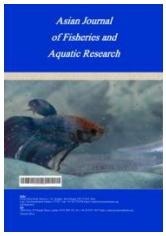

Asian Journal of Fisheries and Aquatic Research

14(5): 40-46, 2021; Article no.AJFAR.73729
ISSN: 2582-3760

Analysis of the Brackish Water Aquaculture Development in Indonesia

Asep Agus Handaka Suryana[1*] and Afifah Sabila[1]

[1]Department of Fisheries, Faculty of Fisheries and Marine Science, Padjadjaran University, Sumedang Regency, West Java, Indonesia.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJFAR/2021/v14i530307
Editor(s):
(1) Dr. Pınar Oguzhan Yildiz, Ataturk University, Turkey.
(2) Dr. Luis Enrique Ibarra Morales, University of Sonora, Mexico.
(3) Dr. Telat Yanik, Atatürk University, Turkey.
Reviewers:
(1) T. G. Sumithra, India.
(2) Jithu Paul Jacob, India.
Complete Peer review History: https://www.sdiarticle4.com/review-history/73729

Original Research Article

Received 01 July 2021
Accepted 10 September 2021
Published 17 September 2021

ABSTRACT

Brackishwater aquaculture is one of the fisheries activities that can be a driving force for the country's economy with its ability to generate profits and reduce unemployment in coastal areas of Indonesia. The development of brackishwater aquaculture can be used as a barometer in fisheries development efforts. This study aims to analyze the development of aquaculture in each province in Indonesia. This research was conducted from August 2020 to July 2021. The type of data used is secondary data obtained from the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries. Data analysis used the quantitative descriptive method. The results of this study indicate that the development of brackishwater aquaculture viewed from the aspect of labors, land area, production, and productivity tended to be low during 2004 to 2016 but there were significant changes in provinces that were not centers of aquaculture activities (Maluku, Riau Islands, DKI Jakarta, and North Maluku) this indicates a positive situation that the province is trying to carry out aquaculture activities by facing the existing risks.

Keywords: Fisheries development; brackish water aquaculture; Indonesia.

**Corresponding author: Email: asep.agus@unpad.ac.id;*

1. INTRODUCTION

Indonesia has a potential area of 2.9 million hectares of brackishwater cultivation with a new level of land use reaching 532 thousand hectares or about 18 percent and is still very much able to be developed [1]. Pond cultivation has the potential to absorb labor and create new farmers because the technology is easy to apply with a relatively fast harvest time so that this pond cultivation activity is very prospective and promises big profits. In addition, commodities that are cultivated through aquaculture activities have a high economic value and can play a major role as a large foreign exchange contributor for the country. However, there are many obstacles experienced in the development of aquaculture, mentioned by Bappenas [2], strategic issues that have an impact on the low development of aquaculture include the large portion of costs and high feed prices, the scale of fish cultivators is dominated by small scale which is also the quality of the source. Human resources are still limited, plus the wage system for some small-scale aquaculture businesses is still daily, access to capital for the development of aquaculture business is limited, the logistics system for cultivation activities is not evenly distributed and efficient with supporting infrastructure is still limited, the availability of high-quality seeds and access technology is still limited (generally still applying traditional systems and or semi-intensive systems), decreasing the quality of cultivated land (the fish rearing period is longer, fish are more susceptible to disease, higher feed conversion), there is no certainty of spatial aquaculture business, and aquaculture data collection system is not reliable and efficient.

Previous research on the development of aquaculture carried out by Saptana [3] stated that the constraints in the development of aquaculture, especially shrimp aquaculture in West Java, were caused by several factors, namely: (1) ecological carrying capacity for shrimp growth in intensive, usually large-scale enterprises. This happens because of: accumulation of pollution from food waste, shrimp excrement, and residues of pest eradication drugs. (2) It is relatively difficult to regulate quality water for aquaculture, especially in intensive ponds that tend to be large-scale, so that residues of dirt in upstream ponds are carried into ponds below. (3) The situation in point 2 above, has been even worse in recent years due to the long dry season which has caused a relatively reduced amount of water flowing through the pipes.

Another study on the development of aquaculture was also carried out by Barokah [4] revealed that the development of aquaculture, especially tiger shrimp commodity in Sidoarjo (East Java) in the period 2005- 2008 continues to decline, this is due to uncertain climatic factors, the rainy season that occurs throughout the year is very disturbing to tiger shrimp farmers because the average harvest will not be in line with expectations and even threatened with crop failure. The rainy season that occurs throughout the year can cause flooding and wash away the shrimp that are cultivated by pond farmers. Another factor that affects the decline in the contribution of tiger prawns is the existence of one of the government programs, namely developing a new type of superior fishery product besides tiger prawns and milkfish.

Another study on the development of aquaculture in Indonesia was also conducted by Juarno [5] stated that based on four observation periods, in 1994-1998 the growth rate of the output for both tiger prawns, white shrimp, and milkfish is negative. This is presumably because the disease has not been successfully overcome. In the period 1989-1993, shrimp ponds were attacked by *Monodon Baculo Virus* (MBV). This condition continued until 2000/2001 and until now. According to Widigdo [6] due to disease, the export quantity in 2000 fell to 70 thousand tons and 90% of the 350 thousand ha of ponds were in an abandoned condition. In the period 1999-2003, the output growth rate became positive, namely 12.6% for tiger prawns, 6.8% for vaname shrimp, and 8.2% for milkfish. The increase is thought to be due to the availability of water sources resulting from the construction of irrigation networks through SPL-OECF/JBIC funds with a value of around Rp. 300 billion. The increase is also suspected to be due to a change in status from the previous level of the Directorate General of Fisheries to the level of the Ministry (Department of Marine and Fisheries Exploration/DELP) at the end of 1999 so that there was an increase in the budget. In the next period, namely 2004-2008, the growth rate of tiger prawns was much reduced, and vaname shrimp had the highest growth rate. The share of the revenue from vaname shrimp also increased but was still lower than the share of the revenue from tiger prawns.

Based on the foregoing, this research was conducted to analyze the conditions of brackishwater aquaculture development in Indonesia with a period of 2004 – 2016.

2. MATERIALS AND METHODS

The research was carried out for eleven months starting from August 2020 to July 2021 in Bandung City and Jakarta, Indonesia. The type of data used is secondary data obtained from the Ministry of Marine Affairs and Fisheries. Data analysis used the quantitative descriptive method.

2.1 Analysis of Brackish water Aquaculture Development Index in Indonesia

Secondary data obtained and used in this study came from the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries. These data include the number of labor, land area, production, and productivity of brackishwater aquaculture in Indonesia. This study uses time series data from 2003 to 2016. The total number of provinces in Indonesia is 34, but due to data limitations, the number of provinces in this study is only 33 (North Kalimantan Province is still part of the East Kalimantan). The following is the development index formula used according to the Annual Fisheries Index by Province for 2006-2009 [7]. The calculated development indices are:

a. Development Index of Labor (Cultivator)

$$IPNijk = \frac{Nijk}{Nijkl}\ x\ 100$$

Keterangan :

IPN : Development Index of Labor (Cultivator)
N : Number of Labor (person)
i : Province i (i = 1, ... , 33)
j : Types of Fisheries Classification
k : Time Period
kl : 1 Year Before Time Period

b. Development Index of Land Area

$$IPLijk = \frac{QLijk}{QLijkl}\ x\ 100$$

Keterangan :

IPL : Development Index of Land Area
QL : Land Area Volume (ha)
i : Province i (i = 1, ... , 33)
j : Types of Fisheries Classification
k : Time Period
kl : 1 Year Before Time Period

c. Development Index of Production

$$IPPijk = \frac{Qijk}{Qijkl}\ x\ 100$$

Keterangan:

IPP : Development Index of Production
Q : Production Volume (tons)
i : Province i (i = 1, ... , 33)
j : Types of Fisheries Classification
k : Time Period
kl : 1 Year Before Time Period

d. Development Index of Productivity (Production/Labor)

$$IPPTijk = \frac{Qnijk}{Qnijkl}\ x\ 100$$

Keterangan:

IPPT : Development Index of Productivity (Production/Labor)
Qn : Production Volume (tons)
i : Province i (i = 1, ... , 33)
j : Types of Fisheries Classification
k : Time Period
kl : 1 Year Before Time Period

3. RESULTS

3.1 Brackish Water Aquaculture Development in Indonesia

3.1.1 Development indices of labor in different provinces of Indonesia

Labor (cultivator) is a person who actively performs work in the cultivation of fish/other aquatic animals/aquatic plants, in the case of cultivators, only people, both household members and laborers who directly carry out fish maintenance, pond repair, water supply and feeding activities included as cultivators [7]. The development index of brackishwater aquaculture activities in the aspect of cultivators in Indonesia (Fig. 1) shows that the development of cultivators in Indonesia tends to be low in each province, but there are differences with Maluku Province. This province is one of Indonesia's maritime axis because from a geostrategic aspect it is located at a cross position between geopolitics and geo-

economics [8] so that the priority activities in this province are capture fisheries and marine aquaculture. Therefore the trend of increasing fishpond cultivators in this province is due to the massive conversion of fishermen to cultivators, the shift in their livelihoods due to various factors. The main factor is the greater and more certain the income they get if they become aquaculture cultivators [9], In addition, it is also influenced by social conditions where aquaculture activities have a lower level of work risk compared to capture fishery activities, but also because of the start of public awareness about the prospects of aquaculture activities.

3.1.2 Development indices of land area in a different province of Indonesia

The land area in the aquaculture development index is the gross area of cultivation, not only the surface area of water used for maintenance but also the area of land/galengan/dykes and so on. The results of research on the development index of aquaculture activities in Indonesia in terms of the land area tend to be low (Fig. 2), although there has been an extreme increase in the Riau Islands province. This happens because in 2013 in the Riau Islands there was a very high increase in land area compared to 2012 from 53 ha to 1007 ha.

The increase in the land area did not last long in the Riau Archipelago Province, because the decline again occurred in 2015 to 77 ha after the enactment of the Minister of Marine Affairs and Fisheries Regulation No. 49 of 2014, dated October 16, 2014, regarding the moratorium on fishing vessels from cultivators, which caused the vessels transporting aquaculture products from Hong Kong that were ready to accommodate grouper production to stop operating, so that after the moratorium, the land used for cultivation was drastically reduced due to lack of demand. [10]. In addition, the development of the land area in aquaculture activities can be caused by the transfer of the function of the pond itself, a decrease occurs if the pond land is converted to another land such as settlements, plantations, and even becomes land for other industries, namely tourism. While the increase in land area development occurs if there is land clearing for pond cultivation activities, it can come from mangrove areas and even rice fields. Then it could be because the land used in that year is rented land, so it can affect the ups and downs of the land area development index graph.

3.1.3 Development indices of production in different provinces of Indonesia

The production in the development index of this study is the entire yield (volume) of aquaculture carried out by fishery companies and households, the calculated fishery production is production for sale, eaten by cultivators themselves, or given to other cultivators as work wages, but the production of activities in the form of hobbies (hobbies) are not counted as fishery production.

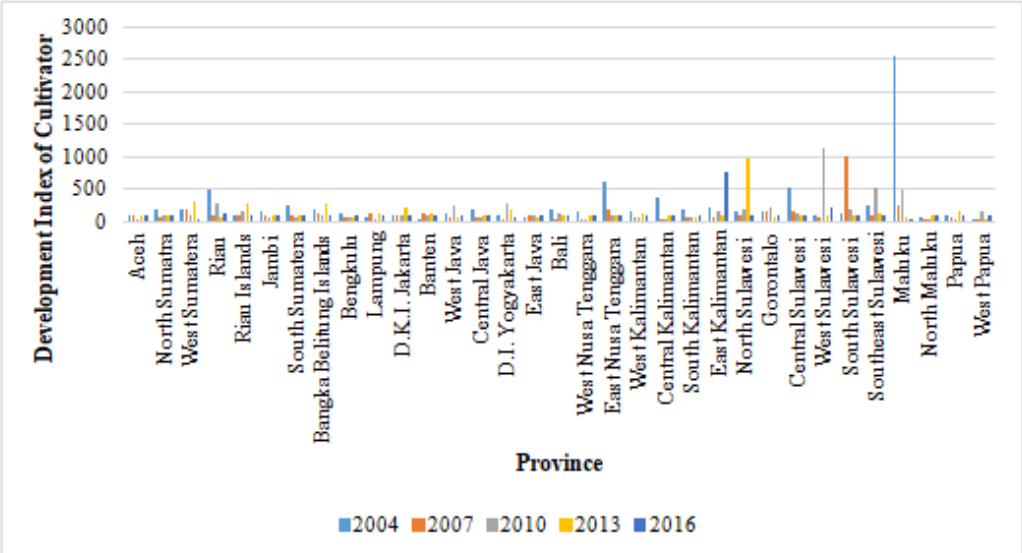

Fig. 1. Brackishwater aquaculture cultivator development index in Indonesia

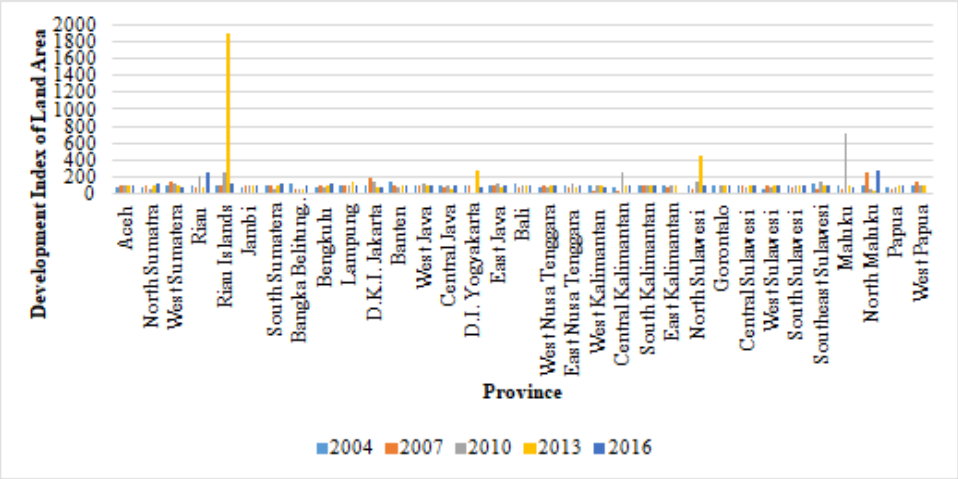

Fig. 2. Brackish water aquaculture land area development index in Indonesia

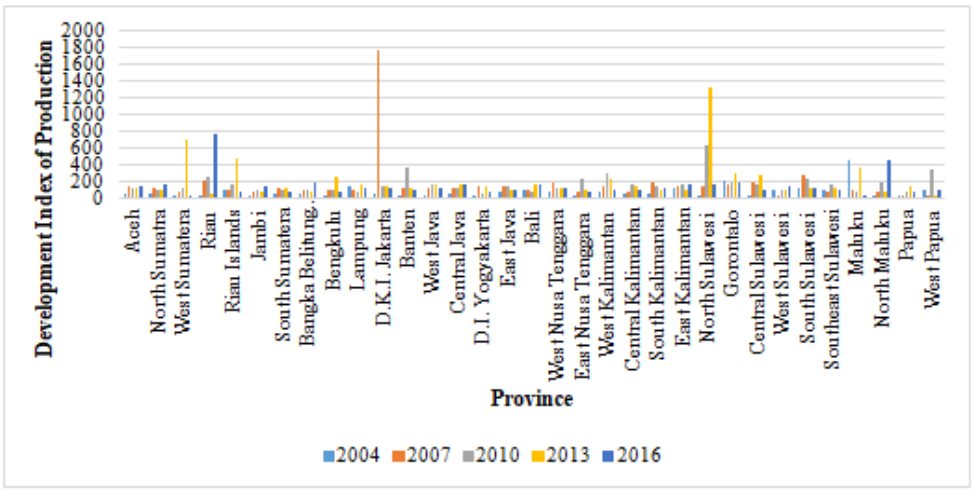

Fig. 3. Brackishwater Aquaculture Production Development Index in Indonesia

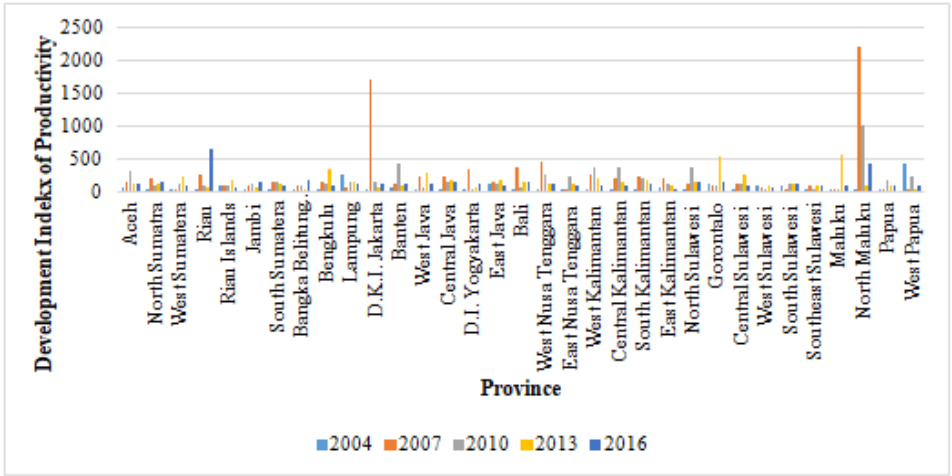

Fig. 4. Brackishwater Aquaculture Productivity Development Index in Indonesia

3.1.4 Development indices of productivity in different province of Indonesia

The production development index of brackishwater aquaculture activities in Indonesia (Fig. 3) shows that the development of production in Indonesia tends to be low. The most significant production development occurred in the Special Capital Region of Jakarta in 2007, normally the production of aquaculture activities in DKI Jakarta ranges from 1000-2000 tons. However, in 2006 only 99 tons of production were produced and in 2007 it returned to normal by producing 1,751 tons which then had a big impact on the graphs produced in this research. The decline in pond production in the DKI Jakarta area in 2006 could be caused by pond cultivation activities in this area using seawater based on high tides (prone to being contaminated with industrial waste and residential waste [11], which means that there is a possibility that in that year there will be crop failure due to low water quality. In addition, the coastal conditions of DKI Jakarta which are prone to drought also contribute to the cause of the decline in production. This is in line with research [12], crop failure is often caused by extreme weather and pests and diseases. The risk factors that affect the production of aquaculture are divided into two, namely controllable risk factors (production inputs) and uncontrollable risk factors (season, disease, and quality of human resources) [13] so that an increase or decrease in production can be caused by this.

Productivity is a measure of the level of efficiency and effectiveness of each source used during production by comparing the amount produced with all sources that have been used or all sources used. Productivity in the calculation of the development index in this study is the division between production per worker. The development index of brackishwater aquaculture activities in the productivity aspect category (Fig. 4) shows a trend that tends to be low in all provinces. However, in contrast to North Maluku Province in 2007, there was a significant difference, this happened because in 2003 and 2007 there was an increase in the value of the productivity index from 26 to 2190. The increase in the value of the productivity development index of North Maluku Province in 2007 could occur because in 2006 the total number of cultivators as many as 1.635 people can only produce a total production of 8 tons so that the productivity is very small, whereas in 2007 although the number of cultivators was only 56 people, it could produce a total production of 5 tons so that productivity increased significantly compared to the previous year due to a large number of cultivators. less but can produce several production that is not much different from the amount produced by 1.635 people in 2006. In addition, the addition of labor inputs can also reduce the productivity of aquaculture activities because most of the level of knowledge of the workforce employed is low and inexperienced [13]. The quality of human resources in North Maluku based on the HDI value is still below the National HDI with elementary and junior high school education levels dominating the workforce [14].

4. CONCLUSION

The development of brackishwater aquaculture in Indonesia seen from the aspect of labor, facilities and infrastructure, production, and productivity tended to be low during 2004 to 2016 but there were significant changes in provinces that were not centers of aquaculture activities (Maluku, Riau Islands, DKI Jakarta, and North Maluku) this indicates a positive situation that the province is trying to carry out aquaculture activities by facing the existing risks.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ACKNOWLEDGEMENT

We would like to thank The Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Indonesia for making this research possible.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ministry of Marine Affairs and Fisheries. Shrimp Cultivation Business Development Strategy. Directorate General of Aquaculture. Jakarta; 2020.
2. Bappenas. Study of Sustainable Fisheries Management Strategy. Directorate of Marine Affairs and Fisheries. Jakarta; 2014.

3. Saptana, Muchidin R. Perspective on the Development of Indonesian Shrimp Agribusiness (Case Study West Java) Research Staff of the Agricultural Socio-Economic Research Center, Bogor. Bogor; 1992.
4. Umi Barokah. Strategy for the Development of Pond Fisheries as a Leading Sub-Sector in Sidoarjo Regency. Lecturer in the Department of Agricultural Socio-Economics, Faculty of Agriculture, Sebelas Maret University, Surakarta. Surakarta; 2011.
5. Juarno O, Oktaviani R, Fauzi A, Nuryartono N. Productivity Performance and Factors Influencing Total Factor Productivity (TFP) of Indonesian Shrimp Farms. Journal of Socio-Economic Marine Fisheries. 2011;6(2).IPB. Bogor.
6. Widigdo B. Shrimp Farming with Biocrete Technology. PT Kompas Media Nusantara. Jakarta; 2013.
7. Ministry of Maritime Affairs and Fisheries, Central Statistics Agency. Fishery Production by Province 2006-2009. Jakarta; 2011.
8. Bappenas. Regional Development Analysis of the Riau Islands Province. Regional Development Analysis Series Riau Islands Province. Jakarta; 2015.
9. Anurogo W, Lubis MZ, Khairunnisa H. Factors affecting land transfer function and its impact on farmers income in Srigading Village, Sanden Sub-district, Bantul Regency Department of Informatics Engineering, Geomatics Engineering Batam State Polytechnic, Batam, Riau Islands. Journal of Geography Education: Studies, Theory, and Practice in the Field of Education and Geography Year 24. 2019;34-41.
10. Ministry of Marine Affairs and Fisheries. Marine and Fisheries Potential of Natuna Regency. Center for Statistics and Information of the Ministry of Maritime Affairs and Fisheries. Jakarta; 2016.
11. Sianipar P, Djamali A, Soeroyo, Sudjoko B. A Study of Several Ecological Factors of Muara Angke Pond, North Jakarta DKI Jakarta. Fisheries Research and Development Center. Agriculture department. Jakarta; 1989.
12. Aini HN, Prasmatiwi FE, Sayekti WD. Income and Risk Analysis of Cabbage Farming on Dry Land and Rainfed Rice Fields in Gisting District, Tanggamus Regency. Lampung University. Lampung; 2015.
13. Hartoyo KK, Fariyanti A. Risks and Strategies for Increasing Vannamei Shrimp Production in Blanakan District, Subang Regency. Bogor Agricultural Institute. Bogor; 2018.
14. Bappenas. Analysis of Regional Development of Maluku Province. Maluku Province Regional Development Analysis Series. Jakarta; 2015.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/73729