



Interreg
Italy - Croatia
AdriAquaNet



EUROPEAN UNION

AdriAquaNet

Enhancing Innovation
and Sustainability in
Adriatic Aquaculture



MID TERM TECHNICAL-SCIENTIFIC REPORT OF **WP5**

Period: 01.01.2019-30.06.2020



The challenge

Adriatic mariculture provides highly valued fish products for both local and distant markets. This sector can further develop thanks to new available technologies and stronger information for consumers. The sector can offer high qualification job opportunities and boost local economy.

The team

Within **AdriAquaNet** project, **4 industries**, **1 consortium** and **6 research laboratories** from both **Italy** and **Croatia** are teaming up to develop and apply technologies for fish farming and marketing. This is the first ever initiative for improving the quality of fish farming and marketing by cooperation between both sides of the Adriatic Sea.

Partners



THE MID TERM TECHNICAL-SCIENTIFIC REPORT

It is a deliverable of WP2.2 due on 30.06.2020 (3rd report) and it was postponed to be delivered with the PR4. Its aim is to show the progress and achievements (state-of-the art) in WP3-4-5 to the project stakeholders (administrative professionals, SMEs and associations, consumers). At the end of the project, this mid-term will be refined in order to prepare the final technical-scientific report. The report will support the scientific management of the project's activities. Scientific Board and the WP leaders (LP, PP1, PP3) are responsible for the content, while LP supervises the work of all WPs. LP supervises all WPs. PP2 assists in formatting, editing and using contents for WP2.

GOAL 1
New approaches to improve fish nutrition and ensure efficient waste management

the fish farm

ACTIONS

- Implement novel feeds to improve farmed fish welfare
- Provide tailored feeding protocols to allow an innovative food management
- Provide new technologies to improve energy saving and farm environmental footprint

GOAL 2
New strategies to enhance fish health and welfare

the fish doctor

ACTIONS

- Develop new vaccines/ vaccination strategies
- Test novel probiotics/ nutraceuticals for controlling infectious diseases
- Develop easy, rapid and effective methods to assess fish welfare

GOAL 3
New fish products for different classes of consumers

the fish market

ACTIONS

- Apply new technologies to develop high-quality fish products
- Transfer knowledge to SMEs for improving the quality of fish products and their marketing
- Promote to consumers the nutritional value of farmed fish and health benefits of its consumption

WP 5

IMPROVING QUALITY AND MARKETING OF FRESH PROCESSED FISH

WP 5 Leader

Snježana Zrnčić

Croatian Veterinary Institute, Zagreb, Croatia

1. OBJECTIVES, APPROACH & ACTIVITIES

The objectives of this WP are:

1. **to produce scientific proofs on the quality** including sanitary aspect and nutritive composition of the fresh farmed sea bass and sea bream and compare it with the quality of the same species from fishermen's catch;
2. **to test possibilities of extension of the shelf-life of fresh fish**, to create new products such as cold-smoked fish fillets and hamburgers made of sea bream and sea bass meat and test the new approach in extensions of shelf-life on the products;
3. **to survey the perception of different groups of consumers** (general consumers, consumers in catering facilities and managers of marketing facilities) in both Italy and Croatia and create marketing plans for the fish farming industry;
4. **to promote the results of the research to stakeholders** (general public, target groups among general public such as children, elder population and athletes, professionals, fish farmers and catering).

The activity plan and timeframe were created among scientific (LP, PP1, PP2, PP3 & PP5) and industrial (PP8, PP11 & PP12) partners at the beginning of the project implementation and it included a sampling plan for microbiological and chemical analysis, for testing shelf-life and delivery of fish for trial production. A strategy to be used for market research and promotion and design of the experimental protocol was set up. During the first semester, PP1 analysed the relevant references, studied the available literature data and evaluated their laboratory methods for application in the analysis anticipated in the project plan in task 5.1. Samples of market sized fish were processed according to the project plan as validation of the methods. Preliminary activities were carried out by LP and the decision to develop a new product was switched from sausages to hamburger made of sea bass and sea bream. Product as smoked fillet of sea bream and the sea bass was developed and their quality analysed. PP5 developed the questionnaire on the preferences of fish consumers pertaining

to the wild and farmed fish in the Croatian language and a test was performed among the partner in the project. According to the results of the test, the authors corrected the questionnaire and performed the survey. During the following periods, partners carried out analysis aimed at evaluating the sanitary and nutritive quality of market sized sea bream and sea bass farmed at PP8 and PP10 as well as at comparing them with marked sized sea bream (PP10) and sea bass provided by subcontractor I-Riba, over different periods of the year (in summer, autumn, winter, spring). The analysis of the sensory and microbiological quality and shelf life of fresh fish and fish fillets preserved in modified atmosphere (MAP) package, vacuum package and package with protective bacterial cultures carried out. The strategy to be used for market research and promotion was carried out and the experimental protocol was proposed and successfully tested the methodology for public opinion surveillance. The results of the physical-chemical, microbiological and sensorial analysis should scientifically demonstrate the sensory, safety and high nutritional quality of farmed fish and enable the comparison with fish obtained from fishing activity. The analytical results will provide the basic information for market promotion and will be transferred to increase the SMEs competitiveness. During the third reporting period, activities on testing the sanitary quality and nutritive quality of the market sized farmed sea bream and sea bass provided by PP8 and PP10 and their comparison with marked sized sea bream (PP10) and sea bass originated from the fishermen's catch provided by PP1 subcontractor I-Riba. Analysis of the nutritional quality of the fish fillets provided from the feeding experiments within WP3.1. have assisted to continue farm experiments in the most optimum way. In addition, the improvement and analyses of the sensory and microbiological quality and shelf life of fresh fish and testing the same parameters in MAP package, in vacuum package and in a package with the addition of protective bacterial cultures has been done. In activity 5.3. marketing research among the general public (consumers) have been completed both in Croatia and Italy and consumers' attitudes have been set up. **Croatian consumers like to eat fish, it is quite expensive, have prejudices about farmed marine fish but they are interested in sustainable fish and further**

education in fish consumption. Italian consumers like to eat fish, have prejudices about farmed fish but are interested in sustainably farmed fish. The activities are at the point of collecting the results of analysis needed to scientifically demonstrate the sensory, safety and high nutritional quality of fish raised in aquaculture and to compare it with the same species obtained from fishermen's catch. The completion of the analysis will provide the basic information which will be used in market promotion and will be transferred to increase the SMEs competitiveness. During this period a **Manual of raw meat standardisation for fish production and product safety** has been completed containing chapters on the Sanitary safety of fresh fish, Possible chemical contaminants of fresh fish, Sensory features of fresh fish, Nutritional quality of fish and Human health benefits associated with fish consumption.

2. EXPECTED RESULTS

Gathered results of all tasks within the WP5 should contribute to the enlightening of the microbiological, chemical and nutritious properties of farmed sea bass and sea bream with highlighting the health benefits not theoretically but based on the calculated health indices. All samples collected and analysed during the last three semesters of the project implementation were tested for numerous parameters. The basic sanitary parameters included microbiological analysis for the presence of total aerobic count, the content of *Pseudomonas* spp., Lactic acid bacteria, Enterococci, Total coliforms, Faecal coliforms, *Enterobacteriaceae* and *Clostridia* and physio-chemical analysis such as pH, TVB-N (Total volatile basic nitrogen) and TBARS (Thiobarbituric acid reactive substances) were set up as indicators of sanitary quality. The shelf life was determined in the fresh fish and during the storage and the optimal packing options were determined for freshly gutted fish; separately sea bass and sea bream. Different package options were tested such as vacuum package, modified atmosphere package and addition of bacterial culture starters with an aim to extend the shelf life of the fresh fish and fish products. New products, cold smoked sea bream and sea bass fillets were produced and their shelf life tested in different packages:

vacuum, MAP and with the addition of protective bacterial cultures. Since many of these parameters are still in testing and analysing numerical and statistical analysis of the duration of fresh fish and fish products under different types of packages will be disclosed in the deliverable at the end of the project. When it comes to the results of sensory and chemical properties most analyses have been completed and results should be analysed to compare nutritional quality over the year and to compare the quality of farmed and wild fish of the same species. Health indices are calculated based on the shares of fatty acids for a particular time of year and should be compared during the year and between farmed and wild fish. All these data will be used as a baseline for the marketing and promotion of Adriatic aquaculture. Some results of the market research have already been and yielded with analysis of general public perceptions of fish consumption. It was concluded that fish is consumed most often once a week at home in Italy and that consumers prefer to buy fresh cleaned fish. They are eating fisheries products in catering facilities 2 to 3 times per month and prefer sea bream and sea bass followed by cephalopods. Most respondents believe that wild fish is of superior quality compared to farmed fish. They are very interested in production method and place of farming, country of origin and its shelf life. Italian consumers showed great interest to purchase fish from sustainable aquaculture. Additional surveillance has been done among customers in catering facilities and manager of customer facilities but data will be analysed and the conclusion obtained will pave the way for how to structure the promotion and marketing campaign. For the moment most of the event for SMEs and the general public have not been carried on due to COVID19 restriction apart from the training course for farmers and veterinarians in Italy, and training course which was organised virtually in Croatia. However, most of the event for the public should be completed in the next period.

3. EXPECTED IMPACT

The main project's goal is **to create synergies between the economic sector in the farming of sea bass and sea bream, fish processing industry and research institutes in the field of aquaculture with high qualification to increase SMEs competitiveness thanks to high quality fresh and processed fish**. Since two fish farms of a different approach to the production – one small family-run farm producing fish for the local market and catering facilities and another big industrial farm covering all different type of consumers and exporting fish to Italy – are very good pilot farms, we will cover the whole aquaculture marine sector in Adriatic. Another small processing facility with extensive experience in fish processing will assist in added value to sustainably farmed fish with all innovative technologies applied within WP 3 and WP4.

Moreover, it is expected that analysis of quality (chemical content and especially fatty acid shares and shares of vitamin and minerals) will exactly contribute to the evaluation of sustainable farming, testing of a new approach to feeding, feeding with new feed formulation and emphasizing preventive approach in disease management and mitigation, their impact during the production cycle will prove the high-quality fresh fish and fish products. Cross-border cooperation will engage the most appropriate research facilities with extensive experience in creating and sanitary control of fish products (LP), fish quality (PP1) and marketing and promotion of healthy nutrition (PP5) with industries represented by a different approach to farming to obtain results which will be applicable for different structures in marine aquaculture, food processing, catering facilities and the general population. Dissemination of the results for the farming industry will be facilitated by an association of farmers in marine aquaculture from Croatia (PP7) and subcontracted partner (API) in Italy.

Besides they will assist other project partners in approaching and addressing all different type of stakeholders which have already been identified through extensive work on surveillance by the University of Rijeka, Faculty of Tourism and Hospitality Management (PP5) in Italy and by the University of Trieste, Department of Life Science (PP2). These two partners together with other partners

of the project will put efforts to identify all possibilities to share the results of the project to all targeted stakeholders such as the general public, consumers in catering facilities, managers in marketing facilities, stakeholders in charge of creating the meals for several important groups of consumers such as children, athletes, elder population. Besides specialized public event which will be visited to disseminate and contact stakeholders several dissemination and training courses will be organised. The mean of dissemination and delivery of results of the project will be printed book **“Manual of raw meat standardisation for fish production and product safety”** and also brochures prepared by PP5 and PP2 and video promoting material. In addition to these public events students of different university programs will be covered during with results of the research carried out in the WP5; not only students of the faculties of project partners but also students of the Faculty of Food Technology, Biotechnology and Nutrition and Veterinary Faculty, University of Zagreb, Faculty of Food Technology, the University of J.J. Strossmayer in Osijek and Faculty of Agronomy and Food Technology, University of Mostar, Bosnia and Herzegovina.

4. PROBLEM(S)

There were several serious problems experienced during the past three semesters. One of the problems was an administrative procedure of public procurement needed to purchase the required equipment and also consumables. So far as the workshop on administrative procedures was held in Karlovac on May 8th 2019, almost at the end of the first semester of the project implementation, the preparation of the documentation for the public procurement was completed during the second period and the delivery of the equipment started during the third period. Unfortunately, soon after the beginning of the third semester, restrictions in social contacts due to Covid19 have started what caused problems in equipment installation and delays in implementation and validation of new methods needed for chemical analysis. Accordingly, analyses were completed for different samples, but for micro and macro elements for which the Atomic Absorption Spectrometer was purchased, were delayed. For the above-mentioned reason, the production of the first deliverable of activity 5.1. *Technical-scientific report on Microbial and chemical quality indexes; Product safety value; Chemical and nutritional properties; Dietetic value* was requested to be postponed.

Similarly, the inability of partners on the project to approach the lab facilities in LP due to lockdown delayed testing of shelf life in previously mentioned techniques. Also, PP10 was not able to send market size fish to partners for analyses due to the same reasons and also the production of new products made of fish meat was delayed.

Partners in the project were not able to organise training courses according to the project AF and were not able to participate in several public events because they were cancelled such as CROFISH in Croatia, Adria4Blue in Rijeka cancelled. Production and testing of fish products in PP11 is delayed due to COVID19.



Figure 1
Preparation of fish tissue for chemical analysis.



Figure 3
Vaccum packed eviscerated sea bass tested for extended shelf life.



Figure 2
Atomic absorption spectrometry (AAS) for minerals determination.



Figure 4
Figure 4. Different bacteriological media used for testing microbiological properties of vaccum packed fresh fish.

NUTRICIONISTKINJA GRETA KREŠIĆ

Po konzumaciji ribe daleko smo ispod prosjeka EU, na Mediteranu su gori samo Slovenija i Grčka

Edi Prodan
05. siječanj 2021 18:45



snimio Marko Gracin

U Hrvatskoj samo 39 posto ispitanika konzumira plavu ribu na tjednoj bazi, dok bijelu ribu konzumira 34 posto ispitanika tjedno. Preferira se sveža, cijela, očišćena i neočišćena riba, dok se riblje prerađevine te dimljena i sušena riba najmanje konzumiraju. Vezano uz cijene, 67 posto ispitanika smatra da su riba i proizvodi ribarstva skupi, dok je za 65 posto ispitanika cijena presudni faktor koji utječe na odluku o kupovini

Vijest da je usred jedne od većih ekonomskih kriza koje potresaju ne samo Hrvatsku, nego i najveće dijelove najrazvijenijeg, «zapadnog» svijeta, rovinjska tvrtka Cromaris ostvarila rekordnu proizvodnju i prodaju orada i brancina, djelovala je kao da je pobjegla iz rubrike «vjerovali ili ne». Cromaris je naime ostvario prodaju od 10 tisuća tona ribe, što znači da je u deset godina od kako je preuzeo i objedinio nekoliko manjih tvrtki za proizvodnju ribe udeseterostručio proizvodnju.

Ono što donekle izaziva zabunu je činjenica da je čak 85 posto od te količine završilo na probrljivim tržištima, najviše u Italiji, odnosno da je manjina potrošena na domaćim trpezama. Također, Cromaris u Italiji, koja je i najveće svjetsko tržište brancina i orade, u drugoj polovici ove godine drži devet posto vrijednosnog udjela, što je rast od 30 posto u odnosu na lani. Sve to je naglalo menadžment rovinjske tvrtke na uvođenje uzgoja dvije nove vrste riba – zubaca i gofa. U Hrvatskoj dakle marikultura bilježi rast i kad praktično sve ostale grane gospodarstva ostvaruju značajne minuse, što znači da prostora za njezin razvoj na fenomenalno strukturiranoj jadranskoj obali ima u izobilju. Tim više ako bi porasla i domaća konzumacija.

Razvoj marikulture

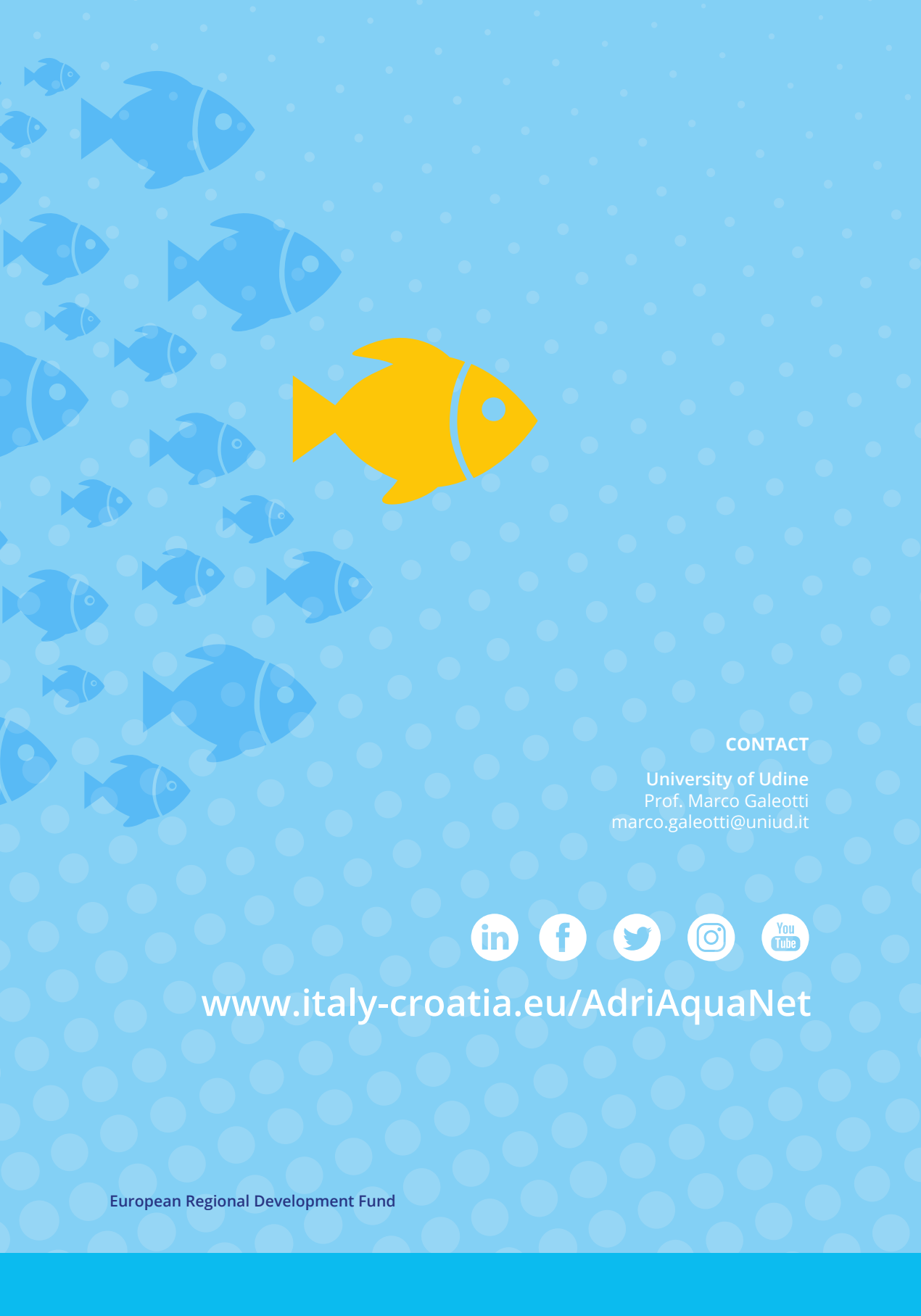
Jedna od poznatijica stanja i perspektiva uzgoja hrane iz mora na hrvatskim je prostorima prof. dr. sc. Greta Krešić, nutricionistica, redovita profesorica i voditeljica Katedre za hranu i prehranu na Fakultetu za menadžment u turizmu i ugostiteljstvu Opatija. Profesorica Krešić je diplomirala, magistrirala i doktorirala na Prehrambeno-

NAČITANJE

- 7 razloga zbog kojih je maslinovo ulje dobro popiti ujutro. Na žličicu
- Toksični roditelji uvelike utječu na sliku djeteta o sebi: Imamo nekoliko načina kako usmjeriti život na bolje
- Ljudi s ovom osobinom teže se zaljubljuju. Proverite spadate li u tu skupinu
- Voće koje smije konzumirati vaš pas: Nije svaka vrsta voća dobra
- DeLight u novoj liniji odijela najavljuje najbepše proljeće do sada

Figure 5

Dissemination of the results of the surveillance on the consumers perceptions of the farmed fish.



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