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# Morphometric Analysis and Gill Net Catch Results of Flying Fish in Lawallu Village, Soppeng Riaja District, Barru Regency, South Sulawesi, Indonesia

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***Abstract***— *This research aims to analyze fish morphometrics and analyze the results of gill net catches of flying fish such as the size suitable for catching flying fish. This research was carried out from December 2022 to April 2023 in Lawallu Village, Soppeng Riaja District, Barru Regency. The research method used is a case study, the unit of which is a fishing activity using one unit of flying fish gill net at the research location. Data collection was carried out by going directly to the field following the fishing operation, determining how the fish was caught and directly measuring the fork length, height, width, and body circumference of the flying fish. The parameters observed are the dimensions of the fishing gear which determines the performance of the flying fish gill net, and the size of the catch. Data was analyzed descriptively and quantitatively. The research results showed that flying fish were caught using gill nets with a mesh size of 3.81 cm. The total catch was 450 fish from the range of 13.0-23.2 cm, the highest size was in the range of 16.3-17.3 cm with 86 fish, while the lowest size was in the range of 22.2-23.2 cm. 17 heads. The percentage of flying fish that were worth catching was 76%, the total catch was 340 fish, in the size range of 15.2-23.2 cm & the percentage of flying fish that were not worth catching was 24%, the total catch was 110 fish, in the size range 13.0-15.1 cm.*

***Keywords***— ***Morphometrics, fish worth catching, gill nets, flying fish, Hirundichthys oxycephalus***

## I. INTRODUCTION

Barru Regency is a fairly long coastal area. The coastline reaches 87 km so it is the district with the longest coastline in South Sulawesi (DKP Barru Regency, 2022). The fertile area means that Barru Regency has abundant potential and natural wealth, including the industrial, agricultural, plantation, and tourism sectors. One of the most prominent sectors is the maritime and fisheries sector. The coastline which stretches in the western region facing the Makassar Strait means that Barru Regency has enormous marine and fisheries potential and can be utilized optimally. This is supported by the marine fishing area, which is around 56,160 Ha, and the existence of various types of fishing equipment that have great potential. Fishing units in Barru Regency in 2011 were 2,174 fishing gear units and in 2012 the number of fishing gear units was 2,183 fishing gear units and 2,171 fishing gear units in 2013 (DKP Kab. Barru, 2015).

One of the fishing tools used by fishermen in Barru Regency is drift gill nets. Drift gill nets are gill nets that are operated by letting them drift in the water. This tool is operated in coastal waters or offshore waters intended for catching small pelagic fish or large pelagic fish. Nets operated in coastal waters are generally on a small scale where setting up/setting down and the number of settings in one trip will differ according to the fisherman who operates them

(Martasuganda, 2008). In general, gill nets are a type of fishing gear made from net material that has a rectangular shape where the meshes of the main net are the same size. The number of meshes in the horizontal direction (Mesh Length/ML) is much greater than the number of meshes in the vertical or inward direction (Mesh Depth/MD) (Manalu, et al. 2014).

One of the main targets for catching drift gill nets in Barru Regency is small pelagic fish, including flying fish that have elongated cigar-like bodies and the ability to float using long pectoral fins. The flying fish species, namely *Hirundichthys oxycephalus*, is known as the stained flying fish, which has a distinctive characteristic, namely its relatively long and large pectoral fin, resembling wings that can be used to fly above the water surface for a while. The ability of flying fish can hover in the air for 10 minutes and can reach a distance of 100 m (Najamuddin et 2 al., 2011; Ali, 2012).

The success of fishing operations cannot be separated from several influencing aspects. Several influential parameters include technical aspects and the composition of the catch which have a major influence on the success of fishing operations (Fauziyah & Afridanelly, 2011). The results of previous research related to gill nets were carried out by (Palo et al., 2019) regarding the Selectivity of Drifting Gillnet to *Hirundichthys oxycephalus* (bony flying fish) in the Southern part of Makassar Strait with the mesh size used by fishermen being 1.25 inch, design of flying fish gill nets in the waters of Takalar Regency, South Sulawesi which also uses a mesh size of 1.25 inches (Najamuddin et al., 2011) and analysis of gill net catches in fishing for flying fish (Exocoetidae) in the waters of the West Coast of Majene The Makassar Strait uses a mesh size of 1 inch (Palo et al., 2016), but for flying fish gill nets with a mesh size of 1.5 inches there is still very little research and until now there is no information about the technical aspects and catch results. Flying fish gill nets in Barru Regency waters.

The results of observations made in the field show that gill nets have been operated in the waters of Barru Regency for a long time and are often found, one of which is the flying fish gill net in Lawallu Village, there are two to three sets of gill nets that are operated and the catch is quite large, so there is the potential for overfishing in For this area, it is interesting to carry out research regarding flying fish catching in Barru Regency waters, such as technical aspects and catches from flying fish gill nets so that we can know the results of the catch, whether the fish are worth catching or not.

## II. MATERIAL AND METHODS

### 2.1 Research Location

This research was carried out from December 2022 to April 2023 at Lawallu Village, Soppeng Riaja District, Barru Regency, South Sulawesi, Indonesia.

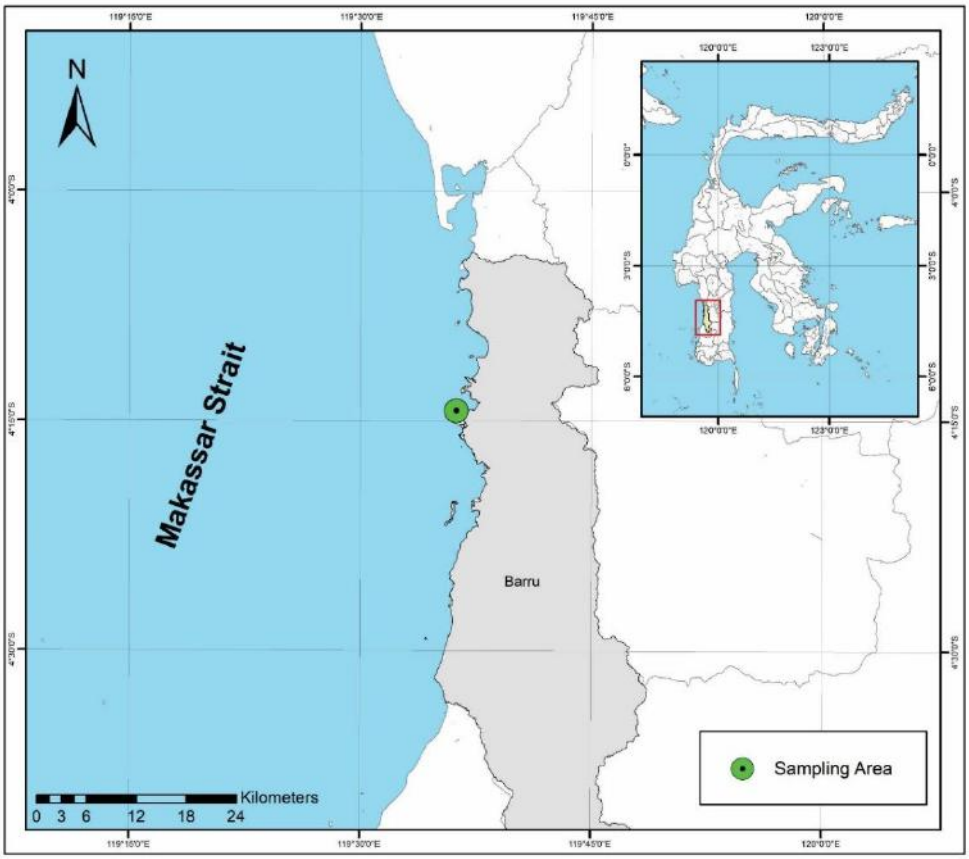


*Fig.1. Sampling in Lawallu Village, Soppeng Riaja District, Barru Regency*

### 2.2 Sample Collection

Data collection was carried out using the observation method. The observation method is a data collection method that is carried out directly in the field through systematic questions regarding any changes that occur in the object being studied. The data required in this research includes primary data and secondary data. Primary data is data obtained from direct measurements in the field. Secondary data is data obtained by conducting direct interviews with fishermen.

### 2.3 Data Analysis

**Analysis of Flying Fish Sizes Worth Catching**

The analysis of catch size is carried out by measuring the body length of the fish, using a ruler with an accuracy of 0.1 cm. The catch measured consists primarily of flying fish, and the measurement taken is the fork length. The fish length is measured from the tip of the snout to the outer edge of the fork in the caudal fin.

The body length of the predominantly caught flying fish is measured and categorized based on size classes by creating a fish length size table using Microsoft Excel. This measurement is carried out to determine the suitable catch size for flying fish caught with gill nets. According to Kholis (2018), the method to calculate the percentage of catchable fish is:

$$Percentage\ (\%) = \frac{Number\ of\ fish\ worth\ catching}{Number\ of\ samples}\ x\ 100\%$$

Determining the number of fish samples taken is based on size groups, where the size groups are adjusted to the results of the catch at the time of sampling, to determine the size suitable for catching or not suitable for catching flying fish caught in gill nets which are predominantly caught, by using references from journals, books or fish base which refers to the reference length of the fish when the gonads first mature or Length at First Maturity (Lm). It is said to be worth catching if the length of the fish caught in the gill net is greater than Lm.

**Mesh Aperture Measurement**

Measuring net mesh openings is an important aspect in determining the efficiency and effectiveness of fishing gear. Measurement of mesh openings based on parameters:

a. Mesh height at hanging ratio 62%
b. Width of mesh openings on shortening 38%

c. Bar

d. Mesh size

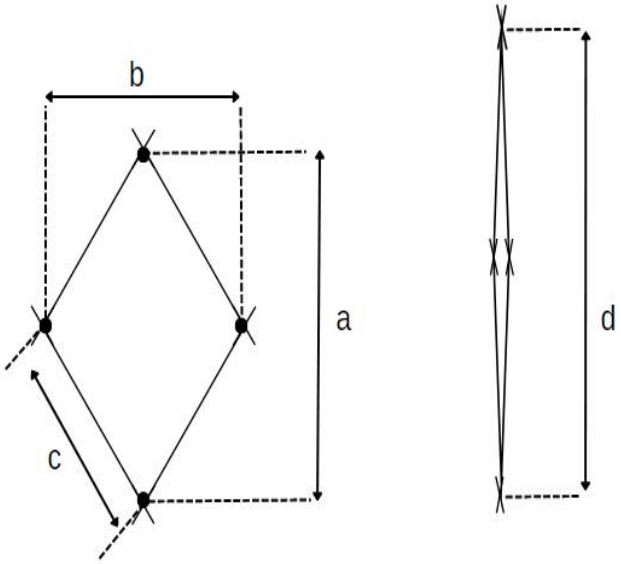


*Fig.2. Design and dimensions of mesh size*

**How to Catch Fish in a Net**

Analyzing data on the position of fish entangled in the net was carried out using fish size data (length, width and body circumference of the fish) which was linked to the position of the entangled fish.

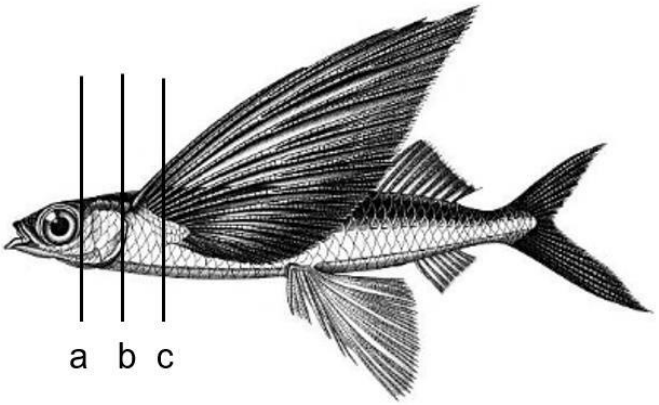


*Fig.3. Proportion of entanglement area index in flying fish*

Information :

a. Position of Fish entangled snagged (ij 0 – 33%)
b. Position of gilled entangled fish (ij 34 – 67%)
c. The position of the fish is wedged (ij 68 – 100%)

## III. RESULT AND DISCUSSION

### 3.1 Gill Net Catch Results of Flying Fish

The catch of fishermen using flying fish gill nets operating in Lawallu Village, resulted in the flying fish species Hirundichthys oxycephalus. The local name for tuing-tuing fish. Flying fish obtained at the research location can be seen in Figure 3.

*Fig.4. Flying fish (Hirundichthys oxycephalus)*

Classification of flying fish (*Exocoetidae*) according to Parin (1999):

Kingdom: Animalia
Phylum: *Chordata*
Class: *Actinopterygii*
Order: *Beloniformes*
Family: *Exocoetidae*
Genus: *Hyrundicthys*
Species: *Hirundichthys oxycephalus*

The flying fish obtained based on the research carried out has an elongated round shape like a cigar, the skin color is dark bluish black on top with a silvery belly, the pectoral fins are very long and extend past the base of the anal fin, the base of the anal fin is parallel to the base of the dorsal fin and the tail fin is forked. where the lower branches are longer than the upper branches in a V shape. The eyes of flying fish are relatively large compared to other fish species.

### 3.2 3.2 Morphometrics of flying fish on the shape of the gill net mesh size

Flying fish morphometrics are ideal for gill net fishing, the proportion of the area index of the long entanglement so that measurements can be made of the morphometrics of fish caught in flying fish gill nets. These measurements include body height, body width and body circumference behind the eyes, operculum, and maximum height of the fish. Measurements were carried out to determine the relationship with the size of the mesh used in flying fish gill nets.


*Fig.5. Area of entangled fish: (a) snagged, (b) gilled, (c) wedged*

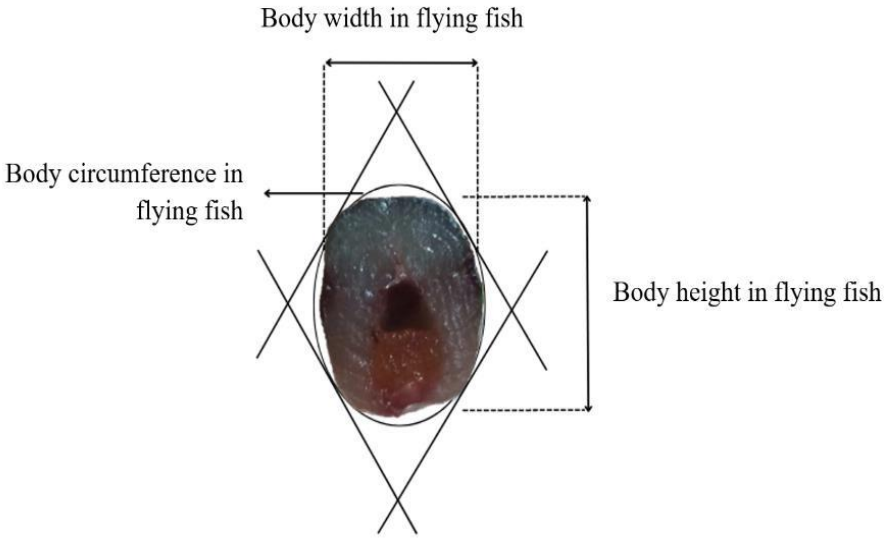


*Fig.6. Measured body area of flying fish*

The results of measurements of flying fish in the entangled area are:

a. Snagged : fish entangled in the area behind the eyes, body height 2.3 cm, body width 2, and body circumference 6.5 cm.
b. Gilled : fish entangled in the area behind the gill covers, with a body height of 2.7 cm, body width of 2.5 cm, and body circumference of 7.5 cm.
c. Wedged : fish is entangled in the area of maximum fish height, body height of 3 cm, body width of 2.5 cm, and body circumference of 8 cm.

Based on measurements of height, width, and body circumference in areas entangled in flying fish, it can be seen that there is a relationship between the mesh size of 3.81 cm in the flying fish gill net and the size of the flying fish that is the target catch so that the mesh size used is appropriate. The working principle of gill nets is to block the direction of fish swimming. With this obstacle, it is hoped that the fish will break through the net and become entangled (gilled) behind the gill covers or entangled (entangled) in the body of the net. Fishing in drift gill nets is the same as the principle of catching in gill nets in general. Generally, fish that are caught are entangled in the area around the operculum (gilled).

In Figure 6 we can see that the fish caught in gill nets with a mesh size of 3.81 cm have sizes in the area behind the eyes, operculum, and maximum height area that are much different from other fish. In part b (Figure 5) which is the operculum area, many flying fish are caught in this area because generally, fish that are entangled in the operculum area will find it difficult to escape, while in part c (Figure 5) which is the maximum height area, there are also many Flying fish are caught in this area because the entangled fish will be stuck at the maximum height. Based on these

measurements, it can be seen that there is a relationship between mesh size and the size of flying fish caught in the gill net used because if the maximum height of the fish is smaller than the mesh size, the fish will escape.

Ikan terbang secara umum memiliki bentuk tubuh yang memanjang seperti cerutu, agak gepeng, garis rusuknya terletak di bagian bawah badan, kedua rahangnya hampir sama panjang kecuali pada ikan terbang yang masih muda dimana bentuk rahang bawah yang sedikit lebih panjang atau rahang bawah lebih menonjol terutama pada individu muda Oxymopharus dari family Oxyphoramphydae, dan atau rahang atas lebih menonjol daripada rahang bawahnya terutama pada jenis Cypselurus. Sirip pektoral panjang diadaptasikan untuk melayang dan terdiri dari duri lunak, dengan variasi ukuran dan jumlah ruas sirip bercabang pada masing-masing spesies. Sirip ekor bercagak dengan cagak bawah yang lebih panjang serta memiliki gigi-gigi kecil yang tumbuh pada kedua rahangnya. Sisiknya sikloid berukuran relatif besar dan mudah lepas. Pada beberapa spesies Hyrundichthys, sisiknya juga tumbuh pada bagian palatin, pada Fodiator dan Parexocoetus juga tumbuh pada vormer dan lidah. Ukuran-ukuran panjang kepala, tinggi, dan lebar juga tergantung pada umur (Hutomo et al., 1985).

This flying fish has an elongated round shape like a cigar, the pectoral fins are very long, usually reaching the back of the dorsal fin, the dorsal fin is slightly longer than the anal fin, it is dark or gloomy, and there are black spots. The caudal fin is branched where the lower branch is longer than the upper branch, and the long pelvic fin reaches the middle of the anal fin and sometimes even far back. Fin radius; D. 10-11; A.11; PI 14-15, on the lateral line there are 50-56 scales, between the dorsal fin and the lateral line there are 32-35 scales. On the back, it is bluish, while on the stomach it is silvery (Ali, 2012).

### 3.3 Appropriate Sizes to Catch Flying Fish

Based on the results of the measurements carried out, it can be seen that the fork length of the flying fish caught can be seen in Figure 6 showing that the total catch was 450 fish in the range of 13.0-23.2 cm, the highest size was in the range of 16.3-17. 3 cm as many as 86 individuals, while the lowest size was in the size range of 22.2-23.2 cm as many as 17 individuals. The percentage of fish suitable for catching and not suitable for catching can be seen in Figure 21 which shows that the percentage of flying fish that are suitable for catching is 76%. The total catch is 340 fish, in the size range of 15.2-23.2 cm & the percentage of flying fish that are not. catchable was 24%, and the total catch was 110 fish, in the size range of 13.0-15.1 cm.

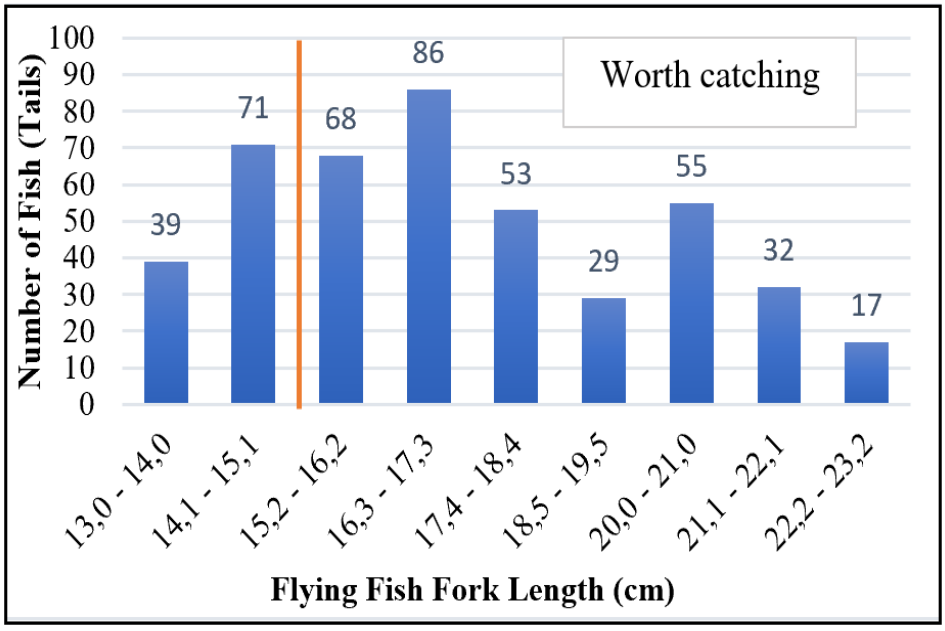


*Fig.6. Fork length interval for flying fish*

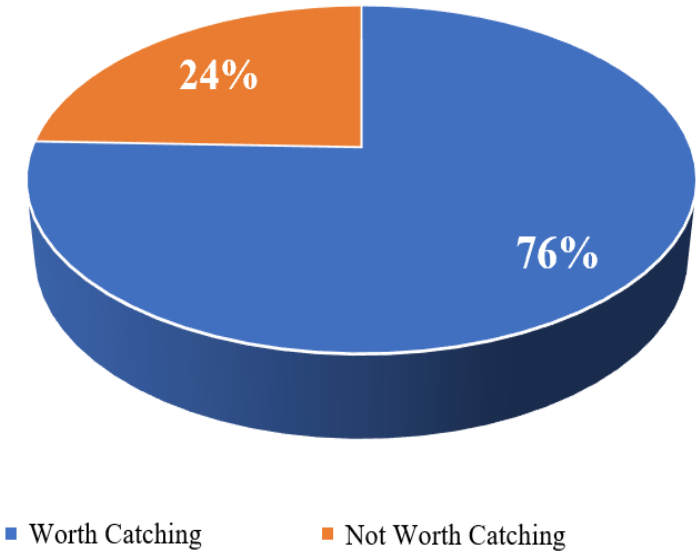


*Fig.7. Percentage of catchable size of flying fish*

The length of a fish can be used to determine whether or not the fish is worth catching by knowing the length at first maturity of the fish. Adult fish suitable for catching in fishing activities are fish that have entered the reproductive phase. Based on data from research on fish size, data on measuring the fork length of 450 fish was obtained.

The results of measuring the fork length of caught fish were identified based on Ali's (2005) research journal in the Makassar Strait with a catchable size or length at first maturity (Lm), namely 15.1 cm. This shows that flying fish that are worth catching have a size that exceeds L50%. Based on the results of observations made, the average fork length of flying fish caught in gill nets was measured at 17.3 cm, which ranged from 13.0-23.3 cm. The percentage of fish that are worth catching is 76% with a frequency of 340 fish, in the size range of 15.2-23.2 cm and fish that are not worth catching is 24% with a frequency of 110 fish, in the size range of 13.0-15.1 cm.

The relationship between the average size caught and the first time the gonads mature is a reference for determining whether the fish caught have matured gonads or not. Based on the analysis, the results obtained were that the dominant flying fish were caught after the gonads matured (Lc > Lm). This means that the fish are still worth catching and have the opportunity to spawn before being caught increasing the population in the waters. This was also stated by Laevastu & Hayes (1981) that a catch is declared worth catching if it provides an opportunity for fish to reproduce before being caught. Identification results can also be seen from the percentage and frequency that are considered suitable for catching. This is in accordance with Laevastu & Hayes (1981), that the size of the fish caught will have a maximum value or reach the optimum fish size. Similar results in research by Palo et al., (2019), the length of flying fish (*Hirundichthys oxycephalus*) caught with gill nets in the southern part of the Makassar Strait has an average size of 18.4-18.9 so it is a fish that is worth catching and Palo et al., (2016) flying fish caught in the waters of the west coast of Majene have an average length of flying fish in the class range of 15-25 cm so that they are also included in the fish that are worth catching with the highest frequency in the length class of 18-19 cm.

## IV. CONCLUSION

From the results of the research that has been carried out, it can be concluded that flying fish were caught using gill nets with a mesh size of 3.81 cm. The total catch was 450 fish from the range of 13.0-23.2 cm, the highest size was in the range of 16.3-17.3 cm with 86 fish, while the lowest size was in the range of 22.2-23.2 cm. 17 heads. The percentage of flying fish that were worth catching was 76%, the total catch was 340 fish, in the size range of 15.2-23.2 cm & the percentage of flying fish that were not worth catching was 24%, the total catch was 110 fish, in the size range 13.0-15.1cm.

## ACKNOWLEDGEMENTS

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