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Research Article

Analysis For Productivity Improvement In Boat Lift Net Fishing Business Through The Use Of Ufl Plus Technology

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Abstract

This research is an action research that pilots the UFL PLUS technology which is an innovative development of underwater dip lights in the boat lift net fishing business. This research or fishing ground took place in the waters of South Konawe Regency, around Hari Island. The fishing base was taken at the location where the lift net fishermen live, namely in Tondonggeu Village, Kendari City. This study revealed that; 1) The design using UFLPlus technology that was found to be able to increase the productivity of the boat lift net business was a use design that included the UFLPlus construction design, the layout and position of the UFLPlus lights, the use of UFLPlus technology on the lift net lighting profile, the use of CCTV on UFLPLus technology, the use of UFLPlus technology on Illumination and the pattern of lighting distribution on the boat lift net, and the use of the UFLPlus technology operating method on the boat lift net and the process of determining the exact time of hauling; 2) The use of UFLPLus technology is able to significantly improve the productivity of the boat lift net business by 41% compared to underwater dip lights without CCTV as the improvement in productivity is influenced by the large number of hauling that can be done.

Keywords

Fishing business, fishing gear, technology, boat lift net

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Introduction

Fishing operations in Indonesian waters, especially coastal waters, are mostly dominated (85%) by relatively small or traditional fishing fleets. Available information and data reveal that the number of foreign vessels operating in Indonesian waters has increased in number as a result of weak Indonesian maritime surveillance (Mulyadi, 2005). These foreign vessels are known to be equipped with high technology and are one of the causes of the decline in the production of local fishermen's catches. Southeast Sulawesi as one of the provinces in Indonesia has enormous fisheries and marine potential. This is because Southeast Sulawesi Province as it is known is an area that has a wider sea area than its land, approximately 70 percent of the sea. Therefore, it is not surprising that fisheries are the mainstay sector in Southeast Sulawesi Province. A good fishing gear is expected to be used to catch fish in the waters. This kind of fishing gear requires careful design and manufacture so that the operation of the fishing gear can be achieved properly. This is in line with the development of fishing technology which is also progressing. Technology and utilization of fisheries have developed along with the increasing need for food and animal protein. One of the indicators in the development of the fishery business is the development of the design of fishing gear.

One of the technologies in the lift net fishery business is the use of lamps as a light source to attract fish. The light fixture that is generally used by lift net fishermen in Tondenggeu Village today is a mercury lamp mounted on the sea surface (fisherman's lamp). However, the results of Hamidi, Baskoro, and Riyanto (2017) research found that the use of surface lamps or mercury lamps still does not show effective and efficient catches of fishermen, especially in terms of economy and the amount of catch production. The mercury lamps currently used by fishermen are very easily damaged due to short circuits due to heat and exposure to sea water. In addition, the use of surface lights reflects more light which has an effect on reducing the intensity of the light produced and is less able to attract fish (Baskoro et al., 2010).

Technological developments have created underwater dip lights (lacuba), which mostly use LED (Light Emitting Diodes) lamps and have been used as fishing aids in the lift net, as researched in several studies (Hamidi et al., 2017; Syafrie, 2012; Taufiq et al., 2015; Thenu, 2014). The advantages of LED lamps include a longer period of use, which is more than 1 year of use with a light resistance of about 50,000-80,000 hours with high efficiency and not easily broken (Nielsen, 2003). LED lamps have better specifications when compared to incandescent lamps (Shen, Kuo, & Fang, 2013).

Sometimes, the condition of the existence of fish is uncertain, especially those determined only based on natural signs commonly used by fishermen, making it difficult for fishermen to know and monitor the condition of fish that come to the net area. In this case, fishermen find it difficult to determine the time for nets to be haulled or wait for the arrival of the target fish (small pelagic fish) or even wait for the non-target fish or by-catch fish and fish that are wasted in the sea (discard) to leave. In addition, the threat of predatory fish or other aquatic animals such as sea snakes and dolphins which are likely to also come to the bagan to find prey and occasionally attack the fish that gather under the lights and scatter them is another obstacle that may be faced by fishermen (Thenu, 2014). Baskoro et al. (2010) stated that a big problem for lift net fishermen in Indonesia is how fishermen know that the fish in the catchable area are a certain type of fish they want. Currently, acoustic technology has been developed to predict the arrival of fish. However, the use of acoustics does not mean that the problems have been resolved. The use of acoustics in Indonesian waters is recognized to still have several shortcomings. These shortcomings include the difficulty of distinguishing one species from another, including the size of the fish from one another. Furthermore, the acoustic function only provides a general description of schools of fish without knowing the type and size of fish.

The addition of CCTV cameras that are connected to the monitor above the lift net is expected to overcome the existing problems. The addition of this facility, in other words, has given the added function of an underwater dip lamp called the Underwater Fish Lamp Plus (UFLPlus). Thus, it is expected that the hauling time or net lifting will be more effective with more catches, initial information about the type and size of fish to be caught can be known earlier, and the catch in one fishing trip can reach the optimum Catch Per Unit Effort (CPUE). If these have been achieved, an increase in the productivity of the lift net fisheries business can be achieved. The size of the tools and assistive technology used is the amount of fishing effort where the amount of fishing effort will have an impact on fishing productivity (Nia & Rahbarianyazd, 2020; Smith, 2000).

In an effort to support and optimize the use of UFLPlus in "light fishing" fisheries so as to increase the

productivity of fishing gear, the researchers designed or designed UFLPlus technology that could work properly as it functions. However, the underwater dip lamp equipped with CCTV equipment is not yet known clearly regarding its ability as a fishing tool to increase catches in boat lift fishing gear. This is the background of the need for research to find out the design of using UFLPlus which is able to increase the productivity of the boat lift net as well as the ability of the UFLPlus to work by comparing it with Lacuba lamps without CCTV. The factors studied in this case are in terms of use or the duration of time needed to then be used as a reference for the effectiveness of using lights on the boat lift net.

Method

Based on the method used, this research is an Action Research. The Action Research method used in this research is to test the UFL PLUS technology, an innovative development of underwater dip lights in the boat lift net fishing business. This research or fishing ground was carried out in the waters of the southern Konawe Regency, around Hari Island. The fishing base is taken from the location where the lift net fishermen live, namely in Tondonggeu Village, Kendari City. The research data were analyzed descriptively, namely by comparing the differences in catches using lacuba without CCTV and with UFLPlus technology. The two independent groups referred to here are two unpaired groups. This means that the data sources come from different subjects. This data source comes from before and after the use of UFL+ which is associated with productivity and the length of time needed in 1 trip.

Research Results

UFLPlus technology design

In the initial design process, the use of UFLPlus technology which is intended to increase productivity in the boat lifting net business, the design, construction and specifications of the UFLPlus technology used in detail must be known in advance. The purpose of designing the UFLPlus technology is to obtain an underwater submersible light model equipped with CCTV. In addition to CCTV, the addition of other innovations is the lighting system that is used to connect with the assembled dimmer so that light intensity settings can easily be done. The lighting system is connected to the power supply system in this case using a switch. The circuit system on the UFLPlus is presented in Figure 1.

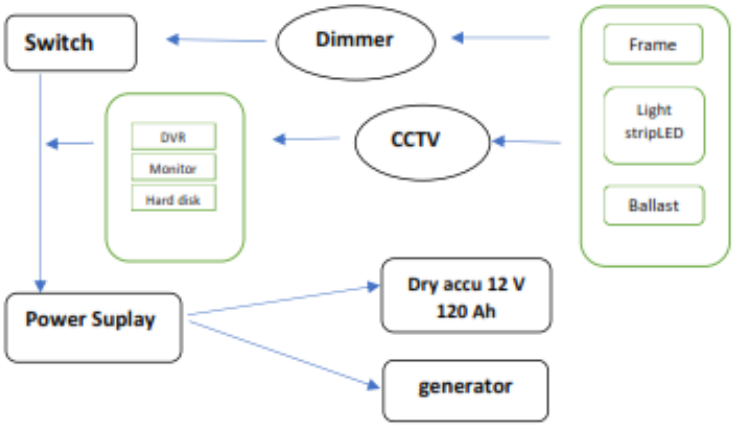


Figure 1. Circuit system on UFLPlus Technology

The results of the UFLPlus technology design (Underwater Fish Lamp Plus) are presented in Figure 2 below.

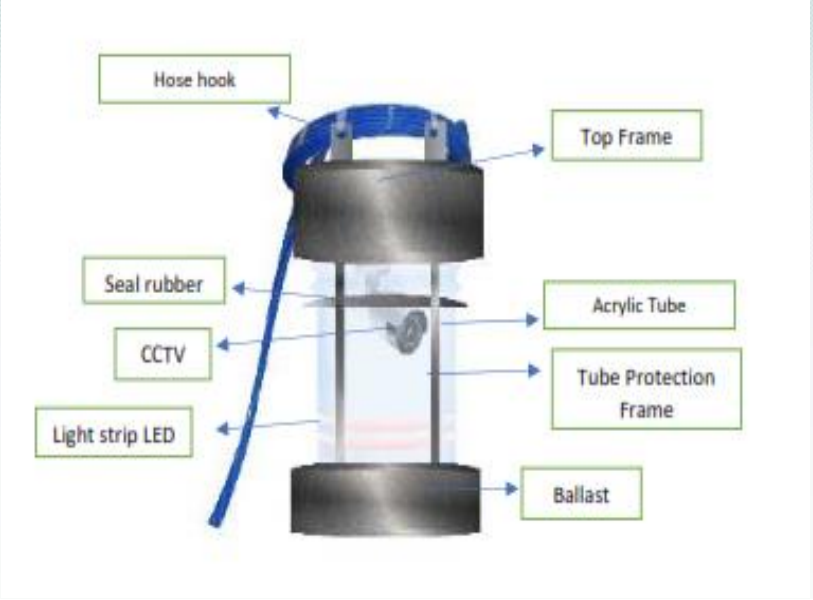


Figure 2. UFLPlus Technology Construction Design

The UFLPlus technology is designed in such a way as shown in Figure 1. It is intended that the placement of the components contained in the UFLPlus can be assembled and integrated together without disturbing the function and working mechanism of each component. Specifications and information related to the construction of UFLPlus technology are listed in Table 1.

Table 1.
Specifications and information in the construction of UFLPlus Technology

No	UFLPlus Part	Component	Size	Total/Material Type
1.	Upper Frame	Rope hook	Height 2 cm Wide 1cm	3/ Stainles stell iron
		Ballast	Height 12 cm Diameter 28 cm	1/ Tin plated iron
2.	Tube	Acrylic tube	Height 20 cm Diameter 18 cm Thickness 4 mm	1/ Acrylic
		Seal rubber	Thickness 4 mm Wide 11 mm Diameter 16 mm	1/ Rubber
3.	Underframe	Under ballast	Height 5 cm	1/ Tin plated iron
4.	CCTV	Lennsa	3,6 mm	2/ Polycarbonate plastic
5.	LED *strip* Lamp	Lamp	DC 2 V, 60 Watt	120/ Plastic and Aluminium
6.	Electricity Cable	Isolator	Length 10 m	1/ Thermoplastic
		Conductor	Length 10 m	1/ Copper
7.	Hose	Hose	Length 10 m	1/ Silicone

UFLPlus technology design on boat lift net

The design of using UFLPlus technology on operated boat ligt net includes;

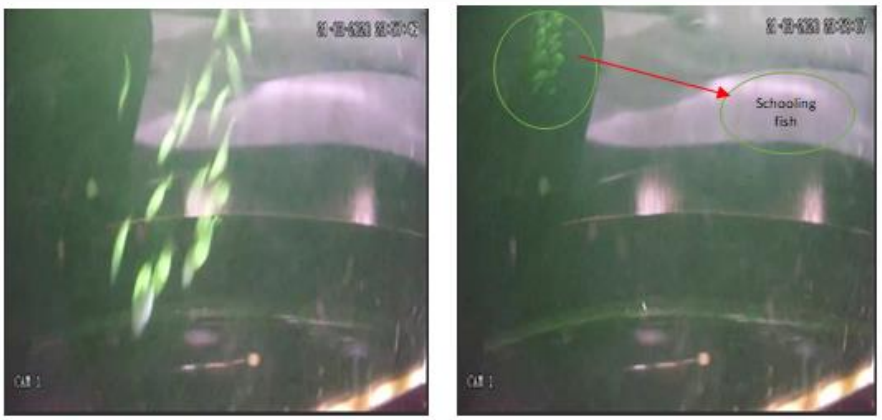
1) Layout and position of lights;
2) Lighting profile on the lift net using UFLPlus technology;
3) Use of CCTV on UFLPLus technology;
4) Illumination and lighting distribution pattern on the boat lift net using UFLPlus technology; and
5) The method of operating the UFLPlus technology on the boat lift net and the process of determining the right hauling time.

UFLPLus is lowered on the right or left side of the hull, ± 0.5 meters from the hull. The position of the UFLPLus lamp is lowered at a depth of 10-20 m from sea level. The lighting system used is a lighting system that comes from a combination of 40 surface lamps or mercury lamps (1,600 Watt) with one unit of UFLPlus lamp (40 Watt) put in the water. The UFLPlus unit integrated with the recording system is presented in Figure 3.

(a) (b)

Figure 3. Observational media (CCTV) that has been integrated with the lighting system (a), storage media (DVR) as well as monitor screen (b)

The results of observing the condition of fish using UFLPlus observed on a monitor screen on board are presented in Figure 4.



(a) (b)

Figure 4. Results of UFLPlus Video Camera Documentation in Water, Schools of fish that have come close to UFLPlus (a) and schools of fish from afar that have come close to UFLPlus (b).

The intensity of the light produced by the UFLPlus lamp is used to attract fish and plankton from the water. The intensity measurement produces the illumination value or the amount of light current in an area. The results of the measurement of the light intensity of the UFLPLus lamp will form a lamp distribution pattern as shown in Figure 5.

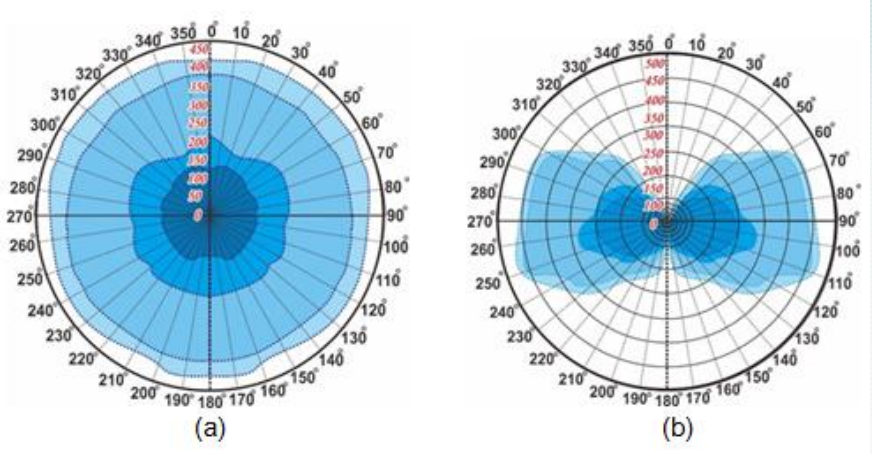


Figure 5. UFLPlus Light Distribution Pattern with Vertical Position (a) and Light Distribution Pattern with Horizontal Position (b).

The method of operating the UFLPlus technology is one explanation that includes the design of using UFLPlus technology on the boat lift net in the field. The use of UFLPLus technology can help increase the number of catches in one night fishing operation, streamline fishing operations and streamline the cost and time required for fishing operations on boat lifts. The complete illustration of the UFLPLus technology operating method on the boat lifts is shown in Figure 6.

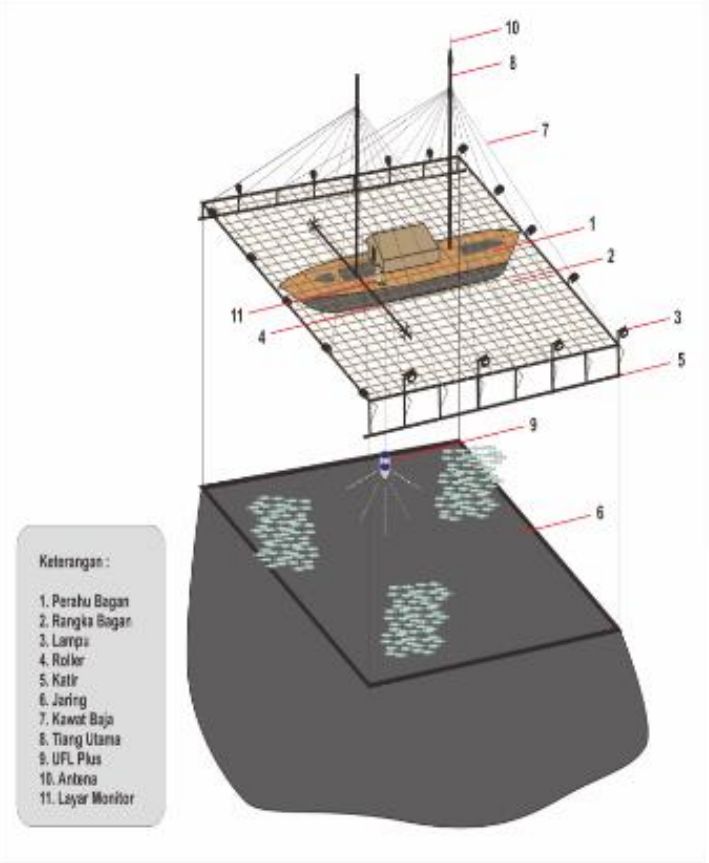


Figure 6. Illustration of the UFLPLus technology operating method on the boat lift net

Analysis of increasing fishery business productivity

The analysis of increasing the productivity of the boat lift fishing business is carried out by finding the productivity level of the boat lift fishing business using UFLPlus technology and then comparing it to those using lacuba without CCTV. The research that has been carried out has revealed the catch of the boat lift net during 12 nights of fishing operations using lacuba without CCTV and using UFLPLus technology. Catch data using lacuba without CCTV or using UFLPlus technology is

expressed in production data (kg) per one night and average production data (kg) per one hauling in one night. More complete data on the catch is presented in Table 2. Table 2 shows that there are differences in the catches of the two types of lights every night of fishing.

Table 2.
Results of Catching Boat Lift Net Using Lacuba without CCTV and Using UFLPlus during the Research

Night	Production using lacuba without CCTV (kg)		Production using UFLPlus (kg)	
	1 Night Production (kg)	The average of 1 time hauling production in 1 night(kg)	1 Night Production (kg)	The average of 1 time hauling production in 1 night (kg)
1	266	133	305	152,5
2	270	135	448	149,33
3	423	141	410	136,67
4	761	253,67	479	159,67
5	745	248,33	480	160,00
6	1.111	370,33	466	155,33
7	1.322	440,67	2.069	413,80
8	1.291	430,33	2.117	423,40
9	1.287	429	2.330	466,00
10	1.071	357	2.080	416,00
11	1.095	365	1.717	429,25
12	648	324	1.393	348,25

Data related to the types of fish caught on boat lift net which are the composition of the catch every night of catching using lacuba without CCTV and using UFLPLus technology are presented in Table 3 and Table 4.

Table 3.
Data on Catches by Type of Fish on Boat Lift Net using Lacuba without CCTV.

Night	Catch Number of Each Fish Type (kg)					Number of Catch per night (Kg)
	Anchovy (*Stolephorus sp*)	Tembang (Sardinella sp)	Selar kuning (*Selaroides leptolepis*)	Kuwe (*Caranx sp*)	Squid (*Loligo sp*)	
1	1	98	41	43	25	59
2	2	98	41	53	28	50
3	3	156	66	87	39	75
4	4	347	117	104	63	130
5	5	324	115	115	57	134
6	6	457	193	171	117	173
7	7	568	189	208	135	222
8	8	546	181	196	173	195
9	9	548	193	195	151	200
10	10	447	161	152	108	203
11	11	426	166	156	143	204
12	12	296	100	77	68	107
Percentage (%)	41,8	15,2	15,13	10,7	17,02	100

Table 4.
Data on Catches by Type of Fish in Boat Lift Net using UFLPlus

Night	Catch Number of Each Fish Type (kg)					Number of Catch Per Night (Kg)
	Anchovy (*Stolephorus sp)*	Tembang (*Sardinella* sp)	Selar kuning *(Selaroides leptolepis)*	Kuwe *(Caranx sp)*	Squid *(Loligo sp)*	
1	108	45	63	25	64	305
2	157	63	92	48	87	447
3	147	57	92	39	75	410
4	169	69	97	54	90	479
5	173	71	93	57	86	480
6	173	70	88	58	77	466
7	879	266	312	230	382	2.069
8	904	280	309	253	371	2.117
9	972	327	371	255	405	2.330
10	909	276	286	226	382	2.079
11	727	249	250	197	294	1.717
12	634	179	182	168	230	1.393
Percentage (%)	41,6	13,6	15,6	11,2	17,8	100

Productivity of boat lift net fishing gear using Lacuba without CCTV compared to those using UFLPlus Technology

The results of observations on the average length of time required for each stage of activity for the operation of a boat lift using a lacuba without CCTV compared to using UFLPlus technology at the research site are presented in Table 5.

Table 5.
Average Time Required

No	Description	The time needed (minute)	
		Lacuba without CCTV	UFLPlus Technology
1	Prepation/Settinga and Lacuba setting without CCTV/UFLPlus	15 - 20	15 -20
2	Lighting (Lamp and Chart)	140 - 160	60 - 90
3	Extinction of Lamp gradually	25 - 30	10 -20
4	Final hauling	20 - 23	15 - 25
5	Herding the fish onto the ship	15 - 20	15 - 20
6	Lifting the fish onto the ship	10 - 20	10 - 20
7	Sorting the type of hauling fish	20 - 30	20 - 30

The difference in the productivity value of the lift net fishing gear using lacuba without CCTV and the productivity value using UFLPlus technology is obtained from the difference between the productivity value using UFLPlus technology and the productivity value using lacuba without CCTV as shown in Table 6.

Table 6.
Average Productivity Value Required for 1 Night

Night	Productivity (kg/minute)		Productivity Difference
	Using lacuba without CCTV	Using UFLPlus	
1	0,67	1,05	0,38
2	0,66	0,98	0,32
3	0,64	0,94	0,3
4	1,15	1,08	-0,07
5	1,10	1,10	0
6	1,62	1,08	-0,54
7	2,20	3,94	1,74
8	2,07	4,03	1,96
9	2,00	4,44	2,44
10	1,68	3,85	2,17
11	1,64	3,65	2,01
12	1,44	2,93	1,49

Discussion

In principle, the use of UFLPlus technology in lift net fishing gear is the same as the use of underwater dip lights without CCTV because they are both underwater and are intended to attract fish. The difference lies in the addition of functions which will therefore affect the design. The purpose of the creation of the UFLPlus design is to obtain a design or model of an underwater submersible lamp equipped with CCTV.Determining the shape or model and materials that will be used to design and construct is the most important first step to consider. The shape of the lamp construction chosen is a vertical tube or cylinder. The consideration for choosing this form is because the tube shape can accommodate CCTV cameras which will be placed adjacent to the LED strip light. The shape of a vertical cylinder or cylinder is a shape formed by two parallel upper and lower circles and a rectangle that surrounds the two circles (Firdawati et al., 2011; Suard, 2020). The shape of the tube is suitable for the construction of underwater dip lights because there are no corners in the space so that the light emitted can be more evenly distributed on all sides to attract fish. In addition, the shape of the tube or cylinder can divide the pressure evenly into each part so that the tube is more resistant to pressure (Nzeakor, Nwokeoma, & Ezeh, 2020; Taufiq et al., 2015).

The lighting stage is the stage of activity that requires more time, both on lacuba lamps without CCTV and UFLPLus lamps. This is because this stage includes the process of turning on all the required lights, which applies to both underwater dip lights without CCTV and UFLPlus lights. When the lights have been lit well and stable, then the next activity is to wait for the arrival of the fish and observe their behavior. Mallawa (2012) stated that the length of time required for the lighting stage on the lift net is around 120 to 240 minutes. This stage includes the process of waiting for the arrival of fish (soaking).The difference in the use of time in the lighting stage was found to be quite large between lacuba without CCTV and UFLPLus technology. The length of time required for actual fishing time or 1 (one) haul using a lacuba without CCTV ranges from 200 minutes or 3 hours 20 minutes to 233 minutes or 3 hours 53 minutes. Meanwhile, the length of time required for actual fishing time or 1 (one) haul using UFLPlus technology based on observations during the study ranged from 100 minutes or 1 hour 40 minutes to 155 minutes or 2 hours 35 minutes.

In other words, the time spent waiting for fish to be caught is reduced and there are more opportunities for catching through the next hauling. This is reflected in the length of time it takes from the lighting stage to lowering the net, to a gradual blackout to lifting the net until the net comes up on the surface of the water. This process is commonly known as one-time hauling. This is in accordance with what was stated by Puspito, Ahmad, and Sururi (2017) where it is stated in their research that the actual fishing time is calculated from the lighting of the lamp until the net is lifted.Other stages such as gradual extinguishing, lifting of nets, herding fish onto boats, lifting fish onto boats and sorting of caught fish only takes under 30 minutes, either by using lacuba without CCTV or by using UFLPlus technology. The length of time used in these stages is not much different or even the same as the length of time it takes for fishermen who use surface lights. This is as stated

by Mallawa (2012) that the average length of time needed at the stage of extinguishing to sorting ranges from 10 to 30 minutes.
The catch in one haul is then compared with the length of time it takes for one haul or the actual fishing time so that the productivity value of the lift net fishing gear is obtained by using lacuba without CCTV and by using UFLPlus technology for one haul. This is in accordance with what Oktaviani, Nelwan, and Kurnia (2018) in their research that the productivity of the boat lift is the amount of catch per hauling divided by the effective time of catching.Based on the results of interviews with fishermen who own the lift net, it is known that if the current is strong, sometimes the stages of the fishing operation process on the fishing gear of the boat lift netered by Tondenggeu fishermen begin with lighting followed by lowering the net. This is different from the process of fishing operations carried out by fishermen in the Makassar Strait as stated by Nessa (2011). In the study, it was stated that towards dusk, setting of the net began after all the ties to the frame had been properly tied, which was then continued with the lighting stage.This research trial begins with setting, lowering the net and lighting as the next stage. The process of this fishing operation is in accordance with that proposed by Nelwan, Zainuddin, and Kurnia (2015) that fishing operations in light fishing begin from the time the lights are turned on until the net is pulled and the net frame appears on the surface.
Based on the notion of productivity, the boat lift net has two productivity models that can be calculated, namely the productivity of the lift net fishing gear every one catch and the productivity of the boat fishing gear every hauling. This is as stated by Oktaviani et al. (2018) that calculating fishing productivity is carried out by calculating the productivity of boat lift catches every time they are hauled. In one night of catching a boat lift using a lacuba without CCTV, the number of hauling carried out is 1 to 3 times the hauling. The period of the day of the moon is one indication to determine the time to go to sea for fishermen. According to Jatmiko (2015) the lunar day period factor indirectly affects the presence of fish. Full moon or bright moon conditions make it difficult for fish to concentrate in one area. Therefore, it is necessary to extend the time before the net is lifted to wait for more fish to arrive. Apart from the extension of time, the UFLPlus and lacuba technology aids are still able to bring in fish even in full moon conditions, but only with a smaller number of fish.
In one stage of catching a boat lift net using a lacuba without CCTV, hauling can usually be done one to three times. This is in accordance with the results of research by Hamidi et al. (2017) who found that the use of underwater dip lights resulted in an average number of hauling three times in one night. On the other hand, the use of UFLPlus showed an increase in the number of hauling, especially during even months. This is because the fish are well concentrated in the light coming from the boat lift net and UFLPlus lamps, especially fish that are phototaxis positive or fish that like high light intensity. Types of fish that are included in positive phototaxis are anchovies (Stolephorus sp) as the types of fish most caught during this study. It was found based on field observations that anchovy is very fast in responding to light, both lacuba and UFLPlus. The attraction and arrival of schools of anchovy at the light source takes a relatively short time, which is about 1 (one) minute since the underwater light is lowered into the sea with about 10 meters from the surface. This condition is related to the process of adaptation of the retina of the fish eye to light. Similar results were also found in the research of (Nessa, 2011) that the retina of anchovy eyes caught on the Rambo lift net through the movement of cone and pigment cells when the aspect of the light adaptation process, it seems that the fish are fast adapted to light and like high intensity light.

Conclusion

Knowing the results and discussions carried out, this study concludes that the design using UFLPlus technology that can increase the productivity of the boat lift net business is a use design that includes the UFLPlus construction design, the layout and position of the UFLPlus lamp, the lighting profile on the lift net with UFLPlus technology, the use of CCTV on technology UFLPLus, Illumination and lighting distribution patterns on boat lift net using UFLPlus technology, and UFLPlus technology operating methods on boat lift net and the process of determining the right hauling time. The use of UFLPLus technology is found to be significantly increases the productivity of the boat lift business by 41% compared to underwater dip lights without CCTV. The increase in productivity is influenced by the number of possible hauling.

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