Indonesian Journal of Contemporary Multidisciplinary Research (MODERN)
Vol.2, No.3, 2023: 525-538

The Effect of Engine Performance on The Speed of Purse Seine Vessels in Takalar Regency

Irawan Alham
Politeknik Pertanian Negeri Pangkajene Kepulauan
Corresponding Author: Irawan Alham irawan.alham@polipangkep.ac.id

A R T I C L E I N F O

Keywords: Engine Work Performance, Speed, Purse Seine Ship, Takalar County

Received : 10 April
Revised : 25 April
Accepted: 25 May

A B S T R A C T

The waters of Takalar Regency are a good fishing area for pelagic fish species. Purse seine vessels are the type of fishing vessels that dominate the area. The purpose of the study was to examine the performance of engine work on the speed of purse seine ships in Takalar Regency. Data is grouped based on HP and ship speed then processed with shipping calculation formulas to obtain HP and ship speed. The result of the calculation of the amount of propulsion for purse seine ships in Takalar Regency with the largest CPI is 330 HP and for the lowest CPI is 115 HP. From the IHP value, a speed of 10.56 knots can be produced for the largest CPI and 2.50 knots for the lowest CPI

DOI: https://doi.org/10.55927/modern.v2i3.4800
E-ISSN: 2985-6108
https://journal.formosapublisher.org/index.php/modern

INTRODUCTION

All purse seine fishing gear fishing businesses in Takalar district use a one boat system. The material used to build purse seine ships is wood.

The shape of the purse seine hull on the bow is "V"-shaped, the middle is "U" shaped (round bottom) and the stern tends to be flat (flat bottom). As this type of fishing vessel, the vessel is designed to have a low hull, in order to make it easier to pull nets and catches, the vessel is equipped with fishing aids such as; Kapstan to pull the ring rope, steering roller to direct the ring rope to the capstan, one boom unit to lift fish from the water to the deck of the ship and other equipment to support the fishing process. In order for the catch to be of good quality, the ship is equipped with hatches to maintain the freshness of the caught fish, the number of hatches is three pieces with different capacities and placements.

The construction of the purse seine ship propulsion system in Takalar Regency consists of an engine, shaft and propeller. The type of engine used as the main propulsion of the ship is a 2-stroke engine with diesel (diesel) as fuel, and the combustion process is directly in the engine (internal combuntion engine), with the engine located inside the ship (in board engine).

LITERATUR REVIEW

Fishing vessels are vessels or floating equipment used to catch fish including for survey and exploration of aquatic biological resources (Anonimous, 1985). The ability or ability of a good vessel is certainly expected to be able to support the effectiveness and efficiency of fishing activities, and in the end it will have a good impact or profit for the fishery business itself. One of the factors that affect the effectiveness and efficiency of the ship is the use of power (HP) from the ship's propulsion engine (Pamikiran, 2009). Furthermore, it is stated that of course the use of propulsion engine power is adjusted to the size, speed, and purpose of using the ship in the field.

As a means of sea transportation, ships need a reliable prime mover. The main propulsion engines on ships commonly used in the world of domestic or international shipping sea transportation are diesel engines, gasoline engines, steam engines, steam turbines, electro motors (HD McGorge, 1995) Of the various main propulsion engines used on ships commonly used on commercial ships, be it tide ships, container ships, cargo ships, tankers are types of diesel engines either 4 stroke or 2 stroke The choice of diesel engine as the main propulsion engine is known that diesel engines have advantages over other types of engines, namely: Has great power, fuel economy, small vibration and low rotation. Diesel engines use fuel that has a cheaper price than other engines, while the fuel used in diesel engines is High speed diesel (HSD), Marine Fuel Oil (MFO), Fuel Oil (FO) (Seehafen verlag, 2019).

METHODOLOGY

The method used in this study is the survey method, which is a direct observation study in the field and literature studies based on the results of previous research to collect data and information to answer the problems in this study.

Tools in Research

The equipment used for data collection was a tachometer, stopwatch, GPS, meter, water pass and stationery. For data processing, a computer was used, Microsoft Office Excel program software was used to complete mathematical calculations and graphic displays.

Data Type

The type of data collected is primary data and secondary data. Primary data was obtained by direct observation on 8 purse seine vessels operating in the waters of Takalar Regency. Data on 8 ships was taken because the ships in Takalar district are very homogeneous between 20-23 GT. The primary data taken is the speed of the ship. Retrieval of ship speed data by calculating the engine speed on the propeller shaft using a tachometer is done by attaching the head end of the tachometer to the axis of the propeller shaft.

Data Processing

Data is grouped based on HP and ship speed then processed with shipping calculation formulas to obtain HP and ship speed.

Ship Speed (Yanmar, 1995).

$$Vs = \frac{BHP}{\Delta} \sqrt{LWL} / 3 \text{ (knots)} \quad \text{.....(1)}$$

Information:

BHP is the power used to rotate the engine (HP)

Daya-daya yang bekerja pada sistem penggerak kapal (Nomura dan Yamazaki 1977)

(1) *Indicated horse power* (IHP), tenaga awal untuk menggerakkan silinder;
(2) *Brake horse power* (BHP), tenaga yang digunakan untuk menggerakkan roda gila;

$$\frac{BHP}{IHP} = 0{,}80 \quad \text{.....(2)}$$

Shaft horse power (SHP), the power used to rotate propellers;

$$\frac{SHP}{BHP} = 0{,}94 \quad \text{.....(3)}$$

Effective horse power (EHP), effective power used to move ships

$$\frac{EHP}{SHP} = 0{,}23 \quad \text{.....(4)}$$

RESULTS AND DISCUSSION

1. General Plan

The general design of a ship must take into account a planning platform consisting of fishing objectives, types of fishing gear used, operational processes and storage of catches. The general arrangement of the ship is shown in Figure 15. The drawing is a technical drawing which generally describes the completeness of the ship's space from different perspectives, namely the top view and side view, from the side view of the ship such as fuel tanks, engine room, navigation, crew room, holds 1, 2, 3 and the bow and bulkheads that separate these rooms.

In Figure 1 the sequence from bow to stern of the division of space on one of the ships in Takalar Regency is explained as follows:

1) Bow niche; located in the bow to be precise in front of the hold below the deck, functioning as a warehouse for equipment and fishing gear needs, anchors, rigging for mooring needs.
2) The hold is a catch storage, one of the three holds functions as an ice storage area when the ship goes to the fishing ground, is well insulated so that the fish stays fresh until the ship returns to the fishing base.
3) Navigation space; located on the top deck behind the midship, higher than the other rooms. The room is where the captain carries out the activities of driving the ship, because with the location of the room being higher, it allows the captain to have a wider view.
4) engine room; as a place for main engines and electrical machines and their equipment, such as capstans, propeller axles, electrical panels and fuel tanks. It is located aft of the midship and is raised above the deck.
5) Fuel Tanks; As a place for fuel oil, it is above the electric engine on the deck behind the midship, the tank is raised to make it easier to carry out maintenance on the electric engine. The tank is made of iron plate and is rectangular in shape.
6) Fresh water tank; As a place for fresh water for the purposes of eating, drinking and rinsing the crew, the tank is located behind the midship above the deck on the port side, made of anti-corrosive plastic with a rectangular shape.
7) ABK Room; This room is located above the engine room. The room is used for shelter and rest and stores all the equipment carried by the crew during the voyage.

Figure 1. Example of One of The Purse Seine Vessels in Takalar Regency

2. Purse Seine Boat Engine

The engine as the propulsion unit of the purse seine ship consists of a cylinder block, piston, connecting rod, crankshaft and flywheel (gear). The cylinder block is the basic part that supports the power unit. The cylinder block is equipped with a cylinder cover which is also the combustion chamber and the support for the valve system. Inside the cylinder block there is a piston that converts heat energy from combustion into mechanical power by moving back and forth along the axis of the cylinder.

The piston is equipped with a piston ring which functions to withstand compression and seepage of combustion product power, prevents the entry of lubricating oil into the combustion chamber, lubricates the outer wall of the cylinder with lubricating oil and transmits heat from the piston to the cylinder wall. The piston ring movement follows the piston movement.

The connecting rod is what connects the piston and crankshaft. The crankshaft functions to change the straight motion of the piston into rotary motion. At the end of the crankshaft, gears or flywheels are installed which are stored in the gear box which functions to equalize the rotating moment that occurs on the crankshaft so that the speed becomes stable.

The crankshaft is connected to the propeller shaft by a connecting shaft. The shaft material is made of stainless steel. On the propeller shaft mounted ship propeller. The position of the crankshaft, gear box and connecting shaft can be seen in Figure 2.

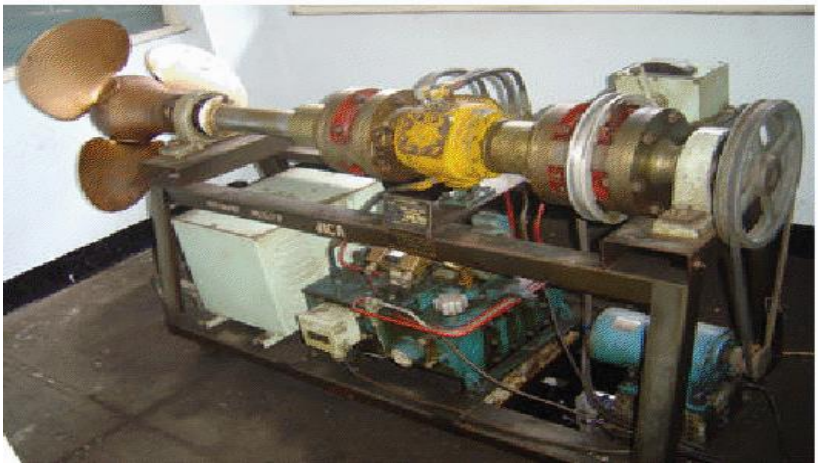

Figure 2. Position of Crankshaft, Gear Box and Connecting Shaft
Source: Directorate General of Primary and Secondary Education, Ministry of National Education, 2003

Purse seine ships operated in Takalar Regency are medium-sized purse seine ships (20-50 GT), with an engine power of 100-300 HP. Arrest operations are carried out with the number of days of trips between 7 – 20 days per trip.

The calculation results based on equations (2) (3) and (4) for the power working on the ship studied with IHP, BHP, SHP, and EHP values are as follows.

Table 1. IHP, BHP, SHP, and EHP Values On 8 Vessels Studied

HP	Sinar Bahagia	Minasa 3	Minasa 5	Bone 1	Bone 2	Taruna	Cahaya Bone 1	Kurnia 1
IHP	300	115	115	300	300	330	190	300
BHP	240	92	92	240	240	264	152	240
SHP	225,6	86,48	86,48	225,6	225,6	248,16	142,88	225,6
EHP	51,8	19,8	19,8	51,8	51,8	57,7	32,8	51,8

3. Ship Speed

Every object that moves and does work means that it has power or power. The power possessed by a ship to move at a certain speed comes from the main engine used by the ship. The power produced or released by an engine is called BHP (brake horse power). The formation of power on a machine is based on the following process Figure 3.

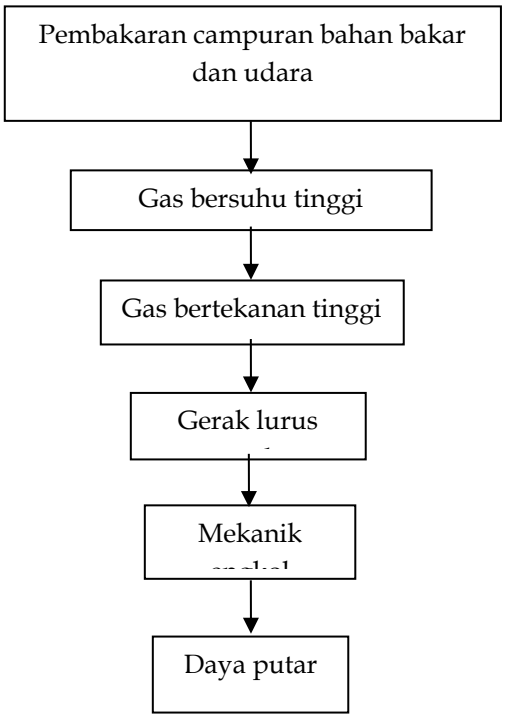

Figure 3. Power Forming Process in Machine
Source: Soenarta and Furuhama (1995)

Figure 3 shows that the fuel and air mixed in the cylinder tube burn and produce a high-temperature gas. High-temperature gas generates high-pressure power and pushes the piston so that it moves back and forth. As a result of this piston movement, the crankshaft moves and produces rotating power or also called BHP. The power generated by the engine is channeled to the engine transmission system used by a ship until it becomes the ship's thrust produced by a propeller called EHP (effective horse power). The performance or workability of a machine is determined by the amount of power released by the machine. Power or power on a ship is a function of resistance, speed, propeller and HP.

The calculation results based on equation (1) for the exact velocity are presented in Figures 4 through 11.

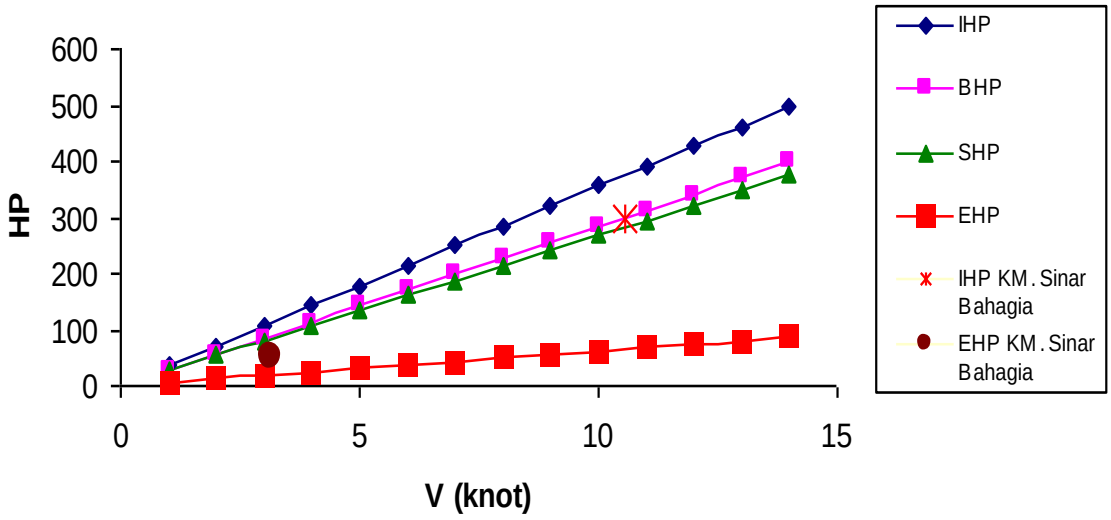

Figure 4. Speed (V) and HP relationship of KM Sinar Bahagia

Figure 4 shows a comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-498 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship is listed as 300 HP and the calculation EHP value is 51.88 HP, from the IHP value it produces a speed of 10.54 knots while the EHP can produce a speed of 1.82 knots. Propulsion used on KM ships. Sinar Bahagia is a type of marine engine, under the brand Yanmar's TF engine.

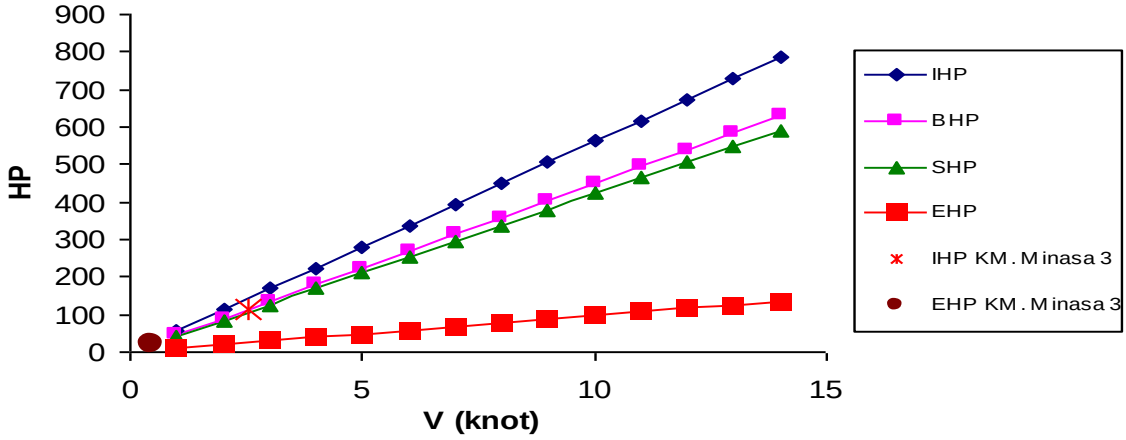

Figure 5. Speed (V) and HP Relationship of KM Minasa 3

Figure 5 shows the comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-785 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship the IHP value is listed at 115 HP and the calculation EHP value is 19.89 HP, from the IHP value it produces a speed of

2.56 knots while the EHP can produce a speed of 0.44 knots. Propulsion used on KM ships. Minasa 3 is a type of land engine, with the Mitsubishi engine brand.

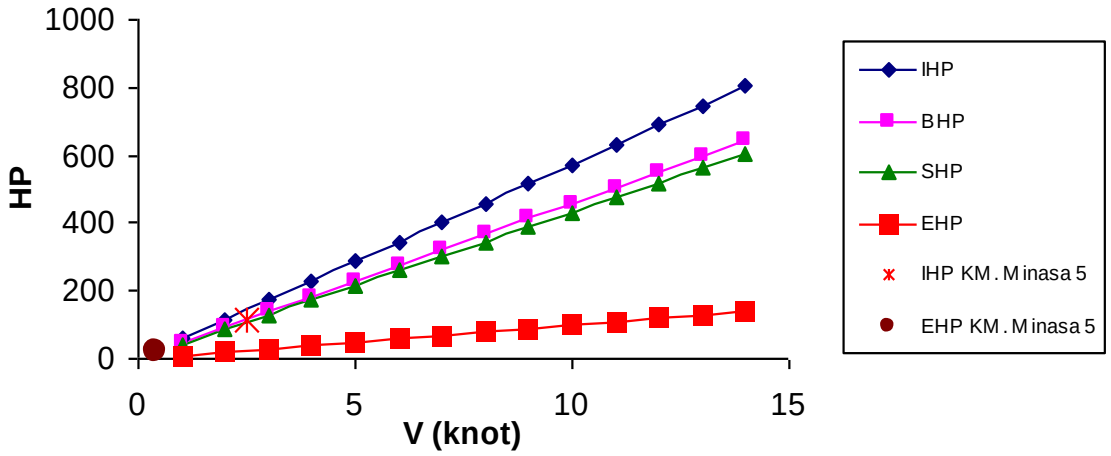

Figure 6. Speed (V) and HP Relationship of KM Minasa 5

Figure 6 shows the comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-803 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship is listed as 115 HP and the calculation EHP value is 19.89 HP, from the IHP value it produces a speed of 2.50 knots while the EHP can produce a speed of 0.43 knots. Propulsion used on KM ships. The Minasa 5 is a type of land engine, under the Mitsubishi engine brand.

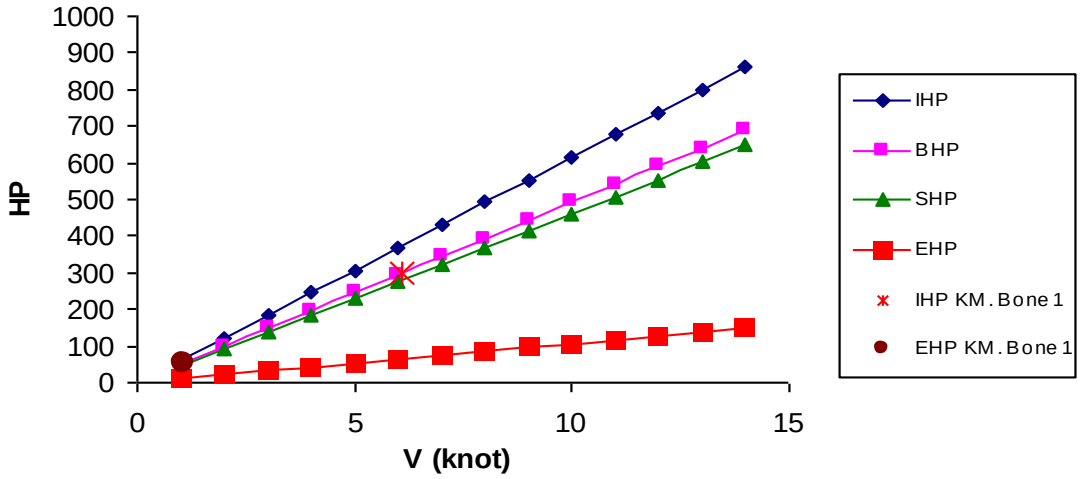

Figure 7. Speed (V) and HP Relationship of KM Bone 1

Figure 7 shows the comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-860 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship is listed as 300 HP and the calculation EHP value is 51.88 HP, from the IHP value it produces a speed of 6.10 knots while the EHP can produce a speed of 1.05 knots. Propulsion used on KM ships. Bone 1 is a type of marine engine, under the brand name TF Yanmar engine.

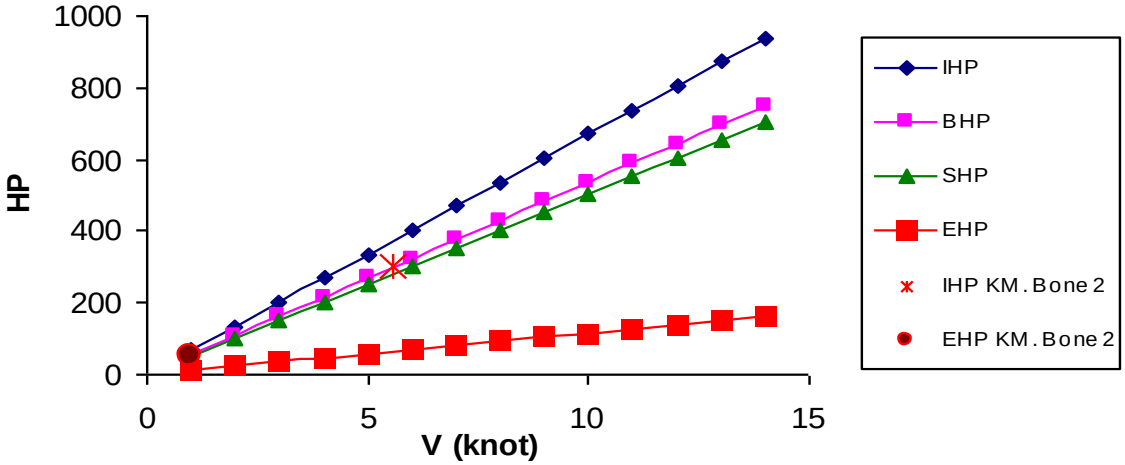

Figure 8. Speed (V) and HP relationship from KM Bone 2

Figure 8 shows the comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-938 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship is listed as 300 HP and the calculation EHP value is 51.88 HP, from the IHP value it produces a speed of 5.59 knots while the EHP can produce a speed of 0.97 knots. Propulsion used on KM ships. Bone 2 is a type of marine engine, under the brand name TF Yanmar engine.

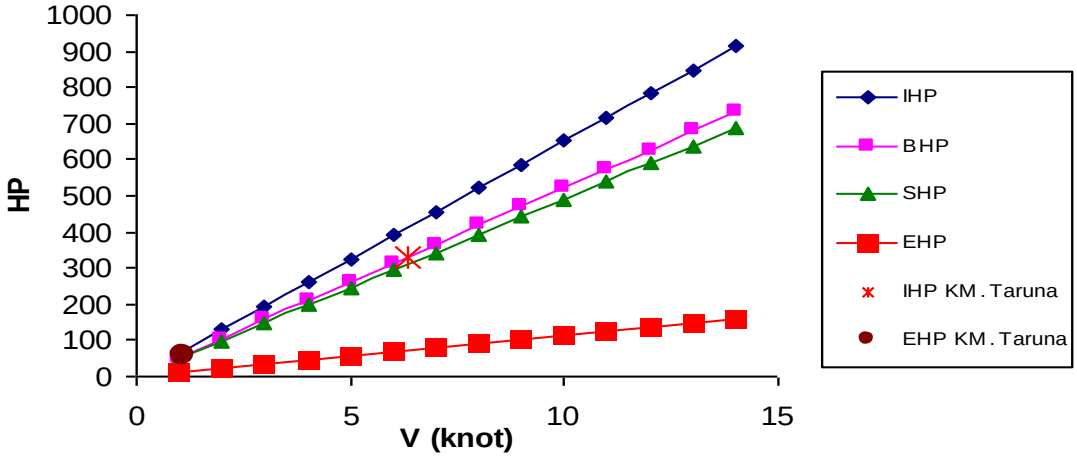

Figure 9. Speed (V) and HP Relationship of KM Taruna

Figure 9 shows the comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-914 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship is listed as 330 HP and the calculation EHP value is 57.07 HP, from the IHP value it produces a speed of 6.32 knots while the EHP can produce a speed of 1.09 knots. Propulsion used on KM ships. Taruna is a kind of marine machine, with the brand Djiandong engine.

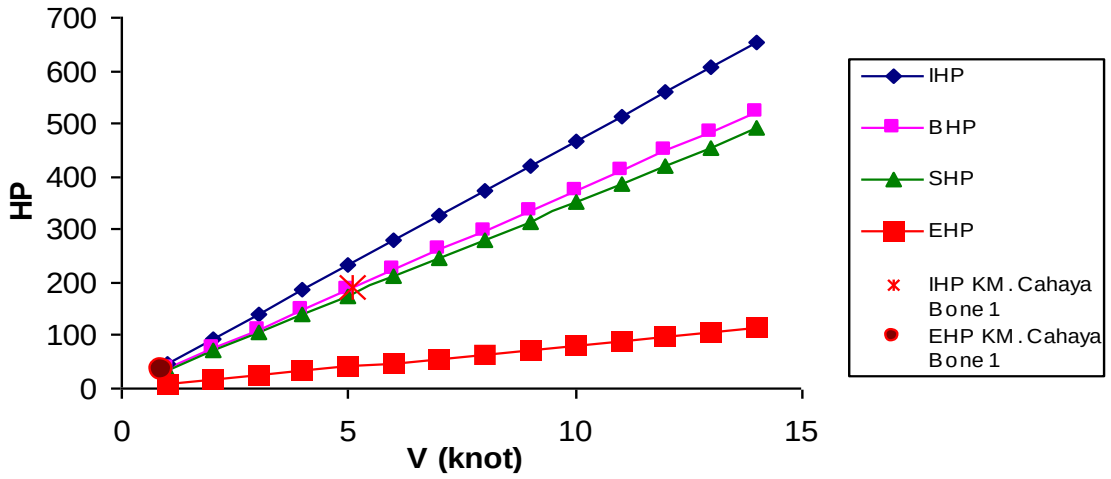

Figure 10. Speed (V) and HP Relationship of KM Light Bone 1

Figure 10 shows the comparison between speed (V) and IHP, BHP, SHP, EHP. HP values range from 0-652 HP with speeds of 0-14 knots. From the picture, it can be seen that the propulsion of the ship is listed as 190 HP and the calculation EHP value is 32.86 HP, from the IHP value it produces a speed of 5.09 knots while the EHP can produce a speed of 0.88 knots. Propulsion used on KM ships. The Light Bone 1 is a type of ground engine, under the Hyundai engine brand.

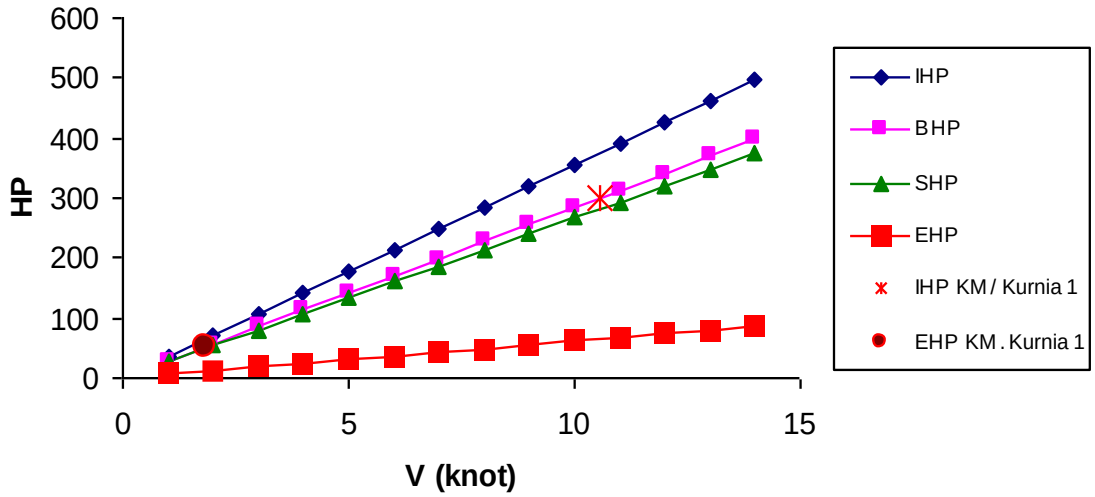

Figure 11. Speed (V) and HP Relationship from KM Kurnia1

Figure 11 shows a comparison between speed (V) and IHP, BHP, SHP, EHP. The HP value has a range of 0-497 HP with a speed of 0-14 knots. From the figure it can be seen that the propulsion power of the ship shows that the IHP value is 300 HP and the calculated EHP value is 51.88 HP, from the IHP value it produces a speed of 10.55 knots while the EHP can produce a speed of 1.83 knots.

The propulsion used on the ship KM. Kurnia 1 is a type of marine engine, with the Yanmar TF engine brand.

The calculation results produce a difference in speed between land engines and sea engines because the different gear boxes and different propeller dimensions produce different thrust. The propulsion system of the ship's propulsion engine will affect the determination of the ship's propulsion power that must be installed, especially whether or not a gear box is used (crankshaft rotation reducer). If this system uses a gear box with a certain reduction ratio, the power of the installed ship propulsion engine is generally greater than a system that does not use a gear box to achieve the same speed. The magnitude of this power is required for propeller rotation according to the desired reduction level. In addition, in each component of the propulsion system, there is a reduction in power due to the friction of these components which converts motion energy into heat energy.

According to Nomura and Yamazaki (1977) the economic speed of the ship will be affected if the ratio between the speed of the ship (V/ , V: the speed of the ship in knots and L: the length of the ship in meters) is close to 1.0 for fast ships the ratio is more than 1.2 and for slow vessels this value is less than 0.8. Table 2 shows that the comparison between ship speed and ship length.

Table 2. Comparison Between Speed and Length of Purse Seine Vessels in Takalar District

	Sinar Bahagia	**Minasa 3**	**Minasa 5**	**Bone 1**	**Bone 2**	**Taruna**	**Cahaya Bone 1**	**Kurnia 1**
V (Speed)	10,53	2,56	2,5	6,1	5,59	6,32	5,09	10,56
L (Lenght)	18,98	19,1	19,4	17,05	18,2	14,4	16,5	16,8
V/√L	2,42	0,59	0,57	1,48	1,31	1,67	1,25	2,58

Table 2 shows that ships that have a ratio with a value of less than 0.8 as slow ships are Minasa 5 and Minasa 3, and fast ships that have a ratio with a value of more than 1.2 are Sinar Bahagia, Bone1, Bone 2, Taruna, Cahaya Bone 1, and Kurnia 1, for more details can be seen in Figure 12.

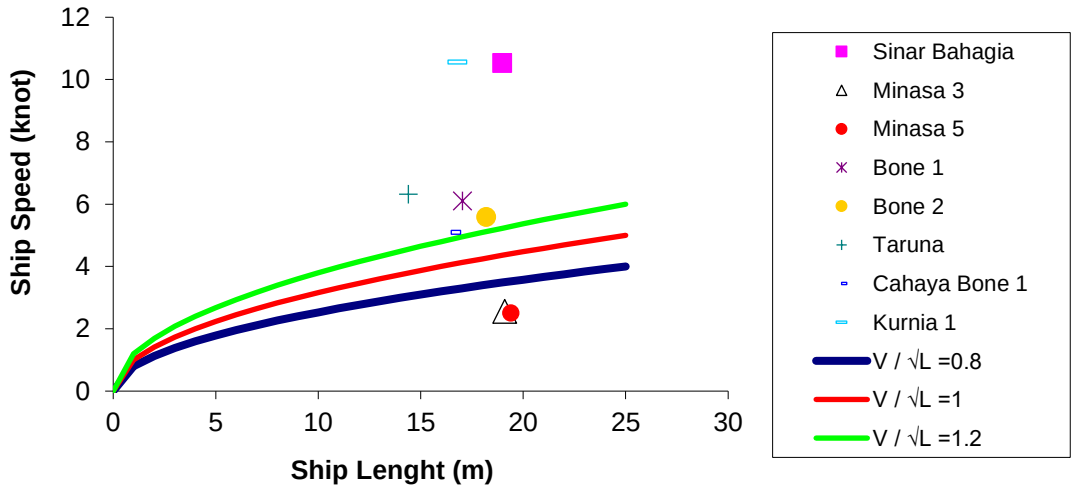

Figure 12. Comparison of Ship Length and Ship Speed

CONCLUSION

The result of the calculation of the amount of propulsion for purse seine ships in Takalar Regency with the largest CPI is 330 HP and for the lowest CPI is 115 HP. From the IHP value, a speed of 10.56 knots can be produced for the largest CPI and 2.50 knots for the lowest CPI.

DAFTAR PUSTAKA

Barani HM. 2005. Profil Pendapatan Usaha Penangkapan Berdasarkan Jenis Alat Tangkap di Perairan Sulawesi Selatan Bagian Selatan. Fakultas Perikanan, Institut Pertanian Bogor. *Buletin PSP* 14(2): 40 – 46.

Direktorat Jenderal Pendidikan Dasar dan Menengah Departemen Pendidikan Nasonal 2003.

[DKP] Dinas Kelautan dan Perikanan Kabupaten Takalar. 2008.

Iskandar BH. 2007. Stabilitas Statis dan Dinamis Kapal Latih Stella Maris. Fakultas Perikanan, Institut Pertanian Bogor. *Buletin PSP* 16(1): 31 – 49.

Iskandar BH., Novita Y. 2000. Tingkat Teknologi Pembangunan Kapal Ikan Kayu Tradisional di Indonesia. Fakultas Perikanan, Institut Pertanian Bogor. *Buletin PSP* 9(2): 53 - 67.

Nomura M, Yamazaki T. 1977. *Fishing Techniques*. Tokyo : Japan Internasional Cooperation Agency (JICA).206 hal.

Soenarta N, Furuhama S. 1995. Motor serba Guna . PT Pradnya Paramita. Jakrta. 225 hal.

Trianto. 1985. Mesin. Jakarta. Pradya Paramitha. 56 hal.

Yanmar. 1995. Buku Petunjuk Mesin Diesel. PT Yanmar Jakarta.

Pamikiran, R.D.Ch. 2009. Penggunaan Daya Mesin Penggerak Kapal Pukat Cincin pada Beberapa Daerah di Sulawesi Utara. Pacific Journal. Vol.3 no.3. 419 – 421.

H D McGeorge.,(1995), Marine Auxiliary Machinery 7th edition copy righ elsevier. Wilwood Avenue, Woburn,2002

Seehafen verlag (2009), Compendium Marine Engineering, Hamburg