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Identification and evaluation of the “real” environmental aspects associated with the activities in each country in function of their specifications.

Identification and evaluation of the “abnormal and emergency” environmental aspects associated with the activities in each country in function of their specifications.

RESULTS

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Introduction

This document develops the methodology presented in the other document previously issued **PROCEDURE FOR THE IDENTIFICATION AND EVALUATION OF THE ENVIRONMENTAL ASPECTS ASSOCIATED WITH SHELLFISHING HARVESTING ON FOOT ACTIVITIES AND** PREVENTION OF THE ENVIRONMENTAL IMPACTS carried out within the project Film: "ECOLOGICAL AND SUSTAINABLE MANAGEMENT OF THE SHELLFISH HARVESTING ON FOOT". In the framework of the Erasmus +. KA2 - Cooperation for Innovation and the Exchange of Good Practices. Strategic Partnerships for vocational education and training. Call 2016.

The methodology selected for the development of this project, takes as reference the UNE-EN ISO 14001:2015 through an identification and evaluation of the environmental aspects occurred during the tasks in real and emergency conditions.

However, the consortium has realized that the ISO 14001:2015 sometimes is too much focused on industrial activities and doesn't' fit exactly the needs of the shellfishing sector. This is why some changes and additional items are proposed. They will be explained when presenting the methodology.

The document has been developed by the consortium of the project as follows:

Inputs have been provided by the partners with a high expertise in this field:

- **Liga para a Protecção da Natureza (LPN) - Portugal**
- **FUNDACIÓN PARA LA PESCA Y MARISQUEO (FUNDAMAR) - Spain**
- **Cooperative M.A.R.E. SOC. COOP - Italy**
- **The University Recep Tayyip Erdogan Universitesi – Turkey**

By other hand, **SGS Tecnos (Spain)** has been in charge of compile these inputs, manage the data and do the proper calculation in order to identify and evaluate the most relevant environmental aspects

Methodology and criteria

Definitions:

We should start defining the main concepts:

Shellfish: Culinary and fisheries term for exoskeleton-bearing aquatic invertebrates used as food; including various species of molluscs, crustaceans and echinoderms.

Shellfishing: Summary of the extractive activity in fishing areas with selective and specific techniques for the capture of shellfish, other marine invertebrates and seaweeds. The shellfish beds are well defined areas of the seashore and swallow depths; they are involved in the marine coastal ecosystem. The regulated activity (Shellfish Operation Licenses) often includes non-extractive tasks

as surveillance or cleaning, and aquaculture tasks as sowing and reseeding the shellfish beds. Other measures to avoid the over-exploitation are to establish restrictions on catch limits, to schedule the shellfishery, to select the techniques, to establish minimum sizes restrictions or to establish limitations and temporary closures.

It does not include aquaculture or not selective fishing techniques. Due to the multiple types of specific shellfishery techniques involved, the catalogue is not exhaustive, especially on fisheries of mobile shellfish (crustaceans, decapods)

Criteria to define the types of shellfishing

A) <u>According to the use of fishing vessel</u>

1) **On foot. No vessel.**
   Low extractive capacity. Traditional hand-operation tools, that comes usually from agricultural implements.
2) **On board/ by diving. Boat as support, manual extraction.**
   Low-medium extractive capacity. The vessel takes part only as conveyance and as work-platform with hand-operation tools. However, just as regions, can be allowed small support engines: individual hydraulic dredge ("idrorasca"), windlass for heave up the rake, external air supply to divers, ...
3) **Fishing vessels. Engines**
   Medium-high extractive capacity. A fishing engine gives power to the shellfish extraction. There are great differences of engine power just as techniques and regions: less of 10 GT (SP, UK) - just allowed offshore (TK/IT) - great vessels (ND).

B) <u>According to fishing areas and type of sea beds</u>

1) **Estuaries and coastal lagoons. Muddy beds.**
   Estuaries often have great ecological value areas (ecosystem services). Remarkable habitats: Seagrass beds; salt marshes.
2) **Open waters. Sandy beds.**
   Beaches and sand-beds. Beaches are often multifunctional public-use areas: navigation, fishing, tourism, sports. Remarkable habitats: Seagrass beds; Mäerl beds.
3) **Open waters. Rocky beds**
   Capes, islets, shallows. Remarkable habitats: Kelp forests.

C) <u>According to the coastal zones</u>

1) **Intertidal**
   There are perceptible tides (few meters) mainly on Atlantic shores. It has properties of high biodiversity due to great changes on environmental conditions (interface sea/land). It suffers usually urban pressure from land.
2) **Shallow subtidal (0 a 10 m.)**
   It is a very productive zone, always submerged with high sun-light penetration.
3) **Deep subtidal (> 10 m.)**
   Large marine areas. Steady environmental conditions: there are not wave effects, salinity or temperature changes.

Combining these three criteria we develop this table of types of shellfishing:

	Codes	Type	Tools	Species	Description	Regional var
ON FOOT	A1-B1-C1 A1-B2-C1	**At beach**. Sandy or muddy shores	Hands Hoe Fork Salt Fish-spear (*fisga*)	Bivalves Polychaeta Razor clams	Mainly by digging using manual tools while low tide allows for. There are some specific "no-digging" techniques: use of salt, "fisga"	Multiple local tools, names and traditional techniques just as regions
	A1-B1-C2 A1-B2-C2	**Inside water till chest**. Sandy or muddy shores	Hand-Rake Fork Shovel & sieve Chisel/Fork & fishing-mirror-box	Bivalves	By using hand-operated dredge with iron teeth which are handled with the rod attached to the shoulder or back	The use of fishing-mirror-box is sometimes allowed (IT) (SP, razor clams with traditional fork)
	A1-B1-C1 bis A1-B2-C1 bis	**Mixed at beach/till chest**. Sandy or muddy shores	Hands Hoe Fork Hand-Rake	Bivalves	Alternating the two previous techniques during the working-day	Multiple local tools, names and traditional techniques as regions
	A1-B3-C1 (A2-B3-C1)	**At cliffs** Exposed rocky shore 1) From land 2) Boat only as transport to inaccesible rocky coast	Scraper Chisel Dip net Ropes	Barnacles Mussel seed	Scrapping rocks with manual tools while low tide allows for Idem, on islands, islets and cliffs	Great popularity in Galicia (SP). *Percebeiros*
	A1-B3-C1 bis	**In tide pools and rocky shallows.** Protected or	Hands	Gasteropoda *Anemonia*	Catching, cutting and scrapping on rocks with manual	Great popularity in Asturias

	Codes	Type	Tools	Species	Description	Regional var
	A1-B3-C2	semiexposed rocky shore	Knife/Sickle Chisel Hook Dip net	*spp* Sea-urchin Seaweeds *Palaemon spp* Mussel seed	tools	(SP). *Go to pedreru*
	A1-B1-C3 A1-B2-C3 A1-B3-C3	N.A. (C3: too much depth to reach on foot)				
ON BOAT - BY DIVING (M	A2-B1-C1 A2-B1-C2 A2-B2-C1 A2-B2-C2	**On boat**. Sandy and muddy shallows 1) Manual dredge	Hand-Rake (long rod)	Bivalves	On anchored boat, by using hand-operated dredge which are handled with the rod attached to the shoulder and by performing body movements	
	A2-B1-C2 bis	2) Mechanical support Muddy shallows of coastal lagoons	Individual hydraulic dredge		It is requested the presence of an operator on foot to guide the dredge into the water	*Idrorasca* (IT)
	A2-B1-C2 (bis) A2-B2-C2 (bis) A2-B3-C2	**By diving** 1) Apnea	Buoy Hands Razor Hook Scraper	Razor clams Sea-urchin Seaweeds *Anemonia spp* Abalone	By hands or manual tools. Diver uses free diving techniques with a snorkel mask	The external air supply must be allowed (IT), partially allowed (SP/TK) or not

	Codes	Type	Tools	Species	Description	Regional var
MANUAL TOOLS)				Polychaeta *Holothuria spp.* Mussels		allowed (PT)
		2) Air supply	Idem + Scuba tank Compressor		By hands or manual tools. Diving equipment with an air supply system provided from the boat	
	A2-B3-C1	See previous A1-B3-C1 (**On exposed rocky shore**. "Percebeiros")				
	A2-B1-C3 A2-B2-C3 A2-B3-C3	N.A. (C3: too much depth to reach without engine)				
ONFISHING VESSE	A3-B2-C2 A3-B2-C3	**With mechanized dredge**	Towed rake Beam Trawl	Bivalves *Rapana venosa*	Drag on the seabed by using engine power	There are usually engine power legal restrictions *Algarna* (TK) *Endeño remolcado* (SP, less of 10 GT)
	A3-B2-C3 (bis)	**With hydraulic dredge** Muddy and sandy beds 1) Offshore	Hydraulic dredge	Bivalves	Drag on the seabed raising the substrate by means of a jet of water favouring the entry of clams	Many local variants. "Turbosoffiante" vessels (IT) Dreç (TK)
	A3-B1-C1	2) At estuaries This zones are often restricted by draught of vessels or not		*Ensis directus*	Idem, it could be combined with a lift pump to transport individual shellfish onto the desk	Great vessels (ND, DK) Less of 10

	Codes	Type	Tools	Species	Description	Regional var
L (ENGINES)	A3-B1-C2 A3-B1-C3 A3-B2-C1	allowed by legal restrictions (estuaries are usually protected areas)		Bivalves		GT (UK)
	A3-B3-C1 A3-B3-C2 A3-B3-C3	**Using traps**	Fishing baskets Clay/plastic vessels	Crustaceans Cephalopods	By releasing trap-lines (trawls) and heaving up them a few hours later with an engine	Multiple types according to species and regions

Below we can find a summarized table with the types of shellfishing. We've considered some types of shellfishing must be evaluated. The column of the left is a normal division of types of shellfishing and the column of the right shows a sub-division for those types of shellfising should be evaluated twice as their impact varies according to other sub-aspects. The evaluation will be done to the 15 types of shellfishing of the column of the right.

Type	Sub-type
On foot at beach	**On foot at beach.** Sandy shores
	On foot at beach. Estuaries
On foot inside water till chest	**On foot inside water till chest.** Sandy shores
	On foot inside water till chest. Estuaries
On foot at cliffs	**On foot at cliffs.** Access by land
	On foot at cliffs. Access by boat
On foot in tide pools and rocky shallows	**On foot in tide pools and rocky shallows**
On boat	**On boat.** Manual dredge
	On boat. Individual hydraulic dredge
By diving	**By diving.** Apnea
	By diving. Air supply
On fishing vessel with mechanized dredge	**On fishing vessel with mechanized dredge**
On fishing vessel with hydraulic dredge	**On fishing vessel with hydraulic dredge.** Less of 10 GT vessels/ Offshore
	On fishing vessel with hydraulic dredge. Great vessels
On fishing vessel using traps	**On fishing vessel using traps**

Identification and evaluation of the "real" environmental aspects associated with the activities in each country in function of their specifications.

Methodology

As it is presented in the procedure document, the evaluation of the environmental aspects is calculated as

Current Value = Frequency + Nature + Magnitude

Every partner evaluated these 3 indicators in each one of the 9 aspects. 7 of them had been previously considered and partners had added 2 new aspects to consider

ISO aspects							New aspects	
Gas emission	Noise	Spills leaks	Not dangerous Waste	Dangerous Waste	Water consumption	Energy consumption	Habitat change	Change on benthic communities structure

The first table is the type of table in which every partner was asked to fulfill. They had to give a mark of 5-10-20 to every type of impact to applied to every type of sub-type of shellfishing. They could also give a 0 or a NA if they think there was no impact at all.

The second table is the final evaluation, showing the average of the marks given by partners. Every item can have a value between 0 and 60; being 60 the sum in the case they give a 20 to the three indicators of impact: frecuency, nature and magnitude.

As all the partners have evaluated the same items, if one of them considered that an item didn't apply (NA), a mark of 0 has been considered and it has been counted to make the averages.

Every partner has been asked to evaluate the impacts of every type of shellfishing in some aspects as is shown in the table

		ISO impacts																						Other impacts					
		Gas emission			Noise			Spills leaks			Not dangerouse waste			Dangerouse waste			Water consumtion			Energy consumption			Habitat change			Change on benthic communities		
Type of shellfishing		Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude	Frecuency	Nature	Magnitude
On foot at beach	**On foot at beach.** Sandy shores																												
	On foot at beach. Estuaries																												
On foot inside water till chest	**On foot inside water till chest.** Sandy shores																												
	On foot inside water till chest. Estuaries																												
On foot at cliffs	**On foot at cliffs.** Access by land																												
	On foot at cliffs. Access by boat																												
On foot in tide pools and rocky shallows	**On foot in tide pools and rocky shallows**																												
On boat	**On boat.** Manual dredge																												
	On boat. Individual hydraulic dredge																												
By diving	**By diving.** Apnea																												
	By diving. Air supply																												
On fishing vessel with mechanized dredge	**On fishing vessel with mechanized dredge**																												
On fishing vessel with hydraulic dredge	**On fishing vessel with hydraulic dredge.** Less of 10 GT vessels/ Offshore																												
	On fishing vessel with hydraulic dredge. Great vessels																												
On fishing vessel using traps	**On fishing vessel using traps**																												

Total evaluation of real environmental aspects

This table shows the average marks of the 4 evaluations made by the partners. The addition of the 3 indicators (frecuency, nature and magnitude) is already shown. Types of shellfishing are ranked by their marks.

Type of shellfishing	Gas emission	Noise	Spills leaks	Not dangerous waste	Dangerous waste	Water consumption	Energy consumption	Habitat change	Change on benthic communities	Total
On fishing vessel with hydraulic dredge. Great vessels	29	25	30	25	23	9	39	39	39	**256**
On fishing vessel with hydraulic dredge. Less of 10 GT vessels/ Offshore	26	23	28	23	23	6	36	34	36	**234**
On fishing vessel with mechanized dredge	26	23	28	23	23	5	39	31	31	**228**
On boat. Manual dredge	25	24	28	24	15	4	33	30	34	**215**
On boat. Individual hydraulic dredge	19	18	20	16	15	6	26	25	33	**178**
By diving. Air supply	19	15	20	16	15	5	26	15	16	**148**
On fishing vessel using traps	13	11	15	11	8	5	19	8	10	**99**
On foot at cliffs. Access by boat	14	13	15	14	0	5	16	10	11	**98**
On foot inside water till chest. Estuaries	5	8	5	10	8	4	0	20	20	**79**
By diving. Apnea	9	8	11	10	0	4	11	13	14	**79**
On foot at beach. Estuaries	0	4	0	6	0	4	0	16	21	**51**
On foot at beach. Sandy shores	0	4	0	6	0	4	0	14	19	**46**
On foot inside water till chest. Sandy shores	0	4	0	6	0	4	0	14	14	**41**
On foot at cliffs. Access by land	0	4	0	6	0	4	0	5	6	**25**
On foot in tide pools and rocky shallows	0	4	0	6	0	0	0	5	9	**24**
Total per aspect	**184**	**184**	**199**	**203**	**128**	**68**	**245**	**278**	**313**	

If we analyze which is the environmental aspect which could be more affected, we find is the changes on the benthic communities, as it's shown in the table below:

Environmental aspect	Mark
Change on benthic communities	313
Habitat change	278
Energy consumption	245
Not dangerous waste	203
Spills leaks	199
Gas emission	184
Noise	184
Dangerous waste	128
Water consumption	68

Identification and evaluation of the "abnormal and emergency" environmental aspects associated with the activities in each country in function of their specifications.

In this case, partners were asked to give inputs about some abnormal events and emergencies which may occur when doing the shellfishing activity, according to the methodology proposed.

The first thing to do was to define a list of risks. Unexpected things that could happen doing this activity. Partners discussed about it and agreed to define this list of risks that could lead to abnormal or emergency situations:

RISK
Sinking
Flooding
Gear loss
Vessel failure
Tools left on the seabed
Disease import
Invasive non-native species
Non-regulated activity. Out-of-law

So in this section we have 8 potential risks. Partners agreed that each one of these risks had to be evaluated for any type of environmental aspects and for any sub-type of shellfishing. As there are 8 risks and 15 sub-types of shellfishing, every partner had to evaluate 15*8=120 risks affecting sub-types of shellfinshing.

Methodology

In this case we evaluate the impact of these risks, according to the system presented in the methodology:

Impact: Depending on the values obtained for severity and probability, the impact factor corresponding to each type of potential aspect is calculated as follows

IMPACT: = probability score X severity score.

The aspects to evaluate are the same ones than in the “real” aspects section:

ISO aspects							**New aspects**	
Gas emission	Noise	Spills leaks	Not dangerous Waste	Dangerous Waste	Water consumption	Energy consumption	Habitat change	Change on benthic communities structure

Below there are shown several tables. Each one of them is preceded by an explanation.

This is the table that every partner was asked to fulfill. They had to give a mark of 1-2-3 to the probability and severity of every environmental aspect applied to every risk. They could also give a 0 or a NA if they think it didn't apply. This table had to be filled for every one of the 15 sub-types of shellfishing.

	ISO impacts														Other impacts			
THE 15 TYPES OF SHELLFISHING WERE EVALUATED IN THIS TABLES	Gas emission		Noise		Spills leaks		Not dangerouse waste		Dangerouse waste		Water consumtion		Energy consumption		Habitat change		Change on benthic communities	
RISk	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity
Sinking																		
Flooding																		
Gear loss																		
Vessel failure																		
Tools left on the seabed																		
Disease import																		
Invasive non-native species																		
Non-regulated activity. Out-of-law																		

Total evaluation of abnormal and emergency environmental aspects

This is the result of the sum of all tables by all partners. Unlike the "normal aspects" evaluation, in this table we have made the addition of all partners' evaluation and not the average, as the marks here are much lower. There were a total of 120 risks affecting types of shellfishing, but here we only show the 20 ones with higher marks, which are the most important. (We show 21 items and not 20 as there is a tie in the position 20th). The table shows that the worst scenarios would be in types of shellfishing where a vessel is used and the vessel has a failure.

Risks affecting types of shellfishing	Gas emission	Noise	Spills leaks	Not dangerous waste	Dangerous waste	Water consumption	Energy consumption	Habitat change	Change on benthic communities	Total
On fishing vessel with mechanized dredge - Vessel failure	22	10	20	0	0	0	7	0	0	**59**
On fishing vessel with hydraulic dredge. Great vessels - Vessel failure	21	9	21	0	0	0	6	0	0	**57**
On fishing vessel with hydraulic dredge. Less of 10 GT vessels/ Offshore - Vessel failure	20	8	20	0	0	0	5	0	0	**53**
On boat. Individual hydraulic dredge - Vessel failure	14	8	13	0	0	0	4	0	0	**39**
On boat. Individual hydraulic dredge - Invasive non-native species	0	0	0	0	0	0	0	18	21	**39**
By diving. Air supply - Vessel failure	14	6	14	0	0	0	4	1	0	**39**
On foot inside water till chest. Estuaries - Disease import	0	0	0	0	0	0	0	18	18	**36**
On foot inside water till chest. Estuaries - Invasive non-native species	0	0	0	0	0	0	0	18	18	**36**
On boat. Manual dredge - Vessel failure	13	5	13	0	0	0	3	0	0	**34**
On boat. Manual dredge - Disease import	0	0	0	0	0	0	0	16	18	**34**
On boat. Manual dredge - Invasive non-native species	0	0	0	0	0	0	0	16	18	**34**
On foot inside water till chest. Estuaries - Non-regulated activity. Out-of-law	0	0	0	2	1	0	0	15	15	**33**

On boat. Individual hydraulic dredge - Disease import	0	0	0	0	0	0	0	14	15	**29**
On foot at beach. Estuaries - Non-regulated activity. Out-of-law	0	0	0	3	1	0	0	12	12	**28**
On boat. Individual hydraulic dredge - Non-regulated activity. Out-of-law	0	0	0	4	1	0	0	10	12	**27**
On boat. Manual dredge - Non-regulated activity. Out-of-law	0	0	0	2	1	0	0	10	12	**25**
On fishing vessel with hydraulic dredge. Great vessels - Flooding	0	0	21	3	1	0	0	0	0	**25**
On foot at beach. Estuaries - Disease import	0	0	0	0	0	0	0	12	12	**24**
On foot at beach. Estuaries - Invasive non-native species	0	0	0	0	0	0	0	12	12	**24**
On boat. Manual dredge - Sinking	2	2	11	5	4	0	0	0	0	**24**
On boat. Individual hydraulic dredge - Sinking	2	2	12	4	4	0	0	0	0	**24**

In this table we just analyze the marks of the types of risks, aggregating the types of shellfishing. In this case it's confirmed that a vessel failure is the most important risk, followed closely by non-regulated activities.

	Gas emission	Noise	Spills leaks	Not dangerous waste	Dangerous waste	Water consumption	Energy consumption	Habitat change	Change on benthic communities	Total
Vessel failure	115	55	109	0	0	0	34	2	0	**315**
Non-regulated activity. Out-of-law	0	0	0	47	18	0	0	111	134	**310**
Invasive non-native species	0	0	0	0	0	0	0	100	108	**208**
Disease import	0	0	0	0	0	0	0	83	96	**179**
Flooding	0	0	114	21	4	0	0	0	0	**139**
Gear loss	19	21	12	56	0	0	18	0	0	**126**
Sinking	4	4	73	24	18	0	0	0	0	**123**
Tools left on the seabed	0	0	0	89	2	0	0	0	0	**91**

In this table we analyze the types of shellfishing and we aggregate the risks. We confirm that types of shellfishing where a vessel is used are the ones more likely to bring risks that may affect the environment

	Gas emission	Noise	Spills leaks	Not dangerous waste	Dangerous waste	Water consumption	Energy consumption	Habitat change	Change on benthic communities	Total
On boat. Individual hydraulic dredge	18	14	40	19	5	0	6	42	48	**192**
On boat. Manual dredge	16	8	37	18	5	0	4	42	48	**178**
On fishing vessel with mechanized dredge	26	14	53	17	4	0	11	17	19	**161**
On fishing vessel with hydraulic dredge. Great vessels	24	12	57	21	5	0	9	15	18	**161**
On fishing vessel with hydraulic dredge. Less of 10 GT vessels/ Offshore	22	10	52	17	4	0	7	14	15	**141**
On foot inside water till chest. Estuaries	0	0	0	14	1	0	0	51	51	**117**
By diving. Air supply	16	8	37	15	4	0	6	10	12	**108**
On foot at beach. Estuaries	0	0	0	14	1	0	0	36	36	**87**
On fishing vessel using traps	10	6	23	19	2	0	3	2	4	**69**
On foot at beach. Sandy shores	0	0	0	14	1	0	0	16	21	**52**
On foot inside water till chest. Sandy shores	0	0	0	14	1	0	0	16	21	**52**
On foot at cliffs. Access by boat	4	6	5	17	3	0	4	6	6	**51**
By diving. Apnea	2	2	4	14	4	0	2	9	12	**49**
On foot in tide pools and rocky shallows	0	0	0	12	1	0	0	14	18	**45**
On foot at cliffs. Access by land	0	0	0	12	1	0	0	6	9	**28**

This last table shows the marks given to the environmental aspects. In this case, the change of benthic communities is the most important one. We should take into consideration that this aspect and the habitat change (ranked 3rd position) are the ones proposed by the consortium and not included in the ISO. This result reinforces the idea of the consortium that the ISO is not enough to analyze the environmental risks for shellfishing and that is why we are going to include new aspects and methodology in the coming steps of the project.

Environmental aspect	Total
Change on benthic communities	338
Spills leaks	308
Habitat change	296
Not dangerous waste	237
Gas emission	138
Noise	80
Energy consumption	52
Dangerous waste	42
Water consumption	0

Finally, we would like to remind that even if this analysis has shown us that types of shellfishing including a vessel are more dangerous for the environment, the aim of the project is to analyze the shellfishing on foot. That is why in further stages of the project we will only take into account the shellfishing on foot types, although in some of them a boat may be present.