A Citizen Science Method: Engaging non-experts in monitoring river sediment and morphological changes.

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Introduction: The DANUBE4all project aims to develop a strategic Danube Basin Restoration Action Plan (DBRAP), integrating environmental, economic, and social objectives for sustainable river basin management. Acknowledging that the success of measures in a River Basin highly depends on the involvement of citizens, local communities, businesses and other stakeholders, the project deals with the development of several new Citizen Science (CS) monitoring methods that empower citizens to become active observers of the changes in connectivity that occur as a result of restoration measures planned in this project and beyond. [1]

Methods: We are developing these CS methods as a tool that enables citizens to systematically observe and document river sediment and morphological changes, contributing to both local and scientific understanding of river dynamics. We will include the following **(Fig. 1)**.

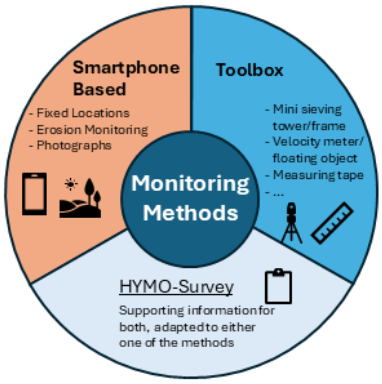

Fig. 1: Tools for Monitoring

The CS methods will be piloted at the Upper Danube Region around the Vienna area. The initial idea is to split the toolbox into two parts.

1. Physical Toolbox: This includes measurement instruments like the one developed in [2], aimed at interested and involved citizens who will receive training and guidance from the project team. This ensures both data quality and participant safety, as measurements will take place within (smaller) rivers.
2. Erosion monitoring: Focused on broader citizen engagement, this only requires a smartphone, allowing a larger group to contribute data on any river size through a simple, accessible method. A similar method was used within [3].

How intensively a HYMO survey will be included in either part is still under discussion.

Results: As the CS methods are still in its early development stage, extensive tests are planned for spring 2025. The mini sieving tower already went through a first testing phase, Pouwels [3] tested the reliability of this CS method compared to the lab method. First tests showed promising results, including statistical analyses.

Discussion: These CS methodologies have strong potential to strengthen citizen involvement in monitoring river sediment and morphology, providing valuable data that complements professional assessments. The initial tests will evaluate the reliability of citizen-collected data and show the need for necessary quality control measures. Ultimately the CS methods will be adapted for the whole Danube River Basin and other river basins.

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References:[1] DANUBE4all, https://www.danube4allproject.eu/, accessed on 21.11.24, [2] J. Le Coz, M. Lagouy, F. Pernot, A. Buffet, and C. Berni, Journal of Hydrology **642**, 131887 (2024), [3]. M. D. Harley and M. A. Kinsela, Continental Shelf Research **245**, 104796 (2022), [4] F. Pouwels, Bachelor's Thesis, Wageningen University (2024).

Citizen Science and Macroinvertebrate Monitoring: Key Learnings from the CS4Rivers Project

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Introduction: Rivers provide habitat for a diverse range of aquatic organisms, including fish, benthic organisms, phytoplankton and zooplankton [1]. However, the alteration of riverbed habitats and disruption of natural flow dynamics pose direct threats to the survival of various aquatic species [2]. Monitoring water bodies is a significant challenge for relevant authorities due to the extensive length of stream networks and the substantial resources required in terms of time, labor, and finances.. Consequently, citizen science (CS) is becoming increasingly important in environmental research and monitoring, including studying river environments [3].
In this context, a CS project - CS4Rivers - has introduced a new approach to monitoring habitat Quality throughout the analysis of macroinvertebrate communities used as an indicator to assess sediment healthy.

Methods: CS4Rivers guided by the University of Siena (Italy), within the NBFC with NRRP funds, is active in the Ombrone river basin (South Tuscany, Italy), throughout various monitoring activities, including assessment of chemical water quality, macroinvertebrate community and riparian vegetation.
For macroinvertebrates, CS4Rivers employs a new protocol called IBS (Simplified Biotic Index), a simplified version of the Italian IBE (Extended Biotic Index). Following a specific protocol, citizen groups collect samples twice a year at the same sites. Data Quality is verified by comparing volunteers-collected data with expert assessment. To support volunteers, detailed training and support material have been developed.

Results: Preliminary results indicate that the IBS effectively identifies critical or valuable conditions in macrobenthic communities. Volunteers will be interviewed using tailored surveys to further evaluate the project's strengths and challenges.

Discussion: After this initial phase of data collection and survey analysis, adjustments to the methodology can be made to enhance accuracy and inclusiveness. These steps will also help improve the perception and engagement of volunteers.

Acknowledgements: The authors would like to thank all the volunteers participating in the project and all the stakeholders involved in supporting CS4Rivers.

References:
[1] Padmalal et al. (2014) *Springer*. https://doi.org/10.1007/978-94-017-9144-1;
[2] Damseth, et al. (2024) *HydroReaserch* **7**:122-130;
[3] Kelly-Quinn et al. (2020) *Hydrobiologia* **850**:3419–3439

Remediation of polluted marine sediments in Bergen city harbour; a collaborative approach to environmental conservation

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Introduction: City of Bergen is Norway's second largest municipality, located on the west coast which has several harbour areas polluted from historical industrial activities. Project Clean Harbor, managed by Agency for Urban Environment, attempts to improve the condition of some of these areas. Several major seabed restauration projects situated in the inner city has been carried out. The project removes pollution and restores the sea bottom, but to ensure that the remediated areas will be kept in good condition a collaborative approach is needed. The project strongly encourages and facilitates efforts to monitor effects of the restored sea bottom. All these extra efforts are communicated with the aim to increase both public awareness and scientific interest, with the overall aim to increase awareness of the collaborative effort needed to preserve the inner-city fjord.

Methods: To assess the level of pollution and condition of the marine environment, thorough sampling and monitoring programs are applied. This includes traditional sampling and analyses of sediments, biota and water, but also the use of USV, drones, and tracking of organisms. Clean Harbour Bergen is involved in both national and international research projects that present a novel approach over the effect of urban sediment remediation on fish communities [1, 2].

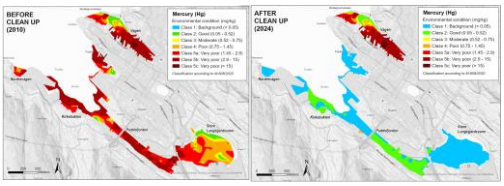

Fig. 1: Marine Seabed restoration in Bergen inner harbour greatly reduces the levels of several damaging toxins, here showing mercury (Hg) before and after.

Results: The Clean Harbor project in City of Bergen has managed to engage various NGOs, companies, researchers, startups and public managers to collaborate and make the most of what could "just" have been capping of polluted marine sediment. This highly collaborative approach to environmental conservation has several upsides both within public awareness of harbour diversity but also increased scientific and management understanding of how urbanization affects coastal marine habitats and how restoration potentially can mitigate ecosystem services. The knowledge gained within this cluster of different actors has been communicated both using media and the city's official channels for public communication and also through large exhibition at the city's aquarium.

Discussion: A well-functioning coexistence between needs, considerations and interest in society and industry activities demands cross sectorial involvement of both research, industry and regulatory bodies.

References:.

[1] Piczak, ML., Berhe, S., Knag, AC., Lennox, RJ., Vollset, KW, Portiss, R., Midwood, JD, Cooke, SJ. Evaluating ecological restoration in urban ecosystems with acoustic telemetry: marine and freshwater case studies. *Urban Ecosyst* **27**, 2135–2150 (2024). https://doi.org/10.1007/s11252-024-01575-5

[2] Fossum, TO, Sture, Ø., Norgren-Aamot, P., Hansen, IM, Kvisvik, BC., Knag, AC. Underwater autonomous mapping and characterization of marine debris in urban water bodies. arXiv (2022). DOI:10.13140/RG.2.2.20080.74249

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Sediment Literacy: Empowering Future Generations for Sustainable Interactions with Natural Resources in an Increasingly Complex World

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Introduction: Sediments are fundamental to ecosystems and human development. As demands on rivers, oceans, and coastal areas grow - from transportation and hydropower to fisheries and cooling networks - conflicts over their use grow, driven by climate change and competing interests. At the same time, misinformation, the lack of willingness to engage deeply with complex topics, and the rapid spread of polarizing narratives through social media hinder public understanding of these challenges. To address this, basic sediment literacy is not only essential for understanding processes that enable informed and sustainable decisions in the management of rivers and oceans. It empowers individuals and communities to engage critically in decision-making, fostering sustainable interactions with natural resources in an increasingly complex world.

Methods: Education plays a vital role in addressing these issues, aligning with the principles of good governance. Institutions have a responsibility not only to ensure transparency and accessibility of information but also to actively disseminate and contextualize this information for diverse audiences. Knowledge transfer between scientists, policymakers, stakeholders, and citizens must be prioritized to foster shared understanding and collaboration.

This contribution draws on the author's background in risk communication and disaster risk reduction to propose strategies for fostering sediment literacy. International examples of successful formats for promoting risk literacy and geological literacy - including interactive workshops, community engagement initiatives, and participatory learning models - are explored [1]. These examples provide a framework for developing literacy programs that are both impactful and adaptable to various contexts.

The potential of artificial intelligence (AI) to deliver tailored educational content is also emphasized. AI can be leveraged to create age-appropriate materials, analyze learning outcomes, and adjust content to meet the needs of different demographics. This technology holds promise for enhancing engagement and ensuring that educational initiatives resonate with their intended audiences. Additionally, the role of digital platforms such as Instagram and TikTok is critically evaluated. While these tools have the potential to engage younger audiences, their effectiveness depends on their integration with other educational approaches, such as museum exhibits and school curricula development. Questions remain about how these methods can complement one another and whether their combined use can create a more comprehensive educational strategy.

Results: The proposed approaches demonstrate significant potential for equipping individuals with the knowledge required to navigate the complexities of sediment management. By integrating AI-driven tools with traditional and digital educational platforms, these initiatives create accessible and engaging content tailored to diverse audiences. International case studies illustrate how participatory learning can deepen understanding and prepare society to address the challenges associated with water body management and sediment dynamics. These strategies provide actionable frameworks for fostering public awareness and improving decision-making processes in various contexts related to sediments as a natural resource.

Discussion: Education is a cornerstone in all sustainable resource management, bridging the gap between technical expertise and public engagement. In addition to advancing understanding of sediment dynamics, effective educational strategies align with the principles of good governance. Institutions have an obligation to provide transparent, accessible, and contextualized information, ensuring that the public can actively participate in sustainable decision-making processes. By emphasizing their responsibilities, institutions can build trust and collaboration among stakeholders. Without such efforts, even the most robust management measures risk failure due to public resistance. Leveraging AI and innovative educational methods, sediment literacy becomes a pathway to informed decisions and sustainable practices.

References: [1] UNDRR, *PreventionWeb* (2025). Disaster Risk Reduction Resources. Available at: https://www.preventionweb.net/ (Accessed: January 2, 2025).

Dirt or no Dirt, that is the Question - Improving Citizens Sediment Literacy

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Introduction: This presentation will summarize the work within the citizen science and communication work package of the national project "Improvement of Ecosystem Services in the Reinfeld Ponds" (VerTe). The Reinfeld ponds are an interconnected system of artificial lakes in the center of the German city of Reinfeld, that is used for leisure activities (rowing, swimming stand-up paddling) but also for raising carp. The ponds receive drained surface run off from nearby agricultural fields, and effluents from domestic sewage treatment plants. When local politicians observed the ponds silting up, the prevailing opinion in the political committees of the city of Reinfeld was that dredging would be the appropriate solution. The project VerTe was then initiated to broaden the spectrum of possible measures. Its objective is to identify sustainable solutions that mitigate sediment accumulation while preserving and improving biodiversity of the water bodies. The diversity of interests that come into play when considering the future development of the ponds required a work package dedicated to information, education and participation for stakeholders and the community, including citizen science activities. In Germany, the term "citizen science" has a broad meaning from developing the scientific question to the development of a project, data collection, scientific evaluation and the communication of results [1]. In this project, citizen science is used not only for communication but also for experiencing nature and research in nature.

Methods: Target groups within the Citizen Science work package in the VerTe project are on one site children (3 to 10 yrs) and on the other site adult stakeholders such as farmers, city citizens, city council members, representatives of leisure activity groups etc. For children, events are organized that comprise 1. A story about the life of Lilly the dragonfly or – for sediment-related events Sam, the pond snail. 2. Feeling different types of sediment in a barefoot path, 3. Discovering and examining different pond inhabitants, 4. Artistic processing of the experience. Primary school pupils are asked afterwards to evaluate the event via a standardized online survey with regard to gaining of knowledge and awareness about the problems with sediment as a habitat and questions concerning the knowledge about importance, benefits and problems of biodiversity Adult stakeholders are engaged in (1) a series of interactive workshops with the aim to cooperatively perform to a system analysis, and (2) in a field work event on sediment focusing on endo- and epibenthic life.

Results & Discussion: Since August 2022, 24 events with children were held with a total of 400 participants. 5 work shops were organized for adult stakeholders, with 20 to 30 participants each, some of them taking part in several of the meetings. Next to a system analysis, the workshops resulted in a conceptual plan for measures to improve the biodiversity of the ponds.
The experience with the different events will be shared during the presentation, and the participants' evaluation of the workshops and children's events will be discussed in the light of sediment literacy of the participants, the perspective of children and their inspiration for further scientific research in nature.

Fig. 1: *Children`s program*

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References: [1] Bonn, Aletta, et al. "Grünbuch citizen science strategie 2020 für deutschland." (2017). https://nbn-resolving.org/urn:nbn:de:101:1-20160621985.