Interreg NEXT Black Sea Basin

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EfxINNOs

Establishing and Operating an Innovative Marine Technology Transfer Network for Enhancing the Transition to a Sustainable Blue Economy in the Black Sea Basin

Produce videos on benthic ecosystem status and threats

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1. Introduction

A series of high-resolution videos and images will be produced using micro-AUVs and ROVs during the surveys of the selected study sites. These visual materials will document the underwater benthic habitats in unprecedented detail, capturing both the structural complexity of the seafloor and the diversity of organisms that inhabit it. By combining wide-area footage with close-up images, the videos will provide an immersive view of the marine environment, offering a valuable tool for both scientific analysis and public communication.

The significance of these videos lies in their ability to convey the state and dynamics of the benthic ecosystem in a visually compelling way. They will serve as a basis for assessing ecosystem health, monitoring temporal changes, and identifying areas under stress, while also raising awareness of the importance of seagrass meadows and other key habitats for biodiversity and ecosystem services.

In addition to being used by the Greek project team for scientific purposes, the videos will be shared with the Bulgarian partners. This collaborative approach will ensure that all stakeholders across the project benefit from the visual documentation, promoting knowledge exchange, joint ecosystem monitoring, and coordinated conservation efforts across the region.

2. Methodological Approach for Benthic Surveys and Video Documentation

The methodology for this project combines advanced underwater survey technologies with rigorous ecological assessment to document and evaluate the status of benthic ecosystems. The primary tool for data collection is the RTsys NEMOSENS micro-AUV, which will be deployed at the selected study sites in Greek waters. This platform, equipped with a GoPro camera, enables high-resolution (4K) imaging and video capture of the seafloor, providing detailed documentation of benthic habitats, including seagrass meadows, rocky outcrops, and soft sediment zones, as well as the organisms inhabiting them. By integrating both still images and continuous video footage, the surveys aim to produce a comprehensive visual record of the benthic environment, capturing both spatial complexity and ecological interactions.

The videos and images that will be produced during the surveys will serve multiple purposes. From a scientific perspective, they will allow the assessment of habitat structure, species diversity, and distribution patterns. Repeated surveys over time will enable the detection of temporal changes in the ecosystem, including early signs of degradation or shifts in species composition. From a communication perspective, the visual materials will be curated and assembled into engaging videos that effectively convey the richness and complexity of the benthic environment to stakeholders and the wider public. The Greek project team will produce these videos and share them with Bulgarian partners, fostering knowledge exchange, collaborative monitoring, and joint conservation efforts across the Black Sea region.

2.1. Assessment of ecosystem health

The assessment of ecosystem health will be based on an integrated analysis of the visual data. Key indicators will include species richness, abundance, and the presence of indicator species that reflect ecosystem integrity. Habitat condition will be evaluated through metrics such as seagrass coverage, sediment characteristics, and evidence of anthropogenic impacts, including litter or physical disturbance. The images and videos collected during the surveys will also be analyzed to identify specific species that feed into the ecosystem health indices defined in A1.8, ensuring that the assessment aligns with the standardized framework established for this project. By combining quantitative ecological indicators with qualitative visual documentation, the project will generate a robust evaluation of benthic ecosystem status that supports both scientific research and management decisions.

All collected materials will be systematically archived and annotated to ensure consistency and accessibility. The videos and images will be used to produce final outputs for dissemination, including educational and awareness-raising materials. This approach ensures that the scientific insights gained during the surveys are not only documented but also communicated effectively to all stakeholders, contributing to informed decision-making and enhanced public engagement in the conservation of benthic ecosystems. Figure 1 shows an indicative image captured using the GoPro camera in the coastal zone near Fanari during the first preliminary survey, revealing healthy stands of *Posidonia oceanica* and *Cymodocea nodosa*. This video footage was used to confirm the presence of key seagrass species, which will be included in the indices defined in A1.8, and to evaluate meadow health in situ, providing a visual baseline for further ecosystem assessment.



***Figure 1**. Underwater image captured during the field expedition using a GoPro camera, showing healthy stands of Posidonia oceanica and Cymodocea nodosa meadows in the coastal zone near Fanari. The video served to confirm species presence and seagrass condition in situ.*

3. Extended Survey Coverage and Video Enhancement in the Nea Peramos Area

Following the preliminary survey activities described above, additional AUV missions were carried out across the Nea Peramos area, extending video and imagery coverage of the benthic habitats at the Greek pilot site. These new surveys broaden the existing dataset used for ecosystem health assessment, providing a larger and more spatially representative set of visual materials for the identification and monitoring of seagrass meadows and other benthic features across the site.

3.1. Video Color Correction Using a New LUT File

As noted previously, the AUV operates at an altitude of approximately 5 meters above the seabed, a survey configuration chosen to balance spatial coverage with the level of visual detail required to reliably identify benthic features. At this altitude, however, the sediment rich waters surveyed in the Nea Peramos area often produce hazy, color shifted footage, a common challenge in coastal shallow water video surveys where suspended particulates scatter and absorb light unevenly across the visible spectrum. This scattering effect tends to shift the color balance of the footage toward green and blue tones while reducing overall contrast, which in turn complicates the visual identification of seagrass and other benthic features, particularly in areas where turbidity varies across the survey track.

To address this limitation, a new Look Up Table (LUT) was developed specifically for the Nea Peramos video dataset using DaVinci Resolve, a professional color grading and video editing application. The correction was first developed on the Color page through node based grading, targeting the greenish, hazy appearance characteristic of sediment scattering, and was then exported as a 33 point three dimensional LUT encoded in the ".cube" format, a standard supported by professional color grading and video editing software. Unlike simpler one dimensional LUTs, which adjust each color channel independently, a three dimensional LUT maps combinations of red, green, and blue input values to corrected output values, enabling a more accurate and perceptually consistent correction of the specific color cast introduced by the sediment rich water column at this site.

The resulting LUT was applied to the raw GoPro footage from the Nea Peramos surveys, allowing the correction to be reproduced consistently across all affected clips without requiring manual regrading of individual sequences, and improving color balance, reducing the sediment induced color cast, and enhancing the overall contrast and visibility of seabed features throughout the footage (**Figure 2**).

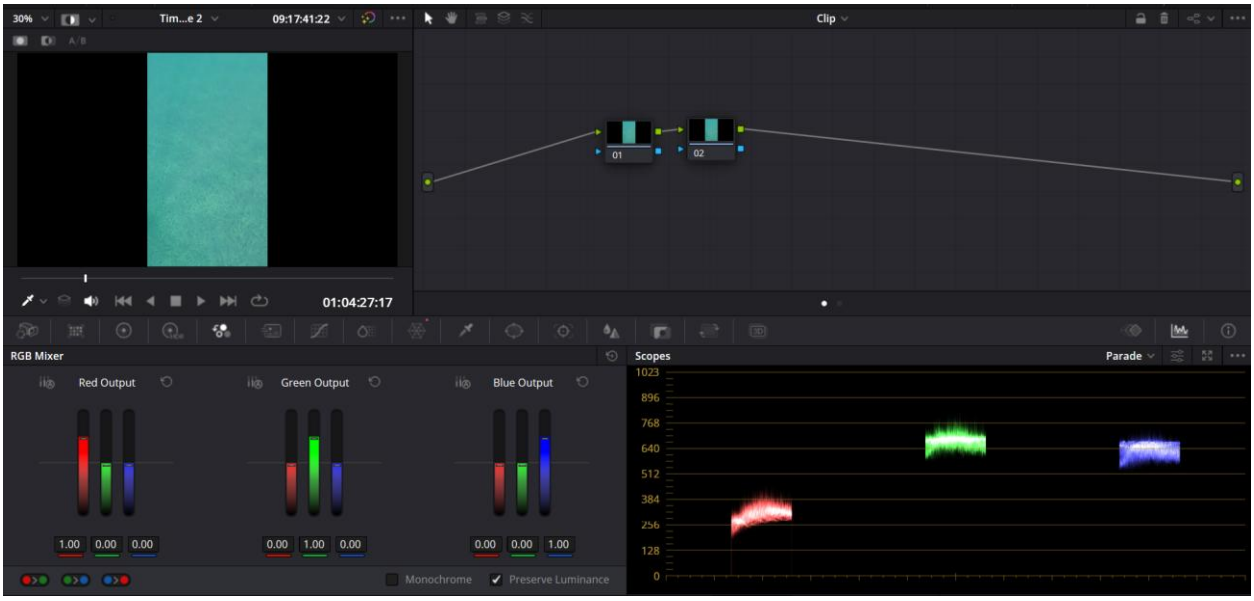


***Figure 2**. Screenshot of the DaVinci Resolve Color page showing the 33 point ".cube" LUT applied as a node based correction to raw GoPro footage from the Nea Peramos survey.*

This correction workflow makes the footage substantially easier to interpret for the identification of seagrass patches, associated fauna, and any marine litter present on the seabed, and supports more reliable and repeatable video based habitat assessment across the site.



Figure 3 Before (left) and after (right) comparison of a Nea Peramos survey frame, showing the raw GoPro footage and the same frame following application of the 33 point ".cube" LUT correction.