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CALCULATION OF RESISTANCE AND ENGINE POWER OF PURSE SEINE FISHING BOATS IN TAKALAR REGENCY USING MAXSURF SOFTWARE

Perhitungan Tahanan dan Daya Mesin Kapal Ikan Purse Seine di Kabupaten Takalar Melalui Software Maxsurf

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ABSTRACT

The main factor in determining the power of a ship's main engine is the ship's resistance resulting from the shape of the ship's hull. Calculation of ship resistance can be done using software, namely Maxsurf Resistance, which can simulate the shape of a ship's hull under water. This research aims to determine the total resistance of a purse seine fishing vessel and the power required to move a 30 GT vessel. The design made from this ship model is then analyze to calculate the ship's resistance a nd the required engine power. The ship resistance calculation method uses the Holtrop method. This method is used because the hull of a 30 GT ship is a V-shaped model. From the results of the discussion, it is concluded that ship resistance can be seen from several speed variations produced by looking at the service speed of 30 GT fishing boats in the Takalar Regency area. From this research, the resistance value for speeds of 0-6 knots resulted in a resistance value of 1.4 kN and engine power of 5,861 hp. Then there is a significant need for engine power or power which occurs from a speed of 7 knots to 10 knots because the value of the ship's resistance continues to increase in line with the speed of the ship. At the maximum speed of a 30 GT purse seine fishing vessel of 10 knots, the total resistance of the vessel is 7.4 kN and the engine power required is 50.572 H.

Keywords: Engine Power, Holtrop, Maxsurf, Purse Seine Fishing Boat, Ship Resistance

ABSTRAK

Tahanan kapal yang dihasilkan dari bentuk lambung kapal adalah komponen penting dalam penentuan daya mesin utama kapal. Perhitungan tahanan kapal dapat dilakukan dengan software yang disebut Maxsurf Resistance, yang dapat mensimulasikan bentuk lambung kapal di dalam air. Tujuan dari penelitian ini adalah menentukan besar tahanan total kapal ikan purse seine dan daya mesin yang dibutuhkan untuk menggerakkan kapal 30 GT. Desaian yang dibuat dari model kapal ini kemudian dilakukan perhitungan tahanan kapal dan kebutuhan daya mesin yang dibutuhkan. Metode perhitungan tahanan kapal dalam penelitian ini menggunakan

metode Holtrop metode ini digunakan karena lambung kapal 30 GT yang menjadi model berbentuk V. Dari hasil pembahasan diperoleh bahwa tahanan sebuah kapal yang dilihat dari beberapa variasi kecepatan yang dihasilkan dari kecepatan servis kapal ikan 30 GT di wilayah Kabupaten Takalar bahwa hambatan untuk kecepatan 0-6 knots dihasilkan nilai tahanan sebesar 1,4 kN dan daya mesin atau power 5,861 Hp. Kemudian terjadi kebutuhan daya mesin atau power yang signifikan terjadi dari kecepatan 7 knots menuju 10 knots dikarenakan nilai tahanan kapal yang terus bertambah sejalan dengan kecepatan kapal. Pada Kecepatan maksimal kapal ikan purse seine 30 GT 10 knots menunjukkan tahanan total kapal adalah 7,4 kN dan kebutuhan daya mesin atau power yang dibutuhkan adalah 50,572 H.

Kata Kunci: Tahanan Kapal, Daya Mesin, Maxsurf, Holtrop, Kapal Ikan Purse Seine

INTRODUCTION

A ship is a type of water vehicle of any shape and type that is driven by mechanical power, wind, or wind, including dynamic support vehicles, underwater vehicles, floating devices, and non-moving floating structures. (Law No. 17 of 2008 concerning Shipping).

A fishing vessel is a type of water vehicle used to catch, collect, cultivate aquatic resources, and conduct fisheries research and training. There are several types of vessels based on fishing operations, such as Trawler, Purse Seine, Gill Net, and Tuna Long Line, among others. Therefore, each fishing vessel has different characteristics (Ayodhyoa, 1972).

According to SPTI 2008, most traditional vessels operating on the Indonesian coast are vessels measuring 30 GT and below, which is 80% of all vessels in Indonesia. The shape of the ship's body or hull that is submerged in water is one of the many factors that must be considered and considered by a ship designer when they plan or build a ship. The hull of a ship can affect the amount of resistance on a ship (ship resistance) when the ship moves on the surface of the water. Ship resistance is one of the important things during the ship design process because it affects the operational costs of the ship. The greater the resistance of a ship, the greater the use of main engine power needed to produce ship propulsion and the costs required will be higher (Indriyani & Dwisetiono, 2021).

This is due to the large resistance of the ship which has an impact on the power of the propulsion engine required is also large. The selection of the main engine power on the ship is a very complex problem before or when the ship is operating because it can cause quite large losses (Rachman et al, 2020). In order for the ship to be used optimally, the ship must have good capabilities in carrying out its function as a fishing vessel. One of the factors that affects the ability of the ship is the use of power (horse power, HP) from the appropriate ship's propulsion engine (Pamikiran, 2013).

Traditional fishing vessels built and operated in coastal areas of Indonesia are made in a way that relies on certain methods of skills passed down from generation to generation by ship craftsmen (Sarwoko & Santoso, 2019). In general, fishing vessels made in Takalar are not planned in advance but are only based on experience in making a ship, so that the determination of ship resistance cannot be known. The amount of ship resistance that will be received by the ship cannot be predicted, so the amount of power needed by a ship to reach the desired maximum speed cannot be known and the process of selecting a ship's propulsion engine depends on previous experience. Therefore, the numerical method using maxsurf can be one way to calculate ship resistance (Sugianto et al, 2017).

The purpose of this study was to determine the total resistance of purse seine fishing vessels and the minimum power needed to move a ship at the desired speed for a ship with a capacity of 30 GT which will be analyzed using Maxsurf software.

METHODS

Time and Place of Research

This research was conducted for 5 (five) months, namely May to September 2022. The research was conducted at the traditional shipyard in Takalar Regency. The implementation method is by directly measuring the purse seine fishing vessel at the Shipyard.

Shipping Software

The modeling used in the shipping software/application is the shape of the ship's body immersed in fluid or seawater. The shipping software/application used is Maxsurf resistance software (Maxsurf, 2017).

Research Methods

a. The first stage of the research began by conducting a field survey at a shipyard in Takalar Regency. This survey aims to obtain ship data or the main dimensions of the ship used to determine the resistance and engine power. The ship data used is data from a 30 GT purse seine fishing vessel built in Takalar Regency and the ship has been operating. The following data on the main dimensions of the KM Cahaya Gunawan ship can be seen in table 1:

Table 1. Main Dimensions of the Ship

No	KM Cahaya Gunawan	Size
1.	LOA	21.15 meter
2.	Lwl	19.5 meter
3.	Lbp	18 meter
4.	B	4.24 mater
5.	H	1.41 meter
6.	Cb	0.6
7.	GT	30
8.	Vs	8 knots
9.	HP	290
10.	Brand	Mitsubishi
11.	Number of Engines	2

b. Making a model of a 30 GT purse seine fishing vessel to be studied using Maxsurf Software. The modeling carried out using Maxsurf Software is the part of the ship's body that is submerged in water.

c. Running ship resistance using Maxsurf Software. The resistance will be run at 5 ship speeds, namely 6, 7, 8, 9 and 10 knots to obtain the ideal speed optimization for a 30 GT purse seine fishing vessel

d. After obtaining the total resistance owned by the 30 GT purse seine fishing vessel, from here we can determine the main engine power that is appropriate for the 30 GT purse seine fishing vessel.

RESULTS

Characteristics of the Ship's Hull

The characteristics of the ship's hull include the shapes of the ship's hull which are influenced by the main dimensions of the ship and the coefficients of the ship's hull shape. According to Maulana et al., (2018), stated that the Comparison of good values for ships in

Indonesia refers to the Standard Form of Purse Seine Ship Construction SNI (2006):

a. Comparison between length and width (L/B) A large L/B ratio is suitable for ships with high speeds and has a good room ratio, but the ship's maneuverability and stability are reduced. While for a small L/B ratio will increase the stability capability, but the ship's resistance increases.
b. Comparison between width and depth (B/H) The B/H ratio affects the stability of the ship, a large B/H ratio improves the stability of the ship, while a small B/H price will reduce the stability of the ship. For river ships, the B/T ratio is taken very large, because the T price is limited by the depth of the river which is generally certain.
c. Comparison between length and depth (L/H) The L/H ratio mainly affects the longitudinal strength of the ship. For large L/H values, the longitudinal strength of the ship is reduced and vice versa for small L/H values, the longitudinal strength of the ship will increase.

Table 2. National Standards for Purse Seine Dimensions in Indonesia

	Principal Dimension Ratio		
Standard Form Source for Purse Seine Ship Construction (2006)	L/B 3.10-4.3	L/H 9.11-11.10	B/H 2.10-5.00

Source: SNI 01-7239-2006

Based on the National Standard of Purse Seine Vessel Dimensions in Indonesia that we have compared with the main ship size data used in the study, the vessel does not meet the L/H ratio value with a value of 15.2, which means that the ship's longitudinal strength is lacking or small and the L/B value is 4.97, which means that the ship's maneuverability and stability are lacking.

2. Modeling

The main ship data used in this study which is the reference parameter in making a ship model in Maxsurf is the Cahaya Gunawan Ship built in Takalar Regency with a size of 30 GT. In making a ship model in Maxsurf Software, there is a basic picture of the shape of a fishing vessel, namely the hull of the ship which is in fluid or salt water. This model is a real model of the Cahaya Gunawan ship with a certain scale.

Figure 1 shows the model of the hull of a purse seine fishing vessel submerged in water which is seen from several views or profile views (side), plane (top), body plane (front) and perspective (3D).

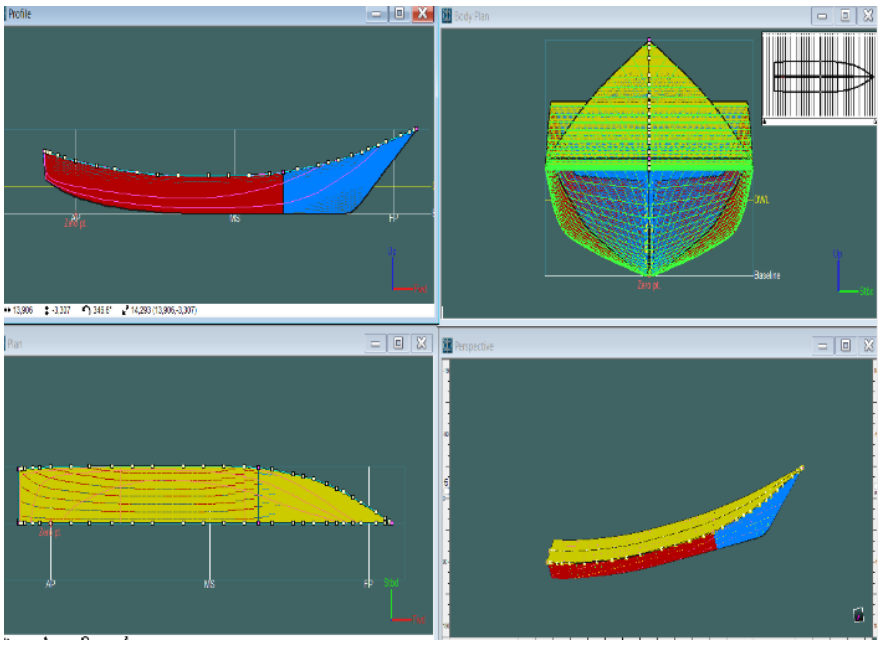

Figure 1. 30 GT Ship Model (Analysis Results, 2023)

DISCUSSION

1. Ship Resistance Calculation

The calculation of ship resistance in Maxsurf Software uses the Holtrop Method. This method is used because the 30 GT ship hull is a U-shaped model. Ships with U-shaped hulls have a larger displacement volume compared to V-shaped hulls. The service speed of 30 GT fishing vessels in Takalar Regency varies from 6 to 10 knots. The table of results of ship resistance calculations with Maxsurf Software shows that at a speed of 6 knots, the ship resistance obtained is 1.4 kN with the power or engine power needed to overcome this resistance of 5.861Hp. At a speed of 7 knots, the ship resistance obtained is 2.2 kN with the power or engine power needed to overcome this resistance of 10.713Hp. At a speed of 8 knots, the ship resistance obtained is 3.5 kN with the power or engine power needed to overcome this resistance of 19.407Hp. At a speed of 9 knots, the ship's resistance obtained is 4.8 kN with the power or engine power required to overcome the resistance is 29.843Hp and at a speed of 10 knots, the ship's resistance obtained is 7.4 kN with the power or engine power required to handle the resistance is 50.572Hp. Based on the results of the analysis, significant changes in power occur from a speed of 7 knots to 10 knots. More complete results of the ship's resistance calculation on Maxsurf can be seen in Table 3 as follows:

Table 3. Calculation of Ship Resistance on Maxsurf Software

No	Speed (kn)	Holtrop Resistance (kn)	Holptrop Power (hp)
1	0	--	--
2	0.5	0	0.004
3	1	0	0.031
4	1.5	0.1	0.097
5	2	0.2	0.221
6	2.5	0.2	0.419
7	3	0.3	0.707
8	3.5	0.5	1.101
9	4	0.6	1.621
10	4.5	0.7	2.297

11	5	0.9	3.175
12	5.5	1.1	4.327
13	6	1.4	5.861
14	6.5	1.8	7.872
15	7	2.2	10.713
16	7.5	2.9	14.753
17	8	3.5	19.407
18	8.5	4.1	24.158
19	9	4.8	29.843
20	9.5	5.8	38.03
21	10	7.4	50.572

The ship's engine power or power obtained from the calculation of the maxsurf software is the effective power of the ship which is influenced by the axis and shape of the ship's hull or the ship's frictional resistance. The calculation of the service area has not been included in the calculation. The following is a trend in the effect of speed on the resistance and power needed to move a ship shown in Figures 2 and 3:

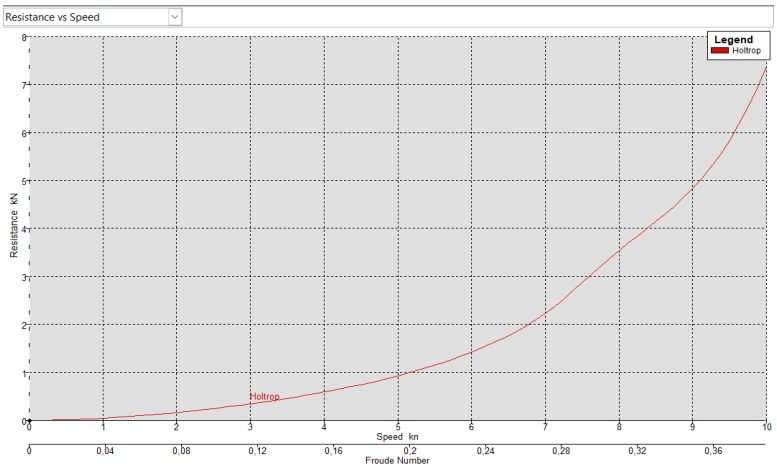

Figure 2. Resistance and Speed (Analysis Results, 2023)

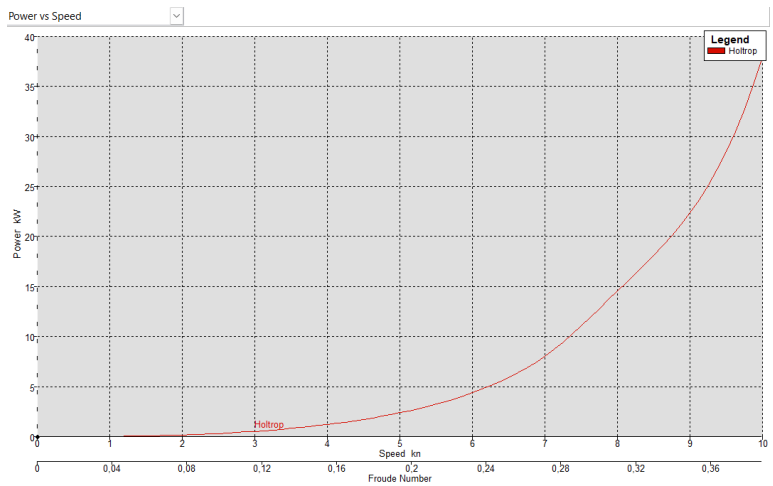

Figure 3. Power and Speed (Analysis Results, 2023)

The line trend in figures 2 and 3 has almost the same speed and power as the ship's speed and resistance, which means that the higher the speed, the greater the ship's resistance is needed

to move a ship. For a ship speed of 10 knots, the ship's resistance is obtained at 7.4 kN with an effective engine power or power needed to move the ship of 50,572 Hp.

2. Ship Wave Shape Moving at Speeds of 6.8 and 10

The wave shape produced by a ship is greatly influenced by the speed of a ship. The faster a ship is, the bigger the waves it produces on the side of the ship's hull. Figures 4, 5 and 6 show the waveform patterns formed due to ship resistance. The images are top-down images when the ship is sailing at a certain speed.

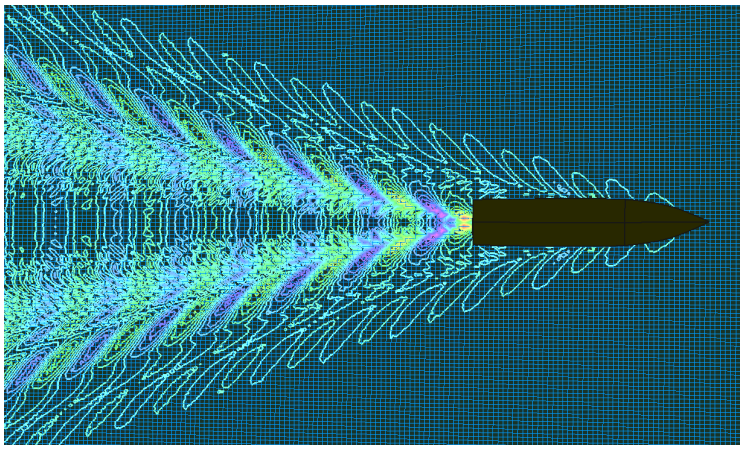

Figure 4. Waveforms Caused by a Speed of 6 Knots (Analysis Results, 2023)

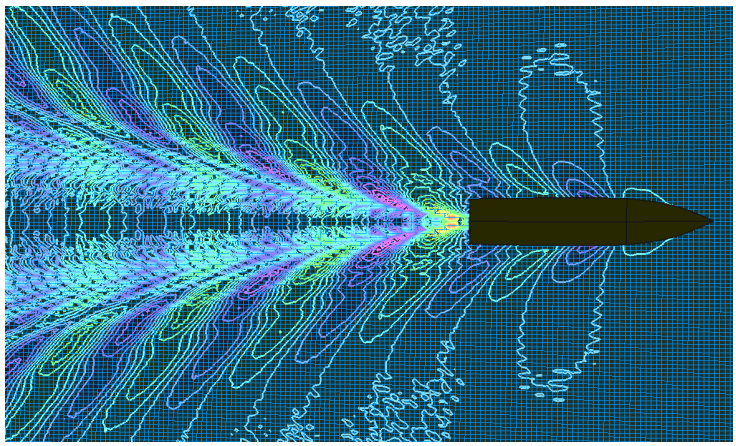

Figure 5. Waveforms Caused by a Speed of 8 Knots (Analysis Results, 2023)

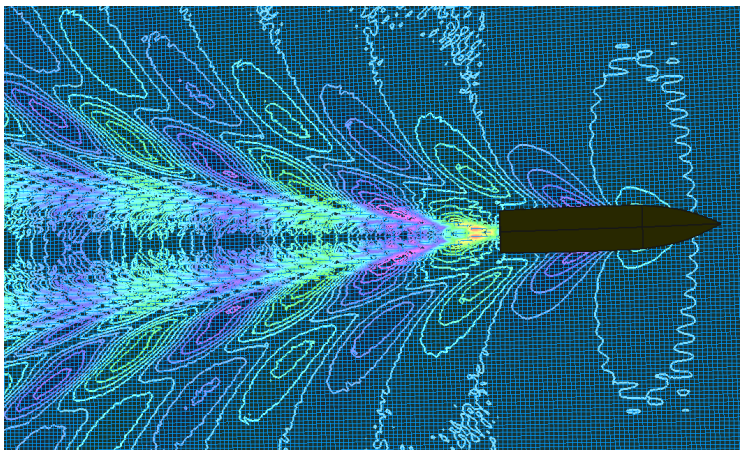

Figure 6. Waveforms Caused by a Speed of 10 Knots (Analysis Results, 2023)

CONCLUSION

From this study, the resistance value for a speed of 0-6 knots is obtained, resulting in a resistance value of 1.4 kN and engine power of 5,861 Hp. Then there is a significant engine power requirement from a speed of 7 knots to 10 knots due to the ship's resistance value which continues to increase in line with the ship's speed. At the maximum speed of a 30 GT purse seine fishing vessel of 10 knots, the total ship resistance is 7.4 kN and the engine power requirement required is 50,572 Hp.

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REFERENCES

Ayodhyoa, A.U. (1972). Suatu Pengenalan Kapal Ikan. Bogor (ID): Fakultas Perikanan dan Ilmu Kelautan, IPB. Bogor.

Alfanda, B. D., & Santoso, B. (2020). Analisa Tahanan Kapal Personal Boat di Selat Bengkalis Dengan Metode Numerik dan Pendekatan Empirik. *Inovtek Polbeng*, *10*(1).

Humaerah, A. A., Burhani, S., & Aulia, N. (2023). Calculation of Thickness of Midship Construction Plates According to the Ship Classification Board. *Vol.3, No.1, 2024: 211-222*

Khresna, R., Budiarto, U., & Rindo, G. (2017). Engine Matching Propeller Pada Kapal Ikan Pipa Paralon Untuk Mendapatkan Sistem Propulsi Yang Optimal. *Jurnal Teknik Perkapalan*, *5*(1).

MAXSURF. Resistance. Program & User Manual Bentley Systems. Incorporated. All rights reserved. Copyright © 2017

Maulana, R., Setyanto, I., & Kurohman, F. (2018). Analisis Perbandingan Dimensi Utama Kapal Purse Seine di Pelabuhan Perikanan Mayangan Kota Probolinggo Jawa Timur. *Journal of Fisheries Resources Utilization Management and Technology*, *7*(4), 67-73.

Pamikiran, R. D.CH. (2013). Kajian Penggunaan Daya Mesin Pengerak KM Coelacanth di Kota Bitung, Provinsi Sulawesi Selatan. *Jurnal Ilmu dan Teknologi Perikanan Tangkap,* 1(3),103-107

Paska, A., Hadi, E. S., & Kiryanto, K. (2016). Analisa Engine Propeller Matching Pada Kapal Perintis Baru Type 200 Dwt Untuk Medapatkan Sistem Propulsi Yang Optimal. *Jurnal Teknik Perkapalan*, *4*(3).

Republik Indonesia. 2008. Undang Undang No. 17 Tahun 2008 Tentang Pelayaran. Jakarta:Sekretariat Negara

Indriyani, R. & Dwisetiono, D. (2021).Kajian Kegagalan Komponen Dan Perawatan Pada Sistem Pelumas Mesin Diesel Di Kapal. *Zonalaut,* 2(1), 1-6.

Rachman, R., & Pranatal, E. (2020). Analisis Perbandingan Metode Simulasi Software Maxsurf Dengan Metode Matematis Untuk Perhitungan Hambatan Dan Daya Mesin Utama Kapal Tanker 6500 Dwt. In *Prosiding Seminar Teknologi Kebumian dan Kelautan (SEMITAN)* (Vol. 2, No. 1, pp. 193-201)

Ridwan, M. (2019). Pemilihan Mesin Induk Kapal Purseiner Masyarakat Pesisir Nelayan Pekalongan. *Jurnal Pengabdian Vokasi*, *1*(2), 99-102.

Rozi, M. F., Winarno, A., & Riyadi, M. (2019). Pengaruh Variasi Jarak Poros Propeller Yang Berbeda Pada Kapal Ikan Tradisional KM. Sri Mulyo di Brondong Lamongan. *Prosiding Seminakel*, 29-39.

Sarwoko, S., & Santoso, B. (2019). Computational Tahanan Kapal Untuk Menentukan Daya

Mesin Utama Kapal Ikan 5 GT. *Jurnal Rekayasa Mesin*, *14*(1), 23-26.

Subandi, H. A., Kiryanto, K., & Mulyatno, I. P. (2016). Perancangan Kapal Ikan Mini Purse Seine Displacement 11 Ton Tipe Katamaran Menggunakan Bahan Pipa Pvc. *Jurnal Teknik Perkapalan*, *4*(1).

Sugianto, Erik. & Winarno, A. (2017). Computational Model Tahanan Kapal untuk Menentukan Kebutuhan Daya Kapal Bulk Carrier 8664 DWT KAPAL : Jurnal Kelautan. Volume 10. No. 2, 2017. ISSN: 2476-9991 (online). Universitas Trunojoyo Madura

Widodo, E. S. (2017). *Simulasi Penerapan Hull Chine Terhadap Tahanan, Daya Dorong Dan Stabilitas Kapal Pada Pb Suberko-02* (Doctoral dissertation, Institut Teknologi Sepuluh Nopember).