



Food security and multidimensional poverty of mud crab fishermen household in small and outer islands of Indonesia. Case study: Enggano Island, Bengkulu Province

^{1,3}Indra Cahyadinata, ^{2,4}Achmad Fahrudin, ²Sulistiono, ²Rahmat Kurnia

¹ Study Program for Coastal and Marine Resources Management, Graduated Program, IPB University, Darmaga Bogor, 16680, Indonesia; ² Department of Aquatic Resources Management, IPB University, Darmaga Bogor, 16680, Indonesia; ³ Department of Agribusiness, University of Bengkulu, Bengkulu, 38371, Indonesia; ⁴ Center for Coastal and Marine Resources Studies, IPB University, Baranangsiang Bogor, 16127, Indonesia. Corresponding author: I. Cahyadinata, cahyadinata@yahoo.com

Abstract. Food security is a condition of adequate food availability, while poverty is a condition where the basic needs are unable to be fulfilled. Food security is strongly related to multidimensional poverty. Therefore, this research aimed to analyze the food security and multidimensional poverty status of coastal communities in Enggano Island who work as mud crab fishermen. In order to reach the purpose, about 42 fishermen were chosen as respondents. The data analysis used was the food security index measurement, income per capita and multidimensional measurement based on the dimensions of education, health, and standard of living. The results show that the fishermen households have three categories of food security which are the food secure (19%), enough food secure (74%), and the low food secure (7%). The first category is distinguished by the availability of food supplies and to fulfill the needs from purchasing, no food lack, no fear of food lack, and the affordable food price. The second category emphasizes on these five characters such as the food supply is available, able to purchase the household needs, never experienced difficulty of food caused by the first two options, never subjected to the fear of food shortage due to the first two options, relatively expensive food price. Furthermore, the food category is identified by five of the following characters, there isn't food supply, not able to fulfill the needs of this household from other sources, lack of food due to three causes or more, fear for the lack of food due to three causes or more, and relatively expensive food price. The fishermen household's poverty is based on the per capita income which is divided into two classes which are, un-poor household (69%) and poor household (31%). From these classes, 7% of them are grouped into multidimensional poverty, 50% are vulnerable to multidimensional poverty, and the rest, 43% are of no multidimensional poverty. The multidimensional poverty are characterized by their educational background which are, some achieving only elementary school level, children dropping out of school, cooking with firewood, and unable to afford any motorized vehicle. Further, the character of vulnerable household on multidimensional is classified by the educational background only achieving an elementary school and using firewood for cooking food. The un-poor household on multidimensional poverty is a household having dimensions of education, healthcare, and affordable standard of living.

Key Words: mud crab, food supply, poor, vulnerable household, Enggano.

Introduction. Food security is a reflection from enough food, availability in quantity and quality, safely varied, nutritious, equally affordable, and not contrary to religious believe, and culture, been able to live a healthy, active, and productive life style sustainably (Indonesian Minister of Justice and Human Rights 2012). Furthermore, the developing countries possess higher vulnerability on food security (Ding et al 2017). The food security is highly related to the food commodity and areas, including processing and serving (Alonso et al 2018). The agriculture crops households have higher food security than other agricultural households (Statistics Indonesia 2014). This is a reflection of prosperity (Baker et al 2015), and it is linked to multidimensional poverty. This is a condition measured from three dimensions which are, education, healthcare, and living standard (Statistics Indonesia and Faculty of Human Ecology IPB University 2015). The

agricultural households with a living source are the agricultural sector (including fishing households) are highly vulnerable undergoing multidimensional poverty than the other non-agricultural sectors (Statistics Indonesia 2014). The destitution of fishermen can assign the bad impacts, one of them in requiring the food consumption needs that is able to inflict the food insecurity (Mulyasari & Arianti 2015).

The fishermen living in Enggano Island, a small island which is relatively located far away from the mainland, possess a higher vulnerability of food security and multidimensional poverty than those living in the mainland. Hence, in combating this situation, specific treatment is needed (Bell et al 2015). Mud crab fishing is one of the alternative commodities that can be expanded due to one of its basic commodities (Cahyadinata et al 2018) requiring an effective fish capturing (Bell et al 2018) and supported by a good selling price to reduce the poverty (Alvarez et al 2018).

Some studies on the mud crab had been done by some researchers in Indonesia, i.e. the ecobiology in Segara Anakan Lagoon, Central Java (reproduction and growth of three species mudcrab) (Tanod et al 2000), characteristics of habitat and potential of mud crab in mangrove at Garut, West Java (Avianto et al 2013), relationship among mangrove, mud crabs and some water quality parameters in Sinjai Timur, South Sulawesi (Chadijah et al 2013), relationship among mud crab with mangrove and substrate in Indramayu, West Java (Sunarto et al 2015), growth of mud crab in the estuary at Segara Anakan, Central Java (Dewantara et al 2017), household welfare of mud crab fishermen in Enggano, Bengkulu (Cahyadinata et al 2019). While, food security and multidimensional poverty of mud crab fishermen household is lack of report.

The food security and multidimensional poverty of fishermen are highly related to food consumption and their income. Mud crab fishermen do not produce most of the foodstuffs they consume and most of the materials are carried into Enggano Island at relatively high prices. To feed, the fishermen would have to sell at a relatively low price. On the other hand, their income is greatly affected by their scale of business (Bene et al 2016). The problem stated in this research is listed following these two questions: (1) how does the food security of coastal communities in Enggano Island affect those who work as the mud crab fishermen? and (2) how does the multidimensional poverty status of coastal communities in Enggano Island who work as the mud crab fishermen? This research aimed to analyze the food security and the multidimensional poverty status of coastal communities in Enggano Island who work as the mud crab fishermen.

Material and Method

Study site. Administratively, Enggano Island is one of the sub-districts at North Bengkulu Regency consisting of six villages namely Kaana, Kahyapu, Malakoni, Meok, Apoho and Banjarsari. The capital of this district is located in the Apoho Village (Statistics of North Bengkulu Regency 2018). The villages on research location are Kahyapu, Kaana and Banjarsari that are located between 102.05° to 102.25° (E) and 5.17° to 5.31° (S) (BKSDA 2018). This research was conducted from August to November 2018.

Data collection. The research is composed of primary and secondary data. The secondary data was gained from available literature. The primary data was derived directly in the field through interviews using questionnaires. They were completed by questions regarding food security, multidimensional poverty, and socio-economical conditions of the mud crab fishermen households.

Sampling. The population of mud crab fishermen in Enggano Island are 50 people. Furthermore, the number of respondents was 42 people (84% of the total population). The used sampling method was census (Nazir 2014) in where 8 fishermen were not selected to be samples due to their absence in the location during the research conducted.

Data analysis

Food security. The food security reflects the fulfilled condition of food for all members of the fisherman household which is measured through a Food Security Index consisting of three dimensions which are, food availability, access, and uses. The food security is recognized as a system that comprises three main components such as the availability, accessibility, and usability of food. It can be realized when there is a synergizing among these three components.

Measuring the food security index in this research was taken by scoring the aspects of each dimension (Table 1).

Table 1

The Food Security Index measurement

No	Dimension	Aspect	Indicator	Score
1	Food availability	Food sufficiency	The sufficiency of food supply	0-6
			No food shortage	0-3
			Fear of food shortage	0-3
2	Food access	Physical, economic and social cccessibility	Foods are produced in the district	0-1
			No trouble to reach purchasing location	0-1
			Purchasing price is not high	0-1
3	Food uses	Intake sufficiency	No malnutrition of babies	0-1
			No dead babies due to sickness	0-1
		Water quality	The main source of drinking water	0-3
			The main water source for cooking	0-3

Source: Statistics Indonesia and Faculty of Human Ecology IPB University (2015).

The research on food security was based on the index that was grouped into three categories and indicator of the index assessment, namely (Statistics Indonesia and Faculty of Human Ecology IPB University 2015):

1. Less secure, index is < 33.33;
2. Fair secure, index is in a range of 33.34-66.66;
3. Secure, index is > 66.67.

Multidimensional poverty. A poverty indicator is distinguished to be of two categories which are urban and rural poverty which both of them are measured based on the per capita income per month. The poverty line issuing by the Indonesian Government (Statistics Indonesia 2017) is IDR 374,478 for per capita per month. For urban and rural areas are defined as IDR 385,621 and IDR 361,496 monthly per capita, respectively. Regarding the villages in Enggano Island they are included in the rural areas, further, the poverty criteria were determined as follows:

- a) Monthly per capita income > IDR 361,496,-: un-poor category;
- b) Monthly per capita income ≤ IDR 361,496,-: poor category.

A utilized formula to calculate the monthly per capita income is presented in the equation (1) below:

$$PK = \frac{PT}{JT} \dots\dots\dots (1)$$

where: PK = per capita income (IDR/individual/month);
 PT = monthly total income of a household (IDR/month);
 JT = number of household members (individual).

Besides being measured using monthly per capita income, poverty can also be measured using multidimensional poverty indicators which are of three dimensions: education, healthcare, and standard of living (Table 2). Each dimension possesses the equal weights namely one-third or 33.33 percent.

Multidimensional poverty measurement

<i>No</i>	<i>Dimension</i>	<i>Indicator</i>
1	Education	- no family member who has completed 9 years of basic compulsory education (Junior High School); - possessing minimally one child in a range of educational age (until class 9) who has dropped out.
2	Healthcare	- possessing at least one family member who suffers from malnutrition; - having one or more children who had passed away.
3	Standard of living	- no electricity; - no access to the clean drinking water; - no access to the affordable sanitary; - using charcoal, coal, or firewood for cooking; - having a house with ground floor; - no motorized vehicles and only one of the following goods: bicycle, motorbike, radio, refrigerator, phone, or TV.

Source: Statistics Indonesia and Faculty of Human Ecology IPB University (2015).

A household would get the multidimensional poverty score from 0 to 100. The higher score of MP indicates the poverty level is getting higher. From this range of score, the household was able to be grouped into four categories as follows (Statistics Indonesia and Faculty of Human Ecology IPB University 2015):

1. Not poor, if a household has the score of MP less than 20;
2. Vulnerable to be poor, if a household possesses the score of MP from less than 20 to less than 33.34;
3. Poor, if a household has the score of MP in a range of 33,4 to less than 50.
4. Very poor, when a household possesses the score of multidimensional poverty equal to 50 or more.

Results and Discussion

Food security. The economic condition of a household is an important factor in food security (Lauria et al 2018). Furthermore, the food security is able to be escalated by uplifting an income (Pangaribuan et al 2015). The food availability for mud crab fishermen in Enggano Island is included in an insufficient category. They indeed have availability of food in their house, however, it is not enough to fulfill their needs during a year and in completing this lack from purchasing (Table 3). Only few of these fishermen get some extra food from Rice Program for Poor People. A frame of government is necessary to be directed to fulfill the food needs. A different policy generates a different level of food that needs fulfillment (Sowman & Cardoso 2010).

Access on food is included in the category of less affordability. The food in Enggano Island is mostly produced or brought in from outside of the island, from Bengkulu City. Almost every village there has small shops selling food, however, at a relatively higher price. This occurs due to the shopkeepers pay for the transportation, loading and unloading costs from Bengkulu City to Enggano Island. Therefore, the food fulfillment requires cross-cutting policies (Pihlajamaki et al 2018).

The food consumed by mud crab fishermen is encompassed into an adequate food intake and low water quality, because it is suitable with culture and the needs of nutrition (Lowitt et al 2018). Enough nutrition intake is indicated by no under-five-age baby died due to malnutrition and measly under-five-age baby died due to sick. The nutrition status of five age baby is related to the family economic level (Burhani et al 2016) and food security (Triwindiyanti et al 2018). To escalate the consumed drinking water, the well water should be boiled first before drinking.

Table 3

The measuring results of food security index

No	Indicator	Number (people)	Percentage (%)
1	The sufficiency of the food supply		
	- there is a supply of food and it is enough for a year duration of time;	3	7.1
	- there is a food supply and to fulfill the shortage of food by purchasing;	33	78.6
	- there is a food supply and to fulfill the shortage from an aid;	0	0.0
	- there is food supply and to require the shortage from other sources;	1	2.4
	- no food supply and to fulfill its need from purchasing;	3	7.1
	- no food supply and to fulfill its need from aid;	0	0.0
2	No food shortage		
	- a household with no food shortage;	11	26.2
	- a household has a food shortage with one reason;	7	16.7
	- a household has a food shortage with two reasons;	11	26.2
	- a household has a food shortage with three reasons or more.	13	31.0
3	Fear of food shortage		
	- no fear of food shortage;	7	16.7
	- fear of food shortage with one reason;	9	21.4
	- fear of food shortage with two reasons;	12	28.6
4	Location of food production		
	- mostly producing in Enggano District;	19	45.2
	- mostly producing in outside of Enggano District.	23	54.8
5	Purchasing location		
	- the purchasing location of food is affordable to be reached;	34	81.0
6	Purchasing price		
	- affordable enough;	23	54.8
	- relatively expensive.	19	45.2
7	The malnourished under five-years-old baby		
	- exist;	0	0.0
8	Under five-years-old baby died due to sickness		
	- exist;	42	100.0
9	Main source of the drinking water		
	- bottled water/refill/tap water;	0	0.0
	- pump;	0	0.0
	- well /spring;	41	97.6
10	The mains source of the cooking water		
	- river.	1	2.4
	- bottled water/refill/tap water;	0	0.0
	- pump;	0	0.0
	- well /spring;	41	97.6
	- river.	1	2.4

The food security possesses a relationship with biodiversity (Garcia et al 2016) and it lifted through increase in fish production, but impacting negatively on the resources (Cisse et al 2015), even though they are renewable (Campbell et al 2016). Index values of food security are between 30.43 and 78.26 with an average value of 56.11. This index showed that 19% of the fishermen in Enggano Island is categorized as food secure, 74% of them is of fair food secure and 7% of them is less food secure. This condition is higher than the food security level of fisherman laborers in South Halmahera Regency achieving 92.78% in the category of less food secure (Salim & Darmawaty 2016) and lower than the level of fishermen in Bandar Lampung City exceeding 56.86% in the category (Yuliana et al 2013).

The food security categories of fishermen are differentiated by the dimension of food availability and access, while the mode of usage are relatively similar to one another. All indicators (three indicators) in the dimension of food availability becomes differentiators for the food security categories. Price of food is a differentiator indicator in the food security categories. Therefore, the food security has a positive and real relationship in the welfare (Tajerin et al 2011).

The food secure household of mud crab fishermen is a possessing food supply and fulfilling its needs of food from purchasing, no food shortage, no fear of scarcity, and the price is affordable enough. The fair food secure of mud crab fishermen is distinguished by their food supply, meeting its need from purchasing, never undergoes shortage with two reasons, having a fear of scarcity with two reasons or more, and the price is relatively expensive. The last category, the less food secured for mud crab fishermen is indicated by there is not any food supply, to fulfill its needs of food coming from other resources, the food lack with three causes or more, possessing a fear of shortage with three causes or more, and food price is relatively expensive (Table 4).

Table 4

The food security categories of fishermen

No	Indicator	Food secure	Fair food secure	Less food secure
1	Adequate food supply	Has a food supply and to fulfill the shortcoming of buying	Has a food supply and to fulfill the shortcoming of buying	Possesses no food supply and to fulfill the needs of food coming from other sources
2	Food sufficiency	No food lack	Lack of food with two causes	Lack of food with three causes or more
3	Fear of food shortcoming	No fear of food shortcoming	Fear of food shortcoming with two causes	Fear of food shortcoming with three causes or more
4	Location of food production	Mostly produced in outside of the sub-district	Mostly produced in outside of the sub-district	Mostly produced in outside of the sub-district
5	Location of purchasing	Easily affordable	Easily affordable	Easily affordable
6	Purchasing price	Affordable enough	Relatively expensive	Relatively expensive
7	Malnutrition of under-five-years-age baby	No	No	No
8	The under-five-years-age baby died due to sick	No	No	No
9	The main source of drinking water	Well/water spring	Well/water spring	Well/water spring
10	The main source of cooking water	Well/water spring	Well/water spring	Well/water spring

The multidimensional poverty. The total income of fishermen household is an accumulation of earnings from all family working members consisting of basic and side incomes. Both monthly incomes of fishermen household are approximately IDR 1,673,810.00 and IDR 815,236.00, respectively. Therefore, the total income of the household is about IDR 2,489,046.00 per month. The income of the household is highly dependent on nature condition (Walelign et al 2016). Furthermore, the per capita income of fishermen family members is in a range of IDR 120,000.00 – IDR 2,166,667.00 per month and an average of IDR 716,553 per month. The number of family members is in a range of 1-7 people and its average are 4 people. The income of fishermen is above the national income average which makes them possess a relatively good life (Nielsen et al

2018) and it escalated using an environmental-friendly fishing technology (Swaminathan & Kesavan 2016).

In terms of poverty indicator that based on the per capita income, 69% of fishermen household has per capita income is higher than IDR 361,496.00 per month and the rest, 31% of the household, possesses a per capita income is lower or equal to IDR 361,496.00 monthly. This means that based on their income, approximately 69% of the fishermen on this island is categorized into un-poor and the rest is poor.

The population included into the poor category has a limitation in the economy (Berman 2018), hence, the habit of fishermen should be adapted to the coastal ecosystem change in dynamics (Deb 2018). A dynamically socio-economic system is related to the ecosystem for poverty alleviation (Fisher et al 2013) and human wellbeing (Fisher et al 2014). The fishermen with a protected ecosystem have a higher income than the fishermen with a rehabilitated ecosystem (Islam et al 2014).

The educational level of the fishermen family member is classified as a low-level category which is approximately 64.28% still finished an elementary school. An education is able to affect fishermen perceptions (Gehrig et al 2018) that can be involved or participated in the environmental conservation process (Gillam & Charles 2018; Islam et al 2016). The fishermen are going to participate in the ecosystem management if they feel to have benefits (Hahn & Castro 2018) and are highly influenced by biophysical condition and socio-economical condition of the territory (Kabir et al 2011).

The healthcare dimension is in a relatively good category due to the fact that there are no family members who have malnutrition and only about 4.76% of fishermen household that observed the death of children. Further, in terms of the standard of living, in general, all fishermen households have access to electricity, clean drinking water, affordable sanitary, firewoods for cooking foods, houses with floor of non-ground, and possessing several affordable household equipment which some of them are motorbike, telephone, refrigerator, and TV (Table 5).

Table 5

The measuring results of multidimensional poverty

<i>No</i>	<i>Dimension</i>	<i>Indicator</i>	<i>Number (people)</i>	<i>Percentage (%)</i>
1	Education	- no family member who had finished nine years of education (Junior High School);	23	54.76
		- have at least one child in the school-age (until class 9) who dropped out of school.	4	9.52
2	Healthcare	- possess at least one of family members who experienced a malnutrition;	0	0.00
		- have at least one or more children who passed away.	2	4.76
3	Standard of living	- no electricity;	1	2.38
		- no access to a clean drinking water;	2	4.76
		- no access to affordable sanitary;	2	4.76
		- using firewood, coal, or charcoal for cooking food;	37	88.10
		- have a house with ground-floor;	2	4.76
		- no motorized vehicle and only have one of the following things: bicycle, motorbike, radio, refrigerator, phone, or TV.	1	2.38

Measuring the multidimensional poverty of mud crab fishermen based on the dimensions of education, healthcare, and standard of living, showed that fishermen households are categorized into un-poor (43%), vulnerable on poverty (50%), and poor (7%). While the measuring poverty based on the per capita income, about 69% of those fishermen are classified as un-poor which means that approximately 26% of those numbers are included into the vulnerable multidimensional poverty. The poor household based on the per capita income is 31%, which means that approximately 25% of them is indicated as

the vulnerable category on multidimensional poverty. The poor fishermen commonly are in relatively young ages (Solaymani & Kari 2014). The poverty level can be declined by promoting sustainable fishery activity through escalating the fishermen socio-economic standard of living (Lynch et al 2017).

The multidimensional poverty of mud crab fishermen that had been measured from three dimensions (education, healthcare, and standard of living), only two dimensions were distinguished which are education and standard of living. Healthcare dimension is relatively similar to all fishermen households, for three household types of poor, vulnerable to be poor, and un-poor multidimensionally (Table 6).

The poor fishermen household multidimensionally is characterized by the elementary school level of the family members, children dropped out of school, using firewood for cooking foods, and no motorized vehicles. Their vulnerability is distinguished by an average of family members education is a primary school, using firewood for cooking foods. Furthermore, the un-poor multidimensionally is a household possessing dimensions of education, healthcare, and standard of living very affordable.

Table 6

Category of multidimensional poverty

<i>No</i>	<i>Dimension</i>	<i>Indicator</i>	<i>Poor</i>	<i>Vulnerable poor</i>	<i>Un-poor</i>
1	Education	- no family members who had completed nine years of education (Junior High School);	Yes	Yes	Not
		- have at least one child in the school-age (until class 9) who dropped out of school.	Yes	Not	Not
2	Healthcare	- possess at least one of the family members who experienced malnutrition;	Not	Not	Not
		- have at least one or more children who passed away.	Not	Not	Not
3	Standard of Living	- no electricity;	Not	Not	Not
		- no access to clean drinking water;	Not	Not	Not
		- no access to affordable sanitary;	Not	Not	Not
		- using firewood, coal, or charcoal for cooking food;	Yes	Yes	Not
		- have a house with ground-floor;	Not	Not	Not
		- no motorized vehicle and only have one of the following things: bicycle, motorbike, radio, refrigerator, phone, or TV.	Yes	Not	Not

The poor fishermen need a particular policy regarding small scale fishing business (Sowman et al 2014) due to the boosters of economic development in 20 Asian countries, including Indonesia (Thorpe et al 2006). The distinctive policy is in forms of financial aid and infrastructure development (Zhang et al 2018a) and the time span can exceed six years (Zhang et al 2018b). However, the poverty alleviation program so far points out a successful pattern for areas close to economic and governmental centers (Ge et al 2017).

Conclusions. Measuring the food security and poverty of mud crab fishermen in Enggano Island generated the following conclusions:

(1) The food security of fishermen households are categorized into, 19% secure, 74% fair secure, and 7% less secure food. The first category is distinguished by the

availability of food and to fulfill their needs from purchasing, no food shortage, no fear of food shortage, and enough affordable food price. The second category is characterized by the availability of food and meeting their needs from purchasing, ever had undergone food lack by two reasons, fear of food lack with two reasons, and relatively expensive food price. The last category is distinguished by no food availability and fulfilling their needs from other sources, food lack with three or more reasons, fear on food lack with three or more reasons, and relatively expensive food price.

(2) The fishermen household based on the per capita income consisting of 69% is grouped into un-poor, and the rest, 31% as poor. The gained per capita income of family members is not able to meet the needs of education and standard of living. The multidimensional poverty of these household are divided into, 7% poor, 50% vulnerable poor, and 43% un-poor multidimensionally. The 7% poor, are distinguished by, the family having only primary school level, incomplete or dropped out of school children, using firewoods for cooking foods, and no motorized vehicles. The vulnerable poor fishermen are characterized by, the education of a family member is at primary school level, and using firewoods for cooking foods. The un-poor households possessing dimensions of education, healthcare, and good standard of living.

The formulated suggestions in this research are as follows: (1) the mud crab fishermen should establish an economic institution such as a cooperative that controls the selling of households food where the availability and affordability of food becomes escalating, and (2) the role of government is needed in socializing the nine-year compulsory educational program and to create awareness to parents and their students of how important it is to attain Junior High School and Senior High School level.

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Authors:

Indra Cahyadinata, Study Program for Coastal and Marine Resources Management, Graduated Program, IPB University, Darmaga Bogor, 16680, Indonesia; Department of Agribusiness, University of Bengkulu, Bengkulu, 38371, Indonesia, e-mail: cahyadinata@yahoo.com

Achmad Fahrudin, Department of Aquatic Resources Management, IPB University, Darmaga Bogor, 16680, Indonesia; Center for Coastal and Marine Resources Studies, IPB University, Baranangsiang Bogor, 16127, Indonesia, e-mail: fahrudina@yahoo.com

Sulistiono, Department of Aquatic Resources Management, IPB University, Darmaga Bogor, 16680, Indonesia, e-mail: onosulistiono@gmail.com

Rahmat Kurnia, Department of Aquatic Resources Management, IPB University, Darmaga Bogor, 16680, Indonesia, e-mail: rahmatku@ipb.ac.id

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