Characteristic of purse seine fishing boat in Ambon Island in relation to the safety of fishing activity

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Abstract. The present study analyses the main dimension characteristics of the purse seiner in 4 location of artisanal fishery in Ambon Island in 2017. A total of 28 traditional purse seiners were measured for its length, breadth, and depth as well as identified its material, the shape of stern and bow. Those purse seiners are made of fibre and wood and they have raked bow, meier bow, raked stern and straight stern. The purse seiners measured have main dimensions ranging from 14.00 – 24.00 m (length), 1.50 – 3.90 m (breadth) and 1.00 – 3.15 m (depth). The analysis of main dimension ratio showed that only two of the purse seiners do not have the ratio value within the range of reference values. This result indicated that 26 of 28 purse seiners are good in maneuver, speed, longitudinal strength and stability and thus guarantee safety and successful of fishing operation.

1. Introduction

Ambon city is located in Ambon Island, and this city is the capital of Maluku Province. Some central fisheries are found to distribute at several coastal villages, and all of those are categorized as artisanal fisheries that use a small boat with or without an engine to catch small and large pelagic species.

A fishing boat is a tool used by fishers for transportation to fishing ground, carrier and storage of fish during fishing operation and return to the fishing base. For artisanal fishermen in general, the fishing boat they used is built traditionally without proper technical design and only based on the past experience of the shipbuilder. This experience is inherited from the older shipbuilder to the younger one. In some cases, if the fisher orders a different type of boat, the shipbuilder gets some difficulties to build it since their expertise is based on the experience only [1]. Nowadays, there is regulation from the government that an application to build a new boat must include a document with the blueprint of that boat [2].

In boat design, main dimensions of the boat namely length (L), breadth (B) and depth (D) are very important because the ratio of these dimensions will affect boat speed, maneuver, longitudinal strength and stability of the boat [3]. Up to now, there is no information about main dimensions of purse seiner operating in Ambon Island waters even though this fishing boat contributes most of the small pelagic fishes caught such as Decapterus spp, Selar spp and Rastrelliger spp in Ambon Island waters [4].

In order to develop better fisheries, information about fishing boat especially its stability and safety are needed. This research was conducted to get the information about characteristics of a purse seine fishing boat operated in Ambon Island waters. The characteristic requires consist of the shape of stern and bow as well as the main dimension and their ratio.

2. Materials and Method

This research was carried out in Ambon Island Maluku Province from October to November 2017. As many as 4 villages in the island namely Laha, Hative Besar, Latuhalat and Seri (Figure 1) were chosen purposively to get the information about purse seiner artisanal fishers in Ambon City.
The sample of purse seine fishing boats belong to traditional fishers at those villages were taken randomly and measured. Main dimensions of fishing boat measured were length (L), breadth (B) and depth (D). At the same time, other characteristics of the fishing boat were also observed.

Data collected were analyzed descriptively and presented in the form of table and graph. The ratio of the main dimension was calculated for purse seiner and then compared to the reference ratio according to Iskandar and Pujiati (1995) [6] as seen in Table 1.

**Table 1. Main dimension ratio of purse seiner**

| Range of main dimension ratio for purse seiner | L/B | L/D | B/D |
|-----------------------------------------------|-----|-----|-----|
| L/B                                           | 2.60 – 9.30 | 4.55 – 17.43 | 0.55 – 5.00 |

L/B : length-breadth ratio which influences the resistance and stability of the vessel
L/D : length-depth ratio; the value of this ratio is restricted in classification rules, being a measure of longitudinal strength of the vessel
B/D : breadth-depth ratio can be taken as a stability influencing factor.

### 3. Results and Discussion

Purse seiner (Figure 2) is the most important fishing boat belongs to traditional fishers in Ambon Island. Most of the small pelagic fishes in Ambon Island waters such as *Decapterus* spp, *Selar* spp, *Rastrelliger* spp, and *Auxis thazard* are caught by purse seine operated in this boat [4]. In purse seiner, there is a deck to put purse seine and other fishing gears needed during fishing operation, and under the deck, there is a compartment to store fish caught. There is also winch pole on top of the deck which is used for hauling purse seine. Most of the purse seiner have raked bow even though some have Meier bow and raked stern as well as straight stern

#### 3.1. Main dimension of purse seiner

Totally there are 28 purse seiner boats measured in this research. The dimension of all purse seiner is presented in Figure 3 and the summary of all dimensions is presented in Table 2. Figure 3 shows that the size of purse seiner boat length has more variation than its breadth and depth. Minimum length of the boat
is 14.00 m and the maximum length is 24.00 m. The mean value for length, breadth, and depth are 17.82 m, 3.10 m and 2.04 m, respectively (Table 2).

Figure 2. Purse seiner in Ambon Island

![Purse seiner in Ambon Island](image)

Table 2. Main dimension of purse seiner in Ambon Island

| Main dimension | Minimum (m) | Maximum (m) | Average (m) | Standard deviation |
|----------------|-------------|-------------|-------------|--------------------|
| Length         | 14.00       | 24.00       | 17.82       | 2.20               |
| Breadth        | 1.50        | 3.90        | 3.10        | 0.41               |
| Depth          | 1.00        | 3.15        | 2.04        | 0.52               |

3.2. Main dimension ratio of purse seiner

The ratio of the main dimension in a purse seine boat is very important in relation to safety and successful of fishing operation. This ratio affects purse seiner speed, longitudinal strength, and its stability. A purse seine is active fishing gear, during the operation the boat will encircle the school of fish. Once the school of fish has been circled, the seine will be pulled out of the water. The hauling is conducted at one side of the boat. Thus, the speed and stability of purse seiner are very essential during the fishing. In addition, longitudinal strength of purse seiner is also important when the fishing is conducted at rough sea.
Comparison or ratio between length and breadth (L/B) will affect the maneuver and speed of purse seiner, the ratio between length and depth (L/D) will determine longitudinal strength of the boat and ratio between breadth and depth (B/D) will affect the stability of purse seiner [7, 8].

The ratio among all main dimensions of purse seiner is presented in Table 3 and Figure 4 - 6. Except for one purse seiner, in general, L/B ratios of all purse seiners of traditional fishers operated in Ambon Island are suitable and fulfill the ranged of L/B reference ratio proposed by Iskandar and Pujiati (1995) [6], which should between 2.60 – 9.30. Table 3 summarized all the ratio of the main dimension of purse seiner sampled, whilst Figure 4 shows the ratio between length and breadth (L/B) of the purse seiner where black dash line showing the requirement range of L/B ratio. This figure shows that the length of all purse seiner operating in Ambon Island waters is proportional to its breadth.

As mention earlier the ratio of L/B has an effect on the ability of the purse seiner maneuver and its speed on the sea. The low value of L/B ratio indicates that purse seiner has good ability to maneuver and good stability on the sea but ability to accelerate the speed is reduced and inversely, high L/B ratio of purse seiner means the boat has a good speed but less ability in maneuver and less stable [7]. From all the purse seiner sampled, only one of purse seiner which has L/B value slightly above the maximum reference range value. Close inspection of the data presented in Figure 2 shows that this purse seiner has a smaller size in term of length and breadth i.e. 14.00 m and 1.50 m, respectively.

**Table 3.** Range of ratio of main dimension of purse seiner in Ambon Island

| Comparison | Minimum | Maximum | Average | Standard deviation |
|------------|---------|---------|---------|--------------------|
| L/B        | 4.10    | 9.33    | 5.86    | 1.07               |
| L/D        | 4.55    | 18.0    | 9.27    | 2.57               |
| B/D        | 0.56    | 3.00    | 1.63    | 0.48               |

**Figure 4.** Ratio of L/B of purse seiner in Ambon Island

Comparison between length and depth or L/D ratio of purse seiner is presented in Table 3 and Figure 5. It can be seen from Figure 5 that only one purse seiner (number 19, L/D=18.00) which has L/D ratio outside the reference limit range of 4.55 – 17.43 [6]. A black dash line in Figure 5 shows the L/D ratio range of purse seiner. In other words, the majority of purse seiner used by artisanal fishers in Ambon Island area has a good balance between length and depth. The ratio of L/D influence longitudinal strength of purse seiner. At the reference ranged, this strength is reduced if the value of L/D is high and increased if its value is low [7]. Longitudinal strength of a purse seiner is very important when operated in the rough sea with a high wave.
Figure 5. Ratio of L/B of purse seiner in Ambon Island

The range of ratio between B/D for purse seiner used by artisanal fishers in Ambon Island waters is presented in Table 3 whilst Figure 6 shows the same ratio for all the purse seiner. Values of this ratio ranging from 0.56 – 3.00 which is within the range for purse seiner according to Iskandar and Pujiati (1995) [6], except for the purse seiner number 20 which has slightly higher B/D ratio (0.56) but still within the range requirement.

Figure 6. Ratio of B/D of purse seiner in Ambon Island

The ratio of B/D affects maneuver and stability of purse seiner during the fishing operation. When hauling, all of the processes are done at one side of the purse seiner, so most of the weight will be center at that side. Thus, a purse seiner should have good stability and maneuver to make it balance during the process of hauling. Within the reference range, the high value of B/D ratio indicates that purse seiner has good maneuver and good stability [8].

4. Conclusion
Most of all the purse seiners operated by artisanal fishers in Ambon Island waters have a suitable main dimension for a fishing vessel. Except for two boats, all purse seiners have main dimension ratios within the range of reference values required which indicate good speed and maneuver as well as good longitudinal strength and good stability which means guarantee safety and successful of fishing operation.
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