Analysis of opportunity loss of lift net operation in Makassar Water

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Abstract. Lift net was a Makassar traditional fishing gear that attached into the seabed, used paraffin lamps as fishing devices and used net with mesh size 0.5 cm. Lift net had low selectivity whereas in order to obtain sustainable fisheries, the catches should be mature fish phase (gonad ripe). This study aimed to determine the value of opportunity loss due to the low selectivity in operation of lift net. This research was held in June - July 2018 in Makassar Waters. This study used secondary data of South Sulawesi Fisheries Statistics 2010 - 2016, primary data such length and weight of lift net catches and some literature studies. There were five species caught by lift net such as mullet (Valamugil seheli), shrimp (Penaeus merguiensis), peperek (Leiognathus equulus), sardine (Sardinella gibbosa), and anchovy (Stolephorus commersonii). Based on the results, the percentage of mature fish of lift net catches was 60% of mullet, 20% of shrimp, 39% of peperek, 5% of sardine and 5% of anchovy. The average value of the opportunity loss of lift net operation during 2010-2016 in Makassar waters was Rp. 437,090,000.

1. Introduction
Lift net is a traditional Buginese – Makassar fishing gear in the form of bamboo in a square form which is attached in the seabed and stands firmly above the water, where in the middle of the building is installed net and operated by using light (light fishing). Because of the fishing gear is plugged in the bottom of the water, so that the depth instrument becomes very limited, which mainly operated in shallow waters [6]. Lift net has 0.2 inch length mesh size and use paraffin lamps. The catches of the tancap bagan are dominated by small pelagic fish such as mullet, anchovy, peperek, shrimp, sardine and others.

The small mesh size of lift net causes the low selectivity of lift net so that amount of immature fish is caught. This can indicate that the benefits received by the fishermen are not optimal so it is not economically, efficient and environmentally friendly. According to Made S [3] one way to increase production is improving productivity of fishing unit, which is high in the amount and value. In addition, the fishing gear unit must be efficient, appropriate to local conditions and does not harm the sustainability resources.

The study of economic analysis on the potential loss due to non-selective catches of lift net becomes necessary to find out how much environmental loss are indirectly used in the operation of fishing gear. Abdurrahmansyah [1] stated that the total loss income of lift net in Sumpang Binangae subdistrict due
the changes in mesh size to the sustainability standard of fisheries resources will gain the additional
catch value of discard about Rp 3,109,500 or 1.22% of the total the total catch per month which about
Rp. 705,353,022 per month.

The Ministry of Maritime Affairs and Fisheries has issued Permen KP No 2 of 2015 concerning the
prohibition on the use of trawls and seine nets in the Republic of Indonesia Fisheries Management Area
(WPP RI) due to the decrease in fish resources because the use of non-environmentally friendly fishing
gear. In the future, in order to get lift net in Makassar survive, it is necessary to assess the value of
potential loss so that the fishing gear can operate effectively, efficiently and environmentally friendly.

2. Methods
This research was conducted in June - July 2018 by using one sample lift net in Tallo, Makassar District.
The fishing ground distances is 3 miles from the mainland with coordinates 119.440 East Longitude and
5.097 South Latitude. The data used in this study are primary data and secondary data. Primary data is
obtained from direct retrieval of fish caught with the length and weight of fish. Secondary data are
obtained from Marine and Fisheries Statistics of South Sulawesi during 2010-2016.

Fish which analyzed are mullet (Valamugil seheli), shrimp (Penaeus merguiensis), peperek
(Leiognathus equulus), sardine (Sardinella gibbosa), and anchovy (Stolephorus commersonii). The
analysis obtains fish length and weight interval, and literature study to obtain the length of first gonad
ripe furthermore it will gain the composition of mature and immature catches of lift net in Makassar Water.

Opportunity loss analysis calculated the total expected value based on immature catches become
fish first gonad ripe. Next, actual value obtained by calculating amount of immature fish with its price.
The results will gain the opportunity loss in the operation of lift net in Makassar Water. Opportunity
loss of lift net formula (Made, S.2005) as follows;

\[ T_I h l = P_Y . Y_s + P_y . Y_d + P_y . Y_o \]  \hspace{1cm} (1)

Where :
- \( T_I h l \) = Total income loss (Rp)
- \( Y_s \) = Amount of fish loss due to changes of mesh size from 0,2 inch to 1 inch (Kg)
- \( Y_d \) = Amount of discard catches (kg)
- \( Y_o \) = Amount of fish escaped on application of environmental friendly fishing method
- \( P_y \) = price per unit (Rp/Kg)

3. Result and Discussion
Opportunity loss of lift net is the potential loss of income due to low selectivity of fishing gear causing
low income for fisherman and environmental loss. It is expected that by analyzing potential loss, it can
be seen the potential income for fishermen if the fishermen by using environmentally friendly fishing
gear.

Lift net in Makassar Water produce fish such as mullet, shrimp, sardine, peperek, anchovy, conch
fish, squid and other fish. This research analyzed the five highest catches of lift net as mullet, shrimp,
peperek, sardine and anchovy. Based on the measurement, the length of mullet of lift net are in the range
of 12.3 cm - 22.5 cm. Based on Mokhtar's [5], mullet (Vanugil seheli) start to enter mature fish (gonad
ripe) phase at 21.5 cm length. If the size applied to the fish, then the percentage of gonad mature fish
caught in lift net in Makassar Water is 60% and the other 40% are immature (Figure 1).

In the study of shrimp length, the species was measured from telson to the end of the carapace. Based
on the result, carapace length of shrimp in lift net is in range of 2.05 cm - 7.30 cm. Based on the study
of Melmambbessy [4], shrimp start to enter the first gonad ripe in 58.37 cm. From the results, it is
obtained that only 20% of mature shrimp and 80% of immature (Figure 2).

The range of peperek length in the Makassar Water is in 4.6 cm - 13 cm. Based on Arsito [2], paperek
fish start to enter mature (gonad ripe) at intervals of 9.3 cm - 10.1 cm. If it is applied to this study, the
percentage of mature fish was 39% and 61% other were immature fish (Figure 3).
The size of sardine is ranging at 3.2 cm - 16.0 cm. Based on Shelvinawati [8], sardine entered in mature phase at a size of 13.2 cm so that if applied in this study, the percentage of mature fish is 5% and the other 95% are gonad immature fish (Figure 4).

The last object is anchovy. In this study the size of anchovy is ranging from 2.0 cm - 6.5 cm. Based on Sudirman [7], anchovy start entering mature phase at a size of 5.5 cm so that if applied in this study the percentage of mature fish is 5% and 95% the other are immature gonadal fish (Figure 5).

Based on the results of the study, it was found that most of fish catches were not yet feasible to catch. In order to maintain the sustainability of pelagic fisheries resources in Makassar Waters, regeneration is
important so that fish caught in lift net is expected to be mature fish (gonad-ripe). The use of environmentally friendly fishing gear gives a low profit in the short term, but in the long term, the fish catch will become bigger furthermore the fishery resource can be sustainable ecology and economically.

In analyzing opportunity loss of lift net, the fish was measured the length and weight. It was estimated the number of at mature fish (MF) and immature gonads (IF) in one kilogram. The estimated is explained in Table 1.

Table 1. Estimation of the Number of Mature Fish and the Immature Fish of Lift Net in Makassar Waters

| Species | Immature Fish Average Length (cm) | Immature Fish Average weight (gram) | Mature Fish Average Length (cm) | Mature Fish Average weight (gram) | Number of Immature Fish/kg | Number of Mature Fish/kg |
|---------|----------------------------------|-----------------------------------|---------------------------------|----------------------------------|---------------------------|-------------------------|
| Mullet  | 15.58                            | 42.23                             | 21.75                           | 152.25                           | 24                        | 7                       |
| Shrimp  | 5.10                             | ccz9.90                           | 6.37                            | 17.06                            | 101                       | 58                      |
| Peperek | 7.76                             | 3.47                              | 10.19                           | 5.39                             | 288                       | 186                     |
| Sardine | 5.67                             | 6.81                              | 14.65                           | 21.98                            | 146                       | 46                      |
| Anchovy | 4.13                             | 5.36                              | 5.62                            | 7.30                             | 187                       | 137                     |

The estimation of opportunity loss of lift net figuring the average of fish production using South Sulawesi fisheries statistic during 2010-2016. The analyzed data in this study are proportion of immature fish is calculated, the simulation of gonad immature fish production to be gonad mature, price, actual value and expectation value and opportunity loss of lift net operation in Makassar Waters. The estimated value of potential loss in the operation of lift net can be seen in Table 2.

Table 2. Estimation of Opportunity Loss at Lift Net Operation in Makassar Water

| Species | Average Production | Fish Price | Immature fish production | Simulation production of IF being MF | Actual Value IF (juta) | Expected Value IF being MF | Opportunity Loss |
|---------|--------------------|------------|---------------------------|--------------------------------------|------------------------|-----------------------------|-------------------|
| Mullet  | 10.39              | 4.12       | 4.16                      | 14.26                                | 17.13                  | 58.75                       | 41.61             |
| Shrimp  | 8.46               | 29.19      | 6.77                      | 11.79                                | 197.58                 | 344.06                      | 146.48            |
| Peperek | 12.78              | 4.72       | 7.80                      | 12.07                                | 36.83                  | 57.03                       | 20.20             |
| Sardine | 10.39              | 4.90       | 9.88                      | 31.34                                | 48.40                  | 153.60                      | 105.21            |
| Anchovy | 32.05              | 11.12      | 30.44                     | 41.56                                | 338.65                 | 462.24                      | 123.59            |

Based on the results, the expected value of lift net in Makassar Water is Rp 1,075,680,000. The value is greater than the actual value with approximately Rp. 638,590,000. Furthermore, it is obtained the average value of the potential loss or loss of the environment in the operation of the fixed chart in 2010-2016 in Makassar waters is Rp. 437,090,000. Sustainable fisheries basically can provide greater volume and profit compared to using destructive fishing.
4. Conclusion
Based on this research, it can be concluded that the actual value of lift net is approximately Rp.
638,590,000 while the expected value is approximately Rp. 1,075,680,000. The opportunity loss value
is obtained from the results of expected value minus actual value, so that the average opportunity loss
or the environment loss of lift net operation during 2010-2016 in Makassar waters is approximately Rp.
437,090,000.

Sustainable fisheries basically can provide greater volume and profit compared to using destructive
fishing. However, it is very difficult to implement an environmentally friendly fishing gear because of
the open access water conditions so that the competition between fishermen catching fish is very tight.
The government needs providing policies furthermore Makassar Waters can be ecologically and
economically sustainable.

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