



## ASSESSMENT CRITERIA FOR THE APPLICATION OF AMBEMAR-DSS\_v1.0

February, 2019

**Elaborated by:**



**Financed by:**



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## MEMORANDUM



## FOREWORD

This work has been carried out with the financial support of SODERCAN S.A., the Regional Government of Cantabria and European Regional Development Funds (ERDF), under the "*Programa de apoyo a proyectos de I+D en Cooperación en Energías Renovables Marinas, I+C=+C 2016*".

AMBEMAR-DSS seeks to establish a basis for understanding and agreement between the different stakeholders, in order to find solutions that allow the development of marine renewable energies minimizing their environmental cost.

The assessment criteria and the results of this study do not reflect the real impacts of an existing project, so they should only be taken as a guide. The DSS developed constitutes a preliminary basis on which to build and improve a system with the input of researchers, promoters and experts from different disciplines.

## DISCLAIMER

AMBEMAR-DSS is a tool for screening the possible impacts that could be caused by the execution of certain marine projects. Its application provides a quantitative and objective idea of their impact on the environment, however, it does not exempt from the need to carry out the appropriate Environmental Impact Study in each case.

## CITATION

The present document should be cited as:

- Guinda, X., Puente A., Juanes, J.A., Royano, F., Fernández, F., Vega, M.A., García, A., García-Alba, J., Aragón, G., Abascal, A.J., Otero, C., Manchado, C., Gómez-Jauregui, V., López, J., Monteoliva, A.P., 2019. Assessment criteria for the application of AMBEMAR-DSS\_V1.0, February 2019. Environmental Hydraulics Institute-IHCantabria, EgiCAD-Universidad de Cantabria and Ecohydros. Santander, Spain.

### Versions:

Version	Date
V1.0	February 2019
V0	January 2018

<http://ambemar.ihcantabria.es/en/>

## EXECUTIVE SUMMARY

This document reflects the assessment criteria used for the application of the first version of the AMBEMAR Decision Support System “AMBEMAR-DSS” to a simulated offshore wind farm located in the Cantabrian sea (N Spain).

It contains information regarding the following aspects:

- Basic data of the Project and its alternatives.
- Environmental and socioeconomic factors around the project area.
- Main actions and effects of the project considered in the case study.
- Impact Matrix.
- Procedures and criteria established for the impact assessment of the selected elements.
- Procedures for the global Environmental Impact Assessment of the project.
- Procedures for the estimation of uncertainties.

## 1. PROJECT INFORMATION

To test the suitability of the first version of AMBEMAR-DSS two offshore wind farm alternatives have been proposed:

- Alternative 1: GBF wind farm
- Alternative 2: Floating wind farm

### 1.1. Project elements

#### 1.1.1. Alternative 1: GBF wind farm

**-Devices:** 5 wind turbines of 5MW each

Height: 150m

Location (ETRS 89): -3.941/-3.904° W, 43.505° N

Distance to coast: 3100m

Depth: 60m

**-Marine restricted area:**

Rectangle of 1000m around devices

**-Coastal substation:**

Location (ETRS 89): -3.896° W, 43.476° N

Buildings: 15\*15=225 m<sup>2</sup>

Restricted area: 30\*33=990 m<sup>2</sup>

**-Electric wiring:** 6291m

**-Maximum device installation noise level:** SEL=200 dB re 1μPa<sup>2</sup>s, SPL=200 dB re 1 μPa

**-Maximum wiring noise level:** SEL=100 dB re 1μPa<sup>2</sup>s, SPL=100 dB re 1 μPa

**1.1.2. Alternative 2: Floating wind farm**

**-Devices:** 5 wind turbines of 8MW each

Height: 200m

Location (ETRS 89): -3.954/-3.905° W, 43.557° N

Distance to coast: 8900m

Depth: 150m

**-Marine restricted area:**

Rectangle of 1000m around devices

**-Coastal substation:**

Location (ETRS 89): -3.896° W, 43.476° N

Buildings: 15\*15=225 m<sup>2</sup>

Restricted area: 30\*33=990 m<sup>2</sup>

**-Electric wiring:** 13083m

**-Maximum device installation noise level:** SEL=200 dB re 1µPa<sup>2</sup>s, SPL=200 dB re 1 µPa

**-Maximum wiring noise level:** SEL=100 dB re 1µPa<sup>2</sup>s, SPL=100 dB re 1 µPa

Information regarding GIS shapefiles corresponding to project elements are resumed in Table 1.

Type	GIS Shapefile Code	Description	Character
Project	Pro_Flot1	Floating devices	Created
Project	Pro_Flot2	Floating devices rotors	Created
Project	Pro_Flot3	Floating devices anchors	Created
Project	Pro_Flot4	Floating devices wiring	Created
Project	Pro_GBF1	GBF devices	Created
Project	Pro_GBF2	GBF devices rotors	Created
Project	Pro_GBF3	GBF devices bases	Created
Project	Pro_GBF4	GBF devices wiring	Created
Project	Pro_Sub	Terrestrial substation	Created
Project calculated	Pcalc1	Marine restricted area	Calculated

Project calculated	Pcalc2	Marine restricted area_3x radius buffer	Calculated
Project calculated	Pcalc3	Terrestrial restricted area	Calculated
Project calculated	Pcalc4	Terrestrial restricted area_3x radius buffer	Calculated
Project calculated	Pcalc5	Noise around GBFs	Calculated
Project calculated	Pcalc6	Noise around Floating devices	Calculated
Project calculated	Pcalc7	Wiring noise	Calculated
Project calculated	Pcalc8	Wiring magnetic camp	N/D
Project calculated	Pcalc9	Wiring electric camp	N/D
Project calculated	Pcalc10	25m buffer around wiring and moorings	Calculated

Table 1. Information regarding GIS shapefiles corresponding to project elements of the case study. N/D: Not available Data

## 2. ENVIRONMENTAL AND SOCIOECONOMIC FACTORS

The environmental and socioeconomic factors considered in the case study are the following:

### Environmental factors:

- Hydrodynamics and sedimentary transport
- Bathymetry
- Substrate type
- Water quality
- Benthic habitats and species
- Ichthyofauna
- Marine mammals
- Seabirds
- Terrestrial habitats and species

### Socioeconomic factors:

- Fisheries
- Macroalgae extraction
- Navigation and shipping routes
- Leisure and tourism

- Marine Protected Areas
- Terrestrial Protected Areas
- Restricted areas (e.g. military, archaeological, scientific...)
- Other uses

Information regarding GIS shapefiles corresponding to environmental and socioeconomic factors are resumed in Table 2.

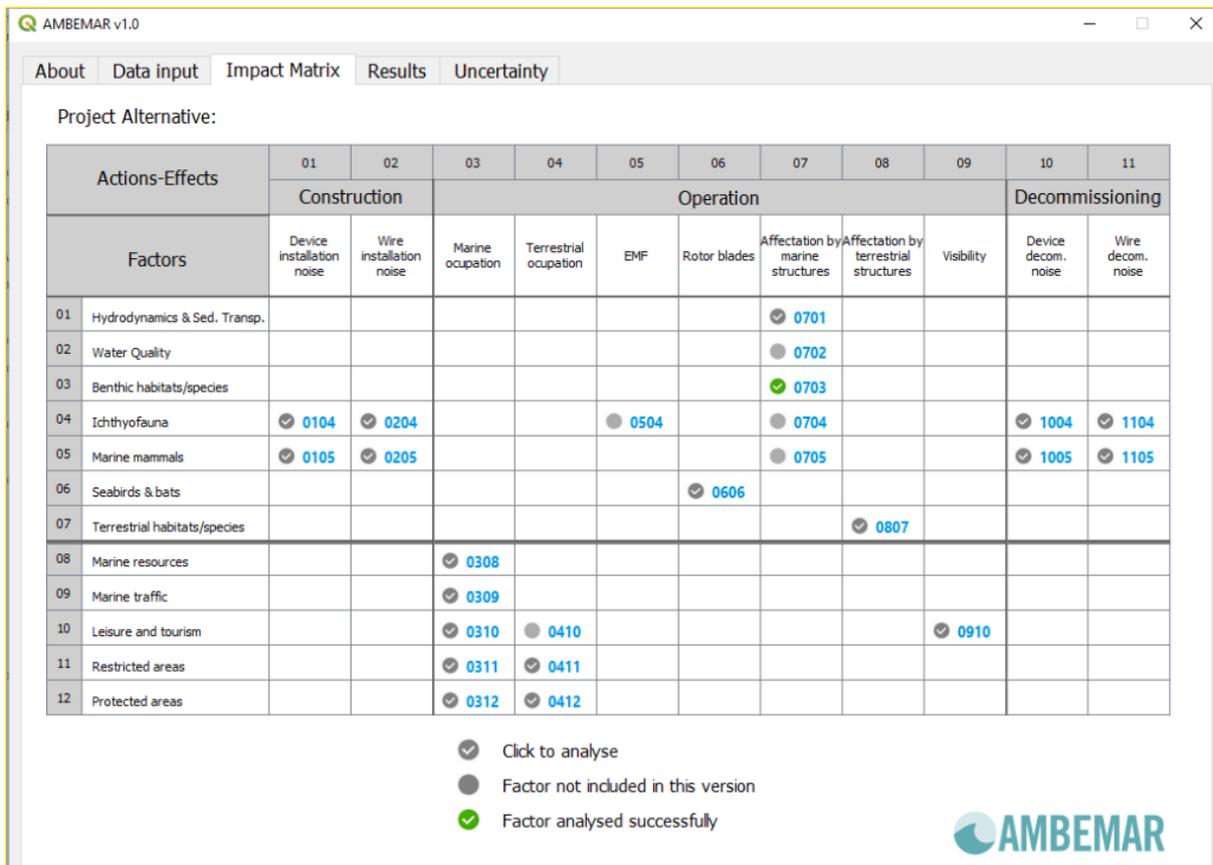
Type	GIS Shapefile Code	Description	Character
Factor	Fact1	Bathymetry	Official
Factor	Fact2	Substrate type	Official
Factor	Fact3	Marine Protected Areas	Official
Factor	Fact4	Terrestrial Protected Areas	Official
Factor	Fact5	Fishing grounds	Official
Factor	Fact6	Macroalgae extraction areas	Official
Factor	Fact7	Marine habitats and species	Created
Factor	Fact8	Marine mammal routes	N/D
Factor	Fact9	Marine mammal colonies (or sightings)	Technical
Factor	Fact10	Seabird routes	N/D
Factor	Fact11	Seabird colonies	Technical
Factor	Fact12	Bats	N/D
Factor	Fact13	Terrestrial habitats and species	Official
Factor	Fact14	Shipping routes	Technical
Factor	Fact15	Harbours	Official
Factor	Fact16	Marinas	Official
Factor	Fact17	Restricted uses (Military; Archaeological)	Created
Factor calculated	Fcalc1	Marine mammal routes_1km buffer	N/D
Factor calculated	Fcalc2	Marine mammal colonies/sightings_10km buffer	Calculated
Factor calculated	Fcalc3	Seabird routes_1km buffer	N/D
Factor calculated	Fcalc4	Seabird colonies_10km buffer	Calculated
Factor calculated	Fcalc5	Marinas_25km buffer	Calculated
Factor calculated	Fcalc6	Benthic habitats/species of interest into Pcalc2	Calculated
Factor calculated	Fcalc7	Terrestrial habitats/species of interest into Pcalc4	Calculated
AMBEMAR result	Scouring1	Hydrodynamic-scouring impact of GBFs	AMBEMAR
AMBEMAR result	Scouring2	Hydrodynamic-scouring impact of Floating devices	AMBEMAR
AMBEMAR result	Visual1	Visual impact of GBFs	AMBEMAR
AMBEMAR result	Visual2	Visual impact of Floating devices	AMBEMAR

Table 2. Information regarding GIS shapefiles corresponding to environmental and socioeconomic factors considered in the case study. N/D : Not available Data

### 3. IMPACT MATRIX

The interaction between (i) project actions and effects and (ii) environmental and socioeconomic factors, are used to generate an impact matrix that will be used as a basis to perform the Environmental Impact Assessment. Each element of the matrix is codified according to columns and rows numbers. Columns represent the actions and effects occurring at different phases of the project. Rows represent the environmental and socioeconomic factors affected by the project.

Figure 1 shows the simplified impact matrix applied in this first version of the AMBEMAR-DSS. Each element of the matrix is evaluated according to the specific criteria described in section 4 and the resulting Impact Values (IV) are then incorporated into the results matrix.



Actions-Effects		01	02	03	04	05	06	07	08	09	10	11
		Construction		Operation							Decommissioning	
Factors		Device installation noise	Wire installation noise	Marine occupation	Terrestrial occupation	EMF	Rotor blades	Affection by marine structures	Affection by terrestrial structures	Visibility	Device decom. noise	Wire decom. noise
01	Hydrodynamics & Sed. Transp.							<input checked="" type="checkbox"/> 0701				
02	Water Quality							<input type="checkbox"/> 0702				
03	Benthic habitats/species							<input checked="" type="checkbox"/> 0703				
04	Ichthyofauna	<input checked="" type="checkbox"/> 0104	<input checked="" type="checkbox"/> 0204			<input type="checkbox"/> 0504		<input type="checkbox"/> 0704			<input checked="" type="checkbox"/> 1004	<input checked="" type="checkbox"/> 1104
05	Marine mammals	<input checked="" type="checkbox"/> 0105	<input checked="" type="checkbox"/> 0205					<input type="checkbox"/> 0705			<input checked="" type="checkbox"/> 1005	<input checked="" type="checkbox"/> 1105
06	Seabirds & bats						<input checked="" type="checkbox"/> 0606					
07	Terrestrial habitats/species								<input checked="" type="checkbox"/> 0807			
08	Marine resources			<input checked="" type="checkbox"/> 0308								
09	Marine traffic			<input checked="" type="checkbox"/> 0309								
10	Leisure and tourism			<input checked="" type="checkbox"/> 0310	<input type="checkbox"/> 0410					<input checked="" type="checkbox"/> 0910		
11	Restricted areas			<input checked="" type="checkbox"/> 0311	<input checked="" type="checkbox"/> 0411							
12	Protected areas			<input checked="" type="checkbox"/> 0312	<input checked="" type="checkbox"/> 0412							

Figure 1. Impact matrix applied in the first version of AMBEMAR-DSS.

## 4. IMPACT ASSESSMENT PROCEDURES AND CRITERIA

The assessment of each of the elements included in the impact matrix is carried out through the interaction between GIS shapefiles corresponding to (i) project actions-effects and (ii) environmental and socioeconomic factors. In this section, the criteria applied for the assessment of each of these elements are resumed (organized according to their matrix codes). The GIS shapefiles included in the assessments are those mentioned in Tables 1 and 2, for actions-effects (AE) and factors (F) respectively.

Thereafter, "Actions-Effects GIS layers" will be referred to as "**AE**" and "Factors GIS layers" as "**F**".

### ➤ **Impact 0104: Device installation noise (01) // Ichthyofauna (04)**

This element evaluates the device installation noise impact on the ichthyofauna, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices (Pro\_GBF1 and Pro\_Flot1)

-AE: Noise layer (Pcalc5 and Pcalc6). Calculated according to the following noise attenuation equations and applied to Pro\_GBF1 and Pro\_Flot1 GIS layers:

$$\mathbf{SPL_r = SPL_{1m} - 20\text{Log}(r)} \quad (\text{eq. 1})$$

SPL<sub>r</sub> = Sound Pressure Level at distance "r" (dB re 1μPa)

SPL<sub>1m</sub> = Sound Pressure Level at 1m (dB re 1μPa) (Reference level)

r = Radius or distance (m)

Similarly applicable to Sound Exposure Level (SEL) values (in dB re 1μPa<sup>2</sup>s):

$$\mathbf{SEL_r = SEL_{1m} - 20\text{Log}(r)} \quad (\text{eq. 2})$$

SEL<sub>r</sub> = Sound Exposure Level at distance "r" (dB re 1μPa<sup>2</sup>s)

SEL<sub>1m</sub> = Sound Exposure Level at 1m (dB re 1μPa<sup>2</sup>s) (Reference level)

r = Radius or distance (m)

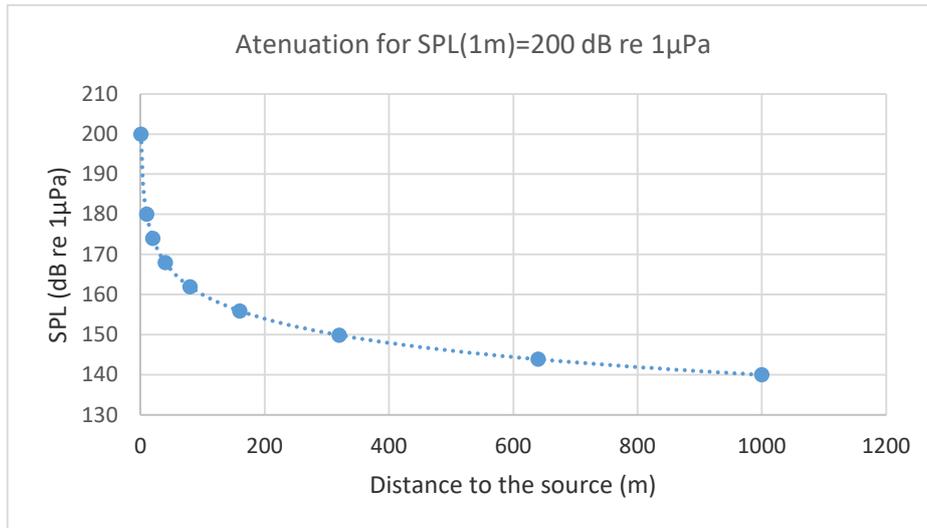


Figure 2. Example of a 200 dB re 1µPa noise attenuation into the sea.

-F: Fishing grounds (Fact5)

-Operation type: DIFFUSE

-Assessment criteria: Based on information from Anderson et al., (2017).

Noise* (SPL: dB re 1 µPa)	Acoustic Sensitivity / Ecologic-Socioeconomic Importance of the species	
	<b>HAS</b>	<b>High Acoustic Sensitivity (HAS)</b>
<b>High Importance<sup>(1)</sup></b>		<b>Low Importance</b>
<160 dB		0
160-180 dB	$IV = -0,04 * dB + 6,4$	$IV = -0,03 * dB + 4,8$
>180 dB	-0,8	-0,6
<b>LAS</b>	<b>Low Acoustic Sensitivity (LAS)</b>	
	<b>High Importance<sup>(2)</sup></b>	<b>Low Importance<sup>(3)</sup></b>
	<170 dB	0
170-190 dB	$IV = -0,04 * dB + 6,8$	$IV = -0,03 * dB + 5,1$
>190 dB	-0,8	-0,6

Table 3. Assessment criteria for the calculation of Impact Values (IV) due to device installation noise affections to ichthyofauna. () Values assigned by default to cetaceans (1), sea turtles and other marine mammals (2) and fish (3). SPL : Sound Pressure Level. \*Pending implementation in software version V1.0.

Noise (SEL: dB re 1 $\mu\text{Pa}^2\text{s}$ )	Acoustic Sensitivity / Ecologic-Socioeconomic Importance of the species	
	High Acoustic Sensitivity (HAS)	
HAS	High Importance <sup>(1)</sup>	Low Importance
<140 dB	0	0
140-160 dB	$IV = -0,04 * dB + 5,6$	$IV = -0,03 * dB + 4,2$
>160 dB	-0,8	-0,6
LAS	Low Acoustic Sensitivity (LAS)	
	High Importance <sup>(2)</sup>	Low Importance <sup>(3)</sup>
<150 dB	0	0
150-170 dB	$IV = -0,04 * dB + 6$	$IV = -0,03 * dB + 4,5$
>170 dB	-0,8	-0,6

Table 4. Assessment criteria for the calculation of Impact Values (IV) due to device installation noise affections to ichthyofauna. () Values assigned by default to cetaceans (1), sea turtles and other marine mammals (2) and fish (3). SEL : Sound Exposure Level.

In the absence of information regarding fish communities, the Impact Values are calculated applying the above mentioned equations and according to SPL or SEL values obtained at a distance of 750m from the source.

➤ **Impact 0105: Device installation noise (01) // Marine mammals (05)**

This element evaluates the device installation noise impact on marine mammals, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices (Pro\_GBF1 and Pro\_Flot1)

-AE: Noise layer (Pcalc5 and Pcalc6). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF1 and Pro\_Flot1 GIS layers:

-F: Marine mammals (Fact8, Fact9, Fcalc1 and Fcalc2)

-Operation type: DIFFUSE

-Assessment criteria: Based on information from Anderson et al., (2017).

Noise* (SPL: dB re 1 μPa)	Acoustic Sensitivity / Ecologic-Socioeconomic Importance of the species	
HAS	High Acoustic Sensitivity (HAS)	
	High Importance <sup>(1)</sup>	Low Importance
	<160 dB	0
160-180 dB	$IV = -0,04 * dB + 6,4$	$IV = -0,03 * dB + 4,8$
>180 dB	-0,8	-0,6
LAS	Low Acoustic Sensitivity (LAS)	
	High Importance <sup>(2)</sup>	Low Importance <sup>(3)</sup>
	<170 dB	0
170-190 dB	$IV = -0,04 * dB + 6,8$	$IV = -0,03 * dB + 5,1$
>190 dB	-0,8	-0,6

Table 5. Assessment criteria for the calculation of Impact Values (IV) due to device installation noise affections to marine mammals. () Values assigned by default to cetaceans (1), sea turtles and other marine mammals (2) and fish (3). SPL : Sound Pressure Level. \*Pending implementation in software version V1.0.

Noise (SEL: dB re 1 μPa²s)	Acoustic Sensitivity / Ecologic-Socioeconomic Importance of the species	
HAS	High Acoustic Sensitivity (HAS)	
	High Importance <sup>(1)</sup>	Low Importance
	<140 dB	0
140-160 dB	$IV = -0,04 * dB + 5,6$	$IV = -0,03 * dB + 4,2$
>160 dB	-0,8	-0,6
LAS	Low Acoustic Sensitivity (LAS)	
	High Importance <sup>(2)</sup>	Low Importance <sup>(3)</sup>
	<150 dB	0
150-170 dB	$IV = -0,04 * dB + 6$	$IV = -0,03 * dB + 4,5$
>170 dB	-0,8	-0,6

Table 6. Assessment criteria for the calculation of Impact Values (IV) due to device installation noise affections to marine mammals. () Values assigned by default to cetaceans (1), sea turtles and other marine mammals (2) and fish (3). SEL : Sound Exposure Level.

In the absence of information regarding marine mammals, the Impact Values are calculated applying the above mentioned equations and according to SPL or SEL values obtained at a distance of 750m from the source.

➤ **Impact 0204: Wiring installation noise (01) // Ichthyofauna (04)**

This element evaluates the wiring installation noise impact on the ichthyofauna, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices wiring (Pro\_GBF4 and Pro\_Flot4)

-AE: Wiring Noise layer (Pcalc7). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF4 and Pro\_Flot4 GIS layers:

-F: Fishing grounds (Fact5)

-Operation type: DIFFUSE

-Assessment criteria: Same as **Impact 0104**

➤ **Impact 0205: Wiring installation noise (02) // Marine mammals (05)**

This element evaluates the wiring installation noise impact on marine mammals, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices wiring (Pro\_GBF4 and Pro\_Flot4)

-AE: Wiring Noise layer (Pcalc7). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF4 and Pro\_Flot4 GIS layers:

-F: Marine mammals (Fact8, Fact9, Fcalc1 and Fcalc2)

-Operation type: DIFFUSE

-Assessment criteria: Same as **Impact 0105**

➤ **Impact 0308: Marine occupation (03) // Marine resources (08)**

This element evaluates the impact produced by the marine occupation of the project on the exploitation of marine resources, considering the percentage of the affected area and the economic importance of the affected resources in the region.

- AE: Marine restricted area around GBF and Floating devices (Pcalc1)
- F: Marine resources (Fishing grounds; Fact5, Macroalgae; Fact6)
- Calculate: % of the resource area affected in the region
- Integration criteria: When several resources are affected, the worst case Impact Value (IV) result is applied.
- Operation type: DIFFUSE
- Assessment criteria:

% Affected area	Economic importance in the region (% GDP)		
	Low (<1%)	Medium (1-5%)	High (>5%)
0	0	0	-0
0-1	0	-0.2	-0.4
1-5	-0.2	-0.4	-0.6
5-10	-0.4	-0.6	-0.8
10-25	-0.6	-0.8	-1
25-50	-0.8	-1	-1
>50	-1	-1	-1

Table 7. Impact Values assigned to the marine resources affected due to marine occupation.

➤ **Impact 0309: Marine occupation (03) // Maritime traffic (09)**

This element evaluates the impact produced by the marine occupation of the project on the maritime traffic, considering the importance of the shipping routes affected and the percentage of their sections occupied.

- AE: Marine restricted area around GBF and Floating devices (Pcalc1)
- F: Maritime traffic (Fact14). Raster data of shipping routes obtained from Halpern et al., (2008) (Online at: <https://www.nceas.ucsb.edu/globalmarine/data>) and modified according to the following statistical procedure, consisting of averaging the neighbour pixel values around each of the grid cells:

- o For QGIS: Application of the "r.neighbours" tool of GRASS.

Calculation parameters:

Neighbourhood: Rectangle (Circular deactivated)

Neighbourhood Operation: Average

Neighbourhood Size: 3 Cells

- o For ArcGIS: Application of the “Focal Statistics” tool of Spatial Analyst.

Calculation parameters:

Neighbourhood: Rectangle

Neighbourhood Settings: Height=3; Width=3; Units=Cell

Statistics type: Mean

Ignore No Data in calculations: Activated

-The importance of the shipping route is defined according to the resulting pixel values (Table 8):

Pixel Value	Importance of the shipping route
< 10	Low
10-20	Medium
> 20	High

Table 8. Importance of the shipping route according to pixel values.

-Operation type: DIFFUSE

-Assessment criteria:

% Section of the route affected (%S)	Importance of the shipping route f(Pixel value)		
	Low	Medium	High
0	0	0	0
0-10			$IV = -0,1 * \%S$
0-30		$IV = -0,0333 * \%S$	
0-50	$IV = -0,02 * \%S$		
> 10 <sup>(1)</sup> // > 30 <sup>(2)</sup> // > 50 <sup>(3)</sup>	-1	-1	-1

Table 9. Impact Values (IV) assigned to the shipping routes affected by marine occupation. (1), (2), (3) Criteria applicable to high, medium and low importance routes, respectively.

➤ **Impact 0310: Marine occupation (03) // Leisure and tourism (10)**

This element evaluates the impact produced by the marine occupation of the project on the leisure and tourism, considering the proximity of marinas and their magnitude.

-AE: Marine restricted area around GBF and Floating devices (Pcalc1)

-F: Marinas (Fact16)

-F: Marinas influence area (Fcalc5). Calculated as a 25km radius buffer around marinas.

-Calculate: % of the marinas influence area affected (marine domain only).

-Integration criteria: When several marinas are affected, the worst case Impact Value (IV) result is applied.

-Operation type: DIFFUSE

-Assessment criteria:

% of Marinas influence area affected (%A)	Importance of the marinas (berth nº)		
	Low (<100)	Medium (100-500)	High (>500)
0	0	0	0
0-10			IV=-0,06*%A
0-30		IV=-0,0133*%A	
0-50	IV=-0,004*%A		
>10 <sup>(1)</sup> //>30 <sup>(2)</sup> //>50 <sup>(3)</sup>	-0,2	-0,4	-0,6

Table 10. Impact Values (IV) assigned to the maritime leisure and tourism affected by marine occupation. (1), (2), (3) Criteria applicable to high, medium and low importance routes, respectively.

➤ **Impact 0311: Marine occupation (03) // Restricted uses (11)**

This element evaluates the possibility of occupation of the maritime space by the project, considering the presence of other restricted uses in the area (e.g. military, scientific, archaeological...).

-AE: Marine restricted area around GBF and Floating devices (Pcalc1)

-F: Restricted uses (e.g. military, scientific, archaeological...) (Fact17)

-Operation type: BOOLEAN

-Assessment criteria:

Impact Value	Criterion
0	The activity does not overlap areas of restricted uses.
-1	The activity <b>overlaps</b> areas of restricted uses.

Table 11. Impact assessment criterion for marine restricted uses.

➤ **Impact 0312: Marine occupation (03) // Marine Protected Areas (MPA) (12)**

This element evaluates the possibility of occupation of the maritime space by the project, considering the presence of Marine Protected Areas in the vicinity.

-AE: Marine restricted area around GBF and Floating devices (Pcalc1)

-F: Marine Protected Areas (MPA) (Fact3)

-Operation type: BOOLEAN/DIFFUSE

-Assessment criteria:

- If the Management Plan of the MPA contemplates the activity to be developed: BOOLEAN

Impact Value	Criterion
0	The activity <b>does not overlap</b> any Marine Protected Area.
0	The activity <b>is allowed</b> in the Management Plan of the MPA.
-1	The activity <b>is not allowed</b> in the Management Plan of the MPA.

Table 12. Impact assessment criterion for MPAs.

- o If the Management Plan of the MPA does not contemplate the activity to be developed: DIFFUSE

Relation of the project with the conservation objectives of the MPA	% Area of the MPA affected*		Integration criterion
	The activity overlaps the peripheral area of the MPA (%Ap)	The activity overlaps the reserve area of the MPA (%Ar) <sup>(1)</sup>	
Compatible	0	0	Worst case Impact Value (IV)
Possible affection	$IV = -0,05 * \%Ap$	$IV = -0,1 * \%Ar$	
Direct affection	-1	-1	

Table 13. Impact assessment criterion for the affection of marine occupation over MPAs. (1) If there is no distinction between peripheral and reserve areas this criterion is applied. \*Pending implementation in software version V1.0.

➤ **Impact 0410: Terrestrial occupation (04) // Leisure and tourism (10)**

-Assessment criteria: Not developed

➤ **Impact 0411: Terrestrial occupation (04) // Restricted uses (11)**

This element evaluates the possibility of occupation of the terrestrial space by the project, considering the presence of other restricted uses in the area (e.g. military, scientific, archaeological...).

-AE: Terrestrial restricted area around substation (Pcalc3)

-F: Restricted uses (e.g. military, scientific, archaeological...) (Fact17)

-Operation type: BOOLEAN

-Assessment criteria:

Impact Value	Criterion
0	The activity does not overlap areas of restricted uses.
-1	The activity <b>overlaps</b> areas of restricted uses.

Table 14. Impact assessment criterion for terrestrial restricted uses.

➤ **Impact 0412: Terrestrial occupation (04) // Terrestrial Protected Areas (TPA) (12)**

This element evaluates the possibility of occupation of the maritime space by the project, considering the presence of Terrestrial Protected Areas in the vicinity.

-AE: Terrestrial restricted area around substation (Pcalc3)

-F: Terrestrial Protected Areas (TPA) (Fact4)

-Operation type: BOOLEAN/DIFFUSE

-Assessment criteria:

- If the Management Plan of the TPA contemplates the activity to be developed: BOOLEAN

Impact Value	Criterion
0	The activity <b>does not overlap</b> any Terrestrial Protected Area.
0	The activity <b>is allowed</b> in the Management Plan of the TPA.
-1	The activity <b>is not allowed</b> in the Management Plan of the TPA.

Table 15. Impact assessment criterion for TPAs.

- If the Management Plan of the TPA does not contemplate the activity to be developed: DIFFUSE

Relation of the project with the conservation objectives of the TPA	% Area of the TPA affected*		Integration criterion
	The activity overlaps the peripheral area of the TPA (%Ap)	The activity overlaps the reserve area of the TPA (%Ar) <sup>(1)</sup>	
Compatible	0	0	Worst case Impact Value (IV)
Possible affection	$IV = -0,05 * \%Ap$	$IV = -0,1 * \%Ar$	
Direct affection	-1	-1	

Table 16. Impact assessment criterion for the affection of marine occupation over TPAs. (1) If there is no distinction between peripheral and reserve areas this criterion is applied. \*Pending implementation in software version V1.0.

➤ **Impact 0504: Electro-Magnetic Fields (EMF) (05) // Ichthyofauna (04)**

- AE: Wiring of GBF and Floating devices (Pro\_GBF4 and Pro\_Flot4)
- AE: EMF layer (Pcalc8 and Pcalc9). Calculated according to the EMF attenuation equations and applied to Pro\_GBF4 and Pro\_Flot4 GIS layers: Not developed
- F: Fishing grounds (Fact5)
- Operation type: DIFFUSE
- Assessment criteria: Not developed

➤ **Impact 0606: Rotor blades (06) // Seabirds and bats (06)**

This element evaluates the impact of wind turbines rotor blades on seabirds and bats, considering the distance to colonies and their protection status.

- AE: Rotor blades of GBF and Floating devices (Pro\_GBF2 and Pro\_Flot2)
- F: Seabird and/or bat colonies (Fact11 and/or Fact12). These GIS shapefiles should include information regarding the importance or the type of protection regime of the different species. For that, a generic system attribute field called "AMBEMAR" should be added at the shapefiles and the different categories should be named as "At\_risk", "Protected" or "Common" (see Table 17).
- Calculate: Distance between rotors and colonies
- Operation type: DIFFUSE
- Assessment criteria:

Distance to colonies (Dist) (km)	Importance of the seabird/bats species		
	Common species	Protected species	Species at risk of extinction
<5	-0,4	-0,8	-1
5-25			$IV=0,05*Dist-1,25$
5-15		$IV=0,08*Dist-1,2$	
5-10	$IV=0,08*Dist-0,8$		
>25 <sup>(3)</sup> //>15 <sup>(2)</sup> //>10 <sup>(1)</sup>	0	0	0
<b>AMBEMAR GIS code*</b>	Common	Protected	At_risk

Table 17. Impact Values (IV) assigned to seabirds and/or bats affected by rotor blades. (1), (2), (3) Criteria applicable to common, protected and at risk of extinction species, respectively. \*Names that should be used in the « AMBEMAR » attribute field of the GIS shapefiles.

➤ **Impact 0701: Marine structures and moorings (07) // Hydrodynamics and scouring (01)**

This element evaluates the impact caused by marine structures and moorings on the hydrodynamics and scouring, considering the type of mooring systems, the hydrodynamic regime of the region, the site depth, the sediment grain size and its density. In case of rocky substrates this element is not applicable.

-AE: GBF and Floating devices mooring systems (Pro\_GBF3 and Pro\_Flot3)

-Direct calculation from AMBEMAR-DSS hydrodynamic module. Results, in terms of scouring surface (m<sup>2</sup>) and depth (m), are obtained from numerical modelling according to the following parameters:

- Type of hydrodynamic regime (related to geographic area). Select among 3 options:

Type of hydrodynamic regime	Wave parameters			Currents parameters	
	Hs (m)	Tp (s)	Θ (°)	U <sub>max</sub> (m/s)	U <sub>mean</sub> (m/s)
Soft (e.g. Mediterranean)	0.5	5	45	0.3	0.15
Medium (e.g. Atlantic)	2	10	315	0.4	0.2
Strong (e.g. High latitudes)	3.2	11	265	0.6	0.25

Table 18. Hydrodynamic parameter values considered as representative of different hydrodynamic regimes or geographic areas. The values shown in the table have been obtained from two research projects (MARUCA and POSEIDON, see references) and from the works carried out by several authors (Dodet et al., 2010; Pérez et al., 2015, 2017; Reguero et al., 2012; Cid et al., 2014).

- Type of mooring system. Select among 4 options:
  - Monopile: 1 cylinder. Diameter: 7 m
  - GBF: 1 cylinder. Diameter 35 m and height 15 m
  - Jacket: 4 cylinders. Diameter: 2 m each
  - Floating: 3 square blocks. Side length: 2 m each
- Depth range of the devices. Select among several options depending on the type of mooring system:
  - Monopile: 20-30 m
  - GBF: 30-60-100 m

- Jacket: 60-100-150 m
- Floating: 60-100-150 m
- o Average sediment grain size (D50). Select among 3 options:
  - Fine and very fine sands:  $0.0625 < D50 < 0.25$  mm (0.125mm)
  - Medium sands:  $0.25 < D50 < 0.5$  mm (0.375mm)
  - Coarse and very coarse sands:  $0.5 < D50 < 2$  mm (1mm).
- o Sediment density. Select among 2 options:
  - Low density sediments (e.g. limestone or siliceous): 2300-2600 kg/m<sup>3</sup>
  - High density sediments (e.g. basaltic): 4000 kg/m<sup>3</sup>

-Operation type: DIFFUSE

-Assessment criteria: (in terms of scouring surface (m<sup>2</sup>) and depth (m) obtained from the numerical modelling and after multiplying the results by the total number of mooring devices). The final IV corresponds to the worst case between surface and depth IVs.

Surface (m <sup>2</sup> ) and depth (m) of substrate affected by the scouring			
Scouring surface (Sscour) (m <sup>2</sup> )	Impact Value (IV)	Scouring depth (Dscour) (m)	Impact Value (IV)
<5000	$IV = -0,0001 * Sscour$	<10	$IV = -0,05 * Dscour$
>5000	-0,5	>10	-0,5

Table 19. Criteria for the impact assessment of the mooring systems on the hydrodynamics and scouring.

-The results of the modelling (scouring surface around the structures) will be used for the assessment of the impact on benthic habitats and species at Impact 0703.

➤ **Impact 0702: Marine structures and moorings (07) // Water quality (02)**

-Assessment criteria: Not developed

➤ **Impact 0703: Marine structures and moorings (07) // Benthic habitats and species (03)**

This element may have several **positive** and **negative** effects that differ depending on the type of substrate of the seafloor: (i) In sedimentary bottoms, the “artificial reef effect” usually produces positive effects on species biodiversity and abundance values. However, the structures may also act as “stepping stones” facilitating the spread of invasive or alien species. (ii) In rocky bottoms, the seafloor occupation and erosive capacity of the structures may produce negative impacts on the existing habitats and species.

Assuming a net positive impact of the “artificial reef effect” on sedimentary bottoms (unless special habitats or species, such as seagrass meadows, are affected), the assessment of this element is focused on the negative impacts caused by the seafloor occupation and erosive capacity of the structures.

This element evaluates the impact caused by the seafloor occupation of the project on benthic habitats and species, considering the percentage of their surface affected and their protection status.

-AE: GBF and Floating devices, moorings and wiring (Pro\_GBF1, Pro\_GBF3, Pro\_GBF4, Pro\_Flot1, Pro\_Flot3 and Pro\_Flot4)

-AE: Scouring results obtained from numerical modelling at Impact 0701 (GIS layers: Scouring1, Scouring2)

-AE: Marine restricted area (Pcalc1)

-Calculate: -3 times radius buffer around Marine restricted area (Pcalc2)

-25m buffer around wiring and moorings (Pcalc10)

-F: Benthic habitat and species (Fact7). This GIS shapefile should include information regarding vulnerability or type of protection regime. For that, an attribute field called “**Prot\_stat**” (Protection status) should be added in the shapefile and the different categories should be named as “Protected”, “Vulnerable”, “Interest” or “Normal”.

-F: Real or Potential distribution of habitats/species of interest into Pcalc2 (Fcalc6)

-Operation type: BOOLEAN/DIFFUSE

-Assessment criteria:

- If there are **vulnerable** or **protected** habitats/species in the Pcalc2 area: BOOLEAN

Impact Value	Criterion
0	Pcalc10 <b>does not affect</b> any of the protected or vulnerable habitats/species
-1	Pcalc10 <b>overlaps</b> any of the protected or vulnerable habitats/species

Table 20. Impact assessment criterion for vulnerable or protected benthic habitats or species.

- o If there are habitats/species **of interest** in the Pcalc2 area: DIFFUSE

% of the area of the habitats/species of interest affected (H/S) into the Pcalc2 area		
H/S of interest "1"	H/S of interest "i"	Integration criterion
$IV = -0,0333 * \%HS1$	$IV = -0,0333 * \%HSi$	Worst case Impact Value (IV)

Table 21. Impact assessment criterion for benthic habitats or species of interest. (i) The calculation will be done for each of the "i" habitats or species and the worst case impact value criterion will be applied.

➤ **Impact 0704: Marine structures and moorings (07) // Ichthyofauna (04)**

The artificial reef effect of the structures and the restriction of the fishing activity into the project area are supposed to produce a net positive impact on ichthyofauna. The impact value introduced in the matrix is 0 (compatible impact).

➤ **Impact 0705: Marine structures and moorings (07) // Marine mammals (05)**

-AE: Marine restricted area around GBF and Floating devices (Pcalc1)

-F: Marine mammals (Fact8, Fact9, Fcalc1 and Fcalc2)

-Calculate: % of the section of Fcalc1 or % of the area of Fcalc2 affected by Pcalc1

-Operation type: DIFFUSE

-Assessment criteria:

% Section/Area (S/A) of Fcalc1 or Fcalc2 affected	Importance of the colony or migratory route* f(n° individuals/year and importance of the species)		
	Low	Medium	High
0	0	0	0
0-10			IV=-0,1*%S/A
0-30		IV=-0,0333*%S/A	
0-50	IV=-0,02*%S/A		
>10 <sup>(1)</sup> //>30 <sup>(2)</sup> //>50 <sup>(3)</sup>	-1	-1	-1

Table 22. Impact Values (IV) assigned to the shipping routes affected by marine occupation. (1), (2), (3) Criteria applicable to high, medium and low importance colonies or routes, respectively.\*Pending implementation in software version V1.0.

➤ **Impact 0807: Terrestrial structures (08) // Terrestrial habitats and species (07)**

This element evaluates the impact caused by the terrestrial occupation of the project on coastal habitats and species, considering the percentage of their surface affected and their protection status.

- AE: Terrestrial substation (Pro\_Sub) and terrestrial restricted area (Pcalc3).
- Calculate: 3 times radius buffer around terrestrial restricted area (Pcalc4)
- F: Terrestrial habitats and species (Fact13) (including information regarding vulnerability or type of protection regime).
- F: Distribution of terrestrial habitats/species of interest into Pcalc4 (Fcalc7)
- Operation type: BOOLEAN/DIFFUSE
- Assessment criteria: Same as **Impact 0703** (calculated over Pcalc4)

➤ **Impact 0910: Visibility (09) // Leisure and tourism (10)**

This element evaluates the visual impact caused by the presence of the devices on leisure and tourism, considering the distance to populated areas and their magnitude.

- AE: GBF and Floating devices and rotors (Pro\_GBF1, Pro\_Flot1, Pro\_GBF2 and Pro\_Flot2)

- Direct calculation from AMBEMAR-DSS visual impact module (MarRojo). Results (visual indicators, described in Table 23), are calculated according to the following parameters:

- o Definition of the maritime domain (geographic area): Digital terrain model.
- o Visibility maps for a specific turbine height.
- o Element of the visual inventory (on which to calculate indicators. Available layers described in Table 24).

-Operation type: DIFFUSE

-Assessment criteria:

ORIGINAL DEFINITION <sup>(1)</sup>	UPDATED DEFINITION <sup>(2)</sup>																
<b>Indicator a: Visibility coefficient of wind farm from element</b>																	
$a = - \frac{\sum_{i=0}^n X_i}{WM_n}$ <p><b>X<sub>i</sub></b>: number of WT visible from area <i>i</i>  <b>WM</b>: total number of WTs in the WF</p>	$a = - \frac{\sum_{i=0}^k (i \cdot SUMA_i) / N_p}{k}$ <p><b>SUMA<sub>i</sub></b>= amount of pixels with visibility to <i>i</i> WTs  <b>N<sub>p</sub></b>= total number of pixels  <b>K</b>= total number of WTs in the WF.</p>																
<b>Indicator b: visibility coefficient of element from wind farm</b>																	
$b = - \frac{n^{\circ} \text{ houses visible from WF}}{\text{total } n^{\circ} \text{ of houses}}$	$b = - \frac{n^{\circ} \text{ pixels of the set S visible from WF}}{n^{\circ} \text{ pixels of set S}}$																
<b>Indicator c: Visibility coefficient of wind farm (side of viewing / angle)</b>																	
$c = - v \cdot n$ <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>View</th> <th>v factor</th> </tr> </thead> <tbody> <tr> <td>Frontal</td> <td>1.0</td> </tr> <tr> <td>Diagonal</td> <td>0.50</td> </tr> <tr> <td>Longitudinal</td> <td>0.20</td> </tr> </tbody> </table> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Number WT</th> <th>N factor</th> </tr> </thead> <tbody> <tr> <td>1-3</td> <td>0.50</td> </tr> <tr> <td>4-10</td> <td>0.90</td> </tr> <tr> <td>&gt; 11</td> <td>1.00</td> </tr> </tbody> </table>	View	v factor	Frontal	1.0	Diagonal	0.50	Longitudinal	0.20	Number WT	N factor	1-3	0.50	4-10	0.90	> 11	1.00	$c = \text{horizontal angle to the WF}$
View	v factor																
Frontal	1.0																
Diagonal	0.50																
Longitudinal	0.20																
Number WT	N factor																
1-3	0.50																
4-10	0.90																
> 11	1.00																
<b>Coefficient d: distance coefficient between the wind farm and the element</b>																	

<table border="1"> <tr> <th>x distance</th> <th>d coefficient</th> </tr> <tr> <td>x &lt; 500m</td> <td>-1.00</td> </tr> <tr> <td>500 &lt; x &lt; 6000m</td> <td>-1.05+0.0002·x</td> </tr> <tr> <td>6000m &lt; x</td> <td>-0.10</td> </tr> </table>	x distance	d coefficient	x < 500m	-1.00	500 < x < 6000m	-1.05+0.0002·x	6000m < x	-0.10	<ul style="list-style-type: none"> <li>- Revision of distance thresholds</li> <li>- Revision of variation law (Hermite's spline):</li> </ul> $P(u) = \sum_{i=0}^3 P_i \cdot B_i(u)$						
x distance	d coefficient														
x < 500m	-1.00														
500 < x < 6000m	-1.05+0.0002·x														
6000m < x	-0.10														
<b>Coefficient e: Population coefficient</b>															
<table border="1"> <tr> <th>Number of people</th> <th>e coefficient</th> </tr> <tr> <td>&gt; 300</td> <td>-1.0</td> </tr> <tr> <td>100-300</td> <td>-0.90</td> </tr> <tr> <td>50-100</td> <td>-0.60</td> </tr> <tr> <td>20-50</td> <td>-0.45</td> </tr> <tr> <td>5-20</td> <td>-0.35</td> </tr> <tr> <td>1-5</td> <td>-0.20</td> </tr> </table>	Number of people	e coefficient	> 300	-1.0	100-300	-0.90	50-100	-0.60	20-50	-0.45	5-20	-0.35	1-5	-0.20	Revision of table for the indicator e by means of participation and agreement among stakeholders.
Number of people	e coefficient														
> 300	-1.0														
100-300	-0.90														
50-100	-0.60														
20-50	-0.45														
5-20	-0.35														
1-5	-0.20														
<b>Combined Impact Value (IV)</b>															
$PA1 = -a \cdot b \cdot c \cdot d$ $PA2 = a \cdot b \cdot c \cdot d \cdot e$	$IV1 = -a \cdot b \cdot c \cdot d$ $IV2 = a \cdot b \cdot c \cdot d \cdot e$														

Table 23. Definition of visual impact indicators, related to the attached references. (1) Previous assessment procedure based on Hurtado et al., (2004). (2) Updated procedure applied in AMBEMAR-DSS according to Machado et al., (2015).

### Visual Inventory

Name	Geometry type	Indicators Spanish Method				
		Ind a	Ind b	Ind c	Ind d	Ind e
Population nuclei	Polygon	x	x	x	x	x
Roads	Line	x	x	x	x	
Railway	Line	x	x	x	x	
Beaches	Polygon	x	x	x	x	
Protected Areas	Polygon	x	x	x	x	
Vantage points	Point	x		x	x	
Sites of Community Importance (SCIs)	Polygon	x	x	x	x	
Special Protection Areas (SPAs)	Polygon	x	x	x	x	
Special Areas of Conservation (SACs)	Polygon	x	x	x	x	
BIC y BIL (Cultural interest)	Point	x		x	x	
Marine protected areas	Polygon	x	x	x	x	
Natural parks	Polygon	x	x	x	x	
RAMSAR areas	Polygon	x	x	x	x	
Biosphere reserve	Polygon	x	x	x	x	
Geological point of interest	Point	x		x	x	

<b>INE (Celdas censo 2 xx). Population distribution</b>	Polygon	x	x	x	x	x
<b>Way of St. James</b>	Line	x	x	x	x	
<b>PRL (landscape small paths)</b>	Line	x	x	x	x	
<b>GRL (landscape paths</b>	Line	x	x	x	x	
<b>Landscape units (Átlas del paisaje España)</b>	Polygon	x	x	x	x	
<b>Landscape areas (POL)</b>	Polygon	x	x	x	x	
<b>Vegetation</b>	Polygon	x	x	x	x	
<b>Land uses</b>	Polygon	x	x	x	x	

Table 24. Information regarding GIS shapefiles corresponding to visual inventory

➤ **Impact 1004: Device decommissioning noise (10) // Ichthyofauna (04)**

This element evaluates the device decommissioning noise impact on ichthyofauna, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices (Pro\_GBF1 and Pro\_Flot1)

-AE: Noise layer (Pcalc5 and Pcalc6). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF1 and Pro\_Flot1 GIS layers:

-F: Fishing grounds (Fact5)

-Operation type: DIFFUSE

-Assessment criteria: Same as **Impact 0104**

➤ **Impact 1005: Device decommissioning noise (10) // Marine mammals (05)**

This element evaluates the device decommissioning noise impact on marine mammals, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices (Pro\_GBF1 and Pro\_Flot1)

-AE: Noise layer (Pcalc5 and Pcalc6). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF1 and Pro\_Flot1 GIS layers:

-F: Marine mammals (Fact8, Fact9, Fcalc1 and Fcalc2)

-Operation type: DIFFUSE

-Assessment criteria: Same as **Impact 0105**

➤ **Impact 1104: Wiring decommissioning noise (11) // Ichthyofauna (04)**

This element evaluates the wiring decommissioning noise impact on ichthyofauna, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices wiring (Pro\_GBF4 and Pro\_Flot4)

-AE: Wiring Noise layer (Pcalc7). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF4 and Pro\_Flot4 GIS layers:

-F: Fishing grounds (Fact5)

-Operation type: DIFFUSE

-Assessment criteria: Same as **Impact 0104**

➤ **Impact 1105: Wiring decommissioning noise (11) // Marine mammals (05)**

This element evaluates the wiring decommissioning noise impact on marine mammals, considering the noise attenuation equations into the water, the acoustic sensitivity of the species and their ecological importance.

-AE: GBF and Floating devices wiring (Pro\_GBF4 and Pro\_Flot4)

-AE: Wiring Noise layer (Pcalc7). Calculated according to the noise attenuation equations (eq.1 and eq.2) and applied to Pro\_GBF4 and Pro\_Flot4 GIS layers:

-F: Marine mammals (Fact8, Fact9, Fcalc1 and Fcalc2)

-Operation type: DIFFUSE

-Assessment criteria: Same as **Impact 0105**

## 5. IMPACT CATEGORIES AND GLOBAL ASSESSMENT

### 5.1. Impact classification

The Impact Values (IV) obtained in the impact matrix are classified into 5 categories, according to the following criterion (Table 25):

Impact Value (IV)	Impact Category
[+1 → 0)	Positive
[0 → -0.2)	Compatible
[-0.2 → -0.6)	Moderate
[-0.6 → -0.8)	Severe
[-0.8 → -1]	Critical

Table 25. Impact Values (IV) assigned to the shipping routes affected by marine occupation. (1), (2), (3) Criteria applicable to high, medium and low importance colonies or routes, respectively.

### 5.2. Global assessment

The final assessment of the project is carried out through four different procedures:

1. **Worst case impact:** Corresponding to that obtained by the element with the lowest IV.
2. **Global environmental impact:** Calculated by averaging the 3 worst impact values obtained among the environmental factors.
3. **Global socio-economic impact:** Calculated by averaging the 3 worst impact values obtained among the socio-economic factors.
4. **Global impact:** Calculated by averaging the two previous results.

In the event that the proposed project presents, globally or punctually, any significant negative impact (moderate, severe or critical), **mitigation measures** should be adopted.

## 6. UNCERTAINTIES

In order to analyse the confidence level of the assessments, the system includes a simple method to estimate the uncertainty. The procedure is based on the **quantity** and **quality** of the information used in the evaluation.

To assess the **quantity** factor, the percentage of items covered in the evaluation is estimated.

To assess the **quality** factor, the reliability of the information used in the analysis is considered. Thus, the use of official information and legally established criteria are given a value of 1. While the use of unofficial layers of information and subjective criteria are given a minimum value of 0.6. As an intermediate point, if the assessments are made using technical information and criteria established by prestigious institutions, the quality value given is 0.8. Then, the global quality factor is obtained by averaging the values corresponding to all the elements of the matrix.

Finally, the **overall confidence level** of the assessment is obtained through the product of the values obtained in the quantity and the quality factors.

## 7. MITIGATION MEASURES

In the event that the proposed project presents, globally or punctually, any significant negative impact (moderate, severe or critical), **mitigation measures** should be adopted in order to avoid, reduce or compensate them.

The optimized alternatives of the project, with mitigation measures included, will be subject to a new impact assessment.

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