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# BIOLOGY OF YELLOW SELAR FISH (*Caranx leptolepis*) AND ICE PRESERVED PROTEIN, LIPID AND CARBOHYDRATE CONTENT

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## Abstract

Yellow Selar fish (*Caranx leptolepis*) as pelagic fish are mostly caught by fishermen in North Sulawesi. However, from observations and preliminary research, fishermen often do not pay attention to fish sustainability because even small fish are caught. This is motivated by the lack of knowledge of fishermen and the lack of research on yellow selar fish in Sulawesi. Research has been carried out with the aim of obtaining the Biological Characteristics of Yellow Selar fish caught by fishermen in North Sulawesi. Obtaining the biochemical characteristics of selar kuning fish (macronutrient content). The results that have been achieved: The average total length of *Caranx leptolepis* without distinguishing males and females is 180 mm and weighs 90 gr. Fish gonad maturity index is between 1.02 to 1.90. From the stomach contents that we observed, the types of food eaten included small fish and shrimp. A total of 96% of small fish and 4% of shrimp were found in the stomach contents of the slugs that were analyzed. Protein and Fat content of Selar fish decreased with the length of storage time using ice. However, the carbohydrate content remained relatively unchanged. The best storage time for tude on ice is 48 hours. More than 48 hours there is a very significant decrease in protein and fat content.

**Keywords:** *Caranx leptolepis,* ice preserved, protein, lipid, carbohydrate

## INTRODUCTION

Yellow selar fish can be found in the waters of northern Sulawesi. Yellow selar fish are classified as pelagic fish in groups (Schooling), these fish are related to other pelagic fish such as the family scombridae and clupidae. The body shape of the selar fish (*Caranx leptolepis*) is smaller than that of other selar fish (Damayanti, 2010). The local people of North Sulawesi know the yellow selar fish as tude fish. Yellow selar fish has high economic value in this area because it is widely consumed by the community. Due to the high demand, fishermen generally do not pay attention to the age of the selar fish that are ready to be caught/consumed.

The biology of yellow selar fish originating from the Sulawesi sea, especially the catch of traditional fishermen, is still little studied. Biological aspects of tilapia include sex, body length, gonad maturity and eating habits, which are important to know in the management of trevally fish by fishermen. Selar fish are

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generally found not far from the shore, swimming in large schools on the muddy seabed to a depth of less than 52 m. Adult age is reached at a body length of about 8.8 cm at the age of less than a year, but there are also those who note a body length of about 11.4 cm. The spawning season of this fish in India is almost all year round, from March to July, but the peak is July to October and also January (Nulurita, 2014).

Yellow selar fish contains high protein in the range of 28.8% compared to mackerel which contains 16.5% protein (Directorate of Nutrition, Ministry of Health, 1989), skipjack tuna contains 20.5% protein (Jamal *et al*., 2011). Meanwhile, research conducted by Hidayat (2005) reported that the protein content of yellow selar fish can reach 65.2% if it is freshly caught. Because of its high protein content, yellow selar fish besides being a consumption fish is also used as a protein source for making peptone (Saputra and Nurhayati, 2013). Besides protein, marine fish contain high lipid components. Marine fish have a lot of double fish fatty acids, which are unsaturated fatty acids. Omega-3 fatty acids are one of the unsaturated fatty acids that cannot be converted into cholesterol in the body, so it can be said that omega-3 lowers blood cholesterol levels (Suptijah, 1999). Selar fish contains omega 3 fatty acids, namely eicosa pentaenoic acid (EPA) and decosa hexaenoic acid (DHA) which function to prevent atherosclerosis (Hafiludin, 2011).

The high protein content in marine fish causes marine fish to be known as foodstuffs that are prone to decay. The high content of unsaturated fatty acids is also very potential for photooxidation and fatty acid oxidation (Mokosuli, 2015). This is a problem for fishermen because it takes a long time to sell their catch from the sea to consumers. Most fishermen and fish traders slow down spoilage by refrigerating and storing it in ice (Susanto *et al.,* 2011; Opara *et al.,* 2007). Ice can be used to slow down spoilage and prolong the shelf-life of fish (Susanto *et al*. 2011). The high temperature in tropical countries including Indonesia and the lack of sanitation and hygiene in fishing causes fish to spoil faster.

Only in about 8 hours since the fish are caught and landed there will be a process of change that leads to damage. The process of putrefaction in fish is caused by the activity of enzymes, microorganisms, and oxidation in the fish's body, with changes such as a foul odor, stiff meat, faded eyes, and mucus on the gills and outer body (Rahmawati, 2012). Therefore, in order for fish and other fishery products to be utilized as much as possible, it is necessary to maintain their condition. Processing is one way to maintain fish from the process of decay, so that it can be stored for a long time until it is time to use it as food. Efforts in carrying out processing can be done in various ways. For example, freshly caught fish can be kept fresh by cooling or freezing it, or it can also be processed into semi-finished products such as in the manufacture of pindang fish and so on (Rahmawati, 2012; Susanto *et al*., 2011).

Hadiwiyoto (1993) states that several things that need to be considered in the assessment of fishery products are (1) the amount of ice used, (2) how to add ice, (3) the duration of the process, (4) the size of the container used and (5) avoid testing. fish that are still dirty and injured. To reduce the number of psychrophilic bacteria on the test, it can be combined in various ways, one of which is the use of coconut water (Seke, 2005). Generally, traditional fishermen in Minahasa, North Sulawesi use ice as a preservative

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for caught fish, including yellowtail fish. Storage with ice has a significant effect on water content, ash, protein, fat, peroxide value, iodine number and omega-3 fatty acid content, but on the head of stored fish it has no significant effect on ash content (Salamah *et al.,* 2004) . The problem that arises when fish are treated with cooling using ice is the process of decreasing the nutritional content of fish. In addition to the nutritional content, storage using ice for a long time also causes changes in the texture of fish meat (Hultmann and Rustad, 2002). This study aims to obtain the Biological Characteristics of Selar Fish caught by fishermen in North Sulawesi and to obtain the biochemical characteristics of slug fish (macronutrient content of selar fish).

## MATERIALS AND METHODS

### Sample

Fish samples were obtained in 3 (three) locations in North Sulawesi as fishing areas, namely in Likupang (North Minahasa), Belang (South Minahasa) and Bitung (Bitung City). Fish samples were obtained directly from fishermen and preserved with ice in a cool box before being analyzed.

### Tools and materials

The tools used include Hirox KH8700 3D Microscope, Carl Zeis Stereomicroscope, cool box, Parkin Elmer UV Vis Spectrophotometer, film bottle, digital scale, petri dish, micrometer, surgical board, 1 set of surgical instruments, object glass and cover, yarn, glass tools etc. The materials used are yellow selar fish (*Caranx leptolepis*), formalin 4% ice, ethanol pa and aquades, label paper etc.

### Research methods

#### a. Fish Biological Analysis

A total of five yellow selar fish were dissected on a surgical board using fish surgical instruments. Then the fish body is dried with a cloth / tissue paper. Each fish is labeled to avoid confusing the fish. Each fish was measured in total length and weighed. Fish surgery using 1 set of different fish tools. The body of the fish is dissected so that the body cavity is opened. The fish gonads were taken and the sex and morphological maturity level of the gonads were recorded. Fish intestines were taken to analyze their eating habits. Bowel length was measured and recorded. Then the gonads and intestines were put into a film bottle (each gonad or intestine was put in a different film bottle) and labeled according to the fish number. Then the gonads and intestines were preserved with 4% formalin.

The fish gonads that had been preserved using formalin were dried using a tissue so that the measurement of gonad weight was accurate. Then all the gonads were weighed one by one using a digital scale. Especially for TKG III and TKG IV female gonads were separated for the next treatment. The female gonads of TKG III and TKG IV were each taken in 3 small samples which could represent the anterior, posterior and middle parts of the gonads. The three pieces of the gonad sample were reweighed to obtain the total gonad weight of the sample.

#### Gonad Maturity Level

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Gonad maturity level (TKG) is a certain stage of gonad development before and after fish spawn. Determination of Gonad Maturity Level (TKG) was determined based on the classification of the gonad maturity level of Cassie modified mullet (Mugil dussumieri) in Effendi and Subardja (2002) as follows:

Table 1. TKG classification of Cassie modified mullet (Mugil dussumieri) in Effendi and Subardja (2002)

| No | TKG | Female | Male |
|---|---|---|---|
| 1 | I | Ovaries like threads, long to the front of the body, clear color, smooth surface | Testes like threads, shorter, ends at the waist, clear color |
| 2 | II | Larger size, dark yellowish coloration, eggs are not clearly visible | The size of the testes is larger, the coloration is milky white, the shape is clearer than TKG I |
| 3 | III | Ovaries are yellow, morphologically the eggs are visible with the eyes | The surface of the testes looks jagged, the color is getting whiter, in the preserved state it is easy to break |
| 4 | IV | The ovaries are getting bigger, the eggs are yellow, easy to separate, the oil grains are not visible, fill - 2/3 of the body cavity, the intestines are pushed into the body cavity | Like TKG III it looks clearer, the testes are getting denser and the body cavity is starting to fill up, the color is milky white |
| 5 | V | Ovaries are wrinkled, thick walls, residual eggs are near the release | The testes on the back are deflated and the part near the release is still filled |

**Gonad Maturity Index**

Gonad Maturity Index (IKG) or Gonado Somatic Index (GSI) is the ratio between gonad weight and fish body weight.

$$IKG = \frac{BG}{BT} \times 100\%$$

description: BG = Weight of the gonads (grams); BT = Body weight (grams)

**b. Biochemical Analysis**

The biochemical analysis of yellow selar fish consists of analyzing the content of glycogen, total protein and total lipid using the AOAC and SNI methods. Analysis of mineral content using the Atomic Absorption Spectrophotometer method. Analysis of essential amino acid content using the Amino acid analyzer method. Analysis of essential fatty acids (omega 3, omega 6, DHA and EPA) using GC/HPLC). Fish spoilage analysis using the SNI method

## RESULTS AND DISCUSSION

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**Biological Characteristics**

**Gender**

The morphological characteristics that can distinguish male and female fish are the distance between the dorsal fins of one and the dorsal fins of two female fish being close together, while in males the dorsal fin one and dorsal fin 2 are far apart (Figure 3).

Figure 3. The position of the fins and the morphology structure of the yellow selar fish from Minahasa

**Body Growth**

The average total length of yellow scallops without distinguishing between males and females is 180 mm and weighs 90 grams.

Table 2. Body Length and Weight of Yellow Selar Fish

| No | Individual | Length (mm) | Weight (g) |
|---|---|---|---|
| 1 | SK1 | 178,3 | 89,80 |
| 2 | SK2 | 179,4 | 90,1 |
| 3 | SK3 | 180,2 | 90,2 |
| 4 | SK4 | 180,4 | 90,8 |
| 5 | SK5 | 180,5 | 88,9 |
| 6 | SK6 | 178,9 | 90,3 |
| 7 | SK7 | 189,2 | 90 |
| 8 | SK8 | 180,2 | 90 |
| 9 | SK9 | 181,3 | 90,2 |
| 10 | SK10 | 180,2 | 89,20 |

Description: SK = selar kuning

Figure 4. Measuring the body length of the trout (compared to a piercer)

According to Saanin (1984), the body length of the yellow selar fish is 16 cm. This difference in total length

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can be caused by several possibilities such as differences in sampling locations, representativeness of the sample fish taken and the possibility of high fishing pressure on fish. The same species of fish but live in different waters will experience different growth due to internal and external factors that affect the growth of these fish. According to Effendie (1997), there are several factors that affect growth, including internal and external factors which include the amount and size of available food, the amount of food that uses available food sources, temperature, dissolved oxygen, water quality factors, age, and environmental factors. fish size and gonad maturity.

**Gonad Maturity Level**

The condition of the gonads is development I with the following characteristics:

- Ovaries are ovoid
- Reddish in color with capillaries
- Eggs can be seen by the eye like white powder
- Gonads fill approximately half of the lower body cavity

Figure 5. Gonad Position in Selar Fish

Figure 6. Gonad Condition of Selar Fish

**Gonad maturity index**

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The gonadal maturity index was obtained, namely the gonad weight divided by the body weight multiplied by 100%. The gonadal maturity index of the 10 fish tested was 1.11 on average (Table 2).

Table 2. Weight and IKG of Selar Fish

| No | Individual | Gonadal weight | IKG |
|---|---|---|---|
| 1 | SK1 | 1,5 | 1,80 |
| 2 | SK2 | 1,3 | 1,90 |
| 3 | SK3 | 1,2 | 1,16 |
| 4 | SK4 | 1,2 | 1,16 |
| 5 | SK5 | 1,1 | 1,14 |
| 6 | SK6 | 1,0 | 1,11 |
| 7 | SK7 | 1,0 | 1,11 |
| 8 | SK8 | 0,98 | 1,02 |
| 9 | SK9 | 1,0 | 1,11 |
| 10 | SK10 | 1,0 | 1,11 |

Gonad maturation is a certain stage of gonad development before and after spawning. Generally, the gonad weight gain of female fish is 10-25% of body weight, and that of males is 5-10%. The comparison between gonad weight and body weight among many researchers called the index Gonado Somatic Index or Gonad Maturity Index ( IKG ). IKG will increase in value and will reach the maximum limit when spawning will occur. According to Bagenal, 1978; Fecundity: the number of mature eggs that will be released by the parent. According to Nikolsky, 1969; Individual fecundity: the number of eggs from that year's generation that will be released (good for use on fish that spawn once a year using thread and then insert the intestines into the film bottle separately according to the number of fish.

Gonadal maturity level according to Takata and Tester (1953), 1). Not cooking. The gonads are very small like threads and are transparent. 2). The cross section of the gonads in male fish is flat with a gray color, the cross section of the female fish is round with a reddish color. 3). Cooking start. Gonads fill of body cavities. The color of the male fish is gray or white, the shape is flat, while the female fish are reddish or yellow in color and round in shape. Eggs not visible. Almost cooked. Gonads fill of body cavities. Gonads in male fish are white, in female fish are yellow. The shape of the egg is visible through the wall of the ovary. 4). Cook. Gonads fill of body cavities. The gonads of male fish are white filled with white fluid. The female gonads are yellow, almost clear or translucent. Eggs can be seen. Sometimes with gentle pressure on the abdomen there is a protruding hole in the release. 5). Copy. Almost the same as the second stage and difficult to distinguish. The male gonads are white, sometimes with brown spots. The female gonads are red, soft and the eggs are not visible. Meanwhile, the level of maturity of the fish gonads according to Nikolsky (1969) is as follows: 1). Not ripe, individuals still do not want to reproduce and the size of the gonads is small. 2). Rest period, sexual products have not developed, gonads are small, eggs cannot be distinguished by the eye. 3). Almost ripe, eggs can be distinguished by eye, testes change from transparent color to race color. 4). Cook, ripe sexual product, sexual product reaches its maximum weight but the product does not come out when the stomach is under pressure. 5).

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Reproduction, when the stomach is given a little pressure the sexual products will protrude from the release hole. The weight of the gonads rapidly decreases from the start of spawning to the completion of spawning. 6). The state of saline, sexual products have been released by the genital orifice are reddish, the gonads are deflated, the ovaries contain some residual eggs. Rest period, sexual products have been released, reddish color of the genital orifice, white eggs, small gonads not visible to the eye.

**Eating habit**

The length of the intestine of the Bentong Selar fish is very short. This characterizes that the bentong fish is a type of carnivorous fish. From the stomach contents that we observed, the types of food eaten included small fish and shrimp. A total of 96% of small fish and 4% of shrimp were found in the stomach contents of the slugs that were analyzed.

Figure 7. The structure and length of the intestines of scallops

**Fish Proximate Analysis**

Carbohydrate content was analyzed by the method of SNI 01-2891-1992 item 9, Fat by the method of SNI 01-2891-1992 item 8.1 and Carbohydrate using the method of SNI 01-2891-1992 item 5.5. The results of the analysis of the content of Carbohydrates, Fats and proteins in tude fish with the same size and body weight based on the origin of the sample showed differences. The highest protein content was samples from Belang, followed by samples from Bitung and finally from Likupang. The results of the analysis showed changes in the carbohydrate, fat and protein content of fish based on the length of time stored with ice. The total carbohydrate content tends to increase with storage time from 6 hours to 96 hours. On the other hand, the fat content increased from 6 hours to 48 hours after being caught and stored using ice, but decreased after 48 hours of storage using ice (Table 1).

Table of Carbohydrate, Fat and Protein Content of Fish

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| Origin of Sample | Carbohydrate | | | | Fat | | | | Protein | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | 48 | 72 | 96 | 6 | 48 | 72 | 96 | 6 | 48 | 72 | 96 |
| Likupang | 0,87 | 0,98 | 1,02 | 1,34 | 3,19 | 3,25 | 3,45 | 2,74 | 25,5 | 20,1 | 6,56 | 3,25 |
| Bitung | 1,2 | 1,32 | 1,38 | 1,54 | 4,25 | 4,27 | 2,95 | 2,55 | 27,9 | 19,1 | 7,34 | 3,21 |
| Belang | 1,35 | 1,42 | 1,48 | 1,45 | 3,35 | 3,45 | 2,56 | 2,35 | 30,3 | 23,1 | 7,26 | 2,96 |

In contrast to the carbohydrate and fat content, the protein content actually continued to decrease along with the length of storage time using ice. The initial protein content of samples from Likupang was 25.5% at 6 hours after catching but after 96 hours of storage the protein content of the analysis results remained 3.25%. The initial protein content of the striped samples at 6 ham after catching was 30.3%, experienced a sharp decrease after 96 hours of storage with ice, which was 2.96%. Samples of Bitung kan protein content 6 hours after capture was 27.9% decreased to 3.21% after 96 hours of storage using ice. Thus, the storage time of Tude fish is only 48 hours with a high percentage of Protein, Fat and Carbohydrates (Figure 2).

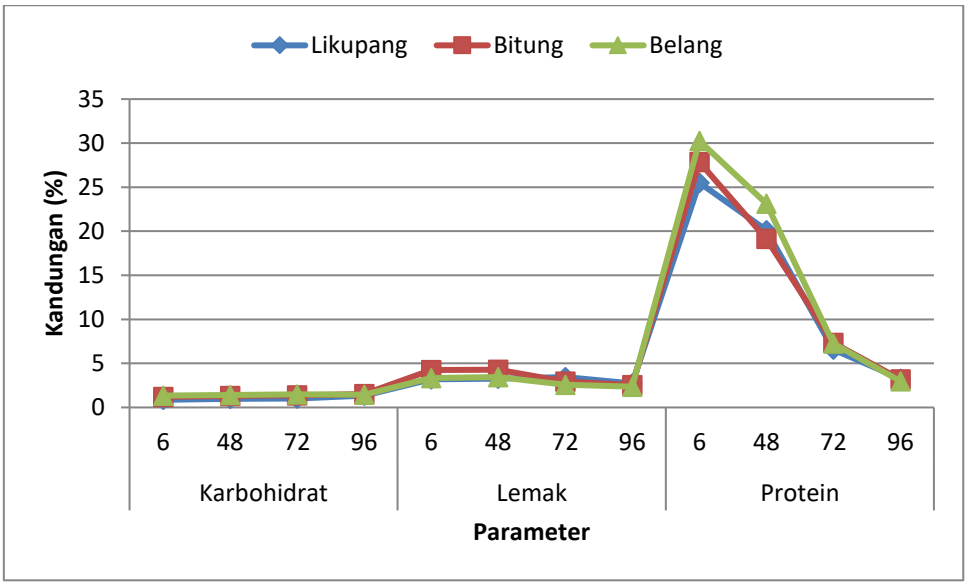


Figure 8. Profile of Carbohydrate, Fat and Protein content of Fish from 6 Hours to 96 Hours after catching

Fish protein components are in the range of 18-35%. Yellow selar fish (*Caranx leptolepis*) which contains 18.8% fish protein (Directorate of Nutrition of the Ministry of Health of the Republic of Indonesia, 1989) and is a small pelagic fish with a maximum length of 16 cm. However, the protein content of fish will decrease often with the process of decay. The bacteria in the fish intestine will start the decomposition of fish protein into amino acids or their derivative compounds. This causes the protein content of fish to decrease from 6 hours after catching to 96 hours after catching. Because the protein content in each type of fish is different, the sensitivity and damage process with ice storage will be different. Fish protein content will increase after prerigor and then decrease during storage. The longer the freezing, the more soluble protein, this means that less protein can be extracted (Suwetja, 2011).

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Lipolytic enzymes are still active even though the fish is dead. This enzyme will break down lipids in fish. The decomposition of fat will give a good taste to the fish at a certain time of storage. Yellow Selar Fish has a distinctive flavor and is a recommended consumption fish for people with Diabetes, Atherosclerosis, Cancer and Toddlers. However, in the long term the decomposition of fat in fish will cause an unpleasant odor. In this study, the unpleasant odor was very strong at the storage time of 96 hours compared to the storage time below. This odor is caused by the oxidation of fish fat that occurs autolysis by microbes. Lipase enzymes can carry out hydrolysis activity at a temperature of -29 0 C. On the other hand, at high temperatures it will take place very quickly. Hydrolysis will produce short chain fatty acids such as butyrate (C4), caproic (C6), caprylic (C8) and caproic (C10) (Lehninger, 2005). These fatty acids cause rancid odor in fish (Suwetja, 2011). Stansby (1982) states that fish with a protein content of 15-20% is included in the high-protein fish group, while a fat content of less than 5% is included in the low-fat fish group.

## CONCLUSION

1. The average total length of yellow scallops without discriminating between males and females is 180 mm and weighs 90 grams.
2. Fish gonad maturity index is between 1.02 to 1.90.
3. From the contents of the stomach that we observed, the types of food eaten included small fish and shrimp. A total of 96% of small fish and 4% of shrimp were found in the stomach contents of the slugs that were analyzed.
4. Protein and Fat content of Selar Fish decreased with longer storage time using ice. However, the carbohydrate content remained relatively unchanged.
5. The best storage time for tude on ice is 48 hours. More than 48 hours there is a very significant decrease in protein and fat content.

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