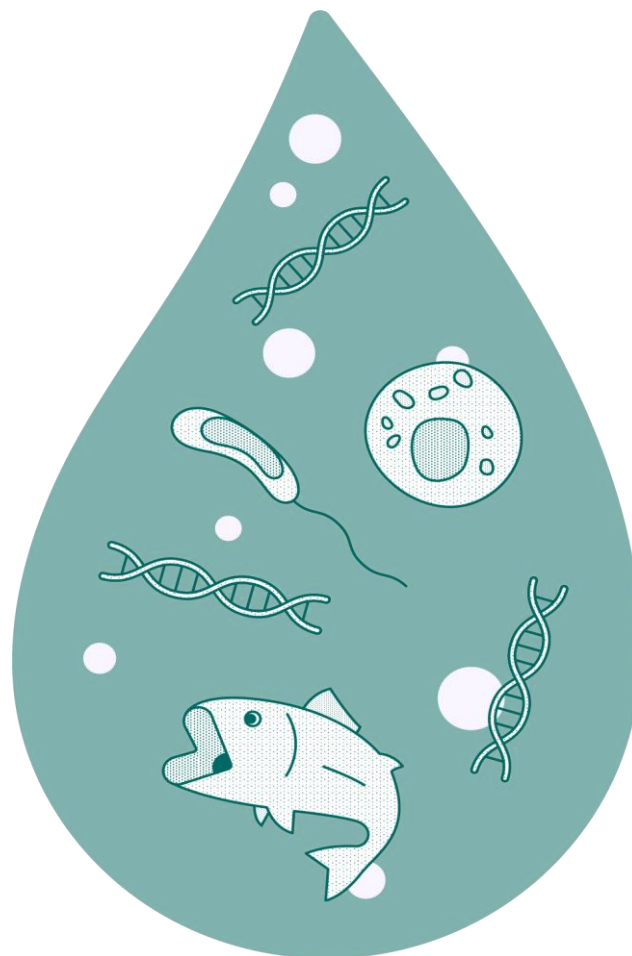




Invitation to market-related dialogue

Automatic environmental monitoring



Dialogue conference to clarify potential for development of automatic environmental monitoring

The Norwegian Environment Agency aims to improve and increase the efficiency of environmental monitoring. We are therefore working towards the development of automatic environmental monitoring involving the use of environmental DNA. To identify the optimal solution and clarify potential and costs, the Norwegian Environment Agency is organising a dialogue conference and one-on-one meetings with interested suppliers, research groups and potential users.

About the dialogue conference

Target group

Suppliers or consortia who can supply all or parts of a solution for automatic monitoring of nature. Research groups involved in relevant fields such as biology, biotechnology, systematics, ecology, mechanical engineering, robotisation, digitalisation, data processing and cybernetics. Potential users within trade and industry, public management and research.

What do we want to discuss during the dialogue conference?

The Norwegian Environment Agency aims to have developed a system for automatic environmental monitoring using environmental DNA. Such a system will require various components to cover every step involved in automatic environmental monitoring. We require information on issues such as;

- Technical solutions currently available on the market
- Potential and limitations with current solutions
- The most significant challenges in developing automatic environmental monitoring
- The costs of developing a complete solution
- The cost of the final product
- The length of time required to develop such a solution
- The most appropriate areas of application for development

By inviting experts and suppliers/entrepreneurs to dialogue, we aim to clarify whether an automated solution for environmental monitoring using environmental DNA is technically possible and viable. We are also seeking dialogue with other users who require solutions for more efficient and improved environmental monitoring.

Practical information on the dialogue conference

Place: The offices of the Norwegian Environment Agency in Helsfyr, Oslo. Grensesvingen 7.

Time: 1 October 2019, 11.30 to 15.00.

Agenda: Introduction by the Norwegian Environment Agency followed by group work. Lunch.

Registration: <https://www.miljodirektoratet.no/aktuelt/arrangementer/dialogkonferanse---automatisk-miljoovervaking/> Deadline 23 September. Free of charge.

Streaming: The first part of the meeting will be streamed and will be held in English.

<https://videoforweb.no/miljodirektoratet/>

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Main purpose of potential procurement

The main objective for the project is to develop tools for automatic monitoring in fresh water in order to exploit to the maximum of the major potential found in environmental DNA.

Sub-goals:

- Develop an automatic sampling system that satisfies the requirements for standardisation of sample material
- Develop an analysis unit that can be connected to the automatic sample collector
- Develop automatic transfer and processing of data to produce warnings regarding potentially harmful organisms

Background

Norway's public management spends NOK 335 million per year on monitoring and charting Norwegian natural environments. In addition to the activities conducted by governmental administration, commercial enterprises such as oil companies, watercourse regulatory bodies and other industry subject to discharge permits are obliged to carry out a large share of environmental monitoring. The current system for environmental monitoring is principally based on manual records taken from field mapping of the environment at a small selection of locations. This is a time-consuming and expensive process, and only provides limited opportunities to detect changes and prevent or minimise the extent of damage. There is a major requirement for improving and increasing the efficiency of environmental monitoring.

In recent years, **environmental DNA** has been proved highly suitable for the above-mentioned purpose - improving and increasing the efficiency of environmental monitoring. It has in particular substantially simplified the process of collecting environmental samples by allowing for registration of a higher number of species from just one sample of water. Aquatic environments are particularly suitable for this method. Part of the problem but also the potential with the use of environmental DNA for monitoring is the establishment of automated measurements.

Nationwide and internationally, there is a significant need for **early detection, warning** and efficient environmental monitoring. Early warning allows for detection of potentially harmful organisms early enough to prevent or limit the damage. An automatic monitoring system will increase the probability of detecting potential hazards at an early stage of establishment. Automatic sample collection will also improve objectivity and reproducibility when taking samples.

Description of requirement and function

The Norwegian Environment Agency aims to have developed a comprehensive system with optimal automation of environmental monitoring. The comprehensive system can be divided into three main parts (as illustrated in figure 1 below);

1. Automatic collection of water samples, including DNA filtration
2. Automatic analysis of the samples
3. Automatic data processing and warnings



Figure 1. illustrates the different steps of automatic environmental monitoring. The first image portrays continuous collection of samples from water. The water samples are then filtered, and DNA is extracted. Finally, the samples are analysed, and warnings are sent if any undesired organisms are detected. This type of device will allow action to be taken at an early stage in order to prevent and limit damage.

Potential benefits – relevant areas of application

Automatic environmental monitoring will provide substantial benefits for society, the environment and private businesses. The establishment/dispersal of, for example, pathogenic organisms or foreign and harmful species already represents major socio-economic costs. It is estimated, for example, that **foreign species in Norway incur socio-economic costs in the range of NOK 1.4 to 3.9 billion per year**, and the ability to implement measures early on is therefore essential. At the same time, national and international regulations and obligations, strategies and political resolutions lay down the framework for how to monitor the environment. The methodology and technology for early detection, warning and modelling of dispersal of foreign organisms are also high priority issues in relation to the research requirement for the Ministry of Climate and Environment. **Consequently, the project has major potential for value creation in trade and industry, for substantial socio-economic benefits and for improving public services.**

The development of an automated tool for utilisation of environmental DNA will initially be most straightforward for aquatic environments, as developments are much more advanced in this field. **Several problems are of relevance, such as identification of pathogenic organisms on crayfish, amphibians and fish, and foreign species and endangered species in all groups of organisms.** This covers problems that are of relevance for several sectors. We aim to focus on tools to monitor the dispersal of harmful foreign organisms, in particular northern pike and the parasite *Gyrodactylus salaris* in Norwegian watercourses. Methodology for this field is sufficiently advanced and the benefits for society are major. At the same time, we aim to **focus on ensuring that the tool can simply be expanded to cover other groups of organisms and problem areas.**

Other relevant areas of application for automatic sample collection of environmental DNA may be;

- Monitoring of the water regulations (EU's Water Framework Directive) and ensuring efficient monitoring of watercourses, ecological status
- Early detection of pollution from petroleum operations and other future offshore industry
- Monitoring in terrestrial environments
- Monitoring of dispersal of antimicrobial resistance and human pathogenic organisms

Information on pre-commercial procurement

The Norwegian Environment Agency has been awarded funds from the Research Council of Norway and Innovation Norway to carry out a pilot project for automatic environmental monitoring using environmental DNA. The purpose of pre-commercial procurements is to contribute to an increase in demand-based innovation that is customised to the challenges faced by the public sector, and for trade and industry to exploit the potential for value creation found in such challenges. The aim is to establish collaboration between the public and private sector to satisfy the actual requirements and to generate yield for both sectors. The actual procurement is not a part of the project and will take place subsequent to the pre-commercial procurement process.

FACTS ON ENVIRONMENTAL DNA

- DNA samples from organisms
- Are found in every type of natural environment
- Can be used to obtain information on biodiversity
- Detection of harmful organisms

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The Norwegian Environment Agency is working for a clean and diverse environment. Our primary tasks are to reduce greenhouse gas emissions, manage Norwegian nature, and prevent pollution.

We are a government agency under the Ministry of Climate and Environment and have more than 700 employees at our two offices in Trondheim and Oslo and at the Norwegian Nature Inspectorate's more than sixty local offices.

We implement and give advice on the development of climate and environmental policy. We are professionally independent. This means that we act independently in the individual cases that we decide and when we communicate knowledge and information or give advice. At the same time, we are subject to political governance.

Our most important functions are procuring and communicating environmental information, conducting and implementing administrative authority, directing and providing guidelines at

both regional and municipal levels, providing professional advice and taking part in international environmental work.