Purse seine productivity in Lhok Pawoh fishing port, Sawang, South Aceh

A Rahmah1,3*, M Ulfa1, A Damora2,3, R M Aprilla1,3 and M Chaliluddin1,3

1Department of Fisheries Resources Utilization, Marine and Fisheries Faculty, Universitas Syiah Kuala, Darussalam, Banda Aceh.
2Department of Aquaculture, Marine and Fisheries Faculty, Universitas Syiah Kuala, Darussalam, Banda Aceh
3Marine and Fisheries Research Center, Marine and Fisheries Faculty, Universitas Syiah Kuala, Darussalam, Banda Aceh.
*Corresponding Author: alvi rahmah@unsyiah.ac.id

Abstract. The capability of catching from fishing gear can be known from the fishing productivity. The purpose of this study was to calculate the productivity of purse seine vessels in the Fishing Port of Lhok Pawoh, Sawang, South Aceh. This research was conducted from June 10th to July 10th 2019. The method used was a census method by collecting some data such as number of fishing trip (during 2018), species and number of catches, and specification of 15 units of purse seine at Lhok Pawoh fishing port, then the data was analyzed descriptively. The results showed that the material of purse seine at Lhok Pawoh were made of local wood with a vessel size of 23-60 GT, LOA was 16-24.2 meters, breadth was 4-7.5 meters, depth was 1.3-1.9 meters, and main engine power was 90-360 HP. The purse seine at PPI Lhok Pawoh has a length of between 1,100-1,500 meters and a width of 45-100 meters with the number of fishermen ranges between 18-28 people/unit. The total catches of purse seine during the research was 162,116 kg, dominated by skipjack tuna (67.97%). The highest productivity (production/GT) for large pelagic target was 2,458.8 kg/GT, and the lowest one was 209.3 kg/GT. The highest productivity (production/GT) for small pelagic target was 2,630.7 kg/GT and the lowest one was 418.3 kg/GT. The highest productivity (production/trip) for large pelagic target was 3,046.0 kg/trip, and the lowest one was 187.6 kg/trip. The highest productivity (production/trip) for small pelagic target was 2,067.3 kg/trip and the lowest one was 340.2 kg/trip.

1. Introduction
The waters in Lhok Pawoh are part of the Fishery Management Area-572 where these waters have abundant potential fish resources. Dominant fish resources are large pelagic fishes, small pelagic fishes, demersal fishes and shrimps, especially near coastal areas. The utilization rate of small pelagic fish in WPP-R1 572 is 0.6 (yellow indicator) or has not exceeded its sustainable potential. Meanwhile, the utilization rate of large pelagic fish is 1.01 (red indicator) or has exceeded its sustainable potential [1]. Utilization of pelagic fish resources is influenced by the ability to catch a fishing gear [2]. The catching ability of a fishing gear can be determined from the productivity of the catch, which is measured by comparing the production to the fishing effort. Each type of fishing gear has a different fishing method, so the productivity is also different [3]. Productivity fluctuation is influenced by many factors, such as size of fishing vessels, power of engine on fishing vessel, number of fishing trips, and others [4-7].
Based on preliminary observations it was found that purse seines are the fishing gear that has the largest contribution of fish catches (± 85%) at the Lhok Pawoh fishing port. Data on catch per unit of fishing gear at PPI Lhok Pawoh was limited, including data on catches from purse seine. The lack of data and information regarding purse seine fishing gear at PPI Lhok Pawoh causes the productivity of this fishing gear to be not known with certainty, even though the productivity of a fishing gear needs to be studied considering that the size of the productivity value will have an impact on business prospects (purse seine fisheries). The purpose of this research was to describe the current condition of purse seine fisheries and to analyze the productivity of purse seine fishing at Lhok Pawoh fishing port.

2. Material and Methods

2.1. Site and Place
The research was conducted from 10 June-10 July 2019 at the Lhok Pawoh fishing port, Sawang, South Aceh Regency.

2.2. Sampling and Measurement procedures
This research uses a census method by collecting data directly on the number of fishing trips (during 2018), species and number of catches, fishing gear construction, and fishermen from 15 purse seine units found at Lhok Pawoh fishing port.

2.3. Data Analysis

2.3.1. The latest condition of purse seine fisheries in Lhok Pawoh fishing port
Data on purse seine fisheries in the form of production of catches and purse seine fishing units (boats, fishing gear, and fishermen) were analyzed using simple statistics in the form of tables and diagrams.

2.3.2. Productivity of purse seine
The productivity of fishing can be determined by comparing the amount of catch production for one year with the fishing effort in the form of fishing trips and the size of the fishing vessel used. The formula used was [8]:

Productivity per GT = \( \frac{\sum \text{Production of catches}}{\text{Tonnage of fishing vessels}} \) (kg/GT/year)

Productivity per fishing trip = \( \frac{\sum \text{Production of catches}}{\sum \text{Trip}} \) (kg/trip/year)

3. Results and Discussion

3.1. The latest condition of purse seine fisheries in Lhok Pawoh fishing port
The purse seiner at Lhok Pawoh fishing port has an average weight of 38 GT, the Length Over All (LOA) ranges from 16-24.2 meters, width ranges from 4-7.5 meters, and depth range from 1.3-1.9 meters with the main engine power ranges from 90-360 PK (Table 1). The specifications for purse seiner at Lhok Pawoh fishing port are almost the same as those at Kutaraja fishing port, Banda Aceh. The purse seiner at Kutaraja fishing port has an average weight of 40 GT, LOA ranges from 16-28 meters, breadth ranges from 3.5-6 meters, and a depth of 1.4-2 meters with the main engine power ranges from 105-320 HP [9].
Table 1. Specification of purse seiner in Lhok Pawoh fishing port

| No | Name of purse seiner          | GT | Dimension of Ship (m) | Merk of Main Engine | Power of Engine (HP) |
|----|-------------------------------|----|-----------------------|---------------------|----------------------|
|    |                               |    | LOA       | Breadth | Depth |                           |                       |
| 1  | KM. Cahaya 03                 | 60 | 22.7      | 7.5     | 1.8   | Mitsubishi               | 360                   |
| 2  | KM. Cahaya 05                 | 43 | 24.2      | 5.5     | 1.5   | Mitsubishi               | 165                   |
| 3  | KM. Cahaya 07                 | 35 | 16        | 5.2     | 1.7   | Mitsubishi               | 120                   |
| 4  | KM. Mina Maritim              | 28 | 18        | 5       | 1.4   | Yuchai                  | 90                    |
| 5  | KM. Jasa 01                   | 29 | 16.8      | 4.5     | 1.9   | Mitsubishi               | 150                   |
| 6  | KM. Jasa 02                   | 39 | 22.1      | 5.6     | 1.6   | Mitsubishi               | 320                   |
| 7  | KM. BerkahCahaya              | 28 | 21.9      | 5.3     | 1.3   | Mitsubishi               | 160                   |
| 8  | KM. Bintang 701               | 34 | 21        | 5.2     | 1.7   | Mitsubishi               | 160                   |
| 9  | KM. Bintang 702               | 51 | 22.7      | 6       | 1.8   | Mitsubishi               | 160                   |
| 10 | KM. SinarNanggrooe            | 41 | 23.1      | 5.8     | 1.6   | Yuchai                  | 170                   |
| 11 | KM. Po Cut Nuri               | 59 | 27        | 7.3     | 1.5   | Mitsubishi               | 240                   |
| 12 | KM. Nawa                      | 26 | 20        | 5.3     | 1.4   | Mitsubishi               | 160                   |
| 13 | KM. Lumba-LumbaSejati         | 23 | 22        | 4       | 1.7   | Mitsubishi               | 160                   |

Generally, the materials of purse seiner in Aceh are made of wood, including purse seiner in Lhok Pawoh fishing port (Figure 1). The form of purse seiner at Lhok Pawoh fishing port is different from the purse seiner at Idi Rayeuk fishing port, East Aceh. The difference is the size of the wheelhouse and engine room. The purse seiner at Lhok Pawoh fishing port has a larger wheelhouse and engine room than the purse seiner at Idi Rayeuk fishing port. Yustom [10] states that the purse seiner at Idi Rayeuk fishing port has weighed range from 20-42 GT only.

Figure 1. Purse seiner at Lhok Pawoh fishing port

The dimensions of the purse seine fishing gear in Lhok Pawoh fishing port are greater than the general size of purse seine in Aceh, which is between 1,100-1,500 meters long and an average width of 77 meters (Table 2), while based on research [9], the size of purse seine fishing gear in Aceh ranges...
from 600-1,350 meters and an average width of 60 meters. The construction of purse seines at Lhok Pawoh fishing port can be seen in Figure 2.

Table 2. Specification of purse seine in Lhok Pawoh fishing port

| Component       | Material   | Size       | Total       |
|-----------------|------------|------------|-------------|
| Bunt            | PA No.18   | 1 Inch     |             |
| Body            | PA No.18   | 1.5 Inch   |             |
|                 | PA No.15   | 2 Inch     |             |
| Main Body       | PA No.12   | 3 Inch     |             |
|                 | PA No.12   | 4 Inch     |             |
| Selvedge        | PE No.18   | 2 Inch     |             |
| Head rope       | PE No.12   | Ø 0.8 cm   | 1,100-1,500 m |
| Foot rope       | PE No.12   | Ø 0.8 cm   | 1,100-1,500 m |
| Float line      | PE No.10   | Ø 0.7 cm   | 1,100-1,500 m |
| Weight line     | PE No.10   | Ø 0.7 cm   | 1,100-1,500 m |
| Purse line      | PE No.28   | Ø 2.4 cm   | 1,300-1,700 m |
| Bridle          | PE No.18   | Ø 0.7 cm   | 1 m         |
| Float           | Sintetic Rubber | L 16 cm | 1,650-2,700 pc |
|                 |            | Ø outside 9.5 cm |          |
|                 |            | Ø inside 0.8 cm  |          |
| Weight          | Lead       | L 3.3 cm   | 2,200-3,000 pc |
|                 |            | Ø outside 2.8 cm |        |
|                 |            | Ø inside 1.2 cm  |        |
| Purse ring      | Brass      | Ø outside 16.3 cm | 88-120 pc |
|                 |            | Ø inside 15 cm   |          |

In addition, fishermen are the most important component in a fishing operation because the success of a fishing activity depends on the performance and expertise of fishermen [11]. The number of purse seine fishermen per boat at Lhok Pawoh fishing port ranges from 18-28 people. This number is more than the purse seine fishermen in Idi Rayeuk fishing port, which are only around 16-20 people/boat [10]. Revenue sharing uses a profit-sharing system where total profits are deducted by operating costs, then the remainder is divided by the percentage: 5% to the bench, 10% for the captain, 42.5% for boat owners (5% given to engineers), and the remaining 42.5% divided equally among all crew members. The purse seine fishermen of Lhok Pawoh catch fish around the waters of South Aceh to Simeulu, where the distance from the fishing base to the fishing ground is around 60-170 nautical miles with an average duration/trip of about 4-15 days. The fishing operation uses tools in the form of FADs and lights to collect fish and a fishfinder to determine the mass of fish schools and their depth.

The total catch of purse seines during the study was 162,116 kg. Skipjack tuna (Katsuowonus pelamis) was the most dominant species caught with a percentage of 67.97% (Figure 3), then mackarel (Auxis spp.) 16.81%, sardines (Sardina spp.) 7.86%, and the remaining 7.36% was baby tuna (Thunnus spp.), scad (Selar spp.), and salam (Elegatis spp.). The total of skipjack is very much influenced by the availability of fish resources itself and seasonal factors. The availability of skipjack tuna in WPP-RI 572 is still in a safe status because the alleged level of exploitation is still below the optimal stage [12]. Based on the research of [13] in North Aceh waters, generally, skipjack tuna are caught every season, but the catch becomes more during the eastern season (June-August) because the highest sea surface
temperature (SST) occurs in July at 30.10°C. The SST range between 28-30°C is the optimum range for catching skipjack tuna.

![Figure 2. Construction of purse seine in Lhok Pawoh fishing port](image)

**Figure 2.** Construction of purse seine in Lhok Pawoh fishing port

![Figure 3. Total and species of purse seine catch.](image)

**Figure 3.** Total and species of purse seine catch.

### 3.2. Productivity of Purse Seine

Catching productivity is the ability of fishing gear to get the catch (fish resources that are the target of catching) in each fishing effort. Figure 4 shows that the highest productivity value (fish production/GT) for large pelagic was KM. Bintang 701 (2,458.8 kg/GT) and for small pelagic was KM. Lumba-lumba Sejati (2,630.7 kg/GT).

The bigger the ship size, the more catch you get and it will affect to productivity value [7]. The size of the ship is also in line with the size of the engine. However, if it is reviewed based on the size of the ship and the power of the engine, KM. Bintang 701 and KM. Lumba-Lumba Sejati is not the ship with the greatest tonnage and engine power. The large vessels are generally equipped with powerful propulsion engines, capable of carrying more crew members and large nets, as well as accommodating larger catches [14]. It will facilitate the fishing process so that it can indirectly increase the catch. However, there are other factors that are also considered influencing the catch and the productivity value, namely production factors (duration of setting, length of hauling, size of the ship, size of the net, engine power, amount of fuel, number of crew, and number of lamps) and fish resource factor [15].
Meanwhile, the highest productivity (production/trip) of purse seiner for large pelagic fish is KM. Cahaya 03 and for the small pelagic fish target is KM. Po Cut Nuri (Figure 5). Based on the number of operating trips, these ships are not among the ships with the highest number of trips. KM. Cahaya 03 made 25 trips with an average duration/trip of 15 days during 2018, while KM. Po Cut Nuri made 39 trips with an average duration of 7 days. The ship with the highest number of operating trips is KM. Jasa 02 (60 trips), KM. Sinar Nanggroe (60 trips), KM. Jasa 01 (55 trips), and KM. Lumba-lumba Sejati (50 Trips). However, these vessels have relatively smaller productivity (production/trip) values. The amount of fishing trips (number and length of trips) does not necessarily indicate the amount of catch obtained in that year. The more settings and hauling that occur, the greater the opportunity to get fish caught per day or per trip on a purse seiner [16, 17].

**Figure 4.** Productivity (fish production/GT) of purse seiner in Lhok Pawoh fishing port during 2018.

**Figure 5.** Productivity (fish production/Trip) of purse seiner in Lhok Pawoh fishing port during 2018.
Productivity is often considered as a relative index of the abundance of fish stocks in the water. Fish schools are also greatly influenced by the trophic level in these waters. The abundance of phytoplankton will attract fish around the area. It is an indicator for potential fishing ground and increasing the catches [18, 19].

4. Conclusion
Based on the research that has been done, it can be concluded that:
1. Purse seiners at Lhok Pawoh fishing port are made of wood with weight ranges from 23-60 GT, LOA ranges from 16-24.2 m, breadth ranges from 4-7.5 m, depth ranges from 1.3-1.9 m, and the power of the main engine ranges from 90-360 HP. The purse seine fishing gear at Lhok Pawoh has a length of between 1,100-1,500 m and a width of 45-100 m with the number of fishermen per boat ranging from 18-28 people. The total catch of purse seines during the study was 162,116 kg, dominated by skipjack tuna (67.97%), tuna (16.81%), and sardines (7.86%).

2. The highest productivity (production/GT) for large pelagic targets is 2,458.8 kg/GT and the lowest is 209.3 kg/GT. The highest productivity (production/GT) for small pelagic targets was 2,630.7 kg/GT and the lowest was 418.3 kg/GT. The highest productivity (production/trip) for the large pelagic target was 3,046.0 kg/trip, and the lowest was 187.6 kg/trip. The highest productivity (production/trip) for small pelagic targets was 2,067.3 kg/trip and the lowest was 340.2 kg/trip.

Reference
[1] Suman A, H E Irianto, F Satria dan K Amri 2016 Indonesian Fisheries Policy Journal 8 97-110
[2] Nelwan A 2011 *Fish Scientiae* 1 117-137
[3] Lintang C J, I L Labaro, dan A T R Telleng 2012 *Jurnal Ilmu dan Teknologi Perikanan Tangkap* 6 1-9
[4] Iriana D, A M Kahan, R Rostika, S Simpati dan Sunarto 2012 *Depik* 1 131-135
[5] Prasetyo A P, H P Kadarisman, S T Haryuni, P F Rachmawati, Suwarto dan A A Utama 2012 *Jurnal Penelitian Perikanan Indonesia* 18 187-195
[6] Saputra S W, A Solichin, D Wijayanto dan F Kurohman 2011 *Jurnal Saintek Perikanan* 6 84-91
[7] Kisworo R, S W Saputra dan A Ghofar 2013 *Journal of Management Aquatic Resources* 2 190-196
[8] Setyorini, A Suherman dan I Triarso 2009 *Jurnal Saintek Perikanan* 5 7-14.
[9] Triasturi N S 2008 *Pengembangan struktur alternatif kapal pukat cincin di Nanggroe Aceh Darussalam* (Bogor: Institut Pertanian Bogor) p 103
[10] Yustom 2009 *Analisis kapasitas penangkapan (fishing capacity) pada perikanan purse seine di kabupaten Aceh Timur Provinsi Nanggroe Aceh Darussalam* (Bogor: Institut Pertanian Bogor) p 106
[11] Pratama M A D, T D Hapsari dan I Triarso 2016 *Jurnal Sainstek Perikanan* 11 120-128
[12] Zedta R R, P A R P Tampubolon dan D Novianto 2017 *Bawal* 9 163-173
[13] Muklis, J L Gaol dan D Simbolon 2009 *E-Jurnal Ilmu dan Teknologi Kelautan Tropis* 1 24-32
[14] Rizwan, I Setiawan dan R M Aprilla 2011 *Jurnal Natural* 11 24-29
[15] Prisantoso B I dan L Sadiyah 2006 *Jurnal Penelitian Perikanan* 12 33-45
[16] Mardhatillah I, A Damora, A Rahmah, N Nur fistallah and M Muhammad *IOP Conf. Series: Earth and Environmental Science* 348 (2019) 012114
[17] Damayanti H O 2020 *Jurnal Litbang: Media Informasi Penelitian, Pengembangan dan IPTEK* 16 29-42
[18] Anwar K., M Chaliliuddin dan A Rahmah 2017 *Jurnal Ilmiah Mahasiswa Kelautan dan Perikanan Unsyiah* 2 396-405
[19] Aprilla R M, Mustaruddin, E S Wiyono dan N Zubainarni 2013 *Jurnal Teknologi Perikanan dan Kelautan* 4 9-20