# Potential Analysis of Low Economic Value Fish in Lamongan Regency, East Java, Indonesia

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**Abstract.** The purpose of this study was to determine the potential of low commercial value fish species in Lamongan Regency, East Java, Indonesia. The processed data included primary and secondary data. Data were processed using the LQ method and analyzed descriptively by way of compiling data into tables. The survey results showed that there are ten types of low commercial value fish in Lamongan Regency, East Java, Indonesia, namely *Sardinella fimbriata* (Tembang fish), *Leiognathus bindus (*Peperek fish), *Harpadon nehereus* (Puso fish), *Sardinella lemuru*, (Lemuru fish), *Saurida tumbil* (Beloso fish), *Gerres abbreviatus* (Kapasan fish), *Anodontostoma chacunda* (Juwi fish), and *Cynoglossus lingua* (Lidah fish). The results of the LQ method showe that there are three types of fish that have the potential to be made of high economic value products, namely *L. bindus* (11.36), *A. chacunda* (2.35), and *S. fimbriata* (2.32). Fish Auction (TPI) that has the potential in terms of fish productivity to be developed is TPI Weru, Lamongan, East Java, Indonesia. The typology of fishermen in TPI Weru has less experience working as a fisherman than other TPI but the level of education is higher and the age of fishermen is younger so that it affects the productivity of fish catches.

**Keywords:** Method of location quotient, trash fish, typology of fishing

## 1 Introduction

Lamongan is one of the regencys in East Java, Indonesia astronomically located on 6°51'54" to 7°23'6" south latitude and between 112°4'41" to 112°33'12" east longitude. Sea sector fisheries production in Lamongan regency, East Java, Indonesia has increased

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every year. Production in 2014, 2015, 2016 and 2017 was 71 553 t, 72 346 t, 73 142 t and 73 356 t [1]. Lamongan as one of the minapolitan areas in East Java, Indonesia [2, 3].

Fishing by fishermen is not only fish with high economic value but many fishermen accidentally catch fish or by catch with low economic value commonly called trash fish [4]. Utilization of trash fish to date has only been used as raw material for animal feed. In fact, trash fish has the potential to be used as food with higher economic value [5] because of its relatively high protein content.

Identification of trash fish potential can be done with several methodes. One method that can be used is location quotient (LQ). LQ is one of the methodes commonly used in the basic economic model that presents a relative comparison between the ability of one sector between the regions investigated with the ability of the same sector in a wider region. The LQ method is one of the methodes commonly used in the basic economic model as a first step to understanding the activity sectors that are driving growth. This method presents a relative comparison between the ability of a sector in the area being investigated with the same ability in a wider area. The unit used as a measure to produce the LQ coefficient is the amount of labor, production, or other units that can be used as criteria [6]. The LQ mathematical formula is stated as follows in Equation (1).

$$LQ = \frac{Si/S}{Ni/N} \tag{1}$$

Description:
LQ : Location quotient value
Si : Number of sectors i in an area
S : Total number of sectors in a region
Ni : Number of sectors i in the reference area
N : Total number of all sectors in the reference area

The formulation of LQ will provide alternative values ie LQ > 1, LQ < 1, and LQ = 1. If using production value as material consideration in calculating LQ, then:

i. LQ > 1, means that the commodity is a base sector. The production of the commodity concerned has exceeded consumption needs in the area where the commodity was produced and the excess can be sold abroad.
ii. LQ < 1, means that the production of these commodities is not sufficient to meet consumption needs in the area concerned and fulfillment is imported from other regions.
iii. LQ = 1, means that the production of the commodity in question is only sufficient for the needs of the local area.

Base economic theory clarifies all economic activities into two sectors, namely the base sector and the non–base sector. Explains that the basis of activity is the activity of a community whose results in the form of goods and services are intended for export out of the community or oriented outward, regionally, nationally and internationally.

While non–base activities are community activities whose results are in the form of goods or services intended for the community itself in the area of the community's economic life.

Each method of analysis has advantages and limitations as well as the LQ method. According to [7], the advantage of the LQ method in identifying the potential of superior commodities is that they are simple, easy and do not require complicated data processing programs. Completion of the analysis is enough with a spread sheet from Excel or the Lotus program, even if the data obtained is not too much you can use a calculator.

The purpose of this study was to determine the potential of low commercial value fish species in Lamongan Regency, East Java, Indonesia. Location of the research are presented in Figure 1.


**Fig. 1.** Location of the research in Fish Auction Sites Lamongan, East Java, Indonesia

## 2 Methods

### 2.1 Data collection techniques

This study was conducted in May 2017 to September 2017. To determine the potential of trash fish was carried out using direct observation method, mapping area, direct interviews in the field and the distribution of questionnaires to fishermen's pillars. in three Fish Auction (TPI – *Tempat Pelelangan Ikan*) Lamongan regency, East Java, Indonesia.

### 2.2 Data and data sources

The type of data collected consists of secondary data and primary data. Primary data obtained directly from the source through the results of observations and interviews in the field. Secondary data were obtained from the Lamongan regency fisheries service, East Java, Indonesia fisheries service.

### 2.3 Data analysis

Data analysis was performed in several stages, namely:

i. Insert data
   Insert data from the results of questionnaires in each TPI in Spreadsheet Ms. Excel.
ii. Calculate the amount of production of each type of fish and the total production of fish caught in each TPI.
   After the data is entered in the spreadsheet then the data is calculated by the amount of production of each type of fish and the total production of fish caught in each TPI. Each was given an S and Si notation.
iii. Calculating the amount of production of each type of fish and the total production of fish caught in Lamongan Regency, East Java, Indonesia.
   Data used to calculate the amount of production of each type of fish and the total production of fish caught in Lamongan Regency, East Java, Indonesia. Each of them is given N and Ni notations.

iv. Calculating the value of LQ
Location Quotient (LQ) is an index to compare the share of fish in each TPI in capture fisheries activities with the total share of these activities in the total activity of Lamongan Regency, East Java, Indonesia. LQ formula with the help of a spreadsheet from Excel so that its value is known. Mathematical formula LQ in Equation (2)

$$LQ = \frac{Si/S}{Ni/N} \quad (2)$$

Description:
LQ : Location quotient value
Si : Number of sectors i in an area
S : Total number of sectors in a region
Ni : Number of sectors i in the reference area
N : Total number of all sectors in the reference area

v. Interpretation of LQ
To be able to interpret the results of the LQ analysis, then:
a. if LQ > 1, it means that there is a surplus of fisheries production in the TPI and the commodity is a base sector;
b. if LQ < 1, it means that fisheries production in TPI is relatively smaller than capture fisheries activities in Lamongan Regency, East Java, Indonesia or the supply of fishery products is not sufficient;
c. if LQ = 1, it means that fisheries production in TPI is equivalent to fishery activities in Lamongan Regency, East Java, Indonesia.

## 3 Results and discussions

Processed data include primary and secondary data. The data obtained were processed using the LQ method and analyzed descriptively by compiling data into tables.

The survey results show that there are ten types of low commercial value fish in Lamongan Regency, East Java, Indonesia, namely *Sardinella fimbriata* (Valenciennes, 1847), *Leiognathus bindus* (Valenciennes, 1835), *Harpadon nehereus* (Hamilton, 1822), *Sardinella lemuru* (Bleeker, 1853), *Saurida tumbil* (Bloch, 1795), *Gerres abbreviatus* (Bleeker, 1850), *Anodontostoma chacunda* (Hamilton, 1822), and *Cynoglossus lingua* (Hamilton, 1822). However, every TPI is not always a landing place for all types of fish. All types of fish with low commercial value are found in TPI Weru while TPI Brondong, Lamongan, East Java, Indonesia and Lohgung, Lamongan, East Java, Indonesia only have two to three types of fish with low commercial value.

The results of interviews of 52 fishermen respondents at the Brondong Fish Auction Place are as in Table 1 below.

**Table 1.** Fish production (kg) in Brondong, Lamongan, East Java, Indonesia

| | *A. chacunda* | *L. bindus* | *C. lingua* | *S. fimbriata* |
|---|---|---|---|---|
| N Valid | 44 | 47 | 26 | 45 |
| Mean | 41.64 | 44.89 | 6.96 | 35.11 |
| Median | 40.00 | 35.00 | 6.50 | 30.00 |
| Minimum | 2 | 10 | 1 | 2 |
| Maximum | 95 | 100 | 20 | 90 |

Information: N = The number of fishermen who catch fish; and Valid = Type of descriptive analysis

Table 1 shows that the average the highest average production in Brondong is *L. bindus* as much as 44.89 kg, *A. chacunda* is 41.64 kg and *S. fimbriata* is 35.11 kg. For more details, as in Figure 2.

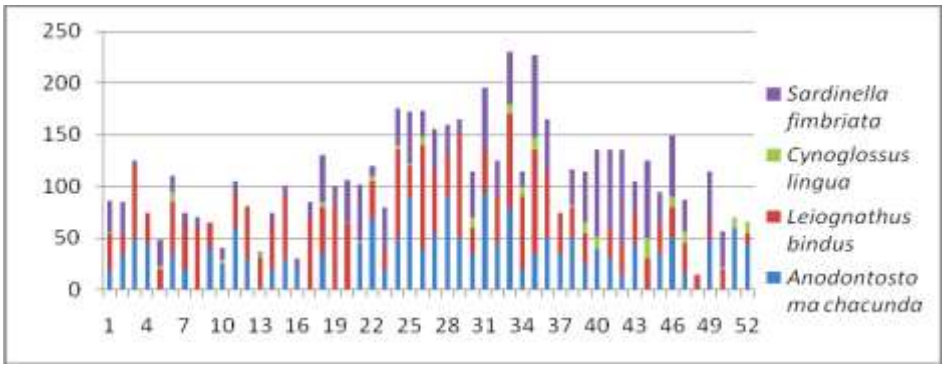


**Fig. 2.** Fish production (kg) in Brondong, Lamongan, East Java, Indonesia

The lowest price of potential low economic value fish in Brondong as in Table 2 below.

**Table 2.** Fish Prices (IDR) in Brondong, Lamongan, East Java, Indonesia

| | *A. chacunda* | *L. bindus* | *C. lingua* | *S. fimbriata* |
|---|---|---|---|---|
| N Valid | 44 | 47 | 27 | 45 |
| Mean | 3 125.00 | 2 297.87 | 10 592.59 | 2 300.00 |
| Median | 3 000.00 | 2 500.00 | 10 000.00 | 2 500.00 |
| Minimum | 2 500 | 2 000 | 10 000 | 1 500 |
| Maximum | 3 500 | 2 500 | 12 000 | 2 500 |
| Sum | 137 500 | 108 000 | 286 000 | 103 500 |

Information: N = The number of fishermen who catch fish; and Valid = Type of descriptive analysis

Table 2 shows that the lowest average price of potential fish with high production in Brondong, namely *L. bindus* is IDR 2 297.87 $kg^{-1}$, *A. chacunda* is IDR 3 125.00 $kg^{-1}$ and *S. fimbriata* is IDR 2 300.00 $kg^{-1}$. For more details, as shown in Figure 3.

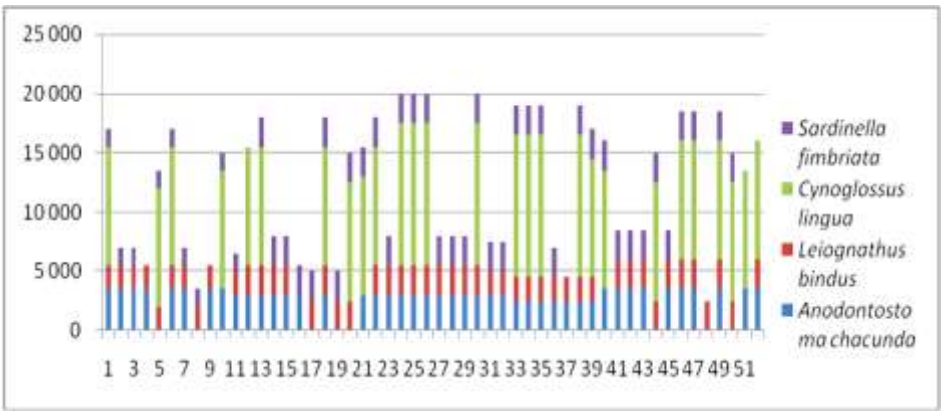


**Fig. 3.** Fish Prices (IDR) in Brondong, Lamongan, East Java, Indonesia

Interviews of 99 fisherman respondents at the Lohgung Fish Auction Area show that *A. chacunda* and *L. bindus* fish production, as in Table 3 below.

**Table 3.** Fish production (kg) in Lohgung, Lamongan, East Java, Indonesia

| | *A. chacunda* | *L. bindus* |
|---|---|---|
| N Valid | 51 | 57 |
| Mean | 8.43 | 7.89 |
| Median | 5.00 | 7.00 |
| Minimum | 2 | 2 |
| Maximum | 50 | 20 |
| Sum | 430 | 450 |

Information: N = the number of fishermen who catch fish; and Valid = type of descriptive analysis

Table 3 shows that the average fish production in Lohgung is *L. bindus* amounted to 7.89 kg and *A. chacunda* as much as 8.43 kg. For more details, as in Figure 4.

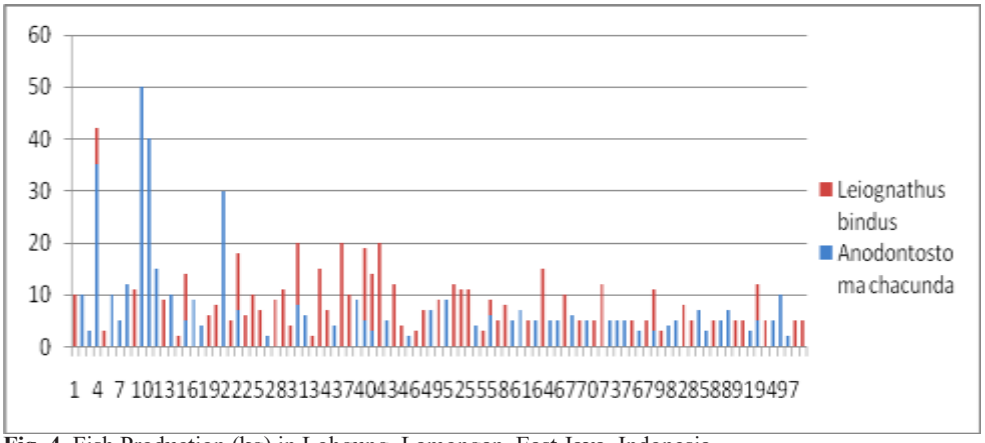


**Fig. 4.** Fish Production (kg) in Lohgung, Lamongan, East Java, Indonesia

The lowest price of potential low economic value fish in Lohgung as in Table 4 below.

**Table 4.** Fish Prices (IDR) in Lohgung, Lamongan, East Java, Indonesia

| | *A. chacunda* | *L. bindus* |
|---|---|---|
| N Valid | 55 | 84 |
| Mean | 3 500.00 | 2 000.00 |
| Median | 3 500.00 | 2 000.00 |
| Minimum | 3 500 | 2 000 |
| Maximum | 3 500 | 2 000 |
| Sum | 192 500 | 168 000 |

Information: N = The number of fishermen who catch fish; and Valid = Type of descriptive analysis

Table 4 shows that the lowest average price of fish in Lohgung is *L. bindus* i.e. IDR 2 000.00 $kg^{-1}$, and *A. chacunda* is IDR 3 500.00 $kg^{-1}$. For more details, as in Figure 5.

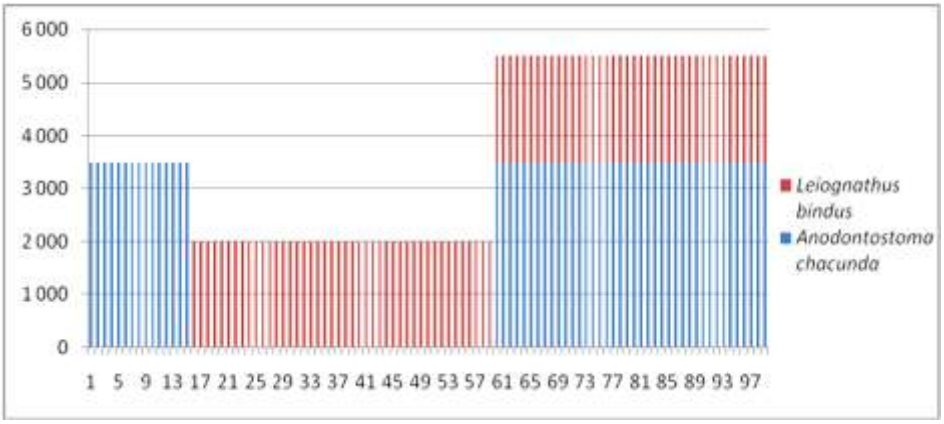


**Fig. 5.** Fish Prices (IDR) in Lohgung, Lamongan, East Java, Indonesia

The results of interviews of 58 fishermen respondents at the Weru Fish Auction Place show that the production of ten types of fish, as in Table 5 below.

**Table 5.** Fish production (kg) in Weru, Lamongan, East Java, Indonesia

| | *A. chacunda* | *L. bindus* | *H. nehereus* | *S. lemuru* | *S. tumbil* | *G. abbreviatus* | *S. fimbriata* | *C. lingua* | *A. albimaculosus* | *P. arsius* |
|---|---|---|---|---|---|---|---|---|---|---|
| N Valid | 28 | 28 | 19 | 4 | 2 | 2 | 12 | 1 | 1 | 3 |
| Mean | 35.11 | 38.14 | 12.74 | 8.75 | 16.00 | 16.50 | 17.08 | 30.00 | 30.00 | 12.33 |
| Median | 35.00 | 35.00 | 10.00 | 2.00 | 16.00 | 16.50 | 15.00 | 30.00 | 30.00 | 5.00 |
| Minimum | 2 | 1 | 5 | 1 | 2 | 3 | 5 | 30 | 30 | 2 |
| Maximum | 80 | 80 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Sum | 983 | 1068 | 242 | 35 | 32 | 33 | 205 | 30 | 30 | 37 |

Information: N = The number of fishermen who catch fish; and Valid = Type of descriptive analysis

Table 5 shows that the highest average fish production in Weru namely *L. bindus* by 38.14 kg, *A. chacunda* by 35 kg, and *S. fimbriata* by 17.08 kg. For more details, as in Figure 6.

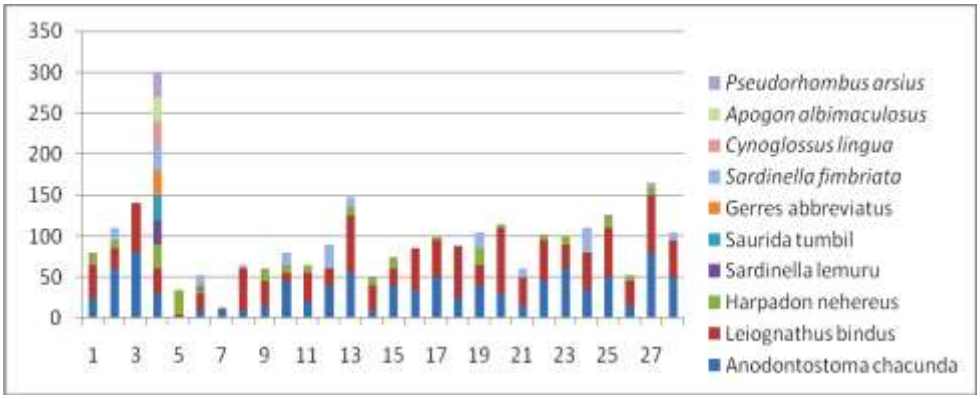


**Fig. 6.** Fish Production (kg) in Weru, Lamongan, East Java, Indonesia

The lowest price of potential low economic value fish in Weru as in Table 6 below.

**Table 6.** Fish Prices (IDR) in Weru, Lamongan, East Java, Indonesia

| | *A. chacunda* | *L. bindus* | *H. nehereus* | *S. lemuru* | *S. tumbil* | *G. abbreviatus* | *S. fimbriata* | *C. lingua* | *A. albimaculosus* | *P. arsius* |
|---|---|---|---|---|---|---|---|---|---|---|
| N Valid | 22 | 22 | 18 | 4 | 5 | 13 | 2 | 18 | 1 | 21 |
| Mean | 1 485.714 | 1 432.143 | 2 659.259 | 571.429 | 640.000 | 914.296 | 652.174 | 1 421.429 | 14.274 | 5 712.143 |
| Median | 1 800.000 | 1 800.000 | 4 000.000 | 2 000.000 | 4 000.000 | 1 800.000 | 7 500.000 | 2 200.000 | 2 000.000 | 8 000.000 |
| Minimum | 1 800.0 | 1 500.0 | 2 500.0 | 2 000.0 | 2 000.0 | 1 800.0 | 5 000.0 | 1 800.0 | 2 000.0 | 3 500.0 |
| Maximum | 2 500.0 | 2 500.0 | 4 500.0 | 10 000.0 | 4 000.0 | 3 000.0 | 10 000.0 | 3 000.0 | 2 000.0 | 20 000.0 |
| Sum | 41 600.0 | 40 100.0 | 71 800.0 | 16 000.0 | 16 000.0 | 25 600.0 | 15 000.0 | 39 800.0 | 2 000.0 | 188 500.0 |

Information: N = The number of fishermen who catch fish; and Valid = Type of descriptive analysis

Table 6 shows that the lowest average price of fish in Weru is *L. bindus* which is IDR 1 432 143 $kg^{-1}$, *A. chacunda* is IDR 1 485 714 $kg^{-1}$, and *S. fimbriata* amounting to IDR 652 174 $kg^{-1}$. For more details, as shown in Figure 7.

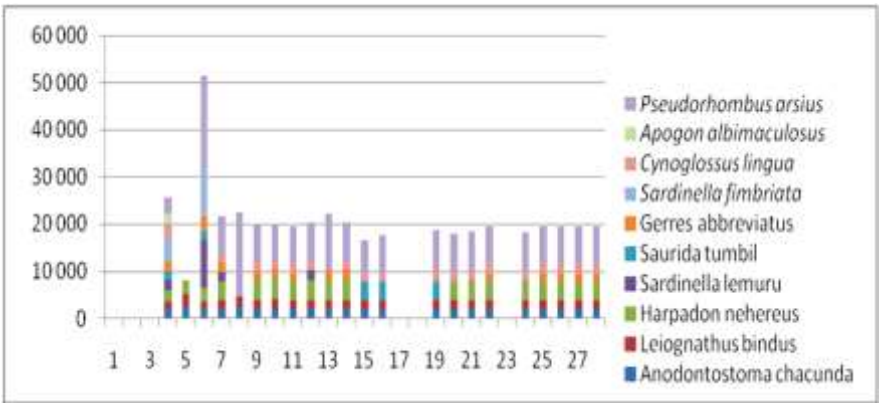


**Fig. 7.** Fish Prices (IDR) in Weru, Lamongan, East Java, Indonesia

From the interviews and the Lamongan regency, East Java, Indonesia fisheries service the LQ method calculation results can be calculated in Table 7.

**Table 7.** LQ Calculation results for each fish type in TPI Lamongan Regency, East Java, Indonesia

| Type of Fish | LQ Value | | |
|---|---|---|---|
| | Weru fish auction place | Brondong fish auction place | Lohgung fish auction place |
| *A. chacunda* | 2.35 | 0.05 | 2.07 |
| *L. bindus* | 11.36 | 0.24 | 9.56 |
| *H. nehereus* | 0.14 | – | – |
| *S. lemuru* | 0.11 | – | – |
| *S. tumbil* | 0.03 | – | – |
| *G. abbreviatus* | 0.03 | – | – |
| *S. fimbriata* | 2.32 | 0.12 | – |
| *C. lingua* | 0.00 | – | – |
| *A. albimaculosus* | 0.03 | – | – |
| *P. arsius* | 0.20 | – | – |

Table 7 shows the highest LQ value or more than one for the type of fish in each TPI namely *L. bindus* (11.36) at TPI Weru and *L. bindus* (9.56) at TPI Lohgung, *A. chacunda*

(2.35) at TPI Weru and *A. chacunda* (2.07) at TPI Lohgung, and *S. fimbriata* (2.32) ) in TPI Weru, while others whose value LQ < 1. [7] states that if the LQ value is greater than one then the base sector. This means that the three types of fish are the base sector in the class of fish species with low commercial value. In accordance with statement [8] which states that if the LQ value is more than one then the commodity is the base sector and the production of the commodity concerned has exceeded consumption needs in the area where the commodity was produced and the excess can be sold abroad or utilized as other products with value high economy. Besides these three types of fish are also habitats in the northern waters of Java. [9], said that the villagers of Weru, Paciran have a very high dependence on marine products. According to [10], TPI Weru has waters with broader coral reefs. The trash fish species are mostly demersal/reef fish species so that they are commonly found in the waters of TPI Weru. TPI Brondong is a high commercial fish auction center while TPI Lohgung is a center for rebon and anchovy production. Mangroves are breeding places for shrimp and rebon, while the waters in the Lohgung TPI area are overgrown with mangroves. This is why TPI Lohgung is the center of *Mysis relicta* (rebon or Zooplankton with a length of 1 cm to 1.5 cm and used for making shrimp paste) and *Stolephorus* sp. (anchovy with a body length of about 145 mm to 5 cm) production.

Based on the results of calculations using the LQ method it can be seen that the types of fish with more than one LQ value have the potential to be utilized as fishery products with high commercial value. In addition, it can be seen that the TPI that has the potential to develop fisheries results is the TPI Weru because there is more raw material supply than the others.

Fishermen's background also affects the productivity of the fish produced. The results of typology survey of fishermen can be seen in Table 8. Based on Table 8, it can be seen that fishermen in TPI Lohgung work as fishermen longer (21.60 yr) compared to other TPI. The fishermen in TPI Weru are younger (42 yr) compared to other TPI. Age greatly affects productivity. The more age a person has, his productivity will decrease. This can be seen in the LQ value of fish species in TPI Weru which is higher than the others. In addition, it is also in accordance with the statement [11, 12] which states that the age of the workforce is sufficient to determine success in doing a job, both physical and non–physical in nature. In general, older workers have weak and limited physical labor, whereas young workers have strong physical abilities.

**Table 8.** Fisherman Characteristics of each TPI in Lamongan Regency, East Java, Indonesia

| Criteria | Fish auction place | | |
|---|---|---|---|
| | **Weru** | **Brondong** | **Lohgung** |
| Length of work (yr ) | 17.44 | 21.32 | 21.60 |
| Age (yr) | 42 | 50 | 46 |
| Education | Junior high school | Primary school | Primary school |
| Total of familiy | 4 | 4 | 5 |
| Total income (million) | 2.18 | 2.60 | 1.01 |
| Catching tool | payang, nets, purse seine | Fishing line | Purse seine, payang, dogol |
| Type of boat | Motor boat | Outboard motor | Motor boat |

In addition, the educational background of fishermen in TPI Weru is higher than the others. Education level also affects productivity. [13] states that there are several factors that affect one's productivity, namely the level of education and expertise, working conditions, type of technology, health, mental attitude, incentive systems, and job satisfaction. According to [14], people who have higher formal or informal education will

have broader insight. The high awareness of the importance of productivity, will encourage the relevant workforce to take productive actions.

The highest amount of income is found in fishermen in TPI Brondong (2 600 000) compared to the others. This is because TPI Brondong is the largest fish landing center in Lamongan, thus affecting the income of fishermen with the amount of capture fisheries production reaching ± 100 t $d^{-1}$ compared to other TPI which only reaches 10 t $d^{-1}$. In addition, the Brondong TPI is also a fish trading center with high commercial value, thus affecting the income of the fishermen in the TPI Brondong.

The fishing gear used varies in TPI Weru using the payang, net, and purse seine. TPI Brondong uses fishing gear such as in Lampung, Indonesia bay waters [15], while TPI Lohgung uses purse seine, *payang* and *dogol* fishing gear. *Payang* fishing gear is a trawl bag used to catch hordes of surface fish (pelagic fish) where both wings are used to frighten or surprise and herd fish into the bag like on the Malabero beach in Bengkulu city, Bengkulu, Indonesia [16]. According to [16], the types of fish that are used for catching by Payang are fish that live in groups on the surface layer of water, both in groups of the same type or in different types. The catch is mainly small pelagic fish species such as *Decapterus macrosoma* (Bleeker, 1851), *Selar crumenophthalmus* (Bloch, 1793), *Thunnus alalunga* (Bonnaterre, 1788), *Sardinella fimbriata* (Valenciennes, 1847), *Anodontostoma chacunda* (Hamilton, 1822) [17]. *Dogol* is used to catch types of anchovy and Rebon fish and is widely used by fishermen from TPI Lohgung because it is a center for producing anchovy and Rebon. Purse seine is used to catch pelagic fish species [18]. The types of fish caught purse seine are *Decapterus macrosoma* (Bleeker, 1851), *Selar crumenophthalmus* (Bloch, 1793), *Sardinella fimbriata* (Valenciennes, 1847), *Thunnus alalunga* (Bonnaterre, 1788), *Anodontostoma chacunda* (Hamilton, 1822), and *Scomberomorus sp*. (Lacépède, 1801) fish such as in Fish Auction Center (PPI – *Pusat Pelelangan Ikan*) Pulolampes, Brebes in Central Java, Indonesia. Indonesia [19] and in the Java Sea, Indonesia [20].

## 4. Conclusions

The survey results show that there are ten types of low commercial value fish in Lamongan Regency, East Java, Indonesia, namely *A. chacunda*, *L. bindus*, *H. nehereus*, *S. lemuru*, *S. tumbil*, *G. abbreviatus*, *S. fimbriata*, and *C. lingua*. The results of the LQ method show that there are three types of fish that have avalue LQ > 1 which the haspotential to be a high economic value product, namely *L. bindus* (11.36) in Weru TPI and *L. bindus* (9.56) in Lohgung TPI, *A. chacunda* (2.35) at TPI Weru and *A. chacunda* (2.07) at TPI Lohgung, and *S. fimbriata* (2.32) at TPI Weru. While the other LQ value < 1. TPI that has the potential in terms of fish productivity to be developed is TPI Weru. The fishermen in TPI Weru have less experience working as fishermen than other TPI but the level of education is higher and the age of the fishermen is younger so that it affects the productivity of fish catches. The highest amount of income is found in fishermen in TPI Brondong because TPI is the biggest fish landing center in Lamongan Regency, East Java, Indonesia and is a center for selling fish of high economic value. The fishing gear used in catching fish are *payang*, net, purse seine, fishing line, *dogol.*

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