Underwater noise and marine mammals in the Adriatic Sea SOUNDSCAPE project

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European Regional Development Fund

Sound characteristics:

- high travelling speed

- low attenuation over great distances

- rapid information acquisition and exchange

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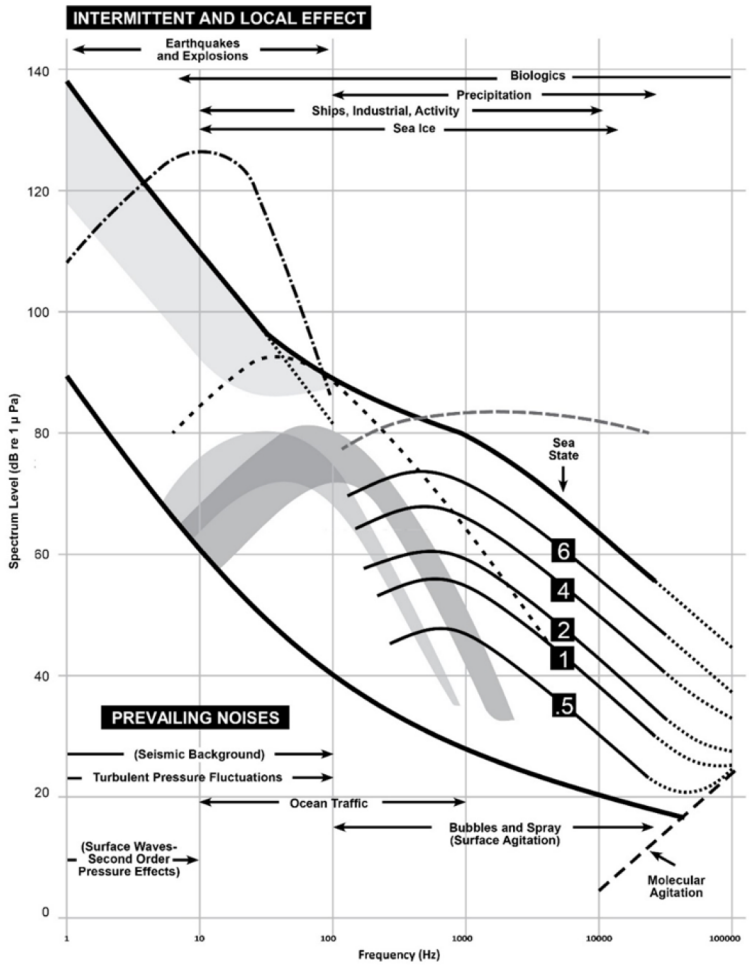
Sources of sea ambient noise

- Natural
- Physical
- Biological
- Anthropogenic



Anthropogenic Noise:

- Impulsive (short duration)
- Continuous (long duration)

Use of sound by underwater animals

Marine invertebrates

•Production of communicative sounds;

•Orientation cue in developmental stages

•Sounds of varying frequencies

Fish

•Variability among conspecific or heterospecific sounds: mate attraction;

evaluation of opponents; reproductive status; territorial status; position; identity

•Hearing specialists and hearing generalists

•Best hearing sensitivity 30 Hz – 1000 Hz

Marine mammals

•Communication; orientation and navigation; locating objects and prey

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Marine turtles

- Best hearing sensitivity:

  200 Hz and 700 Hz

Proposed functions of hearing:

- Predator avoidance
- Navigation
- Communication
- Identification of nesting beaches

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Anthropogenic noise: effects on marine animals

Reactions depend on:

- Received sound levels
- Frequency
- Duration of exposure
- State of the animal exposed
- Novelity of the sound
- Distance to a sound source
- Hearing capabilities
- Other environmental stressors

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Effects of noise on marine life

1. Physiological effects:

   physiological changes that result from exposure to a stressor

2. Hearing loss and masking:

- Damage to the hearing systems of marine animals as a result of noise exposure
- Interference with biologically important sounds = masking

3. Behavioral and acoustic responses :

- Changes in behaviour and vocalization parameters of exposed animals

Soundscape

- Sound as indicator of diverse ecological processes
- Signal diversity reflects ecosystems health
- Use of PAM to monitor soundscapes

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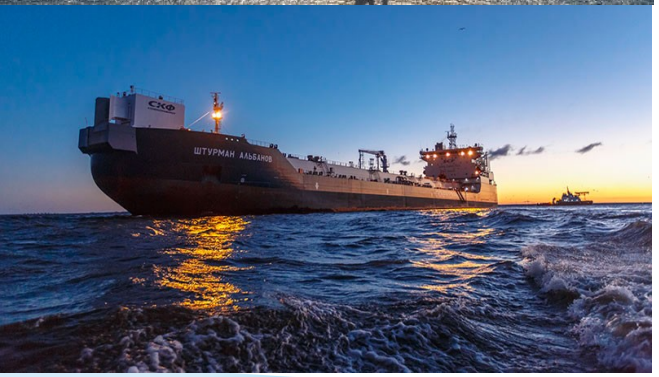

Healthy environment

- Multiple sound sources
- High biodiversity

VS.

Deteriorated environment

- Anthrophony
- Species loss: frequency gaps

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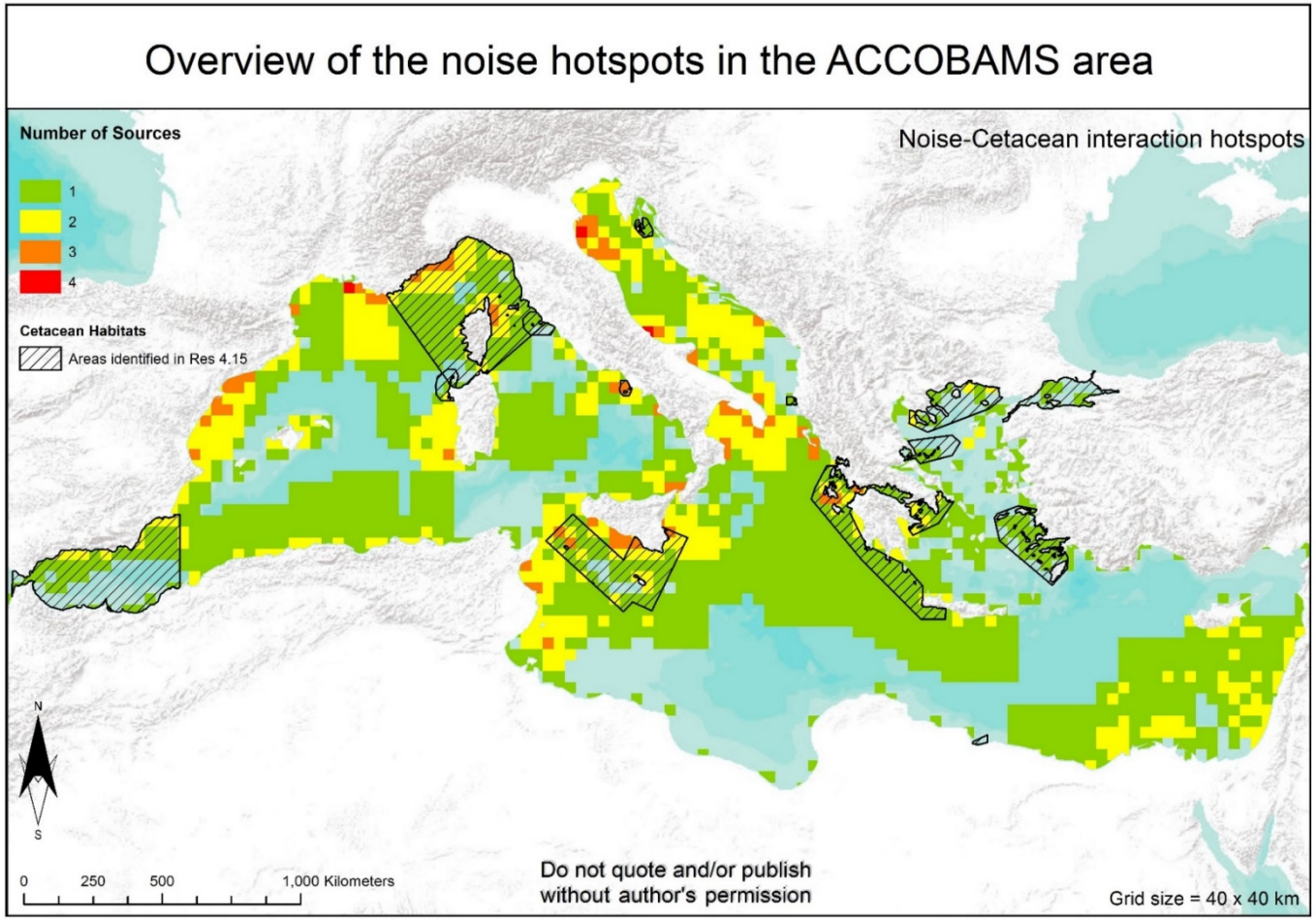
Noise hotspots in the Mediterranean Sea



Noise-cetacean interaction hotspots):

Source categories:

A) seismic surveys

B) coastal and offshore work

C) military activities

D) marine traffic

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SOUNDSCAPES IN THE NORT ADRIATIC SEA AND THEIR IMPACT ON MARINE BIOLOGICAL RESOURCES

SOUNDSCAPE

priority axis 3 - Environment and Cultural Heritage

SO 3.2 Contribute to protect and restore biodiversity

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OVERALL OBJECTIVE OF SOUNDSCAPE:

The overall objective of the SOUNDSCAPE project is the assessment of the impact of underwater noise on the marine fauna and in general on the ecosystem of the Northern Adriatic Sea (NAS) and to create a cross-border monitoring network to ensure an efficient protection of marine biodiversity and to develop a sustainable use of marine and coastal ecosystems and resources.

To achieve this, specific objectives are set:

- Creation of a shared noise monitoring net
- Assessment of noise influence on biodiversity
- Development of mitigation measures

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8 PARTNERS:

INSTITUTE OF OCEANOGRAPHY AND FISHERIES (IOF)

NATIONAL RESEARCH COUNCIL (CNR - ISMAR)

BLUE WORLD INSTITUTE OF MARINE RESEARCH AND CONSERVATION (BWI)

ENVIRONMENTAL PROTECTION AGENCY OF FRIULI VENEZIA GIULIA (ARPA)

CETACEA FOUNDATION (CF)

MARCHE REGION (REM)

MINISTRY OF ENVIRONMENT AND ENERGY (MEE

TEACHING INSTITUTE FOR PUBLIC HEALTH, PRIMORJE-GORSKI KOTAR COUNTY (TIPH)

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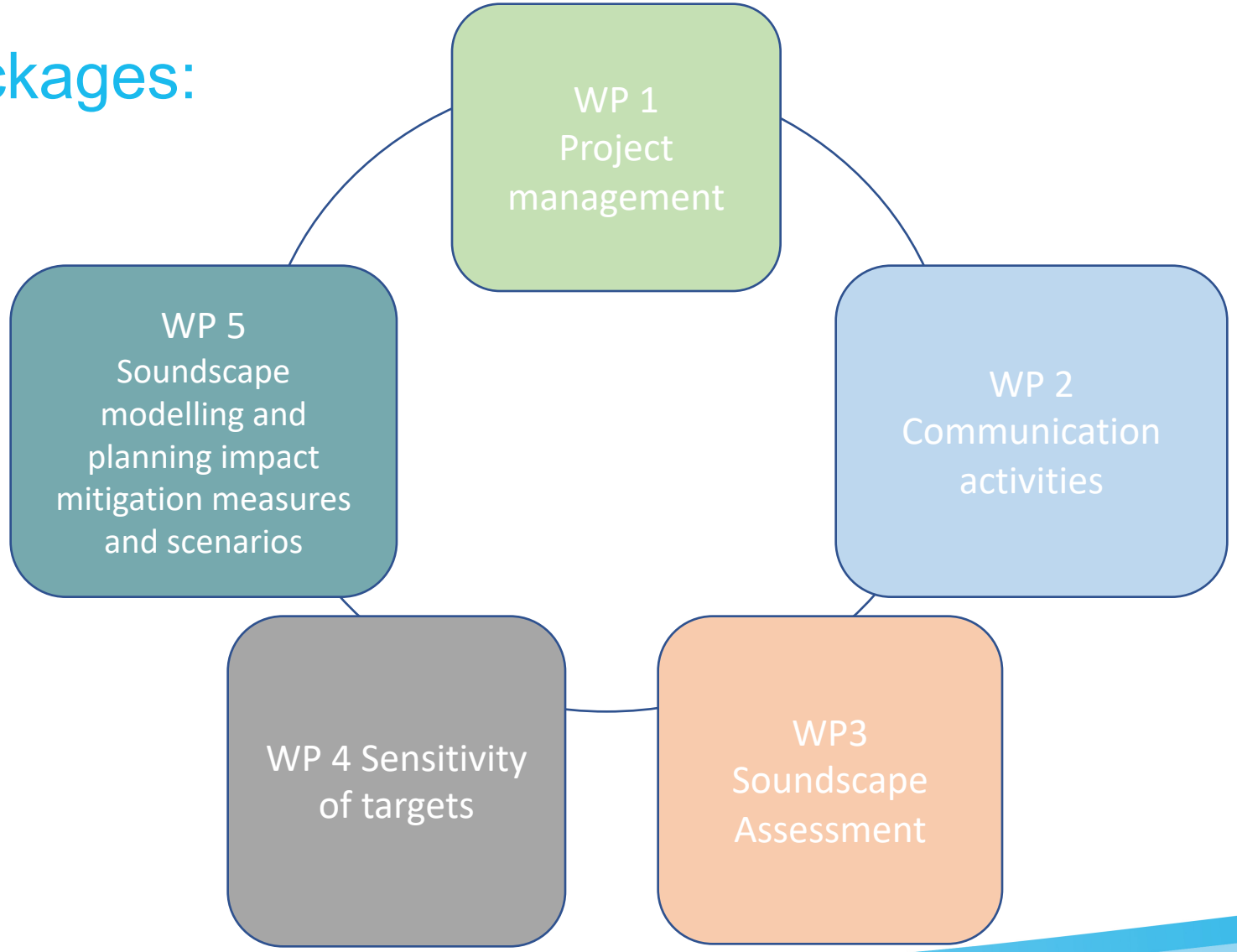
Work Packages:



Project main outputs:

- Support of natural ecosystems through: Analysis of data about target species distribution and anthropogenic noise sources and Assessment of Suitable Areas for target species though the implementation of Habitat Suitability Models

- Underwater noise monitoring network set up and put in operation

- ADRIPLAN data portal integrated and upgraded with new GIS informative layers, obtained through the first description of the noise status in the NAS measured at the eight stations and validated sound propagation by modelling

- Evaluation of strategic mitigation measures by scenario analysis using customizer spatial planning tools and transferability analysis

WP1 Project management (IOF)

INSTITUTE OF OCEANOGRAPHY AND FISHERIES SPLIT

1.1 Start-up activities

1.2 Day to day project management, coordination and internal communication

1.3 Steering and monitoring of the project implementation

1.4 Finantial management

WP2 Communication activities (CF)

2.1 Start-up activities –raise public awareness on the issue of underwater noise pollution and its impact on marine biodiversity

2.2 Establishing the stakeholder partnership – database of stakeholders and end-users

2.3 Promotion of the project using digital tools

2.4 Public events itinerant exhibition will be set up making use of art installations on the theme of sea sounds to promote the importance of preservation of biodiversity in relation to effects of underwater noise.

2.5 Dissemination materials

2.6 Promotion of the project on the EU level – project presentation to the TG-NOISE meetings. The results of the project will be also presented to the DG Mare

2.7 Final Event - final conference

WP3 Soundscape Assessment (IOF)

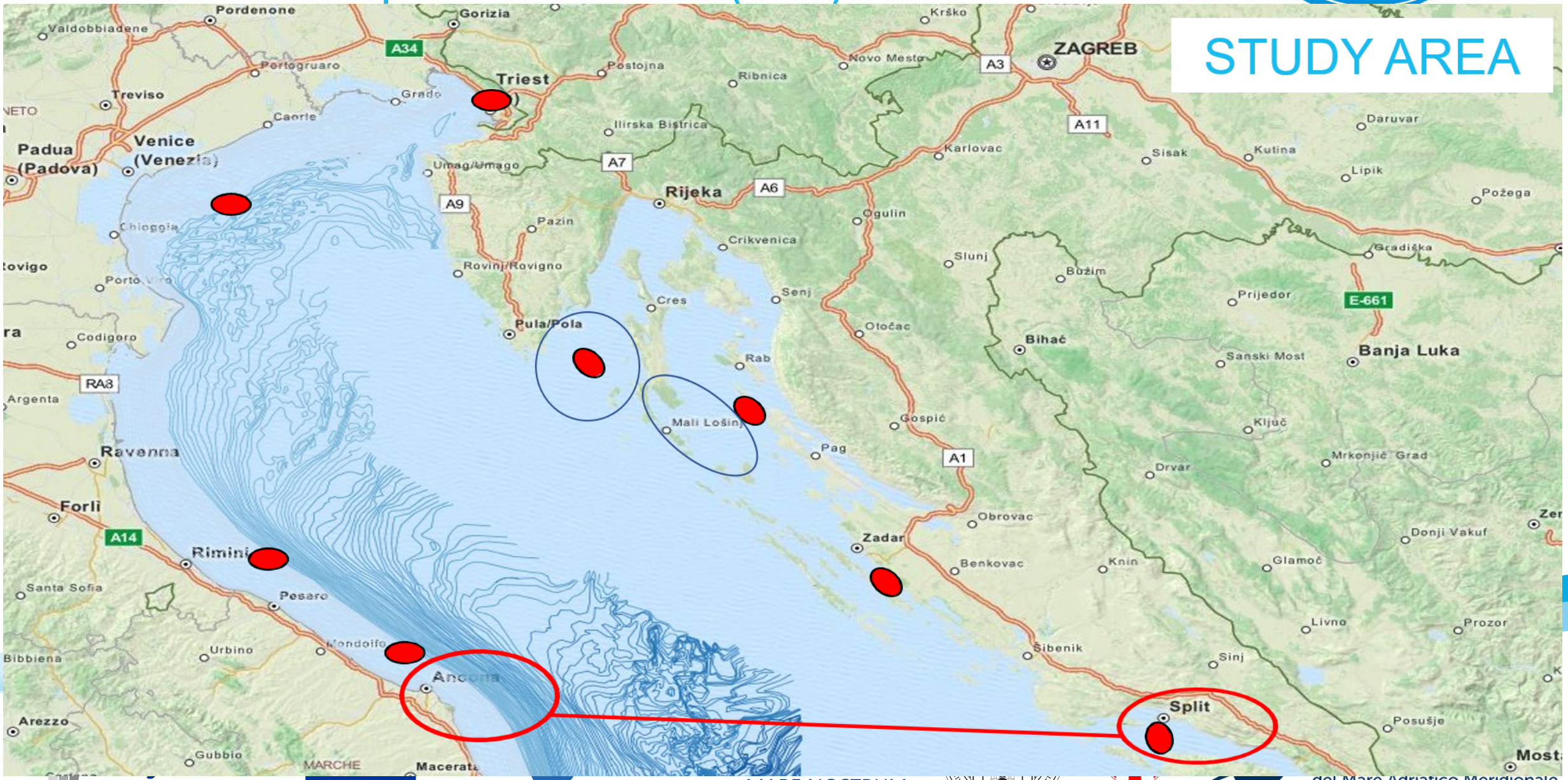
INSTITUTE OF OCEANOGRAPHY AND FISHERIES SPLIT

3.1 Review and analysis of the sources of anthropogenic underwater noise in the Northern Adriatic Sea : database on different anthropogenic sources of underwater noise

3.2 Setting up of the monitoring network of underwater noise measurements : a network for the monitoring of underwater noise will be set up implementing 8 monitoring locations (monitoring procedure will be defined, training operators for deployment/recovery)

3.3 Field surveys for data collection – data recovery on monitoring stations

WP3 Soundscape Assessment (IOF)



WP3 Soundscape Assessment (IOF)

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3.4 Recreational boats noise source level assessment – noise essessment

3.5 Definition of processing protocols – training workshop for data processing

3.6 Processing of data input for modeling and uncertainty analysis

3.7 Processing of data to estimate Acoustic Complexity and Diversity Indices

ENVIRONMENT

HEALTHY VS. DETERIORATED

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WP3 OUTPUTS

INSTITUTE OF OCEANOGRAPHY AND FISHERIES SPLIT

- ✓ IMPLEMENTATION OF THE MONITORING NET
- ✓ EXECUTABLES FOR PROCESSING
- ✓ NOISE PROCESSED DATA
- ✓ ASSESSMENT OF ACOUSTIC DIVERSITY

WP4 Sensitivity of targets (BWI)

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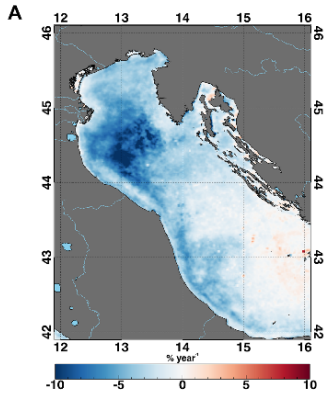
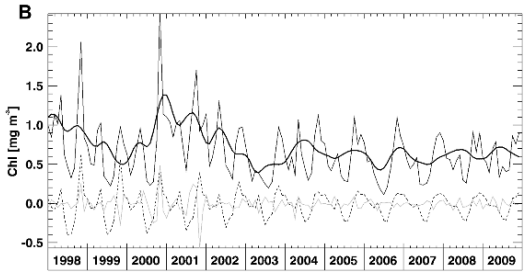
4.1 Data collection about target species: Data on the spatial and temporal presence of common bottlenose dolphin and the loggerhead turtle within Cres and Lošinj archipelago (Croatia)

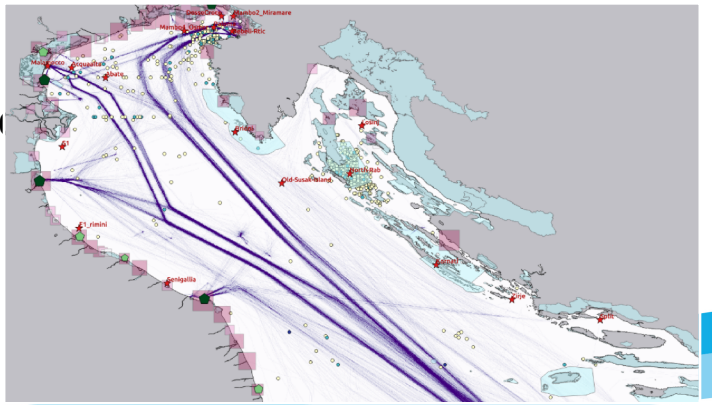
4.2 Review on the sensitivity of each target species: A review of the current knowledge on sensitivity of each target species

4.3 Collecting data for habitat modelling in case study:
Collecting data on environmental, commercial shipping data, recreational boating

4.4 Habitat suitability modelling for specific target species:
Constructing an HSM that will predict the probability of the presence/absen of the target species by relating them to avaiable environmental and anthropogenic variables







WP4 OUTPUTS

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- ✓ ANALYSIS OF DATA ON TARGET SPECIES DISTRIBUTION AND ANTHROPOGENIC NOISE SOURCES

- ✓ ASSESSMENT OF SUITABLE AREAS FOR TARGET SPECIES: IMPLEMENTATION OF HABITAT SUITABILITY MODELS BASED ON THE DISTRIBUTION OF ENVIRONMENTAL VARIABLES AND TARGET SPECIES INCLUDING ALSO THE PROBABILITY TO EXCEED SPECIFIC SOUND LEVELS FOR SPECIFIC TARGET SPECIES

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WP5 Soundscape modelling and planning impact mitigation measures and scenarios (CNR-ISMAR)

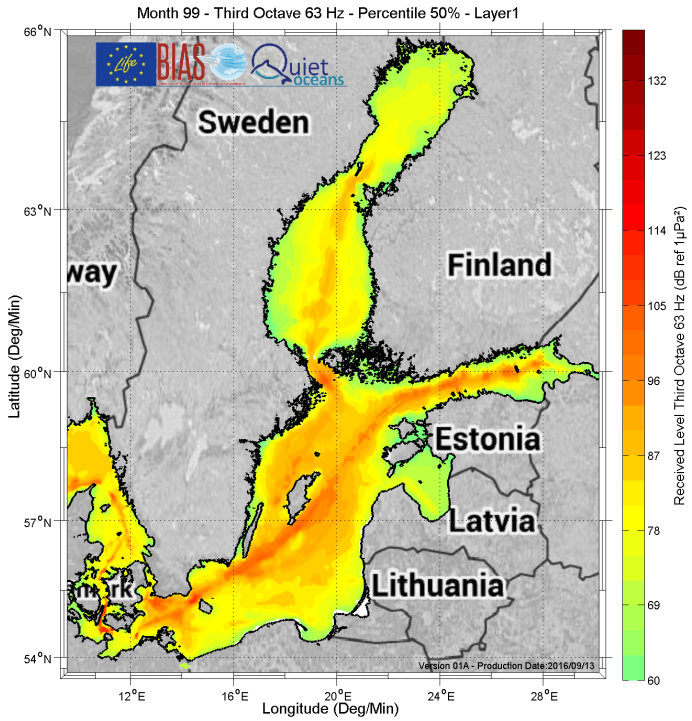
5.1 Collection of environmental data for modeling

5.2 Soundscape modeling for the Northern Adriatic Sea:
- specific frequency bands (MSFD)
- training course for soundscape modelling

5.3 Data integration and tools supporting decisions:
Data incorporated within ADRIPLAN Portal (data.adriplan.eu) developed within the DG MARE ADRIPLAN Project.

5.4 Development of mitigation measures to reduce underwater noise

5.5 Support of implementation of MSFD on Descriptor D11: defining the Good Environmental Status (GES)



5.6 Transferability of mitigation measures: can identified measures transferred in other areas can they become part of existing and under development policies, plans and projects

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WP5 OUTPUTS

- ✓DATABASE OF NOISE SOURCES
- ✓DATABASE OF ENVIRONMENTAL DATA NOISE MAP ATLAS
- ✓HABITAT SUITABILITY MAP ATLAS
- ✓TOOL FOR SPATIAL PLANNING MANAGEMENT FEASIBLE MITIGATION SCENARIOS
- ✓COURSE TO TRANSFER KNOWLEDGE TO MANAGEMENT INSTITUTIONS

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