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Anchovy (the Engraulidae family) and All of the Potential Aspect: A Literature Review

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Abstract

Anchovies are little pelagic fish that are widely distributed in the ocean. This fish has great potential, therefore it must be nurtured. The classic review is the research approach utilized in the literature review. The Mediterranean Sea, Northwest Africa, Bone Bay, Jepara, Ambon Bay, Morocco's Atlantic Coast, Kayeli Bay, Sri Lanka, India, Malaysia, the Red Sea of Eritrea, and Argentina are inhabited to 172 species of anchovy. The catch size, length, and weight of the fish also vary considerably. Seasonal and environmental variables play a significant effect. In certain areas, the potentials for collecting anchovies can still be expanded while maintaining sustainability. This fish is consumed by the general populace. Comprehensive nutrient profile so that it may be turned into food products (food diversification). Moreover, anchovies include vitamins A, B12, D, and E. Dried anchovies, pepes, tinned anchovies, peanut brittle, fried flour anchovies, cassava/kaoami, biscuits, snacks, chili sauce, infant food additions, and anchovies crispy-sweet are among the several forms of anchovies. By empowering the community, anchovy diversification is accomplished very successfully since it may boost their economic. Anchovy waste may also be converted into fish meal for use as quail feed.

Keywords: *Diversification, Nutrition, Anchovy, Society*

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INTRODUCTION

There are several varieties of anchovies in the ocean. In Indonesia, anchovy is one of the most economically valuable fish, and many people consume it. Anchovies are pelagic fish that may survive up to 200 meters deep. Anchovies are among the biggest species and may be found along the coasts of countries (Stephenson & Smedbol, 2019).

Anchovy is a part of the ordo *Clupeiformes* and the family Engraulidae, which includes 16 genera and 172 species (Eschmeyer et al., 2021). These fish are dispersed across the ocean. Anchovy are also affected by the salinity, chlorophyll-a content, and

temperature of the surface water (Ariana et al., 2020). Capturing anchovies throughout the world continues to be conducted and improved. There are still regions where anchovy fishing might be increased, such as Bone Bay (Safaruddin et al., 2017). Yet, other things occurred in the waters of Tegal, specifically that they had surpassed the limit (Sutono & Susanto, 2016). This demonstrates that anchovies are essential to the community.

Excellent utilization, nutritional content, and health benefits. This makes the possibility of anchovy diversification quite promising. The goal of food diversification is to boost the nutritious content of food, and by empowering the local population, it will also benefit the local economy. Thus far, processed dried anchovies, biscuits, peanut brittle, pepes, and various snacks have been incorporated into the company's diversification efforts. In this article, issues pertaining to anchovies and their potential are discussed.

METHOD

Traditional Review is the methodology employed in the literature review. This is the most common method of literature review employed by researchers and is extensively used.

RESULTS AND DISCUSSION

Anchovy

The types of anchovies consumed by the community vary and depend on the region. This is related to the distribution area of the fish (**Table 1**).

Table 1. Distribution of anchovies in the world

No	Types of Anchovy	Deployment Area	Researcher
1.	European anchovy (*Engraulis encrasicolus*)	Mediterranean Sea, Strait of Sicily	(Quinci et al., 2022)
2.	European anchovy (*Engraulis encrasicolus*)	Northwest Africa (Tangier to Cap Bojador)	(Aakre et al., 2020)
3.	Indian anchovy (*Stolephorus* spp)	Bone Bay	(Safaruddin et al., 2017)
4.	Commerson's anchovy (*Stolephorus commersonii*)	Japanese port	(Swastawati et al., 2020)
5.	Shorthead anchovy (*Encrasicholina heteroloba*)	Ambon Bay	(Latumeten & Latumeten, 2021)
6.	European anchovy (*Engraulis encrasicolus*)	Morocco atlantic coast	(Qendouci et al., 2018)
7.	Indian anchovy (*Stolephorus* spp)	Kayeli Bay, Buru Island	(Savitri et al., 2021)
8.	Indian anchovy (*Stolephorus indicus*)	Sri Lanka	(Reksten et al., 2020)
9.	Commerson's anchovy (*Stolephorus commersonii*) and Devis' anchovy (*Stolephorus devisi*)	Thothukudi Coast, India	(Kumar et al., 2014)

10.	Commerson's anchovy (*Stolephorus commersonii*), Shorthead anchovy (*Encrasicholina heteroloba*), and buccaneer anchovy (*Encrasicholina punctifer*)	Pangkor Island, Malaysia	(Ahmad et al., 2018)
11.	Shorthead anchovy (*Encrasicholina heterolobus*)	Red Sea of Eritrea (Rassdarma-southern part of Asseb)	(Abraha et al., 2017)
12.	Goldspotted grenadier anchovy (*Coilia dussumieri*)	Veraval Fish Landing Center, India	(Madathil et al., 2017)
13.	Argentine anchovy (*Engraulis anchoita*)	Mar Del Plata, Argentina	(Czerner et al., 2011)

The European anchovy (*Engraulis encrasicolus*) spawns in the summer along the Straits of Sicily because the temperature rises during this season. Environmental conditions have a profound impact on anchovy. Anchovy reproduction and early development are influenced by oceanographic circumstances. The oceanographic conditions in the Strait of Sicily are intriguing since they vary from year to year (Quinci et al., 2022). Surface water salinity, chlorophyll-a content, and surface temperature also affect anchovies (Ariana et al., 2020). A statistical approach model for predicting anchovy spawning habitats in the Sicily strait shows results that vary each year (Figure 1).

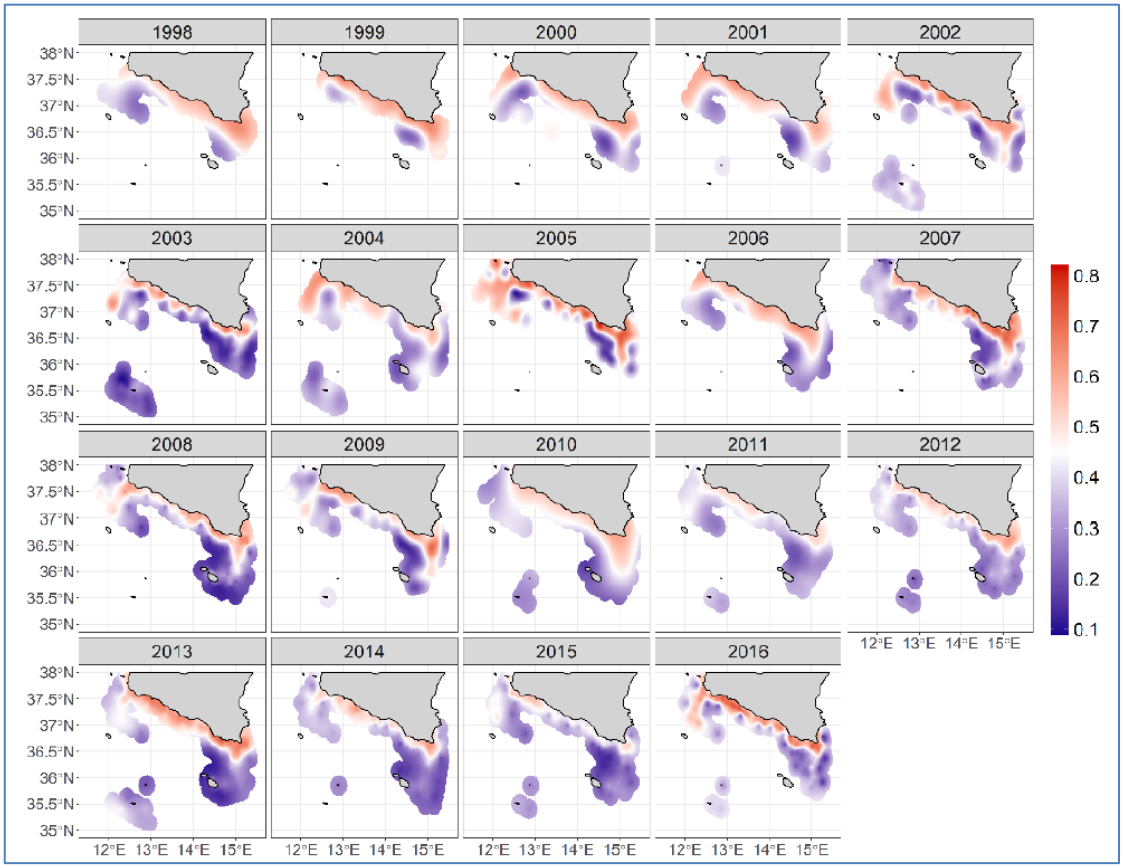

Figure 1. Prediction map of anchovy habitat for spawning (red color indicates potential areas with a large number of eggs and blue color indicates depths greater than 100m) (Quinci et al., 2022)

Anchovies are also found around Pesisir Selatan district, West Sumatra. There are several spots or points that are predicted to have a large number of anchovies. The point or location must have a salinity between 32.27-33.54‰, chlorophyll-a content between 0.16-0.77 mg m^{-3}, and sea surface temperature distribution between 30.28-30.68°C . This value is the appropriate value for anchovy habitat in Pesisir Selatan Regency, West Sumatra (Ariana et al., 2020).

The shorthead anchovy (*Encrasicholina heteroloba*) abundance increases in April-August. Their size varies from 3.4-6.9cm with an average weight of 0.9g. In addition, there was a decrease in the average fish length from 5.48cm to 5.20cm in 2015. This was due to differences in the recruitment season and a decrease in water quality (Latumeten & Latumeten, 2021).

Anchovy Catching Potential

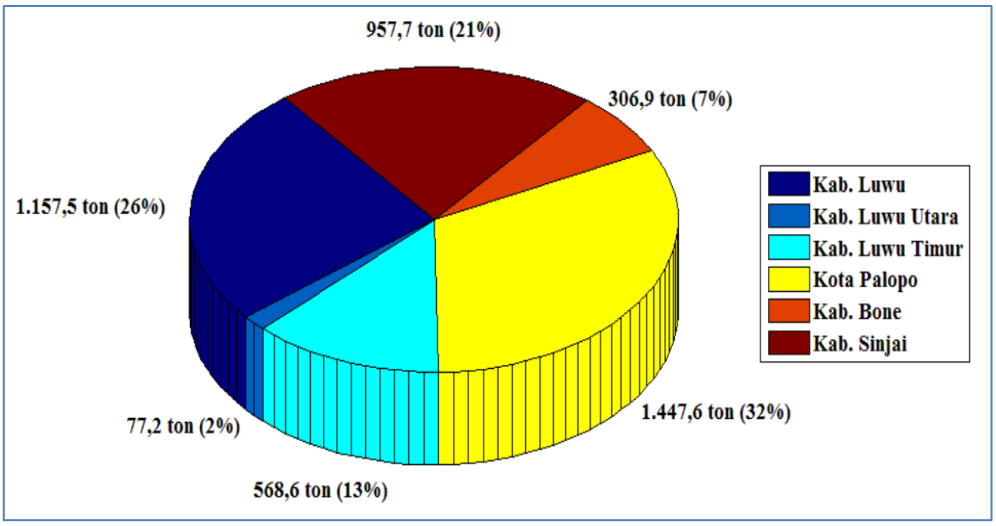

Figure 2. Anchovy fishing potential in South Sulawesi Province in 2016 (Safaruddin et al., 2017)

Potential areas for anchovy fishing are found around the coast (Quinci et al., 2022; Safaruddin et al., 2017). This is because more food (plankton) is found around the coast. The average CPUE value of anchovies in Bone Bay in the last 10 years (2007 – 2016) was 8.68 tons/standard boat lift unit with an estimated sustainable potential (MSY) of 9736 tons/year. The MSY value of shorthead anchovies (Encrasicholina heteroloba) in the inner Ambon Bay is 6.9 ± 4.3 tons (Latumeten & Latumeten, 2021). Things were different in Banten Province, namely 4,860.39 tons (Irnawati et al., 2018).

Figure 3 shows that the potential for anchovy fishing in Bone Bay can still be increased while still paying attention to its sustainability (Safaruddin et al., 2017). Things were different in the waters of Tegal, namely from 1999-2011 there were efforts to utilize the waters that exceeded the optimum limit (Sutono & Susanto, 2016).

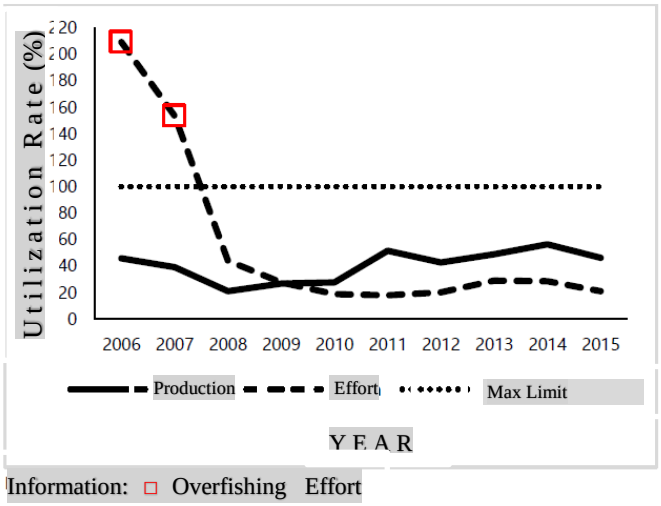

Figure 3. Production, effort, and maximum limit for anchovy fishing in Bone Bay (Safaruddin et al., 2017)

Pandeglang Regency is the center of the anchovy fishery in the province of Banten, whereas Sumur, Citeureup, and Panimbang are the principal production and processing districts. Anchovies have been exported and disseminated outside of the province (Irnawati et al., 2020).

Anchovy Nutrition Content

100g of anchovies has 74 kcal of energy, 10.3g of protein, 1.4g of fat, 4.1g of carbohydrates, 972mg of Calcium, 126.1mg of Potassium, and 3.9mg of Iron (Department of Public Nutrition, 2018). In addition, anchovies contain EPA and DHA fatty acids, namely 0.54g and 1.0g in every 100g of anchovies (Aakre et al., 2020; Sankar et al., 2013). Anchovy also contains vitamin B12, vitamin D, vitamin A, iodine, zinc, and calcium (Aakre et al., 2020). The content of amino acids in anchovies is also quite complete and is not inferior to chicken and beef (**Table 2**).

Table 2. Analysis of amino acid content in every 100g

Amino acid	**Anchovy** (Aakre et al., 2020; Swastawati et al., 2020)	**Chicken** (Alfaig et al., 2014; Wu et al., 2016)	**Beef** (Sinlae et al., 2015)
Valin	√	√	√
Leucine	√	√	√
Isoleucine	√	√	√
Phenyl-Alanine	√	√	√
Histidine	√	√	√
Metionin	√	√	√
Threonine	√	√	√
Lysine	√	√	√
Tryptophan	√	√	
Taurine	√		
Aspartic Acid	√	√	

Proline	√	√	
Tyrosine	√	√	
Glycine	√	√	
Arginine	√	√	√
Alanine	√	√	
Serine	√	√	
Cysteine		√	
Asparagine		√	
Glutamate		√	
Glutamine		√	

Vitamin E is also found in European anchovies (Engraulis encrasicolus). Vitamin E is contained in fish oil or omega-3 (n-3 PUFA). Vitamin E can be used as a building block for natural medicines or functional foods by increasing the expression of the adiponectin gene which helps regulate blood glucose in diabetes mellitus (DM) patients. The results showed that for every 5 grams of fresh anchovies, 3 ml of fish oil and 31.50 µg/g vitamin E were obtained (Mudjahidah et al., 2019).

Anchovy Diversification And Its Utilization

The form of processed anchovy varies greatly and depends on each region. Diversification of anchovy has the potential to be developed because it contains high nutritional value, a distinctive anchovy taste, and can provide added value to the product (Kari et al., 2022). The processed form of anchovy is as follows:

a. Dried Anchovy

Using the sun for drying fish with wooden racks and a plastic roof tunnel construction is regarded as the most efficient method. Low levels of microflora are accumulated in tering fish. Indicators of decomposition include FFA, TBARS, and histamine are also limited (Karim et al., 2017).

The quality of salted anchovy products in Indonesia is regulated based on SNI number: 3461.1: 2013, namely 10% maximum salt content, 60% maximum water content, 0.3% maximum acid-insoluble ash content, Salmonella and Vibrio cholerae must be negative, maximum total bacteria 10^5colonies/gram and the maximum number of Staphylococcus aureusa is 10^3colonies/gram (Junianto et al., 2022). Storage of dried anchovies at 23±2°C, 68% RH for 12 weeks did not affect the number of bacteria, biogenic amines and lipids, and dried anchovies remained microbiologically safe and of good quality (al Bulushi et al., 2020).

b. Anchovy biscuits

These biscuits are made from anchovy flour. Anchovy flour replaces wheat flour because of its more complete nutritional content. Anchovy flour contains 277 kcal, 60g protein per 100g, 2.3g fat per 100g. In addition, anchovy biscuits were proven to be able to improve the nutritional status of Rangas 1 High School students, Mamuju Regency (Thalib et al., 2021). These anchovy biscuits are also high in calcium (Nurani et al., 2018; Thalib et al., 2021).

c. *Pepes*, peanut brittle, and flour fried anchovies

Anchovies can be processed into *pepes* (processed fish wrapped in banana leaves and then baked), peanut brittle or fried in flour. When compared between fresh

anchovy and flour fried anchovy, it is obtained that flour fried anchovy is preferred. In addition, the nutritional value of flour fried anchovy is higher than fresh anchovy. This is due to the addition of flour and vegetable oil in the frying process. Flour fried anchovies have a high fat content while fresh anchovies have a high dissolved protein content. The calcium content of fresh anchovy is higher than that of flour fried anchovy (Swastawati et al., 2020).

d. *Kasuami/Kasoami*
Anchovies are often processed to become flour. Anchovy flour can be used as an addition to other processed foods to increase nutritional content. This product is made from cassava flour from Southeast Sulawesi and is often consumed by people in Buton, Wakatobi, Raha, and Bau-Bau. This product has a low protein content, so it is necessary to add anchovy flour. The best composition is 90% *kaopi* (cassava flour) and 10% anchovy flour (*Stolephorus comesonii*). The protein content of *Kasuami/Kasoami* is generally around 1.15% and after the addition of 10% anchovy flour, there is an increase to around 16.40% (Mamangkey, 2022).

e. Fish sticks (Snack from anchovies)
Anchovies (*Stolephorus sp*) are processed into high-protein snacks. Each 100g of anchovy sticks contains 434 kcal, 11.72% fat, 20.64% crude protein, 61.55% total carbohydrates, and 188.78% calcium (Kurniaty et al., 2018).

f. Toddler food supplement
This additional food preparation is a mixture of sweet potatoes, tofu, and anchovies. This food is specifically for stunted toddlers aged 1-3 years. The ratio of sweet potatoes, tofu, and anchovies that toddlers like the most is 49.6:49.6:0.8. It contains 144.2 kcal of energy, 5.1g of protein, 7.8g of fat, 13.9g of carbohydrates, 1.3g of fiber, 58.6mg of calcium, 68.6mg of phosphorus and 135.2mg of potassium (Putri et al., 2022).

g. Canned anchovies
Canned anchovies is mostly done in the Cantabria region of Spain (Laso et al., 2017).

h. Cheese Stick
This snack uses flour substitutes for white anchovy (*Stolephorus sp*) and black anchovy (*Engraulis sp*). The highest protein and calcium content was obtained at a concentration of 20% white anchovy flour or 20% black anchovy flour (Amanah et al., 2018).

i. Sambal of anchovies
This anchovy sauce is made from red chilies, shallots, garlic, shrimp paste, and dried anchovies (*Stolephorus sp*). The results showed that people's spicy tastes are different. There are 54% of people who like very spicy chili sauce, 33% who like spicy chili sauce, and 8% of people who don't like spicy (Ernawati et al., 2021).

j. Sweet-spicy crispy anchovies
Processed sweet-spicy crispy anchovies made from anchovy (Stolephorus sp). The community of Saramaake Village, East Halmahera was assisted from preparation, processing to packaging. The product is packaged in 100g sizes (Faleh et al., 2017).

Diversification of food products aims to improve the community's economy and nutrition, so it would be better if it involves the community, such as in community empowerment in diversifying anchovy products in Sorong, West Papua and in East Halmahera (Ernawati et al., 2021; Faleh et al., 2017).

In addition, anchovy waste, namely the heads, can be processed into fish meal as a mixture for quail (*Coturnix coturnix japonica*) feed. This fish meal has also been proven to increase the weight of quails so that they can reduce feed costs, and are good for the environment by utilizing waste anchovy heads (Putra et al., 2018). Anchovy waste (Engraulis encrasicolus) can also be processed into hydrolyzed protein powder. This flour is used as a food mixture (Mangano et al., 2021). Natural feed can affect the length and weight of fish (Hasan et al., 2022). And besides, if natural feed is scarce, artificial feed can be used, and it would be even better if waste such as anchovies waste could be used.

The use of anchovies in the field of research can be used as a medium. Media is a material used to grow and reproduce microorganisms. Staphylococcus aureus bacteria can grow on anchovy (*Stolephorus indicus*) media with concentrations of 2%, 3%, 4%, 5%, and 6%. However, concentrations of 3% and 6% of the colonies had the best color (Novitasari et al., 2019).

CONCLUSION

Anchovies dispersed throughout the ocean. The great nutritional value of anchovies allows for the possibility of product diversification. Anchovy-based processed items include dried anchovies, biscuits, sticks (snacks), anchovy sauce, and others. Diversification of anchovies by empowering the surrounding community is highly beneficial since it may add value, boost the local economy, and improve the nutritional value of food.

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