Edelweiss: Journal of Current Innovation in Educational Research
Vol. 1, No. 1, July 2023, pp. 21-27
E-ISSN: 3021-7717
DOI:
https://journal.mitkomindotama.com/index.php/edelweiss/index

Study of the Main Dimensions of Fiberglass Fishing Boats in the Waters of South Buton Regency

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(1 April 2023; 10 July 2023)

ABSTRACT

Availability of vessel design and capacity according to the wishes of fishermen groups on a small scale, especially in the area of South Buton Regency must be carried out. Taking into account the cost of making ships and the use of fiberglass materials, it is hoped that a ship design will be produced that is for accordance with the wishes of the community. The main ship size study provides many options in choosing ships with different characteristics but having almost the same ship volume. This study aims to identify and compare several main ship sizes that are designed and provide choices according to existing requirements. The results showed that with a ship length of 7 m, width of 1.5 m, and of 0.72 m, the ship would have a resistance of 2.8 kN, a power of 14.22 kW and a displacement of 1464 kg and a surface area of 226854.22 cm2. Meanwhile, with a ship length of 7.25 m, width of 1.5 m, and of 0.70 m, it will have a resistance of 2.9 kN, a power of 14.7 kW and a displacement of 1474 kg and a surface area of 232578.12 cm2. Whereas with a ship length of 7.50 m, width of 1.5 m, and of 0.68 m it will have a resistance of 1.6 kN, a power of 15.22 kW and a displacement of 1481 kg and a surface area of 238195.85 cm2.

KEY WORDS: *Fishing Boats; Main Dimensions; Hydrostatic*

1. INTRODUCTION

To increase the productivity of fishermen in South Buton Regency, it is necessary to be supported by adequate maritime infrastructure. The existing organizational structure of fishermen's groups requires a simple boat design that can answer the needs of fishermen. The use of fiberglass as a ship material is considered suitable because of the high costs when using steel material and the difficulty in obtaining wood material [1]. Fishermen generally get boats from grants or assistance from the government and rarely buy directly due to the large cost factor. It is necessary to increase the human resources of local fishermen to reduce the price of boat production [2]. The condition of fishermen who currently lack boats makes them work for skippers/boat owners because it is seen that this job is the best solution for earning a living [3]. There needs to be an increase in ship infrastructure in the area to reduce existing problems. Making fishing boats usually use materials from wood, iron and fiberglass. But now, fiberglass material is preferred because it has advantages compared to other ship materials, moreover it is supported by a good ship design [4]. Fiberglass ships have lightweight but are strong enough so that the performance of the engine is maximized. In addition, fiberglass materials are more resistant to weathering than wooden ships, so their economic life is also getting longer. Maintenance of boats made of fiberglass is cheaper and easier, making it easier for fishermen to maintain boats [5].

Making a real fishing boat must meet several conditions. The ship must be adjusted to the fishing location and the fishing gear used. The success of a fishing vessel design is if it fulfills 3 (three) main factors, namely seaworthiness, operation feasibility and storage feasibility [6]. These three factors are absolutely considered when designing a fishing vessel. In addition, the characteristics of the fishing area and the local wisdom of the local culture will greatly influence the design of the boats we

make. To operate the same fishing gear, the design of the fishing boat may be different if it is operated in an area that has different regional characteristics or if ship is operated by a different ethnic group. However, these differences in characteristics will not exclude safety and security factors as well as the comfort of the ship to be made [7]. Designing ships should pay attention to the level of economic value in ship operations, especially in relation to determining the engine power used. The engine power is planned according to the magnitude of the resistance force exerted by the water or what is commonly referred to as the ship resistance [8].

There are several methods commonly used to predict the capabilities of the ships we have designed. One of the methods for determining ship resistance is a numerical method. This numerical method uses marine software such as Maxsurf, Freeship, Delftship, and others. In this study, the software used is maxsurf software. This software was chosen because it is easier to use in designing and modeling ships. Ship models that have been designed in Maxsurf Modeler can be calculated on ship performance such as resistance, stability, and ship motion. Calculation of the amount of ship resistance is done by using the Maxsurf Resistance feature. With this feature, we can predict the amount of ship resistance using various existing methods such as the Holtrop method, Van Ootmerssen method, Fung method and others. By knowing the amount of resistance that exists, we can determine the engine power used in the design of the ship so that we can easily determine the ship's engine. We can also calculate the ship's resistance by using the hull speed feature in the Maxsurf Software which has the same calculation value but by inputting a different value.

2. LITERATURE REVIEW

In recent years, research on design analysis and material requirements made of fiberglass has been carried out. [9] examines the design of fishing vessels and fish managers based on optimizing operational costs. This study emphasizes ship design that has minimum operating costs and optimum main size. Furthermore, [10] examines the characteristics of the main dimensions of the beach trawl fishing vessels in Pangandaran. The main object of this research is the ratio of the main size of the ship which can affect the characteristics of the ship to the strength, stability, and shape of the ship after the operation. In addition, [11] examined the study of the design of the purse seine fishing vessel at the fish landing center (PPI) in Ambon city. This study correlates the main size with the coefficient on the ship and the type of fishing gear that must adapt to the oceanographic conditions of the surrounding environment.

3. RESEARCH METHOD

This research is divided into 2 main stages consisting of;

1. Conduct surveys and observations at research locations. At this stage we will collect primary data and secondary data from the object of the research study. The data taken is in the form of the main size of the ship used by fishermen groups. In addition, the method of direct interviews in the field is still used to find out supporting data such as the model of the boat that fishermen want and fishing gear that is in accordance with the existing fishery potential.
2. After the required data is collected, proceed with evaluating the shortcomings of previous ships, then designing ships by providing variations in the main ship sizes but having almost the same ships. Ship modeling and resistance calculations use Maxsurf Modeller and maxsurf Resistance. The application is software that uses a 3-D surface to model the desired design and can be used in engineering fields, especially in the maritime field. [7]

4. RESULTS AND DISCUSSION

The ship model that will be analyzed in the Maxsurf Software is a fishing boat model. Modeling was carried out with the aim of knowing how the shape of the ship's hull and the characteristics of the

part of the ship that is immersed in the water. In this section, there are three variations of ship size models analyzed which have different main sizes but have almost the same displacement magnitude. With so many variations of the main sizes that exist, it can be used as an option to determine the most suitable ship's model. We can see the data on the variation of the ship model in table 3.

Table 1. Principal particulars of ship and model.

Main Particulars	Model 1	Model 1I	Model 1II
Length (cm)	700	725	750
Breadth (cm)	150	150	150
Depth (cm)	72	70	68
Draft (cm)	52	52	52

After ship modeling, the next step is to calculate the ship's resistance. The resistance analysis method used in this study is the Holtrop method, the Van Ootmerssen method and the Fung method. The resistance calculation analysis in this study uses several variations of the main ship sizes so that we can identify the relationship between speed and increasing ship resistance and the relationship between speed and power. We can see the relationship between these three variables in each load in the following figure (1).

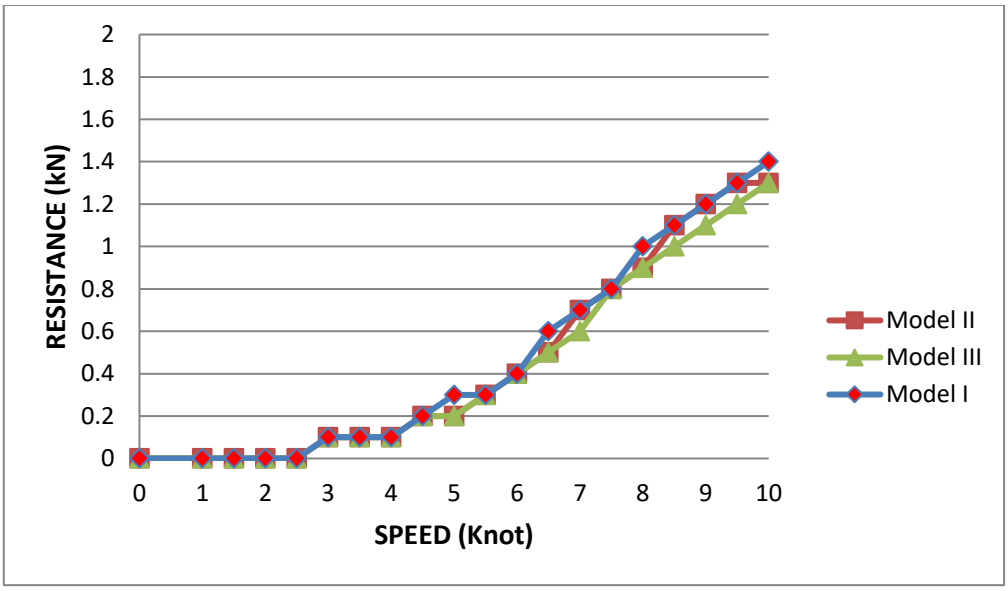

Figure 1. The Resistance Comparison of 3 Ship Models using the Holtrop Method.

Figure 1 shows the relationship between Resistance and Speed, where Resistance is expressed in Newtons (kN) and Speed in meters per second (knots). From the graph, there is an increase in the resistance value in model I, which is greater than the others.

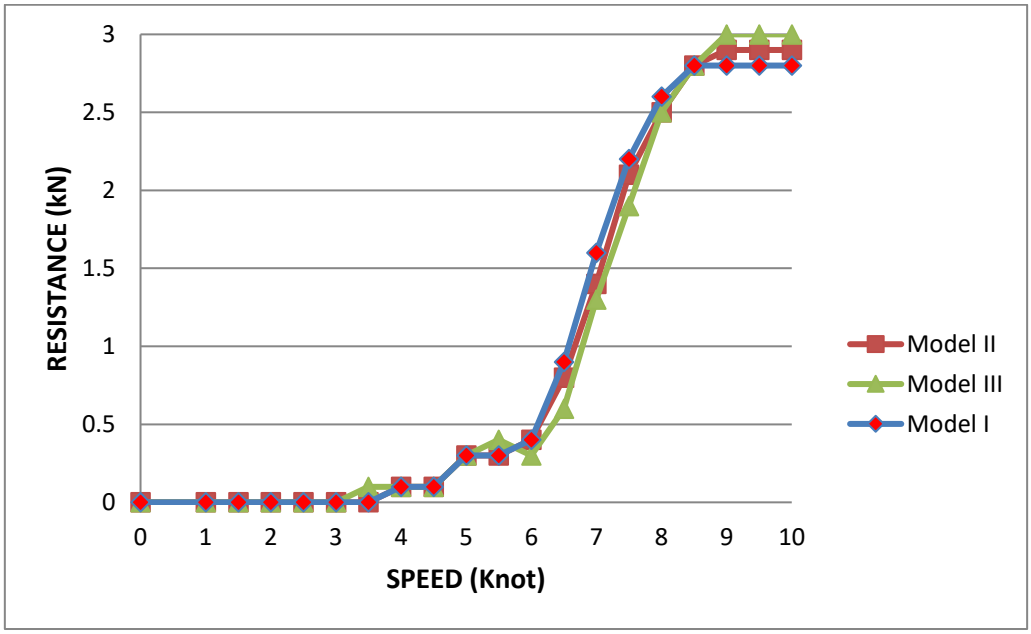

Figure 2. The Resistance Comparison of 3 Ship Models using the Van Ootmerssen Method.

Figure 2 shows that in this method, a significant increase in resistance value occurs from a speed of 6 knots to a speed of 9 knots. While at speeds between 1 knot to 6 knots there is a change in the unstable resistance value.

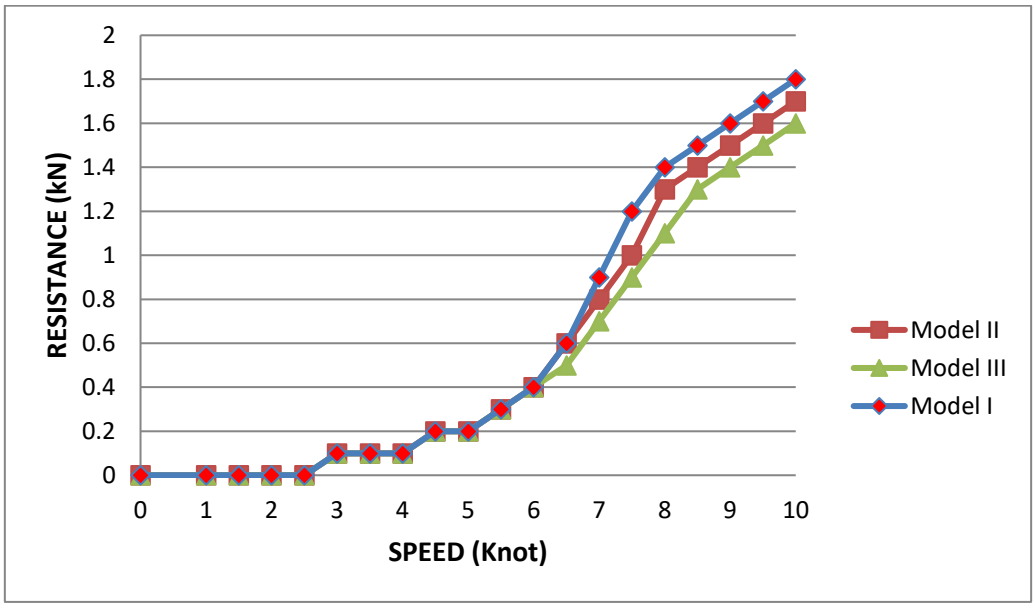

Figure 3. The Resistance Comparison of 3 Ship Models using the Fung Method.

Figure 3 shows that in this method, a significant increase in resistance value also occurs from a speed of 6 knots to a speed of around 10 knots. Whereas at speeds between 1 knot to 5 knots the amount of resistance produced is almost the same. The description of the comparison of resistance can be seen in Figure 4, while the comparison of power and speed can be seen in Figure 5.

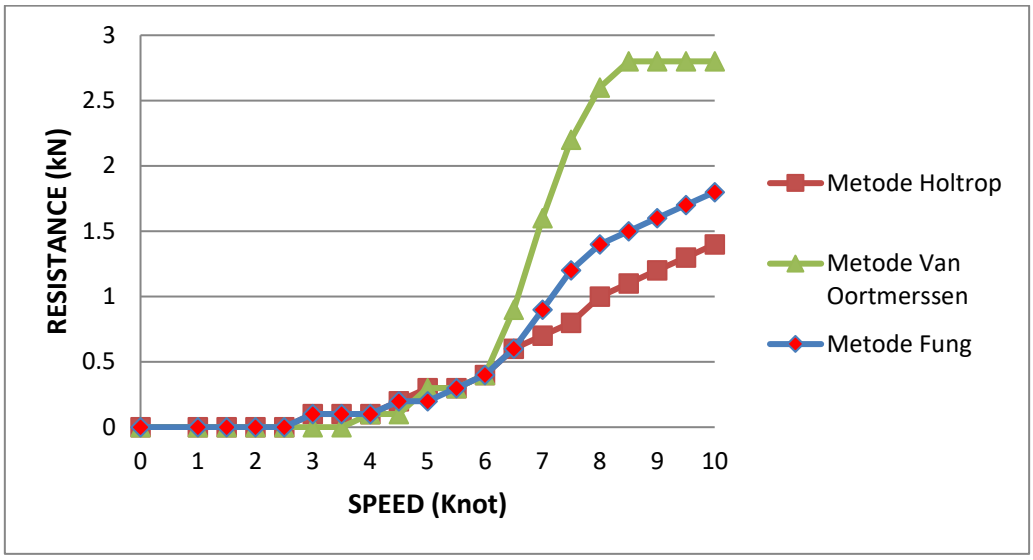

Figure 4. The Effect of Resistance and Speed on Ship Model I.

In Figure 4 it shows that there are three methods used in determining the resistance in this study, namely the Holtrop Method, Van Ootmerssen and the Fung Method. We can see that the development of the largest resistance value is the Van Ommertssen method at speeds of 6 knots to 8 knots. We can see the calculation of ship resistance in each model in table 2.

Table 2. Calculation of ship resistance in each model.

	Model I			Model II			Model III		
speed (knot)	Holtrop kN	Van Ootmerssen kN	Fung kN	Holtrop kN	Van Ootmerssen kN	Fung kN	Holtrop kN	Van Ootmerssen kN	Fung kN
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
1.5	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	0	0	0	0	0
3	0.1	0	0.1	0.1	0	0.1	0.1	0	0.1
3.5	0.1	0	0.1	0.1	0	0.1	0.1	0.1	0.1
4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4.5	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2
5	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.2
5.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3
6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4
6.5	0.6	0.9	0.6	0.5	0.8	0.6	0.5	0.6	0.5
7	0.7	1.6	0.9	0.7	1.4	0.8	0.6	1.3	0.7
7.5	0.8	2.2	1.2	0.8	2.1	1	0.8	1.9	0.9
8	1	2.6	1.4	0.9	2.5	1.3	0.9	2.5	1.1
8.5	1.1	2.8	1.5	1.1	2.8	1.4	1	2.8	1.3
9	1.2	2.8	1.6	1.2	2.9	1.5	1.1	3	1.4
9.5	1.3	2.8	1.7	1.3	2.9	1.6	1.2	3	1.5
10	1.4	2.8	1.8	1.3	2.9	1.7	1.3	3	1.6

We can see that the largest resistance is in the ship model III using the Van Ootmerssen method which has a resistance value of 3 kN at a speed of 10 knots. After calculating the resistance using the

existing method, proceed with calculating the required power on board. We can see the calculation of ship power based on speed in Figure 5.

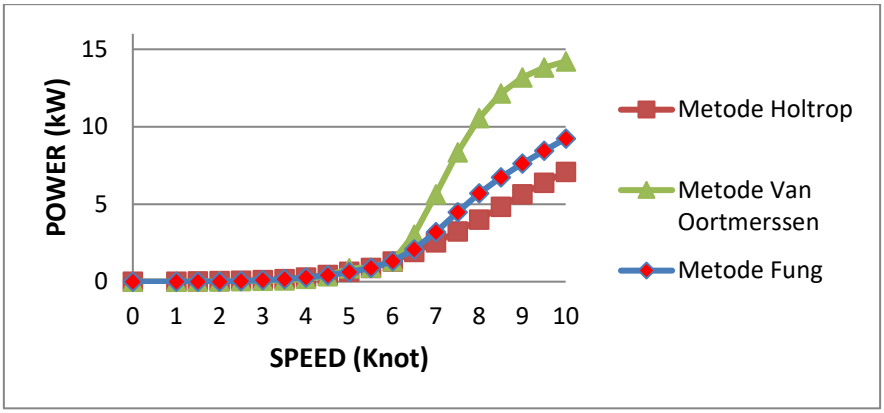

Figure 5. The Effect of Power and Speed on Ship Model I.

Figure 5 shows that there are three methods used in determining the ship's power in this study, namely the Holtrop Method, Van Ootmerssen and the Fung Method. We can see that the calculation of the ship's power is in the Van Ommertssen method at speeds of 6 knots to 10 knots. The ship's power is expressed in the form of (kW) while the ship's speed is in units of knots. The relationship between the calculation of each method in the calculation of ship power in each model can be seen in table 3.

Table 3. Calculation of ship resistance in each model.

	Model I			Model II			Model III		
speed (knot)	Holtrop KW	Van Ootmerssen KW	Fung KW	Holtrop KW	Van Ootmerssen KW	Fung KW	Holtrop KW	Van Ootmerssen KW	Fung KW
0	0	0	0	0	0	0	0	0	0
1	0.005	0.003	0	0.005	0.003	0	0.005	0.003	0
1.5	0.015	0.008	0	0.015	0.008	0	0.015	0.008	0
2	0.033	0.017	0	0.033	0.018	0	0.033	0.018	0
2.5	0.062	0.032	0.048	0.062	0.033	0.048	0.062	0.034	0.048
3	0.105	0.054	0.09	0.105	0.055	0.089	0.105	0.057	0.089
3.5	0.17	0.087	0.159	0.169	0.089	0.156	0.168	0.092	0.153
4	0.267	0.173	0.258	0.264	0.178	0.25	0.261	0.178	0.244
4.5	0.431	0.346	0.409	0.417	0.289	0.395	0.406	0.25	0.382
5	0.645	0.869	0.613	0.628	0.847	0.591	0.612	0.798	0.571
5.5	0.881	0.901	0.876	0.85	0.951	0.837	0.826	1.014	0.803
6	1.292	1.321	1.315	1.208	1.142	1.229	1.141	1.026	1.153
6.5	1.917	3.029	2.082	1.81	2.571	1.902	1.709	2.141	1.745
7	2.545	5.64	3.196	2.419	5.121	2.888	2.297	4.551	2.617
7.5	3.241	8.335	4.476	3.095	7.978	4.046	2.95	7.512	3.663
8	4.005	10.564	5.69	3.837	10.476	5.176	3.668	10.258	4.712
8.5	4.836	12.157	6.735	4.645	12.335	6.175	4.449	12.392	5.663
9	5.632	13.187	7.631	5.477	13.564	7.049	5.312	13.847	6.511
9.5	6.378	13.817	8.444	6.223	14.309	7.851	6.058	14.735	7.297
10	7.089	14.22	9.233	6.928	14.745	8.632	6.756	15.229	8.067

We can see that the biggest power is in ship model III using the Van Ootmerssen method which has a power value of 315,229 KW at a speed of 10 knots. The smallest power value produced is on the ship model III using the Holtrop method, which is to get a result of 6,756 KW.

5. CONCLUSION

Based on the discussion above, it can be concluded that with a ship length of 7 m, width of 1.5 m, height of 0.72 m, it will have a resistance of 2.8 kN, a power of 14.22 kW and a displacement of 1464 kg and a surface area of 226854.22 cm2. Meanwhile, with a ship length of 7.25 m, width of 1.5 m, and of 0.70 m, it will have a resistance of 2.9 kN, a power of 14.7 kW and a displacement of 1474 kg and a surface area of 232578.12 cm2. Meanwhile, with a ship length of 7.50 m, width of 1.5 m, and of 0.68 m, it will have a resistance of 1.6 kN, a power of 15.22 kW and a displacement of 1481 kg and a surface area of 238195.85 cm2.

REFERENCES

S Sudjasta B, Djaya Y. (2017). Design of a 10 Gt Fishing Boat Made of Fiberglass for the Waters Area of Panimbang District, Pandeglang Regency. Build Tech. 2017 Aug 2;11(2):193.

Mustafa W, Asri S, Fachruddin F, Dewa S, Bochary L, Sitepu G, et al. (2019). Enrichment of Fiberglass Small Boat Building Skills for Seaweed Cultivation Micro Business Production Facilities in Jeneponto Regency. J RIGHT Appl Technol J Community Engagem Serv. December 29, 2019;2(2):26–35.

Sulasminingsih S, Setyawan BA, Marasabessy A. (2017). Economic Study of Manufacturing Engineering of Bottom Glass Outrigger Boats from Fiber Glass Materials for Marine Tourism in Banten Village, Kasemen District, Serang City, Banten Province. Build Tech. 20 Dec 2017;13(2):205

Kantu L, Kalangi PNI, Polii JF. (2013). Design and Hydrostatic Parameters of Kasko Fiberglass Ship Type 30 GT Ring Purse at CV Cipta Bahari Nusantara Shipyard, Minahasa, North Sulawesi. J Capture Fisheries Science and Technology [Internet]. 2013 August 29;1(3).

Syahwati NH, Santoso B, Helmi M. (2021). Technical and Economic Calculations for Construction of 3gt Fishing Boats Frp Construction Hand Lay Up Method. SNIT 2021 Oct :65

Azi Muh A, Iskandar BH, Novita Y. (2018). Study of Traditional Purse Seine Ship Design in Pinrang Regency (Case Study of Km. Cahaya Arafah). ALBACORE J Marine Fisheries Researcher. July 27, 2018;1(1):69–76.

Susanto A, Novita Y, Nurdin HS, Dariansyah MR, Supiyono I, Rokhman MS. (2021). Design Characteristics of Static Fishing Boats in the Sunda Strait. Fishing Vessel Research Journal. Jul;8:59

Zulfadli, (2017). Model Prediction of Fishing Vessel Resistance Using Maxsurf and Delftship Applications with Speed Variables on Tensile Testing Equipment. Thesis, Department of Naval Architecture, Faculty of Engineering, Hasanuddin University

Darmawan D.(2017). Design of Fishing and Processing Vessels Based on Optimization of Ship Operations for the Pasuruan Waters. Faculty of Marine Technology, Surabaya Ten November Institute of Technology: Surabaya,.

Apriliani IM, Dewanti LP, Zidni I. (2017). Characteristics of Main Dimensions of Beach Seine Fishing Vessels in Pangandaran. J Airaha. Volume 6(2):048–53

Metekohy O. (2021). Design Study of Ring Trawlers Based at the Fish Landing Center (PPI) Eri Village, Ambon Municipality. Journal of Arika 15(