

# Production of high quality and value added biomolecules using fish by-products and discards in Greece

“VIOAXIOPOIO” ([www.vioaxiopoio.gr](http://www.vioaxiopoio.gr))

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European Union  
European Regional  
Development Fund



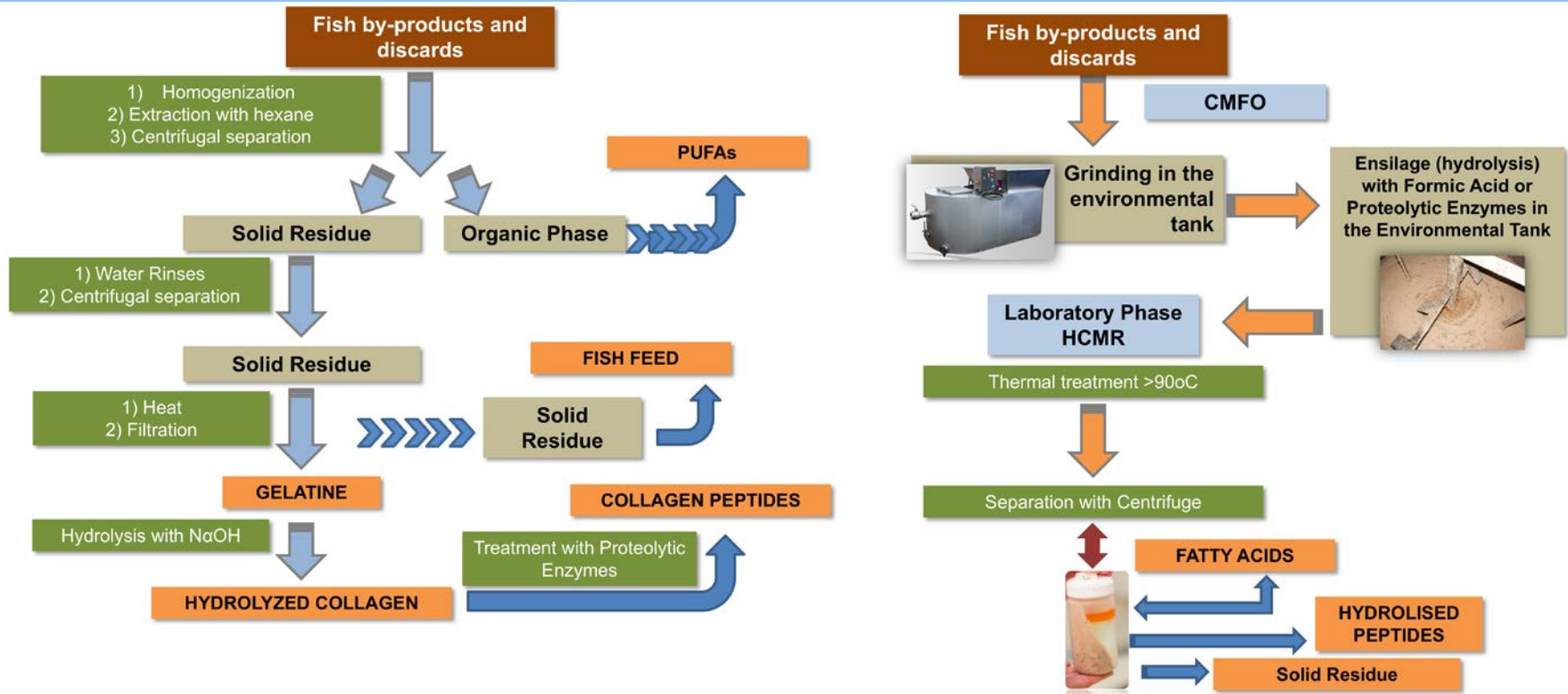
HELLENIC REPUBLIC  
MINISTRY OF  
ECONOMY & DEVELOPMENT  
SPECIAL SECRETARY FOR ERDF & CF

**ΕΡΑΝΕΚ 2014-2020**  
OPERATIONAL PROGRAMME  
**COMPETITIVENESS  
ENTREPRENEURSHIP  
INNOVATION**



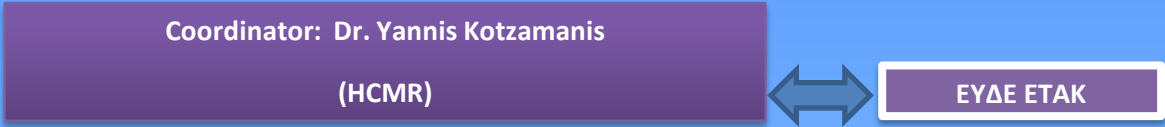
**ΕΣΠΑ**  
**2014-2020**  
ανάπτυξη - εργασία - αλληλεγγύη  
Partnership Agreement  
2014 - 2020

The VIOAXIOPIO project aims at the exploitation of fish by-products and discards (FBPD), which currently are thrown away through the current supply chain (handling, marketing and processing), towards the production of high added value biomolecules (HAVB), such as gelatine, various forms of collagen, unsaturated fatty acids and minerals-trace elements.



## Objectives

1. Design and develop a network for the collection, handling, maintenance and transfer of raw material of fish by-products and discards
2. The creation of practical solutions for the separation and proper storage of fish by-products and discards according to the category of high added value biomolecules to be produced.
3. The development of protocols, adapted to Greek species of fish by-products and discards, for production of high added value biomolecules.
4. The elaboration of an integrated National Business Plan for the exploitation of all raw materials from fish by-products and discards by CMFO



Coordinator: Dr. Yannis Kotzamanis  
(HCMR)

ΕΥΔΕ ΕΤΑΚ

Advisory Board  
Prof. Vassilios Roussis

Work Package Leaders  
Vasilios Katsiotis (CMFO): WP1 & WP4  
Dr. Efstathia Ioannou (NKUA- Pharm): WP2,  
Dr. Yannis Kotzamanis (HCMR): WP3  
Ioanna Argyrou (NAYS): WP5

HCMR Team  
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Dr. Athanasos Machias,  
Dr. Konstantinos Tsagarakis

New personnel:  
Dr. George Triantaphyllidis  
Dimitrios Kanakis (MSc)  
Vasiliki Ilia

CMFO Team  
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New personnel:  
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Nestor-Ioannis Polyzos

NAYS Team  
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Ekaterini Iordanidou (MSc)  
Eleni Theologou (MSc)  
Theonia Kollia  
Ioannis Argyros  
Christos Mitropoulos

# DEFINITIONS

- 1. Discards, or discarded** catch is that portion of the total organic material of animal origin in the catch, which is thrown away, or dumped at sea for whatever reason. It does not include plant materials and post harvest waste such as offal. The discards may be dead, or alive. (FAO)
- 2. Bycatch** is the total catch of non-target animals. Discards are not a subset of bycatch since the target species is often discarded.
- 3. Discard rate** is the proportion (percentage) of the total catch that is discarded.
- 4. Catch** is used to refer to the “gross catch” as indicated in FAO’s diagrammatic presentation of catch concepts.
- 5. Landings** refer to the portion of the total catch brought ashore or transhipped from the vessel.
- 6. The term Animal by-products category 3**, refers to what results from the processing of fishery and aquaculture products in the commercial and processing chain.



**Budget:**  
**799.025,71 €**

**Duration: 3+1 years**

**Starting date: 31/7/2018**

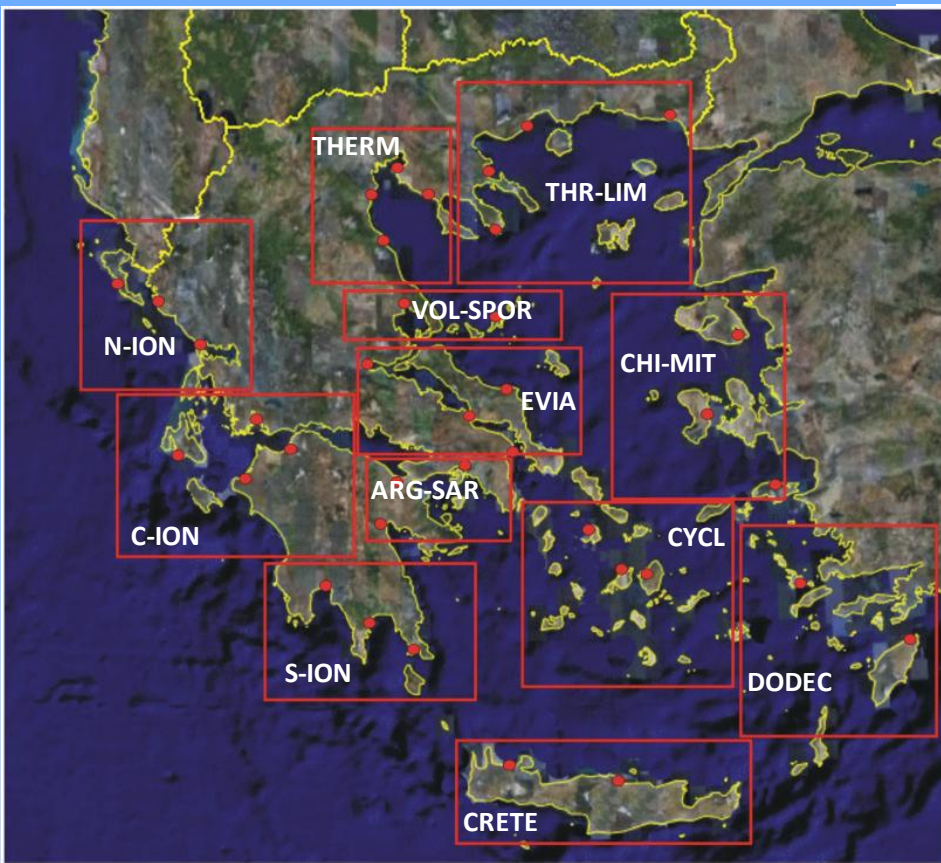
## WP Leader

CMFO	WP 1. Development of a network for the collection, preservation and distribution of raw materials
NKUA	WP 2. Production of collagen and its derivatives
HCMR	WP 3. Production of fatty acids and trace minerals
CMFO	WP 4. Upscaling of processes
NAYS	WP 5. Feasibility study and Business Plan

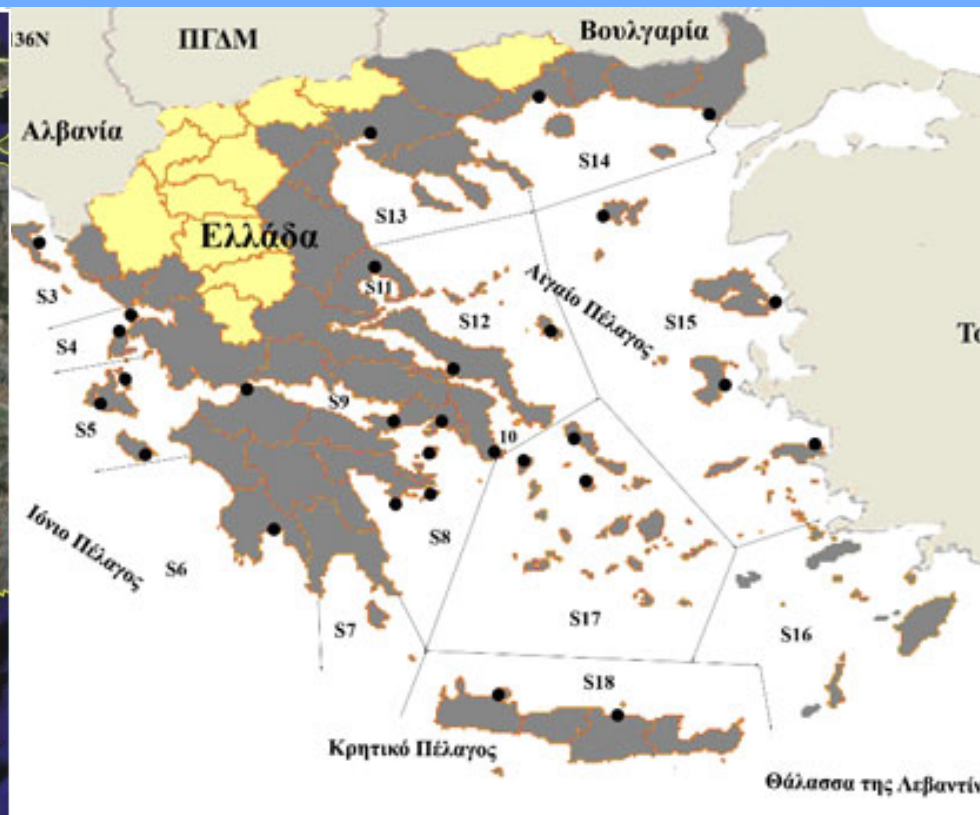


# Organisation of WP 1 Actions

## Development of a network for collection, preservation and transfer of raw material



Areas for the Data of the National Fisheries Data Collection Program (EPSAD)

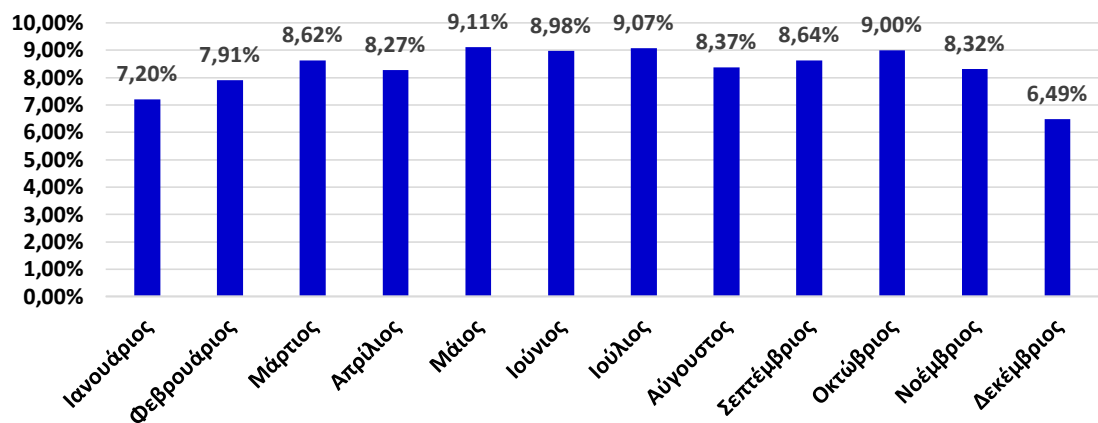


Areas for the data of the Hellenic Statistical Authority (ELSTAT)

# Potential sources of raw material for the production of high value added biomolecules from fish by-products and discards

## A. Fish which are not finally sold at the fish landing sites after the auction procedure

**% of seafood traded in the Piraeus fish landing site per month**

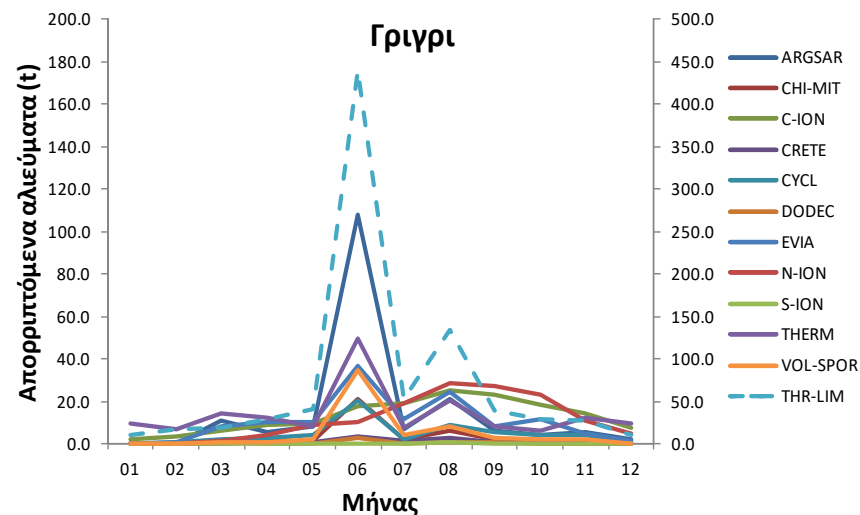
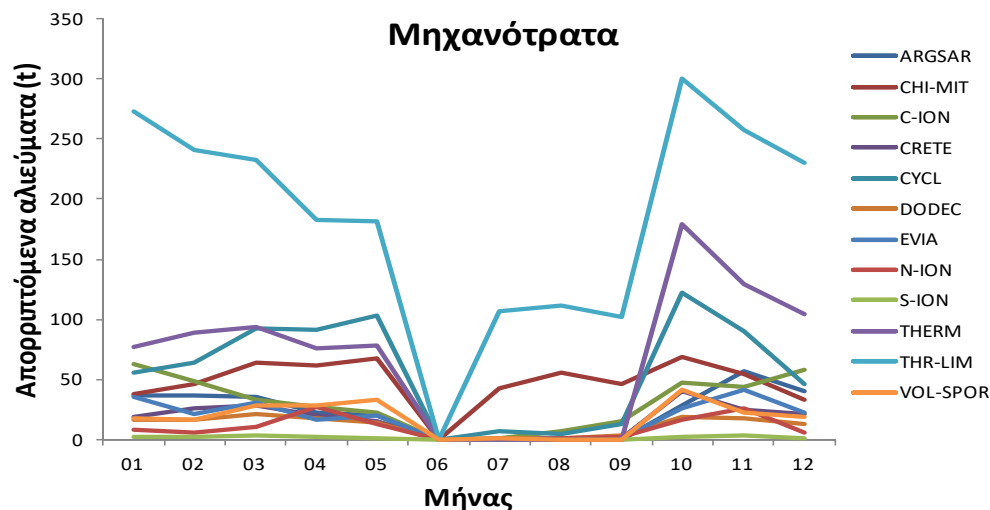


Fish landing site	Tonnes of fish by-products per year
1. Alexandroupolis	3,389
2. Thessaloniki	272,658
3. Kavala	111,027
4. Kalymnos	0,139
5. Messolonghi	2,765
6. Patra	24,855
7. Piraeus	244,643
8. Preveza	1,936
9. Chalkida	41,282
10. Chania	16,051
11. Chios	3,388
<b>Total</b>	<b>722,133</b>



# Potential sources of raw material for the production of high value added biomolecules from fish by-products and discards

## B. Discards



Average estimate of discards (in t) per month and per area for trawlers

Average estimate of discards (in t) per month and per area for the purse seines. The right axis corresponds to the area "Thracian Sea and Lemnos" (THR-LIM, dashed line).

**Analysis: HCMR/IMBRIW**

# Potential sources of raw material for the production of high value added biomolecules from fish by-products and discards

## C. Category 3 animal (fish) by-products from the processing of fishery and aquaculture products in the commercial and processing chain

		Apparent Consumption					Fish by-products per Region in tonnes				
		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Region	Population 2011	120.859.220,00	108.955.000	110.956.000	130.535.000	124.892.000	15,00%	15,00%	15,00%	15,00%	15,00%
Eastern Macedonia and Thrace	608.182	6.796.400	6.126.978	6.239.502	7.340.508	7.023.179	679,64	612,70	623,95	734,05	702,32
Central Macedonia	1.880.058	21.009.543	18.940.175	19.288.018	22.691.530	21.710.580	2.100,95	1.894,02	1.928,80	2.269,15	2.171,06
Western Macedonia	283.689	3.170.209	2.857.954	2.910.441	3.424.010	3.275.991	317,02	285,80	291,04	342,40	327,60
Epirus	336.856	3.764.347	3.393.572	3.455.896	4.065.714	3.889.954	376,43	339,36	345,59	406,57	389,00
Thessaly	732.762	8.188.574	7.382.028	7.517.601	8.844.137	8.461.807	818,86	738,20	751,76	884,41	846,18
Ionian Islands	207.855	2.322.768	2.093.983	2.132.440	2.508.725	2.400.273	232,28	209,40	213,24	250,87	240,03
Western Greece	679.796	7.596.682	6.848.435	6.974.209	8.204.859	7.850.165	759,67	684,84	697,42	820,49	785,02
Central Greece	547.390	6.117.053	5.514.544	5.615.820	6.606.773	6.321.164	611,71	551,45	561,58	660,68	632,12
Attica	3.827.624	42.773.484	38.560.442	39.268.619	46.197.855	44.200.731	4.277,35	3.856,04	3.926,86	4.619,79	4.420,07
Peloponnese	577.903	6.458.034	5.821.939	5.928.862	6.975.053	6.673.523	645,80	582,19	592,89	697,51	667,35
North Aegean	199.231	2.226.395	2.007.103	2.043.964	2.404.637	2.300.685	222,64	200,71	204,40	240,46	230,07
South Aegean	308.975	3.452.778	3.112.691	3.169.857	3.729.202	3.567.989	345,28	311,27	316,99	372,92	356,80
Crete	623.065	6.962.716	6.276.913	6.392.191	7.520.139	7.195.045	696,27	627,69	639,22	752,01	719,50
Mount Athos	1.811	20.238	18.244	18.580	21.858	20.913	2,02	1,82	1,86	2,19	2,09
<b>Total Greece</b>	<b>10.815.197</b>	<b>120.859.220</b>	<b>108.955.000</b>	<b>110.956.000</b>	<b>130.535.000</b>	<b>124.892.000</b>	<b>12.085,92</b>	<b>10.895,50</b>	<b>11.095,60</b>	<b>13.053,50</b>	<b>12.489,20</b>

# Total potential sources of raw material for the production of high added value biomolecules from fish by-products and discards per month and area from the three categories (unallocated catches of CMFO fish, Discarded catches and retail ABP-3)

Raw material per month and area from the three categories (unallocated catches of CMFO fish, Discarded and retail fish by-products Cat-3)																
Area- GSA	Area of DCF		CMFO Fish Landing Sites	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
Ionian- 22	N-ION	North Ionian	Preveza	34,217	31,717	41,511	64,975	55,845	43,825	52,755	52,223	63,145	73,755	70,385	44,155	628,63
	C-ION	Central Ionian	Patra, Messolonghi	118,424	105,624	102,739	107,774	103,104	86,444	89,544	79,619	107,424	136,604	128,174	134,644	1.300,11
	S-ION	South Ionian	-	18,641	17,941	21,233	23,425	22,225	21,125	21,025	14,85	20,825	22,725	24,625	21,925	250,46
Aegean- 22	THR-LIM	Thracian Sea and Limnos	Kavala, Alexandrou/lis	337,117	312,417	316,963	287,248	294,988	506,028	227,888	295,232	210,168	403,208	355,458	308,048	3.854,65
	THERM	Thermaikos	Thessaloniki	271,13	278,48	327,346	339,451	332,381	278,071	240,991	184,184	240,341	433,121	379,101	345,841	3.650,43
	VOL-SPOR	Volos and Sporades	-	73,952	73,152	93,631	102,109	107,209	107,409	77,609	57,473	76,109	116,509	97,209	92,309	1.074,78
	CHI-MIT	Chios and Lesvos	Chios	53,196	62,176	82,722	82,909	88,559	40,839	64,199	75,629	68,089	90,179	75,149	53,189	836,95
	EVIA	Evia	Chalkida	78,445	64,245	87,281	81,516	85,316	91,316	66,616	61,41	63,616	92,416	100,716	77,816	950,61
	ARGSAR	Argosaronikos	Piraeus	347,562	346,702	409,482	440,282	435,892	500,252	403,972	292,771	401,752	442,432	462,952	438,532	4.922,46
	CYCL	Cyclades	-	58,63	66,98	99,5	100,11	111,31	22,68	12,03	17,27	20,64	131,4	97,07	49,47	787,08
	DODEC	Dodecanese	Kalymnos	40,256	41,156	49,762	48,579	45,279	33,369	31,669	22,649	34,969	50,279	48,569	44,069	490,69
Crete- 23	CRETE	Crete	Chania	68,606	74,546	85,625	86,225	79,755	66,435	64,425	45,506	64,155	104,965	88,775	84,265	913,39
		Peloponnese		44,600	44,6	44,6	50,972	57,343	57,343	57,343	57,343	38,229	57,343	57,343	57,343	57,343
<b>TOTAL</b>				<b>1.544,78</b>	<b>1.519,74</b>	<b>1.768,77</b>	<b>1.821,95</b>	<b>1.819,21</b>	<b>1.855,14</b>	<b>1.410,07</b>	<b>1.237,05</b>	<b>1.428,58</b>	<b>2.154,94</b>	<b>1.985,53</b>	<b>1.751,61</b>	<b>20.297,39</b>



## Expected Results

1. The in-depth understanding of the possibilities of utilization of fishery by-products and discards in order to produce biomolecules of high added value).
2. The creation of high added value biomolecules production protocols that will be specialized in the species that exist in the Greek seas and are suitable for fishery by-products and discards that come from the Greek and Mediterranean fisheries.
3. The creation of a database where spatio-temporal factors will be combined with specific species of discards of Greek fish fauna and the knowledge of their composition in order to create a strategy of the possibilities of production of high added value biomolecules based on economic and environmental parameters.
4. The creation of specialized protocols for handling, transporting, maintaining and processing fishery by-products and discards, depending on the production capacity of high added value biomolecules. This will be determined according to the season and the region in order to achieve the desired economic and environmental result.
5. The design of logistics and a suitable network for the collection of fishery by-products and discards for the production of high added value biomolecules or other products that will add value to each caught or harvested kilo of fish.

## Expected Results

6. The creation of knowledge and of a National Exploitation plan of Fish By-Products and discards.
7. The creation of a network of stakeholders and the development of win-win relations with Greek fishermen.
8. The production of integrated technical and financial plans that will allow the CMFO and the manufacturing industries of Greece for the adoption of plans and investment opportunities for the production of high added value biomolecules, as well as the reduction of the environmental footprint of fishery by-products and discards as waste.
9. The optimization of environmental management in relation to the current situation and the creation of a more sustainable and rational way of operation of the fish landing sites and the central fish markets of Greece.



# Results Exploitation



**Ensilage**



**Collagen**



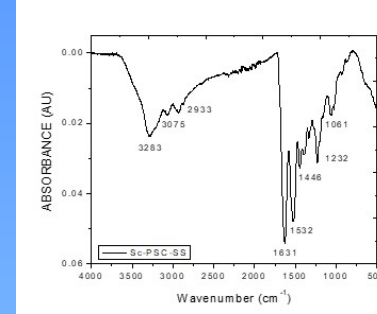
**Fishmeal**



**Polyunsaturated fatty acids**



**Gelatine**



## Next steps – synergies with the B-Blue project

The next steps are synergies with the B-Blue project (Building the blue biotechnology community in the Mediterranean).

<https://b-blue.interreg-med.eu/>

The exploitation of marine bio-resources through biotechnological solutions is a field with massive potential for innovation and economic growth. Implementation of aquaculture/fisheries/processing by-products and discard valorization in the Mediterranean Sea will be one of the value chains that will be further studied in the B-Blue project.

The value chains of the B-Blue project are:

- i) algae production for high-value compounds
- ii) aquaculture/fisheries discard valorisation in added value sectors
- iii) use of microorganisms and ICT tools for marine environment restoration,
- iv) sustainable integrated multi-trophic aquaculture (IMTA).

# Thank you very much!

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