JRA5

Emerging technologies to improve diving-based science delivery

NERC National Facility for Scientific Diving
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Scientific Diving

- a widely-used, well-established, research platform within the ASSEMBLE+ partnership
- geographic gradient from Svalbard to the Red Sea, including Baltic and Mediterranean





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- a widely-used, well-established, research platform within the ASSEMBLE+ partnership
- geographic gradient from Svalbard to the Red Sea, including Baltic and Mediterranean

- currently no formal arrangement across the ASSEMBLE+ partnership that co-ordinates any of the diving effort in terms of standardised methodologies or common datasets





JRA5

- to further improve co-ordination between all the diving units
- to generate standardised methodologies and common datasets
- to develop and evaluate emerging technologies to improve diving-based science delivery





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- Seven partners:
  - SAMS, SBR, HMCR, IO-UG, IO-PAN, SLC, UH-TZS





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- Seven partners:
  - SAMS, SBR, HMCR, IO-UG, IO-PAN, SLC, UH-TZS
- Lead beneficiary: SAMS*
  - * the dive unit at SAMS may convert to a SME during the timeframe of JRA5 and so may not be eligible to lead and/or participate

JRA5: Emerging technologies to improve diving-based science delivery

THREE TASKS

JRA 5.1: Standardising the underwater application of photogrammetry

JRA 5.2: Developing an underwater observation network

JRA 5.3: Dissemination / outreach to new users





JRA 5.1: Standardising the underwater application of photogrammetry

UNDERWATER STEREOPHOTOGRAMMETRY

- derived from terrestrial structure-from-motion multiview stereophotogrammetry (SfM-MVS)
- Generates 3D models from successive overlapping 2D images
- scalable using known dimensions of modelled features
- surface complexity resolved owing to 3D nature of models
- surface area, slope, volume, depth can all be measured
- orders of magnitude more information than in situ

JRA 5.1: Standardising the underwater application of photogrammetry

UNDERWATER STEREOPHOTOGRAMMETRY

Example: Whole coral reef system digitally-mapped in a single 40min dive from colour-corrected GoPro video footage

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UNDERWATER STEREOPHOTOGRAMMETRY

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UNDERWATER STEREOPHOTOGRAMMETRY





JRA 5.1: Standardising the underwater application of photogrammetry

- the task will examine whether common standards can be applied across a widely diverse environmental and research application matrix
- assessments will be made on whether different software/hardware applications markedly influence outcome quality
- where possible, the photogrammetry assessments will be carried out on targets where intra- and inter-annual change would be anticipated





JRA 5.2: Developing an underwater observation network

- Aquatic physicochemical data are important for understanding how ecosystems function and the long-term consequences of anthropogenic drivers.
- There is large-scale monitoring of sea surface conditions using both remote sensing and in-situ platforms but there is a lack of depth-resolved profiles for inshore regions.
- This is a significant data gap as inshore water conditions are important for commercial activities (e.g. aquaculture and fisheries), as well as driving many of the biological traits that determine productivity and distribution of species.





JRA 5.2: Developing an underwater observation network

- A multi-partner diving-based sub-tidal observation network does not currently exist across Europe; the proposed network would concentrate on near-shore coastal key habitats
- This task will initiate such a network and test its efficiency and use based on utilising existing proprietary instrumentation.
- Diving is used because a critical issue for sub-tidal observatories is to be deployed discretely but accurately so as not to be disturbed during recording; diving is then essential for the retrieval of the instrumentation.

JRA 5.2: Developing an underwater observation network

- Prototype sub-tidal multi-parameter recording buoys will be developed based on existing low-cost data-logger technology
- Deployment of the sub-surface arrays will take place at the eight sites in a range of standardised depths and locations that test their operational capability
- Downloaded data will be used for comparative assessments to be made with existing environmental data (e.g. satellite surface sea temperature data, data from existing monitoring programmes close to the study sites)
- A major outcome will be to determine the best ways in which the resultant data are made available to end-users.

JRA 5.3: Dissemination / outreach to new users

- Additional networking funds (NA-1) will facilitate a workshop of interested user-groups to include sub-sea industries, governmental bodies where standardisation of techniques underpins many pan-European research and monitoring initiatives (e.g. the Marine Strategy Framework Directive)
- Target stakeholders: Marine Protected Areas agencies, and a wider scientific diving base (assisted by the European Marine Board Scientific Diving Panel and other facilitating organisations such as the Society for Underwater Technology (SUT) and The Institute of Marine Engineering, Science and Technology (IMarEST)).





JRA 5.3: Dissemination / outreach to new users

The objectives of the workshop will be to:

(a) identify standardised procedures for source material capture methods (which may come from a variety of external suppliers);

(b) provide standard operating procedures to improve final model outcomes based on optimising photogrammetry approaches: software/hardware compromises; and,

(c) highlight diver-based sub-tidal physico-chemical observation.

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