The economic impact of capture fisheries development in Indonesia

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Abstract. Resource-based development is the mainstay of national development, one of which is capture fisheries which have a significant contribution to economic growth in Indonesia. This study aims to (1) determine the economic impact of capture fisheries development, both at the micro and macro level and (2) to determine the role of the capture fisheries sector, both regionally in selected and national fisheries centers. Secondary and primary data used in the study were analyzed descriptively and the minimum requirements approach (MRA) and location quotient (LQ) was used to see the role of the fisheries sector at the regional and national levels. The results showed that the development of capture fisheries in Indonesia had a positive economic impact. Capture fisheries can become Indonesia's leading sector, reflected in an increase in fisherman household and production growth and contribution to GDP. The role of fisheries in capture fisheries centers in the western, central and eastern regions of Indonesia are represented by the Provinces of North Sumatra, South Sulawesi, and Maluku which gives different results. Development of capture fisheries can create economic activities, both for the fisheries sector itself as well as the regional and national economic development as a whole. Increasing competitiveness and creating fisheries centers that have comparative advantages can be realized through the development of supporting infrastructure and modernization of small scale fishers who still use traditional technology.
Key Words: competitiveness, economy, economic growth, fisheries centers, small scale.

Introduction. Development is an activity carried out in a planned and sustainable manner. Development is carried out based on local potentials owned (natural, human, artificial, and social resources) that can create prosperity for the community (Rustiadi 2009). Development planning can be done through two approaches, namely sectoral and regional. The sectoral approach focuses attention on the activity sectors in the region, while the regional approach pays attention to the use of space for the production of goods and services, predicts and estimates the need for facilities for each concentration of activities that can be efficiently linked. In regional development, both must be combined between a sectoral approach and a regional approach (Tarigan 2005).

Capture fisheries as one of the economic activities have great potential to increase economic growth in Indonesia. It can be seen from the growth of gross domestic product (GDP) of fisheries in 2015-2018 with an average growth of 5.20%, where capture fisheries have contributed up to 50%. According to the literature (Suherman & Dault 2009; Huda et al 2014; Pangabean 2016) the development of capture fisheries has had a multiplier effect on the growth of other economic sectors which will ultimately improve the welfare of the community.

Economic growth has always been an indicator of welfare and a solution for every economic crisis. This growth is driven by increased resources, uniquely human and technological resources (Huda 2015; Ulum 2015). Economic growth is a process of increasing a country's economic production which is realized in the form of national income (Huda 2015). One indicator to measure economic growth is fluctuations in the amount of national income or gross domestic product (Rahardja 2008). Measuring the success of economic development based on economic growth, in fact, can not provide a complete picture of the equitable distribution of welfare. It is reinforced by the results of

a World Bank study in 2015 which stated the achievement of economic growth, on the one hand, was able to reduce poverty and enlarge the number of the middle class, but on the other hand widening economic inequality.

The contribution of the fisheries sector to economic growth not only occurred in Indonesia, but also in several other countries, such as the United States, Japan, and European countries. It was confirmed by Finegold (2009) and Fauzi (2010) that the fisheries sector in several countries in the world had big contribution and had become a source of "energy" for economic growth and also a "growth engine" for regional economies. Even in some other countries, fish is "culturally" a part of life. Fauzi (2010) also said that the role of the fisheries sector in several countries was marked by a significant increase in production. Based on the description above, the study was conducted with the aim of (1) knowing the economic impacts of capture fisheries development, both at the micro and macro level regionally in selected fisheries centers (North Sumatra, South Sulawesi and Maluku Provinces) and nationally; and (2) knowing the role of the capture fisheries sector, both nationally and regionally in selected fisheries centers.

Material and Method

Types and source of data. The present research is a quantitative one, using a case study approach, focus and research subjects related to the role of the fisheries sector in terms of the GDP of the fisheries sector in the region. Case studies were carried out, which are in-depth case studies (intrinsic case study). Primary and secondary data were used in this study. Secondary data used in the study are reports of previous research related to research, statistics related to research objectives, provincial gross regional domestic product (GRDP) data, potential fisheries resources, and other data that support the research objectives. Primary data was collected through interviews with several key informants, such as business actors (fishers), fisheries managers and others related to the purpose of the study using a questionnaire and questionnaire as an interview guide.

Data analysis technique. The economic impact of capture fisheries development was viewed from two levels. First level was the micro-level to see the economic impact of capture fisheries development from the perspective of business sustainability through per capita fishermen income and fishing business performance at selected research sites. The second level was the macro-level to see the role of the capture fisheries sector using the Minimum Requirement Approach (MRA) and Location Quotient (LQ).

a) Net Present Value (NPV) is stated by formula:

$$NPV = \sum_{t}^{n} \frac{B_t - C_t}{(1 + i)^t}$$

where t is 1, 2, ...,10; i is interest rates, and $(1 + i)^t$ is the discounted factor

b) Return to Owner (RTO) to find out the net benefits received by the owner

$$RTO = Revenue - Total Cost$$

c) Return to Labour (RTL) to find out the receipt of labour

$$RTL = \frac{profit\ sharing\ (revenue - operating\ costs)}{\sum labour}$$

d) Return to Investment (ROI) o find out the rate of return on investment

$$ROI = \frac{Benefit}{Investasi}$$

e) Payback Period (PP) to find out the length of return on investment

$$PP = \frac{Investasi}{Benefit}$$

f) Minimum Requirement Approach (MRA). The MRA approach assumes that an area will not meet external demand until the area's needs are met first, with the following formula:

$$X_a^i = \left(\frac{PDRB_a^i}{PDRB_a} - \frac{PDRB_{\min peer}^i}{PDRB_{\min peer}}\right) PDRB_a^i$$

The above formula states that the basic GRDP of sector i (in this case fisheries) in region a is the multiplication of the total GRDP of sector i in the region a by the difference in share of the fisheries sector with the minimum share of the closest sector (peer).

g) Location Quotient (LQ). LQ analysis is used to show the role of the fisheries sector by comparing larger areas through the GRDP value-added approach, with the following formulation:

$$LQ = \frac{V_i/V_t}{Y_i/Y_t}$$

where Vi is GRDP value in sector i at the lower regional level, Vt is Lower total GRDP at the regional level, Yi is GRDP value in the sector I at a higher regional level, and Yt is total GDP at a higher regional level.

If the value of LQ>1 then the sector is a base sector, LQ<1 then the sector is an importer or non-base sector and LQ = 1 then there is a tendency for the sector to be closed.

Results and Discussion

Economic impacts of capture fisheries: ***micro-level***. The development of capture fisheries has created many jobs for the community (Finegold 2009; Teh & Sumaila 2011; Benkestein 2013; Rabo et al 2014). Bartik (2003) in his study said that in economic development, policies to increase the number of workers are needed because they provide a greater multiplier effect. The income of capture fisheries business actors at the producer or fishers level generally has an income above the national average regional minimum wage (RMW). The average income of fishermen per month during the period 2008-2018 was 148.5 USD per month, while the average national RMW was 100 USD per month or fishers income 48% higher than the national RMW (MMAF 2018) (Figure 1).
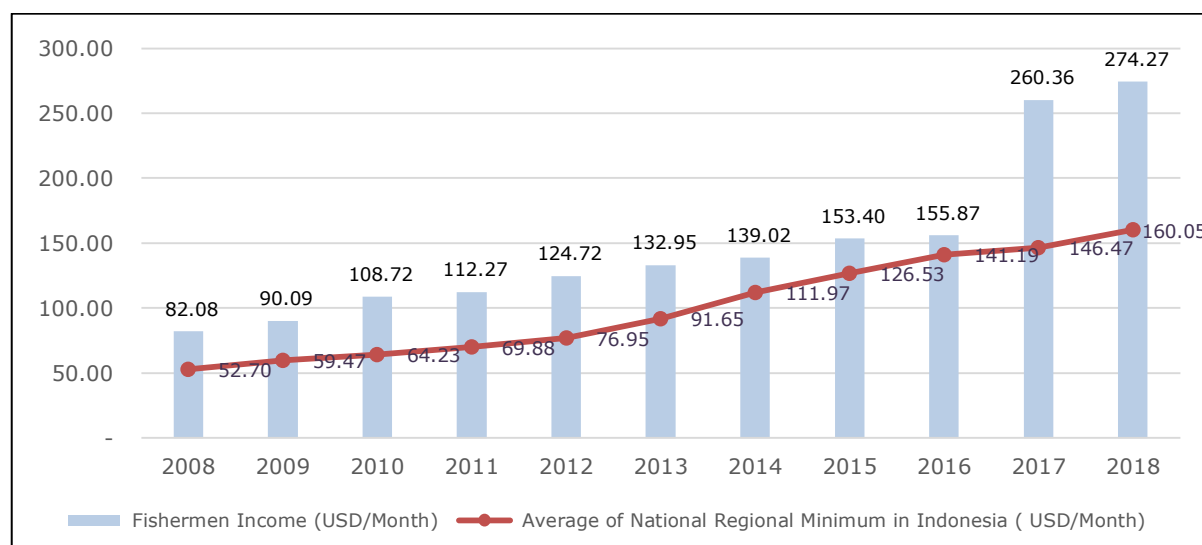

Figure 1. The development of income of fishers (sea) in Indonesia years 2008 - 2018 (Source: MMAF 2018, processed).

Fisher's income above the national RMW does not mean that they can cover their daily living expenses. Rahayu et al (2003), mentions that the size of the income has a very relative size in meeting the needs of life. The average income of fishers which is relatively increased, does not necessarily indicate an increase in overall welfare. The number of poor fishers in fishery centers based on fishery ports is known to be 27% (120,582 inhabitants) of the total population (439,074 inhabitants) in the region (MMAF 2013, processed). Retnowati (2011) mentioned that fishers have high income and are supported by abundant fish resources, but poverty still afflicts many fishermen's lives. It

could be due to high-income inequality. Income inequality is a condition where the income distribution received by the community is uneven (Glaeser 2005). An example of the cause of income inequality among fishers is the profit-sharing system, where the amount of income is determined by the status of the fishermen in fishing activities so that the owner and the captain have more income than the labour. But according to Wekke & Cahaya (2015) there are two factors that would impact to poverty. These factors are cultural and educational.

Poverty has a multidimensional nature, including income, consumption, education, health, and access to necessary infrastructure, so poverty has always been a significant issue in Indonesia as a whole, including fishers. Increasing income and the number of fishers is one of the references. Based on statistical data, the average number of capture (sea) fishery household (FHs) per year has increased by 2.6%. In 2000 there were 475,392 FHs, increasing to 672,240 FHs in 2018 (Figure 2). Increasing the number of FHs is one indicator of the magnitude of the attractiveness of capture fisheries business activities for the community. The results of interviews with the chairperson of the Modern Small Fishermen Alliance (MSFA) of North Sumatra Province, said "to be a fisherman there is no need for complicated requirements, such as diplomas, special skills, age limits, and others. Being a fisherman is enough with just courage and not being seasick "(Syahrial, personal interview, 30 August 2019). However, the number of small fishers and traditional fishers must be regulated because the amount that exceeds the capacity of the catchment area will trigger overfishing (Retnowati 2011).
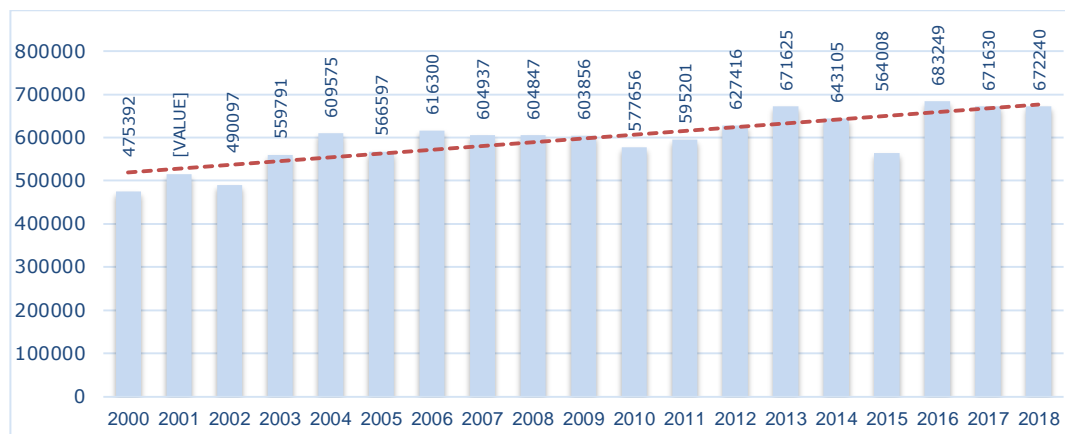

Figure 2. The development of the number of captures (sea) FHs in Indonesia, years 2000 - 2018 (Source: MMAF 2019).

Fishers get the catch using fishing fleets and if the fishing fleet used is getting better, then the catch increasing (Shalichaty et al 2014). The type and size of the fishing fleet used determines the catches obtained by fishermen. The number of fishing fleet vessels in Indonesia is 31.37% of the total fleet, and the rest are types of boats without motorcycles and outboard motors (MMAF 2017). This condition shows that capture fisheries in Indonesia are still dominated by simple or traditional fishing fleets. Outboard motorboats and non-motorized boats certainly cannot carry out fishing operations to the high seas or further fishing ground.

The results of research on the fishing effort for ships <5 GT at the study site showed different results, namely positive and beneficial results. Economic factors that are still positive are one of the reasons that business operators (owners) persist because small-scale fishers fishing businesses have a profit-sharing system between owners and crews. Operational costs are borne by the owner and the crew, while maintenance costs (fixed costs) are borne by the owner. A comparison of the advantages of each location can be seen in Table 1, where the majority of fishers in North Sumatra catch pelagic and demersal fish with fishing gear and gill net. Whereas the majority of South Sulawesi fishers catch demersal fish (reef fish) with stretching and bottom longline fishing gear, and the majority of Maluku fishers catch pelagic fish, such as skipjack and tuna with hand line fishing gear.

Table 1

Performance of fishing business (<5 GT) in capture fisheries centers (Province of North Sumatra, South Sulawesi and Maluku) in 2019

Location	NPV (USD)[*]	ROI (%)	PP (year)	Owner's income		Income per labour	
				USD/year	USD/month	USD/year	USD/month
Nort Sumatra	25,209.7	93	1.07	3,338.7	278.2	667.7	55.6[a]
South Sulawesi	12,431.1	92	1.08	1,646.4	137.2	823.2	68.6[b]
Maluku	18,941.8	63	1.58	2,508.6	209.1	1,254.3	104.5[b]
Average	18,860.8	83	1.25	2,497.9	208.2	915.1	76.3

[*] NPV for 10 years with an interest rate of 12%, [a] labour of 4 people, [b] labour of 2 people. Source: Primary data processed, 2019.

The capture fisheries business performance in North Sumatra has the highest value compared to other locations, but fishers in Maluku have the highest income value. The profit-sharing system and the number of labour per fishing unit are the main factors, where the number of labour fishing units in North Sumatra is generally 4 people, while in the other two locations there are only 2 people. Overall, the average value of the payback period for fishing with a fleet of <5 GT is 1.25 years or 15 months.

The economic impacts of capture fisheries: macro level. The success of capture fisheries in Indonesia has significantly contributed to state revenue. The role of capture fisheries in household income as in the previous discussion, has a positive impact on Indonesia. At the global level (Asia), income from capture fisheries contributes more than 55% of total household income in the world, where China and Japan are the biggest drivers (Dyck & Sumaila 2010). The role of capture fisheries on the economy and national development in Indonesia can be seen from the acquisition of GDP, while the role of capture fisheries on the national economy and regionally, the acquisition of GRDP gives an illustration of the ability of a region to manage its economic potential derived from capture fisheries.

The development of fisheries GRDP in the provinces selected as capture fisheries centers in western, central and eastern Indonesia, obtained the lowest value in Maluku Province (eastern region) (Figure 3). It is due to the "production leakage" of fisheries, where eastern Indonesia is known as a fishing area with high production but the production is not recorded or not landed in the region. It is inseparable from the limited infrastructure of a fishing port that has a low capacity and a fishing fleet operating in eastern Indonesia has a landing based in other regions, such as in Benoa Bali, Surabaya or Jakarta. The fisheries sector's GRDP also shows that the central Indonesian region (South Sulawesi Province) has a higher role in the economy, compared to the western and eastern regions.

GRDP is the amount of added value caused by various sectors or business fields carrying out their business activities in a particular area, which can consider ownership of the factors of production. GRDP statistical data are useful for calculating regional economic growth rates, both overall and sectoral. The GDP value of Indonesian fisheries according to the business field based on current prices in 2018 is 27.27 million USD (20.31%) or occupies the third position after plantation crops (25.75%) and food crops (23.67%) in the agriculture, forestry sector, and fisheries. The calculation of national GDP, in particular the fisheries sub-category in general, includes economic activities classified as capture fisheries and aquaculture.
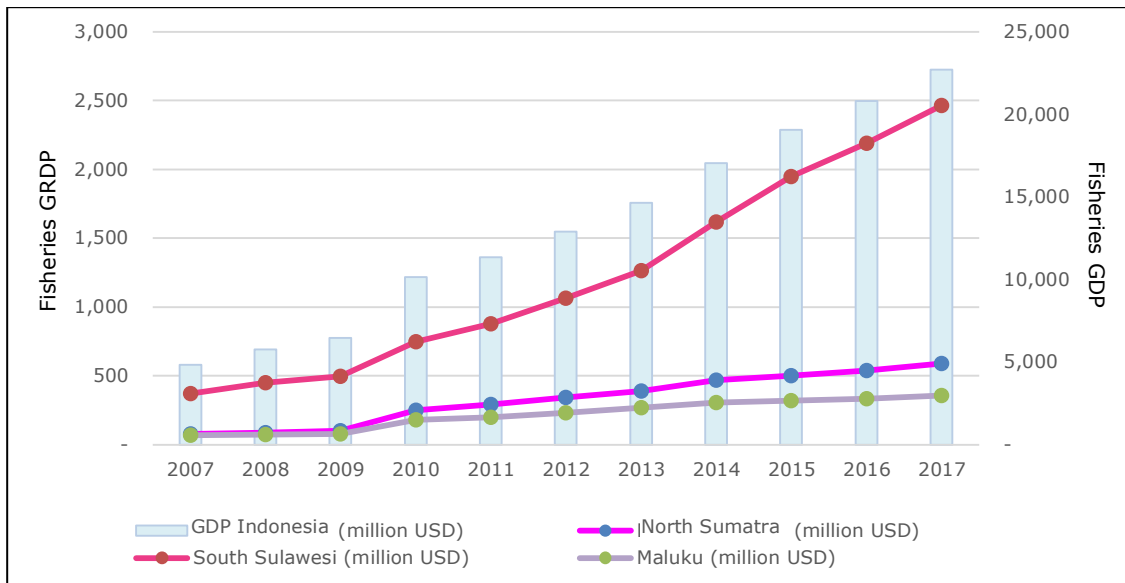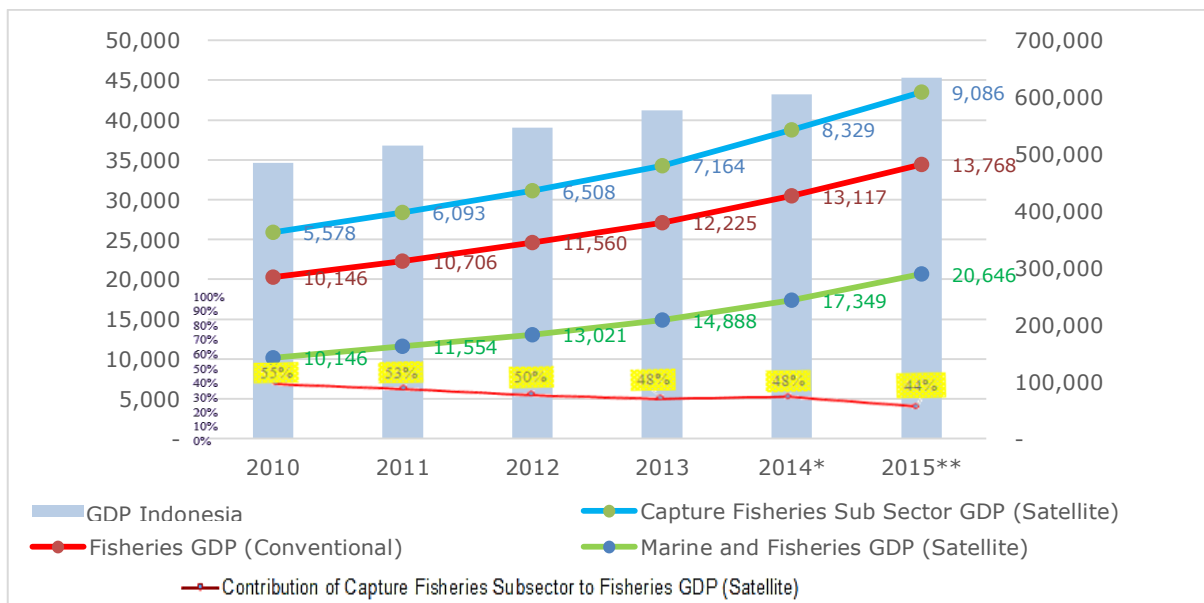
Figure 3. Development of fisheries GRDP North Sumatra Province, South Sulawesi and Maluku in 2007-2017. Source: BPS-Statistics Indonesia 2007-2018 (BPS-Statististics-Indonesia 2019), processed.

Based on data from the Ministry of Maritime Affairs and Fisheries/MMAF (2016), the GDP value of marine and fisheries satellites in 2014 was 24.22 million USD based on current prices and 18.51 million USD based on constant 2010 prices (Figure 4). This value includes capture fisheries, aquaculture, salt extraction, marine and fisheries processing industry, marine and fisheries construction, wholesale trade and retail of marine and fisheries products and water tourism services. The calculation value of marine and fisheries satellite satellites is 39% higher than conventional GDP.

GDP based on 2010 constant prices, *temporary figures, **very temporary figures (Satellite GDP), 1 USD = 14,150 IDR.

Figure 4. Development of GDP of marine and fisheries satellites Development of GDP of marine and fisheries satellites (in million USD). Source: MMAF 2016, processed.

Based on the production value approach, the capture fisheries sub-sector as a whole has an average contribution of 49.6% of the total GDP of fisheries. It shows that capture fisheries have a substantial contribution to fisheries GDP. In the case of 2014, the average increase in growth in the marine and fisheries sector was 7.55%. This value is

2.53% greater than the average increase in national economic growth of 5.02%. Increasing the growth of the marine and fisheries sector is inseparable from the increased demand for fishery products and the better prospects for marketing the products of the marine and fisheries sector.

The role of the fisheries sector. Fisheries as a primary sector mean that fisheries consist of local businesses whose activities depend on external factors, i.e. most fishery products are consumed outside (e.g. restaurants, canneries, and consumers in other regions). The primary sector is the backbone of the regional economy because it has a quite high competitive advantage, while the non-basic sector is another sector that is less potential but serves as a support.

The contribution of fisheries GRDP in North Sumatra Province among the three province in the west region (Aceh, West Sumatra, and Province Riau) has the lowest value, amounted to 0.024%. The contribution of fisheries sector in North Sumatra Province has not a significant role to GRDP in the region, lagging far behind the agriculture, livestock, hunting and agricultural services sectors, the manufacturing sector, wholesale and retail trade and motorcycle and car service. Based on MRA analysis, the sectors that have the most massive multiplier base in the western region are the agriculture, livestock, hunting and agricultural services sectors. MRA analysis results show that the multiplier base value of the fisheries sector does not have an impact on the creation of GRDP in the primary sector. North Sumatra Province is the largest production center, but the fisheries sector has not had a significant impact on the regional economy in the region.

The share of fisheries GRDP in South Sulawesi Province is among the three closest provinces in the central region (Central Sulawesi, Southeast Sulawesi, and West Sulawesi Provinces), still lower than Southeast Sulawesi and West Sulawesi Provinces, which amounted to 0.083%. The contribution of fisheries in South Sulawesi Province has not played a significant role in the GRDP, lagging behind the agriculture, livestock, hunting and agricultural services sectors, the manufacturing industry sector, wholesale and retail trade and motorcycle and car service, and the construction sector. MRA analysis results show that the sectors that have the most massive multiplier base in the middle region are agriculture, animal husbandry, hunting, and agricultural services, while fisheries rank third after education services. It shows that agriculture is still a significant need as a driver of the economy in the region. Fisheries do not rule out the possibility of becoming a mainstay sector in the central part of Indonesia, given the tremendous potential available. The base value of fisheries multiplier in South Sulawesi Province is 3.59.

The share of Maluku Province fisheries GRDP among the four provinces around eastern Indonesia (North Maluku Province, Papua, West Papua, and East Nusa Tenggara) was highest, at 0.126% whereas the share of GRDP between sectors in the eastern region, the role of the fisheries sector of Maluku Province and North Maluku Province played a significant role. Fisheries have a significant contribution in Maluku Province, which is third after the government administration, defense and mandatory social security sectors, wholesale and retail trade and motorcycle and car service. The role of the fisheries sector in the GRDP in the province is higher than the agriculture, livestock, hunting and agricultural services sectors, which rarely occur in the province in general. The high role of the fisheries sector on GRDP in Maluku Province is due to the fact that the region has abundant fish resource potential, people generally live in coastal areas, and there is high demand for fish. MRA analysis results show that the sector that has the most massive multiplier base in the central part of Indonesia is construction, while fisheries rank sixth after mining and quarrying, transportation and warehousing, information and communication, and wholesale and retail trade. The multiplier base value of the fisheries sector in Maluku Province is 1,611.

The LQ calculation results as in Table 2 shows that the fisheries sector in North Sumatra Province is not a base sector for western Indonesia because it has an LQ value <1, while South Sulawesi and Maluku Provinces place fisheries as a base sector because it has an LQ value >1. Fisheries as a base sector show that this sector has great potential

to be developed so that the increasing number of economic activities in the fisheries sector will have a positive effect on economic activity in other sectors.

Table 2

Location Quotient (LQ) analysis between sectors in North Sumatra Province, South Sulawesi and Maluku

| No | Sector | GRDP (Billion USD) | | | | LQ Sumut | LQ Sulsel | LQ Maluku |
		North Sumatra	South Sulawesi	Maluku	National PDB			
1	Agriculture, Animal Husbandry, Hunting, and Agricultural Services	8.82	4.29	0.30	95.03	1.80	1.41	1.03
2	Forestry and Logging	0.39	0.02	0.02	6.47	1.15	0.09	0.80
3	Fishery	1.14	2.47	0.36	24.70	0.89	3.11	4.71
4	Minning and Quarrying	0.63	1.59	0.06	72.70	0.17	0.68	0.29
5	Processing Industry	9.10	4.06	0.15	193.60	0.91	0.65	0.25
6	Electricity and Gas	0.06	0.02	0.00	11.47	0.09	0.05	0.08
7	Water Supply, Waste Management, Waste, and Recycling	0.05	0.03	0.01	0.69	153	1.38	5.73
8	Construction	6.54	3.77	0.21	99.63	1.27	1.18	0.70
9	Large and Retail Trade, Car and Motorcycle Service	8.66	4.13	0.38	124.93	1.34	1.03	1.00
10	Transportation and Warehousing	2.42	1.24	0.15	51.96	0.90	0.74	0.93
11	Provision of Accommodation and Food and Drink	1.15	0.40	0.05	27.38	0.82	0,46	0.58
12	Information and Communication	0.96	1.41	0.09	36.46	0.51	1.20	0.78
13	Financial Services and Insurance	1.54	1.12	0.11	40.36	0.74	0.86	0.86
14	Real Estate	2.36	1.14	0.01	26.84	1.70	1.33	0.11
15	Company Services	0.50	0.13	0.03	16.84	0.58	0.24	0.55
16	Mandatory Government, Defense, and Social Security Administration	1.70	1.29	0.63	35.49	0.93	1.13	5..79
17	Educational Services	0.88	1.54	0.16	31.57	0.54	1.52	1.69
18	Health Services and Social Activities	0.46	0.58	0.06	10.24	0.86	1.76	1.95
19	Others Services	0.28	0.39	0.05	16.90	0.32	0.73	0.91
	Total	47.64	29.61	2.82	923.29	1.00	1.00	1.00

Source: BPS-Statistics Indonesia (2018), processed.

The role of the fisheries sector in North Sumatra Province nationally does not have a comparative advantage (LQ<1), meaning that this region has not been able to independently meet the needs of "fisheries" for its territory and has a tendency to bring in from the outside. Alhowaish et al (2015), stated that the value of LQ<1 shows that the sector is non-base which means that its role is small compared to the role in its region or all sectors. In contrast to the provinces of South Sulawesi and Maluku which have LQ values >1, the fisheries sector has a comparative advantage, and both have been able to meet their needs in the sector, and it is possible to export. This condition was reinforced by the results of the field visit, that the two provinces had exported catch commodities (reef fish and tuna), to USA, Japan, and Korea. If related to the proportion of coastal villages in each of these regions, there is a positive correlation between the regions that have a large proportion of coastal villages with the comparative advantage of the area in the fisheries sector (Figure 5), where the number of coastal villages in Maluku Province is highest (89%) and has the highest LQ value (4.71) whereas South Sulawesi and North Sumatra Provinces have a smaller proportion of coastal villages and smaller LQ values.
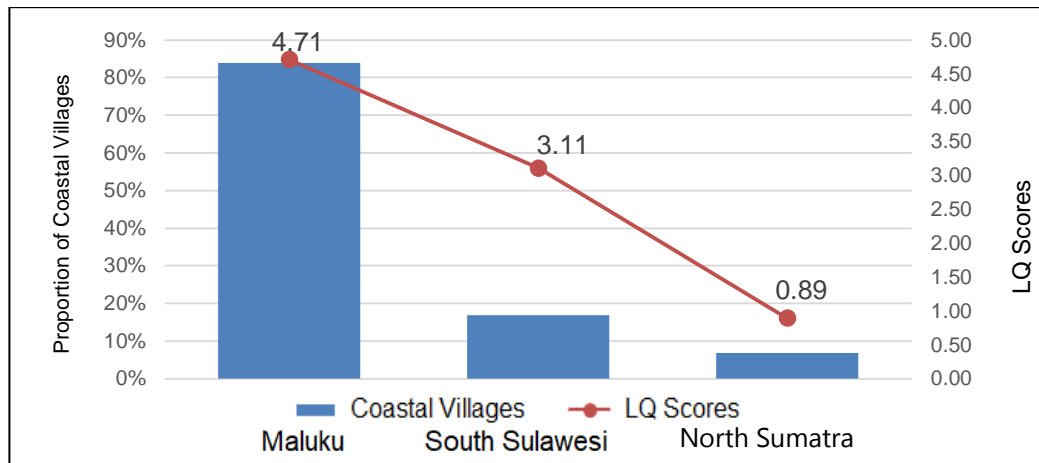
Figure 5. The proportion of coastal villages and LQ scores in North Sumatra Province, South Sulawesi and Maluku. Source: BPS-Statistics Indonesia 2018, processed.

The coastal village is a fishing center and a source of capture fisheries production (Rangkuti 2018; Akbar & Huda 2017; Tinambunan 2016), but generally is still dominated by traditional fishermen (Rahim & Hastuti 2016). It shows that the majority of fishers in capture fisheries centers are still dominated by traditional fisher who have limitations in capacity and use of technology. However, small-scale fisheries with relatively low catches have an economically and socially important role (Béné 2006; Kolding et al 2014; Guyader et al 2012). A fisherman in Asilulu Village, Central Ambon stated: "almost 90% of fisher in Maluku are small-scale one-day fishing, using a fleet of less than 3 gross tonage (GT) and fishing gear stretching and trolling" (Ting, personal interview, 22 August 2019). If referring to Law No. 7 of 2016, small-scale fishermen are defined as fishermen who catch fish to fulfill their daily needs, both not using fishing vessels or those using fishing vessels with the largest size of 10 GT. In 2016, the total number of fishing fleets of less than 10 GT was represented by 508,551 units (94%) (MMAF 2017). Fisheries production-based fishing centers do not necessarily make the region have a comparative advantage with other sectors and regions. The amount of fisheries production is not a measure of the success of capture fisheries development. The analysis shows that there are other factors, such as the ability to meet local needs and export products both outside the region or abroad.

Conclusions. Capture fisheries have played a role in Indonesia's economy and development by giving positive results. The average contribution of capture fisheries to fisheries GDP reached 49.6%. The trend of growth in fisheries GDP that is higher than the growth of national GDP shows that the performance of the fisheries sector continues to improve, although the impact of capture fisheries as measured by the contribution of national GDP is still relatively small (1.12%). Capture fisheries management policies in Indonesia tend to be growth-oriented with production targets that continue to increase over time. The consequences of this management pattern do not rule out the possibility of triggering overfishing and in turn will lead to the depletion of fisheries resources themselves. The policy implication that can be done is to change the pattern of capture fisheries management to increase the competitiveness of capture fisheries commodities. Increased competitiveness and the creation of fisheries centers that have comparative advantages are realized through the development of supporting infrastructure (fishing ports, processing industries, etc.) and the modernization of small scale fishers with traditional technology.

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