



ANDROMEDA WORKSHOP 2: Policy & Decision Makers Perspectives on the Cost-Effectiveness of Microplastic Analysis Methods for Seawater Samples

Event Summary & Participant Recommendations

7th of March 2023





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Recommended citation:

Kopke K., Meyers N., Dozier A., Fitzgerald E., Power O-P., Agnew S., Sempéré R., (2023). *Policy & Decision Makers Perspectives on the Cost-Effectiveness of Microplastic Analysis Methods for Seawater Samples: ANDROMEDA Workshop 2 Event Summary & Participant Recommendations on Cost-effectiveness*. JPI Oceans project.



1. INTRODUCTION

The JPI Oceans-funded ANDROMEDA project brings together a multidisciplinary consortium of 15 international partners to improve the quantification of nanoplastics and microplastics in our oceans and seas. ANDROMEDA aims to develop new sampling and advanced analysis methodologies that focus on microplastic (1-5mm) and nanoplastic (<1mm) particles to enable improved risk assessment of plastic pollution, along with in-situ techniques and cost-effective measurement methodologies for improving the efficacy and efficiency of microplastic monitoring. The primary objectives of ANDROMEDA are:

- The development of an instrument platform for in situ and cost-effective analysis of microplastics
- The advanced characterisation of nanoplastic and microplastic materials and for accelerated microplastic degradation, and
- The characterisation of microplastic degradation.

More information about ANDROMEDA can be found online at <https://www.andromedaproject.net> or on Twitter at @andromeda_EU. You can also contact us directly by emailing the Project Coordinator: richard.sempere@mio.osupytheas.fr.

1.1 ANDROMEDA Online Workshops

As part of the ANDROMEDA project, two online workshops were developed to act as a focal point for proactive engagement and mutual exchange of specialist knowledge between project partners and participating ANDROMEDA stakeholders (see Section 2.3.2 for a summary of the first ANDROMEDA Workshop). These workshops were developed to interactively present, discuss, and build a consensus around cost-effective microplastic analyses methodologies for seawater sampling. The workshops were specifically developed to allow for discussion and feedback to a survey designed and distributed by ANDROMEDA project partners, which was led by Nelle Meyers and colleagues from the Flanders Marine Institute (VLIZ) and the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO) (see Section 2.3.1).

The following document presents the findings from the second ANDROMEDA workshop, which was undertaken on the 7th of March 2023 with 8 participants representing 10 organisations.

2. ANDROMEDA WORKSHOP 2

2.1 Purpose and Objectives

This online event aimed to facilitate knowledge exchange between ANDROMEDA researchers and policy and decision makers with a focus on: i) collating feedback and input concerning preliminary results of the ANDROMEDA survey on cost-effective microplastic analyses methodologies for seawater samples and, ii)



making recommendations relevant for policy and decision makers and future research in the area. The workshop had the following objectives:

- To highlight current ANDROMEDA research and upcoming research outputs concerning cost-effective microplastic analyses methodologies for seawater samples,
- To explore the preliminary results with policy and decision makers considering policy, legal and, regulatory needs; and
- To work together on making recommendations relevant for scientists as well as policy and decision makers.

2.2 Workshop Participants

The event was co-designed, trialled, and implemented by ANDROMEDA project partners from:

- MaREI, the SFI Centre for Energy, Climate, and Marine Research at University College Cork, who are responsible for project communication and stakeholder engagement.
- VLIZ, the Flanders Marine Institute, who are working on simple, high-speed, and low-cost methodologies to detect microplastics from seawater and marine sediments in ANDROMEDA.
- ILVO, the Flanders Research Institute for Agriculture, Fisheries and Food, who are leading ANDROMEDA work on in-situ and cost-effective sampling and analysis methodologies for detecting and quantifying microplastics in environmental samples.

Eight policy experts and decisionmakers representing ten organisations brought their expertise and insight to the second ANDROMEDA online workshop (see Table 1). Individual workshop participants have not been named within this report to ensure that data protection is in line with European GDPR regulations. However, the project team is happy to assist readers of this document to establish contact with workshop participants if their expressed permission is granted.

Table 1: Organisations represented at the online workshop by country and summary remit.

Organisation	Country	Summary Remit of Organisation
OSPAR	International Convention	The mechanism by which 15 Governments and the EU cooperate to protect the marine environment of the North-East Atlantic.
JPI Oceans	Pan-European	Intergovernmental platform aiming to increase efficiency and impact of research and innovation for sustainably healthy and productive seas and oceans.
Joint Research Centre (JRC)	Pan-European	The European Commission's science and knowledge service to provide independent scientific advice and support to European Union policy.



Organisation	Country	Summary Remit of Organisation
Royal Belgian Institute of Natural Sciences (RBINS) - Service Management Unit of the Mathematical Model of the North Sea (MUMM)	Belgium	MUMM represents Belgium in inter-governmental conventions dealing with the protection of the marine environment and supports the implementation of decisions taken, under the authority of the Minister responsible for marine environmental policy.
BELSPO - Belgian Federal Science Policy Office	Belgium	The federal government body responsible for research policy in Belgium.
Flanders Marine Institute (VLIZ)	Belgium	Coordination and information platform for marine and coastal research in Flanders.
Marine Institute (MI)	Ireland	The Irish state agency responsible for marine research, and technology development and innovation, that provides government, public agencies and the maritime industry with scientific, advisory, and economic development services and informs policymaking regulation.
Marine Environment Division of the Department of Housing, Local Government and Heritage	Ireland	A unit of the Irish government, who are responsible for the implementation of the Marine Strategy Framework Directive (MSFD); Ireland's participation in the OSPAR Commission and its subsidiary bodies for the Implementation of the Northeast Atlantic Environment Strategy, that provide policy, scientific and operational advice to support other policy streams and ensuring alignment with MSFD and OSPAR objectives.
Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	UK	The executive agency of the United Kingdom government Department for Environment, Food and Rural Affairs, who carry out a wide range of research, advisory, consultancy, monitoring, and training activities.

2.3 Workshop Structure

The workshop was divided into two sessions with a short break in between. The first session focused on introducing the ANDROMEDA project and the presentation of the preliminary survey results undertaken by Nelle Meyers, followed by an open Q&A session to allow for shared understanding of the presented information. The second session included a presentation summarising the results of the first ANDROMEDA workshop (see Section 2.3.2) and a guided conversation among participants.

The guided conversation approach was adapted for this context based on participant Group Facilitation



Methods developed by the Institute of Cultural Affairs (ICA).¹ Questions included in this session were designed using an ORID (Objective, Reflective, Interpretive, Decisional) methodology². This approach and methodology aimed to entice participants to engage with the group, and to ensure interactions were comfortable for all involved within the online workshop setting.

Table 2: Workshop Agenda

Andromeda Workshop 2 Agenda	
10:00 – 10:10	Welcome – Kathrin Kopke, MaREI - UCC
10:10 – 10:20	Roundtable Introduction
10:20 – 10:30	ANDROMEDA Overview – Richard Sempere, MIO
10:30 – 10:50	Preliminary Survey Results – Nelle Meyers, VLIZ/ILVO
10:50 – 11:00	Open Q&A
11:00 – 11:30	Coffee Break
11:30 – 11:40	Summary of Workshop 1 – Amy Dozier, MaREI-UCC
11:40 – 12:40	Guided Conversation – Kathrin Kopke, MaREI-UCC
12:40 – 13:00	Summary & Wrap Up

2.3.1 Presentation 1: Preliminary Survey Results

An analysis of the cost-effectiveness of microplastics analysis techniques was performed to compare investment and labour costs and the effectivity of different, commonly used methodologies for the analysis of microplastics in seawater on a European scale. Data for the analysis was obtained through an online survey that was distributed in Autumn 2022 to various microplastics experts. Within the survey, a scenario was described of five seawater samples (a batch) that were acquired with a manta net and that were defined in terms of microplastic load, composition and size range, and suspended particulate matter (SPM) concentration. The survey questions were subdivided based on different steps within microplastic analysis and focused on sample acquisition, sample processing, and the actual sample analysis. The questions targeted two types of costs: (1) equipment costs and (2) labour costs, and this was considered within each analysis step. Based on the obtained data, the methodologies used by participants could be classified into six major analysis methodology categories: (fluorescence) (stereo)microscopy; (stereo)microscopy + ATR-FTIR; (stereo)microscopy + μ -FTIR; fluorescence (stereo)microscopy + μ -FTIR; (stereo)microscopy + μ -Raman; and GC-MS- based techniques. Calculated equipment and labour costs per methodology were used to simulate total analysis cost per batch of five seawater samples in terms of equipment usage intensity. Three different simulations were created for high, middle, and low wage European countries, as defined by the World Bank.

In the future, the cost-effectivity analysis and resulting predictive tools can help provide concrete and

¹ Umpleby, S. and Oyler A. (2007). A Global Strategy for Human Development: The Work of the Institute of Cultural Affairs, Systems Research and Behavioral Science, 24, 645-653.

² Brown, J. (2019). A Focused Conversational Model for Game Design and Play-Tests. 10.1007/978-3-030-34350-7_43.



useful recommendations on which workflows provide the greatest value for money when analysing plastic. This cost-effectivity analysis supports the identification of cost-effective methodologies for given scenarios, and the resulting equations allow the individual to calculate the actual total analysis cost associated with these methodologies. In this way, the developed predictive tool can support researchers, policy makers, and other stakeholders in their decision-making process for choosing between different microplastic workflows (e.g. for monitoring strategies).

2.3.2 Presentation 2: Results of Workshop 1

A presentation summarising the outcomes of the first ANDROMEDA workshop (ANDROMEDA Workshop 1) was given to participants following the presentation of the survey results. The first ANDROMEDA workshop was held on 1 February 2023 and exercised the same methodology as Workshop 2. In Workshop 1, the preliminary survey results were presented to scientists and researchers working in the field of microplastics, including representatives from ANDROMEDA's JPI Oceans-funded sister projects: FACTS, RESPONSE, I-Plastic, and MicroplastiX.

Throughout the guided discussion, participants reflected on various positive aspects and concerns surrounding ANDROMEDA's research into the cost-effectiveness of microplastics analysis methodologies. The discussion centred around key topics such as: i) technical issues that may impact the cost of MP sampling, processing, and analysis; ii) affordability and cost-effectiveness within the context of national GDP; iii) the microplastics size class used for the survey, and iv) challenges related to government monitoring programmes.

As a product of this discussion, participants provided the following recommendations:

- Scientists need to actively engage with policy and decision-makers concerning the definition of what to measure for the purposes of government monitoring programmes, ensuring that the data being collected is put into perspective.
- Affordability and cost-effectiveness should be considered in the context of national income and GDP.
- Limitations of the research and data need to be clearly stated and show that the work focuses on cost-effectiveness only, and that the quality of the methodology is not included in the survey and that the calculations pertain to a specific size of microplastic.

Participants also recommended that future research should:

- Incorporate environmental factors to obtain a more detailed picture of costs that occur for different size classes.
- Consider cost based on the findings of inter-collaboration studies between institutes that apply different methodologies and techniques but get comparable results.
- Include calculations that use less expensive equipment or protocols and adjust for different batch level sizes.



A detailed summary of the discussion points and recommendations from Workshop 1 is available in the following report available on the [ANDROMEDA project website](#) and [the MaREI project page for ANDROMEDA](#).

Kopke K., Meyers N., Dozier A., Fitzgerald E., Power O-P., Agnew S., Everaert G., De Witte B., (2023). *Scientist Perspectives on the Cost-Effectiveness of Microplastic Analysis Methods for Seawater Samples: ANDROMEDA Workshop 1 Event Summary & Participant Recommendations on Cost-effectiveness*. JPI Oceans project.

2.4 Post-Workshop Evaluation

The ANDROMEDA project team invited workshop participants to take part in a short post-workshop evaluation survey to provide the opportunity for feedback, as well as to allow the project to assess and improve the quality and relevance of further engagement. Five out of eight workshop participants chose to take part. Participant responses were captured using a combined methodology including a five-point Likert Scale with responses ranging from 1-5 (where 1 means Strongly Disagree and 5 means Strongly Agree), a multiple-choice question, and a field for open-ended comments. All respondents' scores for questions on the five-point Likert scale showed they felt positive towards the duration and organisation of the event, as well as the quality of the presented material and the way it was presented.

All survey respondents indicated that the event was relevant to their work, with three of the respondents indicating that participation may influence their future work. All respondents indicated that their participation in this workshop may support their engagement with people working in the same field in the future.

Multiple choice questions showed that three respondents found all elements of the workshop useful for their purpose of attending, while another participant highlighted their preference for the presentation of the preliminary results, and another participant found the Q&A session most useful for their purpose of attending the event.

In open-ended comments, respondents emphasised their appreciation for the discussion that allowed for mutual understanding of shared priorities. Participants highlighted the clear and concise presentation and the potential of the study to support policy and decision-making processes. Furthermore, participants valued the clear workshop structure and that this event was organised for different target groups and noted that the guided conversation was well prepared and helped participants to express their thoughts. Respondents suggested that similar workshops in the future could potentially have a mixed component where the two different target groups (scientists and policy/decision makers) could interact. Furthermore, it was suggested that future workshops could potentially involve policy and decision makers before the start of similar studies to allow the provision of input from the start.



3. DISCUSSION

The guided conversation segment of the workshop (summarised below in 3.1 - 3.2) presented a series of questions to workshop participants that encouraged reflection on the presented work. The goal of this session was to develop recommendations for researchers and policy makers to support informed decision making that considers cost-effectiveness. These recommendations are outlined in Section 4 of this summary report. The questions were posed to allow participants to express their thoughts in relation to the topic and to explore certain areas of interest in more detail.

3.1 Positive Aspects and Concerns

Workshop participants were asked to identify positive aspects and concerns in relation to Nelle Meyers' presentation and the subsequent Q&A, summarised below in Table 3.

Table 3: Positive Reactions & Identified Concerns from Policy and Decision Makers

Positive Reactions	Identified Concerns
<ul style="list-style-type: none"> ○ Considering cost effective tools is important, especially in relation to monitoring programs and their development and implementation. ○ Very important factors mentioned here that require more research. ○ The tool could be applied to other matrices, such as fish or sediment. ○ The tool is predictive and could give an idea of the volume of microplastics used. ○ The tool could fill a gap for scientists supporting an initial choice of a sampling methodology. 	<ul style="list-style-type: none"> ○ The difference in size categories and other aspects of marine litter may need to be further considered. ○ Specific concern on choosing a size class of 300 µm in relation to monitoring. ○ Need to consider the cost of acquiring samples (e.g., boat hire/nets etc.). ○ Concern around accessibility and further consideration should be given to how to make the tool e.g., available via an app. ○ General concern in relation to the lack of knowledge on sources of microplastics, and how sources to deal with sources.

3.2 The Presented Approach for Policy & Monitoring Requirements

Throughout the guided conversation, participants discussed cost-effective decision-making from their perspective, including adaptations of the presented approach, sources of microplastics, and links to policy and monitoring requirements for microplastics.

3.2.1 Considerations for Adapting the Presented Approach

Workshop participants discussed the creation of a knowledge base that would allow for the evaluation of different available technologies such as the detection between polymer types. Adding additional criteria to the survey (e.g. policy-related fields) would allow a broader view of the potential of each analysis method,



and facilitate the choice of an appropriate technology or methodology. Participants felt that it would be beneficial if diverse methodologies could be evaluated according to cost and what needs to be detected, e.g. if a methodology needs to be able to detect tyre wear particles, then there may be a willingness to accept higher costs.

Participants highlighted that reusing available data in the context of cost efficiency needs to be considered, in addition to planning collection of data for several different types of analyses. Sediment sampling, for example, was referenced several times during the discussion, as these are frequently undertaken by researchers as part of their planned sampling activities. Participants felt that these types of surveys and the associated analyses should be undertaken on a regular basis to gain more information and capture change over time.

3.2.2 Sources of Microplastics

Workshop participants highlighted the importance of understanding the sources of microplastics for informed decision making. Monitoring should be considered context-dependent; consideration should be given to whether there is a need to detect what is there or focus on monitoring in relation to specific sources of microplastics.

Participants stressed that it is critical to understand methodologies and techniques that determine the different sources of microplastics and link those to monitoring and mitigation measures. While there is a lot of information around the methodologies, techniques, and harmonized protocols available, it may be useful to reflect on whether an analysis method should be universally applied (where everyone will use the same method, everywhere, and potentially at the same time), or if it is better to refocus on what are the best metrics for a number of identified sources of microplastic pollution. The presented approach could help to inform changes in monitoring that may need to be applied to a European-wide scale.

3.2.3 Monitoring

Cost efficiency was seen as a significant parameter in environmental monitoring programmes. However, participants emphasised that it is important to clearly distinguish between research ambitions and research needs and the requirements of a monitoring programme that is linked to policies and regulations. Overall, there was consensus that it would be useful to build upon the presented approach and score the methodologies for other criteria. Participants felt that the next step would be to consider the pros and cons of different approaches and their reproducibility. Participants made several suggestions for future survey criteria, which are bulleted below:

- Reproducibility of the methodology
- Strengths and limitations related to detection
- Links to European Commission source emission measures
- Size limitation needed for monitoring
- Availability in commercial labs
- Harmonisation of existing monitoring programmes within and outside of the EU
- Usability for other matrices (wastewater, industrial emissions, etc)



- Contribution to filling current knowledge gaps, e.g. in relation to nano-plastics or risks

Workshop participants highlighted that it would be very important to focus on standardized methodologies of assessment and examine the range of costs in relation to ease of quantification. Alignment with the OSPAR convention and MSFD requirements may require the use of indicators for microplastics and agreed thresholds through a standardized approach.

4. PARTICIPANT RECOMMENDATIONS

The online workshop captured a wealth of information and input from workshop participants, from which specific recommendations have been summarised in the below bullets:

1. Cost-effectiveness is of great importance in a monitoring framework and developed approaches must be accessible to and feasible for all Member States and contracting parties.
2. There needs to be a clear distinction between assessing methodologies and approaches focused on research (generating new knowledge) and for monitoring (what information/data is crucial for environmental assessments) when considering cost-effectiveness.
3. It is important to feed approaches on cost-efficiency into monitoring programmes that are comparable across the EU and what is used at a wider international level, so that an accepted and feasible approach/technique/equipment for microplastics monitoring can emerge.
4. Considerations should be given to what is currently being done. It will be necessary to determine the easiest way to examine trends in the concentrations and use sampling methodologies that have an additional benefit and apply cost efficiency in that context to inform required changes to policy and/or monitoring programmes.
5. Future Research:
 - ✓ Should incorporate other criteria that are important for monitoring and environmental parameters that are mandatory and link to source emissions for microplastics.
 - ✓ Should consider a repetition of a similar survey that includes a wider stakeholder community with focus on policy needs, harmonization, and what is feasible for all.
 - ✓ Should reflect on how to develop approaches that support the European Commission's Zero Pollution Ambition and associated environmental monitoring requirements.

The ANDROMEDA project team would like to thank all workshop participants for taking the time to attend this workshop and for their effort and expertise, which contributed to and shaped the event.

ANDROMEDA is funded by JPI Oceans through support by the following national funding agencies: Belgium: the Belgian Federal Science Policy Office (BELSPO), France: The National Research Agency (ANR), Estonia: Ministry of the Environment of the Estonian Republic (MoE) and the Estonian Research Council (ETag); Germany: Federal Ministry of Education and Research (BMBF), Ireland: Marine Institute, and the Dept of Housing, Planning, and Local Government (DHPLG); Malta: Malta Council for Science and Technology (MCST); Norway: The Research Council of Norway (RCN); Spain: Spanish State Research Agency (AEI); Sweden: the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS).