



ANALYSIS OF THE QUEUE PATTERN OF FISHING VESSELS AT THE NUSANTARA FISHERIES PORT OF PALABUHANRATU, SUKABUMI REGENCY

Wina Fajriatin^{1*}, Dedi Supriadi², Izza Mahdiana Apriliani², and Alexander M. A. Khan²

¹Student of Fisheries, Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia

²Lecture of Fisheries, Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia

*Corresponding Author:

Wina Fajriatin

Address: Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia

Email: winafajriatin@gmail.com

ABSTRACT

This research was carried out at the Nusantara Fisheries Port in Palabuhanratu, Sukabumi, West Java. Held in August - December 2019. The research on fishing vessel queuing patterns is conducted to identify fishing vessel queuing patterns in PPN Palabuhanratu, analyze the utilization of catching unloading facilities at PPN Palabuhanratu, and calculate the time of unloading fish and the factors that influence it. The studied samples were 6 units of hand line fishing vessels with a size of 6-10 Gross Ton. The port facilities analyzed were the loading dock, port pond and Fish Auction Place. The research method was a case study of the pattern of fishing vessel queues, utilization of facilities, and the duration of unloading fish. The analysis was carried out descriptively, described the queue pattern, queuing discipline, and the stages of unloading catches. The results of the queuing pattern that occurred at PPN Palabuhanratu are single-phase single service lines by means of tethering the ship extends in the direction of the dock length. The utilization rate of the dock is 74%, the port pond is 38%, and the TPI building is 101% and the average speed of unloading fishing vessels size 6 Gross Ton is 29.6 kg / minute and 3.78 kg / ABK / minute.

Keywords: Facilities Utilization, Hand line Fishig Vessel, Ship Queue Pattern

1. INTRODUCTION

Queue is a phenomenon that arises in human activity. Queues occur because of levels arrival is greater than ability to serve at a certain time and not happen all the time [1]. The queue is in the condition when objects go to an area to be served, but then face delays caused by service mechanisms experiencing busyness [2]. Queues occur due to needs and services exceeding the capacity of service capacity. Therefore, facility users cannot immediately get services.

Queue problems at the port often occur every day. Ship loading and unloading services are a queuing phenomenon in daily activities [3]. Quality of service and loading and unloading speed is one of the determinants of berth productivity as well as being an important aspect that can affect the queue of ships entering or leaving the port [4]. This queue can be caused by damaged tools that support loading and unloading, labor, availability of warehouses, limited capacity of berths at the jetty and others.

The queue of fishing vessels that occur along the jetty is also due to the capacity or length of the unloading dock that has been available at the port cannot serve all ships. In addition, waiting too long causes losses such as waste of fuel and electricity consumption.

There is a queue of fishing vessels that want to land the catch in PPN Palabuhanratu. Various factors can influence the occurrence of ship queues. Therefore, research is needed to identify the existing ship queue patterns in PPN Palabuhanratu.

2. MATERIALS AND METHODS

2.1 Tools and Materials

The tools used in this study are stationery, stopwatch, length measuring devices with a scale of at least 1 mm, laptops, cameras and questionnaires to get primary data from fishermen owners / skipper / labor fishermen in PPN Palabuhanratu Sukabumi. The material used in conducting research is material obtained from PPN Palabuhanratu and the Department of Maritime Affairs and Fisheries of Sukabumi Regency.

2.2 Research Methods

The research method used is a case study of the queue pattern of fishing vessels that will unload fishes, utilization of facilities related to unloading catches, and the length of time to unload fish. Case study research is a form of research based on human understanding and behavior based on human opinion [5]. Utilization of facilities can be known by comparing the conditions of the use of facilities that occur in the field with the capacity of the facility. The facilities studied included the length of the unloading dock, the area of the port pond, and the area of the Fish Auction Place.

2.3 Method of Collecting Data

Data collection was carried out through a survey method with direct observation and interviews with respondents. Determination of the number of respondents carried out by purposive sampling, provided that respondents can understand and communicate to help achieve research objectives. The data taken are primary and secondary data. Primary data consist of the method of anchoring a fishing boat at the dock, the stages of unloading the catches, the length of time of unloading the fish on the ship, the width of the ship, the length of the ship, the distance between ships, the number of vessels utilizing the jetty facilities, and observing the factors that influence demolition of fish. Secondary data obtained from the manager of PPN Palabuhanratu which consists of the length of the jetty, the area of the port pool, the area of the auction building, the average amount of production per day, the capacity of the space to production, the frequency of auction a day, and the ratio between auction and auction building. Primary data is taken directly in the field. Secondary data were obtained by filling out questionnaires and interviews with the management of PPN Palabuhanratu including recording staff of fish and fisherman demolition activities. Sampling of ships is done to calculate the length of time unloading fish. The determination of the sample of fishing vessels is carried out provided that the fishing vessels unload on the first day. The number of ship samples that were observed were 6 units of ships, size of 6-10 GT.

2.4 Ship Queue Pattern Analysis

The analysis was carried out descriptively, which was describing the queuing pattern, the queuing discipline that occurred and the stages of unloading catches from the hold to the Fish Auction Place. Some possibilities for tethering fishing vessels at the pier: The mooring extend with the pier, the mooring perpendicular to the pier, the mooring angles to the pier.

2.5 Analysis of Utilization of Facilities related to Dismantling of Catches

To determine the utilization of facilities can be calculated using the following calculations [6]:

$$\text{Utilization rate} = \frac{\text{Facility Usage}}{\text{Facility Capacity}} \times 100\%$$

1. Basic Facilities

a. Unloading Pier Length [7]

Calculation of the capacity and length of the unloading pier requirements of the Nusantara Fisheries Port Palabuhanratu are calculated using the formula:

$$L = \frac{(1+s) \times n \times a \times h}{u \times d}$$

Information:

l: length of ship (m)

s: distance between ships (m)

n: average number of ships using the pier per day (unit)

a: Average ship weight (tons)

h: ship length at dock (hours)

u: production per day (tons)

d: long fishing trip (hours)

b. Port Pool Area

The required port pool area is calculated by the formula:

$$L = Lt + (3 \times n \times l \times b)$$

$$Lt = \pi \times l^2 ; \pi = 3,14$$

Information:

L: wide port pool (m²)

Lt: area to rotate the ship (m²)

n: maximum number of ships anchored (units)

l: length of ship (m)

b: ship width (m)

2. Functional Facilities

a. Fish Auction Place Building Area

The area of the fish auction building is an important factor in the auction process so that the landed fish are able to be properly accommodated entirely. This calculation is obtained from the formula:

$$Lg = \frac{N}{p \times i \times a}$$

Information :

Lg: Area of auction building (m²)

N: Average amount of production per day (kg)

p: Factor of space capacity to production (kg / m²)

i: The intensity of the auction per day (times / day)

α : Ratio between auction and auction building (911: 920)

2.6 Analysis of Fish Demolition Time and Factors Affecting it

To calculate the average loading speed, the following formula is used:

- a. Average loading speed of kg of fish per minute

$$\bar{x} = \frac{\sum X_i}{n}$$

Information:

$\sum X_i$: number of catches / vessels / length of unloading time (kg / minute)

n: ship sample (unit)

- b. Average loading speed of kg of fish per crew

$$\bar{x} = \frac{\sum X_i}{n}$$

Information:

$\sum X_i$: number of catches / vessels / ABK / minutes (kg / ABK / minutes)

n: number of sample ships (units)

3. RESULTS AND DISCUSSION

3.1 Fishing Boat Queue Pattern

Queuing system is the arrival of customers to get service, waiting to be served if service facilities (servers) are still busy, get service and then leave the system after being served [8]. The purpose of the queuing system is to offer satisfaction to customers who are waiting [9]. In general, queuing systems can be classified into different systems where queuing theory and simulation are often widely applied.



Figure 1. Mooring of a fishing boat at the loading dock of PPN Palabuhanratu

How to tether a fishing boat at the Palabuhanratu unloading pier, use a mooring fishing boat extending in the direction of the pier length. Elongated fishing boats have advantages in terms of ease of unloading fish better than other mooring methods, but the disadvantage requires a long pier.

In the dismantling facility catches of PPN Palabuhanratu apply a single channel - single phase, for the unloading of Palabuhanratu PPN catches has 1 lane or 1 service facility. Queue discipline applied at PPN Palabuhanratu namely First Come First Served (FCFS) or the first to come will get the first service. For ships that arrive next, can queue up first beside the ship that is being served until the ship that is being serviced is finished.

The queue pattern of the ship there are several ways of tethering a fishing boat at the pier including, the ship mooring extends in the direction of the pier length, the ship mooring perpendicular to the pier and the ship

mooring making angles with the pier. The longitudinal mooring queue pattern with the pier has the advantage in terms of ease of unloading fish better than the other mooring methods, but the disadvantage requires a long pier. The mooring type of ship is perpendicular, if loading is done manually, the capacity is limited, but this method can reduce the required pier length. Angled mooring type, has the advantage of reducing the required dock length, but the disadvantage of this method is that the length of the ship must be the same and on the other hand unloading of fish is more difficult than parallel mooring.

Unloading operations must be directly related to subsequent handling operations, tethering extending to the pier provides high flexibility and the greatest opportunity to achieve high loading speeds [10]. The fishing boat unloading arrangement at PPN Palabuhanratu is right, that is using a fishing boat mooring extending in the direction of the length of the pier, this mooring fishing boat has an advantage in terms of ease of unloading fish better than other moorings, but its weakness requires a long dock.

There are 4 basic queuing structure patterns that commonly occur in queuing systems, namely multi-channel-single phase, single channel-single phase, i.e. one channel one service system, single channel multi-phase, i.e. there are two or more services that are carried out sequentially, and multi-channel multi-phase, which has several service facilities at each stage [11]. PPN Palabuhanratu has implemented a one-way queue pattern with a service system.

Queue discipline is a decision rule that explains how to serve a queue. The queuing discipline used in PPN Palabuhanratu is the queuing method where ships that come first can make a fish landing process or First-Come First-Served (FCFS). There are three aspects that must be considered in the service mechanism, namely; availability of services, capacity of service facilities, and length of service [12]. The service of loading and unloading catches at PPN Palabuhanratu is not always available at any time, because there is a break, and the loading and unloading service is only served from 08.00 to 12.00 WIB.

3.2 Stages of Dismantling of Catching Results Up to TPI

The landing process of catches at Palabuhanratu PPN includes unloading fish, sorting and transporting fish to TPI. The fish landed at PPN Palabuhanratu usually come from Cilacap waters with ships whose trip length is around 24 hours / 1 day. In the process of unloading catches through several stages, namely:

1. Arrival of the ship

The first stage taken after the ship arrives is to take the order number of the arrival of the ship to determine the order of the auction, submit a fishery logbook report, take the Ship Arrival Report (STBLK). The activity was carried out in an integrated post, while ship documents were given to the harbor officers. The ship is docked sideways to the right side of the ship's hull.

Ships that have submitted all documents will then receive an order number. This sequence number is used to determine the order of loading. After obtaining permission and auction serial number from the Fish Auction Place (TPI) officer, they will get moored mooring. Next report to the KUD officer to get a fish basket.

2. Unloading catches from the hold onto the deck of the ship

The next process is dismantling the catch. Before the unloading process begins, the baskets are loaded onto the ship, then several crew members get ready on the hatch that will be unloaded to receive fish that have been removed from the hold and distribute to the basket of fish to be sorted. The number of vessel crews (ABK) in charge of taking fish from the ship's hold is 2 to 3 people, depending on the area of the ship's hold and the number of catches being unloaded, while the crew who is on the deck amounts to 5 to 7 people.



Figure 2. Removing fish catch from the hold

3. Decrease in catch from the deck of the ship to the dock

Fish catches that have been placed into baskets and arranged on the deck are then transferred to the loading dock. The basket containing the catch is ready to be moved by being transported by 2 crew to the dock. Baskets that have arrived arranged above the pier are then recorded the weight of the fish and the name of the ship. After that the fish will be sold directly to consumers or auctioned first. The process of unloading fish starts at 08.00-12.00 WIB. The ship exits the unloading dock after the demolition process is complete and the ship has been cleaned. Ships out to the supply pier to load supplies or take a break.



Figure 3. Transporting fish catch from the deck of the ship to the dock floor

3.3 Utilization of Facilities Related to Unloading Catches

Facilities play a role in supporting the smooth operation of the fishing port. To support the smooth activities that occur at the port, it is necessary to have an analysis of the recalculation of the capacity of the facilities related to unloading fish to ensure the smoothness of the activities carried out at the port.

Loading dock

The loading dock is one of the port buildings used to dock and anchor a fishing boat that will unload catches. The pier found in PPN Palabuhanratu is currently still in good condition and used according to its function. The PPN Palabuhanratu unloading pier is made of longitudinal straight-shaped concrete.

The length of the loading dock must be adjusted to the intensity of the number of ships that will unload the catch. The design of the pier is based on an estimate of the number and size of ships to be moored so that ships can easily and safely carry out loading and unloading [13]. The length of the pier available at PPN Palabuhanratu is 509 m and that is used for dock loading along 81 meters. The length and width of the largest ships are 17 m and 3 m. The distance between ships in the loading dock pool is 0,5 m. The fishing trip length of time based in Palabuhanratu VAT averaged 1 day. Based on the calculation results, it is obtained the need for the loading dock length of 380,43 m. The calculation is with the provisions of the ship docked in length. Thus, the

loading dock facilities are very fulfilling the needs of ship loading today and there is no need to develop more piers. The level of utilization of unloading piers in PPN Palabuhanratu with a percentage of the utilization rate of the facility of 74%.

The length of unloading piers available at PPN Palabuhanratu currently meets the standard length required by a number of mooring vessels. So that the process of unloading fish activities is not hampered and can prevent a decrease in the quality of the fish caught because there is no queue that is too long. The capacity utilization of the facility is still below the threshold of 74% which has been utilized by fishing vessels, so that the port does not need to develop the loading dock facilities.

Harbor Pond

PPN Palabuhanratu has a port pool with an area of 30,000 m², with a loading dock pool depth of 3 m. The maximum wave height in the harbor pond is 1.5 to 3 m. The length and width of the largest ships are 17 m and 3 m so that the area required for the largest rotating ship is 907.46 m². The maximum number of ships that are anchored is 50 ships. Based on the technical criteria of the fishing port according to the Regulation of the Minister of Maritime Affairs and Fisheries No. 08/2012 that the capacity of port B type pool is 75 units so that the existing port pond area has not been fully utilized to accommodate ships that are anchored. The area of ponds in PPN Palabuhanratu is around 30,000 m². With this area, ships in the PPN Palabuhanratu can easily rotate, land their catches and go out to sea.

Based on the calculation, the port pool available at PPN Palabuhanratu is very sufficient in its capacity, the capacity of the port pool used by PPN Palabuhanratu is 11.617 m² with a utilization rate of port pool of 38%, so VAT does not need to develop the port pool anymore and must maximize the capacity of the existing port pool. The level of harbor pool utilization is influenced by the large number of incoming ships, the number of production and the number of fishing gear.

The current size of the port pond in PPN Palabuhanratu has met the broad standard, for the depth of the port pool as deep as 3 m, it has also met the technical criteria for the classification of fishing ports according to the Minister of Maritime Affairs and Fisheries Regulation No. 8 of 2012 concerning Fisheries Ports, that the depth of the port pool type B at least 3 m.

Fish Auction Place (TPI)

PPN Palabuhanratu has a Fish Auction Place (TPI) which is managed by KUD Mina Sinar Laut. This auction place has a building area of 920 m². The width of the TPI Palabuhanratu auction room is 911 m². In one day, the fish auction is held once. The amount of fish production in PPN Palabuhanratu averages 23,000 kg per day. This amount includes fish auctioned. Based on the results of calculations with the provisions of the number of production per day 23 tons obtained TPI building area needs of 929.29 m². The level of utilization of the existing TPI is 101% so that the PPN Palabuhanratu needs to expand the TPI area to a size of 930 m².

Fish auction places in PPN Palabuhanratu have exceeded the optimal limit for the level of utilization of its facilities so that it is necessary to increase the TPI Building area to be able to accommodate fish production. In addition, the port needs to maximize the use of auction space because not all of the available auction space has been used for auction, but only used by traders to place their selling fish.

3.4 Duration of Fish Dismantling

The time for unloading is calculated starting from the fishermen opening the hatch until the fish landing is finished, the fish reaches the dock floor. PPN Palabuhanratu only serves fishermen at 08.00 - 12.00 WIB for the process of unloading fish. The length of unloading time is closely related to the process of unloading fish, which causes the presence or absence of ship queues and also affects the quality of the fish being unloaded. Calculation of the time of unloading a ship is done with a ship size of 6-10 GT.

The average unloading speed in units of kg of fish per minute on a 6 GT stretch fishing boat is 29.6 kg / minute and the average loading speed per kg of fish per crew is 3.78 kg / person / minute. The observations obtained that the factors that can affect the length of time of unloading fish are:

1. Number of Unloaded Laborers

The number of ABK who unload fish can affect the length of time unloading fish. Demolition of fish will be faster if more and more workers are unloading. This is evident in ships that have about 10 unloading workers faster than ships that only have 5 unloading workers.

2. Ship Size

Large ships have more hatches than smaller ships. The bigger the ship, the more unloading labor will be so that it will speed up the dismantling of fish.

3. Number of catches

The fish in the amount of the catch is bigger, the unloading takes longer. Smaller amounts of fish catch require shorter disassembly time.

4. How to dismantle fish

How to unload fish includes the process of unloading fish from the hold, sorting and putting the fish into the basket. To carry out this process, it is necessary to pay attention to the timeliness in carrying out these stages. In the process of dismantling the fish the method used to unload it is different, it will affect the length of time the fish is unloaded.

Unloading speed at PPN Palabuhanratu for fishing vessels is not meeting the normal efficiency standards for unloading speed. Several reasons are obtained for calculating the difference in loading speed of each ship, namely the loading speed is different if the fish are stored in different ways. Then, the number of crew members who unload fish, the more laborers unloaded, the faster the unloading of fish. Dismantling fish must be done as quickly as possible to avoid rising temperatures that can accelerate the decline in fish quality. Large ships have more hatches than smaller ships. The bigger the ship, the more unloading labor will be so that it will speed up the dismantling of fish. One of the efforts that can be done to accelerate the demolition is by maximizing the speed of unloading fish, by increasing service hours. Usually the activity of unloading the fish starts at 08.00-12.00 WIB then in the afternoon or at night if there is a moored ship.

Conclusion

The results of the queuing pattern that occurred at PPN Palabuhanratu are single-phase single service lines by means of tethering the ship extends in the direction of the dock length. The utilization rate of the dock is 2%, the port pond is 13%, and the TPI building is 101% and the average speed of unloading fishing vessels size 6 Gross Ton is 29.6 kg / minute and 3.78 kg / ABK / minute.

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