



Mapping of Ornamental Fish Farming Cultivation Production Areas in Bogor Regency

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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

Aims: Analyze the leading ornamental fish commodities in Bogor Regency and analyze the mapping of ornamental fish farming areas in Bogor Regency.

Place and Duration of Study: Research conducted in Bogor Regency and was carried out from Desember 2020 – September 2021.

Methodology: The method used was a literature study to determine the leading ornamental fish commodities in Bogor Regency and mapping of ornamental fish farming areas in Bogor Regency. After processing the data, the data is analyzed descriptively. Primary data was obtained from interviews with 1 key person at the Department of Fisheries and Livestock, Bogor Regency. Secondary data is obtained through reports from several documents including the Annual Report 2015 – 2019 from the Bogor Regency Fisheries and Livestock Service, Gross Regional Domestic Product (PDRB) 2015 – 2019 Bogor Regency, Bogor Regency Medium Term Development Plan 2018-2023.

Results: The results of this study indicate that the main ornamental fish commodities in Bogor Regency are oscars, corydoras, guppies, bettas, black ghosts, rainbows, manfish and goldfish. The leading areas for ornamental fish production in Bogor Regency are the Subdistrict of Kemang, Megamendung, Tenjolaya, Cibinong, Ciseeng, Nanggung, and Ciampea.

Keywords: Area mapping; ornamental fish; bogor regency; location quotient; shift share.

1. INTRODUCTION

Economic development in Indonesia is carried out through various sectors, one of which is the fisheries sector. The fisheries sector is one of the natural resources that is important for the livelihood of the community and has the potential to be used as the prime mover of the national economy [1]. Fish are basically natural resources (SDA) which are categorized as natural resources that can be renewed or restored [2]. Regional economic growth is basically influenced by the comparative advantage of a region, regional specialization, and the economic potential of the region. Therefore, the utilization and development of all potentials of economic value is a top priority that must be explored and developed in implementing sustainable regional economic development [3]. The ornamental fish cultivation sub-sector is one of the sub-sectors in the fisheries sector which is one of the main drivers in the agribusiness sector and is an important sector that can be improved in order to increase people's income.

Freshwater ornamental fish is a fishery commodity that has high economic value. The Ministry of Maritime Affairs and Fisheries (2014) has set five provinces in Indonesia as targets for the largest freshwater ornamental fish production centers, namely East Java, West Java, DKI Jakarta, D.I. Yogyakarta and Banten. Bogor Regency and Depok City are the two main centers of freshwater ornamental fish cultivation in West Java Province. Bogor Regency has 29 Subdistricts out of 40 Subdistricts in the city whose people carry out freshwater ornamental fish cultivation. Ornamental fish has its own charm to be enjoyed as an art product for its consumers. The beauty that is shown in terms of color, shape, physical completeness and also health conditions [4]. The types of freshwater ornamental fish that are popular are Oscar fish (*Astronotus ocellatus*), arowana fish (*Sclerophages formous*), goldfish (*Sclerophages formous*), betta fish (*Beta splendens*), discus fish (*Symphysodon aequifasciata*) and koi (*Cyprinus rubrofuscus*) [5].

In a study conducted at the University of the West of Scotland on the relationship of the effect

of interacting with ornamental fish in an aquarium on human health and well-being, it was stated that keeping fish in an indoor aquarium can reduce anxiety and relax a stressful atmosphere [6].

Many areas in Bogor Regency have fishery potential that can be developed, especially in the field of aquaculture. According to the Department of Fisheries and Livestock, the value of aquaculture production in Bogor Regency tends to increase in 4 years. During this period, the number of ornamental fish production in Bogor Regency increased from 250,513,180 in 2016 to 290,440,090 in 2019 [7]. Meanwhile, the number of aquaculture areas increased from 35.87 Ha in 2016 to 36.99 Ha in 2019 [8]. This increase shows that ornamental fish have become a very strategic fishery commodity for the economy in Bogor Regency.

Bogor Regency is one of the main supporting districts for ornamental fish production in West Java Province, especially freshwater ornamental fish. In 2015, the production of ornamental fish in Bogor Regency was 242.52 million fish or 42.4% of the total production of West Java or 18.4% of the total national production. The production data shows that Bogor Regency has great potential for ornamental fish to be managed properly so that it has an economic impact on the community [9].

This makes ornamental fish traded as a commodity that is quite in demand by the public because it can fill the market at every social and economic level of society, depending on the type and price of the fish. Seeing its potential, the cultivation of ornamental fish, especially freshwater, has become a fishery business in West Java, especially in Bogor Regency, which is promising because of the large number of ornamental fish cultivators.

As a minapolitan area, every areas needs a place to market their cultivation products, including ornamental fish. Starting in a modern way with the help of the internet, such as a marketplace or in a traditional way, one of them is through the market. One of the ornamental fish

markets in the minapolitan area is the Pasar Ikan Hias Parung.

Most ornamental fish cultivators are members of an organization or association called the Fish Cultivator Group or abbreviated as Pokdakan. Groups are two or more people who interact to achieve a common goal, these interactions are relative and have a certain structure so as to form group dynamics that refer to changing circumstances that describe fluctuations in activity and social systems that are not static and move towards change [10].

Ornamental fish cultivators in Bogor Regency can market their products to the ornamental fish market for direct sale to consumers or send their fish to ornamental fish exporters to meet the demand for ornamental fish in the international market. In Indonesia, part of the use of ornamental fish resources is exported (95%) and the rest (5%) is traded locally [11]. To meet the domestic market, the ornamental fish market also has the advantage of abundant stocks of ornamental fish from farmers/cultivators, various types and varieties of ornamental fish available in this market.

With these advantages, Bogor Regency has the potential to become the largest ornamental fish producer in West Java. Bogor Regency with its climate (land and water feasibility, temperature range, rainfall, and so on) has shown a high enough suitability for use as land for the cultivation of various species of fish, both consumption fish and ornamental fish [12].

2. METHODOLOGY

The method used was a literature study to determine the leading ornamental fish commodities in Bogor Regency and mapping of ornamental fish farming areas in Bogor Regency. Primary data was obtained from interviews with 1 key person in charge at the Department of Fisheries and Livestock, Bogor Regency. Secondary data is obtained through reports from several documents including the Annual Report 2015 – 2019 from the Bogor Regency Fisheries and Livestock Service, Gross Regional Domestic Product (PDRB) 2015 – 2019 Bogor Regency, RPJMD Bogor Regency 2018-2023. The technique of data collection is done by documentation and literature study.

2.1 Research Location

The research was conducted in Bogor Regency. Data were taken from the Fisheries and

Livestock Service Office of Bogor Regency, Jalan Raya Bersih, Komplek Perkantoran Pemda, Subdistrict Cibinong, Bogor Regency, West Java Province, 16915. Research time starts in December 2020 - September 2021.

Geographically, Bogor Regency is located between 16°21' - 107°13' East Longitude and 6°19' - 6°47' South Latitude. Bogor Regency consists of 40 sub-districts and 435 villages with an area of 298,620,26 Ha. In general, Bogor Regency is bordered by, to the north, Tangerang Regency and South Tangerang City (Banten Province), Bekasi City, Bekasi Regency and Depok City, to the east by Karawang Regency, Purwakarta Regency and Cianjur Regency, to the south by Cianjur Regency and Sukabumi Regency, in the west bordering Lebak Regency (Banten Province), in the middle bordering Bogor City.

2.2 Research Method

The type of research used is descriptive quantitative. Descriptive research is research that seeks to describe a symptom, event, event that is happening at the present time [12]. The selection of research locations was carried out purposively with the consideration that Bogor Regency has the potential for freshwater ornamental fish production and is a minapolitan ornamental fish area in West Java.

2.3 Data Analysis Method

Method to analyze the contribution and the leading commodity in this research is the Location Quotient (LQ) and Shift Share (SS) methods. To analyze the area using the ArcGIS application.

Location Quotient in this study is used to determine the location of each ornamental fish commodity and the specialization of the Subdistricts in Bogor Regency for the ornamental fish commodity. According to Stimson et al. (2006), the formula for calculating LQ is as follows:

$$LQ = \frac{(E_{i,r}/E_r)}{(E_{i,N}/E_N)}$$

Information:

LQ : Location Quotient coefficient
 Ei,r : total production of ornamental fish commodity i in Subdistricts r

- Er : total production of all ornamental fish commodities in r Subdistricts
 Ei,N : total production of ornamental fish commodity i in regency
 EN : total production of all ornamental fish commodities in the regency

With the provisions, if $LQ > 1$, ornamental fish i in Subdistricts r is a base commodity and $LQ < 1$, ornamental fish i in Subdistricts is not a non-base commodity. In this study, a commodity is said to be based in a certain Subdistricts if it has an average $LQ > 1$.

The Shift Share (SS) method is a technique that examines the relationship between economic structure and regional growth, first developed by Daniel B. Creamer [13] and used as an analytical tool in the early 1960s by Ashby (1964) until now. The equation formula for Shift Share analysis is as follows:

$$D_{ij} = N_{i,j} + M_{i,j} + C_{i,j}$$

1. National growth is obtained from the formula :

$$N_{i,j} = E_{i,j} \cdot rn$$

2. Industry mix obtained from:

$$M_{i,j} = E_{i,j} (rin - rn)$$

3. Competitive advantage is obtained :

$$C_{i,j} = E_{i,j} (rij - rin)$$

Information:

- I = ornamental fish commodity i in the district;
 j = Subdistrict regional variable (variable);
 Dij = change (delta) of ornamental fish i in the regency;
 Nij = growth (national shift) of ornamental fish i in the regency;
 Mij = mix (proportional shift) ornamental fish i in the regency;
 Cij = competitive advantage (differential shift) of ornamental fish i in the regency;
 Eij = total population of ornamental fish i in the regency;
 rij = growth rate of ornamental fish i in the regency;
 rin = growth rate of ornamental fish i in the Subdistricts;
 r = growth rate of ornamental fish population in the regency.

There are two indicators from the calculation of shift share analysis of the leading sector or commodity of a region, namely:

- i) If the value of the proportional shift component of a commodity ($M_{i,j}$) > 0 , then commodity i in that region is experiencing rapid growth and has a positive influence on the growth of the reference area, and vice versa.
- ii) If the value of the differential shift ($C_{i,j}$) > 0 , then commodity i in region j has a higher competitive advantage over the reference region, and vice versa.

Growth characteristics can simply be determined by a combined analysis of the LQ and Shift Share methods. A commodity can be said to be superior if it has an $LQ \geq 1$ and a value ($M_{i,j} + C_{i,j}$) on Shift Share ≥ 1 .

3. RESULTS AND DISCUSSION

3.1 LQ Analysis Results

The following are the 5 highest values from the LQ calculation. The results of the calculation of the average LQ value for each ornamental fish commodity in each Subdistricts in Bogor Regency show that cardinal tetra ornamental fish with a large LQ value of 35.78 is leading in the Gunung Sindur area, molly is leading in Sukamakmur with an LQ value of 20.20, oscar ornamental fish excels in the Ciomas area with an LQ value of 14.10, leading discus fish in the Subdistrict Gunug Sindur with an LQ value of 11.69 and platis excels in the Tajurhalang area with an LQ value of 10.11. More complete explanation can be seen in Table 1.

3.2 SS Analysis Results

Analysis of the results of the calculation of the Shift Share value on ornamental fish commodities in each Subdistricts in Bogor Regency can be concluded that betta fish commodities have fast and competitive growth in the areas of Cibinong, Ciampea, Tenjolaya, Megamendung, Nanggung. Koi ornamental fish excel in Cibinong and Kemang seen from their fast and competitive growth. Mas chefs excel in the Subdistrict of Cibinong, Ciampea Ciseeng, Tenjolaya and Kemang. Corydoras ornamental fish commodity is superior in the Subdistrict of Cibinong, Ciseeng, Rancabbungur, Tenjolaya, Kemang and Megamendung. Rainbow ornamental fish have fast and competitive growth

in Cibinong, Ciseeng, Tenjolaya and Kemang areas. Black Ghost also excels in the Ciseeng, Rancabungur, Tenjolaya and Kemang areas. Neon tetra ornamental fish excel in the Cibinong, Ciseeng and Kemang areas. Read nose tetra has rapid growth in Cibinong, Ciampea, Ciseeng and Tenjolaya, but lacks a competitive advantage in these areas. The discus ornamental fish is superior in the Cibinong, Ciseeng and Kemang areas. The manfish commodity seems to be growing fast and competitive in the Cibinong and Ciseeng areas. Similarly, guppy ornamental fish that excel in the same area as manfish, namely Cibinong and Ciseeng. Barbus fish and silver dollar fish commodities both grew fast in Cibinong, Ciampea, Ciseeng, Tenjolaya and Kemang, but were competitive in different areas, barbus in Pamijahan and silver dollar in Ciomas and Tajurhalang. The Oscar ornamental fish commodity is superior in the Subdistrict of Ciampea, Ciseeng, Rancabungur and Tenjolaya. Ctenophoma ornamental fish only grows fast in Cibinong Ciseeng and Kemang, but does not have a competitive advantage in any area. Similarly, ornamental fish platis which only grows fast in Cibinong, Tenjolaya, Kemang and Nanggung. Other ornamental fish commodities

only excel in Cibinong, but grow fast in several other areas. More complete explanation can be seen in Table 2.

3.3 Data Analysis

A ornamental fish commodity can be said to be leading if it has an LQ value ≥ 1 and a value $(M_{i,j} + C_{i,j})$ in Shift Share ≥ 1 . The priority criteria for determining the leading commodity are those that have complete data production. The combination of the calculation of the LQ and SS values can be seen in Table 3.

From the combination of the results of the LQ calculation with the Shift Share, it can be seen that the betta ornamental fish commodity is superior in the Megamendung and Nanggung areas. Then the goldfish goldfish excels in the Ciseeng and Kemang areas. Megamendung is the leading commodity for Corydoras ornamental fish. Rainbow and Black Ghost ornamental fish commodities excel in Tenjolaya and Kemang. Such as manfish and guppies which also excel in the Cibinong area. While the Oscars were superior in the Ciampea and Ciseeng areas.

Table 1. Leading areas of ornamental fish production

Ornamental Fish Commodities	Featured Base Area	LQ Value
Cardinal Tetra	Gunung Sindur	35.78
Molly	Sukamakmur	20.2
Oscar	Ciomas	14.1
Discus	Gunung Sindur	11.69
Platis	Tajurhalang	10.11

Table 2. Shift share data analysis

Ornamental Fish Commodities	Mij	Cij	Featured Area
Oscar	3.47	42.43	Ciseeng
	5.77	3.14	Ciampea
Corydoras	18.18	307.52	Megamendung
Guppy	100.46	2268.50	Cibinong
Betta	163.33	1594.61	Nanggung
	23.05	1271.69	Megamendung
<i>Black Ghost</i>	1.75	1007.37	Tenjolaya
	8.59	786.07	Ciseeng
	43.06	447.59	Ciampea
<i>Rainbow</i>	57.45	156.63	Kemang
	16.85	653.70	Kemang
	4.74	185.35	Tenjolaya
Manfish	282.57	1763.37	Cibinong
Goldfish	123.59	4268.59	Kemang
	73.66	1495.04	Ciseeng

Table 3. Matrix analysis of the results of the combination of LQ and SS values

Ornamental Fish Commodities	LQ	Mij	Cij	Featured Area
Oscar	1.46	3.47	42.43	Ciseeng
	1.05	5.77	3.14	Ciampea
Corydoras	3.33	18.18	307.52	Megamendung
Guppy	1.02	100.46	2268.50	Cibinong
Betta	5.15	163.33	1594.61	Nanggung
	3.07	23.05	1271.69	Megamendung
Black Ghost	1.07	1.75	1007.37	Tenjolaya
	1.07	8.59	786.07	Ciseeng
	1.29	43.06	447.59	Ciampea
	1.01	57.45	156.63	Kemang
Rainbow	1.27	16.85	653.70	Kemang
	1.21	4.74	185.35	Tenjolaya
Manfish	1.14	282.57	1763.37	Cibinong
Goldfish	1.01	123.59	4268.59	Kemang
	1.34	73.66	1495.04	Ciseeng

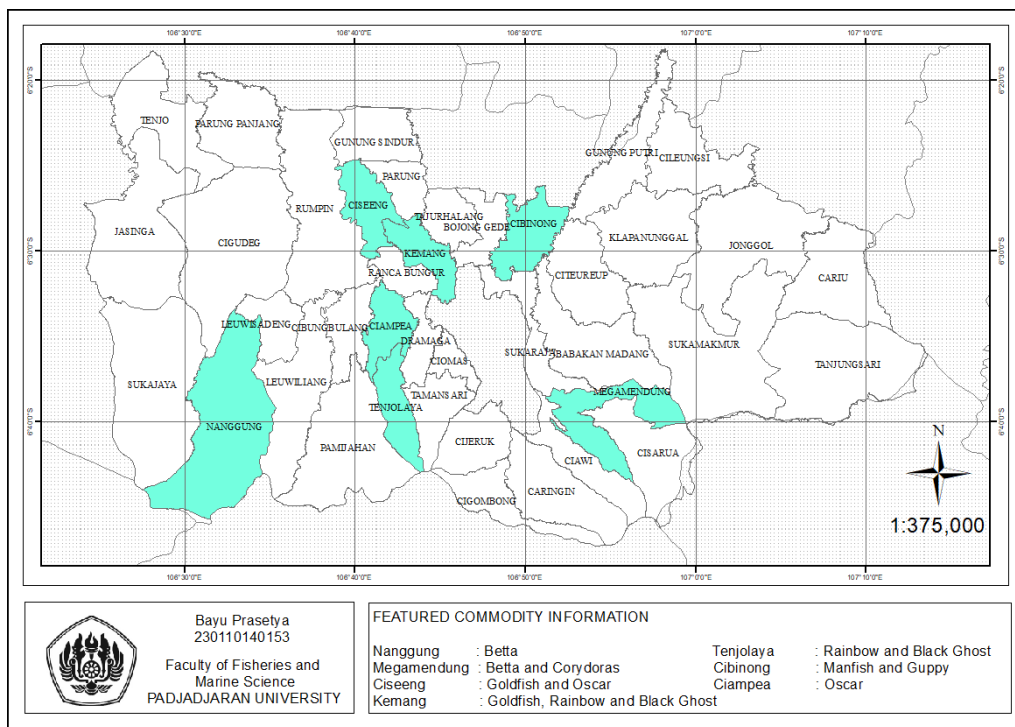


Fig. 1. Map of leading areas of ornamental fish commodity production in bogor regency

From the visualization of the results of the LQ calculation with Shift Share, it can be seen from the map above that the Megamendung and Nanggung areas have a superior commodity, namely betta fish. Then in the Ciseeng and Kemang areas, they have superior commodities of goldfish ornamental fish. Ciseeng Subdistrict also has superior ornamental fish commodities in the form of Oscar ornamental fish commodities. Megamendung is a leading area for corydoras ornamental fish commodities. In Subdistricts

Tenjolaya and Kemang, rainbow and black ghost ornamental fish are the leading commodities. While in the Cibinong area, manfish and guppies are the leading ornamental fish commodities. And finally Ciampea which has a superior commodity, namely Oscar ornamental fish.

4. CONCLUSION

The conclusion of the research on the mapping of ornamental fish cultivation production areas in

Bogor Regency is that the leading ornamental fish commodities in Bogor Regency are Oscar, corydoras, guppies, betta, black ghost, rainbow, manfish and goldfish. The leading areas of ornamental fish production in Bogor Regency are the Subdistrict of Kemang, Megamendung, Tenjolaya, Cibinong, Ciseeng, Nanggung, and Ciampea.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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