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DETERMINING GROSS TONNAGE OF PURSE SEINERS USING A PHYSICAL MODELING APPROACH IN TEGAL, CENTRAL JAVA

PENENTUAN *GROSS TONNAGE* KAPAL *PURSE SEINE* DENGAN PENDEKATAN PEMODELAN FISIK DI TEGAL, JAWA TENGAH

Suharyanto[1*], Ratih Purnama Sari[1], R. Mohamad Adha Akbar[1], Yaser Krisnafi[2], Tonny Kusumo[3]

[1]Fishing Technique Department, Politeknik Kelautan dan Perikanan Karawang, Tanjung Pura-Klari Street, Karangpawitan, West Karawang 41315, Indonesia

[2]Politeknik Kelautan dan Perikanan Sidoarjo, Buncitan Street, 161253, Sidoarjo 46396, Indonesia

[3]Fishing Technology Department, Politeknik Ahli Usaha Perikanan Jakarta, Pasar Minggu Street, Pasar Minggu District, South Jakarta, Jakarta 12520, Indonesia

*Corresponding author: shy_pusdik@yahoo.co.id

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ABSTRACT

The research was carried out at the dock and shipping companies, PT. Indonesian Fisheries, PT. Tiara, and the village cooperative unit (KUD) Karya Mina, at Tegal, Central Java, in October 2023. The research aims to determine the percentage change in the shape of the ship's hull below deck, Cb (coefficient block), and GT (gross tonnage) values of purse seiners in the Tegal using a physical model that is dipped in water. The Cb and GT values research was focused on KM. Himalaya SB with 84.44% accuracy. The results at the three dock and shipping companies showed that the change in the shape of the ship's hull below deck, on average, in parts I, II, III, IV, and V were 14%, 20%, 30%, 11%, and 25%, respectively, and in the case of KM. Himalaya SB parts I, II, III, IV, and V were 15%, 18%, 29%, 9%, and 29%, respectively. The shape was dominated by shapes III and V. The ones that increase Cb and GT values were shape III with a U shape. The results of the average percentage change in shape for 6 ships, including the case example purse seine, have a pattern that tends to be the same. The Cb value obtained from the experimental results was 0.82 > 0.70 from the "f" factor coefficient according to Minister of Transportation Regulation Number 8 of 2013. Based on the GT calculation, it was obtained that the value increased by 17% when compared to the regulation.

Keywords: gross tonnage, purse seiner, ship's hull, Tegal

ABSTRAK

Penelitian dilaksanakan di perusahaan *dock* dan perkapalan PT. Perikanan Indonesia, PT. Tiara dan KUD. Karya Mina di kota Tegal Jawa Tengah. Waktu pelaksanaan pada bulan Oktober 2023. Tujuan penelitian ini adalah untuk menentukan persentase perubahan bentuk badan kapal di bawah dek, nilai Cb (*coefficient block*) dan GT (*gross tonnage*) kapal *purse seine* di wilayah Tegal dengan pendekatan model yang dicelupkan dalam air. Penelitian Cb dan GT difokuskan pada KM. Himalaya SB dengan akurasi 84,44%. Hasil penelitian di ketiga perusahaan *dock* dan perkapalan tersebut diperoleh bahwa perubahan bentuk badan kapal di bawah dek rata-rata bagian I, II, III, IV, and V adalah masing-masing 14%, 20%, 30%, 11%, dan 25%, sedangkan pada contoh kasus KM. Himalaya SB bagian I, II, III, IV, and V adalah masing-masing 15%, 18% , 29%, 9%, dan 29%. Bentuk didominasi oleh bentuk III dan V, yang memberikan peningkatan nilai Cb dan GT adalah bentuk III dengan bentuk U. Hasil rata-rata persentase perubahan bentuk dari 6 buah kapal termasuk di dalamnya kapal *purse seine* contoh kasus mempunyai pola yang cenderung sama. Nilai Cb hasil percobaan diperoleh 0,82 > 0,70 dari koefisien faktor "f" sesuai Permenhub Nomor 8 Tahun 2013. Berdasarkan perhitungan GT, didapat peningkatan nilai sebesar 17% jika dibandingkan dengan permen tersebut.

Kata kunci: *gross tonnage*, kapal *purse seine*, lambung kapal, Tegal

INTRODUCTION

The topic of ship size, better known as ship tonnage calculation, remains an interesting and ever-evolving topic. If a ship is built in a box or half-cylinder shape with a standard geometric shape, it is certainly easy to find the volume submerged in water (actual underwater volume) using existing formulas. However, in fact, a ship is built in such a way that it can float well, has a good righting moment, has adequate load capacity, has low water resistance, and has good gliding power. These demands can be met if a ship is built with changes in shape from the front height to the rear stern, which one generally non-geometric. One of the most important things for a ship is knowing the gross volume, or gross tonnage (GT).

GT measurement of ships according to domestic regulations is stated in Article 3 paragraphs (1) and (2) of the Regulation of the Minister of Transportation Number 8 of 2013 concerning Ship Measurement. It is explained that for ships with a length of less than 24 m, the measurement method uses the domestic method, while for a length of 24 m or more, it uses the international method. The determination of GT is explained in the attachment of rules 1 and 2 paragraphs (1), (2), and (6) with the standard formula and its explanation (Regulation of the Minister of Transportation Number 8 of 2013). The formula for determining GT is as follows:

$$GT = 0.25\,V$$

Note:
V = l x w x h x f
l = Length (m)
w = Width (m)
h = Height (m)
f =`Factor f, the equation will be:

$$GT = 0.25\,(l \times w \times h \times f)$$

Based on the regulation, the value of factor f = 0.85 for flat-bottomed vessels such as barges, f = 0.70 for sloping-bottomed vessels commonly used as motorboats, and f = 0.50 for vessels that are not in the group of vessels commonly used as motorized sailing vessels. The study was conducted to compare the GT value according to the equation above with the results of modeling fishing vessels in Muncar, Banyuwangi, using computer assistance. Determination of the variable value (V) using the block coefficient (Cb). Cb is defined as the ratio between the volume of the ship's body below deck, and the multiplication of the length, width, and height of the ship (Sunardi *et al.* 2019). So that the equation becomes:

$$GT = 0.25\,(l \times w \times h \times Cb)$$

An illustration to obtain the ratio between the volume of the ship's hull below deck and its beam volume is shown in Figure 1.

Indonesia has established a standard formula for determining ship GT, but considering the complicated changes in the shape of the underwater ship body, research to obtain accuracy is always carried out by academics and researchers. Determination of ship GT is carried out using the control point coordinate approach carried out by previous researchers, which uses 13 measurement reference points as stations. The control point coordinate approach method is to determine the volume below the deck by determining the cross-sectional area of each station. The overall volume is obtained using the trapezoidal method numerical integration formula (Mahfud *et al.* 2010). Measurements of the underwater ship body in Bulukumba were carried out using 12 station points. At each point, measurements were taken from below the keel to the upper deck carefully from outside the ship so that the cross-sectional area value of each station was obtained (Rahman *et al.* 2022).

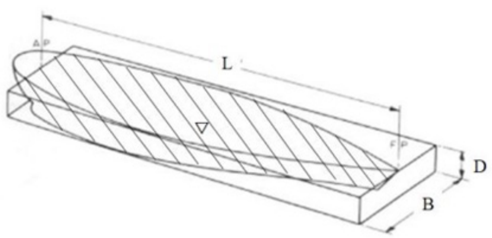

Figure 1. Illustration of the volume of the ship's hull below deck and the volume of the beam (Fyson 1985 in Sunardi *et al.* 2019).

Research on changes in GT based on ship documents and re-measurement was also conducted by previous researchers. A study was conducted on 13 fishing vessels in Jakarta. The results of the old GT values and the re-measurement GT showed differences that tended to be greater than the initial GT. It was obtained that 73% of ships experienced an increase in the new GT value (Sudjasta *et al.* 2018). Almost the same thing in re-measuring through a modeling approach using a computer was carried out in Muncar, Banyuwangi. Modeling using a computer obtained the coefficient of block (Cb) value, which is the main variable for determining the GT value; the results of the study showed Cb = 0.53, while according to Permenhub (Regulation of Ministry of Transportation) Number 8 of 2013, the Cb value used was Cb = 0.70. The results of the conversion using the standard formula obtained the GT value from the re-measurement, resulting a decrease or smaller than the results of the standard formula calculation. The decrease in the GT value was 32% (Sunardi *et al.* 2019). Research at Brondong Nusantara Fishing Port on changes in GT from the values stated in the document and re-measurement obtained the results that the GT value of the document after being formulated into a regression obtained y = 26.899e 0.0025 x with an R square value = 0.0227 with the results of the re-measurement obtained y = 1.1665e 0.1999 x with an R square value = 0.994, and from the results of the graphic display of the two equations, there was an increase in the GT value from the results of the re-measurement (Fadly *et al.* 2020).

Research on the general characteristics of ships and fishing vessels is carried out using experiments through real or three-dimensional modeling. As has been researched on the model approach to determine the speed of Ro-Ro ships in Surabaya at a draft height of 3.3 m and 3.8 m with Cb = 0.80, using modeling to determine the thrust to achieve the desired speed. Each type of draft is made of 3 models to obtain the thrust results carried out in the experimental tank (Ariesta *et al.* 2021). Almost the same thing is the use of modeling to determine the level of safety and stability of Japanese and Vietnamese purse seiners, which is carried out in an experimental tank. Modeling of Japanese-type purse seine uses a scale of 1:30.08, and the Vietnamese purse seine uses 1:30 scale modeling (Trang and Hirakawa 2023).

Non-Tax State Revenue (PNBP) in point (I), namely: utilization of natural fishery resources regarding “fishery levies, fishery product levies on fishing business permits for new or extended fishing vessels.” Then point (II) relates to fishing ports regarding “mooring and anchoring services at ocean, archipelago, coastal, and fish landing base fishing port classes and dock services” to determine the PNBP value using the ship’s GT as the main variable (Government Regulation Number 85 of 2021). The regulations below that support this government regulation are the Regulation of the Minister of Maritime Affairs and Fisheries in Article 3 paragraph (2b), Article 5 paragraphs (1) and (2), Article 6, Article 12 paragraphs (1) and (2), and Article 17 paragraph (2), which states that in determining the PNBP value, the ship’s GT is very important (Regulation of the Minister of Maritime Affairs and Fisheries Number 38 of 2021).

GT of ships, especially for fishing business activities, is very important for both ship owners and the government. In order to achieve justice for ship owners and the government, especially the Ministry of Maritime Affairs and Fisheries related to PNBP, studies on GT of fishing vessels continue to be carried out. A more valid approach to determining the GT of ships must be carried out. Based on this, a study was conducted related to the GT of purse seine ships in Tegal, Central Java. The purpose of this study was to determine the percentage of changes in the shape of the ship’s body below deck, the Cb value, and GT of purse seiners in the Tegal area using a model approach that is immersed in water.

METHODS

Time and location

The location of this research was conducted at a dock and shipping company in the Tegal area, Central Java. Precisely at the dock and shipping company PT. Perikanan Indonesia in Pantai Alam Indah Tegal, PT. Tiara, and the village cooperative unit (KUD). Karya Mina in Tegal Sari. Implemented on October 12-13, 2023.

Research tools and materials

The tools used to make the model include a grinder, a wood saw, a wood chisel, scrap, pliers, and a screwdriver. The materials used include 2.5 mm cor wire (1 kg), 0.5 mm binding wire (¼ kg), cement (20 kg), mil (building lime) (5 kg), 8 mm thick plywood measuring 80x120 (1 sheet), 1.5-inch nails (0.5 kg), foam, fine sand (5 liters), aqua-proof (1 tube/1 kg), and compound flour (2 kg). The tools used for the trial purposes are a 96 x 43.5 x 35 cm fiber tub (1 piece) and a 30 cm ruler, while the materials needed are 1.5 m bamboo with a diameter of 6-7 cm to lift and lower the model during immersion, 5 mm diameter PE rope 1 m long (2 strands), and fresh water in a vessel as much as 66,816 cm^3 or 66.82 liters.

Model building and validation

The physical model of the purse seiner in the Tegal area and its surroundings requires several stages. Observations were made at the research location, followed by measurements, photographs of the ship's hull shape, making a physical model scale, making molds, printing materials, forming models, finishing models, validating models, repairing models, and finally a physical model that is ready for volume testing. In general, the sequence of processes can be seen in Figure 2.

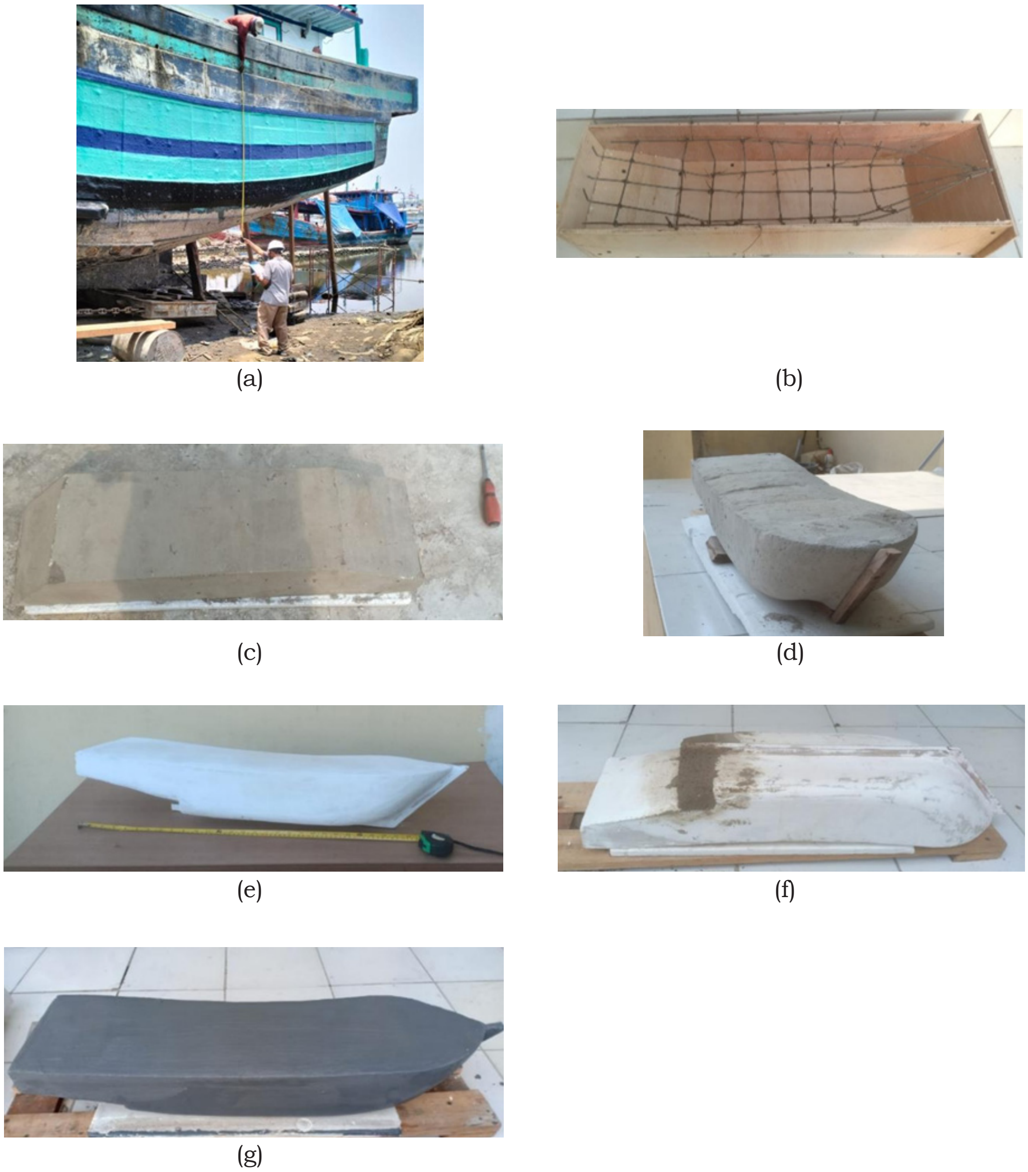

Figure 2. The process of making a physical model of the purse seiner KM. Himalaya SB in Tegal. (a) field measurements, (b) physical model mold from 8 mm thick plywood, (c) cement block, and mil (building lime) mold results with an age of 24 hours that were immediately formed, (d) physical model formation results, (e) physical model ready for validation, (f) improvements from validation result recommendations, and (g) improved validation result model used for trials.

Measurements of 6 ships, namely: KM. Tunas Mulya I (86 GT) and KM. Himalaya SB (71 GT) at PT. Perikanan Indonesia, KM. Duta Baru I (14 GT) and KM. Cinta Sejati (5 GT) at PT. Tiara and KM. XX (50 GT) and KM. XXX (4 GT) at KUD. Karya Mina obtained points of change in the shape of the ship's body under the deck (hull). Furthermore, KM. Himalaya SB was selected as a case study for the model. The selection of KM. Himalaya SB is a case study because the condition of this ship is already in the final painting process, so the bottom of the ship and its surroundings are clean from the remains of barnacles and materials that have the potential to cause injuries to the feet, such as nails, screw bolts, and used wood. So that the condition is quite safe (safety) when taking measurements.

Based on the measurement data results of KM. Himalaya SB, the scale for the model was determined, namely 1:30. The scale number refers to previous research using Japanese-type purse seine ship modeling using a scale of 1:30.08 and for Vietnamese purse seine using a 1:30 scale modeling to determine its stability level (Trang and Hirakawa 2023).

Based on the scale modeling approach, the KM. Himalaya SB, with a length of 24 m, a width of 6.6 m, and a height of 3.5 m, was modeled. The creation of the model size began with determining the size of the mold with a length of 80 cm, a width of 22 cm, and a height of 11.67 cm, which was tilted at both ends to facilitate the formation of the bow and stern. After the mold was formed, a 2.5 mm cast iron frame was made longitudinally and transversely, with foam in the middle. Furthermore, a mixture of cement, lime, and sand was poured into the mold and left for 24 hours. After 24 hours with the mixture still soft, the model was formed. The points of change in the shape of the ship's hull were made with reference to the scale marks on the cement mixture after being removed from the mold, which is shown in detail in Figure 3.

The formation of the model is carried out carefully and thoroughly until completion. After the model was completed, it was continued with validation. In order to determine the level of model accuracy, the completed model is taken to PT. Perikanan Indonesia in Tegal was assessed by workers who are experts in making and repairing purse seiners. Experts in designing, making, and repairing purse seiners made of wood have abilities equivalent to experts (recognition by the company). Finally, minor improvements were made to the validated model.

Data collection

Data collection was obtained from the results of the model experiment, which was dipped into a fiber tub filled with water. The water in the tub was 16 cm high. A 30 cm ruler was installed with double insulation on the tub wall. The model was completely dipped into the water, waited until the water ripples disappeared, and then the water height reading was taken on the ruler. This was done until it was repeated 30 times. The water height before and after immersion was recorded so that the difference in water height was obtained and then converted into the model volume. The volume value of the conversion results was recorded as the main data in this study.

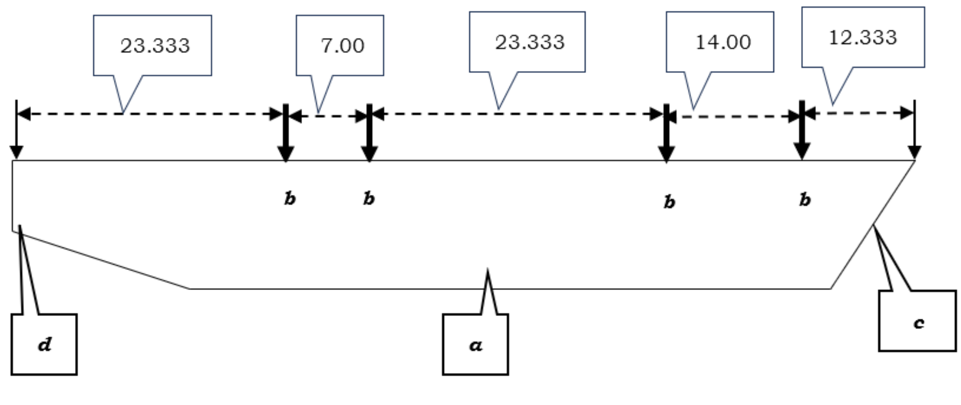

Figure 3. Illustration of mixed cement blocks and reference points for shape changes on the KM. Himalaya SB ship. (a) Molded mixed cement blocks, (b) reference points for shape changes, (c) front or bow, (d) rear or stern, and the numbers above are the distances between the reference points for shape changes in cm.

Data analysis

Data on the percentage of changes in the hull shape of purse seiners in Tegal and its surroundings using a sample of six vessels, the average percentage results were presented with graphical analysis. The data obtained in the trial are volume data, so according to statistical theory, simple statistical analysis can be used on a single piece of data. Single data will obtain the average (mean), median (Me), mode (Mo), quartile (Q), decile, and percentile (Kadir 2022). This study aims to determine the Cb generated from the volume of the experimental model. Data analysis only uses the average (mean). The results of the average (mean) volume data are then entered into the Cb determination formula. Cb is the ratio between the volume of the ship's body below deck and the multiplication of the length, width, and height of the ship (Sunardi *et al.* 2019), then the value of the experimental volume = the volume of the ship's body below deck. Then the following equation is obtained:

$$Cb = Model\ body\ vol/(l \times w \times h\ block)$$

The Cb model value is then used to calculate the GT of the ship. KM. Himalaya SB. Determination of GT KM. Himalaya SB, in addition to using the Cb model value, also uses the Cb value according to the Minister of Transportation Regulation Number 8 of 2013 Attachment I, rule (2), paragraph (6), point (b), namely the use of factor f = 0.70 for ships with a slightly sloping base shape from the middle to the side of the ship, generally used for motor ships. Factor f = 0.85 for barges and f = 0.50 for motor sailing ships. The Cb value for determining the GT KM. Himalaya SB, according to the Minister of Transportation Regulation, uses factor f = 0.70. The GT value of KM. Himalaya SB from the calculation results using factor f = 0.70, and the f model is then compared.

RESULTS AND DISCUSSION

Changes in the shape of the purse seine body in Tegal and its surroundings were grouped into 5 types of shape changes. These shape changes are presented in Figure 4.

The measurement results of 6 (six) ships, namely KM. Himalaya SB (H-SB), Tunas Mulya I (TM-I), Cinta Sejati (CS), Duta Baru I (DB-I), and two ships without a name (TP) obtained the percentage of changes in the I-V shape shown in Table 1.

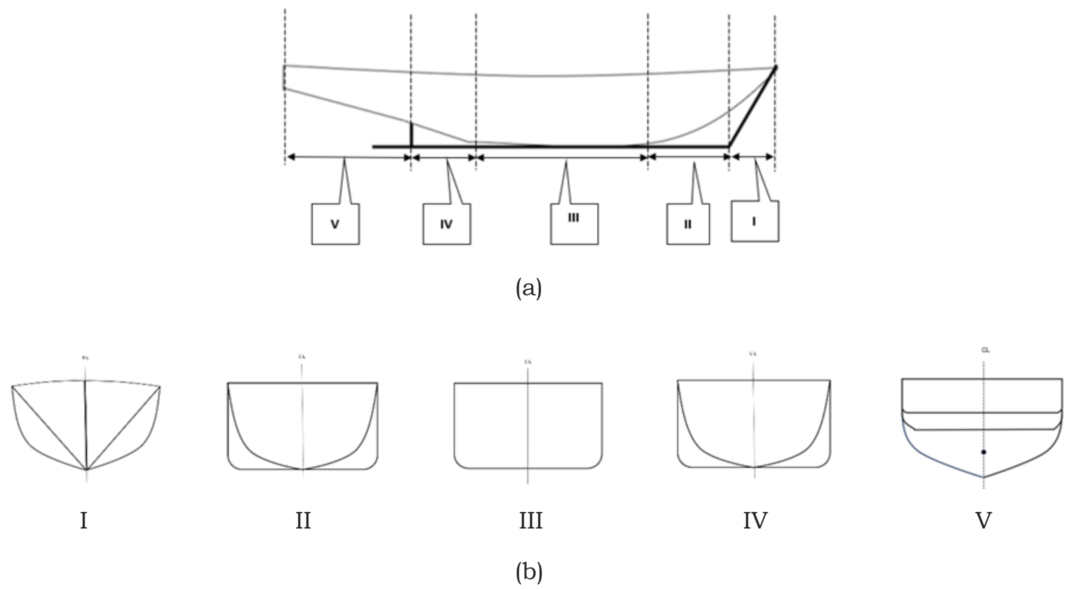

Figure 4. Illustration of changes in hull shape on purse seiners in Tegal. (a) Changes in shape from bow to stern: Section I (V-Round), Section II (Round-Flat U), Section III (Flat U-Flat), Section IV (Round-Flat U), and Section V (Flat-Flat). (b) Sections I-III seen from the front and III-V seen from the back.

Table 1. Percentage changes in the shape of hull sections I, II, III, IV, and V in measurements of 6 ships.

Name	GT	Part I	Part II	Part III	Part IV	Part V
H-SB	71	0.15	0.18	0.29	0.09	0.29
TM-I	86	0.14	0.23	0.22	0.14	0.27
CS	5	0.14	0.15	0.35	0.11	0.26
DB-I	14	0.14	0.20	0.26	0.16	0.24
TP	4	0.13	0.22	0.31	0.10	0.24
TP	50	0.13	0.23	0.35	0.08	0.21
Average		0.14	0.20	0.30	0.11	0.25

Description: The name column is the abbreviation of the ship's name, and the numbers in Table 1 are expressed in percentages. For example, H-SB part I = 0.15%, part II = 0.18%, part III = 0.29%, part IV = 0.09%, and part V = 0.29%.

Model validation

The model was validated first before being used in the volume measurement experiment using the immersion method in a vessel containing water. It is assumed that the results of the expert's values are matched with the level of similarity or accuracy of the model. The assessment team consisted of nine people whose results are shown in Table 2.

The assessment results from experts vary between 70 and 100, with an average value of 84.44. It is assumed that the value obtained is matched with the level of accuracy, so the model used during the experiment is 84.44%.

Volume of the experimental model results

The validated ship model was then used to measure the volume of the ship's body submerged in water. The results of the volume measurements of 30 repetitions are presented in Table 3.

Based on the results presented in Table 3, the figures for the volume of water displaced by the immersed model were obtained. The volume of water displaced was the same as the volume of the model. The average value of the volume of the experimental model was 16.843 L.

Changes in the shape of the hull

Based on the grouping of changes in the shape of the purse seine hull in Tegal (Table 1), the results obtained were that the average shape of section I = 14%, II = 20%, III = 30%, IV = 11%, and V = 25%. The shape of the hull below the deck is dominated by the shape of section III (flat U-flat U), which is 30%, while KM. Himalaya SB, which is used as a case study for the model, has the shape of section I = 15%, II = 18%, III = 29%, IV = 9%, and V = 29%. The percentages of both are shown in Figure 5.

Table 2. Results of model assessment by experts at PT. Perikanan Indonesia, Tegal.

No	Name	Value
1	Manto	85
2	Robi	75
3	Udin	85
4	Budi	90
5	Adi	70
6	Ratno	90
7	Andika	100
8	Bang Dul	85
9	Nefi Parera	80
	Average	84.44

Table 3. The volume of water displaced by a model immersed in a vessel containing water.

No	Volume (L)	No.	Volume (L)	No.	Volume (L)
1	16.704	11	17.122	21	16.704
2	16.704	12	16.704	22	17.122
3	16.704	13	16.704	23	16.704
4	17.122	14	16.704	24	16.704
5	17.122	15	17.122	25	16.704
6	16.704	16	17.122	26	16.704
7	16.704	17	17.122	27	16.704
8	16.704	18	17.122	28	16.704
9	17.122	19	16.704	29	16.704
10	17.122	20	16.704	30	16.704
	Average				16.843

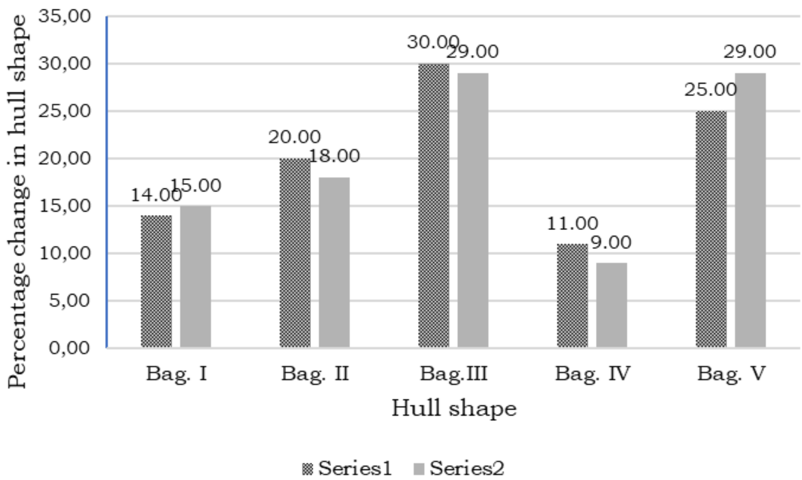

Figure 5. Graph of percentage changes in hull shape of purse seine vessels in Tegal. Series 1 = Average percentage changes in hull shape of 6 purse seine vessels, and Series 2 = Average percentage changes in hull shape of KM. Himalaya SB.

Cb determination

The determination of the Cb model was done by dividing the average volume result by the mold size volume. The average model volume of the experimental results is 16.843 L, and the mold volume is p x l x t = 20.533 L; then, according to equation 4, the results are obtained:

$$Cb = Model\ body\ vol/(l \times w \times h\ block)$$
$$Cb = 16.843/20.533$$
$$Cb = 0.82$$

The next CB model is used to calculate the dimensions of the KM. Himalaya SB ship. Determination of GT according to Permenhub (Regulation of the Ministry of Transportation) Number 8 of 2013:

$$GT = 0.25\ (l \times w \times h \times f)$$
$$GT = 0.25\ (l \times w \times h \times 0.70)$$
$$GT = 0.25\ (24\ \times 6.6 \times 3.5 \times 0.70)$$
$$GT = 0.25\ (388.08)$$
$$GT = 97.02$$

Determination of GT with the Cb physical model of research results:

$$GT = 0.25\ (l \times w \times h \times Cb)$$
$$GT = 0.25\ (l \times w \times h \times 0.82)$$
$$GT = 0.25\ (24\ \times 6.6 \times 3.5 \times 0.82)$$
$$GT = 0.25\ (454.61)$$
$$GT = 113.65$$

The Cb value of 0.82 is greater than the f factor of 0.70, so after the value is entered into the GT determination formula, the results show that the GT value obtained during the study is greater than the GT based on the Minister of Transportation Regulation Number 8 of 2013. The increase in the GT value obtained in the study is 17%.

Hull shape changes below deck

In this study, the changes in the shape of the hull under the deck on KM. Himalaya SB were determined with 6 reference points to obtain changes in the shape of the hull into 5 parts. The average percentage value (%) of parts 1 to 5 of 6 purse seine vessels, including KM. Himalaya SB was 14%, 20%, 30%, 11%, and 25% (according to Table 1). The percentage values of parts 1 to 5 on KM. Himalaya SB were 15%, 18%, 29%, 9%, and 29%, respectively. The average percentage changes in the shape of the hull of 6 purse seine vessels in Tegal and KM. Himalaya SB formed a pattern that was almost the same (Figure 5).

Previous research results related to changes in the shape of the ship's hull still use control point coordinates, namely 13 points. These control point coordinates are used to determine the cross-sectional area, which is then used to obtain the ship's GT value (Mahfud *et al.* 2010). Almost the same research was conducted in Bulukumba using 12 station points. Each point obtained its cross-sectional area value (Rahman *et al.* 2022). Both of these studies determine GT by determining the cross-sectional area first, using the terms control point coordinate reference points and station points.

This study resulted in changes in the shape of the purse seiner hull in Tegal into 5 parts. The dominant shapes, according to Figure 4, are shapes III and V, which were an average of around 30% and 25%. Shapes III and V on KM. Himalaya SB obtained the same value, which was 29% of the ship's length. The shape of part III greatly influences the increase in the Cb value because the shape is almost like a block that is rounded at the edges, forming a U-flat. In determining this shape change, it is used to determine GT through the Cb results from the physical model experiment dipped into water in a vessel with an accuracy level of 84.44%, according to the validation results.

Coeffisient of block Cb dan GT

The Cb value on KM. Himalaya SB is 0.82. Ministerial Regulation Number 8 of 2013 does not use the Cb value but uses the f factor = 0.70. In a study conducted in Muncar Banyuwangi, the purse seiners had a Cb value of 0.53 (Sunardi *et al.* 2019). If the Cb value on KM. Himalaya SB is compared with the f value according to Ministerial Regulation Number 8 of 2013 and the Cb value in the study in Muncar. The results show that the Cb value on KM Himalaya SB is greater than the f value in Ministerial Regulation Number 8 of 2013 and the Cb value in the study in Muncar, which is 0.82 > 0.70 and 0.82 > 0.53. The shape of purse seine vessels in Tegal, which generally has the highest Cb value, is the III shape, which resembles a flat U. This shape is almost the same as a cuboid, where the two lower sides are round, and the average value is 30%, and the average value on the KM Himalaya SB is 29%.

The GT value is influenced by the Cb coefficient, so the GT calculation results will be directly proportional to the research results related to Cb. The results of the study in Muncar, Banyuwangi, on purse seine vessels showed a decrease in the GT value of 32% compared to Permenhub Number 8 of 2013. (Sunardi *et al.* 2019). In a study conducted on 13 fishing vessels with re-measurements in Jakarta, an increase in the GT value of 73% was obtained (Sudjasta *et al.* 2018). In the study on KM. Himalaya SB, the GT value increased by 17% when compared to the Permenhub (Regulation of the Ministry of Transportation).

CONCLUSION

a) The average percentage of changes in the shape of the ship's body below deck on purse seiners in Tegal is as follows: the shape of section I = 14%, II = 20%, III = 30%, IV = 11%, and V = 25%, while for KM. Himalaya SB (case study), section I = 15%, II = 18%, III = 29%, IV = 9%, and V = 28%.
b) The Cb value of KM. Himalaya SB is 0.82. Greater than the Cb value or f factor = 0.70 according to Permenhub Number 8 of 2013 for the motorboat category.
c) GT value of KM. Himalaya SB uses Cb value or factor f = 0.82, amounting to GT = 113.65, while based on Permenhub (Regulation of Ministry of Transportation) Number 8 of 2013, using f = 0.70, amounting to GT = 97.02. There was an increase in the GT value of 17%.

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