ANALYSIS OF EXISTING TRADITIONAL FISHING VESSEL WITH HOLD COMPARTMENT FOR LIVE FISH

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Abstract

Hold compartment for live fish in a traditional fishing vessel are important to increase fishermen's income, especially for grouper fish target capture with high economic value. The analysis object is the existing traditional fishing vessel in Pagerungan Besar Island, Sumenep Regency, East Java. Generally, for Indonesian traditional fishing vessels are building by the traditional method without calculations and design drawings. This research aims to analyze the design of fishing vessel construction with a live fish hatching system and evaluating its characteristics including stability, resistance, engine power, and the condition of the hold compartment of live grouper fish. The method was used descriptive numerical method by taking measurements directly and then design the fishing vessel samples and the trough corresponds to the data size in the field using the Maxsurf student version and CAD software. The analysis was carried out with the maximum speed of the fishing vessel in full loading condition was 10 knots with a resistance of 1,8 kN and engine power required of 24,428 HP. The stability result is illustrated by the GZ curve with 0,276 m in max GZ and 43,6o of max return angle. The stability was evaluated by International Maritime Organization (IMO) criteria standard with loading condition 2 (two) does not pass the IMO criteria. The water quality of the hold fish compartment was fine because the circulation of water from the inlet to the outlet hole is doing well in the transportation process.

Keywords: traditional fishing vessel, hold compartment, live fish, stability, resistance

INTRODUCTION

The contribution of the marine and fisheries sector in Indonesia to Indonesia's Gross Domestic Product (GDP) is only 3.7 percent in 2020 [1]. The Ministry of Maritime Affairs and Fisheries (KKP) noted that the sector has enormous potential, 1.3 times the GDP, or 130 percent [2]. An alternative solution to increase added value is through the sale of live fish. The fishermen in Pagerungan Besar Island, Sumenep Regency, East Java using the hold compartment for live fish in a traditional fishing vessel to accommodate the groupers to keep them alive until the sales process.

The shipbuilding process and hold compartment are carried out traditionally without calculations and design drawings. It poses a risk of ship accident because the fishermen perform activities in the sea, which can be dynamic conditions [3]. According to the problem, this research aims to analyze the design of fishing vessel construction with a live fish hatching system and evaluating its characteristics including stability, resistance, engine power, and the condition of the hold compartment of live grouper fish.

METHOD

The method used descriptive numerical method by taking measurements directly and then design the fishing vessel using the Maxsurf student version and CAD software. The stability calculation was using Maxsurf student version and the stability criteria using International Maritime Organization (IMO) rules [4].

RESULT AND DISCUSSION

Design

The main dimensions of the ships are 14 meter in length over all (LoA), 2 meter in Beam (B), 1.3 meter in Height (H), 0.41 meter in Draft (T). The main dimensions comparison with vessel ratio and the main

dimensions have filled the range in static gear operation as shown in Table 1.

Table 1. Comparison of dimension range ration of fishing vessel base on operation method [5]

Operation Method	L/B	L/D	B/D
Static gear	2,83-11,12	4,58-17,28	0,96-4,68
Existing fishing vessel	7,00	10,77	1,53
Encircling gear	2,60-9,30	4,55-17,43	0,55-5,00
Towed/dragged gear	2,86-8,30	7,20-15,12	1,25-4,41
Multipurpose gear	2,88-9,42	8,69-17,15	0,53-6,09

The lines plan was carried out as shown in Figure 1. Base on lines plan, general arrangement was carried out as shown in Figure 3 by adapted the existing condition, with hold compartment dimension 1.55 meter in length, 0.94 meter width, and 0.65 meter height. Redrawing of hold compartment as shown in Figure 2 with total six hole at the bottom of fishing vessel hull for circulation of water to keep oxygen supply. In order to keep fish alive, the hold handling needed, including paying attention to fish swimming bubbles, adjusting the waters to handling antibiotics to keep fish alive and healthy. So that the grouper caught can survive about 3 days or even more in the hold during the trip.

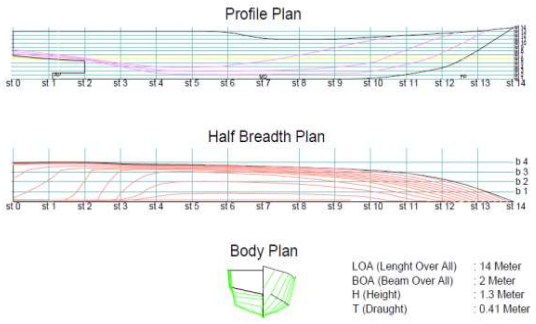

Figure 1. Lines plan

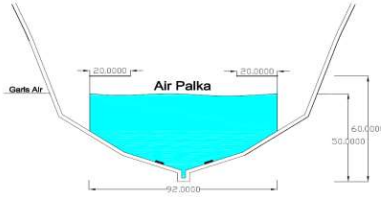

Figure 2. Hold compartment

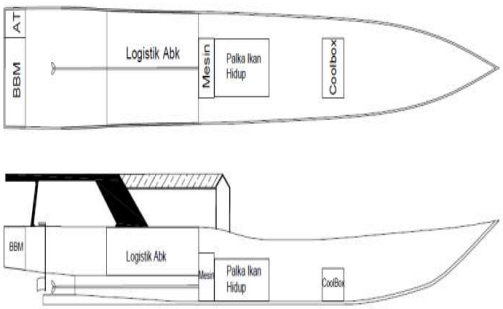

Figure 3. General arrangement

Stability

The stability calculation of fishing vessel using four load condition scenario such as:

1. Load case 1 when the fishing vessels leaving with the load and fuel 100%.
2. Load case 2 when the ship arrived at the fishing ground and reduced fuel to 75%.
3. Load case 3 when the fishing vessel operates in the fishing ground with an additional load and fish weight to fill the hold 100% and reduce fuel to 50%.
4. Load case 4 when the fishing vessels returning to the port with the load remaining 100% and fuel reversal being 25%.

The result of fishing vessel stability calculations using a computer assisted ship design application illustrated by GZ curve as shown by Figure 4 for load case 1 to load case 4.

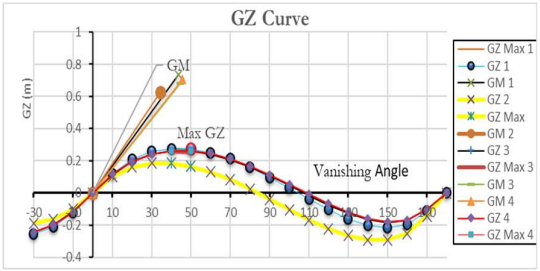

Figure 4. GZ curve for load case 1-4

The results of the stability calculation should be complied according to IMO rules criteria. All defined criteria have met by the IMO standard, except maximum GZ at 30 or greater in load case 2, as shown by Table 2. From the curve, it can be seen that the calculation results of 4 ship conditions show that the stability interval and the maximum GZ

value for each condition have insignificant differences. Also obtained at loadcase 1, 2, 3, and 4 values of vanishing angle, respectively, 104 °, 84 °, 107 °, and 108 °.

Table 2: IMO criteria comparation

Criteria	Value	Units	load case 1	load case 2	load case 2	load case 2
Area 0 to 30	3.151	m.deg	47,12	3,63	44,17	44,25
Area 0 to 40	5.157	m.deg	73,88	55,11	69,52	69,63
Area 30 to 40	1.719	m.deg	26,75	18,73	25,35	25,37
Max GZ at 30 or greater	0.2	m	0,27	0,18	0,26	0,26
Angle of maximum GZ	25	Deg	43,6	34,5	44,5	45,5
Initial GMt	0.15	m	0,73	0,62	0,68	0,70

Resistance

The calculation of resistance was carried out by the Holtrop method with various variations in ship speed from 0 knots to 10 knots, this was adjusted to conditions in the field where the ship uses the Dongfeng type S1115 M engine with a maximum engine power of 27 HP. In addition, this calculation was carried out with 2 ship conditions where each condition has a different load due to the effect of the load being loaded. Condition 1 when the ship will depart by ship was 0.34 m, while condition 2 when the ship returns with the catch load was 0.415 m. Ship resistance calculation results as shown by Table 3.

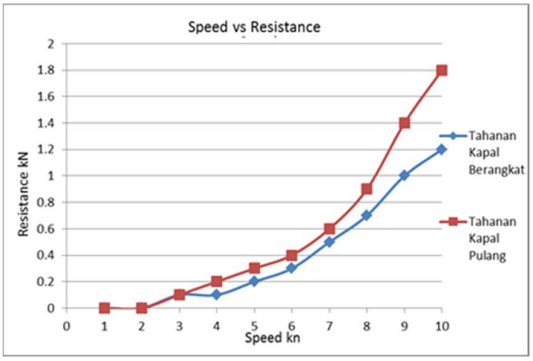

Figure 5. Speed vs Resistance

Table 3: Resistance calculation

Speed (knots)	Departure		Return	
	Ship Resistance (kN)	Engine Power (HP)	Ship Resistance (kN)	Engine Power (HP)
0	--	--	--	--
1	0,0	0,014	0,0	0,016
2	0,0	0,097	0,0	0,113
3	0,1	0,309	0,1	0,361
4	0,1	0,732	0,2	0,860
5	0,2	1,507	0,3	1,794
6	0,3	2,780	0,4	3,423
7	0,5	4,653	0,6	5,711
8	0,7	8,025	0,9	10,426
9	1,0	11,940	1,4	16,771
10	1,2	16,665	1,8	24,428

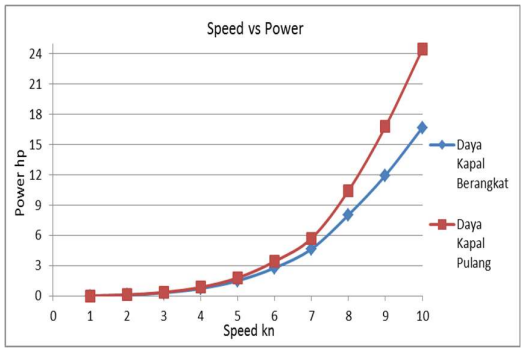

Figure 6. Speed vs Power

In the low speed, ship resistance was constant both on departure and return. but at high speed, the resistance returning more higher than when departing. This condition causes by loading from fish catch so that the hull is more submerged. Meanwhile, to have pass through the resistance, the power are increasing gradually with the engine speed.

CONCLUSION

The conclusions from this research are:

1. The stability was calculated using Maxurf with load case 2 does not passed the IMO criteria.
2. The ship resistance was constant both on departure and return. but at high speed, the resistance returning more higher than when departing.
3. By hold compartment innovation with water hole, the grouper fish can survive about 3

days or even more in the hold during the trip.

REFERENCES

[1] Statistics Indonesia, 2020, Indonesian Gross Domestic Product (GDP), BPS RI

[2] https://bisnis.tempo.co/read/1383928/kontribusi-sektor-kelautan-dan-perikanan-ke-pdb-baru-37-persen/full&view=ok. Accessed on 2020/09/10.

[3] Kadhafi, Muammar. "Mitigasi Kecelakaan Kapal di Pelawangan Pantai Pancer Kecamatan Puger Kabupaten Jember." Warta Pengabdian 13.1 (2019): 28-35.

[4] International Maritime Organization. (2009). International code on intact stability, 2008. Inter-Governmental Maritime.

[5] Palembang, S., A. Luasunaung., and F. P. T. Pangalila. 2013. Study Design Build Multifunction Fibreglass Fishing Boat 13 GT at shipyard CV Cipta Bahari Nusantara Minahasa, North Sulawesi. Journal of Fisheries Science and Technology Capture. 1(3) : 87-92..