



Analysis of the Development Trends in Indonesia Floating Net Cage Aquaculture

**Wanda Nur Litundzira^{1*}, Asep Agus Handaka Suryana¹,
Ibnu Bangkit Bioshina Suryadi² and Atikah Nurhayati¹**

¹*Department of Sosio-Economic, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor 45363, Indonesia.*

²*Department of Aquaculture, Faculty of Fisheries and Marine Sciences, Padjadjaran University, Jatinangor 45363, Indonesia.*

Authors' contributions

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

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ABSTRACT

The purpose of this study is to analyze the development trend of floating net cage aquaculture in Indonesia. The study took place at the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries of the Republic of Indonesia from February to June 2021. The literature survey method was employed to obtain data in this study. The data utilized in this study is secondary data received from the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries of the Republic of Indonesia, in the form of statistical data on floating net cage aquaculture from 2004 to 2016. Data was analyzed using quantitative descriptive analysis, which included study of developmental indexes. The results showed that the development trend of floating net cage aquaculture in Indonesia as seen from fishery households, cultivators, feed, land area, production, and production value experienced fluctuating changes from 2004 to 2016.

Keywords: Floating net cage; Indonesia; trend.

**Corresponding author: Email: wnurlitundzira@gmail.com;*

1. INTRODUCTION

Indonesia has a very large aquaculture potential, it can be seen from the production of aquaculture which has developed very rapidly wherein 2008 it had a total production of 3.855.200 tons to 16.114.217 tons in 2017, which includes marine, brackish, and freshwater aquaculture [1].

Freshwater aquaculture is the second highest producer of production after marine aquaculture [1]. Floating net cages, often known as KJA, are a type of freshwater aquaculture fishery. Floating net cages in Indonesia first appeared in 1988 as compensation for residents whose land was inundated due to the construction of reservoirs, but the activities of floating net cages were eventually carried out by cultivators [2]. Floating net cages in 2017 had the second-highest total production of 353.748 tons when viewed from the types of freshwater aquaculture in Indonesia [1].

The activities of floating net cages that are experiencing rapid development can be seen in how their development trends are with the calculation of the development index. The development index is a statistic that describes a state in relation to a specific point in time [3]. Trend is a movement of an up or down trend in the long term obtained from the average change from time to time. If the average change increases, it is called a positive trend or has an upward trend, while if the average decreases, it is called a negative trend or has a downward trend [4].

In this study, the development trend of floating net cage cultivation will be seen in all 34 provinces of Indonesia, including Aceh, North Sumatra, West Sumatra, Riau, Riau Islands, Jambi, South Sumatra, Bangka Belitung Islands, Bengkulu, Lampung, Special Capital Region of Jakarta, Banten, West Java, Central Java, Special Region of Yogyakarta, East Java, Bali, West Nusa Tenggara, East Nusa Tenggara, West Kalimantan, Central Kalimantan, South Kalimantan, East Kalimantan, North Kalimantan, North Sulawesi, Gorontalo, Central Sulawesi, West Sulawesi, South Sulawesi, Southeast Sulawesi, Maluku, North Maluku, Papua and West Papua [5].

2. MATERIALS AND METHODS

2.1 Time and Place

The research was conducted at the Directorate General of Aquaculture, Ministry of Marine Affairs

and Fisheries of the Republic of Indonesia, for five months from February to June 2021, to determine the development trend of floating net cage aquaculture in Indonesia.

2.2 Types and Data Sources

In this study, a literature survey was conducted to collect data. The data used is secondary data from the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries of the Republic of Indonesia, which includes the number of fishery households, cultivators, feed, land area, production, and production value in floating net cage Indonesia from 2004 to 2016.

2.3 Data Analysis Methods

Data analysis was carried out by using quantitative descriptive analysis which included analysis of the development index to obtain trends in the development of floating net cage aquaculture in Indonesia.

2.3.1 Development Index Analysis

Statistical data on Indonesian floating net cage aquaculture will be studied for their development index utilizing the development index method from the Fishery Production Index by Province 2006 – 2009 book [3]. The formula for calculating the development index utilized in this study to determine the development trend of floating net cage aquaculture in Indonesia is as follows :

a. Fishery Household Development Index

The calculation of the fishery household development index is as follows [3] :

$$IPR_{ijk} = \frac{R_{ijk}}{R_{ijkl}} \times 100$$

Description :

- IPR : Fishery Household Development Index
- R : Number of Fishing Households (a)
- i : Province i (i = 1, ... , 34)
- j : Type of Fisheries Classification
- k : Time Period (years)
- kl : 1 Year Before Time Period

b. Cultivator Development Index

The calculation of the cultivator development index is as follows [3] :

$$IPN_{ijk} = \frac{N_{ijk}}{N_{ijkl}} \times 100$$

Description :

IPN : Cultivator Development Index
 N : Number of Cultivators (person)
 i : Province i (i = 1, ... , 34)
 j : Type of Fisheries Classification
 k : Time Period (years)
 kl : 1 Year Before Time Period

c. Feed Development Index

The calculation of the land area development index is as follows [3] :

$$IPS_{ijk} = \frac{S_{ijk}}{S_{ijkl}} \times 100$$

Description :

IPS : Feed Development Index
 S : Feed Quantity (tons)
 i : Province i (i = 1, ... , 34)
 j : Type of Fisheries Classification
 k : Time Period (years)
 kl : 1 Year Before Time Period

d. Land Area Development Index

The calculation of feed development index as follows [3] :

$$IPL_{ijk} = \frac{L_{ijk}}{L_{ijkl}} \times 100$$

Description :

IPL : Land Area Development Index
 L : Total Land Area (m²)
 i : Province i (i = 1, ... , 34)
 j : Type of Fisheries Classification
 k : Time Period (years)
 kl : 1 Year Before Time Period

e. Production Development Index

The calculation of the production development index is as follows [3] :

$$IPP_{ijk} = \frac{P_{ijk}}{P_{ijkl}} \times 100$$

Description :

IPP : Production Development Index
 P : Production Quantity (tons)
 i : Province i (i = 1, ... , 34)
 j : Type of Fisheries Classification
 k : Time Period (years)
 kl : 1 Year Before Time Period

f. Production Value Development Index

The calculation of the production value development index is as follows [3] :

$$IPQ_{ijk} = \frac{Q_{ijk}}{Q_{ijkl}} \times 100$$

Description :

IPQ : Production Value Development Index
 Q : Total Production Value (rupiah)
 i : Province i (i = 1, ... , 34)
 j : Type of Fisheries Classification
 k : Time Period (years)
 kl : 1 Year Before Time Period

3. RESULTS AND DISCUSSION

This study's examination of the floating net cage cultivation development trend will focus on provinces that have seen a large increase or drop in comparison to other provinces.

3.1 Fishery Household Trend Development Index

Fishery households are those who engage in fish farming operations, one of which is using floating net cages to sell some or all of the catch [6]. The trend of household development of floating net cage aquaculture fisheries in Indonesia in each province is very volatile. The development of floating net cage aquaculture households reflects the level of progress in each province from year to year. West Nusa Tenggara Province experienced a very significant increase and decrease compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 0,00; 0,00; 1.480,00; 135,58; and 110,42 (Fig. 1). Based on the value of the development index, it can be seen that the trend in the development of floating net cage aquaculture households in West Nusa Tenggara Province in 2010 experienced a very significant increase. Then, in 2013 it experienced a very significant decrease of 1.334,42 and in 2016 it again decreased by 25,16.

3.2 Cultivator Trend Development Index

Cultivators are persons who actively participate in fish farming activities, such as laborers and family members who directly maintain fish, give feed, and so on [1]. The development of aquaculture, which impacts labor absorption, income, and poverty levels, may be the cause of the increase in farmers [7].

The development trend of floating net cage aquaculture cultivators in Indonesia in each province is very volatile. The development of floating net cage aquaculture cultivators reflects the level of progress in each province from year to year. West Nusa Tenggara Province experienced a very significant increase and decrease compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 0,00; 0,00; 2.960,00; 135,58; and 110,42 (Fig. 2). Based on the value of the development index, it can be seen that the trend of development of floating net cage aquaculture cultivators in West Nusa Tenggara Province in 2010 experienced a very significant increase. Then, in 2013 there was a very significant decrease of 2.824,42 and in 2016 it again decreased by 25,16.

3.3 Feed Trend Development Index

Feed is critical to a fishery's success, and feed availability is a component in achieving maximum output [8]. Fish feed is critical to the success of aquaculture, but the expenses of obtaining it are high, accounting for 35-70 percent of overall production costs [9].

The development trend of floating net cage aquaculture feed in Indonesia reflects the level of progress in each province from year to year. South Kalimantan Province experienced a very significant increase compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 0,00; 100,00; 0,00; 150,09; 11.637,64 (Fig. 3). Based on the value of the development index, it can be seen that the trend of development of floating net cage aquaculture feed in South Kalimantan Province in 2007 increased and in 2010 decreased. Then, in 2013 and 2016 there was an increase of 150,09 and 11.487,55, respectively.

Bengkulu Province experienced a significant decline compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 0,00; 0,00; 114,71; 476,17; and 178,99 (Fig. 3). Based on the value of the development index, it can be seen that the trend of development of floating net cage aquaculture feed in Bengkulu Province in 2010 and 2013 increased by 114,71 and 361,46, respectively. Then, in 2016 there was a significant decrease of 297,18.

3.4 Land Area Trend Development Index

The area of land or the area of aquaculture is a gross area which means not only the surface

area of the water used for maintenance, but also includes the area of a water body [1]. Trends in the development of aquaculture land area for floating net cages in Indonesia in each province are very fluctuating. The development of aquaculture land area for freshwater floating net cages reflects the level of progress in each province from year to year. Papua Province experienced a very significant increase compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 0,00; 0,00; 0,00; 115.975,00; and 100,00 (Fig. 4). Based on the value of the development index, it can be seen that the trend of the development of floating net cage aquaculture land in Papua Province in 2013 experienced a very significant increase but in 2017 it decreased by 115.875,00.

Banten Province experienced a very significant decline compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 142.857,14; 123,08; 322,00; 94,15; and 35,97 (Fig. 4). Based on the value of the development index, it can be seen that the trend of the development of floating net cage aquaculture area in Banten Province in 2007 experienced a very significant decrease of 142.734,06. Then, in 2010 it increased by 198,92 but in 2013 and 2016 it again decreased by 227,85 and 58,18, respectively.

3.5 Production Trend Development Index

Production is all fish cultivation products that are harvested from the rearing area, namely floating net cages that are managed by fisheries households [1]. Increased production in fish farming is always supported by providing the right feed by paying attention to the amount of feed, timely administration, and nutritional content in accordance with the needs of the fish [10].

The development trend of floating net cage aquaculture production in Indonesia in each province is very volatile. The development of floating net cage aquaculture production reflects the level of progress in each province from year to year. North Maluku Province experienced a very significant increase and decrease compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 40,63; 2.100,00; 204,91; 148,82; and 268,97 (Fig. 5). Based on the value of the development index, it can be seen that the development trend of floating net cage aquaculture production in North Maluku Province

in 2007 experienced a very significant increase of 2.059,37 but in 2010 experienced a very significant decrease of 1.895,09 and in 2013 again decreased by 56,09. Then, in 2016 it increased by 120,15.

3.6 Production Value Trend Development Index

The production value is the value at the time the fish culture results are landed so that the price used is the producer price [1]. An increase in the production value of a cultivated fish commodity can be caused by an increase in demand by consumers [11].

The development trend of floating net cage aquaculture production values in Indonesia in

each province is very volatile. The development of floating net cage aquaculture production value reflects the level of progress in each province from year to year. West Nusa Tenggara Province experienced a very significant increase and decrease compared to other provinces, wherein 2004, 2007, 2010, 2013, and 2016 each had a development index value of 0,00; 100,00; 14.899,94; 756,06; and 159,93 (Fig. 6). Based on the value of the development index, it can be seen that the trend of the development value of floating net cage aquaculture production in the Province of West Nusa Tenggara in 2007 and 2010 has increased by 100,00 and 14.799,94, respectively. Then, in 2013 and 2016 has decreased each - each amounting to 14.143,88 and 596,13.

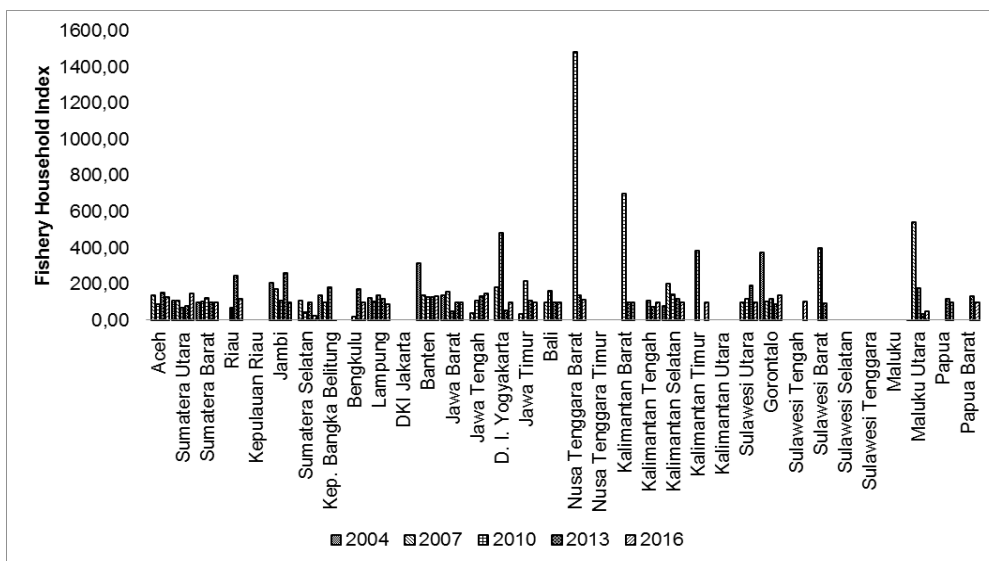


Fig. 1. Fishery Household Development Index in Indonesia

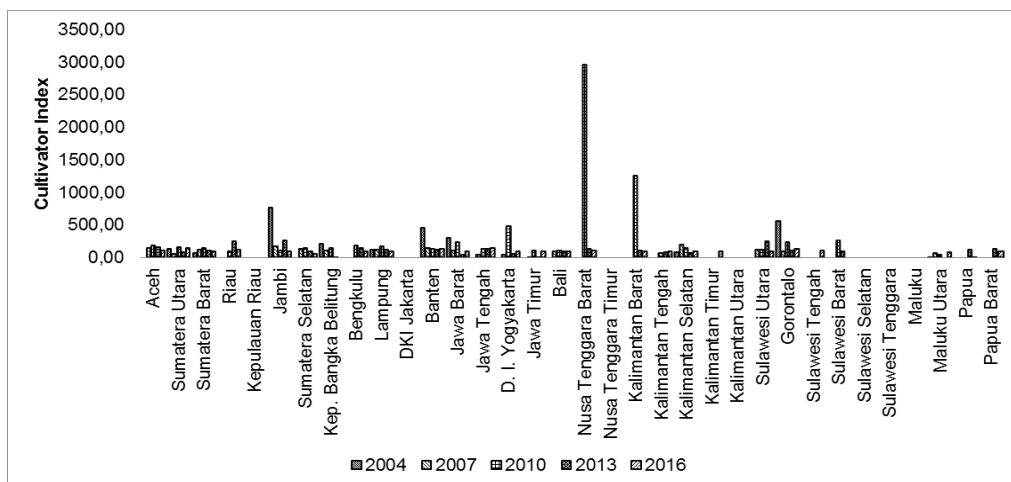


Fig. 2. Cultivator Development Index in Indonesia

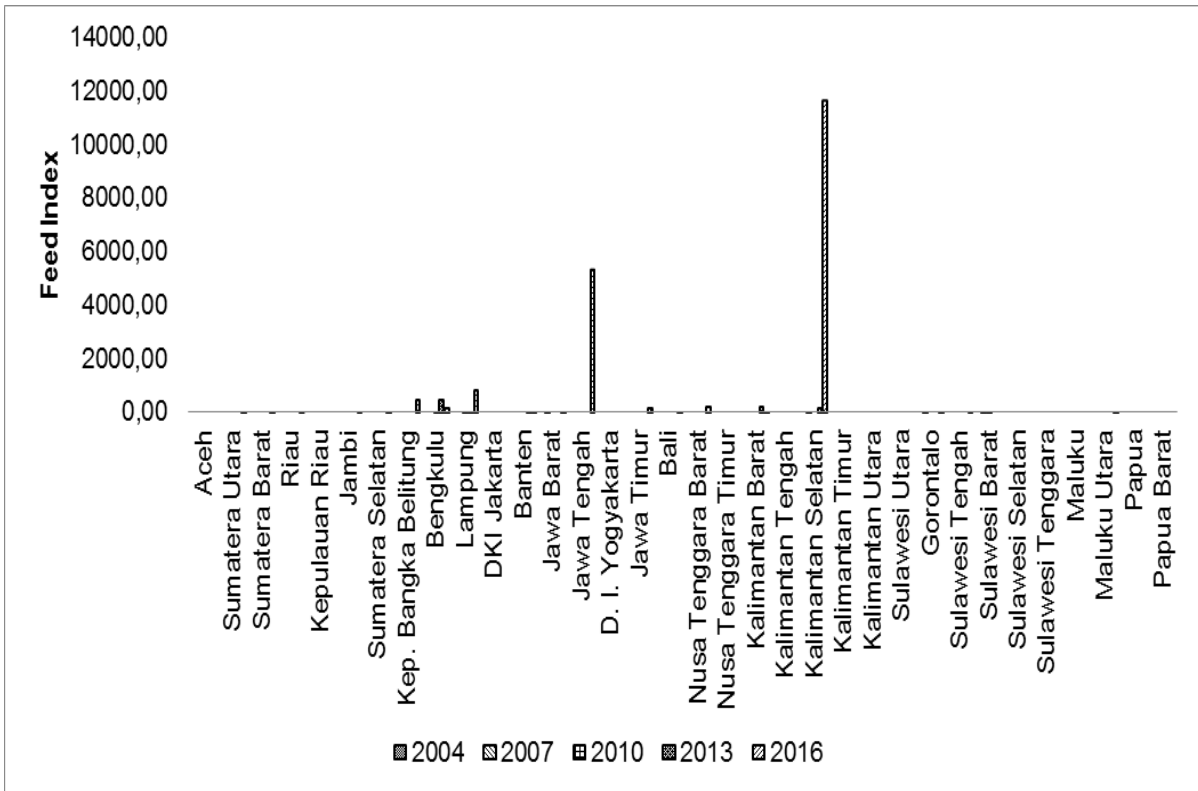


Fig. 3. Feed Development Index in Indonesia

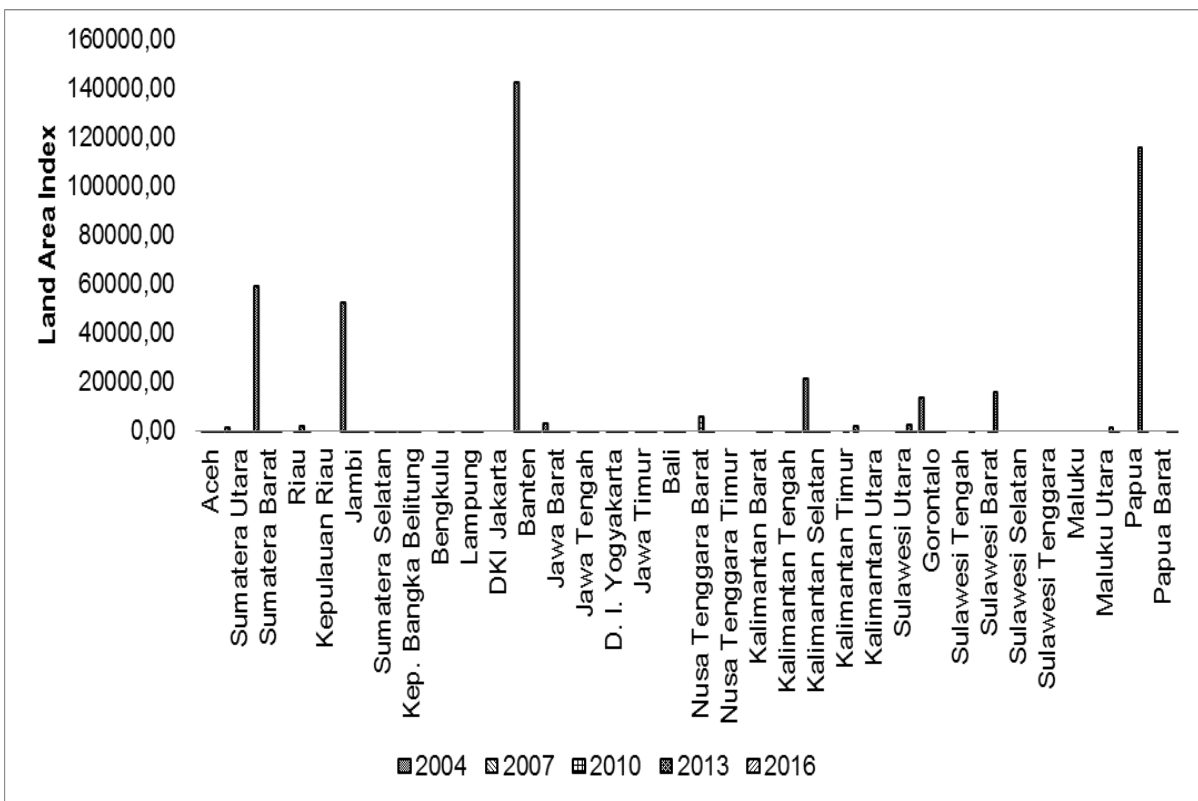


Fig. 4. Land Area Development Index in Indonesia

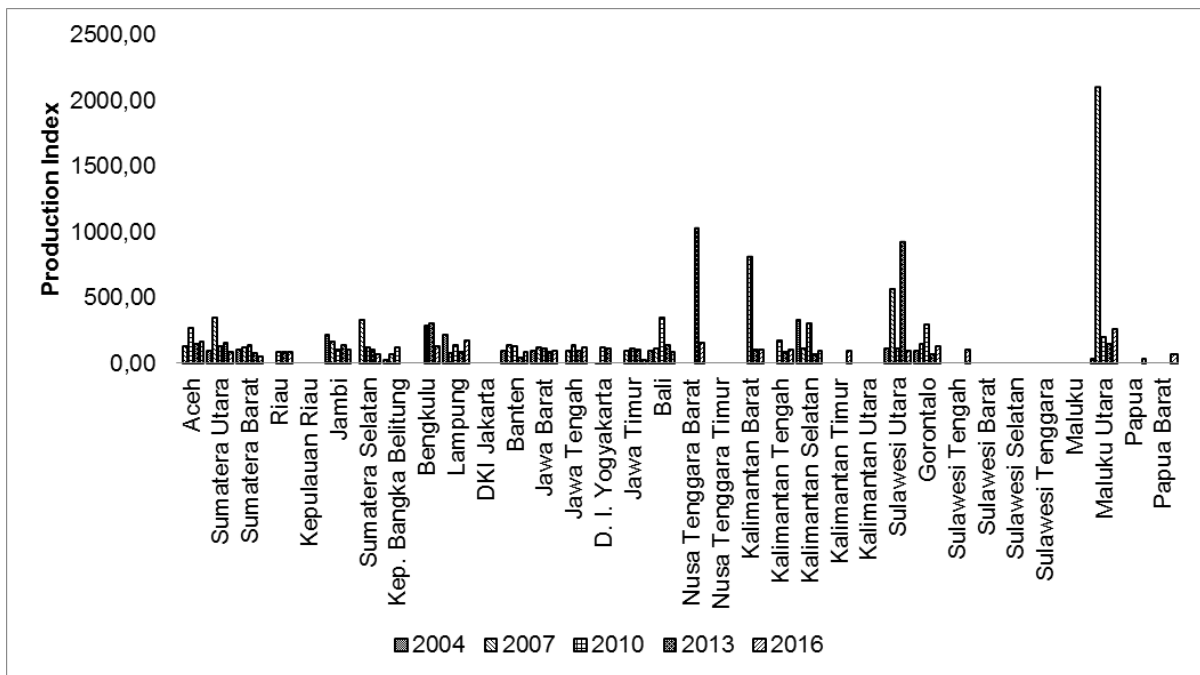


Fig. 5. Production Development Index in Indonesia

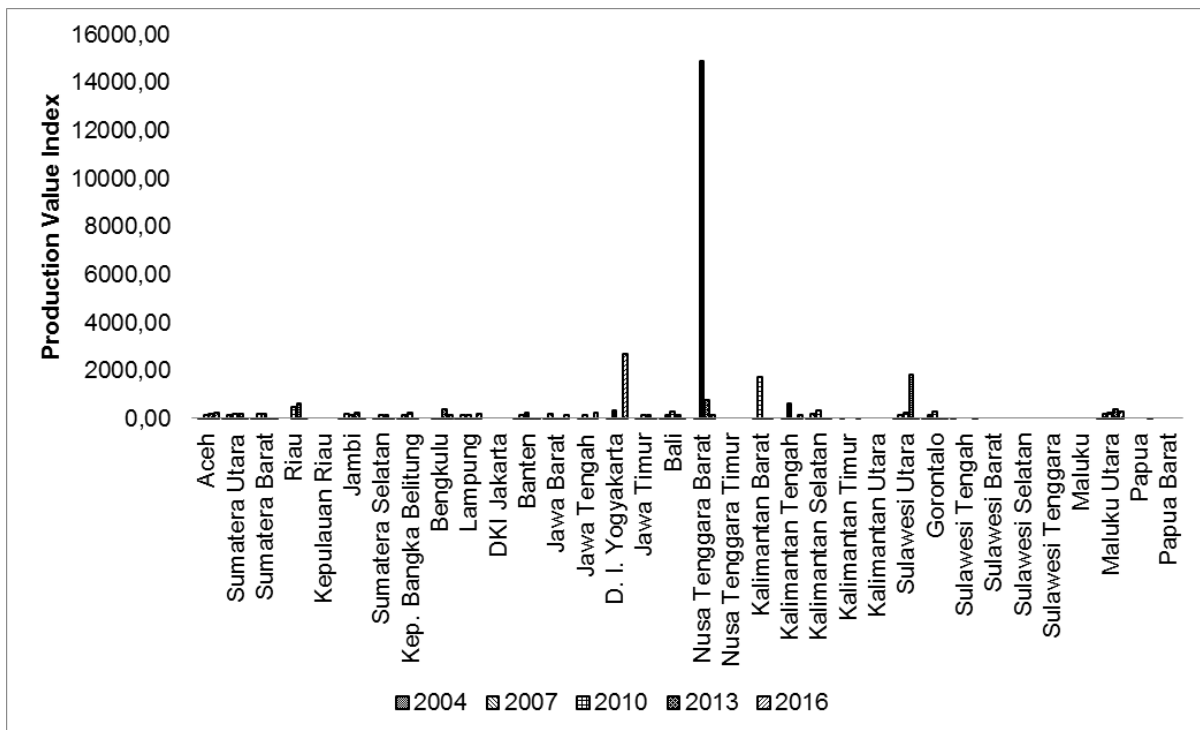


Fig. 6. Production Value Development Index in Indonesia

4. CONCLUSION

The development trend of floating net cage aquaculture in Indonesia as seen from fishery households, cultivators, feed, land area,

production and production value has fluctuated from 2004 to 2016. In addition, when viewed from the total production, West Java Province had the highest production in 2016 of 198.535 tons, supported by a land area of 9.554.900 m².

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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