Analysis of Occupational Safety of Boat Lift Net's Fishermen at the Bungus Ocean Fishing Port (PPS) Bungus West Sumatra

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ABSTRACT

Boat lift nets are one of the fishing gears in PPS Bungus, data from December 2021; 142 Bagan boat boats departed to carry out fishing operations with the number of fishermen boats 6 - 21 people and the weight of the ship 8-30 GT. In recent years, there have been several work accidents experienced by Bagan boat fishermen, such as falling while walking on the boat deck, fatigue, stepping on rotten wood, and broken hands. This study aims to determine the cases of work accidents that occurred in boat-bagan fishermen in the period January 2022 - January 2023, describe the activities carried out by boat-bagan fishermen, and determine the level of risk experienced by boat-bagan fishermen. This study uses a descriptive observational method with data analysis of probability concepts, JSA, and HIRA using the 2004 Australia and New Zealand standard risk control matrix. The results showed that the activities carried out in the operation preparation stage at PPS Bungus were mainly carried out by laborers (non-fishermen), work accidents in 7 operation activities were classified into five low-risk accidents and two moderate-risk and work accidents in the post-operation stage occurred 4 out of 7 activities which were classified into three common risk accidents and one medium risk.

Keywords: Boat lift net, Fishermen, Work accidents.

1. INTRODUCTION

With Padang as its capital, West Sumatra is located on the west coast of central Sumatra, consisting of west coastal lowlands and volcanic highlands formed by Bukit Barisan. The geographical location of West Sumatra is at 0˚54' LU-3˚30' LS and 98˚36'-101053' BT with an area of 42.297 km² and borders the Provinces of North Sumatra, Riau, Jambi and the Indonesian Ocean. The fishing port functions as a base for activities between land and sea activities into a helpful business system. A total of 22 fishing ports are Technical Implementation Units (UPT) of the Ministry of Maritime Affairs and Fisheries (KKP) under the auspices of the Director General of Capture Fisheries, one of which is the Bungus Ocean Fishing Port (Laporan Tahunan PPS Bungus 2021).

Bungus Ocean Fishing Port (PPS) is a port located in Padang City, West Sumatra. One of the fishing gear operating at PPS Bungus is boat lift nets. Based on data obtained during the internship in January - February

2022, it was obtained that the ship's departure proof report (STBLK) record in December 2021 was 142 boat lift nets that departed to carry out fishing operations with the number of fishermen on one ship 6 to 21 people and the weight of the boat 8 to 30 Gross Tonage (GT). Activities carried out by fishermen, starting from before the departure of the operation to returning to the mainland, are activities that have a high risk. The safety factor of ships and fishermen needs to be considered so that the fishing carried out can be said to be successful. Ship accidents in 2021 occurred in 19 cases, an increase of about 58.33%. In 2022, there were 13 ship accidents; this decreased by approximately 31.57% compared to 2021. This ship accident tends to decrease, but ship accidents with the category of sinking ships are still the same as the previous year, namely 5 cases (KNKT, 2022).

In recent years there have been several cases of work accidents experienced by fishermen of the boat lift nets, as described by one of the crew members of the ship lift nets at

PPS Bungus. He told the incidents he and his coworkers had experienced, such as falling while walking on the boat's satin, fatigue, stepping on rotten wood, and breaking his hand. He also told about work accidents on other fishing boats, where almost all boat lift net fishermen experienced the same work accident that he experienced. With some of the incidents described above, awareness of the safety of boat lift nets fishermen still looks lacking, so the risk of work accidents is likely to occur, therefore based on this background, it is necessary to research "Analysis of Occupational Safety of Boat lift net Fishermen at the Bungus Ocean Fishing Port (PPS) Bungus West Sumatra."

The purpose of this study is to determine the cases of work accidents that occurred in the boat lift net fishermen in the period January 2022 - January 2023, describe the activities carried out by boat bagan fishermen, and determine the level of risk experienced by boat lift net fishermen in PPS Bungus West Sumatra.

2. RESEARCH METHOD

Time and Place

The research was conducted from January 16 to January 30, 2023, at the Bungus Ocean Fishing Port (PPS) in West Sumatra.

Method

The method used in this research is descriptive observational medote. This research was conducted to obtain primary data and secondary data, primary data in the form of information data obtained through interviews with respondents using questionnaires, and secondary data used to help complete the research obtained from publications and documentation sourced from Bungus Ocean Fishing Port and other sources. This research requires respondents as many as 15 captains, 15 heads of engine rooms, and 15 crew members (ABK). From some literature or reading about research methodology, information can be obtained that the sample size should not be less (at least) than 10% of the population. In comparison, some states have a minimum of 5% of the population (Bungin, 2011).

Data Analysis
Concept of Probability

According to Noeryanti (2021), probability or chance is used to draw conclusions that contain an uncertain event or science that studies something related to possibility. If an event produces N different results, where each event has the same probability (S), then the probability of event A with A⊂S written as P(A) is expressed as follows:

$$P(A) = \frac{n(A)}{n(S)} = \frac{n}{N}$$

Description:
P(A)   = Chance
n(A)   = event that occurs (A)
n(S)   = The same probability event

The results of the probability calculation are converted into a qualitative assessment in the following Table 1:

Table 1. Probability scoring values based on probability calculation results

Level	Descriptor	Percentage (%)
5	Almost Certain (Ac)	80> - 100
4	Likely (L)	60> - ≤ 80
3	Moderate (Md)	40> - ≤ 60
2	Unlikely (Ul)	20> - ≤ 40
1	Rare (R)	0 - ≤ 20

Source: Januar (2017)

Job Safety Analysis (JSA)

Job Safety Analysis (JSA) is a safety technique that focuses on identifying and controlling hazards related to the sequence of work or activities to be carried out in the work area (Widodo, 2021). Steps to make a JSA: 1). Select the work activity to be reviewed. 2). Divide the work into several activities. 3). Identify the potential hazards that will arise. 4). Establish procedures to minimize potential hazards. Analysis Hazard Identification and Risk Assessment (HIRA)

HIRA is a method for identifying potential occupational hazards by defining the characteristics of hazards that may occur and evaluating risks through risk assessment using a risk assessment matrix (Fitra, 2021). In the risk assessment stage, you can use the 2004 Australia and New Zealand standard risk control matrix, as seen in Table 2-4.

Table 2. Probability scale in AS/NZS 4360 standard: 2004

Level	Criteria	Explanation
1	Rare (R)	May occur only under special conditions / once a year
2	Unlikely (Ul)	It may occur in some circumstances, but it is unlikely that
3	Possible (P) / Moderate (Md)	It may occur in certain conditions
4	Likely (L)	It can occur in almost any condition
5	Almost Certainly (Ac)	It may occur in all conditions

Table 3. Severity scale in AS/NZS 4360 standard: 2004

Level	Accident	Example
1	Insignificant (Is)	No loss, very small material
2	Minor (Mn)	Minor injury requiring immediate treatment at the scene, moderate material loss
3	Moderate (Md)	Loss of working days, requiring medical treatment, substantial material loss
4	Major (Mj)	Injuries resulting in disability or total loss of body function, large material losses
5	Extreme (E)	Causing a very large material disaster

Table 4. Australia - New Zealand Standard Risk Assessment Matrix

AS/NZN 4360: 2004		Severity				
		Insignificant (Is)	Minor (Mn)	Moderate (Md)	Major (Mj)	Extreme (E)
Probability	Almost Certain (Ac)	Moderate	High	High	V. High	V. High
	Likely (L)	Moderate	Moderate	High	High	V. High
	Moderate (Md)	Low	Moderate	High	High	High
	Unlikely (Ul)	Low	Low	Moderate	Moderate	High
	Rare (R)	Low	Low	Moderate	Moderate	High

Note: V (Very high) risk: Stop work until adequate corrections are made, and implement the control plan immediately; H (High risk): still a high priority, set a target time for action; M (Moderate risk): managed with specific monitoring or response procedures with defined management responsibilities; L (Low risk): Managed by routine procedures, not requiring the application of specialized resources;

3.   RESULT AND DISCUSSION

Lift Net

Lift net fishing gear is one of the fishing gear in the Bungus Ocean Fishing Port (PPS) of West Sumatra. Based on the time of the research, three places from 15 boats became the research sample, namely three boats in PPS Bungus, ten boats in Cindakir, and two ships in Gaung. Bagan boats sampled in the study had different lengths of fishing trips, from one-day fishing to 10 days fishing. The weights of the sampled bagan boats ranged from 8 GT to 54 GT, where the most negligible boat weight was KM. Satria-05 and the largest boat weights are KM. Puspa Sari-03 and KM. Dilla De Vicky-05. The crew members on the ship range from 5 to 18 people, with the least number of crew members being KM. Satria-05, and the largest crew is KM. Puspa Sari-03.

Job Safety Analysis (JSA)
Preoperative Stage

This activity is divided into three core activities: checking and fishing needs, transferring to the boat, and heading to the fishing area (Januar, 2017). According to Tamara (2018), the preparation for the fishing ground area for a boat lift net at PPS Bungus is checking the boat, fishing gear, lights: freshwater, fuel, and other food ingredients. Salman et al. (2015) prepare for the operation of the pete-pete boat fuel, checking the engine, the lights and ColdBox, and ice blocks and salt.

The laborers (non-crew), commonly referred to by local people as anak ula, prepare ice blocks, refuel, and prepare fresh water and crew supplies. Fishermen who work on boats are only involved in preparing the needs of going to sea for the personal needs of the fishermen. For the needs of the crew (rations), laborers take them to kiosks that have become subscribed to the ship where the kiosk is

located, not far from where the boat is docked. After all fishing needs are available, they are delivered to the bagan boat, and laborers also deliver fishing needs. Activities Checking fishing gear before departure is carried out by fishermen to maximize the catch later. If fishing gear (waring) is damaged or torn, it is re-sewn so that the waring can be used again as it should. In checking this fishing gear, sometimes fishermen need to be more careful in working, and when sewing waring, their hands are punctured by tailor needles, causing injuries to the hands. Some fishermen fall, and the net gets stuck when checking fishing gear.

The next activity is checking the ship's engine. This is done by fishermen who serve as KKM on the boat. All activities related to the engine and electricity are handed over to the KKM by the bagan boat fishermen around PPS Bungus. Incidents that have occurred when checking the boat engine are KKM slipping due to the slippery floor of the boat engine room due to fuel spills and KKM suffering bruises on the body. Preventing the ship's condition and lights: The crew carries out this activity to ensure that the ship and lights are in good condition and ready to carry out fishing operations. The incident that has been experienced by boat lift net fishermen in PPS Bungus is in contact with electricity when checking the lights.

After all the fishing needs, starting from ice, fresh water, fuel, and crew needs (rations), are available, the laborers (anak ula) deliver the fishing needs to the boat. This is done from morning until noon before the fishermen leave for the fishing ground. Furthermore, the transportation of fishermen to the ship lifts nets for the Cindakir and Gaung areas, and the transportation of fishermen uses a sampan. In contrast to PPS Bungus, bagan boats at PPS Bungus are directly moored at the dock so that bagan boat fishermen now board the bagan ship without using a sampan as an intermediary. PPS Bungus has a harbor pool depth of 3 - 7 m, so it can still accommodate vessels with a larger GT size (Bamesyah et al., 2022). Arriving at the boat, fishermen move from the sampan to the ship lift net in turn; when moving to the boat, the things that fishermen experience falling and slipping because their feet are wet when getting into the sampan the ship.

When heading to the fishing ground, the activities carried out by fishermen are removing the mooring rope, starting the engine, and directing the boat to the fishing ground. KKM carries out the activity of creating the boat engine. The boat engine is heated first before leaving for the fishing ground; the potential hazards that occur when starting the boat engine based on the observation results are mechanical; namely, the stater lever flips when the engine is turned on so that KKM's hand is dislocated.

Stages of Operation

In the stage of boat lift net fishing operations, there are seven activities carried out by fishermen, including turning on the lights, lowering the net, watching for signs of fish gathering, the process of extinguishing the lights, pulling the net (hauling), taking the catch and lifting the net to the boat bagan (Salman et al., 2015). After arriving at the fishing ground, the fishermen prepare to conduct fishing operations. Before lowering the net, the fishermen first turn on the lights. The light source used to attract fish to gather around the Bagan is the help of lamps (Sagala, 2016). The second activity is lowering the net. The net is lowered after seeing shoals of fish gathering around the boat chart. The potential hazards during net lowering are injured hands, lost/damaged ballast, and fishermen splashing into the sea. This can be prevented by wearing PPE (Personal Protective Equipment), doing routine checks, and wearing/providing life jackets (Riantoro, 2014).

The next activity is watching for signs of fish gathering. Based on the results of interviews with fishermen, the length of time to watch for signs of fish gathering depends on the schools of fish that gather on the nets, ranging from 30 to 60 minutes. The lights are extinguished when the schools of fish have gathered on the nets. The lights are extinguished gradually so that the fish caught are not surprised and leave the shipping area (Nandia, 2021), starting from the outermost lighting lamp and finally, the focus lamp to position the fish in one area. Next, the hauling process is carried out after the lights are extinguished, and only the focus light is left.

The hauling process is characterized by rotating the roller to lift the net to the surface (Nandia, 2021). The net still attached to the frame is removed, and the net on the side of the ship is led to the ship's body on one side so that the net resembles a bag and the fish has been

collected in the bag. Based on the study's results, the potential hazards that arise when taking catches are punctured fish and improper footing. Fishermen are hit by a shovel filled with fish (Jamri, 2020). Other potential hazards are collisions, injured hands, and back pain, which can be prevented by wearing PPE (Personal Protective Equipment), using lightweight shovels, and providing life jackets (Riantoro, 2014). The last activity during fishing operations is lifting the net onto the boat bagan. Potential hazards include getting caught in the body of the net or wrapped around the ris rope, which can cause injuries (Nugraha, 2022). The study's results also resulted in fishermen falling because the boat floor was slippery when lifting the net onto the boat.

Postoperative Stages

Activities carried out while heading to the anchorage are the helmsman directing the boat to the anchorage (fishing base), tying the net on the boat, mooring the boat in the harbor pool, attaching the mooring rope, moving the catch box to the auction site, rechecking the fishing gear. The crew of fishermen leaving the boat (Januar, 2017). The helmsman directs the boat to the fishing base; in this case, the ship's captain acts as a helmsman. In this activity, the potential hazards are lost direction and the ship capsizing, which can be prevented by carrying a GPS (Amar, 2021). The next activity is tying the net on the boat; this aims to tidy up the
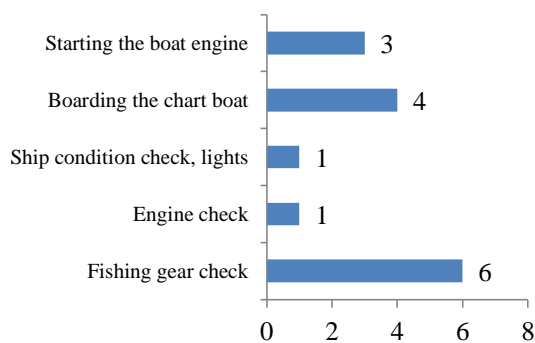
fishing gear used and tie it to the boat so that the fishing gear can be lowered quickly during the next operation. The activity of tying the net on the boat and tidying it up has the potential danger from the research results of falling, slipping, and pinched fingers. Arriving at the fishing base, the boat captain positions the boat correctly so other boats can also moor after the fishing operation.

The activity of lowering the catch in the three areas that became the research object was different. For the Gaung area, the catch is lowered using a canoe with a basket or basin; for the Cindakir area, the catch is obtained at night. If it produces an abundant catch, then it is immediately auctioned to the Gaung area; for PPS Bungus, the catch obtained is lowered by the crew and welcomed by the laborer using a canoe, and then the catch is taken to the ship owner's warehouse. After the catch is unloaded, fishermen prepare to get off the boat; the fishermen recheck the fishing gear before getting off. Things that have happened when checking and tidying up fishing gear by fishermen at PPS Bungus are entangled in nets. When exiting the ship, there is a potential danger of slipping, bumping, and crew/supplies falling into the harbor pool, so prevention can be done by wearing PPE (Personal Protective Equipment) and cleaning the path (Riantoro, 2014).
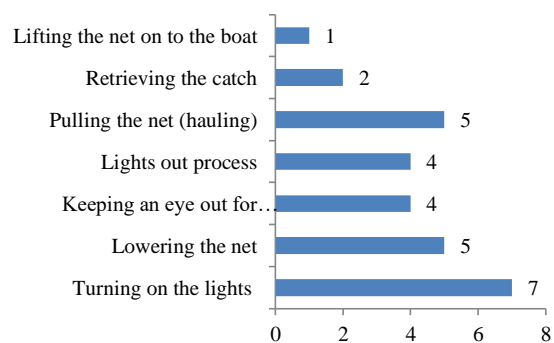

Figure 1. Preoperative work accident

Figure 2. Operation Work Accident

Boat lifts Net Fishermen Work Accident at PPS Bungus.

Work accidents experienced by boat lift nets fishermen at PPS Bungus during preoperations occurred the most when checking fishing gear six times over the past year and the least when checking the condition of the boat, lights, and checking the engine once (Figure 1).

Work accidents experienced by boat lift net fishermen at PPS Bungus during fishing operations occurred the most when turning on the lights seven times over the past year and the least when lifting the net onto the bagan boat once (Figure 2).

Work accidents experienced by boat lift nets fishermen at PPS Bungus during fishing

operations mainly occur when tying nets on boats as many as four and the least when rechecking fishing gear once (Figure 3). Accidents that occurred in boat lift net fishermen in the period January 2022 - January 2023, both during the preoperation stage, the operation stage, and postoperation, can be said to be accidents that are categorized into accidents that may occur only under certain conditions, this is reinforced by the results of interviews with respondents who stated that work accidents exist, but now they rarely occur because fishermen who go to sea have all experienced for many years.
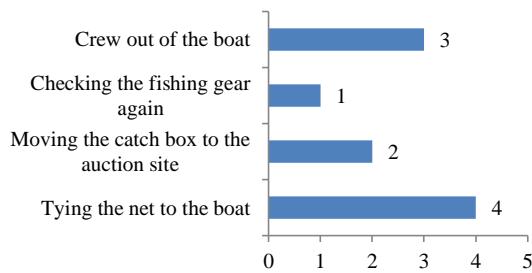

Figure 3. Postoperative work accident

Analysis Hazard Identification and Risk Assessment (HIRA)

The possibility table is categorized based on how many cases of work accidents experienced by boat lift net fishermen during the past year, which are then processed using the concept of probability; the results of the probability calculation are converted into a qualitative assessment. For the calculation results obtained during the study, from preoperation and operation to postoperation stages, the percentage results range from 0- ≤ 20% or in the rare category.

Preoperative Stage

Work accidents when checking fishing gear with a frequency value of 0.4 and seen from the severity (saferity) in the process of checking fishing gear obtained a Minor value. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. Work accidents when checking the engine, checking the condition of the ship and lights with a frequency value of 0.067 and, when viewed from the severity (saferity) in the process of checking the engine, obtained a Minor value, The accident category from the probability and saferity values based on the AS/NZS 4360

standard: 2004 is low risk. Activities carried out by fishermen when transferring to the boat / bagan boat are fishermen boarding the bagan boat, work accidents when boarding the bagan boat with a frequency value of 0.267, and, when viewed from the level of severity (saferity) in the process of boarding the bagan boat obtained a Minor value, the accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. Work accidents when starting the boat engine with a frequency value of 0.2 and when viewed from the severity (saferity) on starting the boat engine obtained a value of Moderate. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is moderate risk.

Stages of Operation

Work accidents when turning on the lights with a frequency value of 0.467 and when viewed from the severity (saferity) on turning on the lights obtained a value of Moderate. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is moderate risk. Work accidents when lowering the net with a frequency value of 0.33 and seen from the severity (saferity) in the process of checking fishing gear obtained a Minor value. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. Work accidents have a frequency value of 0.267 when watching for signs of fish gathering. The value is insignificant when viewed from the severity (safety) while watching for signs of fish gathering. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk.

Work accidents during the process of extinguishing the lights have a frequency value of 0.267 when viewed from the severity (saferity) in the process of extinguishing the lights obtained a value of Moderate, the accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is moderate risk. Work accidents over the past year with a frequency value of 0.33 obtained a value of Minor when viewed from the severity (saferity) while watching the fish gathering sign. The accident category of the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. Work accidents during catch retrieval

have a frequency of 0.133, and when viewed from the severity (saferity) in the process of retrieving the catch obtained a Minor value, the accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. Work accidents over the past year have a frequency value of 0.067 and, when viewed from the severity (saferity) in the process of taking the catch, obtained a value of Minor. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk.

Postoperative Stages

When tying the net on the boat, the work accident is worth a frequency of 0.267, and moving the catch is worth 1.33. Furthermore, when viewed from the severity (saferity) of tying the net on the boat, the value of the minor accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. When rechecking fishing gear, work accidents have a frequency of 0.067 when viewed from the severity (saferity) of mooring the boat in the harbor pool obtained a minor value. The accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is low risk. When the crew exits the boat, the work accident is worth 0.2. When viewed from the severity (saferity) of the crew exiting the boat, the value is Moderate, and the accident category from the probability and saferity values based on the AS/NZS 4360 standard: 2004 is moderate risk.

4.   CONCLUSION

Activities carried out by boat lift nets fishermen at PPS Bungus in the preoperative stage involve laborers (non-crew), especially in preparation for going to sea and the process of delivering supplies to the banana boat using a canoe. Cases of work accidents that occurred in boat mule fishermen in the past year at PPS Bungus at the preoperative stage / before departure, namely, six times checking fishing gear activities with a low-risk category. One accident in checking the engine with a low-risk category. One accident in checking the condition of the boat and lights with a low-risk accident category. Four times in the activity of fishermen boarding the boat with a low-risk accident category. Three times in the activity of starting the engine with moderate accident category.

In the fishing operation stage, work accidents occurred to fishermen seven times when turning on the lights with a moderate category. Five times, accidents are lowering the net with the low-risk accident category. Four times on watching for signs of fish gathering with a low-risk accident category. Four times of light outage accidents with moderate category. Five times of net pulling accidents with low-risk accident category. 2 times accidents in taking the catch with low-risk accident category. One accident involved lifting the net onto the boat bagan with a low-risk category. In the post-stage, there were four accidents in the activity of tying nets on boats with a low-risk category. 2 accidents when moving the catch box with a low-risk category. One work accident involved rechecking fishing gear with a low-risk category. Three work accidents involved crew members getting out of the boat with the potential danger of falling, categorized in the moderate accident category.

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