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SOCIOECONOMIC AND ENVIRONMENTAL IMPORTANCE OF THE FISH MARKET AND FISHERIES IN SLOVENIA

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ABSTRACT

The paper analyses the importance of fisheries and the fish market in Slovenia based on primary information obtained from interviews and secondary data obtained from various sources. The study focuses on the sustainability aspects of fisheries and the fish market in Slovenia, emphasizing socioeconomic factors, problems and anomalies in the market, ecological aspects, and other sustainable development factors as environmental protection and the implementation of sustainable development measures, as well as overfishing and ineffective fisheries management. Most of shortcomings are related to the traceability of fish in the value chain, misleading customers with false information, and price-quality deception. While these findings are country-specific, they have broader implications and highlight opportunities for improving the fisheries and fish market situation in Slovenia and the international trade of fish and fishery products.

Keywords: fisheries, aquaculture, sustainability, socioeconomic factors, fraud, value chain

IMPORTANZA SOCIOECONOMICA E AMBIENTALE DEL MERCATO DEL PESCE E DELLA PESCA IN SLOVENIA

SINTESI

L'articolo analizza l'importanza della pesca e del mercato del pesce in Slovenia sulla base di informazioni primarie ottenute da interviste e dati secondari ottenuti da varie fonti. Lo studio si concentra sugli aspetti di sostenibilità della pesca e del mercato del pesce in Slovenia, sottolineando i fattori socioeconomici, i problemi e le anomalie del mercato, gli aspetti ecologici e altri fattori di sviluppo sostenibile (quali la protezione ambientale e l'attuazione di misure di sviluppo sostenibile), nonché la pesca eccessiva e la gestione inefficace della pesca. La maggior parte delle carenze sono legate alla tracciabilità del pesce nella catena del valore, all'inganno dei clienti con false informazioni e al raggio prezzo-qualità. Anche se questi risultati sono specifici per ogni nazione, hanno implicazioni più ampie ed evidenziano le opportunità per migliorare la situazione della pesca e del mercato ittico in Slovenia e il commercio internazionale del pesce e dei prodotti ittici.

Parole chiave: pesca, acquacoltura, sostenibilità, fattori socioeconomici, frode, catena del valore

INTRODUCTION

The fisheries sector in Slovenia is primarily comprised of capture marine fisheries, aquaculture of finfish (sea bass *Dicentrarchus labrax*), and farming of native freshwater species like trout and some cyprinid species. Commercial and recreational fishing is conducted at sea, while only recreational fishing is allowed in inland waters. Farming of marine and freshwater organisms (aquaculture) and catch from marine fishery are dedicated entirely to human consumption (Ministry of Agriculture, Forestry and Food, 2019). The fisheries sector also includes the processing of fishery resources into canned, dried and frozen products.

The most active fishers make up to one hundred fishing trips per year (Bolje et al., 2019). The catch from commercial marine fishers is landed in five ports: Ankaran, Koper, Izola, Strunjan, and Piran provided with a new infrastructure for landing. In 2016, most landings in the country's fishing ports were catches of sardines, whiting, sea bream, cephalopods (squid and octopus), sole, and other species in smaller quantities (Marčeta, 2016). Aquaculture products are sold to the retail market by intermediaries and, less often, in fish markets. Most of the fishery products sold on the Slovenian market are imported from abroad. Imported fishery products are destined for a variety of uses, such as processing, consumption in restaurants, sale in retail chains, and sale in small local shops (EUMOFA, 2018). Slovenia ranks rather low in the consumption of fishery products in the European Union (EU). In 2017, Slovenian inhabitants consumed on average 11.7 kg of fishery products per capita, while the EU average was 24.4 kg (EC, 2020). In 2017, the global average consumption of fishery products was 20.40 kg per capita, with a higher average due to the inclusion of more developed countries (EC, 2020). In the same year, the most commonly caught organisms in EU fisheries included Atlantic herring, Atlantic mackerel, sandeel, European sprat, blue whiting, sardines, skipjack tuna, Atlantic horse mackerel, European anchovy, Atlantic chub mackerel, Atlantic cod, European hake, yellowfin tuna, European plaice (EC, 2020). The most consumed species in the EU were tuna (mostly canned), cod, salmon, Alaska pollock, shrimp, mussels, herring, hake, squid, and mackerel (EC, 2020, 42). The worrying evidence is fast rate of global fish consumption which increased faster than any other type of animal-based food. Average global per capita fish consumption increased from 9 kg in 1961 to 20.5 kg in 2018 (FAO, 2020). While consumption is increasing, the status of marine fish stocks continues to decline, with marine fish stocks at biologically sustainable levels falling from 90% in 1974 to 65.8% in 2017 (FAO, 2020). Global capture fisheries production reached 96.4 million tons in

2018, with global aquaculture production increasing to 114.5 million tons in 2018 (FAO, 2020). Aquaculture is expected to be the main source of growth in global fish production in 2030 (FAO, 2020). Meanwhile, fish consumption is expected to increase to 18% above 2018 levels by 2030 (FAO, 2020).

There are several drivers as increasing consumers demand, resources limitations, high value of seafood and complex supply chain leading to irregularities as species substitutions, illegal, unregulated and unreported fisheries (IUU), catch method fraud (Fox et al., 2018). Fraud and problems that occur in global fish market may be similar to those in Slovenia. The Slovenian fish market is comparatively smaller, meaning that while fraud and other problems do occur, their scale is smaller. Issues of fraud and other problems in fisheries and fish market can include deception of customers, violations of environmental protection measures and sustainable development policies, poor management of fishery activities and organisations, lack of traceability of catches, lack of fishery inspectors, low customer awareness of the quality of fishery products, and other related problems (The Nature Conservancy, 2019). There are several outstanding issues and challenges in fisheries and fish market that need to be addressed in the future. Globally, the most common issues are friction between fisheries and conservation, overexploitation of fishing resources and lack of gears in poorer populations where fishing is essential for survival, the need for new and more effective fishery management methods and technologies, and the mismanagement of sustainable development initiatives (Leroy et al., 2020).

This study focused on less investigated issues on fish market in Slovenia centred on supply and sustainability of fishery products, customers habits, the perception of fraud in the Slovenian fish market and opportunities in the sector. These issues never been addressed so far, partially because fisheries sector is underrepresented in socioeconomic studies due to its low economic importance in the country. However, such studies are needed for the sector to innovate and prosper. We present findings based on respondents' answers and analysis of secondary data collected from fisheries authorities. In the last section, we review the findings, implications, and suggestions for improving the fisheries and fish market situation in Slovenia as seen from respondents' answers.

METHODS AND LITERATURE OVERVIEW

This study employs two parallel methodological approaches. The primary data collection is based on interviews with 15 different fisheries experts. In the second part of the study, we collected and analysed secondary data from different sources.

Table 1: Catch in Slovenian fisheries from 2015 to 2019 (in tonnes) (SORS, 2021a; 2021b; 2021c).

	2015	2016	2017	2018	2019
Marine catches	196.2	152.4	128.3	126.3	120.7
Marine recreational catches	6.0	14.3	12.3	11.2	13.2
Freshwater recreational catches	141.0	143.5	144.4	129.7	158.4

Our discussion integrates the primary and secondary data to explain the state of fisheries and the fish market in Slovenia. Semi-structured interviews were conducted with stakeholder experts on the supply and demand side of the fish market, as well as with representatives of the main institutions responsible for management and data collection. We contacted active stakeholders in the fish market and fisheries in Slovenia by email and asked them for a responsible person or expert in the selected organisations with whom we could conduct an interview. Interviews were conducted with experts from the following institutions: Ministry of Agriculture, Forestry and Food; National Institute of Biology, Department of Marine Biology Station; Fisheries Research Institute of Slovenia; Fisheries Inspectorate; Fisheries Association of Slovenia; Chamber of Agriculture and Forestry of Slovenia, Chamber of Commerce and Industry of Slovenia; Consumer Association of Slovenia; WWF Adria; Racoon d.o.o.; the Food Supply Chain Relationships Ombudsman; representatives of fishers. By a prior arrangement, we met with each interviewee in person and conducted interviews in the form of a semi-structured questionnaire that lasted around 45 minutes on average. The selected interviewees were informed in advance of the interview process, and we provided them with the questionnaire prior to conducting the interview so that they could be prepared in advance. Interviews consisted of 14 questions, but additional sub-questions could be asked depending on the specific area or discussion. Various explanations were added to the questions, which contributed to a better understanding of the topic itself. All responses from the interview are summarised and explained in the overview of the research. The 15 interviewees were anonymised by assigning them a designation between I1 and I15. The interviews were conducted between July 2019 and January 2020. In Table A in the Appendix we summarised the answers of all the fifteen interviewees in a systematic and shortened comparative way to provide a clear picture of the findings from the interviews. In parallel, we collected data from the Statistical Office of the Republic of Slovenia (SORS), the European Market Observatory for Fisheries and

Aquaculture (EUMOFA), the European Commission (EC) and the Directorate-General for Maritime Affairs and Fisheries (DG MARE). These data sources are used to explain the values and observed trends in fisheries-related issues in Slovenia.

RESULTS AND DISCUSSION

Semi-structured interviews and analysis of secondary data

This section summarises the respondents' answers and the secondary data in individual subsections. The in-depth subsections include information obtained in the interviews, the purpose of which was to study fisheries and the fish market in Slovenia, as well as to investigate the occurrence of fraud and problems in this area and the functioning of certain processes.

Fish market in Slovenia

The total wild catch in Slovenia in 2019 was 292.3 tonnes and total aquaculture production in the same year was 2,138.2 tonnes (SORS, 2021a; 2021b, 2021c, 2021d). The processing sector for fishery products in Slovenia had an annual turnover of €33 million in 2017 (EC, 2020). The fishery sector in Slovenia is declining in last decades and is detectable also through slowly decreasing of the total number of fishing vessels from 185 in 2010 to 137 in 2019 (SORS, 2021e).

Table 1 shows the total wild fish catch from 2015 to 2019 in Slovenia, broken down by fishery type. The economic marine catch has decreased over time due to drastic shrinkage of fishing area. Recreational marine and freshwater fisheries show an upward trend due to popularisation of this activity.

The fisheries sector still employs a decent number of people and is valuable to consumers, workers, stakeholders, and other participants. Table 2 shows the number of people employed in the fisheries sector in Slovenia, excluding the processing sector. Total employment in fisheries and aquaculture is trending downward, with the most drastic decrease observed in capture fisheries.

Table 2: Employment in capture fisheries and aquaculture in Slovenia (number of persons per year, includes all self-employed individuals and full- and part-time employees) (SORS, 2021f).

	2015	2016	2017	2018	2019
Employees in fisheries	124	101	96	89	80
Employees in aquaculture	215	212	198	199	198

Table 3: Trading volumes of fishery products in Slovenia from 2015 to 2019 (in tonnes) (SORS, 2021g).

	2015	2016	2017	2018	2019
Imports	2,401.1	2,751.3	2,787.4	3,119.6	2,985.4
Exports	333.4	280.6	476.8	526.7	803.9

Slovenian fish supply and international fishery trade (Q1)

Most interviewees (73%) agreed that the supply of fishery products is satisfactory, and respondents were convinced that the supply of fishery products is more than enough to satisfy demand. Supply also varies according to the type of fishery product: marine fishery products are more reliably supplied; freshwater fishery products depend on local fish farms. Packaged, frozen, and processed fish can be purchased in larger retail outlets throughout the country, while fresh fish products are poor outside of the major urban centres. Almost one third of interviewees (27%) add some additional comments to illustrate their opinion on fish supply. They mentioned unequal access and supply between regions as the Slovenian coast and the capital Ljubljana had reliable supplies, and that supply varies depending on the retail unit or location, with some retail chains offering more diverse supply. They also noted that the supply from fish farms is modest in terms of product diversity and could be more diverse, especially with regards to freshwater fish. Many of interviewees agreed that there are many opportunities to increase the supply of fishery products in Slovenia.

International trade is important for improving supply in Slovenia, and is also crucial to satisfy demands on fishery products in EU. We collected data on imports and exports of fishery products to illustrate trends in Slovenia (Table 3). Both import and export values show a steady upward trend, with exports increasing markedly from 2017 to 2019. However, Slovenia is not a significant exporter of fishery products, exporting much less than it imports. The countries with the largest catches and aquaculture production in 2018 were China, Indonesia, India, Vietnam, Peru, and the EU-28. In 2018, China was the world's largest fishery product producer, total-

ling 80.97 million tonnes, including wild catches and aquaculture, representing 38% of global production. By comparison, the EU-28 produced 6.66 million tonnes, including wild catch and aquaculture, representing 3% of global production (EUMOFA, 2020).

Fish demand and consumer habits in the Slovenian market (Q2 and Q3)

Almost all respondents (73%) agreed that Slovenian consumers tend to be poorly informed about the fish market, lack awareness of prices, and are unable to assess the quality of a fishery product. Most of respondents (73%) identified the lack of a fish-eating tradition and low historical fish consumption in Slovenia. According to the interviewees, local diets and restaurants could do a better job at integrating seafood products. Some of interviewees (20%) mentioned that habits vary depending on the region in Slovenia and very few Slovenians eat fish twice a week. More specific comments to illustrate the situation are that Slovenians are generally unaware of how to prepare fish, placing the blame on the lack of Slovenian recipes and cookbooks, cooking programmes on Slovenian TV do not promote fish or inform consumers on how to prepare fish, Slovenian consumers tend to prefer cleaned fish, processed fish, and fillets, with a strong customer preference for fish products that do not have bones. Favourite fish species in the country tend to be those most commonly available for sale. On the Slovenian coast, the most frequently consumed species are Patagonian squid, mussels, and grilled fish, while baked trout is the most common dish in the Slovenian interior. Consumers also appreciate canned tuna and smoked salmon. Sardines, musky octopus, and farmed mussels are among the traditional seafood organisms in the Slovenian marine fishery, while trout and carp are the most traditional freshwater species.

Most respondents thought the demand of fish products is low (40%), others either said that the demand depends on the region or they didn't have an opinion. The consumption of fishery products across EU is very variable and is related with cultural habits (Cusa et al., 2021). As shown in Figure 1, the average consumption in EU countries is 24.4 kg per person. The highest consumption is in Portugal (having the largest fishing areas), with 56.8 kg per capita, and the lowest in Hungary, with 5.6 kg per capita. The consumption of fishery products in Slovenia is much lower than average consumption in EU countries being at 11.7 kg per person.

The secondary data collected also show that fishery products are of low interest for Slovenian consumers, who spend considerably less on fishery products than consumers in other EU countries in household expenditures on fishery products (see Figure 2 and Figure 3). Figure 2 shows the differences in nominal household expenditures on fishery products across EU countries in 2019. Note that the figures are total expenditures, so they are related to the country's population size. While Italy has the highest household expenditure, Slovenia is near the bottom of the chart, just ahead of Malta, which spends the least on fishery products.

To exclude the impact of country size, Figure 3 presents per capita household expenditures for selected EU countries in 2019. The highest per capita expenditure on fishery products was recorded in Portugal, while the lowest was recorded in Hungary. Slovenia spent an average of 40 euros per person on fishery products in 2019, far less than the EU-28 average of 110 euros. In 2019, spending on fishery and aquaculture products in Slovenia lagged far behind spending on other animal meats. However, this is also the case in other EU countries (EUMOFA, 2020).

Table 4 shows the out-of-home consumption of fishery products in 2019 in different EU countries. Once again, Slovenia consumes less than its EU counterparts. The country with the highest out-of-home consumption of fishery products is Germany, while the country with the lowest out-of-home consumption is Luxembourg. However, it is worth noting that the EU countries presented, except for Luxembourg, are larger than Slovenia in terms of the size of their populations and economies.

Possible irregularities and fraud in the fish market (Q11)

Most respondents (53%) felt that the greatest difficulties in terms of fraud can occur in the processing and marketing of fishery products, 20% believe fraud is not problematic in Slovene fish market, while 27% had no opinion or think that fraud is so rare that cannot affect the fish market. According to their opinion such fraud can include the substitution of cheaper fish species for more expensive ones, the substitution of farmed fish for wild fish, and the mislabelling of

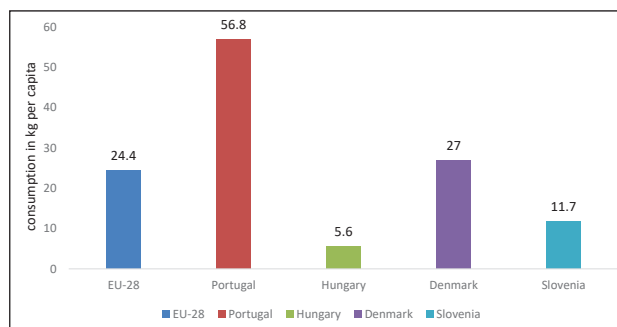


Figure 1: Consumption of fishery products in 2017 (kg per capita per year) (adapted from EC, 2020, 41).

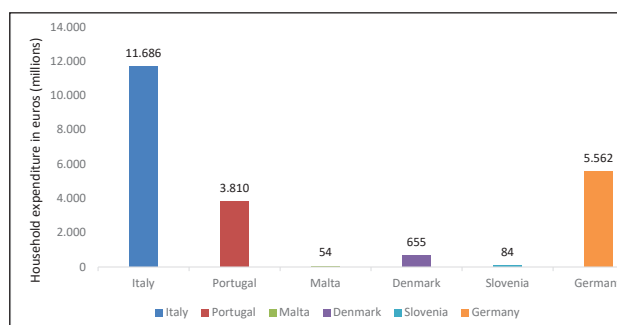


Figure 2: Nominal household expenditures on fishery products in 2019 (millions of euros, out-of-home consumption excluded) (adapted from EUMOFA, 2020).

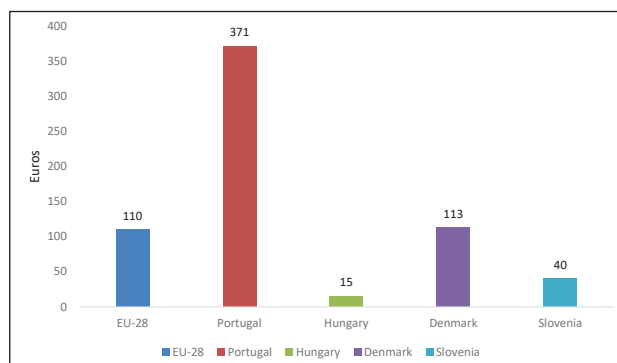


Figure 3: Nominal per capita household expenditure on fishery products in 2019 (in euros, out-of-home consumption excluded) (adapted from EUMOFA, 2020).

fishery products. In some cases, even the freshness of fish can be questioned as some fish are labelled as fresh but already show signs of ageing. These results are more in line with findings in the literature on seafood markets in other countries and international trade in fishery products (Anderson et al., 2018, Cusa et al., 2021).

Table 4: Out-of-home consumption of processed fishery products in 2019 (in 1,000 tonnes) (EUMOFA, 2020).

	Germany	Portugal	Hungary	Denmark	Slovenia	Luxembourg
Tonnes	246.6	11.2	1.3	10.2	0.8	0.5

In the Slovenian fish market, the processing and sale of fishery products are more prone to fraud than catching and farming fish. Fraud can also occur in determining the origin of fishery products, but this is more likely to be found in imported products. It is also worth noting that there are several reasons why fishery organisms may be substituted. One reason is asymmetric information: since customers do not know fishery organisms very well, sellers use the names of more commercially known species when selling lesser-known species to sell them as quickly as possible at a higher price. This is a case of intentional violation in selling. Species substitution can occur because consumers are unfamiliar and do not know how to identify fish species, moreover this is widespread problem (Cusa *et al.*, 2021; Luque & Donlan, 2019). Interviewee 17 pointed out that there is a black market for fishery products in Slovenia. All interviewees agreed that Slovenian consumers are not sufficiently informed about irregularities and violations of quality standards and fraud regulations concerning fishery products.

The violations and irregularities in the market for fishery products may have socioeconomic consequences. Some respondents were of the opinion that violations and fraud can affect the fish market and its growth, while others believed that violations and fraud are of little importance and cannot affect market growth. If fraud were to become more prominently known, it could have a negative impact on the market and affect the sales and growth of fishery products. Fear and mistrust among customers could also harm the overall growth of the fish market. Slovenia is a small country where information can spread quickly and affect the market to some extent. The Slovenian fish market is highly responsive, and thus misinformation can also be spread by journalists who write about the fish market in spite of a lack of familiarity. There is also a lack of informative articles about fisheries in the media, which could help to raise awareness and promote fisheries and their products.

During the project “DNA based technology for fraud detection in fishery products with socioeconomic impact assessment”, we examined the stock of 10 different fish sellers in seven cities, from wholesalers to small retail shops. We examined a total of 17 samples of squid for compliance with the trade name regulations for fish in Slovenia (Official Gazette, no. 46/05). We found that 10 samples were labelled in no compliance with the rules on trade names for fish, though common local names for the species were used instead of the official trade names in two cases because the common names were more familiar

to customers than the official ones. The identification of seafood is possible via DNA-based technologies and in Slovenia, DNA barcoding is commonly used to identify species on fish market upon requirements of the authority for safe food. More sensitive PCR assays (e.g. Q-PCR) are available but are not in routine use yet. The main problem is the high number of species on fish market and lack of commercial test systems. The design of new test systems is time consuming and demands expertise from several disciplines. The extent of fraud in fisheries and its socioeconomic impact is currently being investigated in Slovenia (Mavrič, 2020). One of our group’s main achievements has been developing suitable test systems for the most urgent groups, such as squids (Grbec, 2020; Rubinič, 2020).

Quality of fish and fishery products according to standards and regulations (Q5 and Q6)

Most interviewees thought that Slovenian fishery products are of good quality (80%). Quality is influenced by many factors, including the production environment, the natural environment where the wild fish are caught, and processing methods. Low-quality fishery products have a greater chance of appearing to be less fresh or may be sold as frozen or processed products to cover up low quality. Consumers often do not know how to determine the quality of fishery products offered and often overspend on purchases as a result. Increasing consumers’ knowledge of fishery products will result in this happening less often. However, even with experience, it is difficult to determine the quality of certain processed fishery products. In addition, price and quality are not always correlated. Some products are cheaper even though there is nothing wrong with them, and their quality may be the same as more expensive products.

Most diverse answers were received on legislation issues; one third (33%) of interviewees replied that legislation is appropriate for fish market in Slovenia, while one third think should be improved and a third replied that legislation is too restrictive. In more detailed answers interviewees expressed that legislation could be improved in certain areas and current legislation has some limitations that make it difficult to perform certain tasks in fisheries. Interviewees felt that legislation placed undue limitations on fish farmers and fishers, stating that legislation should be more in line with the actual situation in the fisheries sector. Other shortcomings were mentioned regarding the traceability of fishery products, declarations and labelling, sale of fresh products, assessment of product quality and monitoring.

Table 5: Aquaculture production in Slovenia (in tonnes per year) (SORS, 2021d).

	2015	2016	2017	2018	2019
Aquaculture total	1,590.0	1,825.9	1,729.6	1,937.7	2,138.2
Freshwater aquaculture	958.9	1,161.7	1,003.7	1,254.2	1,224.6
Mariculture	631.1	664.2	725.9	683.5	913.6

Aquaculture and fish farming in Slovenia (Q7)

Marine finfish farming has been decreasing due to the lack of space and unfavourable conditions for aquaculture development along the Slovenian coast (Flander-Putrlje *et al.*, 2020). Indeed, there is currently only one company engaged in marine fish farming in the country. Most respondents (60%) confirmed that aquaculture activities are increasing, especially in mussel farming. Mussel farming is increasing, and there is still room for development, especially given the high demand for mussels. The conditions for farming mussels are more favourable than for fish, and these farms have a very low environmental impact since mussels are filter-feeding organisms.

Development opportunities exist for freshwater fish farming and closed aquaculture facilities. Fish farms in Slovenia are divided into farms for cold-water species such as trout and those for warm-water species such as carp. Cold-water species are mainly farmed in the Gorenjska and Dolenjska regions and the interior of the country. Warm-water species are farmed in the eastern regions of Štajerska and Prekmurje. Further potential to develop freshwater aquaculture in Slovenia is through aquaculture farmers starting to sell more of their products to retail chains to make them available to a wider range of consumers. The challenge, however, is that the distance between the fish farms and urban centres results in high transport costs and expensive logistics for shopping centres. Few measures exist to encourage more young people to start aquaculture businesses. There are also opportunities to create links between fishers and mussel farmers. Fishers could reduce the damage caused by fish-eating farmed mussels by fishing near mussel farms. The development of closed rearing systems also has potential, but the technology is currently very expensive. Water recycling systems for fish farms could help develop additional freshwater aquaculture in Slovenia. This technology purifies water and reduces the water needed for fish farming. However, the problem is the expensive initial investment in technology compared to traditional flowing fish farms. There are also opportunities for farming new species of fish that can be attractive and affordable options for consumers. For example, companies such as Mytilus and ProSub farm and sell species such as clams and oysters, which fetch a higher price than mussels. Organic aquaculture has not

yet been implemented in Slovenia because it is still too expensive for Slovenian fish farmers. Most respondents named rainbow trout, brown trout, and carp as the most common farmed freshwater species, while the most common marine species were sea bream, sea bass, and mussels. Most respondents felt that consumers would not notice the differences between a wild-caught fish and a farmed fish aside from the lower prices of farmed fish. Respondents assumed that the better-informed and more demanding consumers along the Slovenian coast would be more able to tell the difference between farmed and wild-caught fish. Consumers tend to value caught fish more than farmed fish. Respondents varied in their opinions, with some saying that caught fish is of much better quality, while others believed that farmed fish could also be of good quality if the farming process were suitable and well managed.

Table 5 shows the aquaculture production in Slovenia between 2015 and 2019. Both freshwater and marine aquaculture are slowly increasing, though production is higher in freshwater aquaculture due to the limited space for mariculture along Slovenia's short coastline.

Processing, marketing, and trademarks of fishery products (Q8)

Respondents in majority (60%) agreed that processing of fishery products is satisfactory by number of companies in the field, but opinions differed among the respondents concerning future opportunities for seafood processing in Slovenia. Some believed that such opportunities existed, while others believed that the area was not promising. Others added that seafood processing is not a developed industry in Slovenia at all. There is significant competition in the seafood processing industry from abroad, and some products are simply not profitable to process in Slovenia. According to the respondents, most processing companies in Slovenia are smaller, local, and boutique oriented, except for Delamaris, a larger processor. Opportunities are most promising in the processing of freshwater fish and mussels. Processing fishery products adds new value to products and can make a product more attractive to the market. The only trademarked brand of which the respondents were aware was Piranski brancin, owned by the Fonda company. Other Slovenian trademarks for fishery

products are owned by the following companies: Prosub, Mytilus, Aquaculture Goričar, Faronika (Tolmin Fishing Association), G20, and Rival. Most of these companies are active in aquaculture. They have a diverse range of products, offering both domestic species and imported products. The following companies are involved in processing in Slovenia: Delamaris, Droga Kolinska, Prosub, Goričar, Cerkvnik, Rival, Fonda, Mytilus, and some smaller local processing companies.

Sustainable development and ecological practices in fishery (Q4)

Most of respondents (73%) agreed that sustainable development is sufficiently implemented in fisheries, while others recall some unsustainability practices or uncertainties due to lack of studies to prove this issue and pointed out more investments into sustainability practices. Responses regarding sustainable development and ecological practices in fisheries were mixed. Some respondents said that sustainable development is not sufficiently implemented in fisheries, while others disagreed. Most respondents agreed that bottom otter trawls are harmful to the seabed, that the Adriatic Sea is overfished, and that fish stocks have been depleted. Historical overfishing and degradation of coastal ecosystems have also been noted in other countries (Jackson *et al.*, 2001). Prolonged fishing restrictions could help fish stocks to recover, though this creates social problems due to loss of income among fishers and other people involved in the fishery value chain. A few interviewees noted that Slovenia shares the northern Adriatic Sea with two other countries that should cooperate more on sustainability issues. Since Slovenia owns a very small part of the sea, the interviewees noted that its influence on the Adriatic Sea is limited. There are several parameters which influence on sustainability in fishery as overfishing, habitat modification, climate change, pollution, ecosystem changes, and diseases (Asche *et al.*, 2018). In the last two decades fishery in the Northern Adriatic is faced with extensive jellyfish blooms, and during certain periods fishing was impossible and economic loss was estimated (Palmieri *et al.*, 2014).

Fishery and tourism (Q9)

Respondents mentioned that the link between fisheries and tourism might be promising and agreed in (46%), and slightly smaller percentage replied that intertwining with tourism should be better (40%), and (13%) have no opinion on this issue. Fishing tourism in Slovenia is not currently well developed and was identified by most respondents as a promising growth area and such activities may help attract more tourists and provide additional income to practitioners. Places where fishing is linked to tourism are along the major Slovenian rivers, lakes, coastal towns, and in areas with fish farms and commercial ponds. Among inland waters, fishing is connected with tourism along the

Soča, Sava, and Kolpa Rivers and around Lake Bohinj. This result is in line with Mihalič *et al.* (2014) findings on the diversification of fisheries and the development of fishing tourism along the Slovenian coast.

There are some good practices on the Slovenian coast or in freshwater aquaculture mentioned by responders and described as follows. Along Slovenian coast fishing tourism is run by fishers who take tourists for recreational fishing excursions and fishing picnics. At fishing picnics, the fisherman shows the tourists the fishing techniques and later prepares a meal with the catch. If there was no catch, the guide has other fish and molluscs in stock, which he prepares. More and more fishers are getting involved in tourism activities because their fishing income is too low, and they are looking for additional income opportunities. Such diversification is partially due to the depletion of fish stocks in the Adriatic Sea. Fishing now requires more inputs (fuel and time), making tourism a more attractive option. Fishers often spend half a year fishing and half a year on tourism activities, as both cannot be practised at the same time due to legal restrictions and technical constraints (small vessels, ensuring safety on board). A good example of a business that links fishing and tourism is the Fonda fish farm, where tourists visit their fish farm at sea on their boat (Janeš *et al.*, 2017). Similar practices are carried out by mussel farmers, where tourists visit the mussel farms by boat and then enjoy a tasting of shellfish dishes. Fishing competitions for large marine fish are held on the Slovenian coast and attract fishers from Italy and Croatia. An interviewee added that fishing tourism attracts demanding guests who spend more money than other tourists do.

Fish farmers and fishing associations in fresh waters cooperate with tourism associations and municipalities to implement these projects. The most successful such project is in the town of Kobarid, where the festival of Soča trout (Festival soške postrvi) takes place. Another project that is worth mentioning is the fly-fishing festival organised in Bohinj. These fish festivals demonstrate various fishing-related activities that may be of interest to tourists. Usually, these activities include demonstrations of fly fishing, tasting of fish dishes, learning about different kinds in which different groups (e.g. children) can participate in fun activities and music programmes. Fish farmers manage farming ponds as an additional activity or in conjunction with others. For example, a pond manager might allow recreational fishing and purchase of the catch. Restaurants near some ponds may allow guests to catch fish themselves from the pond, and the restaurant would then prepare them to order. Good examples of commercial ponds can be found in Kamnik, Naklo, and near Ptuj.

Expected trends in the Slovenian fish market (Q10)

Most respondents (73%) felt that there is room for development in the Slovenian fish market, while 26% believed that fish market is stagnating, and the rest have no opinion. However, developing commercial fisheries

remains a challenge as fish stocks in the Adriatic Sea are overfished. One approach mentioned was for Slovenian fishers to sell more of their catch in Slovenia since most of their catch is currently sold to Italy.

73% of respondents believe that fish market will develop in the future, most respondents felt that mussel farming at sea would increase. Mussel farms have some growth potential, including for new processing plants to help the sector to develop. Most respondents said that commercial marine fishing will continue to decline, with fewer commercial fishers overall and more fishers who combine their activities with tourism and other potential sectors where they can earn additional income. Respondents expected a further decline in catches as fish stocks are overfished in the Adriatic Sea. Despite the decline in commercial fishing, they believed that there would be a will to maintain this activity because of its history and tradition. Marine fish farming still has some potential for development, with the possibility of farming new species, but the potential increase in the extent of fish farming at sea is limited and has less growth potential. This is due to the lack of space along Slovenia's small coast. Respondents believed that freshwater aquaculture would continue to develop. Freshwater fish farming may continue to grow in number with the possibility of creating more value through local processing. Some interviewees mentioned that there could be problems due to warming waters and other consequences of climate change, with one interviewee suggesting a greater shift to freshwater fish such as catfish or tilapia. Other development opportunities could include the establishment of aquaponics facilities for carp farming. Potential opportunities to increase the consumption of fishery products exist in public settings, for example, schools and nurseries, where there is an opportunity to encourage children's eating habits. It is very likely that the number of imported fishery products will increase, which would hurt the local economy. In order to increase the consumption of fishery products, it will be necessary to raise consumer awareness and promote fishery products in the long term, which may take up to fifteen years. Opportunities for growth in fishery product processing exist only at the local and boutique levels. Larger industrial facilities are not feasible in Slovenia because there is not enough caught or farmed fish in the country for large-scale processing. Given the strength of competition in the seafood processing industry (Galati *et al.*, 2020), smaller Slovenian companies have little chance against foreign competition in the domestic and international markets.

Suggestions for improving the Slovenian fishery market and the socioeconomic conditions in the fishery sector

Most respondents agreed that consumers in the fisheries market need more awareness, education, and motivation. More promotion of fish and fishery products is needed and must be implemented in the long term. Such major behavioural changes in the fisheries market may take up

to fifteen years to realise, so promotional projects need to be on a long term. Public institutions such as schools and nurseries should also incorporate information on fisheries into education and integrate fishery products into their menus, as this is an opportunity to change local eating habits. Consumers need to be informed about different aspects of fishery products. Awareness-raising activities should focus on how to identify fish species, the fishing season in Slovenia, and cooking with local fish. However, knowledge about seafood may not be enough to expect more sustainable consumption (Almeida *et al.*, 2015). It is also important to consider different socioeconomic factors such as the level of individual or household income, different consumer preferences, and labelling in order to provide consumers with accurate information and build trust into fishery products (Mavrič *et al.*, 2020; Altintzoglou and Nøstvold, 2014).

There are also opportunities to produce innovative products that could be more attractive to consumers. Companies already active in the fishery market require additional motivation, and new entrepreneurs need to be incentivised to enter the fishery market, especially in freshwater aquaculture and fish processing. Consumers should also be encouraged to purchase less common species, including bycatch. Restaurants and caterers should include more new fish species in their menus. A further option is the encouragement of new, specialised fish restaurants.

Demand and supply for local Slovenian fishery products appear to be mismatched, as consumers do not have a strong preference for locally caught or farmed fish and are not willing to pay a higher price than Slovenian fishers can obtain by selling abroad. Therefore, consumers should be encouraged to buy local fishery products, and conditions for selling local fishery products on the Slovenian market should also be improved, including closing the quality-price gap, an important factor behind Slovenian fishers selling most of their catch to Italy. Selling fish on the Slovenian market could fetch higher prices if these products were advertised as local and indigenous, representing an opportunity to develop new brands. A major problem in the fisheries sector is the small number of commercial fishers and their small fleet. This is also a challenge for small-scale fisheries in other Mediterranean coastal communities, including neighbouring Italy (Malorgio *et al.*, 2017). Some commercial fishers engage in fishing only to receive various subsidies and financial bonuses. Associations of fishers in Slovenia are poorly organised. Better organisation among fishers and fish producers would allow them to increase economies of scale and improve marketing channels to obtain higher prices for their products in the Slovenian fisheries market. However, this may not be the case if there is a lack of quality, innovation, and efficiency in the agri-food value chain (Pennerstorfer & Weiss, 2013). Some respondents believed that the state of fish stocks in the Slovenian sea would improve if all fishing activities were restricted for a certain period and fishers were redirected to other activities such as tourism.

There is a lack of public awareness of the quality of freshwater fish species, which can be just as high as marine species. Species such as carp, northern pike, and pikeperch are not well known, and increasing demand for these species is one potential area to investigate. European funds, including the European Fisheries Fund, has not been used effectively enough and has had little impact on the fisheries market in Slovenia. New measures are needed to encourage young people to get involved in aquaculture. Such measures should also encourage greater production, construction of new fish farms, and the promotion of fishery products. To further develop aquaculture, fish farmers need positive partnerships with fish value chains and retail chains to offer their products, as most consumers shop at larger retail outlets. Good production practices and short supply chains will be necessary for aquaculture to ensure the growth of this industry. It may also be important to consider stakeholder preferences on the potential benefits of diversified small-scale fisheries activities and investigate lessons learned and best practices from similar experiences abroad (cf. Vindigni *et al.*, 2020).

Fisheries and the fish market in Slovenia affect several sectors, such as employment, education, tourism, the environment, and sustainable development. Preserving the environment, supporting economic fisheries and aquaculture, investing in new environmentally friendly technologies, and creating new jobs in fisheries-related sectors are all possible proposals we could put forward to improve the Slovenian fisheries market. However, the most important suggestion we can make concerns about the eating habits of Slovenians concerning fish and seafood. Slovenians should eat more fish since it is a healthy food source and is easier to digest than beef or pork.

CONCLUSION

The fish market in Slovenia is limited in economic gains, yet it is important for participants in the fisheries value chain. Slovenian fisheries are divided into commercial fisheries (small-scale fisheries), aquaculture, processing and marketing of fishery products, and recreational fisheries, which are closely linked to tourism. Due to overfishing and high exploitation pressures in the Adriatic Sea, commercial fishing has suffered and is declining. Aquaculture in Slovenia is divided into freshwater aquaculture (trout and carp) and marine aquaculture (sea bass and mussels). Freshwater aquaculture and mussel farming have the best growth opportunities as local conditions are most favourable, although problems caused by climate change may affect these activities. As the most environmentally friendly option, mussel farming likely has the greatest growth opportunities. Marine aquaculture has limited development potential because coastal space for the establishment of new fish farms is quite limited. Opportunities do exist in the processing and marketing areas, especially for smaller

niche farms. There are also opportunities to create new innovative products and offer new species of fish. On the Slovenian market, conditions do not exist for the development of a larger industrial processing company, mainly because of strong competition from abroad and the lack of constant sources of fish. If the consumption of fishery products in Slovenia increases, the fish market will shift toward imported fishery products, while only informed and conscious consumers will seek fish and fishery products from local producers.

Throughout the interview process, interviewees repeatedly mentioned the importance of promoting the consumption of fishery products. The situation in the Slovenian fishery market can be improved by providing the right information to the public. Promotion of consumption and education campaigns about local fishery products are too short-lived in Slovenia to achieve visible results. The promotion of fishery products needs to be more long-term to change consumers' dietary habits. Consumers need to be motivated and educated so that they can buy quality products at reasonable prices and so that they know how to cook fish to make a good meal. Most consumers are not used to consuming fishery products, so consumer education and spreading awareness are necessary to achieve higher consumption levels.

One suggestion that would help consumers with awareness is a website where consumers can view information about fishery products and trends in the fishery market. The website could promote local suppliers of fishery products, which would help local fishers and fish farmers. Such a website would inform consumers on how to prepare quality meals and warn them of possible fraudulent practices in the market and possible pitfalls. Consumers would thus have all the information about the fishery in one place. It would be possible to link to the Slovenian Consumers' Association website, which would share information on the various tests and recommendations for fishery products.

Options for growth in the fisheries market in Slovenia do exist, but the country's natural environment limits the scope of such possibilities for the sector. Climate change and the scarcity of fishery resources in the Adriatic Sea may negatively impact the fishery market. In the next decade, the fisheries sector will have to focus even more on sustainable development with minimal impact on the natural environment.

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APPENDIX

Table A. The simplified summary of interviewees answers.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
	Is the supply of fishery products satisfactory?	Is the demand for fishery products satisfactory?	Are the consumer habits in relation to fishery products poor?	Is sustainability implemented enough in the Slovenian fishery market?	Is the legislation for the fishery market appropriate?	Is the quality of fishery products satisfactory?	Is the development of aquaculture increasing?	Is the processing of fishery products satisfactory?	Is the connection between tourism and fishing satisfactory?	Will the fishery market in Slovenia develop in the next 10 years?	Can the possible frauds affect the fishery market?
11	Yes, but depends on the region	Didn't know	Yes, rather poor	Yes, but could be improved	Yes	Acceptable (yes)	Yes, but shellfish farming	Could be better	Yes	Yes, but only shellfish farming	Yes
12	Yes	Didn't know	Yes, no tradition	Yes	Could be improved	Yes	Yes	Satisfactory number of companies in this segment (yes)	Yes	Yes, but only Aquaculture	No, but would if there would be more cases
13	Yes, but problems with fresh products	Didn't know	Yes	Yes	Yes	Yes, but not for fresh products	Yes, but shellfish farming	Yes, but only from imported fishery products	Didn't know	Yes, but only aquaculture	Didn't know
14	Yes	The supply is higher than the demand (demand is low)	Yes, eating low quantities of fish	Didn't know, but said there were some unsustainable practices	Yes	Yes	Yes, slowly increasing	Knew only few fishery processing companies	Didn't know	Yes, but only niche segments	Yes
15	Yes	Demand is rising slowly (demand is low)	Yes, no eating habits	No studies to know exactly	No, too restrictive	Yes	Stagnating	Yes, but could be improved	Yes	Yes, but only aquaculture	Yes, but for a short time period
16	Yes	Demand is low	Yes, relatively bad	Yes	Could be improved	Yes	Stagnating	Yes, but only from imported fishery products	It's well connected already (yes)	Yes	Yes
17	Yes	Demand is fluctuating (demand is low)	Only better on the Slovenian coast	Yes, but is limited	Could be improved	Yes	Increasing, mostly shellfish farming	Yes, but mostly from fishery products	Yes, some connections already	Yes, but only shellfish farming	Yes
18	Depends on the region	Depends on the region	Better on the Slovenian coast otherwise poor habits	Yes	No, too restrictive	Mostly yes	Increasing, mostly shellfish farming	Yes, but could be better	Yes, but should be better	No, the market will change to importing products	Not enough cases to affect the market (no)
19	Limited offer	Depends on the region	Yes, but depends on the region	Yes	Yes	Yes, but the processed products can be of lower quality	Didn't specify, but said could be improved	Yes, but additional development chances are limited	Yes, some connections already	Yes, but in limited scope	Didn't specify, but said frauds should be sanctioned
110	Yes	Higher demand in the tourist active months	Yes, mostly poor, better on the Slovenian coast	Yes	No, too restrictive	Yes	Increasing	Yes, but could be better	Should be better	Yes, but only aquaculture	Not enough cases to affect the market (no)
111	Yes	Demand is high only for commercial known species	Yes, very poor	Could be improved, not enough investments into sustainability	No, repressive for participances on the market	Yes	Didn't know	Didn't know	Should be better	No, the market will change to importing products	No
112	Yes	Demand could be higher (demand is low)	Didn't know	Didn't know	Yes	Depends, every product is different	Not enough development, could be improved	Yes	Some connections, but not well developed	No, unless there is a long-term strategy	No
113	The offer could be more diverse	Demand is rising	Yes, should eat more fishery products	Yes, but could be improved	Should be reviewed and improved	Yes	Increasing	Yes, but will increase if demand will increase	Yes, but should be better	Yes, but we need better promotion	Yes
114	Yes	Didn't know	Better on the Slovenian coast otherwise poor	Yes, but could be improved	Should be improved	Didn't know	Increased, but mostly shellfish farming	Mostly smaller and local processing companies, all other is imported (Not satisfactory)	Some connections already, but should be better	Depends on the natural resources	Yes
115	The offer could be better	The demand is low	Yes	Yes	No, too restrictive	Yes	Stagnating	Very small numbers of companies for processing Slovenian fishery products, mostly is imported (not satisfactory)	Some connections already, but is not satisfactory (should be better)	Yes, slowly will increase	Yes

SOCIO-EKONOMSKI IN OKOLJEVARSTVENI POMEN TRGA RIB IN RIBIŠTVA V SLOVENIJI

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POVZETEK

Prispevek analizira pomen ribištva in trga rib v Sloveniji iz primarnih podatkov, pridobljenih iz intervjujev ter iz drugotnih podatkov iz različnih virov. Raziskovanje se osredotoča na trajnostne vidike ribištva in trga rib v Sloveniji s poudarkom na socio-ekonomskih dejavnikih, težavah in odstopanjih na trgu, ekoloških vidikih ter drugih dejavnikih trajnostnega razvoja kot so varovanje okolja in izvajanje trajnostnega razvoja, prelov in nekateri neučinkoviti ukrepi v upravljanju ribištva. Sladkovodna akvakultura in gojenje školjk na morju sta po mnenju intervjuvancev najbolj obetavni panogi glede na lokalne razmere, ki ju lahko prizadenejo klimatske spremembe. Majhni nišni pridelovalci imajo možnosti v razvoju novih inovativnih produktov, predelavi in oglaševanju ter vzreji novih vrst. Razvoj večjih predelovalnih obratov ni možen zaradi velike kompeticije na trgu rib in premajhnega stalnega vira rib. Povečano povpraševanje po ribjih proizvodih bo povzročilo večji uvoz, medtem ko bodo le osveščeni kupci povpraševali po lokalnih ribah in ribjih proizvodih. Izpostavljena je potreba po stalnem oglaševanju in osveščanju kupcev o lokalnih ribiških proizvodih, kar bi spodbudilo večjo porabo lokalnih ribiških proizvodov. Nujno je skupno oglaševanje lokalnih dobaviteljev ribiških proizvodov, prikaz pravilne priprave rib ter osveščanje o možnih poneverbah in slabostih na trgu rib. Večina pomanjkljivosti na tem področju je bila zaznana v sledljivosti rib v vrednosti verigi, goljufanju kupcev z napačnimi informacijami in cenovno-kakovostnimi zavajanjem. Kršitve, ki se pojavljajo na ribiškem trgu, so zamenjave ribolovnih vrst, pogosto manj cenjene z bolj cenjenimi, zamenjave ulovljenih rib z gojenimi, neustrezno označevanje, sveže ribe pogosto niso resnično sveže, pojavljajo se lahko sporne prakse v predelavi in prodaji, v določenih primerih je težko ugotoviti lokacijo vzreje ali ribolova rib. Večina intervjuvancev je menila, da je ponudba večja kot povpraševanje. Povpraševanje po ribiških izdelkih je večje na Obali in v večjih mestih, predvsem v Ljubljani. Izkazalo se je, da je ozaveščenost potrošnikov v Sloveniji slaba, večine možnih kršitev ne poznajo, potrošniki slabo poznajo ribolovne vrste in ne prepoznajo kakovosti ponudbe. Intervjuvanci so poznali omejitve glede ribolovnih orodij, časa ribolova in velikosti ulovljenih rib, a so bili mnenja da se kljub temu povzroča škoda morskemu okolju. Veliko intervjuvancev je menilo, da je investicij v trajnostni razvoj premalo ali so neučinkovite, saj niso videli zadostnega učinka. Edini način za okrepitev staležev rib v slovenskem morju, je zaustavitev ribolova za določeno obdobje, ki je zaradi socialnih in ekonomskih razlogov težko uresničljiva. Predstavljene ugotovitve so specifične, a imajo širše implikacije za izboljšanje stanja v ribištvu in na trgu rib v Sloveniji ter v mednarodni trgovini rib in ribiških izdelkov.

Ključne besede: ribištvo, akvakultura, trajnost, socio-ekonomski dejavniki, zavajanja, oskrbna veriga

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