

Potential of pelagic fish in the seawaters of Salahutu district, Ambon Island and analysis of protein and fat content

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Abstract. The coastal and marine waters of Salahutu sub-district Ambon Island have the potential for catching small pelagic fish. It is supported by high mineral and plankton elements and warm seawater temperatures due to upwelling, which comes from the rotation of seawater currents from the Seram Island Sea, Banda Sea Island, and the surrounding seas of Ambon Island. The study aimed to determine the protein and fat content of small fresh pelagic fish consumed by the people of Salahutu District, Ambon Island. This study used descriptive methods and laboratory tests. The results of the analysis of protein and fat levels in several species of pelagic fish showed different protein and fat content. The highest average protein content in *Euthynnus affinis* species was 23.08 %. Then *Decapterus russelli* species with a protein content of 22.41%, *Rastrelliger brachysoma* species with a protein content of 21.41%, *Selar crumenophthalmus* species with a protein content of 19.80% in the fish species *Decapterus macrosoma*. The highest average fat content in *Rastrelliger brachysoma* species is 1.41 grams, followed by *Decapterus russelli* species with an average fat content of 1.23 grams, *Selar crumenophthalmus* species with an average fat content value of 1.15 grams, *Decapterus macrosoma* species with an average with a fat content of 1.12 grams, and the lowest fat content in small pelagic fish was for *Euthynnus affinis* with an average of 1.00 grams. The nutritional content contained in pelagic fish meat is very good for maintaining body balance and body health.

Key Words: fish Meat, Kjeldahl method, Soxhlet extraction method.

Introduction. The marine area of Salahutu District, Central Maluku Regency, is adjacent to Seram Island, Haruku Island and Saparua Island which are marine waters with great potential for catching various types of pelagic fish. There is an ample supply of pelagic fish species sold in traditional markets in Tulehu Village, Salahutu District. The traditional market of Tulehu Village is a place for supplying and selling pelagic fish catches, which will be transferred to other areas such as the Mardika market in Ambon City or other traditional markets. Public demand in this area for pelagic fish for consumption is relatively high, both for large and small fish, so the traditional market of Tulehu Village is very crowded with people from various regions on Ambon Island and other islands around it. The coastal area and waters, as well as the sea of Ambon Island, is a marine and fishery resource with great potential with a catch production of 22,343.7 tons per year, including the catch of fishers in Salahutu District, Ambon Island (Limmon et al 2017).

Abundant nutrients and plankton may influence the high catch of small pelagic fish in these seas due to the movement of seawater that carries various nutrients to the surface of the seawater. The circular movement of seawater from the waters in the islands adjacent to Ambon Island, Salahutu District, and Central Maluku causes a change in temperature at the sea surface at night. These coastal waters allow fishers to catch

abundant small pelagic fish species in the sea in the evening. Giménez et al (2021) pointed out that fishing areas can vary according to the preferences of the fish. For example, in the pelagic fish category, fishing areas are influenced by sea surface temperature, upwelling, and oceanic fronts. These factors indicate the presence or absence of a food source for pelagic fish, namely plankton. These three factors are interrelated, where certain sea surface temperatures and oceanic front phenomena indicate upwelling, which brings nutrients in the form of plankton to be consumed by the pelagic fish as a link in the food cycle of pelagic fish.

The habits and preferences of the community in consuming small fresh pelagic fish are a gift given by the creator to the people in this area because there are abundant natural resources in the waters and the sea for the community's welfare. Fish traders sell fresh pelagic fish that are preferred at low and affordable prices, and the number of fish is 5-20 fish, with prices ranging from Rp. 10,000 to Rp. 20,000, depending on the size of the pelagic fish being sold. Siaila and Rumerung (2022) state that fishers' catch of pelagic fish is quite high. It is sold in the traditional market of Tulehu Village, and distribution is also to the Mardika market as the main market on the island of Ambon with affordable prices.

The amount of pelagic fish purchased by the community is sufficient for protein and animal fat for the family per day. Lall and Anderson (2005) state that fish is a source of protein that humans need because it contains high protein and essential amino acids needed by the body. In addition, the biological value reaches 90%, with negligible binding tissue, so it is easy to digest compared to other animal protein sources. Vågsholm et al (2020) argue that fish is one of the foodstuffs that contain various substances valuable for human nutrition. Besides the low price, the absorption of fish protein is higher than other animal products such as beef and chicken because fish meat has shorter protein fibres than beef or chicken protein fibres. Fish protein gave the most considerable contribution in the group of animal protein sources, around 57.2%. Pelagic fish protein plays a vital role in meeting the animal protein needs of the community in this blood because it contains a high nutritional value.

In addition to protein, fat is also essential for our bodies. One source of fat that is very good for our bodies is fat from pelagic fish. Giménez et al (2021) states that fish has a lot of fat content needed for health and body resistance. Essential fatty acids are such as linolenic acid and linoleic acid. These essential fatty acids are required for all tissues' average growth and function, including optimal brain cell development. Fish meat is also a valuable source of minerals and vitamins. Thus, the consumption of pelagic fish by the people in this area daily provides a high nutritional contribution to their body tissues. Maulu et al (2021) states that fish is an important food source for the community, especially for meeting the needs of protein, vitamins, minerals, and fatty acids. Fish contains protein consisting of essential amino acids that are not damaged during cooking and unsaturated fatty acids needed for growth and health (Abraha et al 2018).

The levels of protein and fat in small fresh pelagic fish that have not been processed into food for public consumption vary. It is necessary to analyse the protein and fat content so that in the management of food, protein and fat levels must be maintained to have nutritional value. Loss of protein or fat levels can be caused by how the fish is processed as food, either due to heating or boiling. Fish protein can be denatured and will lose its solubility and biological properties. Fresh or raw food ingredients are still in their natural form or have not undergone a processing process. Fresh fish need to be appropriately managed to maintain the nutritional value content (Ministry of Health of the Republic of Indonesia 2014). The study aimed to determine the protein and fat content of small fresh pelagic fish consumed by the people of Salahutu District, Ambon Island, and surrounding communities.

Material and Method. This study used descriptive methods and laboratory tests. Research took place between March and May 2022. Descriptively, the data obtained were related to the community's consumption of small pelagic fish. A survey was conducted with a family approach to 30 respondents through interviews and filling out questionnaires. Laboratory tests were carried out at the Chemical Laboratory, Faculty of Mathematics and Natural Sciences, Pattimura University. Protein content was determined using the Kjeldahl method. The first step was mashing each sample of pelagic fish and taking a few grams of each treatment. Then, it was put into a 100 ml tube (Kjeldahl flask), followed by the addition of 1.5 grams of selenium mixture. Next, a concentration of ± 20 ml concentrated H_2SO_4 was heated for 120 minutes. Then, it was cooled and put into a 100 ml Erlenmeyer flask before being put into a distillation apparatus and added a solution of 5 ml of 30% NaOH and a few drops of phenolphthalein indicator. The distillation process was carried out for ± 15 minutes. Then, the distillation results were added to a 5 ml boric acid solution with a concentration of 2%. Distillation results carried out the determination of protein content by titrating using 0.01 N HCL solution. This process was repeated 2 times for each sample of small pelagic fish types. The determination of fat content using the Soxhlet extraction method for pelagic fish meat was carried out by smoothing or separating the solvent liquid from oil or fat by adding the solvent n-Hexane, which was inserted into a centrifuge (rotary evaporator RE 300B England). This centrifuge process was carried out in order to obtain the fat weight. The determination of fat content was carried out by calculating the weight of fat compared to the weight of the sample.

Fresh small pelagic fish species analysed for protein and fat content were purchased directly at the traditional market in Tulehu Village, Salahutu District, Ambon Island. Small pelagic fish samples are described using Figure 1.



Figure 1. Various types of pelagic fish purchased at traditional markets in Tulehu Village and used as samples for analysis of protein and fat content.

Results. From the results of a familial approach to 30 respondents regarding the use of small pelagic fish purchased at the traditional market of Tulehu village through interviews and filling out questionnaires by respondents. Respondents' answers are explained in Table 1 below.

Table 1

The answers of 30 respondents regarding the use of small pelagic fish consumed by families

Questions /statements	Respondents' answer								Σ	
	SS		S		TS		STS			
	f	%	f	%	f	%	f	%	f	%
We consume fresh pelagic fish every day because it is easy to obtain and sold in the traditional market of Tulehu village.	7	23.3	16	53.3	5	16.7	2	6.7	30	100%
The price of small fresh pelagic fish is relatively low and not expensive, so our family consumes it every day.	5	16.7	20	66.7	2	6.7	3	10	30	100%
It can be replaced by consuming small fresh pelagic fish to meet the needs of animal protein and fat.	15	50	9	30	5	16.7	1	3.3	30	100%
Consuming small pelagic fish is very good for maintaining the health of our bodies.	23	76.7	4	13.3	1	3.3	2	6.7	30	100%
The composition of the nutritional content of fresh pelagic fish is a chemical compound that our bodies need.	13	43.3	10	33.3	3	10	4	13.3	30	100%
Σ	63	42%	59	39.3%	16	10.7%	12	8%	150	

Note: SS = strongly agree, S = agree, TS = disagree, STS = strongly disagree.

The data in Table 1 above shows that respondents' answers related to questions or statements regarding the use of small fresh pelagic fish are as follows:

1. Respondents with 76.7% SS – S answers and 23.3% TS – STS answers related to their daily consumption of fresh pelagic fish because they are easy to obtain, and fish are sold in traditional markets in Tulehu village.
2. Respondents with 83.3% SS – S answers and 16.7% TS – STS answers related to the price of fresh small pelagic fish, which is relatively cheap and not expensive, so that their family consumed it every day.
3. Respondents with 80% SS – S answers and 20% TS – STS answers related to the need for animal protein and fat can be replaced by consuming fresh small pelagic fish.
4. Respondents with 90% SS-S answers and 10% TS-STS answers related to consuming small pelagic fish are very good for maintaining the health of our bodies.

5. Respondents with 76.7% SS – S answers and 23.3% TS – STS answers related to the composition of nutrients in fresh pelagic fish, which are chemical compounds that our bodies need.

The respondent's answers to the use of various types of fresh small fish consumed and the nutritional content, especially the levels of protein and fat as chemical compounds needed for our bodies, can be explained in Figure 2 below.

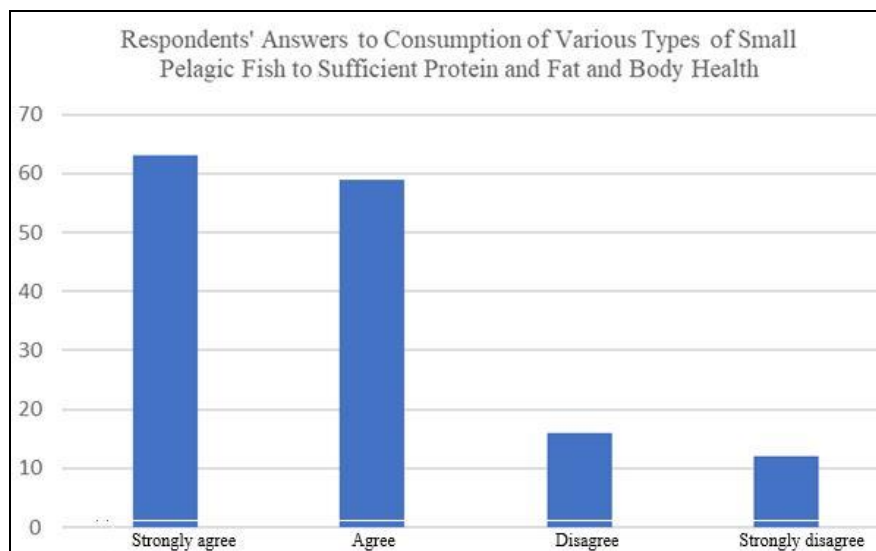


Figure 2. Consumption of small pelagic fish as a family meal menu and as a source of protein and fat useful for health.

The answers of respondents who answered strongly agree (SS) amounted 42%, who answered agree (S) amounted 39.3%, who answered disagree (TS) amounted 10.7% and those who answered strongly disagree (STS) amounted 8%. Analysis of protein content of 5 types of small pelagic fish species used the Kjeldahl method and two repetitions obtained the percentage of protein levels for each small pelagic fish species. Results are shown in Table 2.

Table 2
Results of analysis of protein levels in types of small pelagic fish consumed by the community of Salahutu District, Central Maluku Regency, Ambon Island

Meat types of pelagic fish	Protein level analysis						Σ Average
	Repetition I			Repetition II			
	Sample weight	Titration ml HCl 0.1	Protein level	Sample weight	Titration ml HCl 0.1	Protein level	
<i>Euthynnus affinis</i>	0.73	19.30	23.21%	0.74	19.45	22.94%	23.08%
<i>Decapterus russelli</i>	0.74	18.05	22.42%	0.75	19.25	22.40%	22.41%
<i>Decapterus macrosoma</i>	0.84	18.50	19.30%	0.80	16.60	20.30%	19.80%
<i>Selar crumenophthalmus</i>	0.75	18.50	21.43%	0.75	18.35	21.39%	21.41%
<i>Rastrelliger brachysoma</i>	0.72	17.40	21.23%	0.73	18.60	22.11%	21.67%

The results of the analysis of protein levels of various species of small pelagic fish in Table 2 show different protein levels, with the highest average protein value of 23.08% in the pelagic fish *Euthynnus affinis* and then *Decapterus russelli* species with a protein

content of 22.41%, *Rastrelliger brachysoma* species with protein content of 21.67%, *Selar crumenophthalmus* species with a protein content of 21.41% and the lowest protein content is 19.80% in fish species *Decapterus macrosoma*.

The results of the analysis of fat from several pelagic fish meat are known to have different levels of fat, according to the Soxhlet extraction analysis, to the fat content of each small pelagic fish, as shown in Table 3.

Table 3

Results of analysis of fat content in small pelagic fish types consumed by the community of Salahutu District, Central Maluku Regency, Ambon Island

Meat types of pelagic fish	Fat content analysis						Σ Average
	Repetition I			Repetition II			
	Sample weight	Fat weight	Fat level	Sample weight	Fat weight	Fat level	
<i>Euthynnus affinis</i>	10.29gr	0.09gr	0.98gr	10.32gr	0.10gr	1.02gr	1.00gr
<i>Decapterus russelli</i>	10.80gr	0.13gr	1.23gr	10.62gr	0.13gr	1.23gr	1.23gr
<i>Decapterus macrosoma</i>	10.59gr	0.12gr	1.11gr	10.39gr	0.12gr	1.12gr	1.12gr
<i>Selar crumenophthalmus</i>	10.66gr	0.12gr	1.14gr	10.53gr	0.12gr	1.15gr	1.15gr
<i>Rastrelliger brachysoma</i>	10.45gr	0.15gr	1.41gr	10.51gr	0.15gr	1.41gr	1.41gr

The fat content data in Table 3 above shows that the highest average fat content in the *Rastrelliger brachysoma* species is 1.41 grams, followed by *Decapterus russelli* species with an average fat content of 1.23 grams, *Selar crumenophthalmus* species with an average fat content value of 1.15 grams, *Decapterus macrosoma* species with an average with a fat content of 1.12 grams, and the lowest fat content in small pelagic fish species *Euthynnus affinis* with an average value of 1.00 grams.

Discussion. The coastal and marine waters of the Salahutu District, Central Maluku Regency, located on Ambon Island, are a potential fishing zone for various types of small pelagic fish. These waters are marine waters with an archipelago of islands such as Seram Island, Haruku Island, and Saparua Island. It also deals directly with the waters of the Banda Sea. This group of islands allows the movement of water that carries minerals and plankton needed by various types of small pelagic fish. The existence of a group of islands in marine waters is a potential pelagic fishing area where naturally small pelagic fish always look for habitats that follow their physiological needs, especially habitats that are suitable for oceanographic conditions to the distribution pattern of pelagic fish (Zainuddin et al 2017; Lima et al 2022).

Changes influence the distribution pattern and the presence of pelagic fish in oceanographic conditions. Therefore, it dramatically determines the distribution pattern of small pelagic fish associated with oceanographic conditions, namely sea surface temperature and chlorophyll-a, mostly contained by phytoplactons in marine waters. The pattern of various types of small pelagic fish distribution in coastal and marine waters, Salahutu Sub-district, Ambon Island, which is high, and its presence in each of the islands adjacent to Ambon Island provides oceanographic characteristics that allow seawater movement. It affects the increase in water mass that moves from the bottom up to the surface, changes in temperature, and the high chlorophyll content of plankton, especially phytoplankton (Rubio-Rodríguez et al 2018). States that there is a mass movement of water from the Pacific Ocean entering the waters into several bays. The waters of the Seram Sea and its surroundings occur upwelling, namely the rotation of seawater that rises to the surface. Therefore, the location of the waters will be abundant in food sources such as phytoplankton and affect pelagic fish growth patterns and its existence (Hutubessy et al 2014).

The high catch of various types of small pelagic fish in these waters is closely related to the ability of fishers to identify the characteristics of marine water parameters by paying attention to seawater temperature, clarity, and density of zooplankton and depth. Fish catch position can be predicted from sea surface temperature parameters, chlorophyll-a distribution, and currents (Sahetapy et al 2018). Temperature is an environmental parameter that is most often needed in the ocean because it helps study the physical, chemical, and biological processes that occur in the ocean. States that there are differences in species and amounts of catch between groups of small pelagic fish caught in various Maluku marine waters, such as Arafura Sea, by fishers and small pelagic fish in different depth strata. The deeper the fishing area, the lower the catch (Natan et al 2019).

The fishers in the Salahutu area of Central Maluku Regency have the potential for high catches. 83.3% of people buy fish every day at the traditional market of Tulehu Village. Even small pelagic fish are seen being sold along the highways of Hurnala Hamlet and Mamoki Hamlet. There are also pelagic fish for sale from 6.30-18.00 in Tulehu village. This condition of selling pelagic fish makes it easier for people to get fresh pelagic fish for consumption. It follows the community's answer that 76.7% of pelagic fish is easily obtained from the traditional market of Tulehu village. Latuconsina et al (2022) state that the potential of pelagic fish caught by fishers from the calculation results can be obtained from the conclusion that the greater the ratio of catching pelagic fish minus operational costs, the profit will be obtained. Usually, it will be efficiently distributed to the nearest market. Limmon et al (2017) argues that the Central Maluku fisheries statistics report that the production of small pelagic fish is of high potential in this area, so management efforts must continue to pay attention to sustainability and maintain the community's need for small pelagic fish.

As many as 80% of people get protein and fat from small pelagic fish consumed every day. Based on the results of the analysis of the protein content and fat content of small pelagic fish obtained by fishers' catches in the seawater of Salahutu District, it showed that there were differences in protein content and fat content. It turned out that small pelagic fish had high protein content in *Euthynnus affinis* species at 23.08%, and the lowest protein content was 19.80% in the species *Decapterus macrosoma*. The results of the analysis of the fat content of small pelagic fish showed that there were differences in the fat content contained in the flesh of small pelagic fish, the highest fat content was in the species *Rastrelliger brachysoma* at 1.41 grams, and the lowest was in *Euthynnus affinis* species with a fat content of 1.00 grams. The difference in protein and fat levels is suspected to be a difference in the depth of the catch of small pelagic fish. The deeper the habitat of the pelagic fish, the less nutrient content and mineral elements are obtained. Suseno et al 2010 argue that the deeper a fish habitat, the less feed is obtained and the less protein content. Consequently, pelagic fish are in the zone which always gets a higher food supply and very high protein and fat content than deep-sea fish that live in mesopelagic habitats.

The protein contained in the meat of small pelagic fish is excellent for people to eat. Besides being easy to obtain and cheap, it also maintains the stability of our bodies and health. Various research results show that the protein of small fresh pelagic fish consumed is beneficial for our health. Soselisa et al (2021) states that fish protein contains complete amino acid taurine than other foods. The amino acid taurine serves to stimulate the growth of brain cells. Fish protein is higher than legume protein, and fish protein is easy to digest, especially for children and adults. In addition, fish has fat with Omega-3, which helps the growth of eye cells and maintains cholesterol stability.

The fat content in the meat of small pelagic fish, which is different in each species, is very good for public consumption because our bodies quickly absorb the fat content in small pelagic fish. The pelagic fish contains various fatty acids that are good for our health, so to get various types of fatty acids, the best way is to consume small pelagic fish. Silooy et al (2019) points out that fish contains fatty acids in sequence, namely oleic acid (Omega-9), palmitic acid, stearic acid, palmitoleic acid, lauric acid, and myristic acid. The diversity of fish fatty acids is due to several factors such as the type of species, the availability of feed, the fish age, and the size and habitat of the fish.

There is a request from the community in Salahutu and the community around the island of Ambon to consume small pelagic fish to get 90% of the nutrition for body health by consuming small pelagic fish. Various types of small pelagic fish contain nutrients such as protein, fat, and minerals that are good for health. Jordan (2015), said that mothers who live in coastal areas know the nutritional content of marine fish for consumption by families, especially toddlers and children, for growth and health. Tebiary et al (2022) states that fish's nutritional advantages, which contain protein, fat, and minerals, can help the body's metabolism. As an antioxidant that protects the body from free radiation, antioxidants prevent heart disease, and fatty acids maintain body health, especially maintaining stable cholesterol levels. Protein helps the body and brain growth. Thus, based on the question, 76.7% of the community answered that our bodies very much need the composition of the nutritional compounds in small pelagic fish.

Conclusions. Coastal and marine waters in Salahutu District, Central Maluku Regency, located on Ambon Island, are potential areas for small pelagic fish. These waters receive a high supply of mineral elements and plankton as a food source for small pelagic fish. In addition, fluctuations in seawater temperature are good for the growth of small pelagic fish because of the movement of upwelling seawater currents, namely the rotation of seawater that rises to the surface from the Seram Sea, Banda Sea, Saparua Sea and Haruku Sea as well as marine waters around Ambon Island. The traditional market in Tulehu Village, Salahutu District, Central Maluku Regency, Ambon Island, is a center for selling and shopping for various types of marine fish as well as the distribution center for small pelagic fish catches and various other types of fish from various marine waters around the island of Ambon. Differences in protein content and fat content of small pelagic fish *Euthynnus affinis*, *Decapterus russelli*, *Decapterus macrosoma*, *Selar crumenophthalmus* and *Rastrelliger brachysoma* were caused by different habitat depths of each pelagic fish species. The fishes are excellent for public consumption to maintain body health.

Conflict of interest. The authors declare that there is no conflict of interest.

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