

Title: Acoustic characterization of submarine cable installation in the Biscay Marine Energy Platform (bimep).

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Abstract for Poster presentation

The Biscay Marine Energy Platform (*bimep*) is an offshore infrastructure for the demonstration and testing of wave energy harnessing devices promoted by the Basque Entity of Energy (Ente Vasco de la Energía - EVE). *Bimep* is located close to Arminza town (Basque Country, Northern Spain) and it consists on an 5.3 km² sea area between 50 and 90 m depths where four static submarine cables will be placed, operating at 13kV and 5MW.

On the first of June 2009, the General Council on Environmental Quality Assessment of the Ministry of Rural, Marine and Natural Environment of the Spanish Government, on the light of the Environmental Impact Study (EIS) of the *bimep* project undertaken by AZTI in 2008, decided not to submit the project to the whole Environmental Impact Assessment (EIA) process. Nevertheless, the Environmental Impact Statement (EIS) of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the need to implement the proposed Environmental Monitoring Program (EMP) of the EIS. Among other environmental factors, an increase in noise from shipping activity would be expected during installation of submarine cables and consequently may affect marine mammal communities.

Hence, on August 29 of 2013, the EVE entrusted to AZTI to carry out the acoustic EMP of the installation of the submarine cables, which consist on an acoustic characterization of: (i) sound background levels; (ii) cable installation operations; and (iii) a propagation of the measured cable installation sound. The results showed a background level of 70-80 dB. The acoustic signal during cable installation is characterized by a 11 kHz frequency and 188,5 dB re 1µPa which is able to affect a 400 km² area. Impacts over marine mammal's communities were not expected due to the temporality, the season and intensity of the installation operations.

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Acoustic characterization of submarine cable installation in the Biscay Marine Energy Platform (bimep)

BILBAO MARINE ENERGY WEEK

Bilbao, 20-24 April 2015

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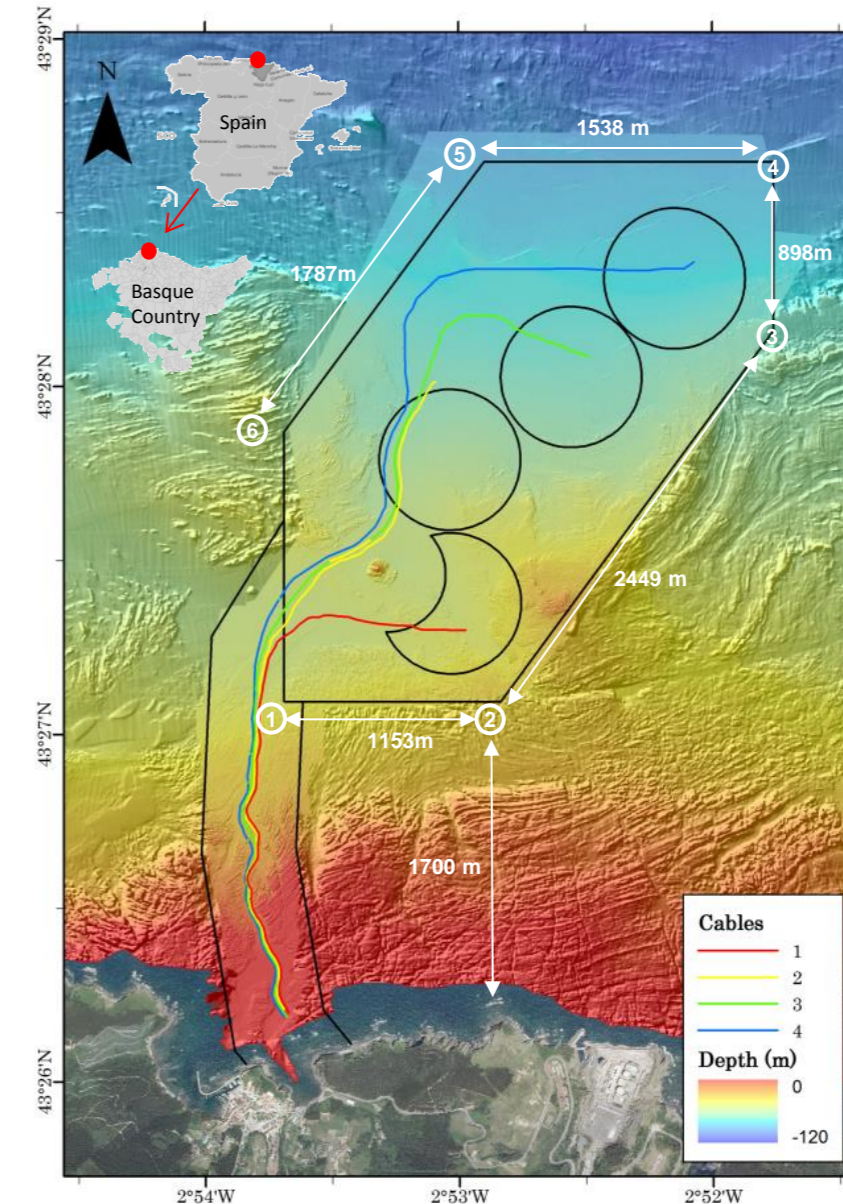
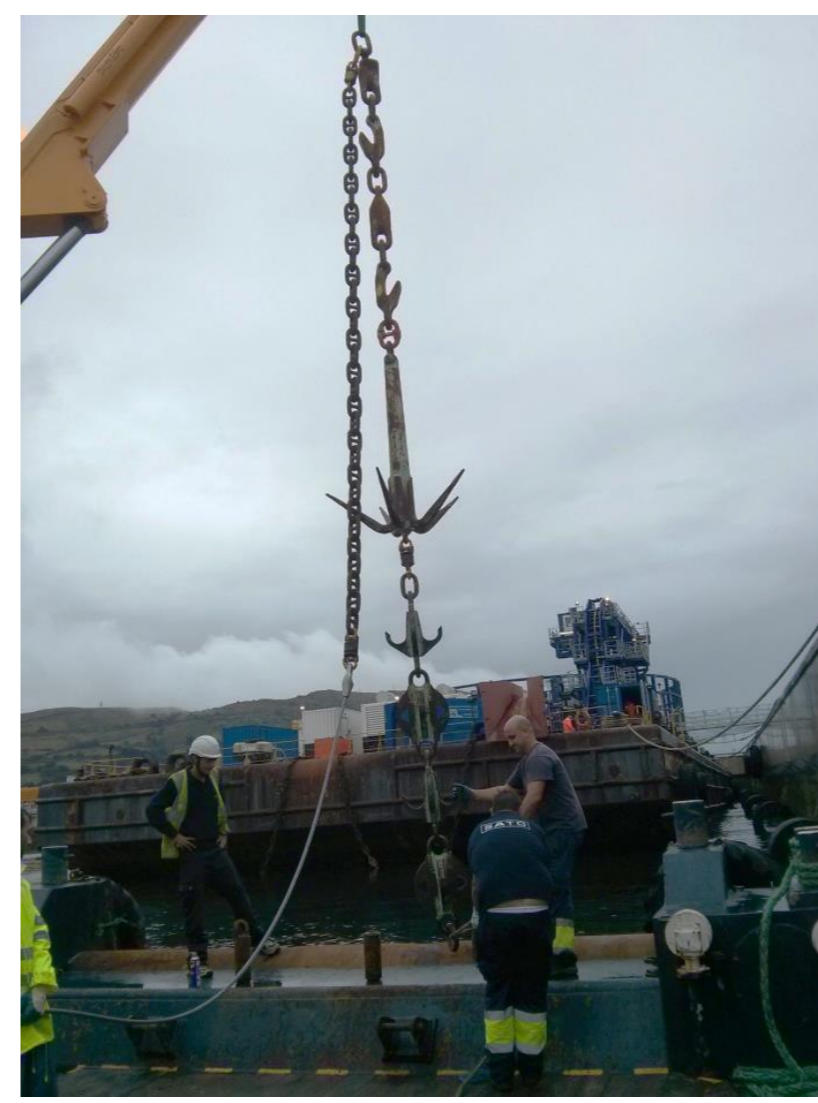
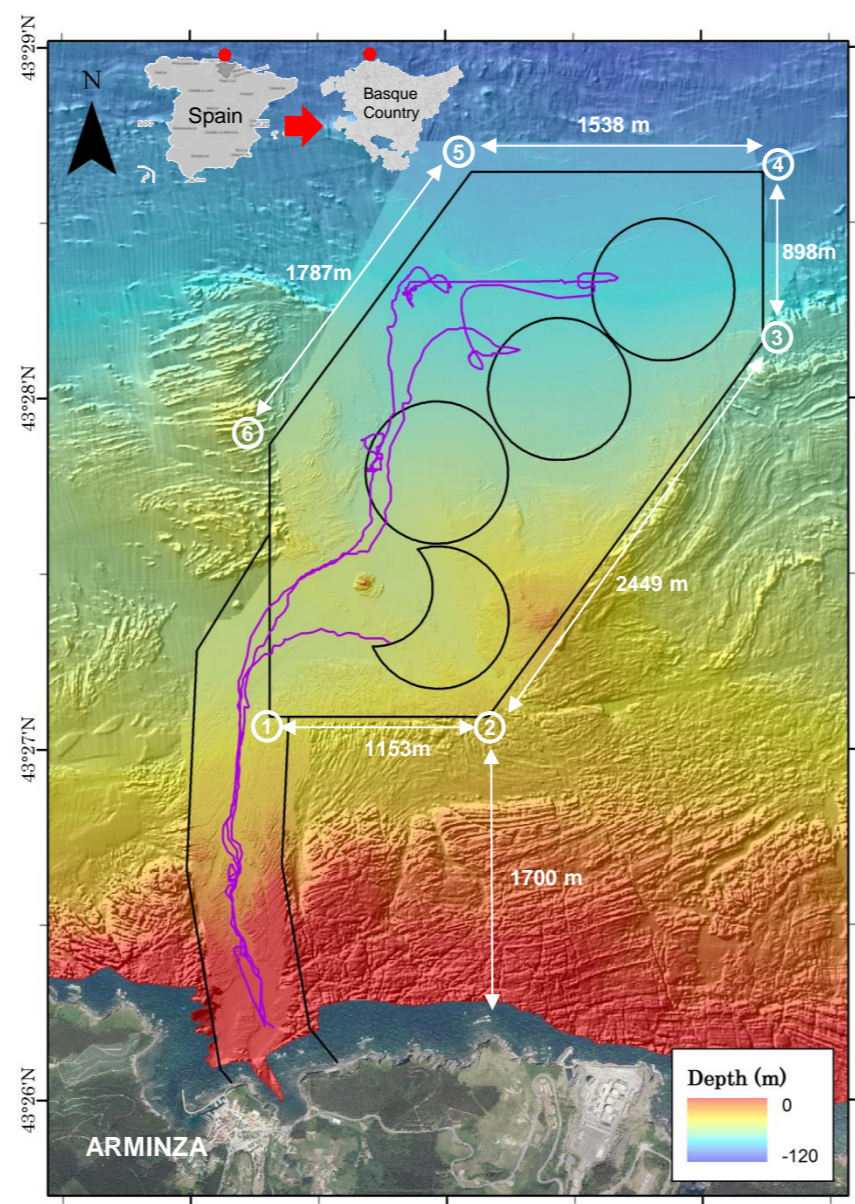
CTN bimep

1. INTRODUCTION

- On the first of June 2009, the General Council on Environmental Quality Assessment of the **Ministry of Rural, Marine and Natural Environment of the Spanish Government**, on the light of the **Environmental Impact Study (EIS)** (Bald *et al.* 2008) of the **BIMEP project** (www.bimep.com) undertaken by **AZTI**, decided to **not submit** the project to the whole Environmental Impact Assessment (EIA) process.
- Anyway, the **Environmental Impact Statement (EIS)** of the Ministry, taking into account the great uncertainties about some predicted environmental impacts, underlined the **need to implement** the proposed **Environmental Monitoring Program (EMP)** of the EIS. Among other environmental factors, an **increase in noise** from shipping activity would be expected during installation of **submarine cables** and consequently may affect marine mammal communities.
- Consequently, on August 29th of 2013, the **Basque Entity of Energy** (promotor of the BIMEP project) entrusted to **AZTI** to carry out the acoustic EMP of the installation of the submarine cables, which consist on an acoustic characterization of: (i) sound background levels; (ii) cable installation operations; and (iii) a propagation of the measured cable installation sound.

2. THE BIMEP PROJECT

- Promoted by the **Basque Entity of Energy (EVE)**, BIMEP represents an **offshore test site** for the demonstration and proving of **wave energy converters (WEC)** promoted by the Basque Entity of Energy (EVE)
- It consists of 5,3 km² sea area between 50 and 90 m depths where **four static submarine cables will be placed, operating at 13kV and 5MW**. Wave energy generation devices will be connected to these cables through dynamic submarine cables.
- The **installation of the submarine cables began on the 11th of September 2013** with the **PLRG** of the cable route
- And **ended between the 20th and 27th of September 2013** with the **laying of the four submarine cables**.
- In land, BIMEP will provide a research centre in Arminza (Bizkaia, Basque Country, Northern Spain) where developers will be able to control the behavior and performance of the devices.



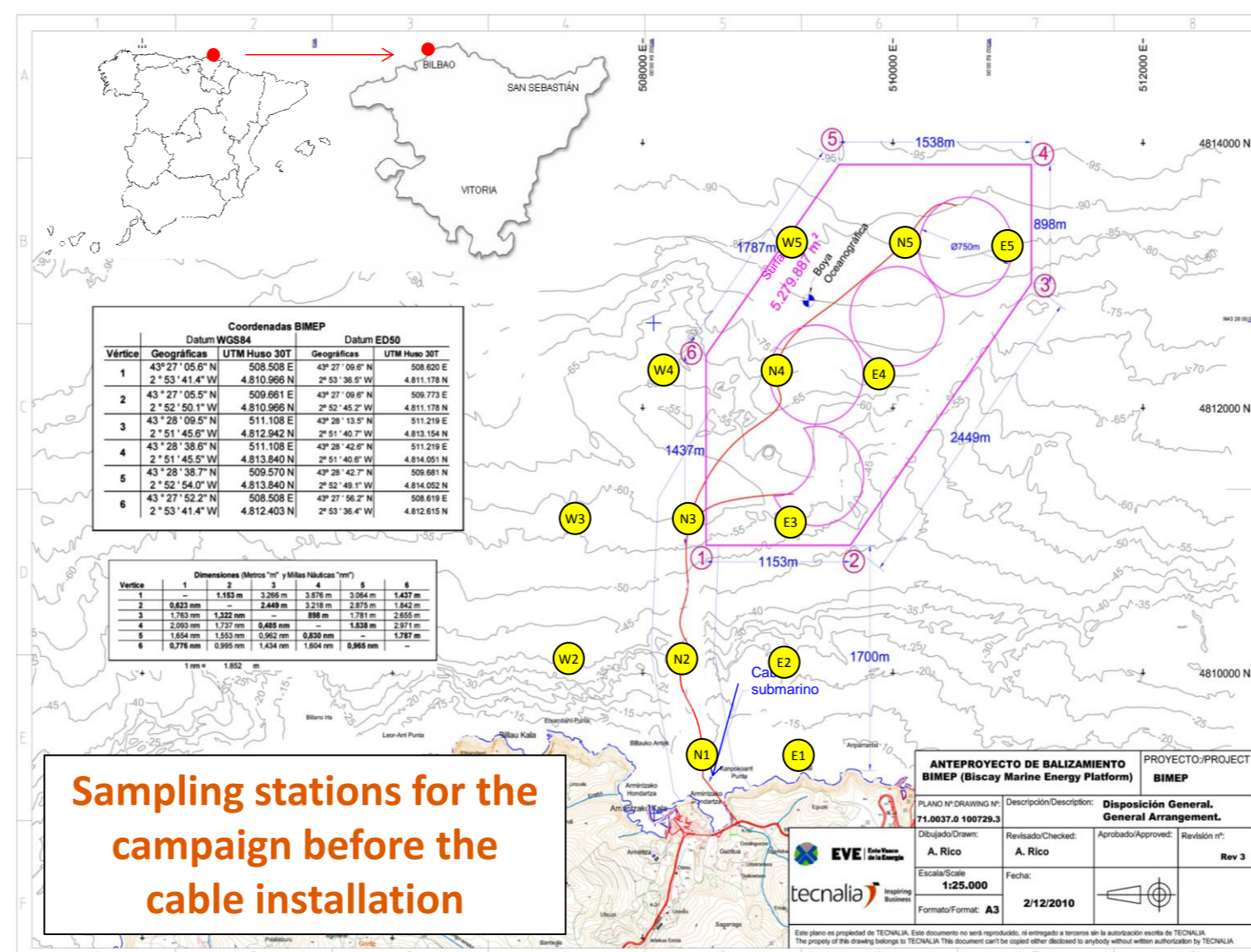
3. METHODOLOGY

- Sampling campaign:** Two sampling campaigns were undertaken: (i) the first one was done **prior to the installation** of the cables. The objective of this campaign was the establishment of the baseline noise levels in bimep; (ii) the second one was done **during the installation** of cable number 2.

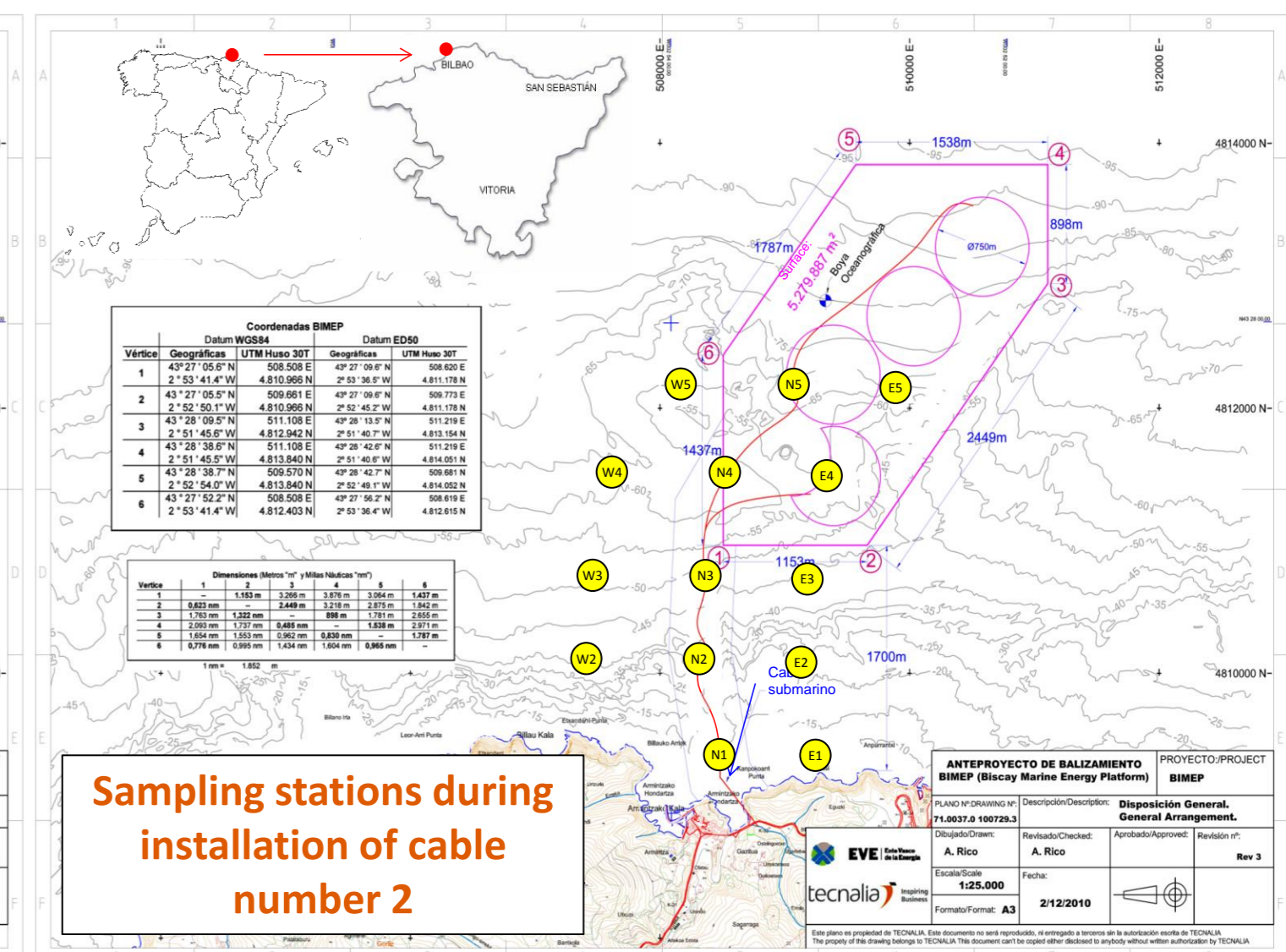


The sampling campaign was done with an **icListen HF 200 kHz hydrophone** of Ocean Sonics (<http://oceansonics.com/>). In each campaign 5 minutes measurements at 10 m depth were done in 15 sampling points all along the cable route.

- Sound propagation:** according to the obtained results a propagation of the sound in the bimep area was done by means of Bellhop and Ram models.

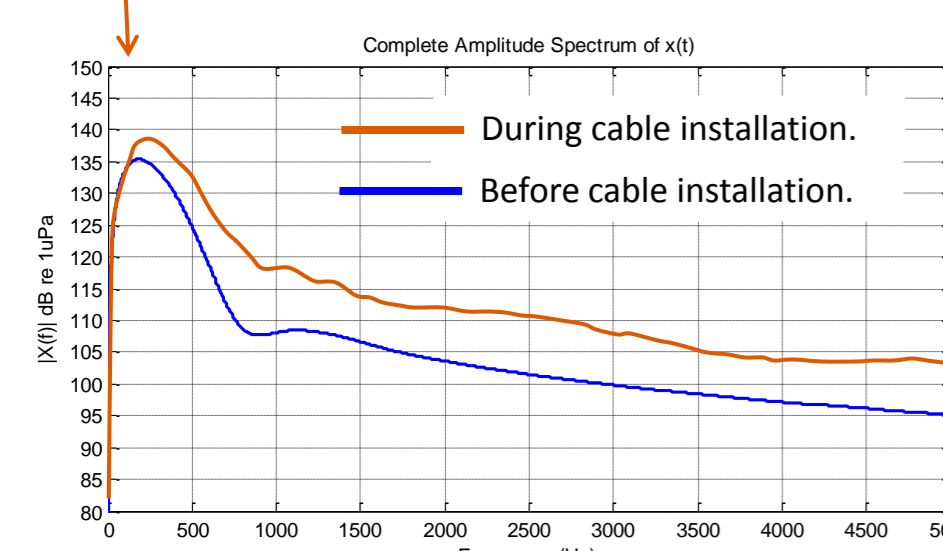
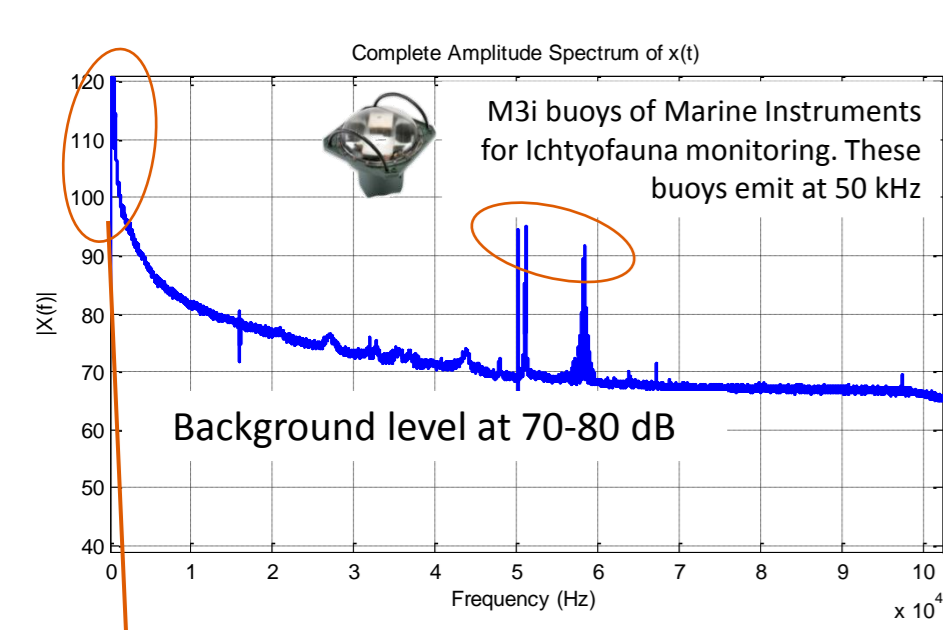


Sampling stations for the campaign before the cable installation

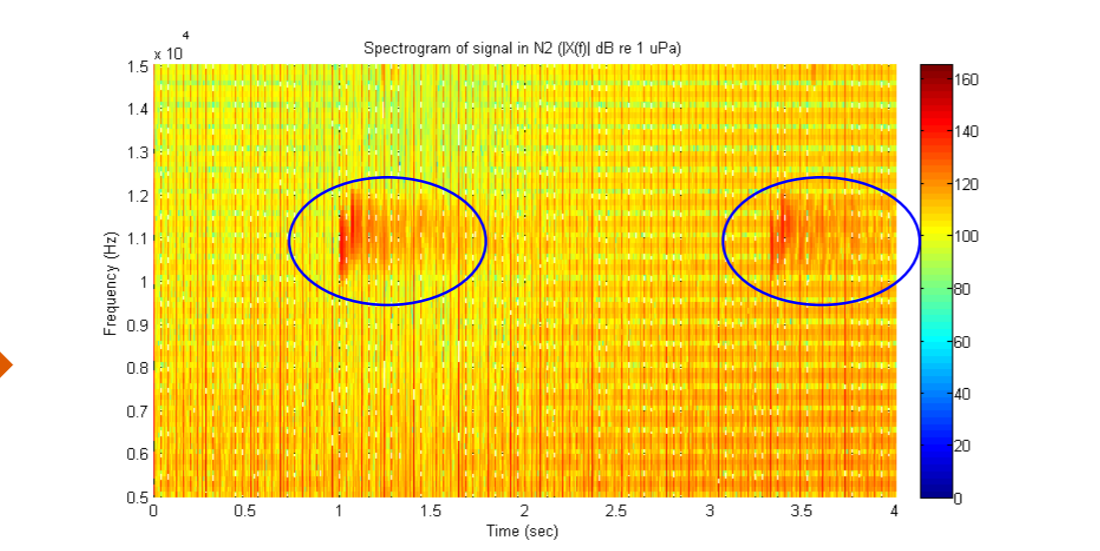


Sampling stations during installation of cable number 2

4. RESULTS: sound levels and propagation



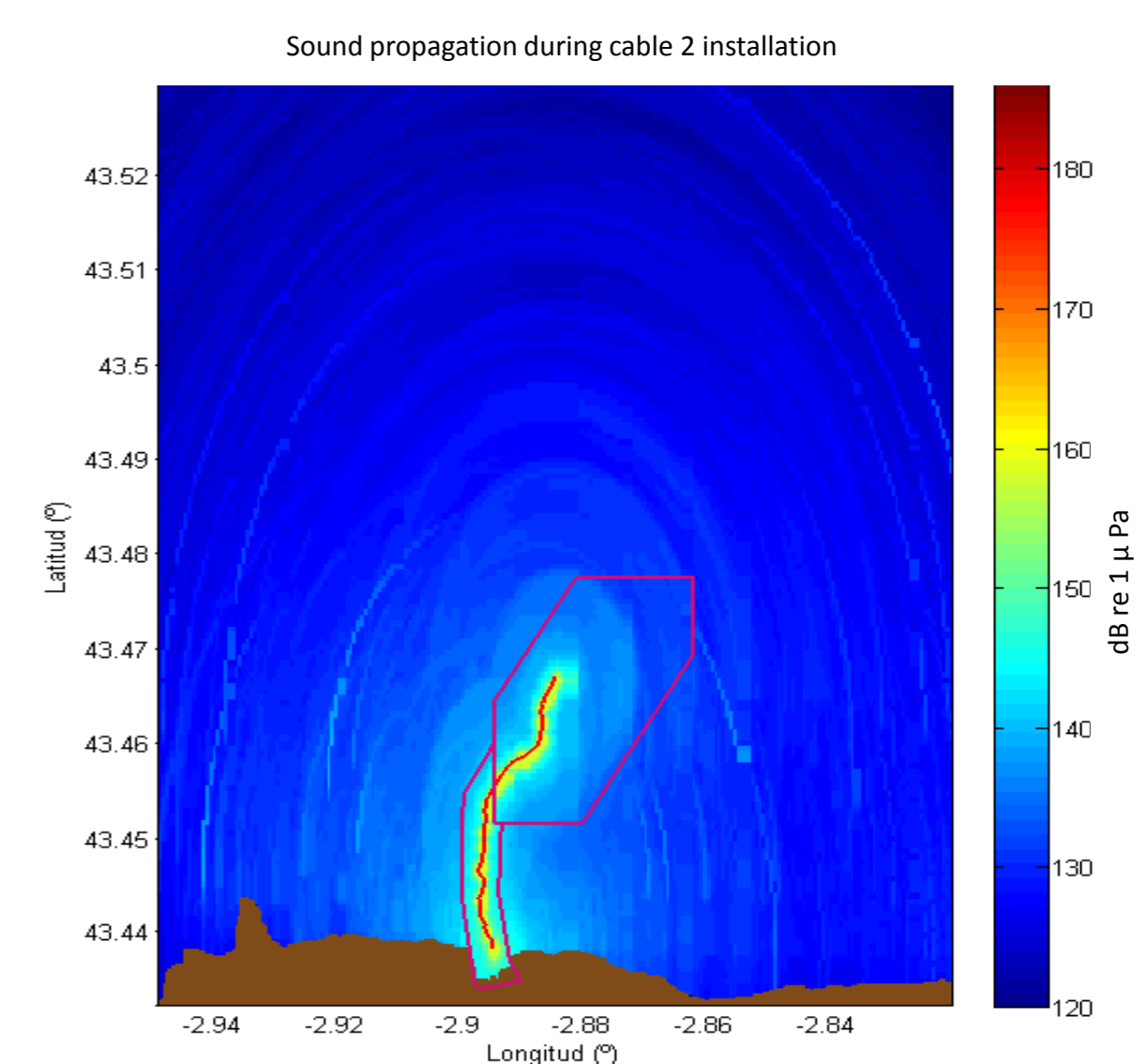
- Sound background levels** between 70-80 dB
- During cable installation an increase of the average sound can be observed in low frequencies: **140 dB in 11 kHz**, about **30 dB above the background level** in this frequency.



Taking into account the characteristics of the sound measured in the sampling points (view precedent paragraph), and the transmission losses of the sound in the field, the intensity in the source (cable vessel) of the sound was modelled.

Measured sound (dB re 1µPa) Source Level (dB re 1µPa @ 1m)

Station	Measured sound (dB re 1µPa)	Source Level (dB re 1µPa @ 1m)
N1	134.0	180.8
N2	142.0	192.0
N3	139.0	191.5
N4	133.0	185.0
N5	148.0	201.6
E4	128.0	184.3
E5	127.4	184.4

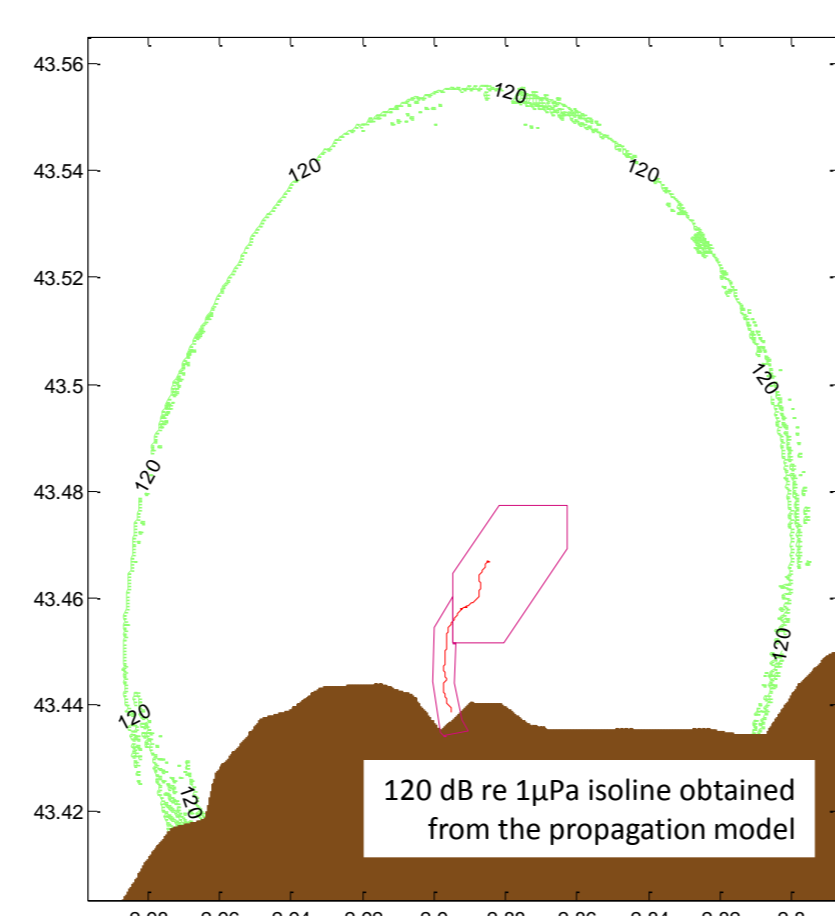


5. DISCUSSION

- During cable installation, an impulsive sound average of **188,5 dB re 1µPa at 11 kHz** has been isolated.

- Taking into account the marine **mammal noise exposure criteria** established by Southall *et al.* (2007) (table below): (i) injury levels of **190 dB** where **not achieved**; (ii) levels between **174-180 dB** where achieved **10-15 m** from the source and (iii) levels of **120 dB** have a widespread distribution from the source affecting an area of **400 km²** (see figure on the right)

Exposure limit	Effect
190 dB re. 1µPa (RMS)	Auditory injury criteria – pinnipeds
180 dB re. 1µPa (RMS)	Auditory injury criteria – cetaceans
174 dB re. 1µPa (Peak)	Aversive behavioural reaction in harbour porpoise
120 dB re. 1µPa (RMS)	Level B - Harassment in cetaceans and pinnipeds exposed to continuous sounds



- Taking into account (i) the **installation date** (in december and far from the breeding season) and (ii) the **temporality of the impact** (7 days of intermittent installation works), it's expected that the **impacts** over marine mammals have been **below** the impacts **expected** in the **EIS of bimep** (Bald *et al.* 2008).

6. CONCLUSION

- During cable installation, an impulsive sound average of **188,5 dB re 1µPa at 11 kHz** has been isolated.
- Taking into account the source of the sound measured, the acoustic impact threshold for marine mammals in the bibliography, the **installation date** (in december and far from the breeding season) and the **temporality of the impact** (7 days of intermittent installation works), it's expected that the **impacts** over marine mammals have been **below** the impacts **expected** in the **EIS of bimep**.

7. REFERENCES

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Acknowledgements

This work has been funded by bimep S.A.