and fishing	-.06381	.04070	.119	-.1441	.0165
		Seaweed and governmental officer	-.05435	.13311	.684	-.3169	.2082
		Seaweed and others (outsides of fishery)	.06232	.05479	.257	-.0457	.1704
	seaweed and fishing	Seaweed culture	.06381	.04070	.119	-.0165	.1441
		Seaweed and governmental officer	.00946	.13379	.944	-.2544	.2733
T-environment		Seaweed and others (outsides of fishery)	.12613*	.05641	.026	.0149	.2374
	Seaweed and governmental officer	Seaweed culture	.05435	.13311	.684	-.2082	.3169
		seaweed and fishing	-.00946	.13379	.944	-.2733	.2544
		Seaweed and others (outsides of fishery)	.11667	.13873	.401	-.1569	.3903
	Seaweed and others (outsides of fishery)	Seaweed culture	-.06232	.05479	.257	-.1704	.0457
		seaweed and fishing	-.12613*	.05641	.026	-.2374	-.0149
		Seaweed and governmental officer	-.11667	.13873	.401	-.3903	.1569
T-harvest	Seaweed culture	seaweed and fishing	.02100	.04237	.621	-.0626	.1046
		Seaweed and governmental officer	.01087	.13858	.938	-.2624	.2842
		Seaweed and others (outsides of fishery)	.05254	.05705	.358	-.0600	.1650

	seaweed and fishing	Seaweed culture	-.02100	.04237	.621	-.1046	.0626
		Seaweed and governmental officer	-.01014	.13928	.942	-.2848	.2646
		Seaweed and others (outsides of fishery)	.03153	.05873	.592	-.0843	.1473
	Seaweed and governmental officer	Seaweed culture	-.01087	.13858	.938	-.2842	.2624
		seaweed and fishing	.01014	.13928	.942	-.2646	.2848
		Seaweed and others (outsides of fishery)	.04167	.14443	.773	-.2432	.3265
	Seaweed and others (outsides of fishery)	Seaweed culture	-.05254	.05705	.358	-.1650	.0600
		seaweed and fishing	-.03153	.05873	.592	-.1473	.0843
		Seaweed and governmental officer	-.04167	.14443	.773	-.3265	.2432
T-market	Seaweed culture	seaweed and fishing	-.13763*	.05266	.010	-.2415	-.0338
		Seaweed and governmental officer	.03804	.17226	.825	-.3017	.3778
		Seaweed and others (outsides of fishery)	-.15362*	.07091	.031	-.2935	-.0138
	seaweed and fishing	Seaweed culture	.13763*	.05266	.010	.0338	.2415
		Seaweed and governmental officer	.17568	.17313	.311	-.1658	.5171
		Seaweed and others (outsides of fishery)	-.01599	.07300	.827	-.1600	.1280

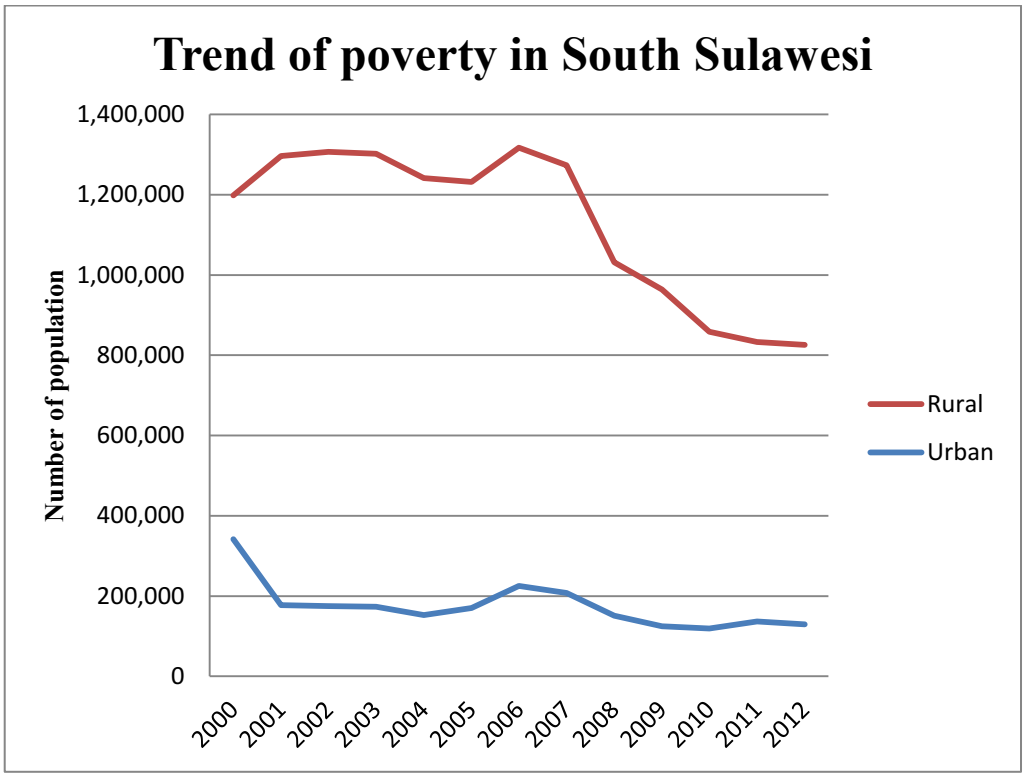
Seaweed and governmental officer	Seaweed culture	-.03804	.17226	.825	-.3778	.3017
	seaweed and fishing	-.17568	.17313	.311	-.5171	.1658
	Seaweed and others (outsides of fishery)	-.19167	.17952	.287	-.5457	.1624
Seaweed and others (outsides of fishery)	Seaweed culture	.15362*	.07091	.031	.0138	.2935
	seaweed and fishing	.01599	.07300	.827	-.1280	.1600
	Seaweed and governmental officer	.19167	.17952	.287	-.1624	.5457

*. The mean difference is significant at the 0.05 level.

Appendix 4. Trend of poverty in Indonesia and South Sulawesi Province

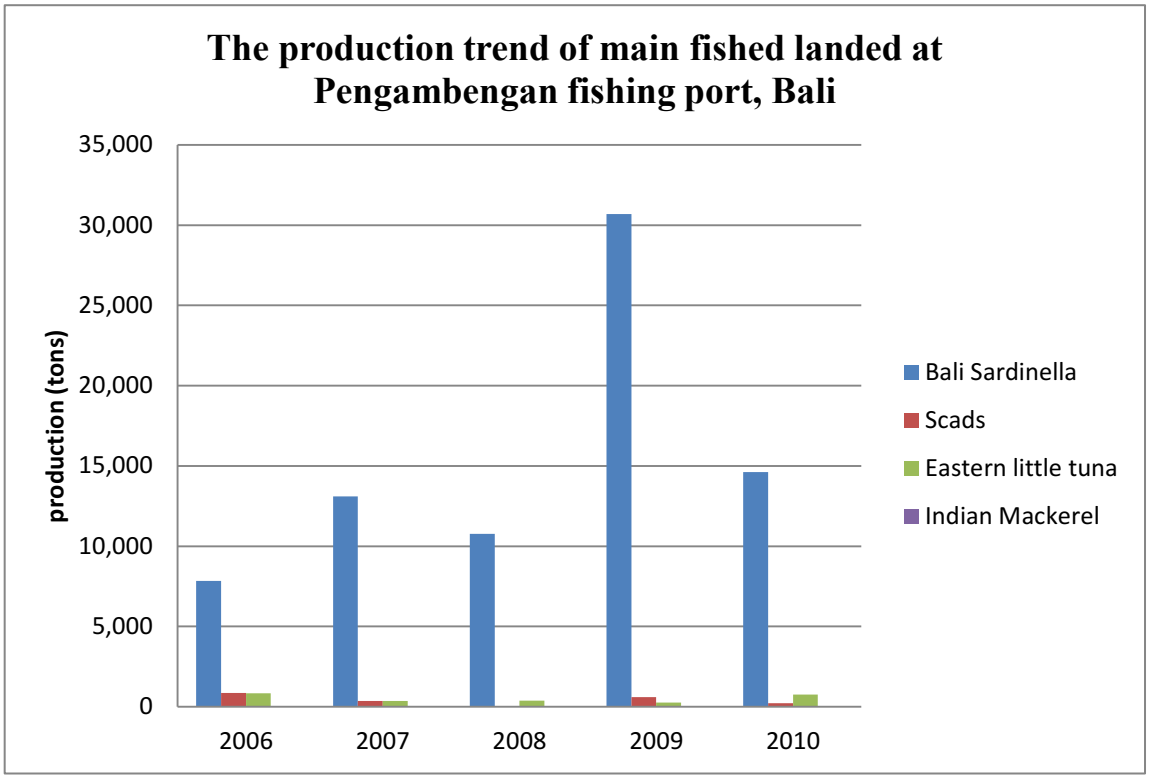


Source: CBS, 2010-2012



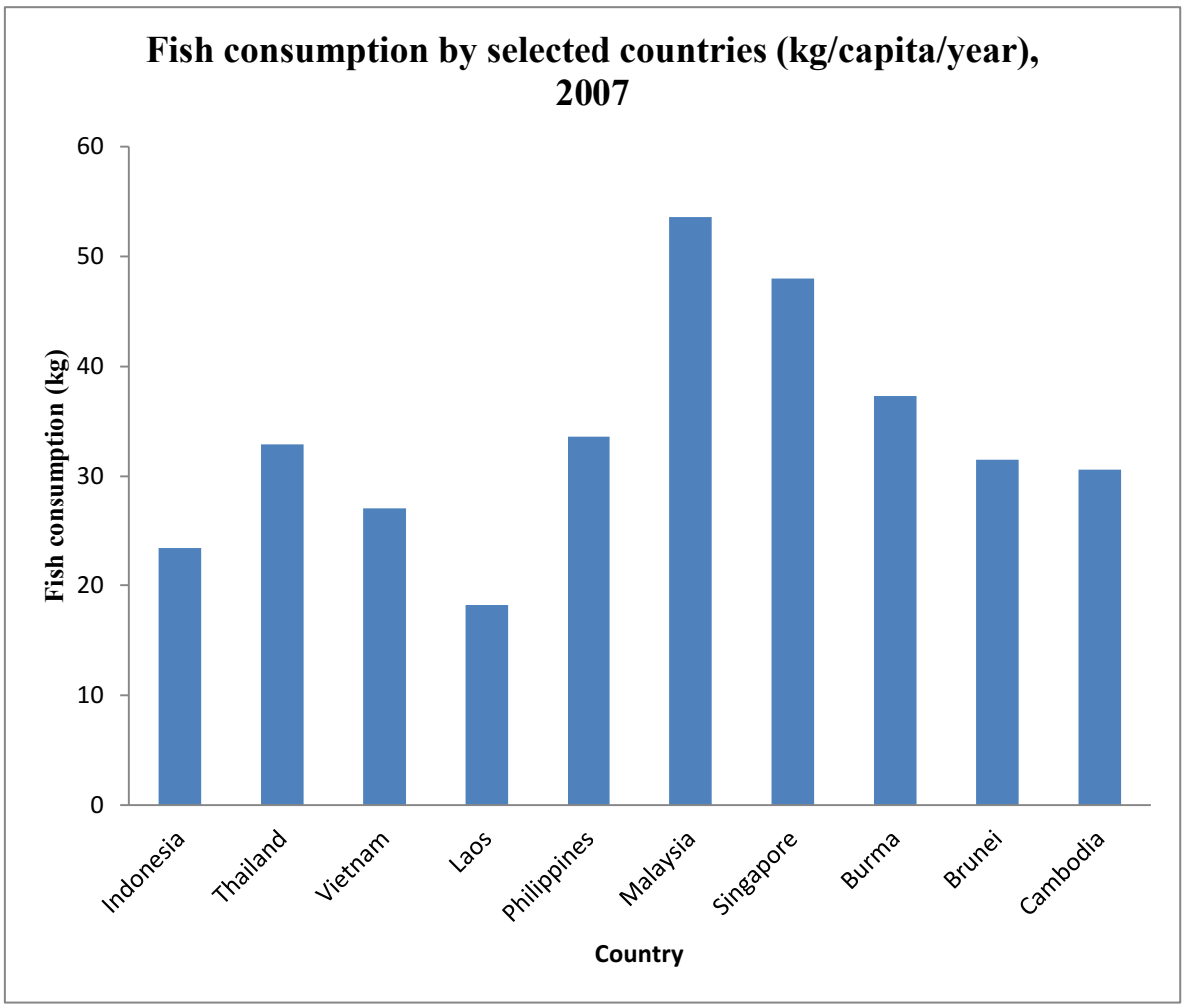
Source: CBS, 2010-2012

Appendix 5. The production trend of main fishes landed at Pengambengan fishing port, Bali



Source: Pengambengan fishing port, 2011

Appendix 6. Fish consumption by selected countries in 2007



Source: FAO, 2007

Appendix 7. The status of Bali Strait according to several researchers

Year	Researchers	Location	MSY (ton)	TAC (ton)	Status of fishing
1982	Sujastani and Nurhakim	Bali Strait	36,000	28,800	Overfishing
1986	Martosubroto, Naamin and Nurhakim	Bali Strait	62,317 to 66,306	49,853.6 to 53,044	Overfishing
1986	Salim	Bali Strait	47,512 to 80,332	38,009 to 64,265	Overfishing
1992	Diponegoro University	Muncar	40,000	32,000	Overfishing
1992	I.G.S. Merta	Jembrana, Muncar	34,000	27,000	Overfishing
1999	Brawijaya University	Jembrana, Badung, Muncar	30,000	24,000	Overfishing
2004	Brawijaya University	Bali Strait	31,161	24,928.8	Overfishing
2010	Daduk Setyohadi	Bali Strait	47,235.63	46,711.58	Overfishing
2010	Daduk Setyohadi *Prediction for 2020*	Bali Strait	53,342.78	41,787.71	Overfishing

Source: Setyohadi, 2010

Appendix 8. The village regulation about Marine and Coastal Management of Laikang Village, Takalar District.

REGULATION OF LAIKANG VILLAGE
MANGARABOMBANG SUB DISTRICT TAKALAR DISTRICT
NUMBER 04/PDL/XII/2006
CONCERNING
MARINE AND COASTAL MANAGEMENT OF LAIKANG VILLAGE
BY THE GRACE OF GOD
HEAD OF LAIKANG VILLAGE

Considering:

a. Coastal and marine zones is a units within the Republic of Indonesia is the region that can be managed by the coastal communities
b. That the utilization of coastal areas in the Laikang Village has a leading commodity that is seaweed and fishing activities to increase income of the community.
c. That in addition to positive implications, as well as a negative impact on the sustainable management of coastal and marine resources.
d. There are indications that a conflict of interest in coastal zone exploitation especially culture fishery activities that can lead to social vulnerability and conflict in society kinship.
e. That as a concerning form of village government to the business in coastal communities, it is deemed necessary established the regulation about coastal zone management that includes exploitation, conservation and other forms of management.
f. That for this purpose should be regulated and defined by regulations of the village.

Remembering:

a. Law number 32 of 2003, about local government and village (state agency Republic of Indonesia of 2004 number 125, addition of state sheet number 4310.
b. Law number 5 of 1990 about natural resource conservation and the ecosystem (state agency Republic of Indonesia of 1990 number 49, addition of state sheet number 3299)
c. Law number 23 of 1997 about environmental management (state sheet Republic of Indonesia of 1997 number 68, addition of state sheet number 3669)
d. Law number 31 of 2004 about fisheries (state sheet Republic of Indonesia of 2004 number 118, addition of state sheet number 4433).

e. Decree of the Minister of Marine and Fishery No. 34/Men/2002 of General Guidelines for Spatial Planning of Coastal and Small Islands.

By Agreement

THE PEOPLE'S REPRESENTATIVES OF LAIKANG VILLAGE

DECIDED:

To en act: VILLAGE REGULATION ABOUT MARINE AND COASTAL MANAGEMENT IN LAIKANG VILLAGE

CHAPTER I

GENERAL PRINCIPLE

Article 1

In this law, the meaning of:

a. Village is a community units, which has the authority to regulate and manage the interests of local communities based on the origin and local customs are recognized by the National Government System and located in the Takalar District.
b. Village Governance is an activity undertaken by the government of the village administration and the Village Representative Body.
c. Village government is head of village and his staffs.
d. Head of village is head of Laikang Village.
e. Village staff is village governmental implementer, which consist of the staff element, implementer element and region element.
f. Village Consultative Board is refer to BPD is representative of the community in the village that serves to protect the customs, set up the village regulations, accommodate and as the aspirations channel of the community and to control the organizer village administration.
g. Sub village is as part of the village territory which is the environment of village government administration.
h. Coastal zone is an area utilized for managing marine and fisheries resource throughout administration area of Laikang Village.

CHAPTER II

SUBJECT AND OBJECT'S RULE

Article 2

Subject Rule

1. Subject rule is the people or society group as the resource user who benefiting from marine and coastal resource in Laikang Village.
2. User group consist of fisher group, fish farming and fisheries businessman.

Article 3

Object Rule

1. Object rule is the catching fisheries activities and fish culture and any potency inside the area.
2. Fish culture is the activities done by people or group with certain location and time includes seaweed culture, fish cage and fish pond.
3. Catch fisheries is the activities done by the people or group who catch fish by using certain fishing gears.
4. Non biological resource includes marine transportation services, mining, tourism and research.

CHAPTER III
COASTAL ZONE UTILIZATION

Article 4
Seaweed culture

1. Seaweed culture is done by using area that has been given mark.
2. Marking reported to the head of village as evidence of location.
3. New marking within 1 year is not used then it can be used by someone else.
4. Location was not used for 3 consecutive years can be used by someone else.

Article 5
Fish Pond

1. Opening of a new pond is by permission of Head of Village.
2. The fish pond data includes the owner and the pond area should be reported to the Head of Village

Article 6
Catching Fisheries

1. Catch fish is done by using fishing gear that does not damage environment.
2. Fish catching in the bigger scale and bigger fishing gear reported to head of village for controlling the fishing gear.
3. Type of fishing gear are prohibited including poisons, blasting and trawl.
4. Fish catching by using big trawl *(parere)* is allowed as long as not disturbing culture farming and traditional fishing gear.
5. Not allowed catching the biota which protected by government.

Article 7
Marine Transportation

1. It needs a sea route connecting the area between sub village in rural areas Laikang.
2. Types of marine transportation consists of the main route and an alternative route
3. Determination of main and alternative route made by the village government

Article 8
Coastal Tourism

1. Tourism activities are the use of coastal area and waters for bathing and other tourist activities.
2. Utilization of the coastal tourism does not conflict with the sustainable use of natural resources in the ecotourism concept.
3. Tourism object includes coastal tourism, coral reef ecosystem, seaweed culture, fishing tourism and beach bathing.

Article 9

Research Service

1. Research must be done through coordination with head of village or head of sub village.
2. Research result reported to village government and resource user group as the document.

Article 10

Conservation

1. Determination of the conservation in the village conducted by the head of village with the consideration of conservation groups in the community.
2. In the process of establishment, made some process of determining the location with consideration exploitation aspect for local communities and the sustainability guarantee
3. Coastal and marine conservation include the Marine Protected Area, Mangrove and Coastal

Article 11

Non-biological resource exploitation

1. Exploitation of non-biological resources includes shipwrecks, sand mining and stone
2. Exploitation of non-biological resources committed in the discussion of technical utilization, outcomes and partners
3. The utilization should involve local people as technical responsible appointed by the Head of Village

CHAPTER IV

RETRIBUTION FOR MARINE AND COASTAL ZONE UTILIZATION

Article 12

Type of Retribution

Type of retribution includes:

a. Seaweed collected by seaweed trader (middleman)
b. Crab trader
c. Fish farmer
d. Big trader of fish

Article 13

Retribution Value

1. The retribution amount will be determined by the head of village
2. Retribution value will be calculated based on the frequency and the volume of quantity by using standard units without the scale of business.

Article 14

Procedure for collecting Retribution

1. Withdrawal of retribution made on posts, which have been determined.
2. Withdrawals made by the staffs appointed by the head of village in a decree.
3. Procedure for collecting retribution collection be regulated by head of village.

CHAPTER V

INTEGRATED MANAGEMENT

Article 15

Component Manager

Component manager consist of:

a. Fisheries business group
b. NGOs based in Laikang Village.
c. Donor institutions and partner agencies
d. Laikang coastal community forum
e. Private business

Article 16

Integration in Management

1. Marine and coastal zone management Laikang Village done in a coordinated by all components of management
2. Management coordination is carried out through the village government and Resource User Groups (KPS)

Article 17

Management Efforts

Management effort intend to:

a. Improving human resource as user through counseling, trainning and study
b. Improving environmental quality through conservation and rehabilitation
c. Improving facility and infrastructure of resource management.
d. Provide information needed by the society.
e. Fulfill of dispute in the resource utilization.

CHAPTER VI

PUNISHMENT

Article 18

Type of punishment

Punishment for violation of this rule may be in the form of:

a. Giving strong warning.
b. Expulsion where done by the community.
c. Penalty within amount determined by head of village based on the level of violation.
d. Revocation business license
e. Temporarily foreclosure of fishing gear
f. Give over to police up to civil court.

Article 19

Punishment mechanism

1. Punishment can be done either directly or indirectly.
2. Direct punishment do if proven and openly violated the utilization of the resources and must be stopped as soon as possible.
3. Indirect punishment done by providing opportunities for offenders to perform self-defense

CHAPTER VII
REVOCATION RULE

Article 20

1. Revocation of this rule can be done through BPD meeting attended by the head of village and community leaders.
2. Proposed revocation rule can be done if:
    - Considered to be ineffective
    - Not according to the development efforts undertaken by the community

CHAPTER VIII
FINAL PROVISIONS

Article 21

With the enactment of this village regulations, then all conflicting provisions and / or not in accordance with the regulations of this village declared no longer valid.

Article 22

The things that have not been regulated in this village regulation as long as the implementation will be further regulated by the village regulation decree.

Article 23

This regulation shall enter into force at the date it is enacted

Enacted in: Laikang
Date : December 2, 2007

_____
Head of Laikang Village
Nai Laidi

Appendix 9. Production of capture fisheries and aquaculture fisheries of Indonesia

A. Indonesian marine capture fishereis production by major fish (tons)

Major commodities	2004	2005	2006	2007	2008	2009
Tunas	176,996	183,144	159,404	191,558	194,173	203,269
Skipjack tunas	233,319	252,232	277,388	301,531	296,769	338,034
Eastern little tunas	310,400	309,794	329,169	399,513	421,905	404,283
Other fish	3,112,018	3,246,770	3,293,729	3,340,120	3,308,778	3,381,673
Shrimp	245,913	208,539	227,164	258,976	236,922	236,870
Seaweed	**8,677**	**9,670**	**4,996**	**4,643**	**2,917**	**3,030**
Others	232,918	198,350	220,341	237,939	240,459	245,076
Total	**4,320,241**	**4,408,499**	**4,512,191**	**4,734,280**	**4,701,923**	**4,812,235**

Source: MMAF and JICA, 2011

B. Indonesian inland open water capture fishereis production by major fish (tons)

Major commodities	2004	2005	2006	2007	2008	2009
Common crap	9,951	9,012	9,013	9,096	8,183	6,361
Mozambique tilapia	18,289	13,759	14,390	11,209	8,548	10,677
Snakehead murrel	41,014	32,784	31,194	30,300	29,842	27,930
Bilih fish	34	136	19	1,036	2,742	13,121
Other fish	242,837	220,119	220,119	240,128	232,918	216,641
Shrimp	14,310	14,267	14,267	14,825	15,352	16,715
Other fish	4,445	4,919	4,919	3,863	3,597	4,291
Total	**330,880**	**294,996**	**293,921**	**310,457**	**301,182**	**295,736**

Source: MMAF and JICA, 2011

C. Indonesian aquaculture production by major fish (tons)

Major commodities	2004	2005	2006	2007	2008	2009
Shrimp	238,857	280,629	327,610	358,925	409,590	338,060
Grouper	6,552	6,493	4,021	8,035	5,005	8,791
Nile tilapia	97,116	148,249	169,390	206,904	291,037	323,389
Common crap	192,462	216,920	247,633	264,349	242,322	249,279
Milk fish	241,438	254,067	212,883	263,139	277,471	328,288
Asian seabass	4,663	2,935	2,183	4,418	4,371	6,400
Pangasius cat fishes	23,962	32,575	31,490	36,755	102,021	109,685
Clarias cat fishes	51,271	69,386	77,272	91,735	114,371	144,755
Giant gouramy	23,758	25,442	28,710	35,708	36,636	46,254
Mud crab	3,015	4,583	5,525	6,631	7,829	7,516
Shells	12,991	16,348	18,896	15,623	19,662	15,857
Seaweed	410,570	910,636	1,374,462	1,728,475	2,145,060	2,963,556
Others	161,955	195,411	182,521	172,866	199,826	166,734
Total	**1,468,610**	**2,163,674**	**2,682,596**	**3,193,563**	**3,855,201**	**4,708,564**

Source: MMAF and JICA, 2011

Appendix 10. Livelihood development based on local product