



LIFE MARINAPLAN
PLUS
LIFE15 ENV/IT/000391
MONITORING
PROTOCOL



Monitoring Plan sub-action 1.2



**Reliable and innovative technology for the realization of a sustainable
MARINE And coastal seabed management PLAN**

**LIFE Environment and Resource Efficiency project
LIFE15 ENV/IT/000391**

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Chapter 1. Introduction

1.1 Introduction

The port of Cervia is interested by a cyclic problem of inlet silting. Relevant data are present about port bathymetries, in particular from 2009 and up to now. The technological solutions adopted in the past, including seasonal dredging and/or sand handling through boat propeller as well as docks lengthening (completed in 2009), didn't solve the problem.

The overall objective of the MarinaPlan Plus project is to apply and demonstrate at industrial scale an innovative and reliable technology for marine and coastal management able to ensure navigability and access to ports throughout the year, thus allowing at the same time thriving maritime economy and environmental sustainability. The technology avoids the usual collection of littoral materials nearby the entrance of harbours through the installation of submerged and static devices, called "ejectors", which are fed by pressurized water, aspire a mixture of water and sediments and convey it through a pipe in an area where does not constitute obstacle to navigation.

Demo plant environmental and socio-economic impacts on port of Cervia environment will be monitored through the planning of replicated targeted sampling campaign, the setting up of specific indicators, a collection of existing data on them, and space/time statistical analysis of the collected data. Furthermore, demo plant electric energy consumption and CO₂ and particulate emission will be assessed. Finally, communication and dissemination impact of the project will be assessed too.

1.2 Scope of the document

The scope of the document is to define the design of the benthic macroinvertebrates sampling. Benthic macroinvertebrates are considered as biological quality elements in the assessment of the environmental status of the coastal ecosystems (i.e. Water Framework Directive and Marine Strategy Framework Directive). The aim of the assessment is to determine if there is any impact of the ejectors and of ejectors' discharges on the surrounding ecosystems. A sampling design (area, number of samples, timing and/or frequency) was defined coherently with the "*LIFE project specific indicators*" Excel file. The final result is to define how the environmental impact of the demo plant can be assessed.

Chapter 2. Sampling design

The possible impact on sediment characteristics, benthic macroinvertebrate and fish assemblages of the demo plant needs to be assessed simultaneously at a variety of spatial scales, encompassing the full extent of environmental variability where the ejectors are found. The sampling sites will be located in one putatively impacted location and four control locations, two in the north and two in the south with regard to the plant site, separated by 3-400 m (Figure 1). Two sampling areas (800 m²) are defined at each location, 20-30 m apart. The two areas within the putatively impacted location are represented by the removing and discharging sediment areas, i.e. the ejectors' and ejectors' areas. Replicated samples will be done in each area. The sampling will be done at each area one time before the plant operation starts, and two times after plant shut on.



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Chapter 3. Sampling methods

At each sampling area replicated samples of marine sediment and fauna will be manually taken by scientific SCUBA divers for 1) sediment grain size analysis, 2) percentage of organic material in the sediment, 3) benthic macrofauna. Equal sample size will be assured using an aluminium frame (23.5×13.5 cm). In the laboratory, macrofaunal samples will be stained with Rose Bengal and fauna sorted. All species will be identified to the lowest practicable taxonomic level, and numbers of individuals counted. The data obtained from the study will form a multivariate matrix of response variables that can be analysed with respect to a priori generated hypothesis: species composition, abundance, and diversity will be differed between impacted and control areas, before and after the intervention, taking into account the natural variability among locations and areas within locations.

Fish assemblages will be sampled by video cameras randomly placed within each study area at each sampling time. High definition (Full-HD) thirty minutes video will be recorded for each video camera deployment. Videos will be subsampled and analysed for fish species identification and size and abundance estimates.

The replicability of the sampling in time will be guarantee through the use of GPS system with accuracy of 2 meter.

Data will be analysed using univariate and multivariate statistical tools, using the software PRIMER and R. The approach should allow to discriminate the potential additional stress caused by the demo plant from the background of the anthropogenic pressures.



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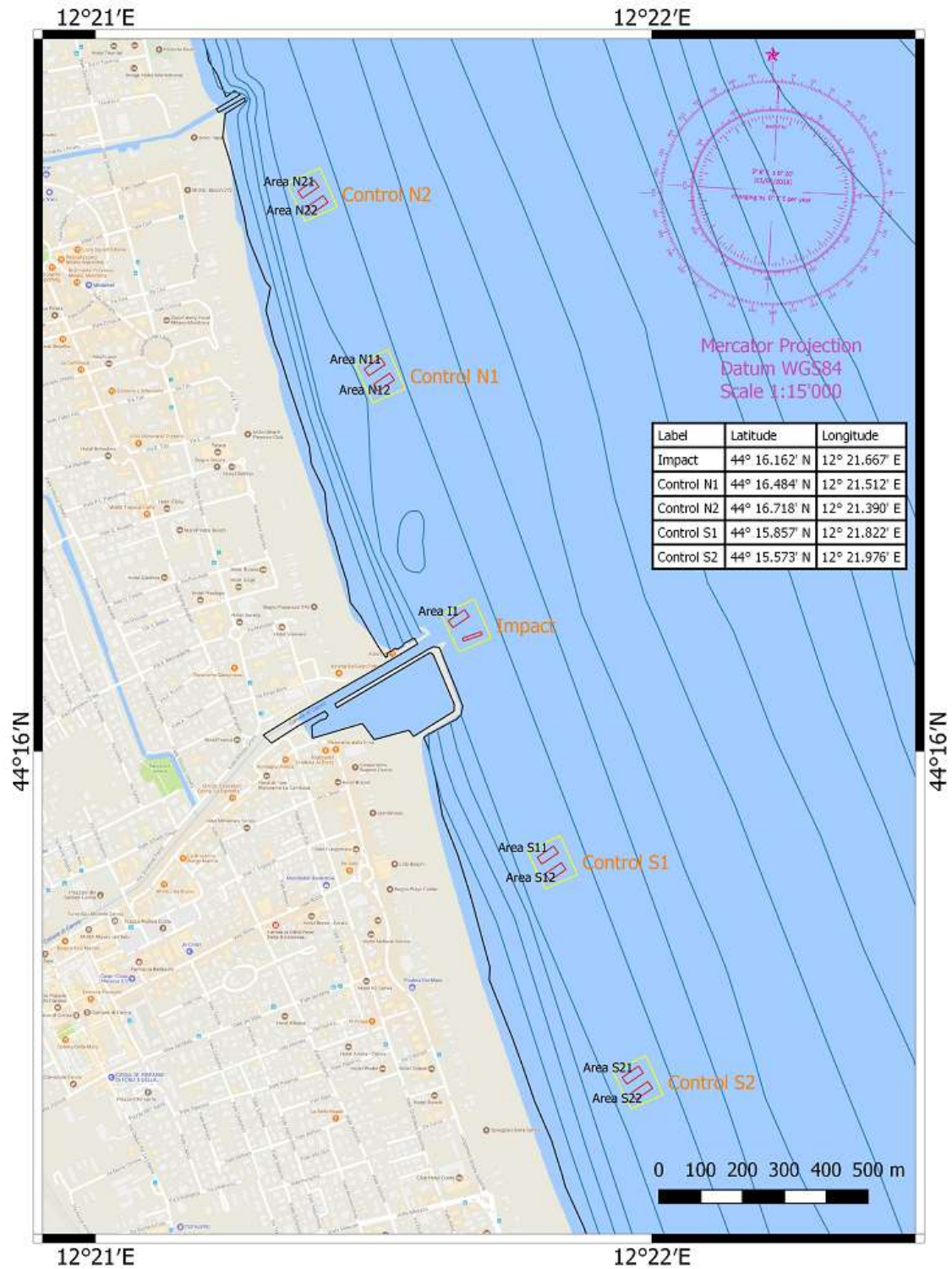


Fig. 1: Map of plant impact zones and control zones.