Seakeeping and Safety Assessment of Fishing Vessel 30 GT

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***Abstract*— in Indonesia, many fishing vessels are made from generation to generation in a traditional way. As a result, the ships built did not comply with the regulations and permits of the naval architects. The fishing industry is one of the most dangerous because it works on the high seas. Therefore the performance in hydrodynamics and safety should be evaluated on these traditional vessels. The main objective of this research is to evaluate the hydrodynamic performance and safety of fishing vessels. Following standard specifications or criteria, seakeeping performance is evaluated using Maxsurf Ship Design software. Assessment of existing safety equipment uses IMO (International Maritime Organization) regulations and the Torremolinos protocol. As a result, the ship can only operate at a wave height of 0,1-0,5 meters or undersea state 3. Ship safety inspections reveal that they still do not meet the required requirements and do not have the necessary equipment specified by the World Maritime Organization (IMO).**

Keywords— fishing vessel, seakeeping, safety equipment.

I. INTRODUCTION

The fishing industry is still one of the most critical drivers of economic development. With around 6.4 million people involved in fishing activities, fishing is essential to Indonesia. Around 700,000 fishing vessels exist in Indonesia, with 25% dugout canoes and 50% without motors [1]. According to the Ministry of Maritime Affairs and Fisheries of Indonesia, all catch fisheries production grows every year. It caught 8.02 million tons of fish in 2020 [2]. Foreign currency generates revenue and improves living circumstances, particularly in coastal locations. Indonesia is an archipelagic country with 17,508 islands, a sea area of 5.8 million km2, and an 81,290 km coastline [3]. Because of the country's vast seas and lengthy coastline, becoming a fisherman is one of the primary vocations of Indonesians living along the ocean [4]. The ship is part of one of the actual cargo fleets. Trade, export-import, and fishing in the sea for fishers. This is inextricably linked to modes of transportation such as ships [5].

Because the Indonesian waterways are so extensive, ships used as transportation are highly demanded. Indonesian fishers frequently employ traditional fishing vessels when sailing to catch fish. Traditional fishing vessels are the most common type of vessel created in Indonesia. They are mainly composed of wood and constructed using relatively simple conventional methods, such as without line or hydrostatic design, stability calculations, and the advice and permission of naval architects. Figure 1 [6] shows a fishing boat as proof.

According to [7], traditional vessel builders preserve their design templates and include any particular adjustments based on rules of thumb and trial and error approaches to handle the manufacturer's urgent difficulties without considering the repercussions. Most traditional vessel builders are unaware of the science of fishing vessel design and the relevance of blueprints throughout the building process [8].

Ship maneuverability is generally assessed in calm seas, but ships at sea frequently experience such circumstances; therefore, waves influence the ships, even if just a little [9]. They operate in more harsh weather than bigger commercial vessels, putting the fleet and personnel in danger. The ship must be seaworthy and safe. Fishing is a labor-intensive and strenuous job that attracts people from poorer backgrounds [6]. Commercial fishing is one of today's most dangerous jobs, with high death rates reported in specialized literature. [10]. As a result, estimating a ship's maneuverability under wave conditions is critical [11]. This has a significant detrimental influence on safety, and as a result, fishing vessels are involved in the majority of worldwide marine accidents, with many lives lost each year [12].

Examining a vessel's behavior should be obligatory in a seaway from the beginning (conceptual) stage because further upgrades are difficult and expensive. It is widely understood that conceptual design techniques must be simple to use while maintaining a high level of forecast accuracy. This is also true for seakeeping evaluation, which requires specialization in vessel class and actual operating conditions [13]. However, the hydrodynamic performance in seakeeping and safety is still insufficient. Most fishing vessels operate on the open sea, where they are subjected to waves and storms that might cause operations to be disrupted during specific seasons. This scenario influences the ship's mobility, causing the crew's health. The necessity to determine the hydrodynamics of fishing vessels is addressed in a review study by [6,14].

The performance of a fishing vessel in a seaway, rather than calm water, determines its final success.

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Many designers still choose the hull form and direct proportions primarily based on their performance in calm water. As a result, seakeeping performance must be included in the design process from the conceptual design stage, as further enhancements are complex and costly. The fundamental reason is that various characteristics have a role in seakeeping, necessitating thorough studies to determine the hull form for the best vessel behavior in waves [15].

Seakeeping is the study of a ship's movement in a body of water. Seakeeping is a research subject covering behavior and performance indicators that reflect a ship's capacity to retain its function while at sea. As a result, seakeeping analysis is critical in determining the ship's capacity to survive in hazardous situations when confronted with inclement weather. Furthermore, the safety component of fishing vessel safety equipment must be considered. Many fishing vessels still do not fulfill the required safety requirements in Indonesia.

Figure 1. Traditional Fishing Vessel in Indonesia

According to Webster [16], traditional fishing vessels are also more stable, evaluating the higher risk of capsizing than conventional fishing vessels. The report also suggests that traditional fishing vessels are valued similarly to large vessels for safety reasons. As a result, more research into the seakeeping performance of fishing vessels in the seas during operation is required.

The primary goal of this research was to evaluate the stability and safety of traditional fishing vessels. This research is significant because it can enhance small vessels and, as a result, increase the productivity of coastal fishing [13, 17, and 18] have all been researched to understand better the seakeeping performance of fishing vessels. Loughran [19] investigated the safety of fishing vessels in the United Kingdom; they discovered that vessel movement was one of the three primary causes of fishing vessel accidents, while capsizing was caused by inadequate coordination stability performance, the most common cause mortality among fisherman. As a result, traditional fishing vessel performance, particularly seakeeping and safety issues, must be considered while designing traditional fishing vessels.

II. METHOD

A. *Data*

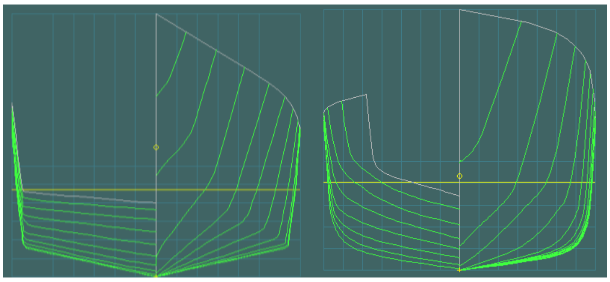
The main size characteristics of the fishing vessel employed in this study may be found in Table 1. The ship is 30 GT in size and has two hull models, namely the U and V hull shapes, as illustrated in Figure 1.

TABLE 1.
SHIP'S PARTICULARS

Main Dimension	Unit	30 GT
Length Over All (Loa)	M	20
Breadth (B)	M	4,3
High (H)	M	2
Draft (T)	M	1,35
Block Coefficient (Cb) U/V	-	0,61/0,551
Crew	Man	12
Speed (Vs)	Knot	9

Figure 2. Fishing Vessel 30 GT

Specifications for Multipurpose Net/Line Hauler fishing vessels with "U" and "V" hull types made from wood and propelled by a single marine inboard engine.



(a) Type V (b) Type U

Figure 3. Hull Type of Fishing Vessels 30 GT

B. *Seakeeping Criteria*

The seakeeping criteria used to use the standard form [20] as shown in the table below：

TABLE 2.
SEAKEEPING CRITERIA

Parameter	**Value**
Roll	6 deg
Pitch	3 deg
Lateral acceleration (at working deck AP & FP)	0,1 g
Vertical acceleration (at working deck AP & FP)	0,2 g

C. *Strip Methods*

In this study, the most crucial formulae for a linear frequency-domain strip method for slender ships in basic waves are presented. The formulas will be presented without being deduced. The reader is directed to Newman for a more comprehensive treatment of the theoretical foundation [21]. Each section is subsequently

considered a two-dimensional section to calculate its hydrodynamic properties. The section coefficients are then integrated down the hull length to get the global coefficients of the vessel's equations of motion.
There are two coordinate systems in use:

- The x, y, z ship-fixed system, with axes pointing ahead, starboard, and below. The ship's center of gravity is time-independent in this system.
- The inertial system ξ, η, ζ. This system tracks the ship's steady forward motion at speed V and matches the time average of the ship-fixed system, x_g, y_g, z_g.

The strip method's main goal is to calculate the ship's rigid-body movements, which are the three translations of the ship's origin in the ξ, η, ζ, and three rotations around these axes. We denote:

u1 surge	u4 roll
u2 sway	u5 pitch
u3 heave	u6 yaw

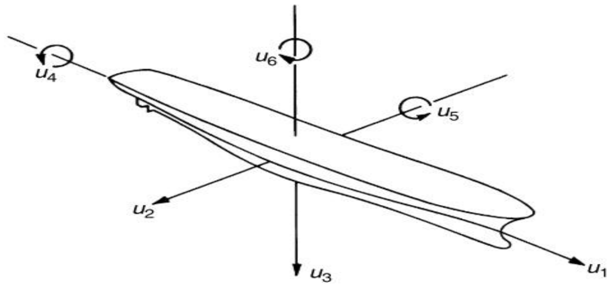


Figure 3. Six degrees of freedom motion for motion ship

$\vec{u}$ is a vector with six components. It's utilized to bring the motions together$\vec{F}$. $\vec{u}$and $\vec{F}$ are harmonic functions of time *t* that oscillate at the encounter frequency ω_e. The ship's forces and moments are similarly arranged in a six-component vector $\vec{u}$.

$$\vec{F} = \mathrm{Re}\left(\vec{F}e^{i\omega_e t}\right)\vec{u} = \mathrm{Re}\left(\vec{u}e^{i\omega_e t}\right) \quad (1)$$

The fundamental equation of motion is derived from

$$\vec{F}=M.\ddot{\vec{u}}=[-\omega_g^2(M+A)+\ i\omega_e N+S]\vec{u}=\vec{F}e \quad (2)$$

Here M, A, N, and S are real-valued 6 x 6 matrices. For mass distribution symmetrical to y = 0, the matrix m is :

$$M = \begin{bmatrix} m & 0 & 0 & 0 & mz_g & 0 \\ 0 & m & 0 & -mz_g & 0 & mx_g \\ 0 & 0 & m & 0 & -mx_g & 0 \\ 0 & -mz_g & 0 & \theta_{xx} & 0 & -\theta_{xy} \\ mz_g & 0 & -mx_g & 0 & \theta_{yy} & 0 \\ 0 & mx_g & 0 & -\theta_{xz} & 0 & -\theta_{zz} \end{bmatrix} \quad (3)$$

The mass moments of inertia θ are related to the origin of the ship-fixed coordinate system:

$$\theta_{xx} = \int(x^2+y^2)dm;\ \theta_{xz} = \int xz\ dm; \quad (4)$$

If we disregard impacts from a dry transom stern and other hydrodynamic forces caused by the ship's forward speed, the natural healing forces matrix S is as follows:

$$S = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \rho g A_w & 0 & -\rho g A_w X_w & 0 \\ 0 & 0 & 0 & gm\overline{GM} & 0 & 0 \\ 0 & 0 & -\rho g A_w X_w & 0 & gm\overline{GM}_L & 0 \\ 0 & 0 & 0 & 0 & 0 & -\omega_g^2 \end{bmatrix} \quad (5)$$

The waterline area is A_W, the x coordinate of the waterline's center is x_W, the metacentric height is GM, the longitudinal metacentric height is GML, and the circular eigenfrequency of yaw movements is ωg. N stands for the damping matrix. The letter A indicates the matrix of increasing mass. In the case of a ship moving forward, the division of forces into hydrostatic (S) and hydrodynamic (A) factors is rather arbitrary. $\vec{F}e$ denotes the vector of exciting forces that a wave may apply to a ship at a fixed system (diffraction problem).

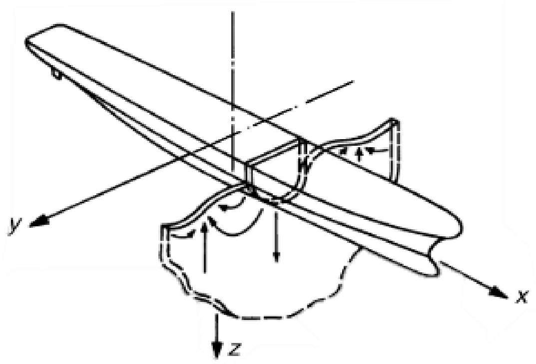


Figure 4. Principle of Strip Method

D. JONSWAP Spectrum

The JONSWAP spectrum is essentially a fetch-limited form of the Pierson-Moskowitz spectrum, except that due to non-linear wave-wave interactions, the wave spectrum is never finished and may continue to evolve for a long time. As a result, the α (*alpha*) phrase in the JONSWAP spectrum denotes that waves continue to expand with distance (or time), but the γ (*gamma*) term denotes a more dramatic peak in the spectrum. Hasselmann [22] concluded that the latter was crucial, resulting in higher non-linear interactions.

The JONSWAP (Joint North Sea Wave Project) spectrum is an empirical connection that describes how energy is distributed in the ocean with frequency.
The following is the fundamental equation:

$$S(\omega) = \frac{\alpha g^2}{\omega^5}\exp\left[-\beta\frac{(\omega^4 p)}{\omega^4}\right]\gamma^4 \quad (6)$$

Where :

$$a = \exp\left[-\frac{(\omega-\omega_p)^2}{2\omega_p^2\sigma^2}\right] \quad (7)$$

$$\sigma = \begin{cases} 0.07, & if\,\omega_p \le \omega_p \\ 0.09, & if\,\omega_p > \omega_p \end{cases} \quad (8)$$

$$\beta = \frac{5}{4} \quad (9)$$

α a constant associated with wind velocity and fetch length; see below. Normal readings for the northern North Sea vary between 0.0081 to 0.01
ω is the wave frequency
ω_p is the peak wave-frequency

E. Sea State

The standard sea condition code was agreed upon by the World Meteorological Organization in 1970 - see below. Each code refers to different wave heights, but the corresponding wave periods are not specified.

TABLE 3.
WMO SEA STATE CODE

WMO Code	Relevant Wave Height (m)		Description
	Range	Mean	
0	0	0	Calm (glassy)
1	0.0 to 0.1	0.05	Calm (rippled)
2	0.1 to 0.5	0.3	Smooth (wavelets)
3	0.5 to 1.25	0.875	Slight
4	1.25 to 2.5	1.875	Moderate
5	2.5 to 4.0	3.25	Rough
6	4.0 to 6.0	5.0	Very rough
7	6.0 to 9.0	7.5	High
8	9.0 to 14.0	11.5	Very High
9	Over 14.0	Over 14.0	Phenomenal

Data on the status of the sea may also be accessed for specific marine regions and seasons. This information might be beneficial while planning a route. Hogben and Lumb are among the most significant sources of this knowledge [23].

F. Safety Data

The table below from IMO/Torremolinos Protocol shows safety data that must be filled with fishing vessels.

TABLE 4.
LIFE-SAVING EQUIPMENT

Life-Saving Equipment	IMO/ Torremolinos
Life jacket	2-3
Lifebuoys	2
Parachute distress rocket signals	<12
Smoke signals	<2
Survival craft	1
First aid kit	1

TABLE 5.
WATERTIGHT BULKHEAD

Navigation and Fishing Lights	IMO/ Torremolinos
Aft peak, forepeak	1
Engine room	1
Fish hold	1

TABLE 6.
FIRE FIGHTING EQUIPMENT SYSTEM

Equipment and Systems for Fire Protection	IMO/ Torremolinos
Water pump, hydrants, and hoses	2
Carbon dioxide cylinder system	1
Portable fire extinguishers	1
Breathing apparatus	1

TABLE 7.
NAVIGATION AND FISHING LIGHT

Navigation and Fishing Lights	IMO/ Torremolinos
Red	1
Green	1
White	1
Red and Green	1

III. Results and Discussion

A. Seakeeping

The hydrodynamic performance of the vessel's hull forms in seakeeping and safety could be analyzed after modeling using the Maxsurf modeler. The Motion module for seakeeping analysis was utilized for this—figure 5 shows how the vessel's hull forms were produced using Maxsurf.

According to [24], habitability, maneuverability, operability, and survivability are the four critical areas of assessed seakeeping features. Since [25] were unable to come up with criteria for universally agreed-upon fishing vessel seakeeping requirements, Using the criteria given by M. Tello, the Seakeeper module was used to assess the seakeeping performance of the vessel. The parameters are shown in Table 2.

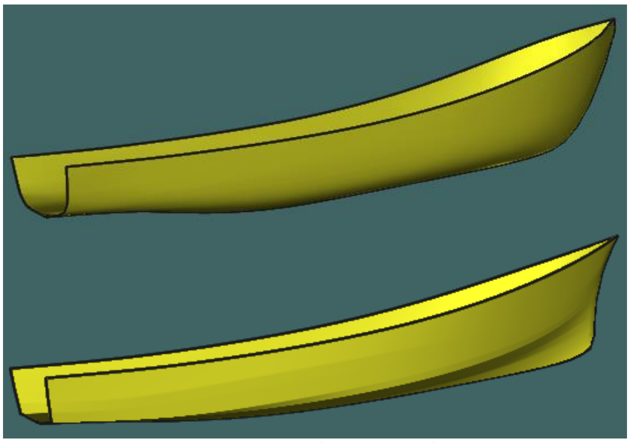


Figure 5. Hull from Maxsurf

The limit value describes the human tolerance limit for various forms of ship vibration. On fishing vessels, vertical acceleration is the most significant predictor of comfort and workability. As a result, the vertical acceleration must be estimated in each possible place where the operator would work or dwell. For example, motion sickness is linked to RMS vertical acceleration; MSI reflects the amount of seasickness accepted by passengers and staff on board the ship when at sea [26]. The back and forward ends of the vessel were chosen for investigation in this study.

Sariöz & Narli [27], on the other hand, propose that the lateral acceleration of the RMS caused by rolling motion is proportional to the produced interrupt (MII). According to this explanation, the RMS roll motion, representing the rolling reaction, is closely connected to sailing stability. According to Monk's account, working at sea is frequently limited to a set turning degree because excessive turning might cause the ship to capsize. According to [28], lateral acceleration diminishes the crew's capacity to complete the duty by

50% while decreasing the RMS roll angle by 25% to 30%.

It is vital to evaluate the vessel's seakeeping ability in various sea state situations. Table 3 shows the standard sea condition code developed by the World Meteorological Organization (WMO) in 1970. Each code represents a variety of wave heights. In seakeeping performance evaluation, the wave spectrum representing the spectral wave height also characterizes the sea state. A wave spectrum must be chosen; in this case, the JONSWAP (Joint North Sea Wave Project) spectrum was used. According to the information in table 1, the vessels were expected to have the highest speed at which they can move, 9 knots.

RAO (Response Amplitude Operator) is a common acronym for a seakeeping study that shows how the vessel's response develops over time. The RAO was compiled into a table to assess Tello's seakeeping criterion for fishing vessels in this study. Tables 8 to 13 show the outcomes of seakeeping.

The following sea and sea beam can be seen in the figure below as an instance of the ship's orientation towards the direction of waves coming in during head sea conditions:

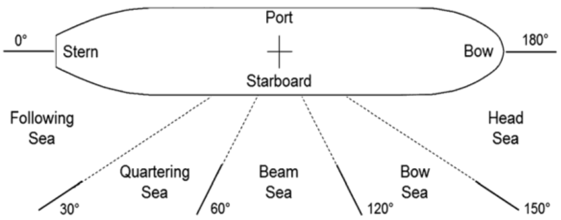


Figure 6. The direction of Ships Against Wave Directions

a. Head Seas

Waves in the direction of the bow of the ship. Head seas occur when the direction of the wave flows towards the ship

b. Following Seas

The direction of the wave is in line with the vessel's direction. This is the opposite of Head Seas

c. Beam Seas

The direction of the wave is straight against the ship's body.

TABLE 8.
SEAKEEPING 30 GT (V) FOR FOLLOWING SEAS

a	b	c	d	e	f
3	0,228 & 0,192	0	3,52	0	Fail
4	0,304 & 0,257	0	4,69	0	Fail
5	0,380 & 0,321	0	5,87	0	Fail
6	0,456 & 0,385	0	7,04	0	Fail

TABLE 9.
SEAKEEPING 30 GT (V) FOR BEAM SEAS

a	b	c	d	e	f
3	0,570 & 0,851	1,012 & 0,541	1,50	9,93	Fail
4	0,759 & 1,135	1,349 & 0,721	2,00	13,24	Fail
5	0,949 & 1,419	1,686 & 0,902	2,50	16,54	Fail
6	1,139 & 1,702	2,023 & 1,082	3,00	19,85	Fail

TABLE 10.
SEAKEEPING 30 GT (V) FOR HEAD SEAS

a	b	c	d	e	f
3	2,483 & 1,366	0	2,88	0	Fail
4	3,311 & 1,822	0	3,84	0	Fail
5	4,138 & 2,277	0	4,80	0	Fail
6	4,966 & 2,733	0	5,76	0	Fail

TABLE 11.
SEAKEEPING 30 GT (U) FOR FOLLOWING SEAS

a	b	c	d	e	f
3	0,177 & 0,192	0	3,30	0	Fail
4	0,236 & 0,256	0	4,41	0	Fail
5	0,295 & 0,320	0	5,51	0	Fail
6	0,354 & 0,384	0	6,61	0	Fail

TABLE 12.
SEAKEEPING 30 GT (U) FOR BEAM SEAS

a	b	c	d	e	f
3	0,450 & 0,906	0,799 & 0,408	1,45	9,71	Fail
4	0,600 & 1,208	1,065 & 0,544	1,93	12,94	Fail
5	0,749 & 1,510	1,331 & 0,680	2,41	16,18	Fail
6	0,899 & 1,812	1,597 & 0,816	2,89	19,41	Fail

TABLE 13.
SEAKEEPING 30 GT (U) FOR HEAD SEAS

a	b	c	d	e	f
3	2,199 & 1,530	0	3,07	0	Fail
4	2,932 & 2,040	0	4,10	0	Fail
5	3,664 & 2,550	0	5,12	0	Fail
6	4,397 & 3,060	0	6,14	0	Fail

Where :
a = Seat State
b = Vertical Acceleration RMS (at Working Deck AP & FP)
c = Lateral Acceleration RMS (at Working Deck Ap & FP)
d = Pitch RMS
e = Roll RMS
f = Status

Pass means fulfilling the criteria, while fail means it does not meet the criteria set by Tello in table 2. Sea state is taken from 3 to 5 based on data from BMKG (Meteorological, Climatological, And Geophysical Agency), and remembering the previous discussion that fishing vessels generally sail on the high seas. The overall result failed does not mean that the fishing vessel cannot sail in such conditions, but it is ineffective if it sails in such conditions. That means the ship can sail optimally at a sea state under 2 with 0,1 – 0,5 meter wave height.

The hull V type is better than the hull U type in maneuvering. This can be seen from the values obtained from tables 8 - 13; the hull V type value is more significant than the hull U type. The Hull V type is slimmer than the U type. That causes the hull V type easier to shake than the hull U type, which has a larger shape. Because it is easy to shake, which causes the hull V type to have a high value, this correlates to what Fadillah stated [29]. The Lateral Acceleration form hull V type value is greater than the hull U type. It has been described above that Lateral Acceleration affects rolling, so a rolling V-type hull is more significant than a U-type hull in maneuverability.

B. Safety Assessment

While working on fishing vessels, low stability, trapped water on the deck, lack of navigation lights, and slippery decks cause capsizing, sinking, collisions, and labor accidents. The survey was also used to analyze the fishing vessels' safety equipment; the results were then compared to the standards specified by the International Maritime Organization (IMO) safety rules.

TABLE 14.
SURVEY ON LIFE-SAVING EQUIPMENT

Life-Saving Equipment	**IMO/ Torremolinos**	**30 GT**	**Status**
Life jacket	2-3	12	Pass
Lifebuoys	2	4	Pass
Parachute distress rocket signals	<12	1	Pass
Smoke signals	<2	0	Fail
Survival craft	1	0	Fail
First aid kit	1	0	Fail

TABLE 15.
SURVEY ON A WATERTIGHT BULKHEAD

Navigation and Fishing Lights	**IMO/ Torremolinos**	**30 GT**	**Status**
Aft peak, forepeak	1	1	Pass
Engine room	1	1	Pass
Fish hold	1	1	Pass

TABLE 16.
SURVEY ON FIRE FIGHTING EQUIPMENT SYSTEM

Fire Fighting Equipment and System	**IMO/ Torremolinos**	**30 GT**	**Status**
Water pump, hydrants, and hoses	2	0	Fail
Carbon dioxide cylinder system	1	0	Fail
Portable fire extinguishers	1	2	Pass
Breathing apparatus	1	0	Fail

TABLE 17.
SURVEY ON NAVIGATION AND FISHING LIGHT

Navigation and Fishing Lights	**IMO/ Torremolinos**	**30 GT**	**Status**
Red	1	1	Pass
Green	1	1	Pass
White	1	1	Pass
Red and green	1	1	Pass

A survey on a watertight bulkhead is summarised in Table 15. The solitary watertight bulkhead on the fishing vessel meets the standards. A survey of life-saving equipment is being conducted to see whether enough equipment is available in the event of an accident. All vessels should carry life jackets and keep them in a readily accessible location. Lifebuoys must also be available and kept on the ship's port or starboard side. Every vessel must have a first-aid kit with a manual to treat injuries on board. Table 16 summarises the survey on life-saving equipment and shows how to parachute distress rocket signals and smoke signals can be fitted to call for aid. The ships lack life-saving equipment, which is critical in an emergency.

The assessment of the navigation and fishing light of the vessels is shown in Table 17. According to international regulations, fishing vessels must be equipped with the required lights to avoid a nightfall accident:

1. A sidelight or a lantern with red and green lights is perpendicular to the ship's centerline.
2. A lantern can be used as an all-around light, a fishing light, and an anchor light. The color white denotes completeness.
3. The upper fishing light is visible from all sides.
4. Green indicates trawling, whereas red indicates various fishing methods.
5. When it comes to fishing light, white signifies all around. If the vessel employs floating fishing gear that extends beyond 150 meters from the vessel, this light will signal the position of the floating fishing gear so that those vessels may avoid it.

It's also essential to have firefighting equipment on board. The firefighting equipment system onboard the vessels is shown in Table 28. At a minimum, one fire extinguisher must be stored in the vessels in a fire. According to the survey report, the vessels that meet all of the standards for a watertight bulkhead fail to meet specific safety requirements. As a result, it may be concluded that the fishing vessels studied do not meet the safety criteria set out by the International Maritime Organization (IMO) or the Torremolino's recommendations. Safety is an essential factor to consider while evaluating the performance of fishing vessels.

Additionally, vessel crews or operators should check that they are operating safely and that the vessel is in excellent shape before heading out to sea. Safety rules for designing and constructing vessels, as advised by safety authorities, should also be known to and offered to vessel builders. Improvements in this area are required to guarantee that fishing operations are conducted safely. Small fishing vessels must also undergo regular safety inspections to ensure operating safely.

IV. CONCLUSION

The fishing vessel's seakeeping and safety performance assessments were carried out following the relevant international regulations or standard criteria. The result of seakeeping can be sailed at wave height 0,1 -0,5 m or in sea state 2. The Ships can be sailed at a higher sea state but are not optimal. The crews of this ship were still comfortable sailing to catch fish. Seakeeping analysis obtained that maneuver hull V-type is better than hull U-type; however, stability hull U-type is better than V-type. For a fisherman, if want to get much fish should be chosen hull U type but if want to ship with good maneuver should be chosen hull V type. It all depends on the willingness of the fishers.

Many fishers are still unaware of the dangers of shipping. As can be observed from the survey table, several types of equipment do not meet the standards' criteria. The importance of cruise safety cannot be overstated. Small fishing vessels' poor performance may impact the operations' finances. As a result, it is critical for Indonesian fishing vessels to satisfy the standard requirements, maintain the safety of fishers, and boost the fishing industry's efficacy and production. Nonetheless, it is difficult to get a clear picture of small fishing vessel performance in Indonesia since varied design factors and operating regions might lead to different evaluation findings. Assessments of fishing vessels are necessary to enhance the vessel and, as a result, increase the productivity of fisheries activities.

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