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FAD DESAIGN AND CONSTRUCTION IN KENDARI FISHING PORT: CASE STUDY KMN. BUKIT SAFA

Desain dan Konstruksi Rumpon Nelayan Pelabuhan Perikanan Samudera Kendari: Studi Kasus KMN. Bukit Safa

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ABSTRACT

Fish aggregating devices (FADs) have various designs and constructions depending on the area where they are used. This study aims to observe the design and construction of FADs used by fishermen at the Kendari Fishing Port. The method used in this research is a case study. The FAD observed is the one used by fishermen on the vessel KMN. Bukit Safa. The data collected includes the size and components of the FAD. The collected data were analyzed using descriptive analysis. The design and construction of the raft light fishing aid used on KMN. Bukit Safa consists of a wooden frame, Styrofoam, lamps, batteries, and a power inverter. The design and construction of the FAD consist of components such as weights, ropes, floats, attractors, and a lamp housing. The rope used for the FAD is called tali mandar, which is made from a mixture of PA and PE rope materials with a diameter of 24 mm. A total of 30 rolls of rope were used, equivalent to approximately 2400 m. The FAD floats are made from Styrofoam measuring 100 cm x 100 cm x 60 cm. The FAD weights are made of concrete, which is a mixture of cement and sand, weighing around 100 kg. The weights used are cube-shaped with dimensions of 60 cm x 60 cm x 60 cm

Key words: Construction, Design, FAD, Kendari Fishing Port

ABSTRAK

Rumpon memiliki berbagai macam desain serta konstruksi sesuai dengan daerah dimana rumpon tersebut digunakan. Penelitian ini bertujuan untuk melihat desain serta konstruksi rumpon yang digunakan nelayan di Pelabuhan Perikanan Samudera (PPS) Kendari. Metode yang digunakan pada penelitian ini adalah studi kasus. Rumpon yang menjadi pengamatan adalah rumpon yang digunakan oleh nelayan pada kapal KMN. Bukit Safa. Data yang dikumpulkan meliputi ukuran serta bagian-bagian rumpon. Data yang terkumpul dianalisis menggunakan analisis deskriptif. Desain dan konstruksi alat bantu lampu rakit yang digunakan

pada KMN. Bukit Safa, memiliki desain dan konstruksinya yang terdiri dari rangka kayu, styrofoam, lampu, aki dan power inverter. Desain dan konstruksi rumpon memiliki bagian yang terdiri dari pemberat, tali, pelampung, atraktor dan rumah lampu. Tali rumpon yang digunakan disebut tali mandar, yang merupakan tali yang terbuat dari campuran bahan tali PA dan PE dengan diameter 24 mm. Tali yang digunakan berjumlah 30 roll atau sekitar 2400 m. Pelampung rumpon dibuat menggunakan Styrofoam berukuran 100 cm x 100 cm x 60 cm. Pemberat rumpon menggunakan beton yang dibuat dengan campuran semen dan pasir dengan berat sekitar kurang lebih 100 kg. pemberat yang digunakan memiliki bentuk kotak dengan ukuran 60 cm x 60 cm x 60 cm.

Kata Kunci: Desain, Konstruksi, PPS Kendari, Rumpon

INTRODUCTION

Increasing the catch is an effort to develop activities in the capture fisheries sector. This development can be achieved by improving fishing operations and utilizing appropriate technology. One technology widely used by fishermen to increase catches is the use of fish aggregating devices (FADs).

FADs are tools that function to gather fish in a given water area, making it easier for fishermen to conduct fishing operations according to the fishing gear used (Hikmah *et al*., 2017). With FADs, fishing areas can be identified in advance, saving time and money. The use of FADs has been shown to increase fish production in a given water area (Albert, 2014). In addition to being used as fish aggregators, FADs can also serve as spawning grounds for marine life and several species of squid (Hasaruddin *et al*., 2015). According to the Ministry of Maritime Affairs and Fisheries (2011), FADs are tools used to trap fish using lures or attractants such as coconut leaves, areca nut leaves, nipah palm leaves, rope, or other solid objects.

FADs (Fragments and Aggregating Devices) come in various designs and constructions, depending on the region where they are used. These differences in design and construction are also influenced by oceanographic conditions, target fish species, material availability, and even local fishing culture and habits. Furthermore, various types of FADs have been developed over time, including live FADs, deep-sea FADs, portable FADs, and palm fiber FADs (Kholis, 2020). The variety of FAD designs and constructions indicates that not all FADs can be optimally applied in every water area, making site-specific studies crucial. Therefore, this study aims to examine the design and construction of FADs used by fishermen at the Kendari Ocean Fishing Port (PPS).

RESEARCH METHODS

This research was conducted from February to April 2024 at the Kendari Fishing Port (PPS). The research method used was a case study. The FADs used by fishermen on the KMN Bukit Safa vessel were examined. Primary data collected included the size and components of the FADs through direct measurements, direct observation, and interviews. In addition to the dimensions, the materials used in the FADs' construction were also observed. The collected data were then analyzed using descriptive analysis to obtain an overview of their design and construction.

RESULTS

KMN. Bukit Safa conducts fishing in the waters of WPPNRI 714. The KMN. Bukit Safa fishing ground is located south of Taliabu Island, approximately 4 nautical miles from the coastline.

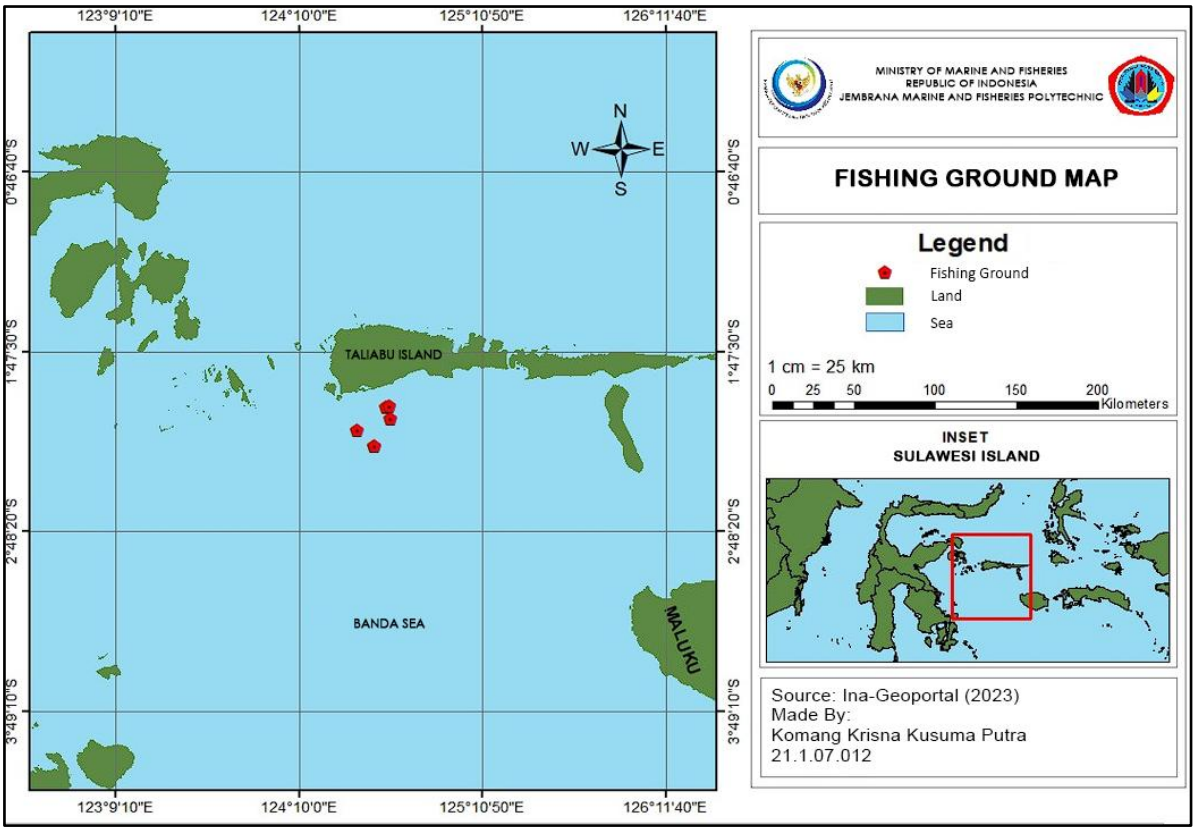

Figure 1. Location of fishing grounds

Fishing at the Kendari Fishing Port uses purse seine fishing gear with the aid of fish aggregating devices (FADs) to collect the fish. The type of FAD used is a fixed FAD using a natural attractor made from coconut leaves. This FAD is installed near Taliabu Island. This FAD has a house-shaped section with lights on the ends. This section serves as a guard post and a place to observe fish when they have gathered around the FAD. The lights on the ends are also used to collect fish at night. Fish that usually gather at night include kite and tuna. The FAD rope used is called mandar rope, which is a rope made from a mixture of PA and PE rope with a diameter of 24 mm. The rope used is 30 rolls or approximately 2400 m. Of the total number of ropes used, 2 rolls are used for double rope, and 1 roll is used for FAD weights, the rest is used for FAD weight lines. The FAD float is made from Styrofoam measuring 100 cm x 100 cm x 60 cm. The float is wrapped in green netting, and then tied used tires are added to the outside. This aims to increase buoyancy and protect the FAD float. The FAD is weighted using concrete made from a mixture of cement and sand, weighing approximately 100 kg. The weights used are box-shaped, measuring 60 cm x 60 cm x 60 cm. The weight hooks attached to the concrete are made from used tires for added strength. The FAD design drawing can be seen in Figure 2.

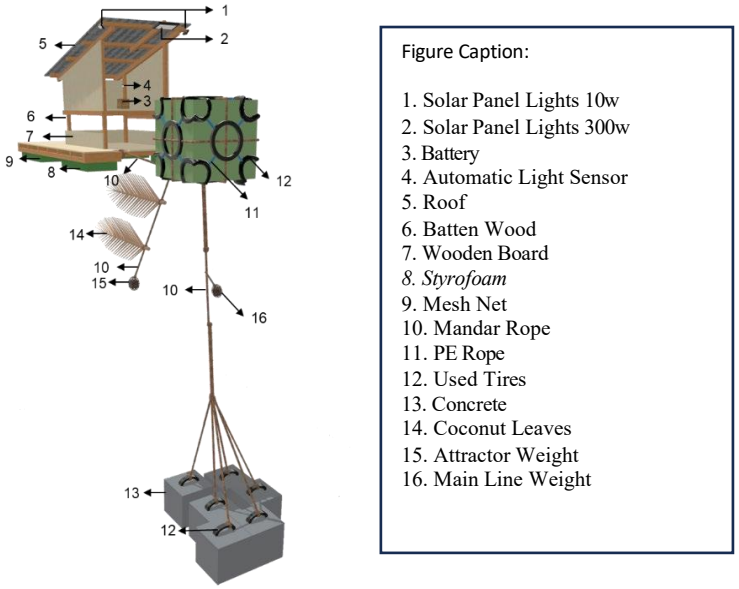

Figure 2. Fish aggregating device design

The construction of this fish aggregating device (FAD) consists of a float, rope, fish attractor, anchor, and lamp housing. The tools and materials used in the FAD can be seen in Table 1.

Table 1. Fish aggregating device tools and materials

No	Tools	Specification	Quantity/Unit
1.	Solar panel lights	10w	2 units
2.	Solar panel lights	300w	1 unit
3.	Battery (accumulator)	40v	1 unit
4.	Automatic light sensor	220v	1 unit
5.	Zinc roof	180 cm x 80 cm	2 units
6.	Wooden battens	W7 x H5 (cm)	± 59 meters
7.	Planks	W25 x H2 (cm)	± 40 meters
8.	Styrofoam	3m x 1m	2 units
9.	Grid netting	25 m = 1 roll	1 roll
10.	Mandar rope	24mm,80m = 1 roll	30 rolls
11.	PE rope	5mm, 2.5 kg = 1 roll	1 roll
12.	Used tires	Motorbike	13 units
13.	Cement	50 kg = 1 sack	6 sacks
14.	Coconut leaves	2 m = 1 stick	10 sticks
15.	Attractor weight	± 5 kg	1 stone
16.	Main rope weight	± 5 kg	1 stone

DISCUSSION

The FADs used in KMN. Bukit Safa are fixed or non-moving FADs. The FAD rope used is called a mandar rope, this mandar rope is a mixed recycled rope that uses PA and PE rope materials with a diameter of 24 mm. The results of interviews with FAD owners stated that a total of 30 rolls or approximately 2,400 meters of rope were used, of which 2 rolls were used for double rope and 1 roll to tie the FAD weight, then 27 rolls or approximately 2,160 meters as the main rope. The double FAD rope is used as a connection from the weight rope, then the single rope and after the single rope is connected to the double rope that is connected to the

FAD float. In addition, the mandar rope in the middle is given a weight from coral. This coral is wrapped using used fishing nets, then tied to the mandar rope. The mandar rope is given a weight to prevent the slack rope from floating on the water surface. The FAD floats are made from Styrofoam measuring 100 cm long, 100 cm wide, and 60 cm high, wrapped in green mesh. Used motorcycle tires are then tied around the outside to protect the floats and increase their durability.

According to Jayanto *et al*. (2019), the Styrofoam floats serve as pullers for the FAD, allowing it to stand upright in the water. The weights are made from a mixture of cement and beach sand, weighing approximately 100 kg. These are then molded into a box shape measuring 60 cm long, 60 cm wide, and 60 cm high. Used tires are used as anchors for the concrete. The FAD stones are made large because interviews with FAD owners revealed that previously, FAD owners used smaller stones, which resulted in the FADs being washed away or displaced by the current. The FAD weights are made from used tires combined with cast concrete to prevent the FADs from being swept away (Dantes, 2019).

The FAD lamp house is made of teak wood in the form of a small house for fishermen to fish, guard the FAD and as a place for solar panel lamps. This lamp house has a length of 320 cm, a height of 172 cm, a width of 231 cm. The lamps used in this lamp house are 3 lamps, one 300 watt lamp and two 10 watt lamps, the 300 watt lamp has a lumen of 27,000 lumens while the 10 watt lamp has 1200 lumens. This lamp is able to penetrate water to a depth of 7 m. According to Mauko & Daga (2017), the application of LED lights can increase the number of fish concentrations in FADs which ultimately increases the catch.

FADs are positioned in empty waters or areas not yet occupied by other FADs, and are spaced far apart from each other. Fishermen use FADs as fish shelters because they contribute to their income. These FADs are equipped with lights to attract positively phototactic fish, which congregate around the FADs from night to early morning, creating a food chain. According to Larasati *et al*. (2024), the use of FADs has proven efficient because they attract large numbers of fish, especially those that have been in place for a considerable period. The raft lights at the KMN Bukit Safa function as fish herders. Before herding fish, the raft lights use coconut leaf attractants on the FADs, which allow fish to shelter and feed around the FADs.

The operation of fishing gear using FADs at KMN Bukit Safa begins at 5:00 a.m., beginning with checking for schools of fish around the FADs using a fish finder. Once fish are visible on the water's surface and detected by the fish finder, the setup process begins. Next, the raft lights are then lowered and prepared for the installation of the lights. Two people in charge of the raft lights or called "Pakurung" prepare equipment such as batteries, power inverters and lights, if the equipment has been installed on the raft lights and is on, the captain turns off the solar panel lights that are on the ship using the remote. The raft lights are carried by two pakurung people approaching the FAD light house located at the stern of the ship. The Pakurung takes the attractor and ties the FAD light house to the raft lights as seen in figure 3.

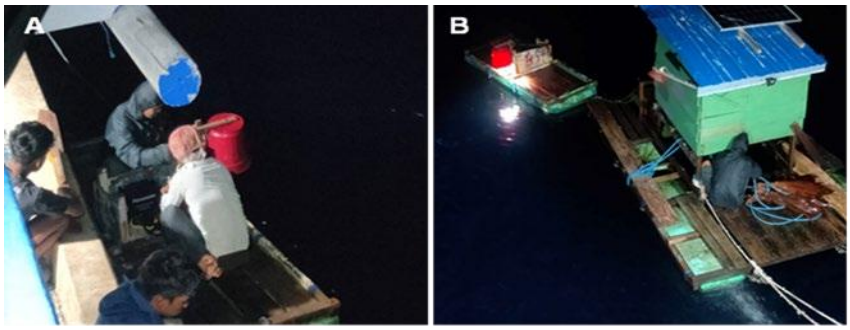

Figure 3. A) Preparation of equipment, B) Taking the attractor from the fish aggregating device lamp house

The FAD float is tied to the stern of the vessel and pulled away from the raft light, ensuring it doesn't obstruct the net during setup. The FAD float is pulled to the stern of the vessel approximately 100 meters away from the raft light to prevent the net from getting caught on the float during setup. After removing the float, the vessel turns toward the raft light and approaches it to a distance of approximately 15 meters.

This distance prevents fish from escaping during setup, or lowering the net around the raft light. Before lowering the net, the captain waits for the flashing signal from the person in charge of the raft light. If there is no flashing signal, setup is canceled. Operating the raft light takes approximately 40-60 minutes, from preparation to the completion of the lower line of the net. An illustration of fishing operations around FADs at KMN, Bukit Safa can be seen in Figure 4.

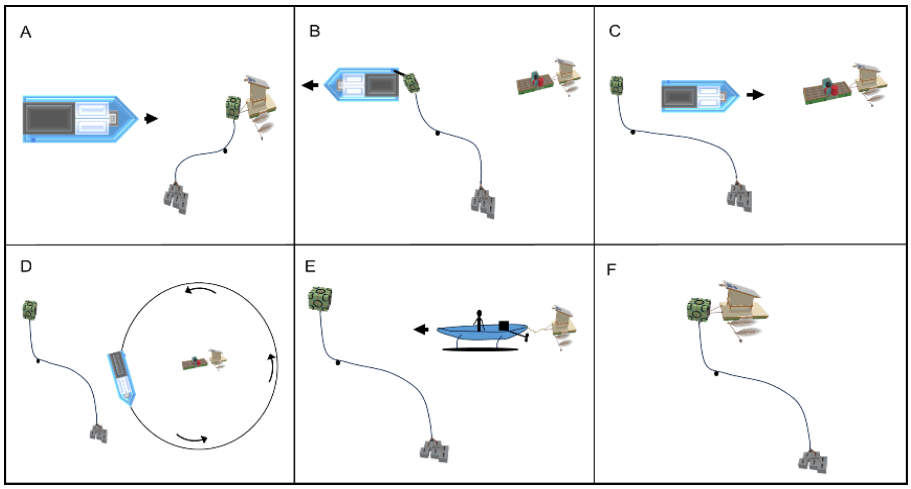

Figure 4. Fishing operations around FADs: A) Vessel approaching FAD, B) Buoy removal, C) Vessel approaching raft lights, D) Lowering fishing gear, E) Returning light housing and attractor, F) Lights and attractors installed on FAD buoys.

Utilization of raft lights and FADs at KMN. Bukit Safa catches small pelagic fish as its main catch, such as scad (*Decapterus macrosoma*) and tuna (*Auxis rochei*), which congregate at night at FADs. This is similar to other vessels described by Khikmawati *et al*. (2024), as the main catch of KMN. Diva Bahari, operating in Kendari using purse seine fishing gear, catches scad at Rp10,000–Rp13,000/kg and tuna at Rp10,000–Rp13,000/kg. Therefore, mackerel and skipjack tuna are the main catches at KMN Bukit Safa due to their good price and large catch. These catches were also obtained by Nasution *et al*. (2015) where the catch in the area around FADs installed in the Indian Ocean waters was dominated by skipjack tuna, mackerel,

yellowfin tuna, mackerel, swordfish, sunglir fish, and squid. According to Satyawan *et al*. (2023), the use of FADs and lights as attractors plays a crucial role in a fishing operation using purse seine fishing gear. Purse seine fishing gear or purse seines operated in the Kendari area have a smaller net length compared to those operated in the Indian Ocean (Jatmiko *et al*., 2020). The catch results can be seen in Table 2.

Trip	Fishing Ground	Catch (Kg)		Fishing Ground Coordinates
		Kite	Cob	
1	1	7340	875	2° 05’ 855”S / 124° 25’ 617”E
2	1	6570	780	2° 06’ 013”S / 124° 24’ 896”E
	2	8340	2480	2° 05’ 855”S / 124° 25’ 617”E
	1	2685	-	2° 06’ 471”S / 124° 26’ 207”E
3	2	5260	-	2° 05’ 033”S / 124° 24’ 968”E
	3	8780	-	2° 05’ 299”S / 124° 25’ 933”E

The KMN. Bukit Safa vessel uses white LED lights to collect fish. According to Jaya *et al*. (2023), fish gathered around the lights are generally pelagic fish such as skipjack tuna, mackerel, scad, lemuru, mackerel, scad, tembang, and selar. Fish gathered around the raft lights and fish aggregating devices used by KMN. Bukit Safa include scad and tuna. The use of lights as a fishing aid is related to the behavior of fish that prefer light (Saragih, 2022). Fish that are positively phototactic will react in groups to light, by approaching the direction of the light and gathering around the light at a certain distance and time span (Rosyidah *et al*., 2009). KMN. Bukit Safa sailed 3 trips with 6 fishing ground locations located south of Taliabu Island. The Banda Sea is a basin-shaped water area that separates the Sunda Shelf in the west and the Sahul Shelf in the east. Fadila *et al*. (2016) stated that this region is one of Indonesia's waters with high pelagic fish resource potential. The Banda Sea is home to various pelagic fish species, such as tuna, scad, skipjack tuna, mackerel, and yellowfin tuna (Bubun *et al*., 2014; Hamka & Rais, 2016; Manik *et al*., 2018). Most of the catch from these waters is marketed through the Kendari Ocean Fisheries Port (PPS). Fishing gear such as purse seines, drift gillnets, cast nets, and trolling lines have significant potential as leading capture fisheries businesses in the Kendari PPS area (Mustaruddin *et al*., 2019).

The use of fish aggregating devices (FADs) as aids in collecting fish has been shown to increase the success of fishing operations. According to Muhamad (2016), the use of FADs has also been shown to increase fish production in a given body of water. Chaliluddin *et al*. (2018) also said that the success rate of fishing operations in areas around fish aggregating devices (FADs) was higher, around 90%, compared to catching schools of fish swimming freely in a body of water.

CONCLUSION

The design and construction of the raft light aid used in KMN. Bukit Safa, has a design and construction consisting of a wooden frame, styrofoam, lights, batteries and a power inverter. The design and construction of the fish aggregating device (FAD) has parts consisting of weights, ropes, floats, attractors and lamp housings. The operation of the raft light at KMN. Bukit Safa begins with lowering and preparing the raft light, removing the attractor on the FAD, removing the FAD float, and operating the fishing gear.

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