



The alternative livelihood development strategy in order to improve local fishermen revenue in the border region of Indonesia and Timor Leste

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Abstract. The impact of climate change is causing obstacles for fishermen because of the increasing risk of fishing, changing seasons and fishing locations, uncertainty of the wind season, thus affecting the number of catches. Climate change conditions that disrupt marine ecosystems certainly can worsen the economic life of fishermen households. The decrease in fish catch will have implications on household income. Fishermen in Belu have dependence on fishery sector especially capture fishery. Local fishermen need a strategy to increase revenue through alternative livelihoods to adapt to erratic fishing season. One of the economic adaptation strategies that fishermen can do is adaptation of human resources in fishery households through economic activities outside the fishery. This research aims to determine the income of fishermen households, analyzed the contribution of alternative efforts to total household income and analyze the involvement of family members of fishermen and the time spent to perform alternative livelihoods in the border areas of Indonesia and Timor Leste. The research was conducted using survey method through interview and observation technique. The results suggest that alternative livelihoods should be developed as a form of adaptation fishing households in retained revenue caused by decreased income from the main livelihoods as fishermen due to climate change.

Key Words: development strategies, alternative livelihoods, fishermen revenue, border region, climate change.

Introduction. Indonesia is the largest archipelago in the world that lies between two continents, Asia and Australia that has millions of people living in coastal areas and utilizing coastal resources as a source of livelihood. The welfare of millions of coastal communities is determined by the existence and preservation of coastal ecosystems because it is very vulnerable to various threats, one of the serious threat of climate change as a result of global warming. Judging from its geographical location, the sea and coastal areas of Southeast Asian countries are estimated to be one of the world's most productive regions and play an important role for the economic development of every country in the region. However, rapid development and ignoring environmental sustainability have caused ecological disasters in coastal areas (Mulyadi 2005).

Belu Regency, as one of the the regencies in East Nusa Tenggara Province, has a nationally strategic value because it is a border district that still faces various complex problems. Data shows that Belu regency has a low human development index of 59.72 and the percentage of poor people reaches 14.58% (BPS 2017). Belu Regency's economy is still dominantly contributed by the agriculture, livestock, fisheries and forestry sectors, namely 24.70% of the total GRDP of Belu (BPS 2017). The fact shows that the high rate of poverty in rural areas is not only caused by scarcity of resources but also because the

pattern of available resource management is not optimal, so the productivity of these resources is still low and has not encouraged the improvement of the welfare of rural communities (Laynurak 2008). Further stated that although the community had access to these resources, it did not have a significant effect on the welfare of the community, for this reason, efforts to optimize natural resources management are needed.

Climate change as the impact of global warming is a phenomenon of changing physical conditions of the earth's atmosphere, including temperature and distribution of rainfall which have a wide impact on various sectors of human life (Ministry of Environment 2001). Global climate change may damage coral reefs, such as bleaching and the sinking of the reef. A number of studies have accordingly addressed the issue of vulnerability assessment (Briguglio 1995; Adger et al 2001; Shea & Subbiah 2004; Downing et al 2005; Luers 2005). The impact of climate change causes constraints for fishermen in fishing activities because the risk of fishing is greater and affects the amount of catch. Climate change conditions that disrupt marine ecosystems can certainly worsen the economic life of fishing households in Belu Regency, where in recent years the fishing activities of fishermen here are usually 7-8 months decreased to 5-6 months due to erratic and impactful seasonal changes on fishing business income (Paulus 2018). The decline in fish catches will have implications for household income, where fishermen in Belu Regency have a dependency on the fisheries sector, especially capture fisheries. Since some of the worst sufferers of climate change are rural communities (Shaw et al 2010), it is important to focus on the impacts of climate change on their livelihoods so as to maintain a decent life, livelihood, and environment.

Patriana & Satria (2013) stated that the adaptation and economic strategies undertaken by fishermen in facing the problem of climate change is dominated by adaptive patterns that are reactive. So far there are still traditional fishermen with relatively limited access to technology and information so that a more anticipatory form of adaptation does not yet exist and is not yet known by the public. The form of adaptation that has been carried out by fisheries households in Belu includes the following: adaptation of the allocation of human resources in households which includes optimization of domestic workforce, dual livelihood patterns for salt-making and fish processing businesses. As a form of adaptation to climate change, a scientific study is needed through an alternative business development strategy to encourage fishermen to increase income during the fishing season and famine (Paulus et al 2018). Paulus & Fauzi (2017) stated that providing alternative livelihood for coastal communities is an essential part to cope with uncertainty arising from external and internal shocks in the communities. By identifying key variables of sustainable livelihood, it helps policy makers to map which elements that could be used as input variables to deliver the policy to sustain the livelihood of the communities. The aims of this study are (1) to determine the income of fishermen households in four coastal villages located in the border area, (2) to analyze the contribution of alternative businesses to the total income of traditional fishing households, and (3) to analyze the involvement of fishermen family members and the amount of time needed to conduct alternative businesses.

Material and Method

Description of the study sites. This research has been conducted in four coastal villages spread across two districts in Belu regency for seven months, which lasted from February to August 2018. Research sites are presented in Figure 1.

Types and sources of data. The type of data in this study are primary and secondary data. Primary data is obtained from interviews with respondents and field observations, while secondary data is obtained from related agencies such as the central bureau of statistics of Belu district, animal husbandry department, department of fisheries, department of industry and commerce, village office, and department of community empowerment and village governments.

Data collection. The study was conducted using survey methods through interview and observation techniques. Forty (40) respondents were taken purposively with the criteria of respondents are traditional fishermen and also undertake other fisheries economic activities, especially fish and salt processed businesses as an adaptation steps which taken to deal with the risk of decreasing income caused by climate change.

Data analysis. Data were analyzed to obtain the mean, standard deviation and standard error of the mean (SEM), then performed a descriptive-qualitative analysis to explain the phenomenon found in this study. The standard deviation formula is $SD = \sqrt{((average/(n-1)))}$, while the standard error of the mean (SEM) = $\sqrt{((SD/n))}$.

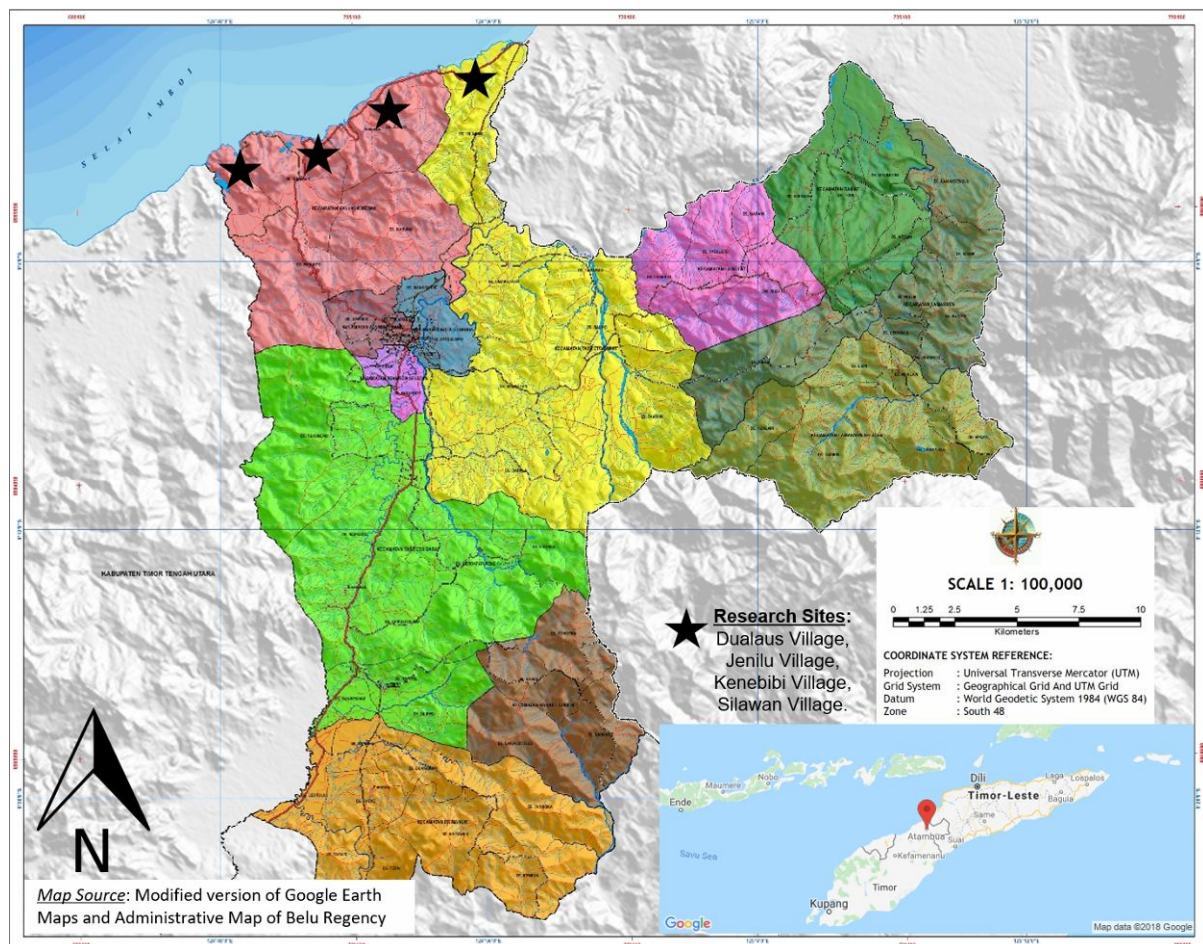


Figure 1. The research sites in border area of Belu Regency, Indonesia.

Results and Discussion

Fishermen income. Coastal communities depending on natural resources as a livelihood often cope with the uncertainty of income by diversifying livelihood. This aims to minimize the risks and weaknesses of fishermen (Chambers et al 1989; Ellis 1998; Allison & Ellis 2001; Davies 2009). Therefore, in fishing communities, fishing activities are rarely an exclusive job. This activity is always combined by fishermen with other jobs. According to Kusnadi (2000), in situations of over-exploitation and inequality in marketing of catches, economic rationalization will encourage fishermen to diversify sources of employment rather than relying solely on fishing. Diversification of the source of work is a form of multiple livelihood strategies developed by fishermen. In Belu, the main source income of fisheries household is fishing business and the alternative business namely grilled fish business, shredded fish business and sea salt making business. The alternative business selection by respondents is driven by the low income of households coming from capture fisheries and also utilizing the availability of fisheries

and other marine resources and in accordance with the processing skills of the local community. The average income of the fishermen household in Belu is presented in Table 1.

Table 1

Average income of fisherman household respondents in Belu regency (USD/year)

<i>Variables</i>	<i>Fishing</i>	<i>Grilled fish</i>	<i>Shredded fish</i>	<i>Sea salt making</i>	<i>Total</i>	<i>Flats income monthly</i>
Average	1,018.70	928.79	1,162.63	924.08	4,034.20	336.02
STDEV	171.77	176.43	136.57	159.60	181.44	15.11
SEM	49.58	50.93	39.29	46.07	28.69	2.39

Van Oostenbrugge et al (2004) found that the low income and high uncertainty of incomes earned by crew members of purse seiners was not found sufficient to sustain a household, which meant that other sources of income were needed. As seen in Table 1 the source of income for fishermen households in Belu is fishing as the main livelihood, another alternative business are grilled fish, shredded fish and sea salt making. The results of the study show that the average household income of fishermen for one year in the amount of USD 4,034.20±181.44 or the fisherman's household earns an average monthly income of USD 336.02±15.11. If the average income is based on the source of income, then it is obtained for the fishing business in the amount of USD 1,018.70±171.77, the grilled fish business in the amount of USD 928.79±176.43, the shredded fish business in the amount of USD 1,162.63±136.57 and the sea salt making business in the amount of USD 924.08±159.60.

The results of this study were higher than those of Fatimah (2014) who found that the average income of fishermen in Muncar District, Banyuwangi District was USD 57.98 per month; Paulus & Sobang (2017) found that traditional fishermen on Rote Island earn USD 52.07 per month. Further stated that in real terms the traditional fishermen household income decreased. The difference between the two results of the above research may be due to differences in the effective time of fishing, the fishing gear used, and the price of fish. This is in line with the opinion of Suyanto (1996) cited by Ekadianti (2014) that the income of fishermen is very dependent on the catch and marketing of the fish. While the capture itself is generally strongly influenced by the type of boat, fishing gear, season and natural conditions, especially wind and full moon and the potential of existing fish resources. In the rainy season fish production usually decreases, while in the dry season it is relatively large because high rainfall will affect the salinity of sea water. The effective time of catching fish for fishermen in Belu lasts five to six months. The dominant fishing fleet is outboard motor boats with fishing gear used in the form of fishing rods and their modifications.

The result of this study almost the same as that obtained by Siskawati et al (2016) that fishermen with fish trap in Membalong sub-district earn USD 500 per month while fishermen with gill nets get USD 824 per month. The results of this study are not much different from the results of Sumual et al (2016) study which states that 26.67% of fishermen in Arakan Village, South Minahasa Regency have revenues between USD 71 to USD 358 and 6.67% of fishermen have income greater than USD 358. Nevertheless, there is a challenging issue to achieve sustainable level of alternative livelihood whereby various variables could influence the sustainability of the livelihood in the coastal economic system (Paulus & Fauzi 2017).

Contributions of alternative incomes. Income contribution is the amount of each business's contribution made by the respondent to the total household income within a year. The average contributions based on the type of fishermen's household income are presented in Table 2.

Table 2

The average contribution by type of fisherman's household income (%)

<i>Variables</i>	<i>Fishing</i>	<i>Grilled fish</i>	<i>Shredded fish</i>	<i>Sea salt making</i>
Average	52.00	12.14	21.71	8.57
STDEV	9.73	4.41	6.02	2.64
SEM	3.68	1.67	2.28	1.00

As seen in Table 2 the average contribution of fishing business as $52 \pm 9.73\%$, grilled fish business $12.14 \pm 4.41\%$, shredded fish business $21.71 \pm 6.02\%$, and sea salt making business amounted to $8.75 \pm 2.64\%$. Based on the average contribution obtained that the fishing business contributed the highest followed by the shredded fish business, grilled fish business and the lowest business of sea salt making. In this study, the contribution of the fishing business is the main livelihood, while the fish processing business and the manufacture of sea salt are side businesses. Shredded fish business contribution is quite high, this is because shredded fish business has become a profitable side business for housewives in addition to having received training, easy access to raw materials for tuna or skipjack. If the contribution is compared between the main business as a fisherman and the three alternative businesses, attained contribution 52% of the main business and 42.43% of alternative business. This illustrates that alternative business activities have an important role in the economy of traditional fishermen households, especially in adapting the decline in income from the main business as fishermen caused by climate change. The results of the study are almost the same obtained by Tarigan (2010) that the main business contribution as a fisherman is 43.34% and an alternative business is 56.66% for fishermen in Batu Bara Regency. Based on the results of this study, the fish processing and cooking of sea salt on the Belu coast can be an alternative livelihood that needs to be improved as a form of adaptation of fishermen households to climate change in increasing their income; this is important because in the observations during the study it was found that fish processing businesses were still carried out because of the easy access to raw materials for fish and sea water, carried out in traditional ways with limited capital support. It is in line with the opinion of Allison & Mvula (2002) which stated that the development of a dual livelihood strategy is aimed at fishermen not only relying on the results of the catch. This matter needs to be done especially for lower-level fishermen who have limited facilities, who cannot go to sea all year long. However, this does not apply to all fishermen's families, only a small portion of fishermen's families have side jobs, the rest only depend on the catch in the sea.

Involvement of workers of family members in alternative business activities.

Although the adaptation process is basically a change in behavior at the individual level (Adger et al 2003; Paavola & Adger 2006), but in this discussion the adaptation process is presented in the household analysis unit. The adaptation in question is how fishermen's households in Belu are carrying out socio-economic actions in responding to various forms of ecological change in their territory due to climate change. Based on observations at the research site, the adaptation choices made by fishermen include: diversifying sources of income and mobilizing household members and relying on assistance from various parties. In sustaining the economy of fishermen households in this study it was found that family members (wives and children) contributed in conducting alternative businesses as a source of additional income, this is important because fishermen's family members have a lot of time and can be directed to productive activities to supplement their income. The percentage of involvement of fisherman household members in alternative business activities is presented in Table 3.

Table 3

The involvement of fisherman family members in alternative business (%)

<i>Variables of family members involved</i>	<i>Type of alternative business</i>		
	<i>Grilled fish</i>	<i>Shredded fish</i>	<i>Sea salt making</i>
fw	71.85	82.61	60.72
cw + fw	12.09	10.20	9.40
mw + cw + fw	16.06	7.19	29.88

fw = female worker; cw = children worker; mw = male worker.

As seen in Table 3, in case of the grilled fish effort, the involvement of women workers (fishermen's wives) is by 71.85%, women and child workers by 12.09%, and women, child and men workers by 16.06%. In the shredded fish business involvement of family members of fishermen indicates that the contribution of women workers is by 82.61%, a combination of female and child workers by 10.20%, and the combination of female, child, and the male workers force amounted to 7.19%. For sea salt making business, the involvement of female workers is as much as 60.72%, female and child workforce equal to 9.40%, and female, child and male workers are 29.88%. Based on the results of this study, it is illustrated that the most dominant fish processing businesses carried out by female workers are followed by a combination of female and child for shredded fish, and a combination of involvement between female workers, child labor and male labor for grilled fish. Whereas in the sea salt making business shows that the most dominant is carried out by female workers followed by a combination of female workforce, child labor, and male labor and the lowest is carried out by a combination of female workforce and child labor.

The economy of a household will increase if it is supported by a wife's income. The role of the wife in the livelihood of the fisherman's household is the participation of the wife in helping the husband to make a living both in the field of arrest and non-fisheries (Kusnadi 2009). Harper et al (2013) conclude that recognizing and quantifying the role of women in fisheries has profound implications for management, poverty alleviation and development policy. Our study showed that family members of fishermen engage in productive activities to support household income of fishermen. The dominant types of alternative businesses carried out are grilled fish, shredded and sea salt business. The results showed that the role of fishermen's family members (wives and children) in conducting alternative businesses to support fishermen's household income was quite high. The research result is in line with the opinion of Kusnadi et al (2006) which states that the position and the role of wives of fishermen in coastal communities is very important, because the fisherman's wife took a major role in the socio-economic activities on land. Usman (2013) also noted that the decline in the income of fishermen in the famine season encouraged fishermen's wives to be able to play their role as supporting the fishermen's household economy. Even not infrequently, in such situations, the wife of a fisherman instead acts as the backbone of the household economy. In line with FAO (2016) women are actively involved in fish processing and marketing. They also participate in capture fisheries in coastal areas and estuaries as well as in other forms of harvesting of aquatic organisms. Women are also employed in large-scale fish processing plants. In India alone, it is estimated that about 700.000 women and youth are employed as labourers in the fish processing industry (Tietze et al 2007; INFOFISH et al 2008). Women's involvement results in increased well-being of their households, as women's income is largely spent on food and children's education (INFOFISH et al 2008). Study findings suggest that women can gain from increasing trade opportunities through their involvement in value adding activities and enterprises. Besides wives, fishermen's children are also involved in several jobs to earn income (Helmi & Satria 2012). A boy will follow his parents or relatives to fish in the sea or clean a boat that has just arrived to sea (O'Riordan 2006; ICF 2011). Aside from helping their parents' domestic activities, girls also help their mothers who work in fish and seaweed processing industries (Stein 1995; Solidarity Center 2007; Sahu et al 2009). The economic activities of fishermen's children are usually done after they return home from school. These children immediately

helped their fathers to clean up the boat, confirming the damaged nets, as well as fishing in the sea (FAO 2010). In addition, other activities that can be entered by children are in the business of sea salt making (ILO 1996; ICF 2011). According to present study, in summer and school holidays, children are busy helping their parents to prepare stoves to cook sea water into salt, while at the time of harvesting fish the children are busy participating in selling fresh fish and grilled fish and cleaning fish for processing into floss. The types of activities in the fisheries sector undertaken by children in Belu are similar to the findings of Ferdousi & Faruk (2016), Mathew (2010) and FAO (2010).

Outpouring of time for members of fishermen's families in alternative businesses. The alternative businesses undertaken by wives by involving children will be very helpful in fulfilling fishermen's household needs and can increase family economic income. If women were given more opportunities to participate in income-generating activities like fisheries they would be in a position to improve the overall standard of living of the household (Halim & Ahmed 2004). The time allocation of fishermen's wives in increasing their income is not only limited to fishery processing business but also in non-fisheries sector activities such as making sea salt. In the household, the worker's wife's working time is grouped into three activities, namely household activities (cooking, taking care of children and husbands, shopping), livelihood activities (productive activities) and social activities (Akbarini et al 2012). The average time spent by family members in alternative businesses in our study is presented in Table 4.

Table 4
The average outlay time of family workers in alternative business (hours per day)

Variables	Grilled fish			Shredded fish			Sea salt making		
	fw	cw	mw	fw	cw	mw	fw	cw	mw
Average	4.86	0.86	1.06	7.06	2.21	1.10	8.17	1.76	6.92
STDEV	0.900	0.669	0.529	0.840	1.075	0.729	0.797	1.304	1.039
SEM	0.340	0.253	0.200	0.318	0.406	0.276	0.301	0.493	0.393

fw = female worker; cw = children worker; mw = male worker.

As shown in Table 4 the grilled fish business gets a female workforce outlay of 4.86 ± 0.900 hours per day, child workers 0.86 ± 0.669 hours per day, and male workers 1.06 ± 0.529 hours per day. In the shredded fish business, the female labor time was 7.06 ± 0.840 hours per day, child workforce was 2.21 ± 1.075 hours per day, and male workers was 1.10 ± 0.729 hours per day. In the sea salt making business, women spent labor time 8.17 ± 0.797 hours per day, child workers 1.76 ± 1.304 hours per day, and male workforce 6.92 ± 1.039 hours per day. The results showed that the highest outlay of time for alternative businesses was done by female workers, followed by male workers and the lowest by child labor. The time spent by fishermen's family members on three alternative businesses is female labor at 20.09 hours per day, male workers at 9.08 hours per day, and child workers at 4.83 hours per day. The results showed that alternative business activities were mostly carried out by fishermen's wives and children compared to men. The time allocation of female workers in Belu was higher than the results obtained by Suminar (1996) in Paulus & Sobang (2017) which found that the level of women's participation in the economy of fisherman households was very low as indicated by the low average allocation of women's time to activities that are income generating by 1.85 hours per day, compared to men 6.5 hours per day. The big difference in the results of research of Suminar (1996) with the results of our study may be due to the type and number of alternative business done. However, the results of the research are in line with the results of Ekadianti (2014) study which found that the average time spent by fishermen's wives in productive activities was around five to six hours per day. Alternative business choices made by respondents are very dependent on the availability of resources, the technology that is owned by the fishermen's family, and the economic value of the product being cultivated (must be easy to market). Alternative businesses carried out by respondents in this study are businesses that have been done downhill and

the products have a definite market. Based on Kusnadi (2009) that there are three things that need to be considered in the selection of alternative businesses, namely: (1) the types of alternative livelihoods that will be managed by the wives of fishermen are very dependent on the structure and potential of local economic resources available, both in coastal areas and by utilizing the potential of marine resources; (2) the determination of the type of business as an alternative livelihood will affect the choice of technology and equipment needed to support the business; preferably, the type of technology and equipment used is appropriate technology; and (3) extensive marketing network and further to ensure the business continuity of alternative livelihoods. So far, small-medium industrial products in fishing villages have a limited range of consumers and marketing areas.

Conclusions. Based on the results of the discussion above, it can be concluded that: (1) alternative business needs to be developed as a form of adaptation of fishermen households in maintaining income which is caused by a decrease in income from the main livelihoods as fishermen due to seasonal changes; (2) the contribution of alternative businesses to the total income of fisherman households in Belu is higher than the contribution of the main business of fishing business; and (3) the involvement of female workers and child labor in alternative businesses is higher than that of male workers. Based on the conclusions above, it may be advisable alternative business development by domestic fishermen in border areas of Belu Regency should be supported by the government policy through business capital and technology facilities so that the role of alternative businesses in increasing fisherman household income can be further improved.

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