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STUDY OF SQUID HANDLINE OPERATION TECHNIQUES AND CATCH RESULTS IN ARAFURA WATERS

Studi Teknik Pengoperasian Pancing Ulur Cumi dan Hasil Tangkapan di Perairan Arafura

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ABSTRACT

Arafura waters are one of the main squid (Loligo sp.) fishing areas in Indonesia with an important contribution to national capture fisheries production. This study aims to describe the squid handline operation technique and analyze the types and quantities of catches on KM. Bandar Nelayan 118 based in Benoa Harbor, Bali. The study was conducted in October–November 2023 through direct observation on board, interviews with the captain and crew, and documentation of fishing activities. Data were analyzed descriptively qualitatively. The results showed that squid handline operations were carried out at night with the help of 2000 watt metal halide lamps, using four main techniques, namely bottom fishing (ahe-ahe), mid-line fishing (kokokan), surface fishing (lempang), and sate fishing. Fishing gear is selective and only catches Loligo sp. squid without bycatch. The total catch during the study reached approximately 9,902 kg, with daily fluctuations influenced by currents, baiting techniques, bait color, and the location of the catch. This study demonstrates that squid handline fishing on the KM. Bandar Nelayan 118 is effective, selective, and has the potential to support sustainable capture fisheries in the Arafura Waters.

Keywords: Squid (loligo sp.), Hand line, Arafura waters, Fishing technique

ABSTRAK

Perairan Arafura merupakan salah satu wilayah penangkapan utama cumi-cumi (*Loligo* sp.) di Indonesia dengan kontribusi penting terhadap produksi perikanan tangkap nasional. Penelitian ini bertujuan untuk mendeskripsikan teknik pengoperasian pancing ulur cumi serta menganalisis jenis dan jumlah hasil tangkapan pada KM. Bandar Nelayan 118 yang berbasis di Pelabuhan Benoa, Bali. Penelitian dilaksanakan pada Oktober–November 2023 melalui observasi langsung di atas kapal, wawancara dengan nakhoda dan anak buah kapal, serta dokumentasi kegiatan penangkapan. Data dianalisis secara deskriptif kualitatif. Hasil penelitian menunjukkan bahwa pengoperasian pancing ulur cumi dilakukan pada malam hari

dengan bantuan lampu metal halide 2000 watt, menggunakan empat teknik utama, yaitu pancing dasaran (ahe-ahe), pancing pertengahan (kocokan), pancing permukaan (lemparan), dan pancing sate. Alat tangkap bersifat selektif dan hanya menangkap cumi *Loligo* sp. tanpa hasil tangkapan sampingan. Total hasil tangkapan selama penelitian mencapai ±9.902 kg, dengan fluktuasi harian yang dipengaruhi oleh arus, teknik memainkan umpan, warna umpan, dan penentuan daerah penangkapan. Penelitian ini menunjukkan bahwa pancing ulur cumi pada KM. Bandar Nelayan 118 efektif, selektif, dan berpotensi mendukung kegiatan perikanan tangkap yang berkelanjutan di Perairan Arafura.

Kata kunci: Cumi-cumi (l*oligo* sp.), Pancing ulur, Perairan arafura, Teknik penangkapan.

INTRODUCTION

As an archipelagic nation, Indonesia possesses vast potential for marine resources and capture fisheries, with a marine area of over 5 million km² and the world's longest coastline. This geographical location makes the marine and fisheries sector a crucial pillar of national development, both in terms of the economy, food security, and job creation for coastal communities. Optimal and sustainable utilization of fisheries resources is a strategic necessity, given the high dependence of the community on this sector for food and livelihoods.

One important commodity in Indonesia's capture fisheries is squid (Loligo sp.), which has high economic value, good nutritional content, and market demand that continues to grow steadily year after year. Squid not only serves as a source of animal protein for the community but is also an export commodity that contributes to the country's foreign exchange earnings. Squid fishing in Indonesia is carried out using various fishing technologies, including handline squid jigs, a simple yet effective fishing gear used by traditional fishermen to target squid stocks in specific water columns, particularly at night when squid exhibit high feeding activity and are more responsive to light stimuli (Mustamin et al., 2023; Rema & Selvika, 2025).

Spatially, the Arafura Waters are known as one of the most productive areas for squid fisheries in Indonesia, with fishing fleets contributing from several major ports such as Benoa, Muara Baru, and Cirebon. This high water productivity is influenced by favorable oceanographic characteristics, such as water fertility, natural food availability, and current dynamics that allow for the distribution of large quantities of squid. Therefore, the Arafura Waters play a strategic role in supporting national squid fisheries production. However, this situation also presents challenges to sustainable utilization, particularly related to increasing fleet capacity, the intensity of fishing effort, and the potential pressure on resource stocks if not managed effectively and scientifically (Faizah & Kasim, 2023).

In field fishing practices, squid fishermen employ various operational methods, such as squid jigging, which has been shown to increase catch efficiency when combined with appropriate techniques. The use of auxiliary lights as a lure is crucial because light can attract squid upward into the water column, facilitating the capture process. Furthermore, adjusting the depth of the fishing line is crucial for the success of operations, given that squid distribution is dynamic and influenced by aquatic environmental conditions. Along with technological advancements, fishing gear continues to innovate, including the development of semi-automatic fishing rod designs aimed at improving operational efficiency, reducing the workload for fishermen, and increasing catch productivity in several Indonesian waters, including Sulawesi (Suwardi et al., 2024).

Although squid fisheries have significant potential, their productivity and sustainability still face various challenges, both technically and in terms of management. These challenges include the effectiveness of fishing gear, optimal stock utilization strategies, and resource management policies that balance economic interests and ecosystem sustainability. In the

Arafura Sea, high fishing intensity demands a more comprehensive study to ensure rational and sustainable utilization of squid resources (Faizah & Kasim, 2023).

More specifically, the KM. Bandar Nelayan 118 is a squid fishing vessel owned by PT. Bandar Nelayan, based at Benoa Harbor, Bali, and actively conducts squid fishing operations in the Arafura Waters using handline fishing gear. This vessel operates on relatively long voyages and long operating durations, relying on manual handline jigging techniques for fishing. These operational conditions provide a significant opportunity to directly assess the effectiveness of handline fishing techniques on a commercial fleet scale, particularly in relation to catch yields, business efficiency, and the potential for developing fishing technology.

Therefore, this research is crucial to examine the operational handline fishing techniques employed on the KM. Bandar Nelayan 118 and their impact on squid catches in the Arafura Waters. This study is expected to provide scientific contributions in the form of empirical information regarding squid fishing practices in the field, as well as provide the basis for recommendations for the development of more effective, efficient, and sustainable fishing technologies to support squid fisheries productivity in Indonesia.

RESEARCH METHODS

Place and Time

This research was conducted from October to November 2023 in the Arafura Sea, Aru Islands. The coordinates of the research point were 07º - 08º South Latitude and 133º East Longitude.

Work procedures

To obtain accurate, objective, and relevant data, this research was conducted through a series of systematic and planned data collection procedures. The method used refers to the capture fisheries research approach, which emphasizes direct field observation, structured interviews, and documentation as supporting data (Sudjana, 2017; Suryabrata, 2018). The data collection procedures included direct observation, interviews, documentation, and descriptive data analysis to obtain a comprehensive picture of the squid handline fishing gear operating techniques, the types and quantities of catches in the Arafura Waters using the KM. Bandar Nelayan 118, based in Benoa, Bali. The following are the steps of the work procedures carried out in this research:

1. Direct observation of squid fishing activities using the KM. Bandar Perisai 118, including the type and quantity of catch obtained during the study, was then recorded using a previously prepared daily observation sheet.
2. Interviews with the captain and crew of the KM. Bandar Nelayan 118 to gather information on the type of bait, size of bait, size of line used, fishing gear arrangement, techniques used, and determination of the location of squid fishing areas.
3. Documentation is carried out in every activity on the ship, starting from preparation, assembling fishing gear, to the fishing process.
4. The data was analyzed descriptively qualitatively regarding the operating techniques, types and quantity of catch.

Data Analysis

The data analysis used in this study uses a descriptive method, which systematically describes the situation based on the facts onboard the KM. Bandar Nelayan 118. According to Arkham et al. (2015), the collected data is described and presented in tables and diagrams.

Squid handline fishing operations include preparing tools and materials, assembling fishing gear, casting techniques, baiting techniques, and fishing aids. The type and quantity of catch are calculated based on the day and the location or coordinates of the fishing point.

RESULT

Squid fishing boat specifications

The squid fishing vessels used at the Benoa Public Works Agency (PU Benoa) are wooden vessels that use handline fishing gear. The squid fishing vessels moored at Benoa Port, Bali, comprised 290 vessels with vessels exceeding 100 gross tonnage (GT) in 2023. The following are images and specifications of the vessels in the study.

Figure 1: Squid fishing vessel (Source: Personal Documentation, 2023)

The squid fishing vessel used in data collection was the squid (loligo sp.) handline fishing vessel named KM. Bandar Nelayan 118, owned by PT. Bandar Nelayan. It is 27.31 meters long, 7.45 meters wide, and 2.75 meters deep, with a gross tonnage of 140 GT. The vessel was built in Benoa, Bali, in 2001.

Squid fishing gear specifications

The fishing gear used to catch squid (Loligo sp.) in Benoa Harbor, Bali, is generally operated using the handline technique, which involves reeling the line to the bottom or mid-water. The squid fishing rods used in the study on the Bandar Nelayan 118 vessel used one or two artificial shrimp baits, using bottom and surface fishing rods, and five to nine artificial baits for mid-water fishing (shaking). Handline fishing rods consist of fishing line, rod, bait, and sinker. The hook size and line diameter are adjusted to the type of fish being caught (Latuconsina, 2010). The following table lists the squid fishing rod specifications on the Bandar Nelayan 118 vessel:

Table 1. Specifications of the squid handline fishing rods used in the study

No	Specification	Size/number	Manufacturing materials
1.	Line winder	701 (17 cm)	Plastic
2.	Main line	500 (1.00 mm)	Monofilament
3	Branch line	200 (0,65 mm)	Monofilament
4	Sink	100-250 gr	Rebar
5	Swivel	3 cm	Stainless steel
6	Bait	2,5 (10 cm) dan 4,0 (14 cm)	-
7	Snap	3,5 cm	Steel

Characteristics and construction of squid fishing rods

The characteristics and construction of the squid fishing rods on the KM. Bandar Nelayan 118 vessel at the Benoa public port in Bali are as follows:

1. Bottom fishing (aeh-ahe)

   This fishing gear consists of a reel, a mainline with a number of 500 with a length of approximately 60 meters, then followed by a swivel (swivel) coupled to the swivel, a branchline with a number of 200 with a length of 1 meter is tied and then given an apolo. This fishing gear usually uses 2 apolo and at the bottom is given a snap then a

pendulum/weight. Research by Worang et al., (2022) Regarding bottom fishing in the waters of Manado Bay which states that the bottom fishing gear used is similar in construction to bottom fishing in general, showing the use of bait, branch lines, and operating techniques. The following is the construction of bottom fishing gear in the research:

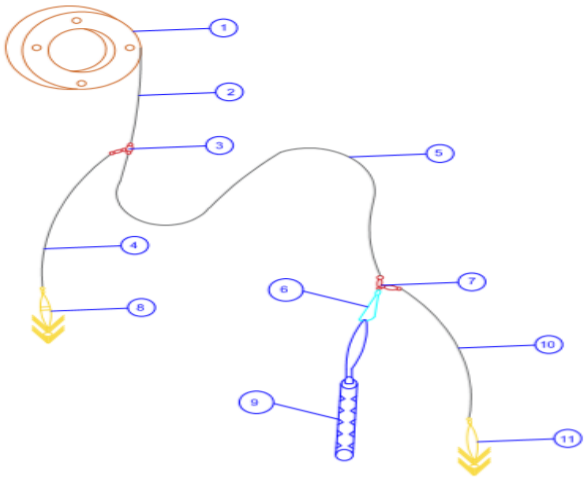

Figure 2: Construction of a bottom fishing rod (Source: Personal Document, 2023)

Information:

1: String winder	**5**: Base rope
2: Main Rope	**6**: Snap
3 and **7**: Kili-kili (*swivel*)	**8** and **11**: Apolo
4 and **10**: Branch rope	**9**: Pendulum/Weight

2. Mid-line fishing (shake)
   This fishing gear consists of a reel, a mainline with a number of 500 with a length of approximately 60 meters followed by a swivel, given a base line with a number of 200 with a length of 18-20 meters, on the base line is given an apolo with a distance of 2 meters as much as 5-9 apolo and at the bottom is given a swivel then snap and the last is a banbul/weight. Research by Tanjaya & Almohdar (2023) which states that variations in the construction and configuration of fishing gear (including jigs) affect the catch. The following is the construction of a shaking fishing gear:

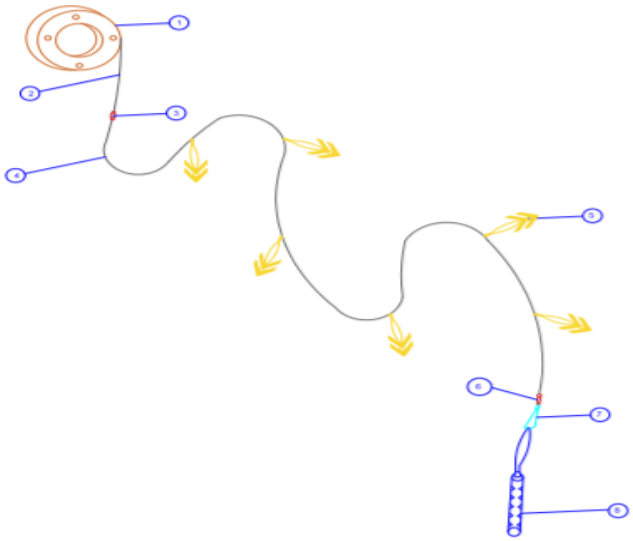

Figure 3: Construction of a shaking fishing rod (Source: Personal Document, 2023)

Information:

1: String winder	**5**: Apolo
2: Main rope	**7**: Snap
3 and 6: Kili-kili (*Swivel*)	**8**: Pendulum/Weight
4: base rope	

3. Surface fishing (casting)
   This fishing gear is the simplest of all squid fishing gear, consisting of a reel, 200-string line, a snap, and finally a shrimp. This is in accordance with Sudirman's (2020) opinion in Lestari (2023), who stated that hand line fishing is a very simple fishing method because it only consists of fishing line, hook, and weight. The following is the construction of a throw fishing rod:

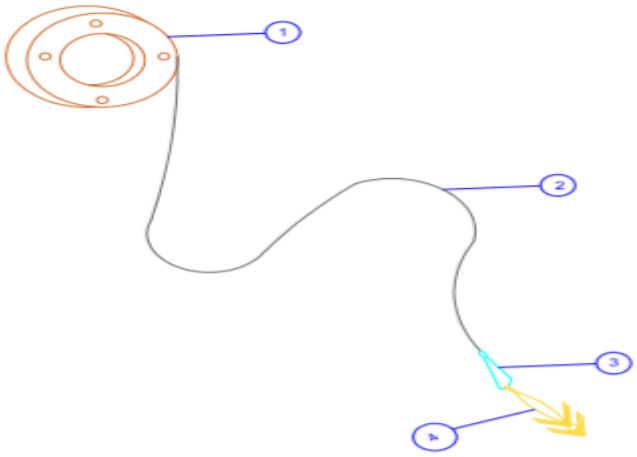

Figure 4: Throwing fishing rod (Source: Personal Document, 2023)

Information:

1: rope winder

2: Fishing Line
3: Snap
4: crustaceans

4. Satay fishing rod
   This fishing gear is a self-modification by fishermen at the Benoa Bali public harbor. This fishing gear has the same arrangement as the bottom fishing rod (aeh-aeh) except this fishing gear does not use apolo or crustaceans but uses live squid as bait skewered with bamboo. This fishing gear consists of a reel, a main line with a number 500 with a length of approximately 60 meters followed by a swivel (kili-kili) then given a branch line on the swivel with a length of 2 meters and tied with modified bamboo. The bamboo assembly consists of bamboo with a hook from apolo, rubber hose and string then at the bottom is given a snap and a weight/pendulum.

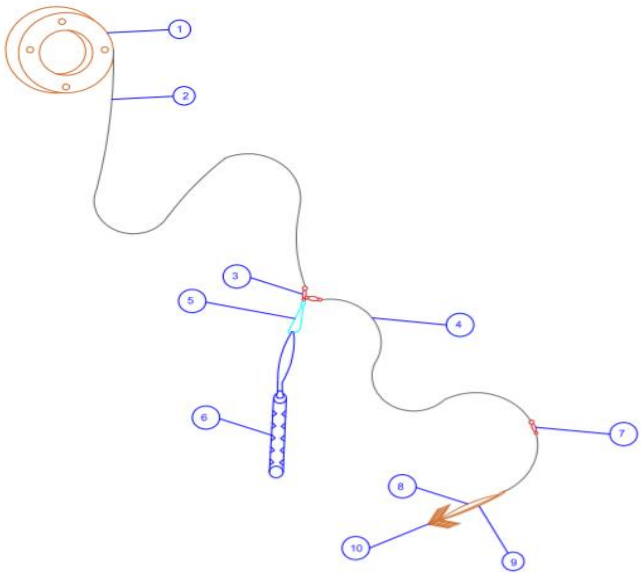

Figure 5: Satay fishing rod (Source: Personal Document, 2023)

Information:

1: String winder	**6**: Pendulum/Weight
2: Main Rope	**8**: Base rope
3 and **7**: Kili-kili (Swivel)	**9**: Bamboo
4: Branch rope	**10**: Hook
5: Snap	

DISCUSSION

Operation of fishing gear

Preparation

Before carrying out squid fishing activities on the KM. Bandar Nelayan 118 vessel, the initial stage is preparing all fishing equipment. This preparation includes assembling the fishing rods, checking the condition of the lines and hooks, and repairing damaged equipment so that it is ready for use during fishing operations. This stage of fishing gear preparation is very important because it directly influences the effectiveness and success of squid fishing at sea. A similar study conducted by Isral (2024) on handline fishing operations in the waters of North Bababulo Village explained that fishing rod preparation is part of the initial activities before the equipment is lowered into the sea to catch target biota. The same thing was also reported by Triharyuni (2012), who stated that the readiness of fishing gear before the operation is crucial for fishing efficiency and reduces the risk of equipment damage during fishing activities.

Determination of fishing areas

The KM. Bandar Nelayan 118 does not have a fish finder to locate squid underwater. Therefore, two methods are used to locate fishing areas: first, based on experience from previous fishing trips, and second, using a parasite system or anchor drop. This parasite system utilizes ocean currents to guide the vessel toward a school of squid. After the parasite is lowered, the crew also lowers their rods. If the squid are busy, the parasite is raised and the anchor is lowered. Squid fishing requires effective information to maximize catches. According to Prasetyo et al. (2014), knowing the areas and times when fish can be caught in large numbers can make fishing more effective.

Fishing Aids

The squid fishing aid on the KM. Bandar Nelayan 118 uses 2000-watt metal halide lamps as the primary light source. Overall, the vessel is equipped with 20 lamps, but only six are turned on during each fishing operation: three on the port side and three on the starboard side. Metal halide (MH) lamps are the primary light source commonly used on squid fishing vessels due to their high light intensity and ability to penetrate the seawater column at night, attracting squid, which exhibit positive light-phototaxis (Rudin et al. 2024). The use of lamps as a fishing aid aims to capitalize on the squid's positive light-phototaxis, which attracts them to light. This allows them to gather around the light source, facilitating the fishing process using a handline. Metal halide lamps are selected based on their high light intensity and ability to penetrate the water column, effectively attracting squid from various depths. Furthermore, the number of lamps used is adjusted to accommodate water conditions, fuel efficiency, and vessel stability during fishing operations.

Squid fishing rod operating techniques

Fishing gear operates overnight from 6 p.m. to 6 a.m. Fishing is carried out using four fishing techniques: bottom fishing, shaking, casting, and skewer fishing. Fishing gear is operated at a depth of approximately 60 meters, depending on the number of squid at the fishing location. Squid fishing techniques are often based on the principle of handline jigging, where the fishing line and bait are lowered to a certain depth and then moved up and down to stimulate squid predators to attack the baited hook (Fei et al., 2023). This fishing method is generally carried out at night because squid have positive phototaxis behavior, which makes them attracted to light around the boat or light sources on handlines (FAO, 2024). The following is a more detailed explanation of the operation of squid handlines:

1. Bottom fishing (ahe-ahe)

Bottom fishing (ahe-ahe) is a squid fishing technique used by fishermen to catch squid at the bottom of the water. This fishing gear is operated by throwing and extending the bait until it touches the bottom. After touching the bottom, the bait must be played with by jerking it continuously to make it look lively and attract the squid. The throwing technique must also be considered, namely by throwing against the current. Research by Fitri et al. (2023) found that adding LED lights to squid-jig fishing rods has been proven to increase the effectiveness of squid catches because the light can attract the target's attention at night, making bottom fishing operations more efficient in attracting active squid in the lower water column.

2. Mid-line fishing (shake)

A shake fishing rod is a fishing tool used by fishermen to catch squid in the middle of the water. The operating technique is not much different from bottom fishing, namely by throwing it and extending it to the middle of the water and jerking it to attract the squid to eat the bait or apolo. Usually this shake fishing rod uses 5-9 apolo and the bait size used is number 2. Suwardi et al (2024) Stated the construction and operation of squid fishing rods (including design elements of jigs or fishing tools that are often played up and down in the water column).

3. Surface fishing (casting))

Surface fishing is a common squid fishing tool used by fishermen to catch squid that are active in the surface layer of the water. The technique of operating this fishing gear is done by throwing bait in the form of shrimp or jigs towards the squid that are seen playing on the surface of the water, then playing the bait by pulling it slowly to resemble the movement of live prey to stimulate the squid to eat. This is in line with the opinion of Subani & Barus (1989) who stated that surface fishing is operated by throwing bait around active squid groups on the surface, then pulling it slowly to attract attention and trigger a feeding response. The use of this technique is considered selective and environmentally friendly because it only catches target species of a certain size and minimizes bycatch.

4. Satay fishing rod

The satay fishing rod is a squid fishing tool modified by fishermen in Benoa Harbor, Bali, to catch squid playing or resting on the water's bottom. Unlike the three squid fishing techniques above, which use fake shrimp as bait, this satay fishing gear uses live squid as bait. This is in line with Sudirman and Mallawa (2012), who stated that the use of natural bait tends to be more effective in increasing catches because it has a smell, taste, and movement that more closely resembles natural prey, thus attracting the attention of the target organism. The operating technique of this fishing gear is by impaling live squid onto a bamboo stick with pieces of fish as bait, then lowering it until it touches the water's bottom and pulling it back up about one and a half to two fathoms from the bottom.

Type and quantity of catch

The squid caught using handlines during the research on the Bandar Nelayan 118 vessel was Loligo sp., with no bycatch. The catch of Loligo sp. as the primary target, and its species composition, has also been widely discussed in recent studies on squid catches in Indonesia. For example, Merliana et al. (2025) found that the composition of Loligo sp. squid catches can be influenced by fishing techniques and attractor technology in the Makassar Strait, resulting in varying amounts of squid caught based on the intensity and color of the attractor used.

The total catch during the research was approximately 9,902 kg. The following is a diagram of the total catch during the research:

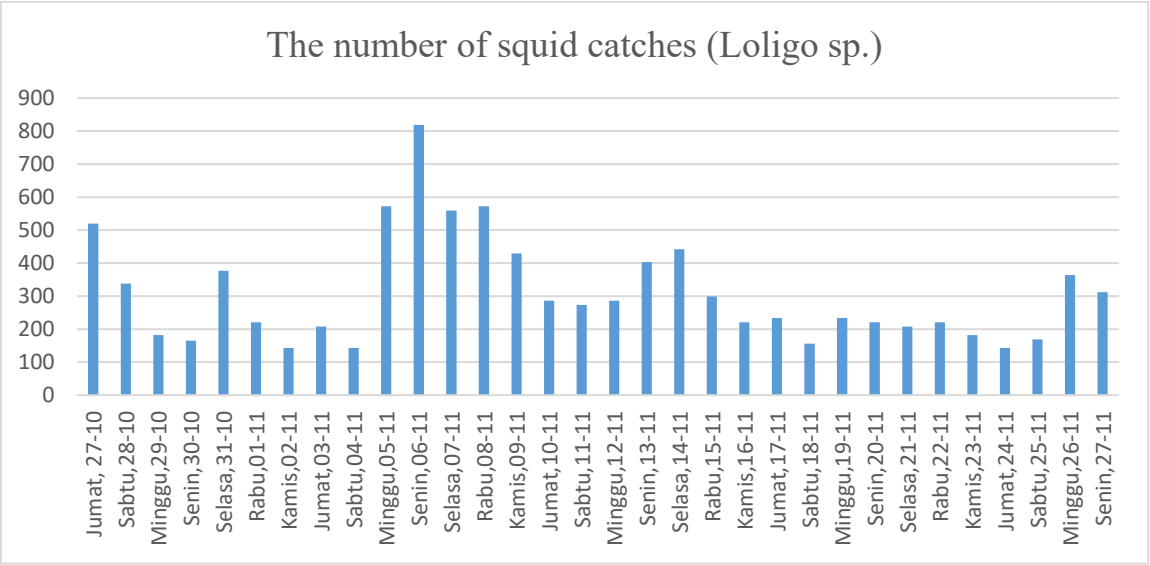

Figure 6. Graph of the number of catches (Source: Catch Data of KM. Bandar Nelayan 118, 2023)

The graph above shows that the highest catch occurred on 06 with a total catch of 819 kg, and the lowest number of catches occurred on 02, 04 and 24 with a total catch of 143 kg. The different numbers of catches in this study were caused by several factors, including current, bait color, bait playing technique and determining the fishing area. These factors are very determining in getting optimal catch results.

CONCLUSION

The conclusion of this study shows that squid handline fishing operations on the KM. Bandar Nelayan 118 in Arafura Waters are carried out at night with the aid of metal halide lamps as a lure, using four main techniques: bottom fishing (ahe-ahe), mid-line fishing (kokokan), surface fishing (pemulang), and sate fishing. All techniques are carried out manually (handline jigging) at depths of up to approximately 60 meters, adjusting to the distribution of squid in the water column. The fishing gear used is selective and environmentally friendly, targeting only Loligo sp. species without causing bycatch. During the study period, a total catch of approximately 9,902 kg was obtained, with daily catch fluctuations influenced by current conditions, baiting techniques, bait color, and the accuracy of determining the fishing area. Overall, squid handline fishing on the KM. Bandar Nelayan 118 has proven effective and has the potential to support the development of productive and sustainable squid fisheries in Arafura Waters.

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