



FUTURE
EUAQUA

Work Package 6

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Final Conference
20 April 2023

Overview of WP6

WP Leader: UNIBO

Participants: NOFIMA, EMAR, ATEL, APLASMA, TP, HCMR, CS, FEAP, PUAS

Start month: 6 End month: 40

Objectives

The main aim of WP6 is the development of innovative high quality minimally processed fish products and related packaging conditions, in order to valorise aquaculture raw materials. The shelf-life of the most promising packed products will be characterized, in terms of physico-chemical (also through the development of a prototype for the rapid evaluation of fish texture), sensorial and microbiological phenomena, with particular attention to the modification of nutritional and metabolomics aspects.



















Task 6.1 (M7-40) Development of new minimally processed fish products : **Subtask 6.1.1.** Novel non-thermal processes; **Subtask 6.1.2.** New formulations and valorisation of fish and fish by-products; **Subtask 6.1.3.** Nutritional Assessment of the new products.

Task 6.2 (M7-40) Product quality and shelf-life : **Subtask 6.2.1.** Safety and shelf-life modelling; **Subtask 6.2.2.** Quality evaluation of the raw material and fish products by metabolomics indicators.

Task 6.3 (M7-42) Rapid evaluation of fish texture via system identification and modelling techniques: **Subtask 6.3.1.** Tests and improvements of prototype; **Subtask 6.3.2.** Industrial validation of prototype.

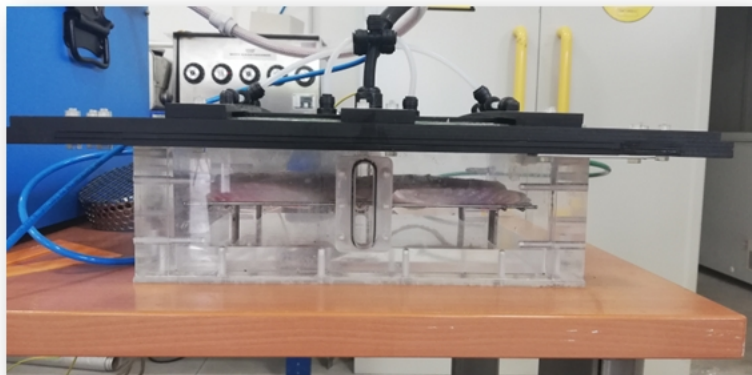
Task 6.4 (M7-36) Development of new packaging solutions.

Task 6.1: Development of new minimally processed fish products

Fish specie	Fish provided by	Preparation (Filletting, skinning, freezing)	Processing optimization	Processing in industrial environment	TRL
 Sea bream	  Galaxidi Kefalonia	 EMAR	 Plasma prototype: APLASMA	 EMAR	7
 European sea bass	 Avramar	 EMAR	 PEF prototype optimization: ATEL	 EMAR	8
 Atlantic salmon	 Salmar	 EMAR	 Cryo-smoking prototype:: CS	TP	8
 Rainbow trout	Commercial	 EMAR		 EMAR	8

Task 6.1: Development of new minimally processed fish products

Seabream fillets treated with cold gas-plasma, individually packed in MAP



D6.3



Nutrition facts obtained for each innovative products compared to the traditional one



Industrial partners

**economia
del mare**



Improvement of shelf life compared to the traditional product

Cold plasma treated compared to untreated → + 40%

Optimization of the process together with the involved industrial partners for the selected combination species/technology

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Task 6.1: Development of new minimally processed fish products

Cryo-smoking and smoked salmon fillets individually packed under vacuum



Industrial partners

 **MedicAir**
FOOD

economia
del mare


Tagliapietra
LE ECCELLENZE DEL MARE

Improvement of shelf life compared to the traditional product

Smoking at 5° C compared to 20° C → + 20%


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Task 6.1: Development of new minimally processed fish products

Seabass fillets treated with PEF during brining and after packaging in MAP



Industrial partners

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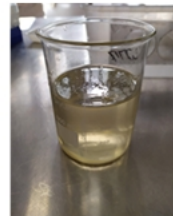
D6.4

Similar shelf life for PEF treated and control samples

Task 6.1: Development of new minimally processed fish products

Trout fish balls formulated with chitosan and packed in MAP

Mechanical separation



Industrial partners

**economia
del mare**

MANTIS SHRIMP SHELLS



Addition of chitosan extracted by crustaceans by-products → +14 %

D6.5

RP activities & outcomes

Task 6.2: Product quality and shelf life

- a) seabream fillets subjected to cold plasma treatment
- b) seabass fillets subjected to PEF and brining
- c) cold-smoked salmon fillets
- d) novel formulation of fish balls obtained with rainbow trout flesh

Packed innovative products in operational environment

economia
del mare



MedicAir
FOOD

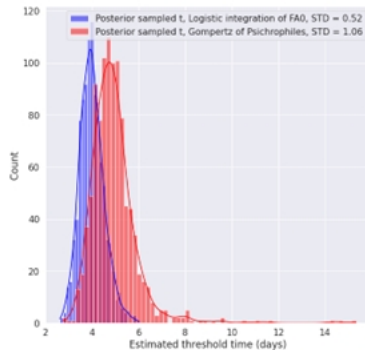


Analytical determination for shelf life studies

Microbiological	Physical	Chemical
Mesophiles	Colour	Dry matter (%)
Psychrophiles	Texture Analysis	Fat (%)
Enterobacteriaceae		Myofibrillar Proteins mg/ml
Lactic Acid Bacteria		NaCl (%)
Yeasts		NMR
		Peroxides (mEq O ₂ / kg Fat)
		pH
		Phenols (mg / 100g Fresh Weight)
		Sarcoplasmic Proteins mg/ml
		TBARS (nmol/mg)
		Water Activity (A _w)
		Water Content (%)



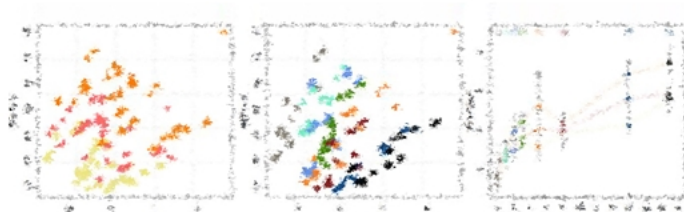
Aim: to define a robust but accessible experimental design, to optimize the costs and analyses needed to characterize the degradation phenomena undergone by a newly developed product.



mathematical modelling
of the obtained results

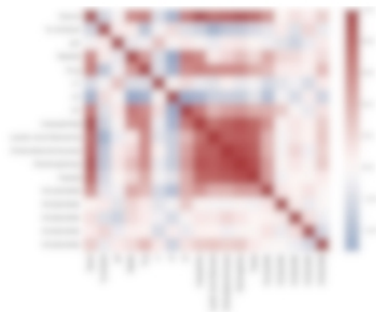
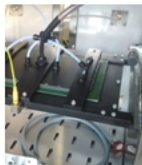
Task 6.2.1: Product quality and shelf life

The derived mathematical model, which integrates all analytical measurements performed, can express the overall quality of each seafood product, and extrapolate kinetic parameters that define a more robust indication for shelf-life.

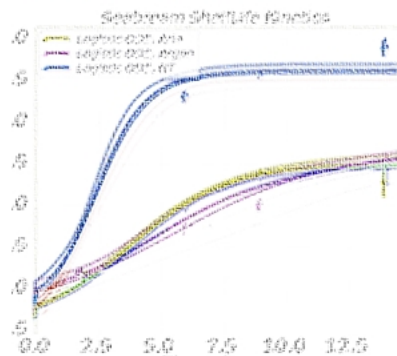


Example: seabream fillets subjected to cold plasma treatment

Sea bream



Spearman's correlations matrix resulting from cold gas-plasma seabream fillets. Correlation coefficients between parameters' pairs are represented by the colours shown in the legend on the right side.



Seabream shelf-life kinetics, from numerical integration of FAO scores variation as a function of time. The two treatments present a very different shelf-life kinetic with respect to the untreated (NT) samples.

D6.7

Task 6.2.2: Quality evaluation of the raw material and fish products by metabolomics indicators

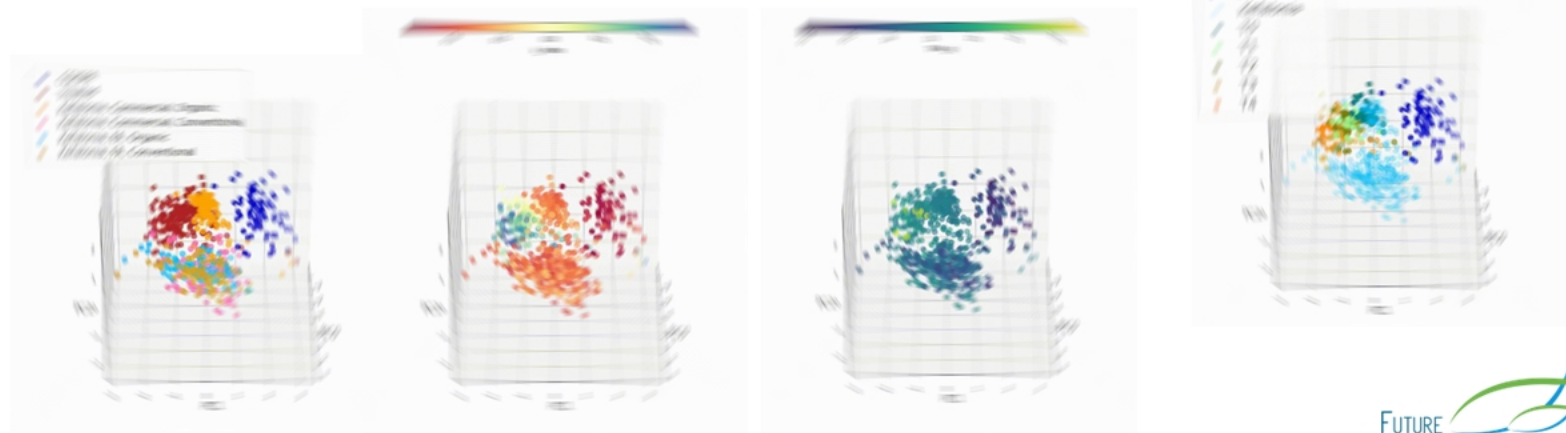
The derived mathematical model, based on the NMR-spectroscopy, defines a metabolomics space that describes 45% of the overall variance found in the molecular quality of a seafood product.

Sea bream

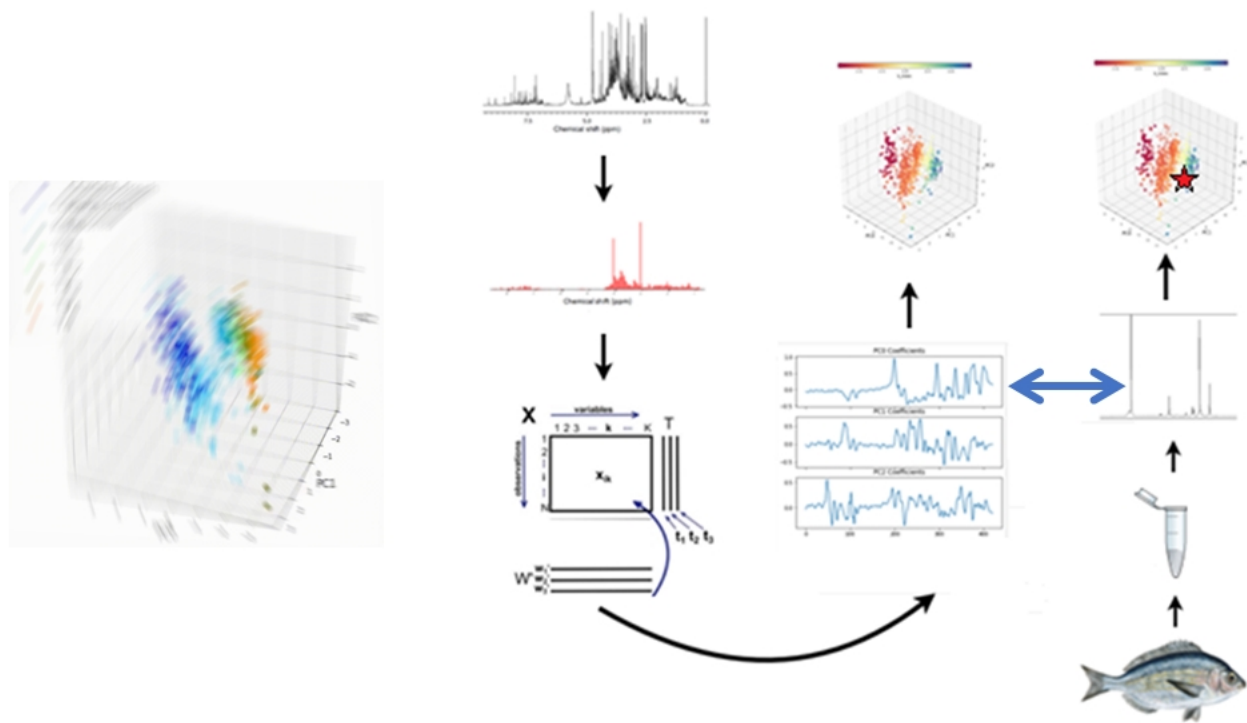


D6.6 (coming very soon)

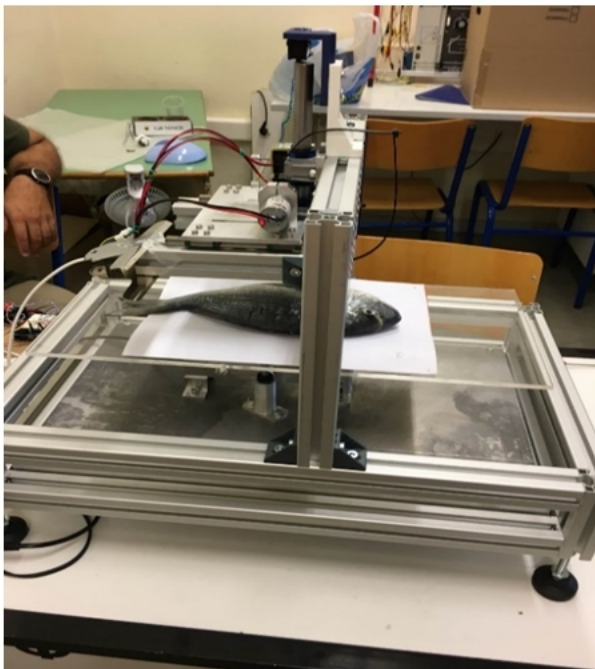
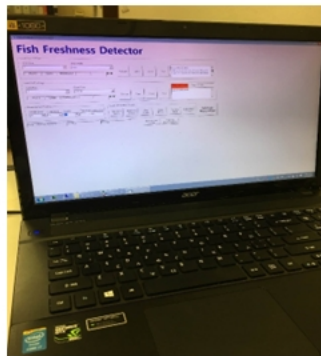
Case study: seabream fillets subjected to cold plasma treatment



Task 6.2.2: Quality evaluation of the raw material and fish products by metabolomics indicators



Task 6.3: Rapid evaluation of fish texture via system identification & modelling techniques



- Non-destructive evaluation of fish flesh texture attributes via a custom-built device and in-house developed operational algorithm: FTET
- Device & algorithm developed and industry-tested with fine tuning

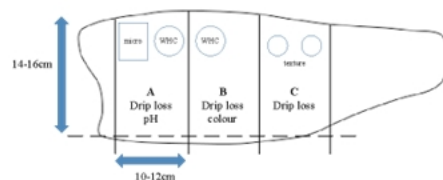
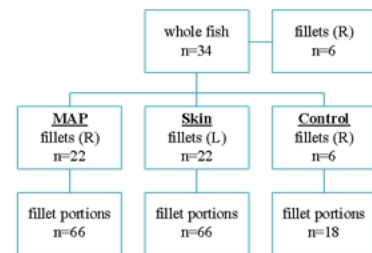
D6.9

Fish
Texture
Evaluation
Tool

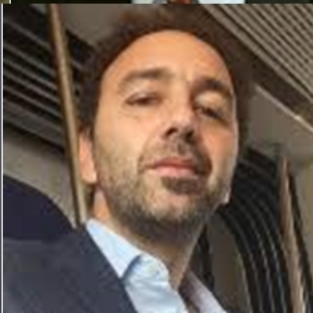
Task 6.4: Development of new packaging solutions

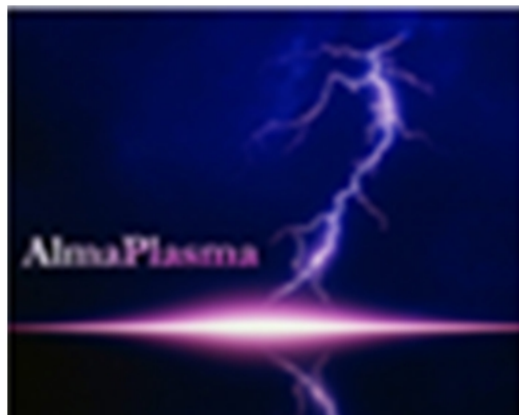
- Trials show vacuum skin-packaging to be a good alternative to MAP – same shelf-life, less packing material
- The novel packaging methods also gives better color and firmer fillets
- Salmon fed FutureEUAqua had the same quality and shelf-life as conventionally fed salmon in both packaging methods

However, FutureEUAqua feed gave a better texture!



D6.10





Thank you for your attention and contribution!

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