Effectiveness of Fluorescent Lamp on Lift Net Fishery

by Agus Suherman

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ORIGINAL ARTICLES

Effectiveness of Fluorescent Lamp on Lift Net Fishery

[1]Gondo Puspito and [2]Agus Suherman

[1]Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, Bogor Institute of Agriculture.
[2]Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, Diponegoro University.

ABSTRACT

The research aims to determine the composition of the lift net catch and effectiveness of the fluorescent lift net catches lamp. Three fluorescent lamps that operated on lift net catch is *a standard fluorescent lamps*, *fluorescent reflector lamps* and *fluorescent lamp dipped into the water*. Each fluorescent lamp operated 2 times a night for 10 nights. The results showed that the composition of the catch consisted of *sardinella fimbriata* weighing 95.2 kg, 58 kg of *Rastrelliger sp.*, anchovies 44.4 kg, 34.5 kg of *mysis sp.*, *Trichiurus sp.* 29.5 kg, 20.5 kg *pampus argentus*, squid 16, 5 kg and 14 kg of cob. Lamp dipped in the water is very effectively operated by the lift net catch floating, aquatic organisms as it can catch weighing 151.10 kg. standard lamps and reflector lamp get the catch weighing 96 kg and 65.50 kg.

Key words: Effectiveness, florescent lights, lift net catch, Palabuhan Ratu waters.

Introduction

Fishing with lift net catch success is largely determined by the tools in the form of arresting intensity light generated by the lamp. Light intensity greatly influences the behavior of the fish to come closer (Mara and Maurizio, 2005). Light serves as a collector types of positive fototaksis small organisms, such as anchovies and *mysis sp.*, and also the types of organisms rather large-sized predators, such as *Trichiurus sp.* and squid. Lift net catch that really only designed to capture the types of smaller body sized organisms, but in fact can also catch other types of large sized organisms.

Light sources widely used by fishermen initially lift net catch was lighting torches. This is type of kerosene lamp. Government policies make the stop subsidizing kerosene fuel prices can be extremely costly. This resulted in fishermen switch to use other energy sources, such as gas and electricity.

One of the fishery areas affected by kerosene subsidy removal policy is Palabuhan Ratu, West Java. Fishermen lift net catch in this area were forced to switch to use tubular fluorescent lamp that is generated by electric energy. The types of this lamp is deliberately chosen because it has a strong higher light than incandescent lamps for the same voltage and power. In addition, fluorescent lamps has a longer life span and energy saving compared to other lamp types (Supriono and Satiawan, 2005).

In the last decade of research on light bulbs as fish collectors focus on the effect of light intensity on the behavior of fish are closely associated with the catch of fish (Choi and Arakawa, 2001). The use of fluorescent lamps is relatively more convenient and practical compared with torches. The problem, fishermen do not know how operate the most effective operation to collect fish. Some fishermen use fluorescent lights by hanging at the bottom of the lift net catch. Some fishermen use the hood in the form of buckets, covered with a cloth.

This research tries to solve the problem how to use fluorescent bulbs, by hanging above the water surface, given reflector and suspended above the surface of the water or immersed in water. The goal is to get the catch composition lift net catch and determine how to use fluorescent spiral shaped form as the most effective way to catch fish on the lift net catch. The type of fluorescent lamp used is a spiral, because it has several advantages compared to tubular fluorescent lamps. The advantages of fluorescent lamps include: brighter, better light quality and smaller size for the same power as tubular fluorescent lamps (Hindarto 2011).

Publications that discuss the use of fluorescent lights in a way dipped in water or a reflector as a tool for catching fish on the lift net catch has not been found. The study, published only describes the use of incandescent and fluorescent lamps immersed into water (Hasan and Widipangestu, 2000). Most studies on the use of reflector lamp only applied to light torches (Puspito, 2006 and 2008). However, the three publications are used as an input in discussing the results of this research.

Corresponding Author: Gondo Puspito, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Science, Bogor Institute of Agriculture.
E-mail: gpuspito@yahoo.com

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2. Theoretical Study:

Illumination light spiral-shaped fluorescent *Philips* lamp brand with 24 *watts* of power at medium air is used as the research material is shown in Figure 1. Illumination of high value leads to the side. Illumination or light power is the *flux* of light falling on a plane surface. The luminous *flux* emitted by a light source is the amount of light emitted in one second (Cayless and Marsden, 1983).

Based on Figure 2, the direction of the light emitted fluorescent light in all directions. The use of fluorescent lights on the lift net catch by hanging above the water level is not very effective, because the emitted light can not be fully utilized. Light beam between 0-90º angle and 270-360º not lead to surface water, but into the air. The spectrum of light is strongly influenced by the color of light bulbs and lamps surrounding radiation (Monton, Kamonpan and Suppachai, 2011)

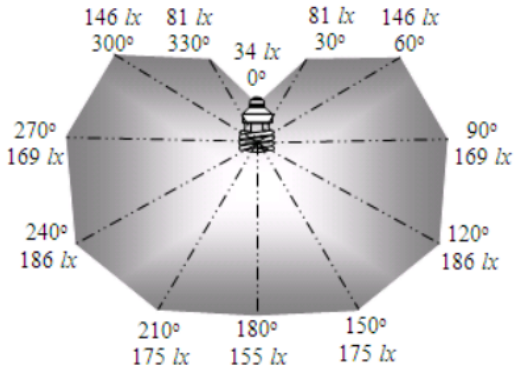

Fig. 1: Fluorescent light illumination by light beam direction.

The intensity of the light decreases with distance from the light source. Decrease in light intensity is influenced by the optical properties of the medium and varying optical conditions in the water. The intensity of light decreases in proportion to the square of the distance from the light source (Jerlov, NG 1968). Utilization of maximal fluorescent lights can be done by dipping into water or adding light reflector. The first way is so that all the light emitted just scattered in the water. The intended use of reflectors to direct all light downward of lift net catch. Construction reflectors can be designed with a simple mathematical calculation (Wisudo, Sakai, Takeda, Akiyama and Arimoto. 2002).

In Figure 2 is shown transmitting light from one side of the fluorescent lamps as a basis for designing the construction of a conical reflector. The light emanating from the lower end of the lamp leads to the end frame of the web P_{kjr} after slightly touching the tip reflector at the point *e'* and refraction of light did not exist. According Cayless and Marsden, 1983 said that the calculation starts with determining the height of the light from the reflector lamp h_r. The formula is $h_r = 1/2\ ø_{lt}.cot\ (1/2\alpha)$, so the high end of the lamp frame is h_{ref} calculated as the $h_{ref} = H + H_r + h_{lt}$. *E* is the coordinate point ($h_{ref}\ tan\ 30^o$, 0) and *b* ($1/2P_{kjr}$, 0). Furthermore equation of the line *d-e* or y_{ref} and *b-c* or y_{lt} can be made, namely:

$y_{ref} = H_{ref}.\ x.cot\ (1/2\alpha)$ and 1

$y_{lt} = H - (2H/P_{kjr}).x.$ 2

To get r_{ref} or spokes outer portion reflector, then $y_{ref} = y_{lt}$ and obtained:

$r_{ref} = (H-H_{ref})/(2H/P_{kjr}-cot(1/2\alpha))$. 3

The length of the reflector PS_{ref} calculated using the formula:

$PS_{ref} = r_{ref}.cosec\ (1/2\alpha)$. 4

3. Methods:

The research uses experimental methods to test a spiral-shaped fluorescent lamp on the operation of the lift net catch floating in the waters of the Gulf of Palabuhan Ratu between May-June 2010. Fishing operations with lift net catch made during 10 nights between the 7:00 p.m. to 04:00 am. during the dark moon.

Fluorescent lamp used *Phillips* branded with 24 *watts* of power. The light is operated by 1) without being treated (standard bulbs), 2) put into a jar and dipped into the water (Fig. 3a), and 3) given reflector light (Figure 3b). Conical reflector made with an angle $\alpha = 60$ °. Reflector is designed to illuminate the entire area of the inside of the net at a depth of 4 m from the lamp or sinking depth ½ nets. The inner part of reflector coated with

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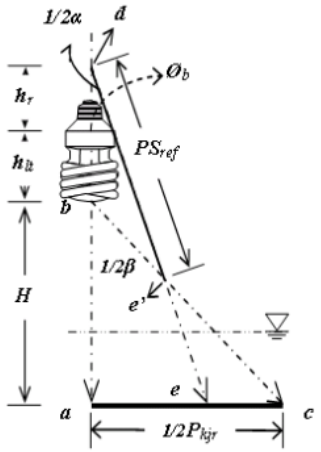
silver paint coated reflector to amplify the reflected power. According to equation (1) and (2), 2 reflector diameter and length r_{ref} PS_{ref} reflector side is 34.24 cm.



Description:

A	:	reflector Angle (°);
β	:	light angle (°);
$Ø_b$	:	light body diameter (cm);
h_r	:	High reflector of the lamp (cm);
h_{lt}	:	High light (cm);
H	:	Distance from the light frame nets (cm)
e'	:	The meeting point of light by the end of the reflector (x,y)
PS_{ref}	:	The length of the reflector (cm); and
P_{kjr}	:	The length of the frame of the web (cm).

Fig. 2: The meeting between the fluorescent light path **(*b*-*c*)** and the reflector at the point ***e'*** as a basis for designing reflectors.

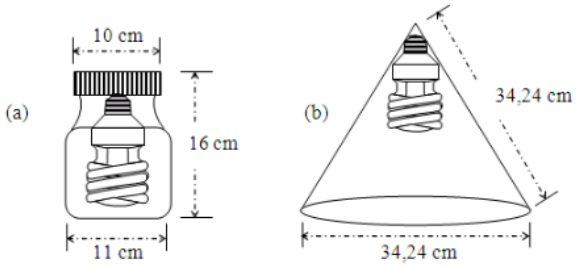


Fig. 3: Dye Lamp (a) and reflector light (b).

At each operation lift net catch, netting sunk 7 m below sea level. Dye lights positioned 4 m above the frame of the net, while reflector lamp or lamp standard 1 m above sea level. Position lights dip (a) and standard light bulbs reflector or (b) on the lift net catch described in Figure 4. Operation of any fluorescent sequence to the lift net catch is as follows:

1. Operation lift net catch on the first night begins by using 4 standard bulbs. After removal of the net, the operation continued using dye and the next 4 lamp 4 reflector lights. Appointment net lift net catch done 2 times for each light treatment by first doing burnout on 3 lights;
2. On the second night, the order of use of the lights changed. Likewise for the fourth day onwards, and
3. Standard light illumination and light enters the water reflector measured prior to removal of the net. Three position measurements within 1 m and 4 m from the center of the lift net catch.

Data collected in the form of a fluorescent light illumination into the water and catch species composition and weight lift net catch used by the lamp. All data is presented in the form of chart and comparative analyzed descriptively. Program *surfer* used to describe the distribution patterns of fluorescent light illumination into the water.

Results and Discussion

4.1. Illumination Light:

The light distribution pattern of standard light, reflector lights and dye lamps is seen in Figure 5. The light coming from the standards lamp and the dye lights radiate in all directions. This resulted in the existence of the types of fish are attracted to the light will be spread around the lamp. The light emitted by the reflector lamp

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direct more downward. Group of fish are more concentrated at the bottom of the lamp. Diffuse light distribution patterns in standard lamps and dye lighting, according Puspito (2008), will lead to positive fototaksis groups of fish will not last long around lights. While the light focused towards making groups of fish can be more durable under the lights (Matsuda, Torisawa, Hiraishi, Nashimoto, Yamamoto, 2005).

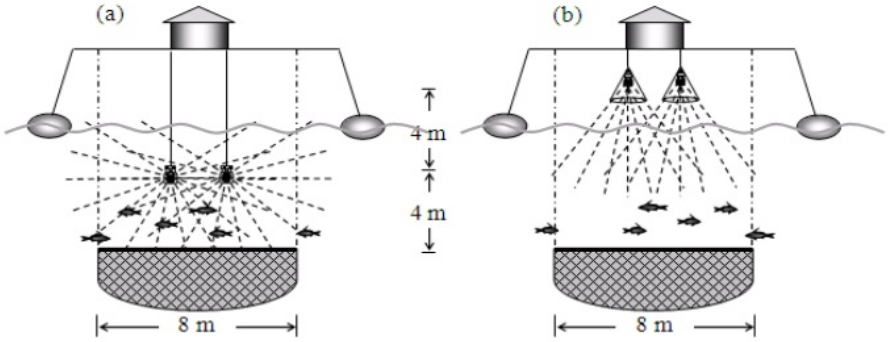

Fig. 4: Position lights dip (a) and reflector light or standard (b).

Standard light illumination, reflector light and dye light decreased in line with the increase in depth. According to Ben Yami (1987), degradation of light illumination will occur along with the increasing distance from the light source. Cayless and Marsden (1983) formulates light illumination as the ratio between the light intensity with the square of the distance from the light source. The light emitted by a standard light only reaches a depth of 6 m, since only a small fraction of light that goes into the water. This is different from reflector light illumination measured to a depth of 9 m. Light enters the water is a combination of the light coming from the lamps and the reflected reflector light wall. The use of silver coating on the walls will reflect reflector light come by 91-95%. In dye light, illumination light can be measured to a depth of 10 m. Dyed light penetration into the water depends on the depth of installation. The deeper the dip lights installed, the deeper the penetration of light. Three fluorescent light penetration into the water is high enough. Because the waters of Indonesia located in tropical and marine, so transparent value is quite high, between 20-35%. As a result, the number of fish stimulated to come more and more light sources (Ayodhyoa 1981). Figure 6 shows a decrease in all three fluorescent light illumination with the increasing water depth measured at the measurement position 1 m from the center of the lift net catch.

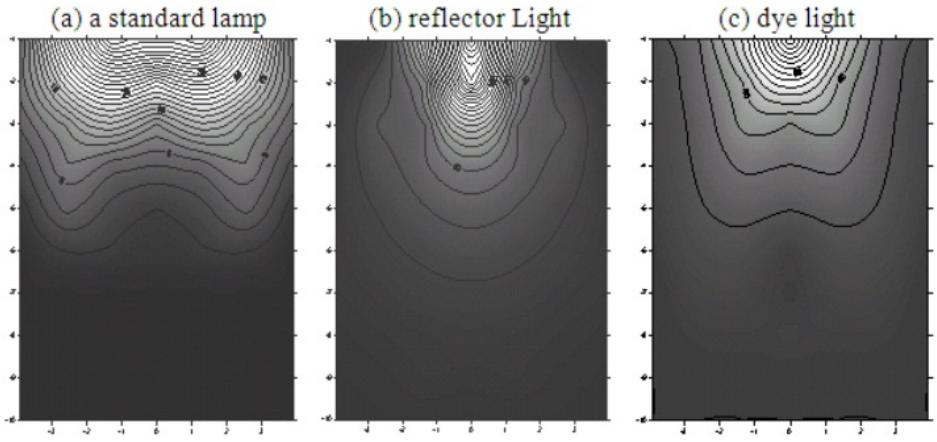

Fig. 5: Distribution pattern of florescent light in the water.

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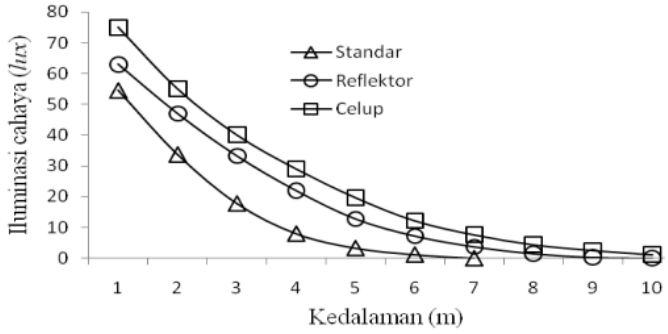

Fig. 6: Fluorescent light illumination.

4.2. Total of Catch Composition:

The catch lift net catch form 3 types of positive fototaksis organisms and 5 predators. Weight totaling 312.60 kg. Positive fototaksis organisms include *sardinella fimbriata* weighing 95.20 kg, *Rastrelliger sp.* 58 kg, anchovies (*Stolephorus commersonii*) 44.40 kg, and *mysis sp.* 34.50 kg. While the predator organisms consist *Trichiurus sp.*29.50 kg, *pampus argentus* 20.50 kg, squid (*Loligo sp.*) 16.50 kg and cob (*Auxis thazard*) 14 kg. Weight description of each type of organism is shown in Figure 7.

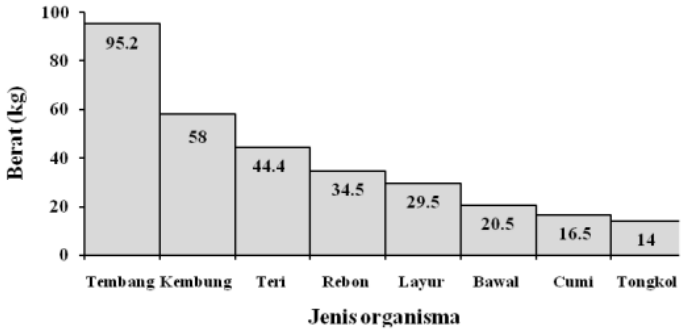

Fig. 7: The Wight of lift net catch by type of organism.

The catch is dominated by positive organisms fototaksis *sardinella fimbriata.* Percentage weighing up to 41.02% of the total weight of the catch fototaksis positive organisms. The next sequence is a *Rastrelliger sp.* 24.99%, 19.13% anchovies, and *mysis sp.* 14.86%. *sardinella fimbriata* and *Rastrelliger sp., Rastrelliger sp.* are common in the waters of the Palabuhan Ratu bay and can be caught throughout the year (Hasan and Widipangestu. 2000). The anchovies and *mysis sp.* only at certain times. Fishing operations were conducted in August-September did not provide satisfactory results, because the anchovies and *mysis sp.* arrest took place between November to January.

Sardinella fimbriata known as pelagic fish like in the open water surface to a depth of 150 m (Nybakken 1992)., *Rastrelliger sp.* is a pelagic fish that eat plankton with the endemic area is at a depth of water between 20-90 m (Bal and Rao 1984). Anchovies always are at a certain depth during the day and move to the surface of the water at night. While *mysis sp.* considered nocturnal organisms that inhabit the coastal seabed, estuaries and bays (Gunarso 1988). The four living organisms are clustered and highly interested in the light, because in the area there is a plankton food (Gunarso 1988; Hutomo and Azkab 1987). The use of light in the lift net catch - which operated in coastal waters - will attract these organisms come came to *lift net catch*. Mesh sizes are small lift net catch designed to catch small fish and *mysis sp.* (Monintja and Martasuganda 1991). S*ardinella fimbriata* and body size greater than anchovies and *mysis sp.* allowed to participate caught when removal of the net.

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4.3. Catch Composition:

Species composition of the catch weight lift net catch that uses standard lamp, reflector lamp and dye lamp is relatively different. Described in Figure 8 weight every type of organism under construction catches lift net catch used fluorescent lamps. Lift net catch that uses dye light weight bags produced the highest catch of 151.10 kg, or 48.34% of the total catch by weight, then the reflector lights 96 kg (30.71%), and standard lights 65.50 kg (20.95).

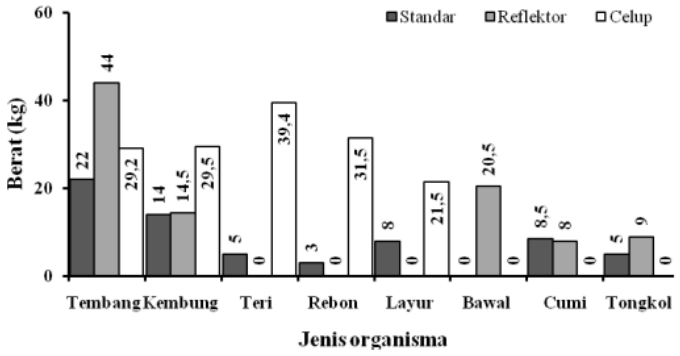

Fig. 8: Weight of each type of organism catches lift net catch based treatment on fluorescent lights.

(1) Standard Fluorescent Lamp:

Most of the standard fluorescent light emitted into the air and a few others into the water (Figure 1). This resulted in the penetration of light into the water is very low and the water area illuminated with low light illumination quite extensive (Figure 5a). These conditions resulted in highly dispersed in water plankton (Exterminate, 1995).

The presence of plankton organisms that spread fototaksis make positive, such as anchovies, *mysis sp.*, *Sardinella fimbriata* and *Rastrelliger sp., Rastrelliger sp.*, follow scattered chasing food. According to Nurdin and Hufiadi (2009), the four organisms actually enjoys water column is between the light and dark areas. *Sardinella fimbriata* and *Rastrelliger sp.*, according Laevastu and Hayes (1981), perform diurnal movement and spread during the night to feed on plankton. The existence of the four organisms is not clumped under the *lift net catch*, but the spread from the lift net catch to the lift net catch around. The number of each type of organism which is right below the lift net catch is very little.

Figure 8 informs that catches lift net catch form positive fototaksis organisms dominated by S*ardinella fimbriata* weighing 22 kg and 14 kg *Rastrelliger sp.*. The anchovies and *mysis sp.* only caught a little bit, that is, each weighing 5 kg and 3 kg. This can be understood as a predator organism prefers small organisms, namely anchovies and *mysis sp.*. Badrudin et. al (2004) mentions *Trichiurus sp.,* juvenile and adult *Trichiurus sp.* prey on small fish. The squid, according Raharjo and Bengen (1984), prey on small fish and crustaceans. Likewise, the cobs prey to small fish, such as anchovies, sardines and fish larvae (Gunarso 1988). The use of standard fluorescent lights on the lift net catch eventually produce S*ardinella fimbriata)* and *Rastrelliger sp.* in large quantities, while anchovies, *mysis sp.* and predator organisms in small amounts.

(2) Florescent reflector Lamp:

The area waters is illuminated by fluorescent reflector conical. Direction of the light beam expand with increasing water depth. High light is illuminated near the surface and decreases with increasing depth (Fig. 5b).

Lighting patterns that form a cone made all positive fototaksis organisms are in a narrow area at the bottom of the lift net catch. The presence of predatory organisms that come from deep water to make hordes of anchovies and *mysis sp.* dispersed away from the lift net catch. These conditions resulted in the arrest of anchovies and opportunities *mysis sp.* the lift net catch is very small. At the end of the lift net catch will be many organisms capture predators. At the moment there are no anchovies and *mysis sp.*, where S*ardinella fimbriata* and *Rastrelliger sp.* are not disturbed by predatory organisms. Both of these fish have a larger body size than anchovies and *mysis sp.* organisms that are not eaten by predators. Appointment net lift net catch will only produce two types of fish catches. In Figure 7 is shown the lift net catch that uses fluorescent reflector only able to capture two types of organisms fototaksis positive, that S*ardinella fimbriata* weighing 44 kg and 14.5 kg

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Rastrelliger sp. The predator is caught organisms consisting of 20.5 kg P*ampus argentus* , squid 8 kg and cob 9 kg.

Pampus argentus very rarely caught by the lift net catch. This type of fish only live in muddy seabed at a depth of 20-50 m by forming a gang (Genisa et. Al. 1986). Reflector lighting patterns which only leads to the lowest light illumination render is at the bottom near the bottom waters. It affected the existence of small organisms are more gathered at the site. Possible *pampus argentus* caught by the lift net catch, because while trapped prey on anchovies and *mysis sp.* that gathered near the habitat. According Kuthalingga (1963), *pampus argentus* main food is shrimp., P*ampus argentus* also prey on small fish.

3) Light dye in water:

The light is emitting dye light in water to all directions. Column of waters is shined wider than standard bulbs and reflector lamps (Figure 5c). Thus, areas with low light illumination is very spacious. This resulted in the distribution of plankton in the lift net catch that uses dye lights are on a very broad area around the light source. Plankton, according to Basmi (1995), very fond of water illuminated by light with low illumination.

Approximately 85.77% of the catch using light dye lift net catch is dominated by positive fototaksis organisms (Figure 7). Its kind in the form of S*ardinella fimbriata*, *Rastrelliger sp.,* anchovies and *mysis sp.*. The existence of four types of organisms spread following the distribution of plankton. This resulted in predatory organisms that come too spread out, especially around the lift net catch. Sulaiman (2006) mentions that the fish come under the lift net catch light source comes from many directions around the lift net catch. Furthermore, the fish move around light sources, or sometimes moves away and then close again.

Anchovies caught the largest number compared to other types of organisms. According to Sulaiman (2006), the pattern of spread of herd anchovies under the lift net catch, so the types of fish caught were more likely than other types of organisms. The existence of a large group of anchovies will invite *Trichiurus sp.* for prey. As a result, this predator fish species most likely to be caught as compared to other types of predators. *Trichiurus sp.* senses of sight, according to Wawengkang (2002), has a higher acuity than the senses of sight of other fish species. Anchovies are shiny color will determine the interest *Trichiurus sp.*

4.4. Construction of Florescent Lighting Options for Fisheries Lift Net Catch:

Mesh sizes in the lift net catch is very small about 5 mm. It is tailored to the types of organisms that also catch small, ie anchovies, *mysis sp.*, *sardinella fimbriata* and *Rastrelliger sp.*. The use of dye lights turned out very well be used to help capture these four types of organisms. Catch weight reached 129.6 kg, or higher than 58.5 kg reflector lights and standard lamps 44 kg. However, if seen such kind of catch predator organisms that have high economic value, then the lift net catch with reflector lights produce the greatest number of catches, which weighs 37.5 kg, while the lights dipped in water and standard light 21.5 kg respectively. Anchovies , *mysis sp.*, *sardinella fimbriata* and *Rastrelliger sp.* have low economic value (Murtijo 1997, Suwoyo and Mangampa Mukhlis 2008 and 2010). The squid, *pampus argentus*, tuna and *Trichiurus sp.* have high economic value (Dahuri 2010, 2010 and Rusky Sjafrie et. Al. 2011).

Lift net catch can use the dye light or reflector light. On the use reflector lights, mesh sizes lift net catch should be expanded. The goal is to reduce the burden of withdrawal and hydrodynamic pressure when the net lifted up. This is so that predatory organisms can be easily captured. Lift net catch is actually intended to catch small organisms can be transferred function to capture the large predatory organisms.

5. Conclusion:

The conclusion of this study is:

1. The composition of the catch consisted of 95.2 kg *sardinella fimbriata*, 58 kg of *Rastrelliger sp.* 44.4 kg of anchovies, 34.5 kg of *mysis sp.* 29.5 kg *of Trichiurus sp.,* 20.5 kg of *pampus argentus*, 16.5 kg of squid and 14 kg tuna.
2. The use of dye lights floating in the water on the lift net catch is very effective, because it can capture aquatic organisms weighing 151.10 kg, or 48.34% of the total catch by weight, or heavier than the reflector light 96 kg (30.71%) and standard lamp 65.50 kg (20.95%).

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