Lift net units optimization in Krueng Raya waters, Aceh Besar

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Abstract. Operation of lift net is a potential utilization for fisheries in Aceh. Recently, the factors affecting the fishing catch by lift net units are unknown. The information of production factors affecting fishing catch by lift net is required in order to optimize the operation capture. This research aimed to describe lift net units, fishing catch composition, and lift net units optimization in Krueng Raya waters, Aceh Besar. This research had been done from June until July 2017 in Krueng Raya waters, Aceh Besar. The data were collected through questionnaires which were distributed to 30 respondents. The lift net units and fishing catch composition were analyzed by using descriptive method. Lift net units optimization was analyzed by using a multiple linear regression model. The result of descriptive analysis shows that lift net units in Krueng Raya consist of a boat, a lift-nets house which is used as a house for fisherman to take a rest, whereas the floor of the house is used for fishing operations. In one lift net boat, there are fish handler, chef and crew. The fishermen use lamp, roller, scoop, generator, and fish basket as fishing catch equipment. The fishing catch compositions of lift net units in Krueng Raya are Stolephorus \textit{sp} (74.7\%), \textit{Rastrelliger} \textit{sp} (14.4\%), \textit{Decapterus} \textit{sp} (7.6\%) and \textit{Euthynous} \textit{sp} (3.1\%). The multiple linear regression analysis results, \(Y = -498.667 + 5.302\ (X_1) - 23.643\ (X_2) + 19.661\ (X_3) - 20.478\ (X_4) - 0.130\ (X_5)\) indicate that the production factors; the lamp capacity significantly affected fishing catch, whereas the amount of the fuel insignificantly affected fishing catch.

1. Introduction

Lift net is one of the fishing gears that is used widely by fishermen in Krueng Raya waters. The gear can be classified into two types, i.e an original type of fixed bagan and floated bagan. Lift net in Krueng Raya are included floated bagan type, the floated bagan is not fixed in one place but it can be moved according to the preferable fishing ground [1]. The number of lift net in Krueng Raya, Aceh Besar District in 2012 is 48 units and has been increasing in 2013 and 2014 to 67 units [2]. The increasing of lift net are generally caused by the development of the fishing ground, uncomplicated technology and one-day fishing operation. Lift net is a fishing gear that is quite effective for catching fish target (small pelagic fish) such as anchovy, mackerel, squid, sardinela, scad and others [3, 4, 5].
Lift net operation is supported by various fishing equipment and production factors such as fuel, engine generator power and lamplight. The fishing equipment used on the lift net is lamplight, which has changed from a torch to kerosene pressure lantern. Since the price of petrol was highly increased, fishermen would prefer electric lamp rather than kerosene pressure lantern.

The simple fishing operation strategy of lift nets used by fishermen in Krueng Raya. Fisherman in Krueng Raya has not considered the main factor which can affect catches such as net wide, mesh size, light intensity, the number of lamp, the generator strength, operation time and labour. The efficient use of the production factor is needed in order to avoid inefficient production factor usage. A study on the lift net units optimization in Krueng Raya, Aceh Besar was carried out. This research aimed to describe lift net units, fishing catch composition, and lift net units optimization in Krueng Raya waters, Aceh Besar.

2. Location and Methods
This research was conducted from June until July 2017 in Krueng Raya waters, Aceh Besar.

![Figure 1](image_url)

Figure 1. Research location in Krueng Raya waters, Aceh Besar

The data were collected through questionnaires which were distributed to 30 respondents. The description of lift net units and fishing catch composition were analyzed by using descriptive method. The lift net units optimization was analyzed by using a multiple linear regression model

\[ Y = a + X_1 + X_2 + X_3 + \ldots + X_n + e. \]

Where:
- \( Y \) = fishing catch (kg)
- \( X_1 \) = Fuel (L),
- \( X_2 \) = engine generator power (VA),
- \( X_3 \) = Lamp capacity (watt),
- \( X_4 \) = Setting and hauling (set),
- \( X_5 \) = net area (m²)
- \( e \) = error

Statistical test for multiple linear regression model are F-test, t-test and coefficient determination (R²).

3. Results and Discussion
3.1 Results
1. Description of lift net units in Krueng Raya, Aceh Besar
The result of descriptive analysis showed that lift net units in Krueng Raya consist of three subsystem: the boat, fisherman, and fishing gear. In the boat of lift-nets there are a house which used as a house for fisherman to take a rest, whereas the floor of the house is used for fishing operations. In one lift net boat there are fish handler, chef and crew. The fisherman use lamp, roller, scoop, generator, and fish basket as fishing catch equipment. Three subsystem are related to each other as supporting system to the success of fishing operations. Lift net boat in the Krueng Raya waters is a type of motorboat or outboard sized 0 GT made of wood material. Net material of lift net made of PE (Polyethylene) with a mesh size of 0.4 inches, there are operated by 6-8 fishermen.

![Figure 2. Boat lift net in Krueng Raya waters, Aceh Besar](image)

### 2. Fishing catch composition

The fishing catch compositions of lift net units in Krueng Raya, Aceh Besar during the study are anchovy (*Stolephorus* sp.), mackerel (*Rastrelliger* sp.), scad (*Decapterus* sp.) and mackerel tuna (*Euthynnus* sp.).

| No  | Common name     | Latin name     | Amount (kg) | Percentage % |
|-----|-----------------|----------------|-------------|--------------|
| 1   | Anchovy         | *Stolephorus* sp. | 3320        | 74.7%        |
| 2   | Mackerel        | *Rastrelliger* sp. | 644         | 14.4%        |
| 3   | Scad            | *Decapterus* sp. | 336         | 7.6%         |
| 4   | Mackerel tuna   | *Euthynnus* sp. | 140         | 3.1%         |

### 3. Lift net units optimization

The results of analysis of lift net production factors carried out in this study obtained coefficient of determination ($R^2$) from the multiple linear regression function of 63.6% and categorized as having a very strong relationship to the production factor variables tested. The F-statistic test results (testing of the estimator model) with the aim to find out whether the proposed estimator model is feasible to predict parameters and production functions and to test the effect of independent variables ($X_1$, $X_2$, $X_3$, $X_4$, $X_5$) simultaneously on the dependent variable ($Y$).

| Df  | SS     | MS    | F-stat | F tab | P-value |
|-----|--------|-------|--------|-------|---------|
| Regression | 5 | 202610.0 | 40521.99 | 8.396 | 3.35 | 0.000 |
| Residual    | 24 | 115824.7 | 4826.03  |       |       |      |
| Total       | 29 | 318434.7 |  |       |       |      |
The coefficient of determination ($R^2$) from the multiple linear regression function is 0.63 and is categorized as having a very strong relationship with the production factor variables tested. Furthermore, for partial analysis which means individually, the t test is used as the basis for decision making to see the effect of each factor of production variables on the catch. The results of the t test of lift net production factor in the Krueng Raya Waters can be seen in the following table:

| Coefficients | Standar error coef | tStat | P-value |
|--------------|--------------------|-------|---------|
| Intercept    | -498.667           | 198.409 | -2.513  | 0.019   |
| X1           | 5.302              | 2.862  | 1.852   | 0.076   |
| X2           | -23.643            | 17.953 | -1.316  | 0.200   |
| X3           | 19.661             | 7.068  | 2.781   | 0.010   |
| X4           | -20.478            | 24.527 | -0.833  | 0.412   |
| X5           | -0.130             | 0.116  | -1.117  | 0.274   |

Where: $t_{table}$ (0.05) = 2.064

3.2 Discussion

Lift net fishing equipment operated by fishermen in Krueng Raya Waters is mostly made by the fishermen themselves with expertise and skills that are inherited from generation to generation. The majority of lift net fishermen in Krueng Raya waters are purchasing materials to make lift net from outside the area because it's not available in their area. It takes 1 month by fishermen to be able make one lift net, but if the process is carried out by more than 5 people it will be faster to make. Lift net fishermen in Krueng Raya use mercury and neon lamplights to help them catch fish, the number of lamplights used by fishermen are about 50-80 lamplights, the capacity of lights ranges from 35-60 watts.

The generator set as the electricity source on the lift net is also very important. The generator set used by lift net fishermen in Krueng Raya has a capacity of 5000-8500 watts. Roller functions as a roller and stretcher during the process of setting and hauling. Fish are taken using a spoon and put into a fish basket after catching in the lift net. Lift net in Krueng Raya waters are operated by 6-8 fishermen, consisting of 1 handler, where the duty of the handler is to take full responsibility on the lift net and to monitor the movement of fish, the chef consists of 1 person in charge of preparing food, crew ranges from 4-6 people, which are in charge of helping the handler operate the lift net.

**Figure 3.** (a) Lamp as fishing catch equipment used to attract fish; (b) Generator as energy for lamp

Based on Table 1, it shows that the main catch is anchovy (*Stelophorus* sp.) with total catch 3320 kg (74.7%). While the by-catch caught by fishermen are mackerel (*Rastrelliger* sp.) with total catch
644 kg (14.4%), cad (Decapterus sp.) 336 kg (7.6%) and mackerel tuna (Euthynnus sp.) 140 kg (3.1%). Anchovy (Stelophorus sp.) is fish target of lift net, so the chances of getting anchovy are greater than the other species. According to Thenu et al [6] anchovy moves to the surface of the water at night, so that the lift net operated at night is very potential to catch anchovy. Anchovy is one of the positive phototactic organisms which moves closer to light. Fishes that move close to the lights below the lift net come from various directions around the lift net, then the fish will swim around the lights. Light fishing at present acts as a good means and efficient way of obtaining adequate catches of bait fish and cephalopods such as sardines, herring, anchovies, mackerel, squids, etc [7, 8, 9].

The multiple linear regression analysis results is

\[ Y = -498.667 + 5.302 (X_1) - 23.643 (X_2) + 19.661 (X_3) - 20.478 (X_4) - 0.130 (X_5) \]

From the multiple linear regression function equation, it can be seen that fuel (X_1) and lamp power (X_3) have a positive regression coefficient, the other variables (X_2, X_4, X_5) are negative regression coefficient. This means that each addition of one unit of a variable that is positive will increase production by the variable's constant. Based on table 2, analysis of variance (ANOVA) showed that F-test value is 8.39655 with a probability value of 0.000, indicate that simultaneously the variable production factor had a significant effect on the catch.

Interconnection of all of these input factors during the operation of fishing gear will facilitate the fishing process so that it is indirectly able to increase the catches [10]. The relationship between these variables can be seen from determination coefficient (R^2) is 0.636 or 63.6%, it can be categorized as having a very strong relationship because if the value of R^2 approaches one (1 = perfect correlation) then it will also relate dependent and independent factors. Based on t-test statistics indicating that the production factors; the lamp capacity (X_3) is significantly affects fishing catch. This is in accordance the statement Oktafiandi et al [11] that the catch with 12 watt lights will produce more catches compared to the use of 5 and 9 watt lights. So the usage of bigger watt of the lamp, the more fish gather under the lamp and vice versa. Fishing with light is one of the most widespread fishing techniques, producing high catch rates, and contributing a significant amount of product to the total global catch of marine fish [12,13,14]

4. Conclusion

The research result showed that lift net units in Krueng Raya consist of: the boat, fisherman, and fishing gear. In the boat of lift-nets there are a house for fisherman to take a rest, whereas the floor of the house is used for fishing operations. In one lift net boat there are fish handler, chef and crew. The fisherman use lamp, roller, scoop, generator, and fish basket as fishing catch equipment. The fishing catch compositions of lift net units in Krueng Raya are Stolephorus sp (74.7%), Rastrelliger sp (14.4%), Decapterus sp (7.6%) and Euthynnus sp (3.1%). The multiple linear regression analysis results, Y = -498.667 + 5.302 (X_1) - 23.643 (X_2) + 19.661 (X_3) - 20.478 (X_4) - 0.130 (X_5) indicate that the production factor; the lamp power(X_3) significantly affected fishing catch.

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