



Study of Squid Fishing Operation (Squid Jigging) and the Role of Parachute Anchors in Argentina Water and the Falkland Islands-UK in FV. Agnes 107

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Abstract

Falkland Island is an England area whose largest income comes from fisheries: the export of squid. Squid brings important economic value and occupies the third number in fisheries after fish and shrimp. The squid fishing line's operation consists of automatic fishing machines, roll, yudei, fishing line, swivel, and ballast. The fishing line for squid has operated automatically. The influence of waves and currents influence the fishing line to not operate properly. Meanwhile, a parachute anchor is a tool that maintains the balance of the ship and fishing line. The operation system of the parachute anchor is to restrain the movement of currents underwater. The mainline and float line connected to a hydraulic machine at the bow of the ship. The main rope sizes are 50 m, 60 m, 70 m, 80 m, and 90 m. In calm water or wind speeds of less than 10 km per hour, the size of the mainline used is 50 m, and if the wave is big or the wind speed is more than 35 km per hour, the size used is 90 m. The application of the right size keeps the boat and fishing line in balance. The number of catches during one trip is 119,970 kg, with the lowest catch occurred in January, amounting to 1,710 kg, and the largest catch occurred in March, amounting to 82,530 kg. Types of the catch divided into 2: squid with 20 kg and 10 kg. For 20 kg size, mostly obtained in March with a total catch of 2M = 33,040 kg and for the size of 10 kg with a total catch of a size of Y is 23,510 kg.

Keywords: fisheries management; sustainability of fisheries; capture fisheries resources.

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1. Introduction

The Falkland Islands is a Great Britain national territory in the South Atlantic Ocean which consists of two main islands, West Falkland and East Falkland, and 700 other small islands which are located at the coordinates 51040'00 "to 52030'00" southern latitude and 59030 ' 00 "to 63019'25" east longitude. The Falkland Islands has located 483 km from the mainland of South America. The land area is 12,173 km² with a coastline of 1,288 km. Thus, Falkland's biggest income from an economic perspective comes from the fisheries sector and squid exports. The potential for squid in this area is huge [1]. In the fishing process, a vessel requires an ideal balance to perfect the fishing process. The main factor in the success of the squid fishing activity is the anchor. On fishing boats, the anchor utilization is different from the anchor utilization in general. The anchor utilized is a parachute anchor. The parachute anchor has the same role as the parachute we understand. Generally, a parachute is always in contact with the wind. Otherwise, on fishing boats, parachute squid is connected to the currents of seawater. Moreover, seawater flow is the movement of water masses vertically and horizontally towards its balance. In other words, it is a very broad movement of water that occurs throughout the world's oceans. The current can also be define the flowing motion of a mass of water due to wind gusts or differences in density or long wave motion. The displacement of the current influenced by factors, including the direction of the wind, differences in water pressure, differences in water density, Coriolis force, Ekman currents, and seafloor topography [2]. The parachute anchor is not a current invention in the field of squid fishing. Each fishing vessel for squid requires a parachute anchor to control the boat's balance while it is operating. With parachute anchor, the lay of the fishing line used on upright squid fishing boats: in that, the boat moves to withstand the current speed, and the sails withstand the wind from above. Thus, this research aimed to 1) analyze the role of parachute anchors in squid fishing operations, 2) analyze the depth of the main parachute anchor line in keeping with the weather conditions in Argentina water and the Falkland Islands, and 3) analyze the composition of the catch during the fishing operation.

2. Material and Method

2.1. Study Area

Place and Period of the Study Implementation. The research conducted from 11th November 2015 to 6th May 2016. The research was carried out on FV. Agnes 107 using automated jigging machines owned by Agnes Fisheries Co., LTD. Squid fishing operation accomplished in the Argentina waters and the Falkland Islands - England.

2.2. Types of equipment and Materials

Some equipment and materials used in the research are the squid jigging vessel FV. Agnes 107, automatic squid jigging machines, camera, roll meter, ruler, stationery, navigation tools (global positioning system, radar, fish finder, etc.), map of fishing grounds, and weather report from marine weather facsimile.

2.3. Methods of Collecting Data

Data were collected by direct observation at FV. Agnes 107. Observations conducted the data to determine the

catching squid stages using automated jigging machines (automatic fishing machines). The data collected to analyze the control of the parachute anchor mainline include: 1) wind speed and wave height in Argentina Water and Falkland waters, 2) depth of the mainline of the parachute anchor, 3) state of the parachute at sea, and 4) catches during fishing operation. Moreover, data collected by direct observation on the ship. The results of the observations recorded in a practical journal book. Also, documented an image of the object of observation.

3. Result and Discussion

3.1. Result

The parachute anchor is a tool to bear an important role in the squid fishing rod's operation. Without the anchor, the squid fishing rod cannot operated. All through the way to the fishing ground, all the crews worked on making parachute anchors. After all, the tools have installed in place, the parachute anchor then being operable. The technique of operating the parachute anchor can explained as follow:

- (1) The initial step of the wind direction from the bow of the ship should be considered. The ship should be positioned against the wind.
- (2) Before dropping the buoy ball, the skipper instructs the size of the rope to be used. The size is adjusted to the condition of the water at the moment.
- (3) The float ball is dropped following the drop in the parachute and ballast. After that, the ship moves slowly backward.
- (4) The parachute stretch from the top of the ship should be considered. If the stretch is not ideal, the float is stretched so that the parachute sinks.

When the ship position needs to be moved, the parachute anchor should immediately be raised under the sea (Figure 1 and Figure 2). The following are the stages of the pull of the parachute anchor in the sea:

- (1) The sail is lowered firstly;
- (2) The underwater lamp is lifted to the ship;
- (3) All squid lights are turned off;
- (4) The fishing line is slightly lifted so as not to get entangled with other fishing rods.
- (5) The crews rushed to the bow of the vessel to anchor the parachute. Several parts of the parachute anchor pulling process should be done.
- (6) The trip line is removed from the float line. Then, the float is attached to the block tack.
- (7) Manila rope, floating rope, and parachute are constructed into one line. The manila rope is set parallel to the side, in a circular set in a horizontal direction, and then the parachute is stacked into 4th levels until a ballast.



Figure 1: preparation of parachutes and buoy line



Figure 2: preparation of the main ropes of a parachute anchor

3.2. Discussion

3.2.1. Role of Parachute Anchor

In fishing vessels, parachute anchor carries an important role, controlling the balance of the boat and fishing for the squid. When the parachute anchor is in operation, the vessel sails with the current. Certain internal factors and external factors influence the speed of ships operated by currents between 0.04 - 0.08 knots; they are:

- (1) The strength of currents under the sea and winds above sea level;
- (2) The size of the wave;
- (3) The depth of the manila rope; and
- (4) The stretch of the parachute in the water.

Adjustment of the main anchor line's size can be analyzed by seeing the condition of the waters at the fishing ground. Day by day, the Agnes 107 vessel receives a weather report from Korea's high net marine technology as

a source of information related to weather conditions. The changes in the weather are updated every 3 hours. The update contains some information, including temperature in the water, dew point, temperature above sea level, wind direction, wind speed, precipitation, and waves. The skipper can determine the depth of the main rope for the parachute anchor to be applied based on the information acquired. In operating the parachute anchor, all the devices used should be properly installed. The perfect installation will positively impact the fishing process so that fishing operations can be operated efficiently. Otherwise, a slight fault in the parachute anchor's operation will have a negative impact on the fishing operation. The fishing operation will be hampered if the crews busily repair the broken anchor part of the parachute. The number of fishing line supervisors will also be decreased due to the damage to the parachute anchor. The damage can be seen when the parachute anchor is pulled. As well as, there are some damages to the parachute anchor, they are:

- (1) In the branch rope that breaks when lowering the anchor, there is a part that is being twisted with another branch rope. A fast anchor pulling can cause the branch rope to become tangled and break
- (2) The branch ropes become tangled and entangled in the parachute fabric. In case, during the towing process, the hydraulic machines are not aligned.
- (3) The float rope that is damaged due to the rotating engine pulled the float rope so the boat sail against the buoy's position.
- (4) The parachute gets entangled in the fishing line because the parachute anchor gets affected from under the sea, which causes the parachute to approach the boat.
- (5) The sail fabric is wrinkled or torn due to fish hitting the stretch of the parachute.

Moreover, on the parachute anchor's main rope, a marked size mark for the operation of the parachute anchor exists. The size is 50 m, 60 m, 70 m, 80 m, and 90 m. Using the main rope for the parachute anchor should be adjusted to the condition of the waters in the fishing area. Below is a chart of the size of the parachute anchor main rope's use during the 1st operating trip. In the Figure 3, it can be seen that the use of the main anchor rope for 1st trip varies. In January, 70-meter size is usually utilized, although there is the use of 90-meter size once. Meanwhile, in April, the main rope for parachute anchor size 90 is used 3rd times. From the facts, it can be seen that a lot of big waves occurred in April. It can be concluded that the main rope adjustment for the parachute anchor is mostly used at a size of 70 meters 40 times in 1 trip. On the contrary, a size that is rarely being utilized is 90 meters 4 times in 1 trip.

3.2.2. Squid Fishing Rod Operation Technique

A squid fishing rod is a catching tool included in the type of light fishing, in which the operator uses the lamp to tow the squid in the waters around the vessel. There are some types of lights used, such as surface lights and underwater lights. Each squid fishing rod has a different shape and construction from other types of fishing rods, in which in a series of fishing rods, there are 17-25 fishing rods (jigs) with different colors and different forms. This difference is intended to make the fishing rod looks more attractive to the squid in the waters. This fishing gear is classified as environmentally friendly fishing gear, so it can support sustainable fisheries management. Sustainable fisheries management is a condition of balance between economic development and sustainability of fishery resources [3,4].

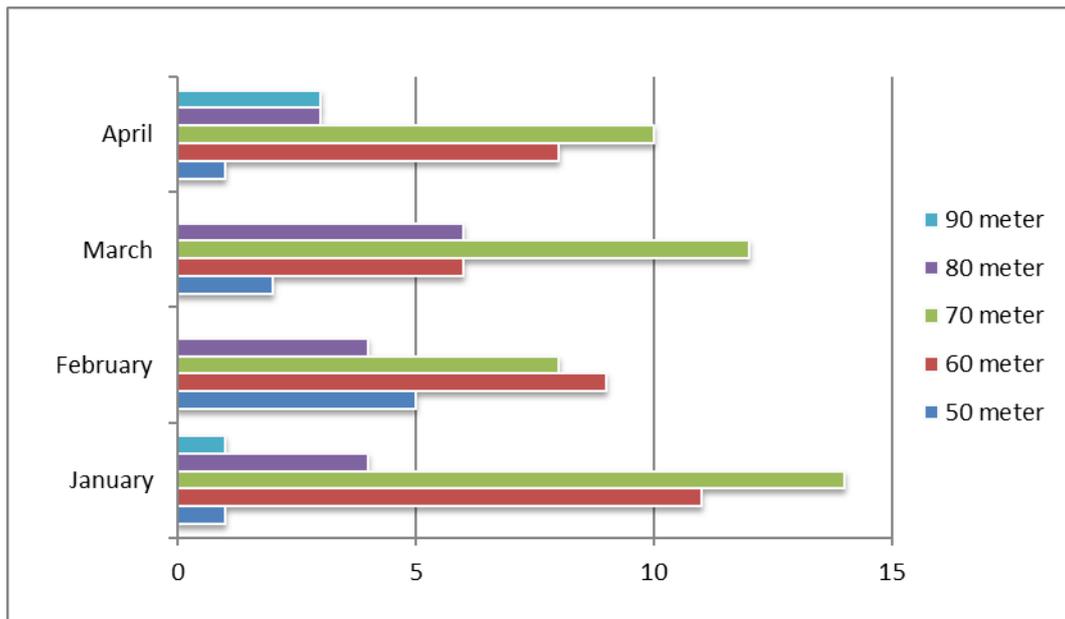


Figure 3: the size adjustment of the main rope for the parachute anchor during the 1st trip

In catching squid, the squid fishing rod is usually stretched from the fishing line through the wheels (rollers) located on the yudei. There is a sinker at the end of the fishing line where the weight is lowered first, followed by the rods until the last fishing line extends to the specified depth. Then the fishing line is rolled back into the reel drum. After the fishing rod reaches a certain depth, the fishing line will move automatically upward past the squid hordes in the waters around the ship. In case the squid is phototaxis positive, the squid will approach the fishing rod because the fishing line has bright color in the water. Thus, the squid that is close to the fishing line will get caught and lifted upwards and continue to be pulled over the block (roller) on the outer edge of the yudei, which then usually falls directly onto the yudei and then continues to slide into the ditch before being pushed into the storage room for squid ready to be sorted. The squid fishing rod's movement when rolling with the reel is not flat but intermittently in the form of a small stab. The stab can be occurred because of the shape of the drum. Moreover, there are some stages in the operation of the squid fishing rod, as explained in the Figure 4.

3.2.3. Composition of Catch

The squid caught during a fishing trip varies in size. At the beginning of the fishing season (in January), the squid caught are sized S with a length of between 9-11 cm and a weight of 120-170 grams for each. In the following month, the caught squid's size continues to increase in weight until the end of the fishing season, April. Also, the size of the squid caught at the end of the fishing season is the largest, M size with a length of 18-20 cm and with a weight of 360-480 grams. However, in 2016 the number of the catch is decreased. The amount of squid obtained is fewer. For more details, see table 1, which shows the percentage of catch in one trip. In a study conducted in the Java Sea, it was found that the catch of squid from September to December was dominated by squid with a length of > 25 cm and a weight of > 300 gr, but in other months the catch was dominated by smaller sizes [5]. When we compare it with other fishery resources, it is obtained that the abundance of the catch of demersal fish resources in the South China Sea is influenced by dissolved oxygen conditions and brightness [6,7].

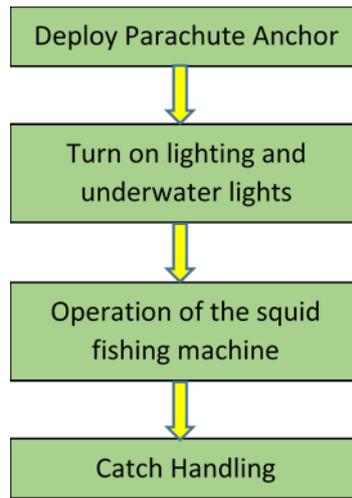


Figure 4: stages of operation of the squid fishing rod

On Table 1, it is shown that the catch in 2016 was significantly reduced. Efforts to maximize capture were made during the operation. Starting from the use of two lamps simultaneously of different sizes which aim to collect squid, taking reference to the fishing grounds of 2015, 2014, 2013 where a lot of squids was obtained at that time, and going early to the island of Falkland to operate faster than other ships has also been implemented. In 2016, the total catch of squid was 119,970 kg. The results of this year were said little compared to the previous year. The fishing activity lasted for 4th months because the catch was obtained only in a small amount. In January, the catch was only 1,710 kg. It can be assumed that in January, the catch was few. Most of the catch occurred in March, with a total catch of 82,530 kg. Figure 5 concludes that in one fishing trip, the squid sizes that are usually caught are S, 2M, and Y sizes, while the least caught sizes are M and Z.

Table 1: Composition of the catch for one trip

Month	Composition of the catch for one trip (kg)					TOTAL	%
	S	2M	M	Y	Z		
January	200	660	680	190	0	1,710	1
February	4,500	2,280	6,400	8,430	760	23,450	20
March	19,200	33,040	3,900	23,510	5,430	82,530	69
April	0	521	93	0	0	12,280	10
TOTAL	23,900	36,501	11,073	32,130	6,190	119,970	100

Based on the Table 2, the monthly catch varies. In January and April, no squid was obtained with 180 grams - 190 grams or squid size Z. The sizes that were usually obtained during fishing operations were squid in 2M weighing 230 - 350 grams and size M weighing 350 - 490 grams. The fishing rod used is suitable for the large number of catches obtained. Generally, 23 fishing rods were used with a string size of 80 mm.

Table 2: Presents of Catch of Squid for one trip

Size	Catch of Squid for one trip (kg)							
	January		February		March		April	
	Kg	%	kg	%	kg	%	kg	%
S	200	10,4	4,500	19,2	19,200	23,1	0	0
2M	600	34,4	2,280	9,8	33,040	40	10,420	84.85
M	680	35,4	6,400	27,3	3,900	5	1,860	15.15
Y	190	19,8	8,430	36	23,510	28,4	0	0
Z	0	0	760	3,2	5,430	6,5	0	0
TOTAL	1,710	1,4	23,450	19,5	82,530	68,8	12,280	100

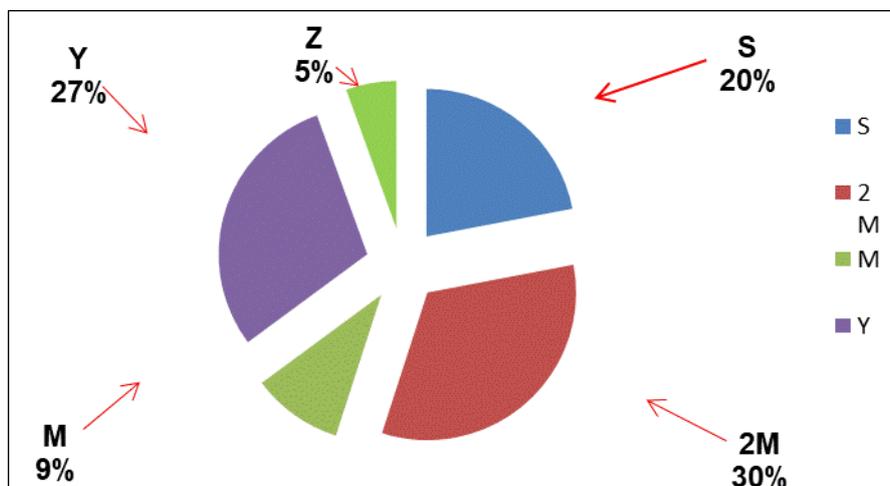


Figure 5: squid catch by size

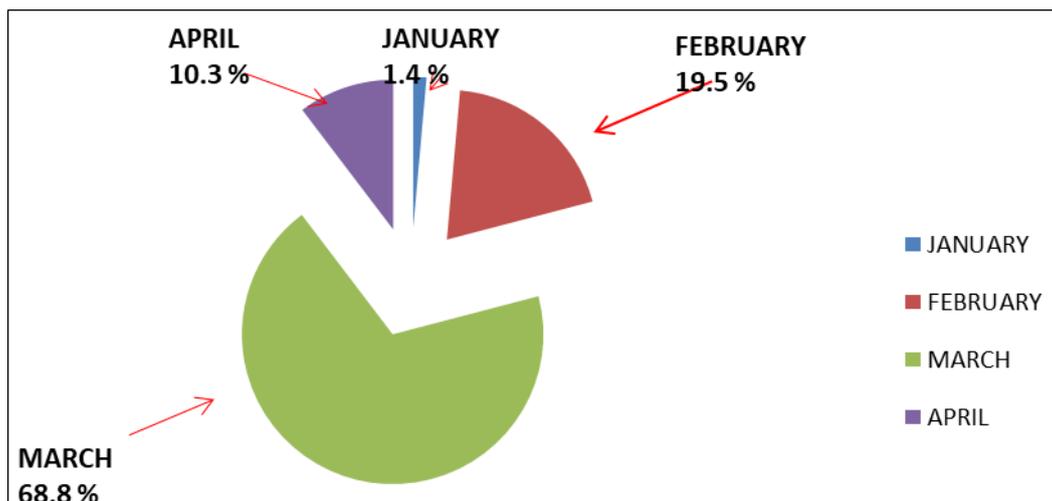


Figure 6: Monthly catch in one trip

Figure 6 shows that the minimum catch occurs in January, where the number is 1.4%, while the maximum catch occurs in March, which is 68.8%. Analyzed from the number of squids caught by size, it indicates that every month the caught squid has increased in length or weight, which is caused by the squid has experienced significant growth. The growth of squid is influenced by several factors, including the availability of food and the availability of various types of nutrients such as zooplankton and phytoplankton in the water.

4. Conclusion

Based on the results of 6 months of practice on the squid fishing vessel FV. Agnes 107, it can be summed up some conclusions, they are:

- (1) The stages of operation of the squid fishing rod include setting, and hauling is installed automatically. The setting of the fishing gear installation consists of fishing line (PA monofilament size 100 mm), swivel, branch rope (PA monofilament 70 mm, 80 mm, 90 mm, 100 mm), squid fishing rod, weight, and speed of fishing rods. Meanwhile, hauling is the process of pulling wherein its line a squid is entangled.
- (2) The parachute anchor is practically necessary for the operation of the squid fishing rod. If the parachute anchor is not operated, the fishing line will get tangled with the fishing line on the right side or the left side if the current influences the fishing line.
- (3) The correct size setting of the parachute anchor mainline causes fishing more efficient. The size of the main rope for the parachute anchor is divided into several parts; they are the size of 50 meters, 60 meters, 70 meters, 80 meters, and 90 meters. In calm water or wind speeds of less than 10 km/hour, the parachute anchor's main rope is 50 meters. Meanwhile, in the large waves or wind speeds of more than 35 km / h, used 90 meters rope.
- (4) The total catch during 1st trip is 119,970 kg. The lowest catch was obtained in January, amounting to 1,710 kg, and the highest catch was obtained in March, amounting to 82,530 kg. Types of catch are divided into 2: squid packaged 20 kg and squid packaged 10 kg. For the size of 20 kg, a lot was obtained in March with a total catch of a size of 2M is 33,040 kg and for a size of 10 kg with a total catch of a size of Y which is 23,510 kg.

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