



Comparison of the Main Dimension of Multifunctional Fishing Vessels in South Buton Regency, Southeast Sulawesi

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ABSTRACT

Multifunctional fishing vessels are fishing vessels that in operation use more than one fishing gear and must be designed in accordance with the function, main dimensions, fishing gear used and standard criteria of Indonesian fishing vessels. This study aims to compare the main size of multifunctional fishing vessels in South Buton Regency, Southeast Sulawesi which will affect the seaworthiness of the ship. Data were analyzed descriptively comparative by comparing the length and width (L/B), the comparison between length and draft (L/D) and the comparison between width and draft (B/D). From the calculation results, it is found that the L/B value is between 7.52 m - 9.19 m and B/D is between 2.67 m - 3.45 m, these values have met the standard criteria for the ratio of the main dimensions of multifunctional fishing vessels in Indonesia. While the L/D value is between 20.00 m - 27.09 m where the value exceeds the standard. Multifunctional fishing vessels in South Buton Regency are feasible to operate and must still anticipate external pressures and the use of fishing gear is in accordance with the concept of blue economy.

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1. Introduction.

Multifunctional fishing vessels are fishing vessels that in operation use more than one fishing gear. These fishing vessels consist of small to large-sized ships or boats made of wood, steel or fiberglass. The type and shape of these fishing vessels differ according to the purpose of the business, water conditions, fishing areas and others.

A ship must comply with construction, design or technical standards to be seaworthy. Thus the ship will be safe in operation so that no unwanted accidents occur (Talley, 2021).

The hull construction on a fishing vessel must have the strength that can support all the loads on the ship and have good stability (Dabit et al, 2020). Finite Element Analysis (FEA) has become a solution to predict from material strengths that cannot

be shown in a logical way and allows designers to see all the academic forces that occur in the model (Yaqin in Dabit, 2020).

With Statistical Energy Analysis (SEA) noise on small fishing vessels can be reduced (Burella, 2021).

The main causes of fishing vessel accidents are crew errors in decision-making and their lack of understanding of vessel stability. This includes operations, vessel modifications, and maintenance (Davis et al, 2019). Loss of stability (LoS) is the main cause of fishing vessel accidents that cause fatalities for fishermen (Domeh et al, 2023). International management-based fishing vessels are needed to ensure bio-economic sustainability (Espino et al, 2014). Therefore, stability damage in particular, the study of survival after accidents is an integral part of the vessel design process, providing life cycle flood risk management for vessels (Vassalos, 2014). As a consequence, ship survival is a relevant attribute for new ship design (Papanikolaou, 2014).

Meta-models are suggested to predict vertical motion characteristics for a given speed and wavelength during the concept design stage. The independent variables are hull size (Δ), main dimensions (L, B, T) (Sayli, 2010). Ship parameters af-

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fecting motion dynamics have been classified into two groups: displacement (Δ) and main dimensions (L, B, T), coefficients defining details of the hull shape (CWP, CVP, LCB, LCF, etc.) (Sayli, 2007).

The people of South Buton Regency have made a multi-functional fishing fleet using hand line and gill net fishing gear, which is environmentally friendly so that it is safe to use and does not disturb the marine ecosystem. The use of this fishing gear is in accordance with the concept of blue economy. In supporting a sustainable blue economy, each country must have the right strategy in balancing economic growth, maritime resource use and optimal environmental utilization (Olteanu & Stinga, 2019). Pollution and overexploitation of resources will result in excessive pressure on marine ecosystems (Koundouri & Giannouli, 2015). In general, economic progress will increase the use of natural resources and will increase environmental depletion and pollution (Sverdan, 2021). The blue economy concept can be seen in its ability to increase the success of sustainable ocean development for the benefit of communities and ecosystems, high monitoring of material values, and policies of the concept (Louey, 2022). Small-Scale Fisheries (SSF) households are the largest group of ocean users (Cohen et al., 2019).

The design of the fishing vessel must be in accordance with its functions such as the main dimensions that are expected, according to the size of the fishing gear used, the type of fish caught and influence to determine the speed of the ship when operating (Nanlohy et al., 2011). Seaworthiness is very influential on the performance of the ship at sea so that the ship's design must be considered and adjusted by the standard criteria for Indonesian fishing vessels (Azis & Iskandar, 2017). Comparison of the main size of the ship is planned to have a reasonable shape and size and not deviate from the provisions so that the ship is seaworthy.

This research has been conducted by (Arpriliani et al., 2017) and (Azis et al., 2017), the results are only on the characteristics of the ship. In this research, the feasibility of the ship will be produced which will be related to the application of the blue economy concept.

The purpose of this research is to compare the main size of multi-function fishing vessels in South Buton Regency, Southeast Sulawesi which will affect the seaworthiness of the ship.

2. Methodology.

The object of this research is a vessel used in the process of multifunctional fishing operations in South Buton Regency. Data collection was carried out using a survey method, namely direct measurement of the main size and shape of the ship, interviews and literature studies. The data were analyzed descriptively comparing the length and width (L/B), the comparison between length and depth (L/D) and the comparison between width and depth (B/D). The results of the calculation of the ratio value of the main dimensions of the ship are then compared with the ratio value (Iskandar & Pujiati, 1995). Comparative values for fishing vessels in Indonesia can be seen in Table 1.

Table 1: Ratio of main dimension values of fishing vessels based on operating methods in Indonesia.

Operation Methods	Ratio of Main Dimensions (M)		
	L/B	L/D	B/D
Encircling Gear	2,60 - 9,30	4,55 - 17,43	0,56 - 5,00
Towed/Dragged Gear	2,86 - 8,30	7,20 - 15,21	1,25 - 4,41
Static Gear	2,83 - 11,12	4,58 - 17,28	0,96 - 4,68
Multipurpose Gear	2,88 - 9,42	8,68 - 17,15	0,53 - 6,09

Source: Authors.

3. Results and Discussion.

a. Main Dimensions of Ship.

Multipurpose fishing vessels in South Buton Regency have various sizes consisting of ship length (L), breadth (B), height (H) and draft (D). The main dimension of the ship can be seen in table 2 below.

Table 2: Main dimension of multifunctional fishing vessels in South Buton Regency, Southeast Sulawesi.

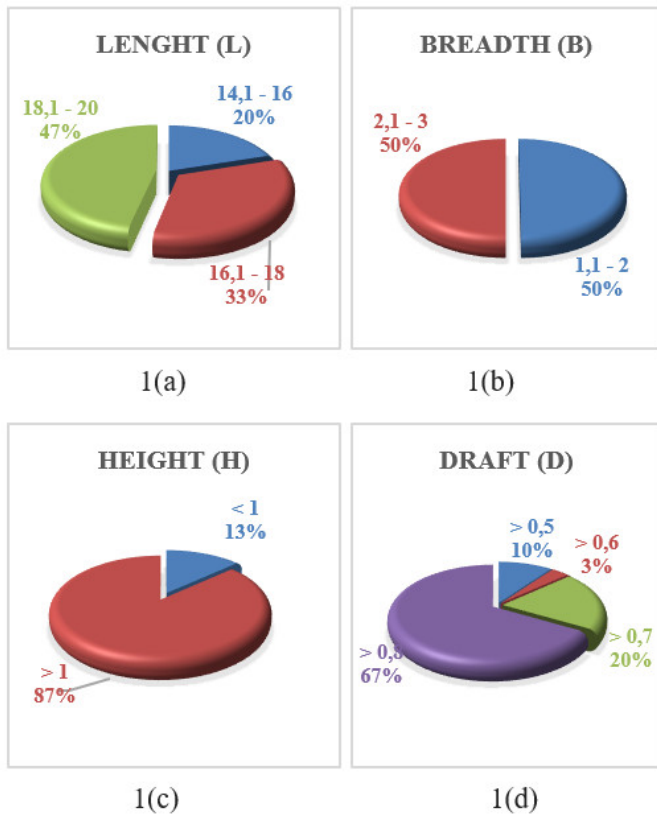
Ship	Main Dimension (M)			
	LOA	BOA	H	D
1	14,9	1,9	0,83	0,55
2	16,1	2	1,1	0,75
3	17	1,85	1,1	0,85
4	17,3	2,3	1,2	0,85
5	18,2	2,7	1,3	0,85
6	18,8	2,3	1,2	0,85
7	18,9	2,5	1,2	0,85
8	19,3	2,45	1,2	0,85
9	20	2,6	1,2	0,86
10	18,5	2,2	1,2	0,85
11	15,8	1,95	1,1	0,7
12	17,5	2	1,1	0,85
13	19,6	2,5	1,2	0,85
14	16,2	2	1,1	0,75
15	14,8	1,9	0,82	0,55
16	16,8	1,95	1,1	0,76
17	19,2	2,4	1,2	0,86
18	19,8	2,5	1,3	0,86
19	18,6	2,2	1,2	0,84
20	15,6	1,85	1,1	0,8
21	14,8	1,88	0,82	0,56
22	17,8	1,98	1,1	0,85
23	20	2,8	2,65	0,86
24	19,4	2,5	1,2	0,85
25	18,8	2,42	1,2	0,85
26	17,6	1,9	1,1	0,84
27	20	2,6	1,2	0,86
28	16,8	1,92	1,1	0,74
29	14,9	1,9	0,83	0,6
30	16,2	1,85	1	0,7

Source: Authors.

In table 2 it can be seen that the length of multifunctional fishing vessels in South Buton Regency is in the range of 14.8 m - 20 m, the width of the ship is between 0.82 m - 2.65 m, the height of the ship is between 0.8 m - 1.2 m, and the laden ship is between 0.55 - 0.86 m.

The percentage of the main dimension of the multifunctional fishing vessels can be seen in the following figure 1.

Figure 1: Percentage of main dimensions of multifunctional fishing vessels.



Source: Authors.

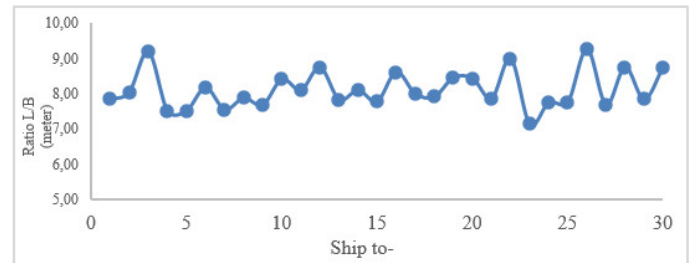
Figure 1(a) shows that 47% of the vessel lengths are between 18.1 m - 20.00 m, 33% are between 16.1 m - 18.00 m and 20% are between 14.1 m - 16.00 m. In Figure 1(b), it can be seen that the breadth of the multifunctional fishing vessel is 50% between 1.1 m - 2.00 m and 50% between 2.1 m - 3.00 m. Figure 1(c) shows that the height of the multifunctional fishing vessel is 87% at a value > 1 m and 13% with a height < 1 m. Figure 1(d) shows that the draft of multifunctional fishing vessels in South Buton Regency with draft > 0.8 m is 67%, > 0.7 m is 20%, > 0.5 m is 10% and > 0.6 m is 3%. So it can be concluded that based on the main dimension of the ship above, the majority of multifunctional fishing vessels in South Buton are categorized as having a large main size.

b. Ratio of Main Dimension L/B.

In ship design, the L/B ratio value is used to analyze the motion and speed of a ship. The smaller the L/B ratio value, the ship will have a good ship's motion but affect the ship's speed,

which becomes slow. The L/B ratio of a multifunctional fishing vessel can be seen in Figure 2 below.

Figure 2: L/B ratio of multifunctional fishing vessels in South Buton Regency.



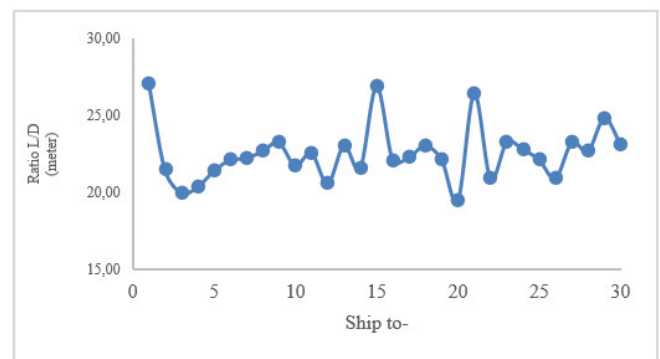
Source: Authors.

From Figure 2 above, it can be seen that the L/B value of multifunctional fishing vessels in the South Buton Regency is between 7.14 m and 9.26 m. Thus, the average L/B value of the vessels is 8.12 m. This value is relatively high, which means that the multifunctional fishing vessels in South Buton Regency have a good ratio of space, but reduce the stability of the ship and the ship's ability to move and have small ship resistance. The L/B of fishing vessels in the South Buton Regency is almost close to the maximum ratio value, therefore it has a slim hull shape and can be operated at high speeds.

c. Ratio of Main Dimension L/D.

The L/D ratio value is related to the longitudinal strength of the ship. The greater the L/D value of a ship, the weaker the longitudinal strength of the ship. The L/D ratio can be seen in Figure 3 below.

Figure 3: L/D ratio of multifunctional fishing vessels in South Buton Regency.



Source: Authors.

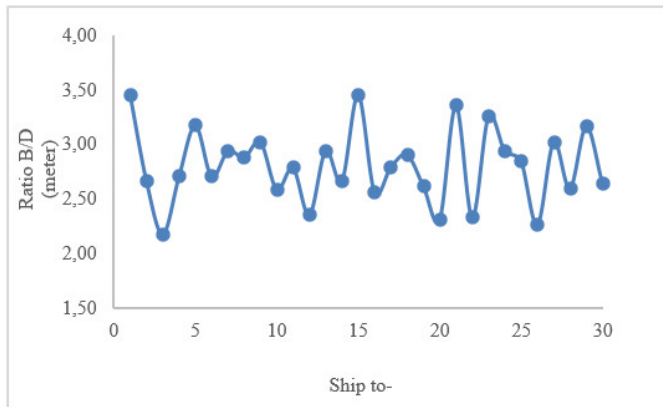
Based on the analysis results in Figure 3 above, the L/D ratio value is between 19.50 m - 27.09 m with an average value of 22.56 m. The average value is far exceeding the predetermined maximum number of 8.68 m - 17.15 m. So that the multifunctional fishing vessels in South Buton Regency have a very weak longitudinal strength, as a result the vessels will easily break if

they get external forces.

d. Ratio of Main Dimension B/D

The B/D ratio value is used to analyze the stability and thrust capability of the ship. The greater the B/D value, the stability of the ship increases, but the thrust of the ship decreases. The B/D ratio is shown in Figure 4 below.

Figure 4: B/D ratio of multifunctional fishing vessels in South Buton District.



Source: Authors.

From Figure 4 above it can be seen that the B/D value is between 2.28 m - 3.45 m with an average value of 2.80 m. The average value is considered low/small because it is closer to the minimum B/D value, although it is still within the limits of the specified value, where the specified value is 0.53 m - 6.09 m. This shows that the fishing vessels have poor stability but the B/D value is still within the limits of the specified value. This shows that these fishing vessels have poor stability but very good thrust.

The results of the above analysis can be seen in table 3 below.

Table 3: Comparison ratio of main dimension of multifunctional fishing vessel.

Dimensions	Ratio (Meter)	Average (Meter)	Criteria
L/B	7,14 - 9,26	8,12	Meet
L/D	19,50 - 27,09	22,56	Does not meet
B/D	2,28 - 3,45	2,80	Meet

Source: Authors.

In Table 3, it can be seen that the L/B and B/D ratios of multifunctional fishing vessels in South Buton Regency have met the standard criteria for the ratio of the main dimensions of multifunctional fishing vessels in Indonesia while the L/D ratio exceeds the standard. Nevertheless, the vessels are suitable for operation but must anticipate external pressures because they have weak longitudinal strength. Henceforth, the construction of multifunctional fishing vessels in South Buton

Regency should follow the rules and under the supervision of BKI, so that the vessels can operate properly and are seaworthy. Thus sea accidents can be minimized.

4. Use of Fishing Gear.

a. Gill net.

Gill net is an environmentally friendly and economical fishing gear because in one operation it can catch several types of fish. The advantages of using environmentally friendly fishing gear include producing quality fish, not harmful to fishermen, production is not harmful to consumers, and does not endanger the marine ecosystem. The use of gill net fishing gear can be seen in Figure 5.

Figure 5: Gill net fishing gear.



Source: Authors.

b. Hand line

Hand line is an active fishing tool, and it is also environmentally friendly. Its operation is relatively simple and does not use many auxiliary tools such as other fishing gear. The hand line fishing gear is shown in Figure 6 below.

Figure 6: Hand line fishing gear.



Source: Authors.

Multifunctional fishing vessels in South Buton Regency in operation are in accordance with the concept of blue economy, namely the fishing gear used in operation is environmentally friendly so that it is safe to use and does not disturb the marine ecosystem. With seaworthiness, this multifunctional fishing vessel can be used throughout the year and can reduce maintenance costs so that it can improve the economy of the people

in South Buton Regency in accordance with the concept of blue economy.

Conclusions.

From the above discussion, it can be concluded that the L/B value is between 7.14 m - 9.26 m and B/D is between 2.28 m - 3.45 m. These values have met the standard criteria for the ratio of the main dimensions of multifunctional fishing vessels in Indonesia. While the L/D value is between 19.50 m - 27.09 m, the value exceeds the standard criteria for the ratio of the main dimensions of multifunctional fishing vessels in Indonesia. These vessels have a slender hull shape, weak longitudinal strength and poor stability. Multifunctional fishing vessels in South Buton Regency are suitable for operation and are in accordance with the concept of blue economy because the fishing gear used in their operation is environmentally friendly so that it is safe to use and does not disturb the marine ecosystem.

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