Analysis of Capture Fisheries Development Trends in Indonesia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Indonesia's fishing capture industry has very great potential in order to become the national economy's key driver. Change in population, pricing, technology, and productivity are the key indicators of trend. The objective of this study is to assess the evolution of Indonesian fisheries. This study was carried out at the Ministry of Maritime Affairs and Fisheries from August 2020 to July 2021. According to this study, 34 provinces in Indonesia were surveyed using a literature review method. Primary data in the form of expert opinion (expert judgment) consisting of 10 capable respondents. Secondary data was adopted from statistical data of the Ministry of Marine Affairs and Fisheries Center from 2005-2018. Data analysis was performed by using descriptive quantitative analysis techniques. The development of capture fisheries competitiveness in Indonesia has experienced fluctuating changes and tends to increase during 2006 to 2018.

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1. INTRODUCTION

Indonesia is known as the world's largest maritime country, with 3.25 million km2 of sea and 2.55 million km^2 of EEZ [1]. There are 5.8 million km^2 of ocean in Indonesia that can be utilized. There is a maximum sustainable yield (MSY) of 6.5 million tons per year in Indonesian marine waters, with a catch limit of 5.2 million tons per year (80 percent of the MSY) [2]. As a result of Indonesia's geographic location on the equator, and its tropical environment, the country possesses a wealth of species and potential fishing resources [3]. Indonesia is divided into 34 provinces, each having its own set of natural resources, including marine and fisheries. The capture fisheries sector is one of the possible marine and fisheries resources.

Late 1960's was the beginning of the rapid development of Indonesian capture fisheries, based on Indonesian capture fisheries statistics In fact, the Indonesian government had undertaken various actions and initiatives to improve Indonesia's capture fisheries, but none of them proved successful. The factor that influenced the rapid development of capture fisheries after the late 1960's was the boat motorization program, because at that time 95% of fishing boats in Indonesia were boats without engines. Between 1951 and 1967, only the Strait of Malacca experienced a successful development of capture fisheries [4]. Every year, Indonesia produces a very high amount of capture fisheries, making capture fisheries the key engine of the national economy [5]. The capture fisheries sector is vital to Indonesians' economic and social well-being. In Indonesia, it is predicted that 3,326,900 people work as fishermen, with 2,573,300 people working at sea and 753,600 working in public waters [5].

Based on the existence of capture fisheries, which are still dominated by small-scale fisheries, about 85% of the national capture fisheries are still characterized by small-scale capture fisheries [6]. In 2012 the number of fishermen was approximately 2,200,000 consisting of full fishermen as many as 1,200,000 people, part-time fishermen as many as 640,000 people and part-time fishermen as many as 340,000 people, and the number of fishermen in 2014 was approximately 2,180,000 people [7].

Indonesia's capture fisheries production climbed by 1.95 percent between 2015 and 2017 [1]. Capture fisheries production reached a record high of 7.3 million tons in 2018 [3]. The growth in Indonesian fishery productivity is attributed to a greater use of important marine fisheries regions and improved aquaculture technologies [1]. According to a report published by the cabinet secretariat for maritime affairs in 2016, Indonesia has a lot of potential in the sector of Capture Fisheries.

Fishing fleets, fish resources, fishermen, fishing ports, production support facilities, fish processing units, and catch marketing units are the seven primary components of a general model for the growth of capture fisheries in Indonesia based on an optimization method [8]. Regional development is an attempt by local governments and people to manage existing resources in order to create new jobs and strengthen the regional economy. Also attempts to raise people's living standards, improve community quality, create jobs, and build the country economy [9].

Regional development is an effort of local governments and their communities to manage existing resources to create new jobs and improve the regional economy [10]. Regional development aims at improving people's living standards, improving community quality, generating employment, and economic growth. According to Sukirno [11] economic growth is the development of activities in the economy that make goods and services produced in society increase and is a major measure of the success of the community. development carried out. Growth must proceed in a planned manner in order to create a more equitable development. Marine and fisheries development planning is based on the concept of sustainable development and is supported by human resources and natural resources in achieving high competitiveness [12].

A trend is defined as a long-term upward or downward movement (tendency) derived from the average change over time on average. These alterations have the potential to increase or decrease. When the average change rises, the trend is said to be positive or upward. A negative trend, on the other hand, is defined as a reduction in the average change, or a trend that has a propensity to decrease [13]. Therefore, the objective of this study is analysis

of capture fisheries development trends in Indonesia.

2. METHODOLOGY

This study was carried out at the Ministry of Maritime Affairs and Fisheries from August 2020 to July 2021 with the goal of analyzing the development trend of Indonesian capture fisheries. This study employed a survey literature technique to determine the development trend of Indonesian capture fisheries in 34 provinces. In this study, secondary data have been used which is realized in the form of numbers and analyzed using descriptive statistics. Secondary data collection techniques were obtained from statistical data from the Ministry of Marine Affairs and Fisheries in Jakarta.

2.1. Data Analysis

The data was analyzed using quantitative descriptive analysis. The purpose of the quantitative descriptive analysis in this study is to determine the development trend of Indonesian capture fisheries.

1. Determine the most important indicators and factors, such as human resources, facilities and infrastructure, production and value, and productivity. The next step in the project is to collect secondary data from statistical data on Indonesian capture fisheries from 2006 to 2018.
2. Identify priority weights or relative importance among indicators, variables and sub-variables.
3. Expert judgment is used to weight the principal indications and factors based on the primary data. Ten experts were interviewed, including lecturers from the Department of Social Economic FPIK Padjadjaran University and lecturers from the Department of Water Resources FPIK Padjadjaran University, as well as four people from the West Java Province's Marine Affairs and Fisheries Office, including the Head of Capture Fisheries, the Head of Section of Management of Fish Resources, and the Director of Fisheries.
4. Calculating the weight of each indicator, variable, and sub-variable based on the results of the expert judgment questionnaire.

5. Using secondary data, statistical data on capture fisheries in Indonesia in 2018 to evaluate the competitiveness profile of each province, process data collected throughout the study.
6. Using secondary data, calculate the scores and values of primary indicators, variables, and sub-variables, as well as the value based on weight and score.
7. Score = (Data each Province)/(Total data of Indonesia) x 100
   Value = Weights x Score

   Productivity is determined using data from the Marine and Fisheries Ministry statistics. The following is the formula for calculating productivity for the main metrics of fisheries competitiveness (Yulistyo 2011) :

a. Productivity Production per Trip

$$Ppt = \frac{Pik}{Tik} \quad . \tag{1}$$

Information :
Ppt : Manufacturing productivity per trip (ton / trip)
P : Total Production (tonnes)
T : Total Trip (trip)
i : Province i (i = 1, ..., 34)
k : Period of time

b. Productivity Production per Fishermen

$$Ppn = \frac{Pik}{Nik} \quad . \tag{2}$$

Information :

Ppn : Productivity per fisherman production (tons / person)
P : Total Production (tonnes)
N : The total number of fishermen (people)
i : Province i (i = 1, ..., 34)
k : Period of time

c. Productivity Production Value per Trip

$$Pnpt = \frac{NPik}{Tik} \tag{3}$$

Information :

Pnpt : The productivity of the production value per trip (IDR / trip)
NP : Values Production (IDR)

T   : Total Trip (trip)
i   : Province i (i = 1, ..., 34)
k   : Period of time

d. Productivity Production Value per Fishermen

$$Pnpn = \frac{NPik}{Nik} \qquad .(4)$$

Information :

Pnpn   : The productivity of the
production value per fisherman (IDR / person)
NP   : Values Production (IDR)
N   : The total number of fishermen (people)
i   : Province i (i = 1, ..., 34)
k   : Period of time

7. Based on the value weighted average, all provinces in Indonesia have been warned about the competitiveness of their fisheries.
8. Using quartiles, specifies criteria for the competitiveness of Indonesian fisheries across the province. The criteria are separated into four quartiles: Q1 is a very competitive area, Q2 is a highly competitive area, Q3 is a sufficiently competitive area, and Q4 is a low competitive area.
9. Indonesian fisheries development index analysis (Yulistyo 2011). The following is the calculated development index:

a. Production of Capture Fisheries Development Indeks
b.

$$IPPijk = \frac{Qijk}{Qijkl} \, x \, 100 \, ... \qquad ..(5)$$

Information :

IPP   : Production of Capture Fisheries Development Index
Q   : Production Volume (tons)
i   : Province i (i = 1, ..., 34)
j   : Type Classification of Fishing
k   : period of time
kl   : 1 years prior to the period of time

b. Facility of Capture Fisheries Development Indeks

$$IPSijk = \frac{Sijk}{Sijkl} \, x \, 100 \, ... \qquad ..(6)$$

Information :

IPS   : Facility of Capture Fisheries Development Index
S   : Means of Fishery Enterprises (ship)
i   : Province i (i = 1, ..., 34)
j   : Type Classification of Fishing
k   : period of time
kl   : 1 years prior to the period of time.

c. Fishermen Development Indeks

$$IPNijk = \frac{Nijk}{Nijkl} \, x \, 100 \, ... \qquad ..(7)$$

Information :

IPN   : Fishermen Development Index
N   : Number of Fishermen (people)
i   : Province i (i = 1, ..., 34)
j   : Type Classification of Fishing
k   : period of time
kl   : 1 years prior to the period of time

d. Work Productivity per Labor Development Indeks
e.

$$IPPTijk = \frac{Qnijk}{QNijkl} \, x \, 100 \, ... \qquad (7)$$

Information :

IPPT   : Development Index Productivity per Labor
Qn   : Production is divided Fisherman (tons / person)
i   : Province i (i = 1, ..., 34)
j   : Type Classification of Fishing
k   : period of time
kl   : 1 years prior to the period of time.

3. RESULTS AND DISCUSSION

The final score generated from the major indicators of each province that demonstrates the competitiveness rating and categories between provinces in Indonesia is based on the research that has been done. The overall competitiveness grade depicts a region's relative position to another in terms of all variables and the extent to which the region can realize its variable potential. Table 1 shows an overview of the overall score based on calculations and

competitiveness assessments done against 34 provinces.

Information:

X1 = Human Resources
X2 = Infrastructures Fishing
X3 = Production and Production Value of Capture Fisheries
X4 = Productivity

The development of Indonesia's capture fisheries index from 2006 to 2018. The development index for capture fisheries production, the development index for fishery facilities and infrastructure catch, the development index for capture fisheries fishermen, and the development index for capture fisheries productivity are all included in this development index.

3.1 Production Trend Development In Indonesia

The results of the development index based on features of capture fishery output over a 12-year period from 2006 to 2018 were based on the research that was done. Indonesia's output growth was unpredictable throughout this time, and it tended to increase in different regions by quartile (Fig. 1).

The production of regions with a very high competitiveness category (Q1) tends to increase, but not dramatically. Regions with extremely high competitiveness category (Q1) experienced an increase from 2006 to 2015, with an index value of 102.59 in 2006 and 110.39 in 2015, and a not-so-significant fall from 2015 to 2018, with an index value of 96.43 in 2018. The index score for the first quarter of 2018 is below 100, indicating that capture fisheries production in 2017 was higher than in 2018. according to data from the ministry of maritime affairs and fisheries that in 2017 the amount of production in the Q1 region was 3,215,099 tons and in 2018 it decreased to 2,893,059 tons [14]. During the period 2006–2015, regions with a high competitiveness category (Q2) saw similar developments as those with a very high competitiveness category (Q1). However, in 2017, the development of the Q2 region increased significantly and was higher than that of the Q1 region. In 2017, the Q2 region's index value was 161.75.
Every year, the number of regions in the sufficient competitiveness category (Q3)

decreases, but the loss is not large. There were rises and declines in the very high competitiveness category region (Q1) and the high competitiveness category area (Q2). The index readings for 2006, 2009, 2012, 2015, and 2018 were 105.15, 102.65, 100.17, 95.63, and 91.73, respectively. The reduction and increase in the low competitiveness category (Q4) was less substantial, although there was a considerable increase in 2018. There was an increase from 2006 to 2009, with an index value of 89.00 in 2006 and 100.37 in 2009. With an index value of 87.45 in 2012, there was a decrease. Then, from 2015 to 2018, it indicates a rather insignificant change. In 2018, the Q4 regional index value was higher than the Q3 regional index value of 127.09 in the same year.

3.2 Facilities and Infrastructures Trends Development Indeks

The quantity of facilities and infrastructure, particularly the number of vessels or fleets used in capture fisheries activities, varies dramatically throughout a 12-year period from 2006 to 2018. There was a rise in capture fisheries facilities and infrastructure from 2006 to 2018. The development of capture fisheries facilities and infrastructure indicates the amount of improvement from year to year, with 2018 marking the pinnacle of success in this area (Fig. 2).

The development of regions in the very high competitiveness category (Q1) has been fairly stable, but there was an increase in 2018. In 2006, it had a value of 105.76, and in 2009, it had a value of 97.99, indicating a fall. The index then rose again in 2012, reaching 101.75, before dropping again in 2015, to 99.43. With a value of 121.97 in 2018, there was a substantial increase. Between 2006 and 2012, there were no major changes in regions with a high competitiveness category (Q2), but there was a considerable increase in 2018. In 2009 and 2015, the Q2 region had a reduction in index, with index values of 91.33 and 89.57, respectively, over a 12-year period. However, in 2018, with an index value of 186.54, there was a significant increase. The Q2 index value in 2018 is 186.54, indicating that the facilities and infrastructure in 2018 are greater than in 2017, as the index value is greater than 100.
During the period 2006–2018, the number of regions with sufficient competitiveness (Q3) decreased twice, in 2009 and 2015. In 2009, it

had a value of 100.77, and in 2015, it had a value of 79.18. However, in 2018, there was a significant increase. In 2018, the index value for facility and infrastructure development was 206.31, implying that facilities and infrastructure had doubled since 2017. according to data from the ministry of marine and fisheries that in 2017 the number of ships in the Q3 region was 74,994 units and in 2018 increased to 154,721 units [14]. Significant changes occurred in regions with a low competitiveness category (Q4). During the period 2006–2018, the region with moderate competitiveness (Q3) was similar to the region with moderate competitiveness (Q2). During the period 2006–2018, regions in the low competitiveness category (Q4) experienced two declines in 2009 and 2017. It had an index value of 81 in 2009, 13 in 2013, and 74.92 in 2015. However, in 2018, there was a significant increase. In 2018, the index value for facility and infrastructure development was 119.47.

Table 1. Ranked Competitiveness Province in Indonesia

| Province	X1	X2	X3	X4	Final Score	Ranked	Category Competitiv eness
DKI Jakarta	0,10	0,12	2,38	6,27	8,87	1	Very High
Central Jawa	0,37	0,42	2,58	3,64	7,01	2	
East Jawa	1,92	2,08	2,27	0,47	6,74	3	
Maluku	2,41	1,47	1,33	0,68	5,90	4	
South Sulawesi	2,29	1,88	1,38	0,27	5,82	5	
North Sumatra	2,67	1,08	0,88	0,36	4,99	6	
North Sulawesi	1,18	0,78	1,85	0,74	4,55	7	
South East Sulawesi	1,68	1,34	0,69	0,23	3,95	8	
Aceh	0,94	0,68	1,25	1,04	3,93	9	High
Central Sulawesi	1,14	1,95	0,34	0,12	3,55	10	
Papua	1,31	1,13	0,53	0,13	3,10	11	
West Nusa Tenggara	1,27	1,09	0,44	0,13	2,93	12	
West Jawa	0,44	0,58	1,12	0,73	2,86	13	
South Kalimantan	0,40	0,81	0,66	0,93	2,79	14	
North Maluku	0,48	0,29	0,64	1,09	2,50	15	
East Kalimantan	0,68	0,70	0,62	0,43	2,43	16	
East Nusa Tenggara	1,00	0,77	0,38	0,19	2,34	17	
Bangka Belitung Islands	0,66	0,64	0,60	0,39	2,29	18	Sufficient
West Kalimantan	0,42	1,09	0,35	0,31	2,17	19	
West Sumatra	0,48	0,64	0,64	0,37	2,14	20	
Riau Islands	0,82	0,89	0,27	0,14	2,13	21	
West Papua	0,41	0,62	0,47	0,42	1,92	22	
Bali	0,42	0,66	0,45	0,35	1,88	23	
Riau	0,47	0,51	0,30	0,24	1,53	24	
Lampung	0,37	0,49	0,31	0,34	1,52	25	
Gorontalo	0,29	0,36	0,30	0,46	1,41	26	
West Sulawesi	0,54	0,58	0,17	0,11	1,40	27	Low
Banten	0,35	0,37	0,28	0,28	1,27	28	
Central Kalimantan	0,22	0,23	0,22	0,54	1,22	29	
South Sumatra	0,13	0,13	0,23	0,69	1,18	30	
Bengkulu	0,33	0,09	0,16	0,58	1,15	31	
Jambi	0,11	0,35	0,16	0,41	1,03	32	
North Kalimantan	0,28	0,23	0,08	0,40	1,00	33	
DI Yogyakarta	0,07	0,03	0,05	0,36	0,51	34	

(Source: Data Processing)
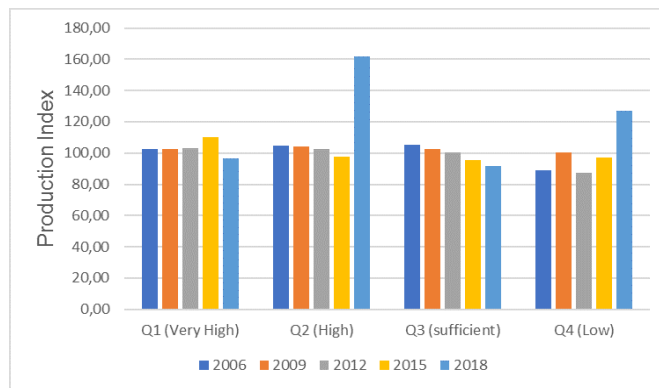
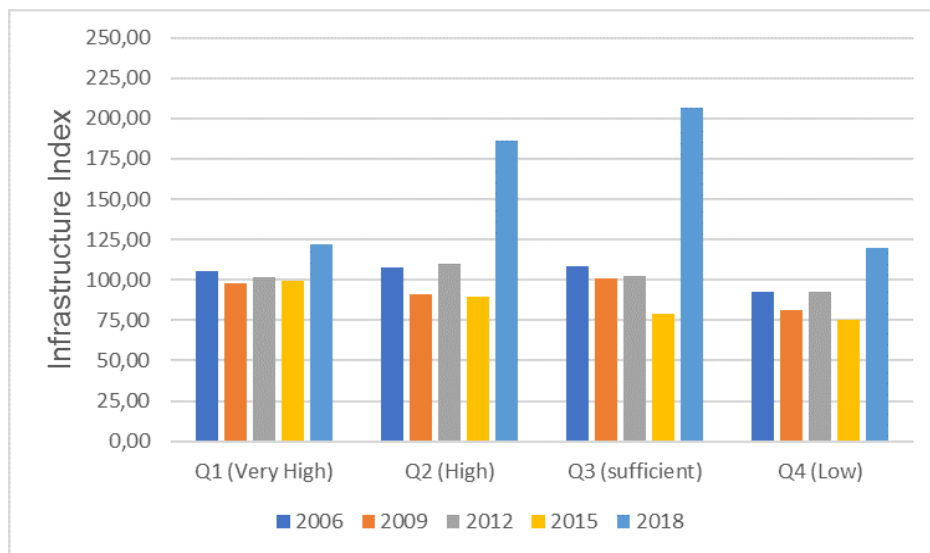**Fig 1. Development Index of Capture Fisheries Production in Indonesia**

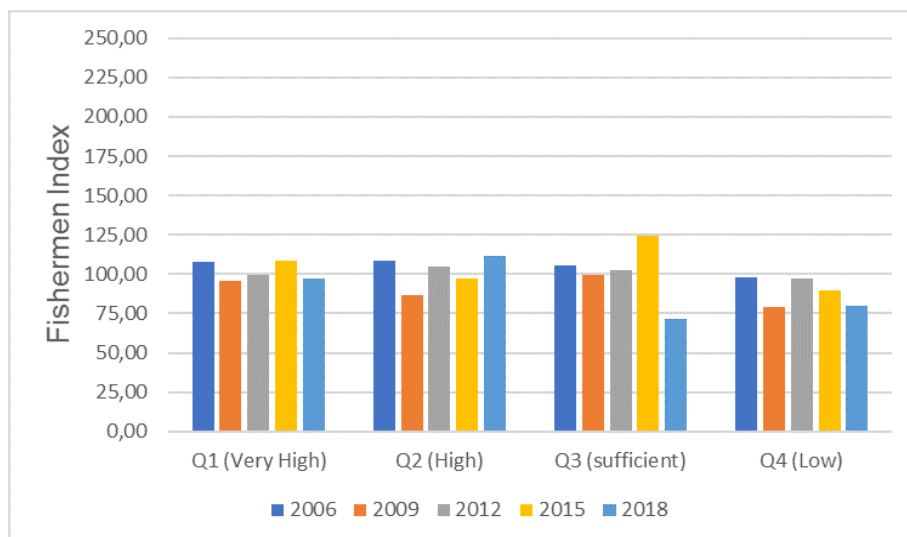**Fig 2. Infrastructures Development Index fisheries in Indonesia**

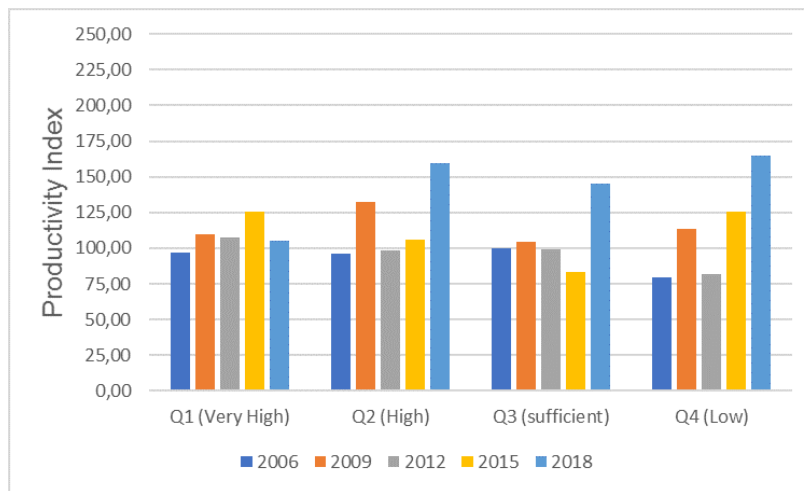**Fig 3. Fishermen Development Index in Indonesia**

Fig 4. Capture fisheries development index productivity in Indonesia

3.3 Fishermen Trend Development Indeks

The number of fishermen in capture fisheries activities within a period of 12 years during the period 2006 – 2018 varies greatly. During the period 2006 – 2018 there was a decline in the development of capture fisheries fishermen in Indonesia. In 2018 the fisherman development index of all provinces decreased. (Fig. 3).

In the period 2006–2018, regions in the very high competitiveness category (Q1) did not show significant growth. In 2018, however, it fell. In 2018, the fisherman development index was 97.71. Regions in the high competitiveness category (Q2), which are the same as those in the very high competitiveness category (Q1), did not show significant growth between 2006 and 2018. The Q2 region, on the other hand, saw an increase in 2018. In 2009 and 2015, the index dropped in the Q2 region, with index values of 86.81 and 96.87, respectively.

Regions with sufficient competitiveness category (Q3) experienced an increase of two times during the period 2006 – 2018 in 2012 and 2015. Index value the development of fishermen in 2012 amounted to 102.81 and in 2015 it was of 124.68. Furthermore, it experienced a non-significant decrease during period 2006 – 2009 and 2012 - 2015. Regions with competitiveness category low (Q4) experienced a similar development to the power category region high competitiveness (Q2) during the period 2006 – 2018. However, regions with the low competitiveness category (Q4) in 2015

decreased with the development index value is 89.93.

3.4 Productivity Trend Development Indeks

The productivity of catch fishing activities varies considerably throughout a 12-year period from 2006 to 2018. From 2006 to 2018, the productivity of capture fisheries increased. The productivity of capture fisheries will rise in lockstep with fishery production, but will fall in lockstep with the number of capture fisheries fishermen (Fig. 4).

In the very high competitiveness category (Q1), the regional productivity development index did not change considerably. However, it fell twice, in 2012 and 2018, with a development index score of 107.19 in 2012 and 105.40 in 2018. In 2009 and 2015, there was an increase. In 2009, the fisherman development index was 109.39, and in 2015, it was 125.96. During the period 2006–2018, regions in the high competitiveness group (Q2) had significant growth. In 2012, the Q2 area witnessed a fall in index, with a score of 98.13. However, in 2018, there was a considerable increase. The development index was 141.67 in 2018.

During the period 2006–2018, the category of areas with sufficient competitiveness (Q3) experienced a very considerable increase only once, in 2018. In 2018, the fishermen development index was 144.96. It did, however, fall twice, in 2012 and 2015, with the value of the development index falling to 99.18 in 2012 and 83.46 in 2015. Between 2006 and 2018, the number of regions in the low competitiveness

category (Q4) increased. However, in 2012, with an index value of 82.06, it dropped. The index value for the Q4 area in 2012 was 82.06, which was below 100, indicating that productivity in 2011 was higher than in 2012.

4. CONCLUSION

The following conclusions have been reached as a result of the research:
From 2006 to 2018, the development of provincial fisheries in Indonesia fluctuated and tended to increase in terms of production, facilities and infrastructure, fishermen, and productivity. Production growth rose significantly in 2018 in sites with high competitiveness categories. Facilities and infrastructure received a development index score of 206.31 in 2018, implying that they have doubled in value since 2017. The number of fishermen rose and decreased between 2006 and 2018. Productivity in the Q2, Q3, and Q4 regions increased at a faster rate from 2006 to 2018.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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