Pelagics: What are the opportunities and challenges?

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4 October 2023

Turid Rustad from the Norwegian University of Science and Technology provides an overview of pelagic fish and the impact of the growing global demand for food

Pelagic fish are fish that live in the pelagic zone of oceans or lakes – that is, in the open part of the oceans. The pelagic zone makes up the main part of the oceans, and therefore, a large number of species live in this zone. Some of the pelagic fish live in areas close to the coast – that is, at depths of around 200 m while other species live in the open ocean and at depths below the continental shelf.

The coastal group of fish includes anchovies, sardines, shad and menhaden, while tuna, mackerel, swordfish and sharks belong to the ocean group, however, there are no strict boundaries between the groups.

In the FAO global marine capture database, finfish represent about 85% of total marine capture production, with small pelagics as the main group, followed by gadiformes, tuna, and tuna-like species. In 2020, anchoveta was among the top species with almost 4.9 million tonnes per year, followed by Alaska pollock (Gadus chalcogrammus) at 3.5 million tonnes and skipjack tuna (Katsuwonus pelamis) at 2.8 million tonnes. Even if the unit value is low, small pelagic species, such as mackerel, herring, sardine, and anchovy made up 6.7% total value in 2020 (FAO, 2022).

The consumption of fish has increased in the last decades, from only 9kg per capita in 1961 to 20.5 kg in 2019. The increase in fish consumption is due to increased supplies but also increased incomes and changes in consumer preferences.

Pelagics as food

Pelagic fish are highly valuable as food. They have a high content of valuable and easily digestible proteins and contain essential fatty acids such as DHA, EPA, and fat-soluble vitamins (E and D). The fat content can vary over a wide range, both between species but also within species, depending on season and fishing area. There can also be large variations in fat content within one catch.

Pelagic fish are highly perishable. This is due to the high nutrient content and their neutral pH, as well as the delicate structure of the fish. Different fishing gear may cause physical damage to the fish, which again results in more rapid degradation and quality loss. The catch of pelagic fish is seasonal, and there is a need for efficient preservation and processing methods.

The high content of unsaturated lipids makes the raw material highly susceptible to oxidation, resulting both in loss of nutritional value and in the formation of off-flavours, which have a negative impact on consumer acceptance. There is a need to minimize oxidation during storage and processing. Fish proteins have a balanced amino acid composition and contain all the essential amino acids. The proteins are also important for the eating quality of the fish and fish products (water holding, gelling, texture).

The challenges of processing

During processing and storage, the proteins are susceptible to changes which can reduce both their functional and nutritional properties. Several pelagic species have a high content of histidine in the muscle. This necessitates efficient preservation to control histamine poisoning. This includes the use of efficient chilling methods – like the use of RSW or flaked ice onboard fishing vessels but also maintaining low temperatures throughout the value chain.

To preserve both lipids and proteins there is a need to develop efficient processing and storage methods that can preserve them. To preserve the lipid quality, efficient application of antioxidants is also needed. To control both microbial and enzymatic degradation, the fish need to be rapidly chilled after being caught to temperatures close to freezing, and the low temperature needs to be maintained between capture and processing.

A large part of pelagic fish – mainly small pelagic fish such as Peruvian anchoveta, menhaden, blue whiting, capelin, sardine, mackerel, and herring have traditionally been used to produce fish meal used for feed. The proportion of the world's fisheries that are processing fish meal is decreasing, and there is a higher proportion of raw materials or by-products that are used in the production of fish meal.

A hungry market

With a growing world population as well as an increase in seafood consumption, this means that we have to use more of what is caught directly for human consumption. A growing proportion of fish stocks are overfished. Fish stocks are declining, and many are overfished. There is a need to have total utilization of the catch. Using the side streams to produce food or food ingredients will increase the amount of both highly valuable proteins and lipids for a growing population.

Traditional processing methods for pelagics include smoking, canning, salting and drying. In South Africa, sardines make up more than 80% of the total catch. Around 85% of this catch is used to produce canned food.

Due to societal changes such as higher income and smaller family sizes, there has been an increase in the demand for more convenient food products. Consumers want healthy products that are safe to eat, have a high sensory quality and with a reduced content of additives. This has resulted in increased interest in new preservation methods such as high-pressure processing, the use of ultrasound, and pulsed electric fields.

Production of more convenient and ready-to-eat fish products leads to generating more byproducts or side streams such as heads and viscera. These side streams can make up 45-70% of the fish and have a high nutrient content. These byproducts can be made into fish meal and oil that are destined for feed purposes, but they could also produce protein and lipid fractions that can be used for human consumption. One method to produce both protein and oil from side streams is by using enzymatic hydrolysis, which will result in both isolated proteins and oils. The main challenges are to optimize processing conditions with regard to processing costs, yield and properties.

FAO (2022) The state of world fisheries and aquaculture 2022.
https://www.fao.org/3/cc0461en/online/cc0461en.html

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