eDNA/eRNA-based Pathogen Detection in Water and Air

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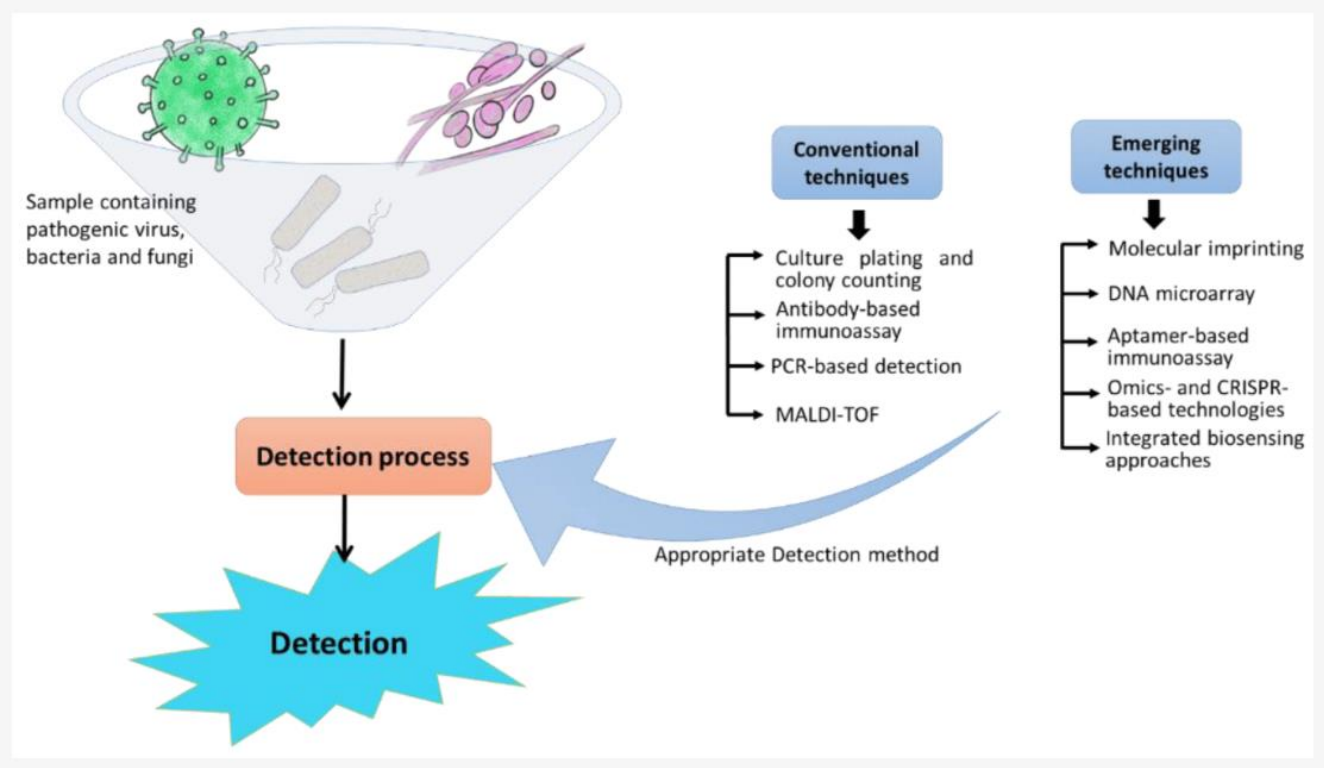
Pathogen detection methods

- DNA-based (Nucleic acid based)
- Antigen/Antibody detection based
- Culture based



Nehra M, Kumar V, Kumar R, Dilbaghi N, Kumar S. Current Scenario of Pathogen Detection Techniques in Agro-Food Sector. Biosensors. 2022; 12(7):489. https://doi.org/10.3390/bios12070489

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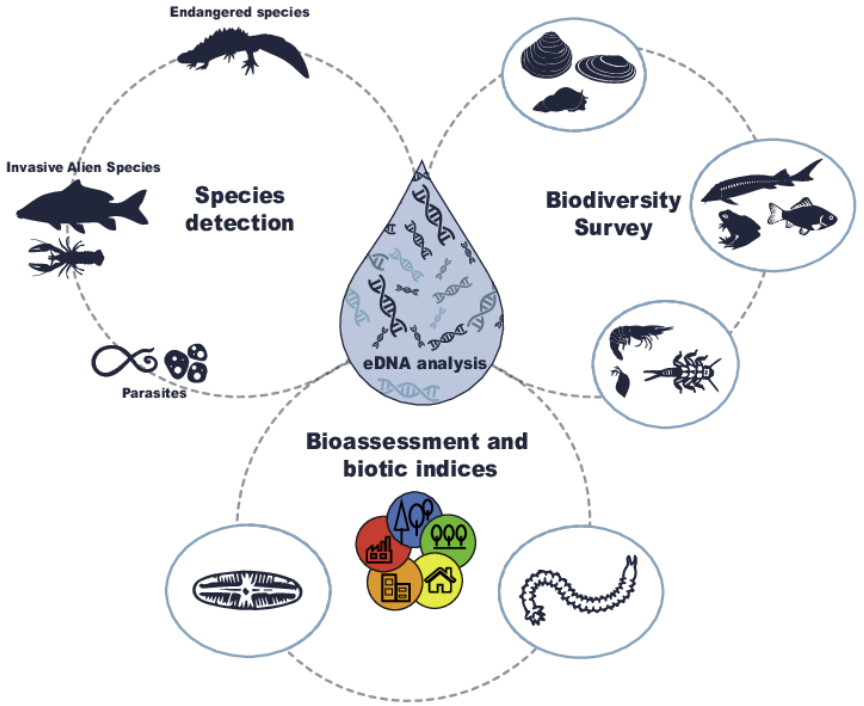
eDNA/eRNA: What is it?

“e” is nothing but environmental.

DNA/RNA are the nucleic acids

In simple terms, the use of environmental DNA/RNA to detect (or monitor) pathogens/biodiversity



Pawlowski, Jan & Apothéloz-Perret-Gentil, Laure & Mächler, Elvira & Altermatt, Florian. (2020). Environmental DNA applications for biomonitoring and bioassessment in aquatic ecosystems.

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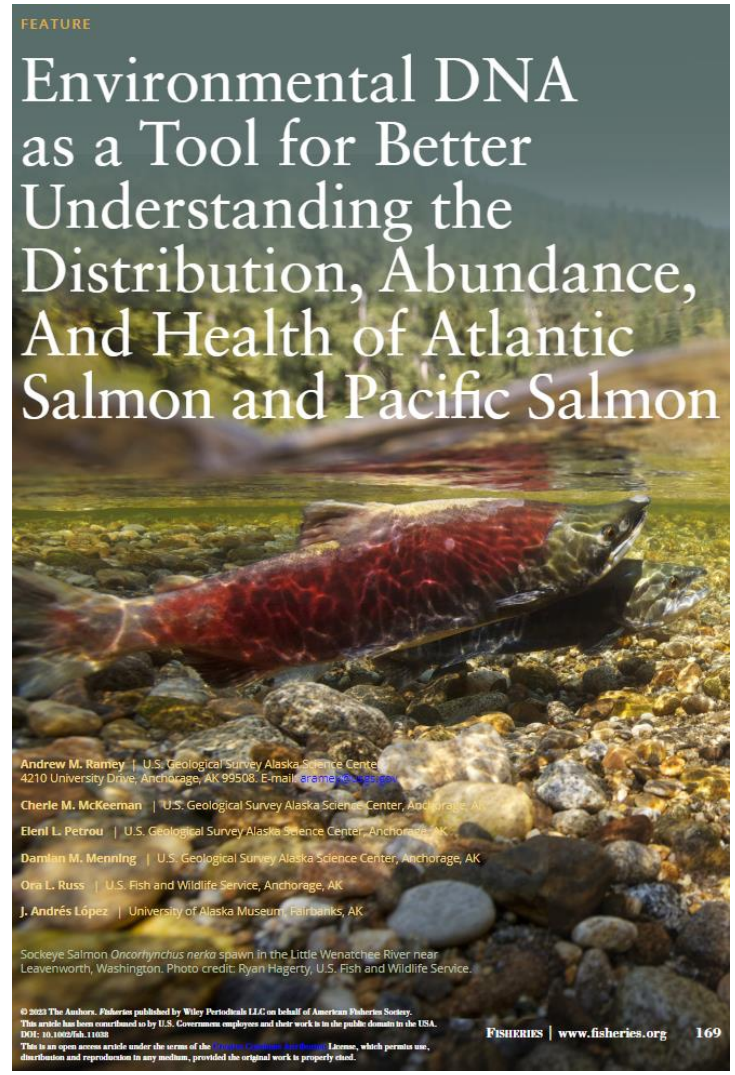
eDNA/eRNA in salmon aquaculture

Salmon eDNA has been used mainly in riverine settings to ascertain species distribution and detect non-native species.

eDNA has also been used to detect pathogens of salmon

Studies have also used eDNA to find an association between salmon farms and wild populations in terms of pathogen transmission



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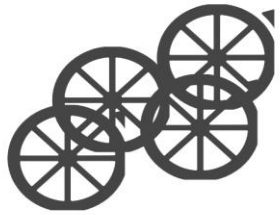
Sample types

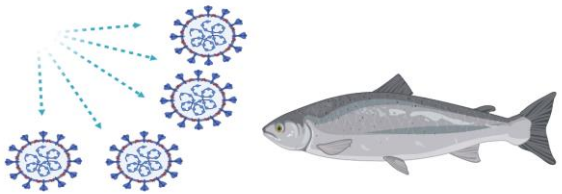
Water

Sludge

Biofilter carrier



Aerosol?



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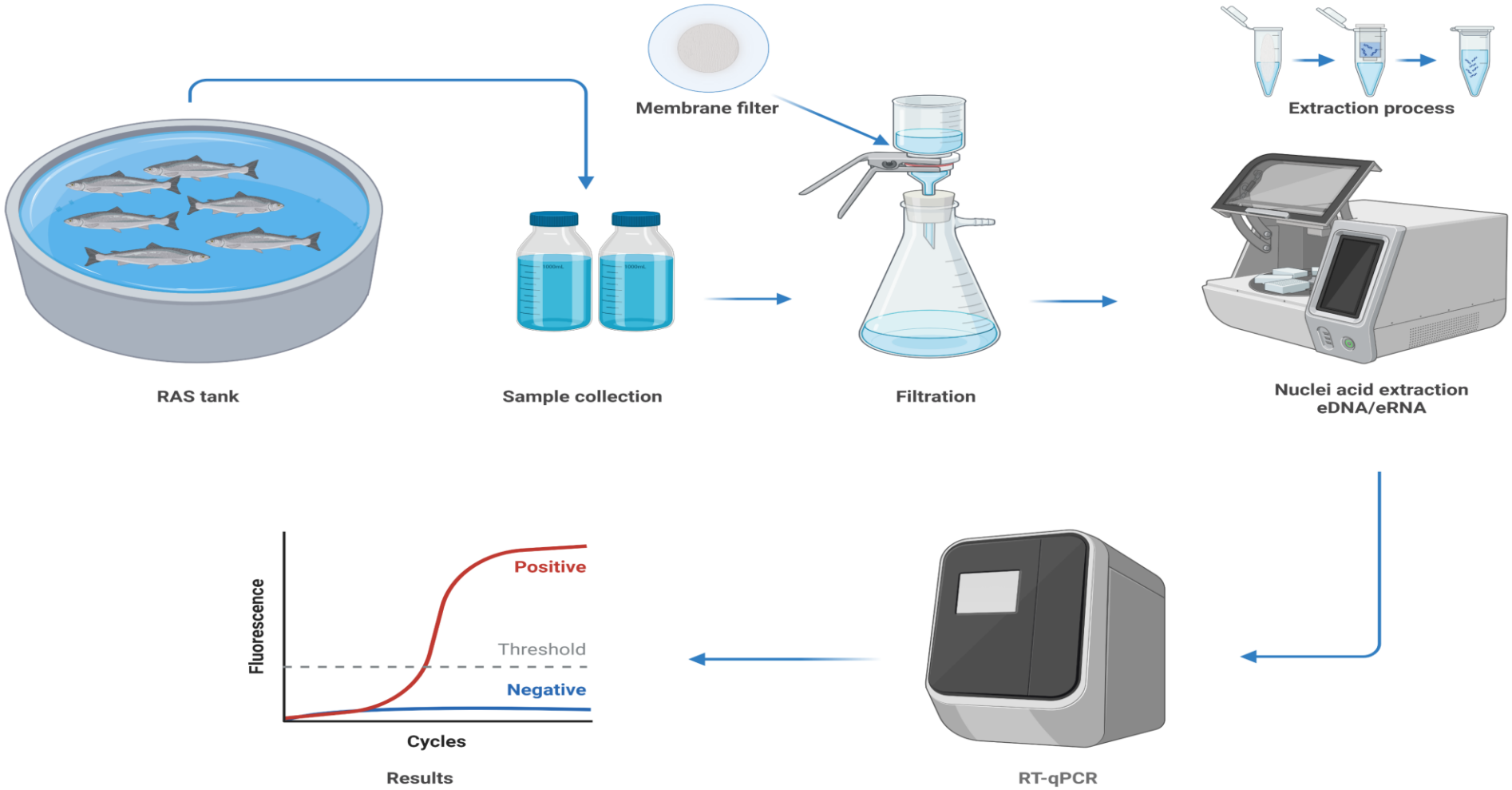
How is it done?



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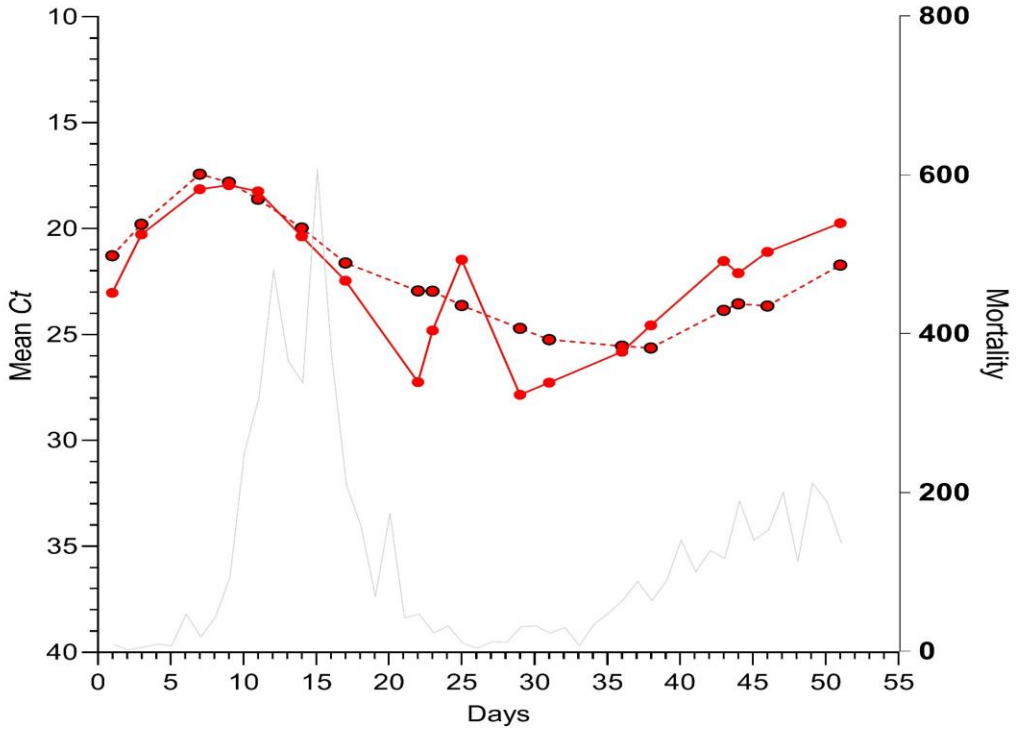
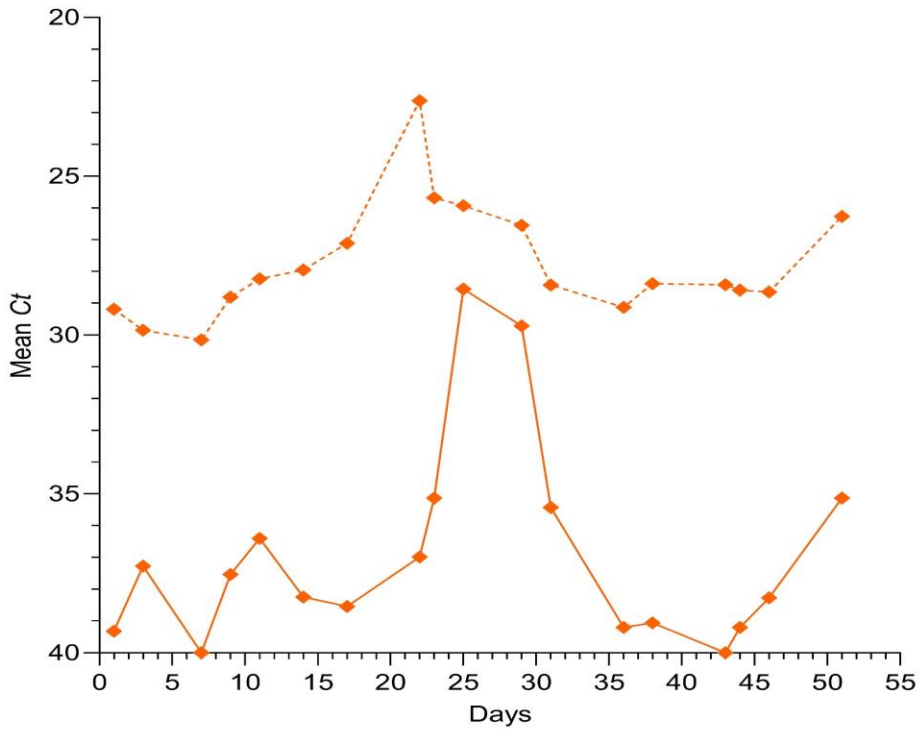
What do the results indicate?



Salmon Gill Pox Virus



F. psychrophilum

-----/---- Water

——/—— Fish

Ct ≥ 40 is considered negative

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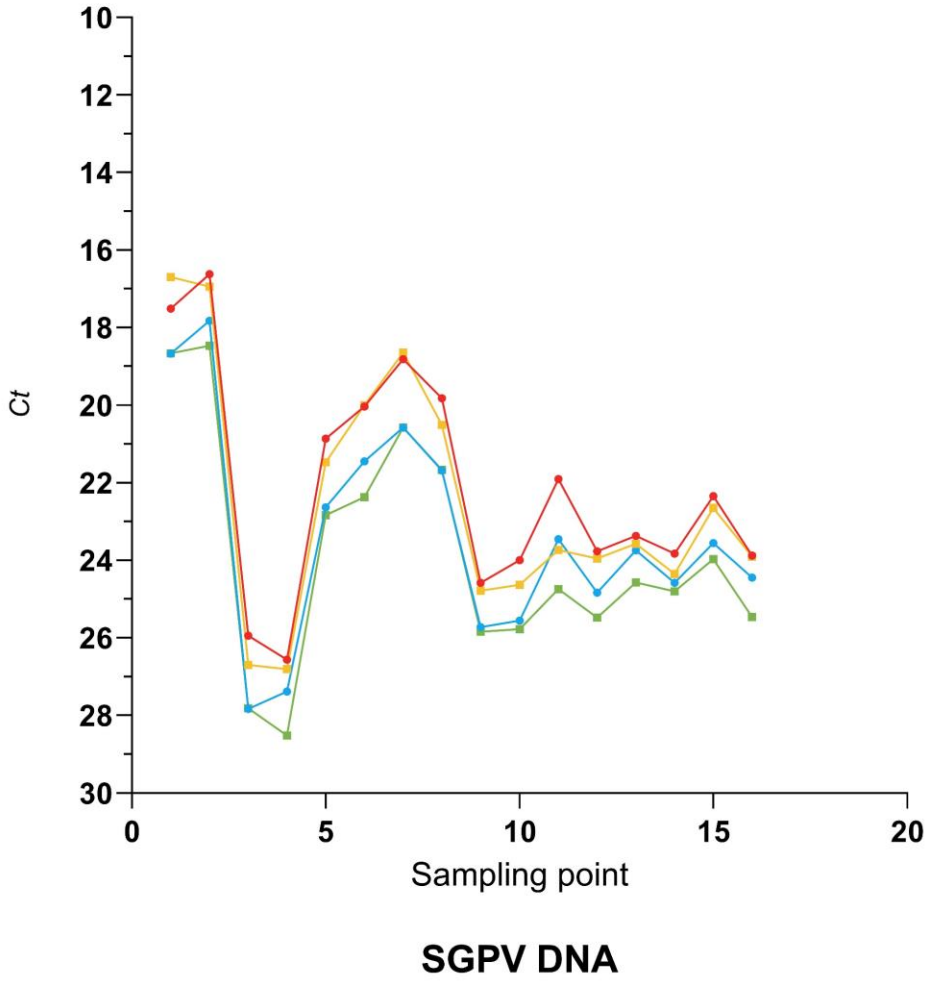
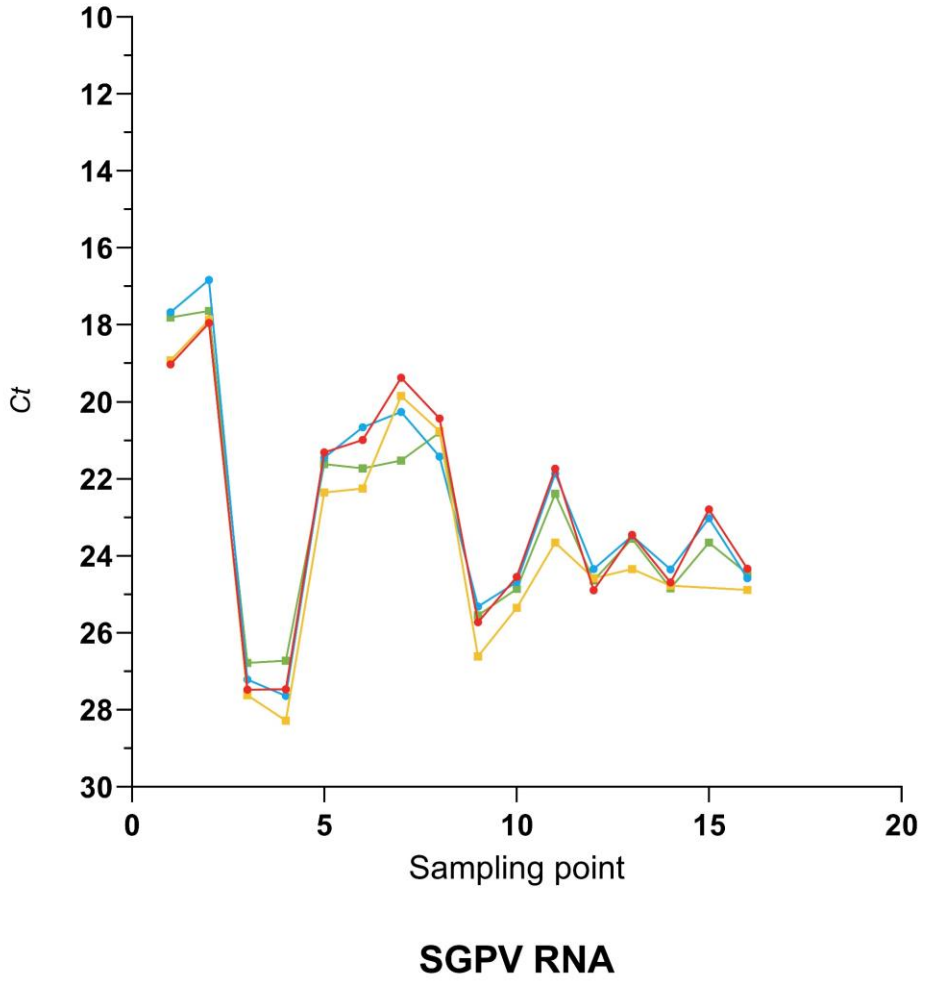
eDNA vs eRNA



SGPV DNA



SGPV RNA

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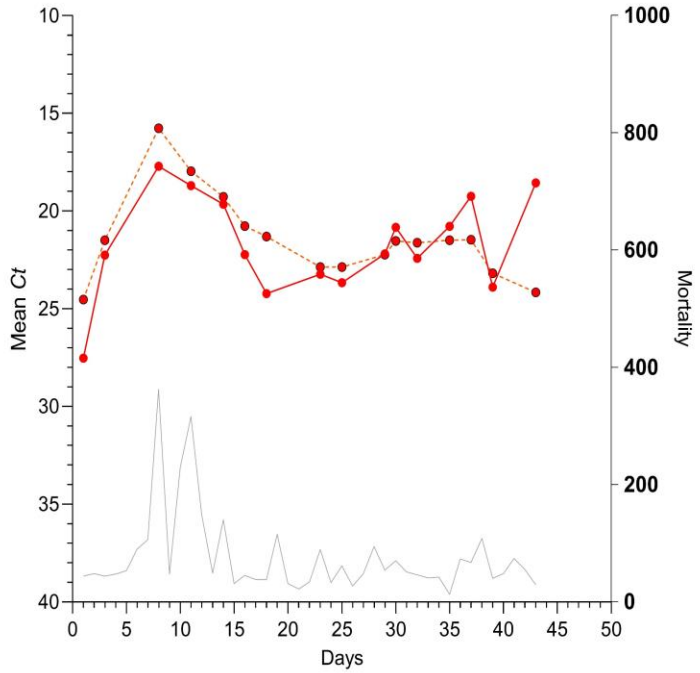
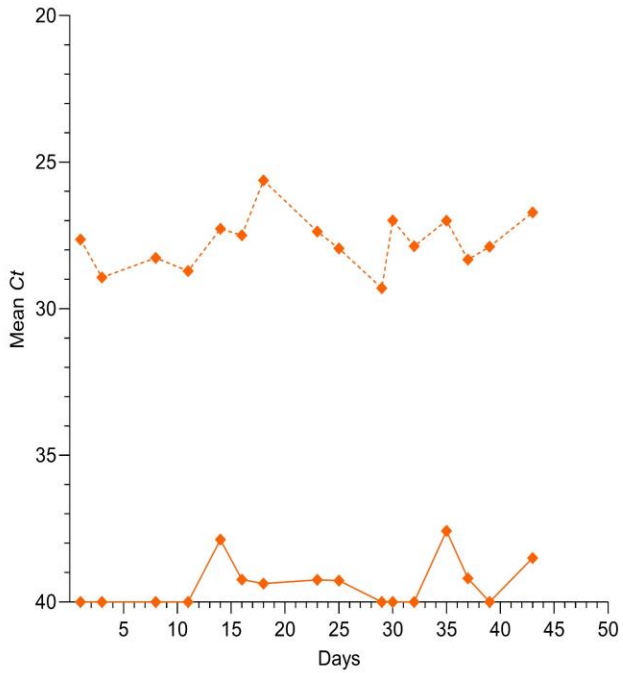
eDNA/eRNA from the aerosol in Atlantic salmon RAS

Sample collection



Salmon Gill Pox Virus



F. psychrophilum

-----/---- Water

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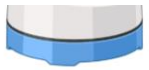
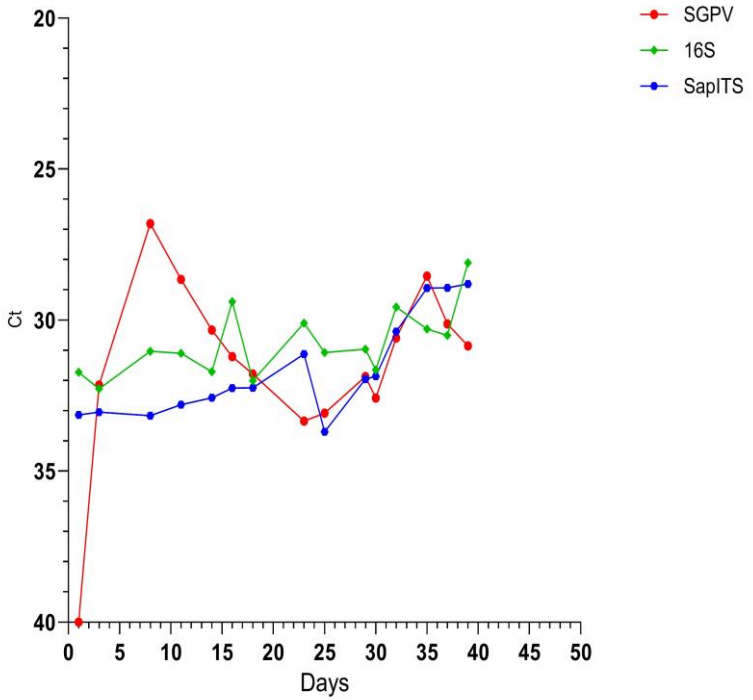
Ct ≥ 40 is considered negative



Coriolis Compact

Extraction procedure similar to water/fish samples

RT-qPCR



Coriolis Micro

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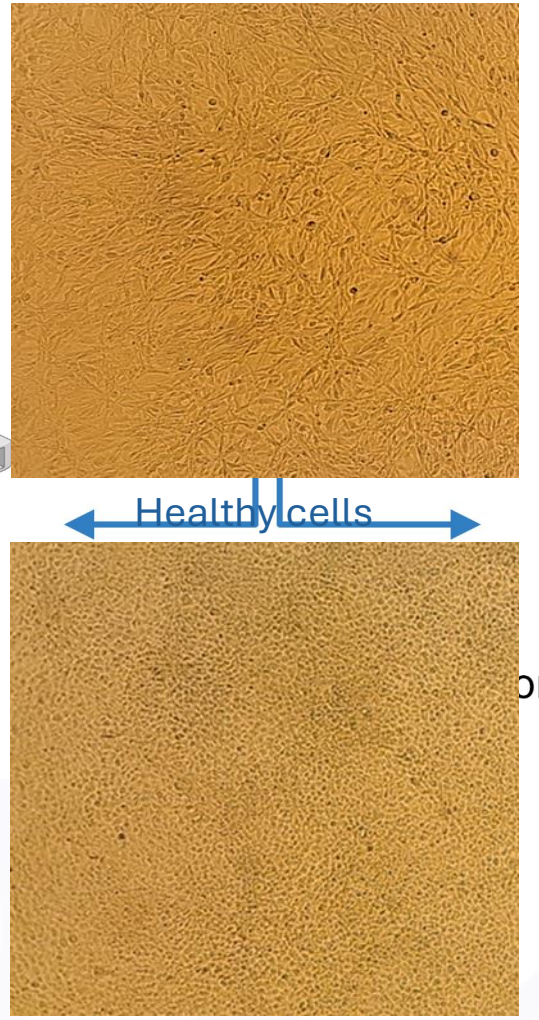
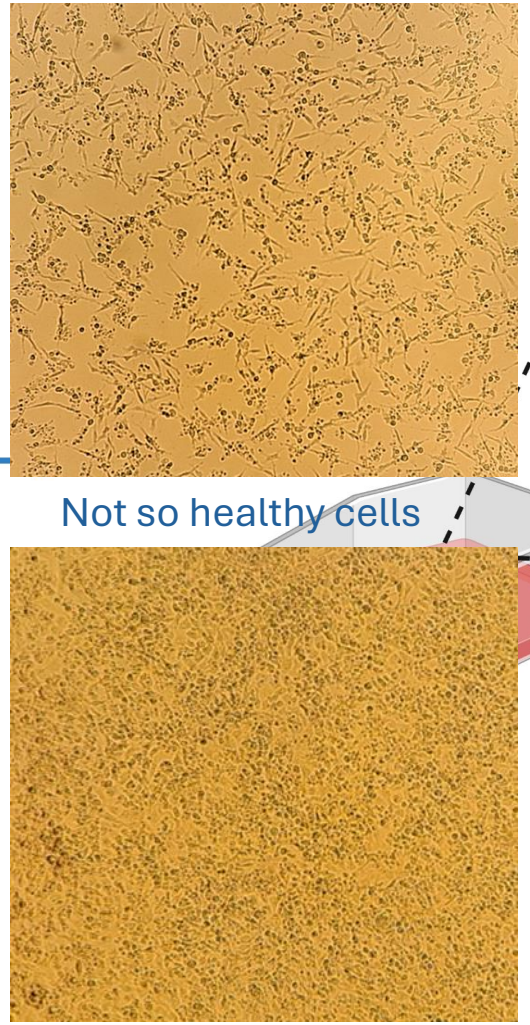
Is it just eRNA, or do we find live pathogens?

Coriolis Micro

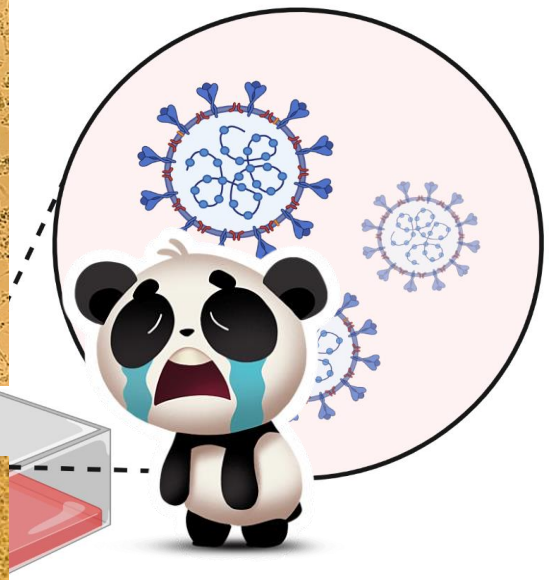


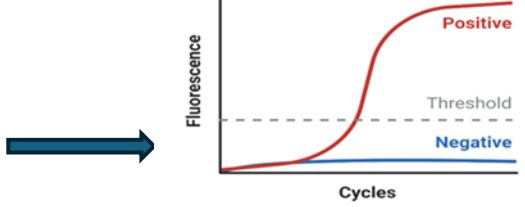
Healthy cells

Coriolis Compact



Not so healthy cells





Confirmation with RT-qPCR

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Why eDNA/eRNA?

Convenient

Reliable and comparable results to fish samples

Non-invasive

Large quantities of samples can be collected and processed.

Although not used as a confirmation, it indicates the disease status/early onset.

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Implementation

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Safeguarding Future Production of Fish in Aquaculture Systems with Water Recirculation

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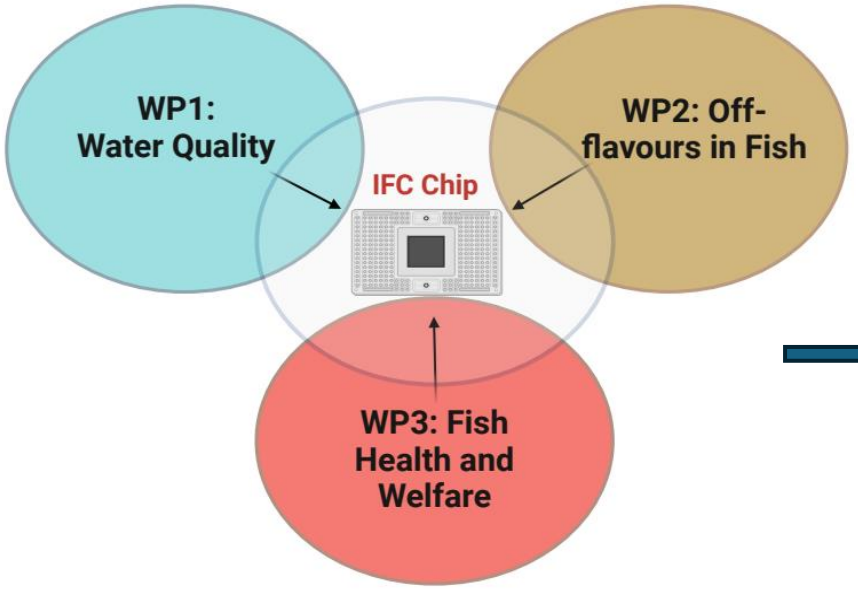
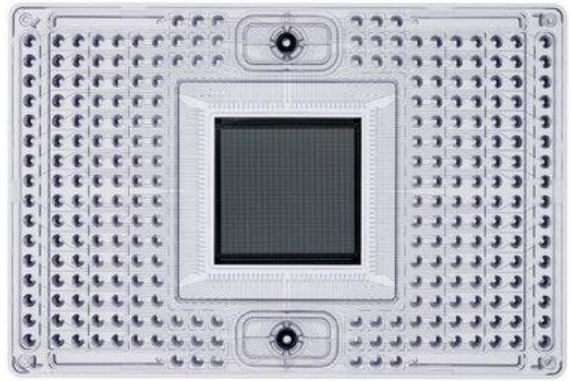
Work package 1: Water quality
Contributors: Fernando Fernando, Sara Sousa e Brito, Sujan Khadka

Work package 2: Off-flavours
Contributors: Julia Södergren, Pedro Martínez Noguera, Mariana Rodriques da Silva, Matteo Egiddi

Work package 3: Fish health and welfare
Contributors: Manuel Thibaud Blonc, Dhiraj Krishna, Cyril Henard, Hazim Sajiri, Hanxi Li





48 samples

48 different test/assay

One single output

Fast, efficient and high throughput (as opposed to conventional methods)

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Takk fyri!

Thanks to Debes, Petra and Maria

The PATO team

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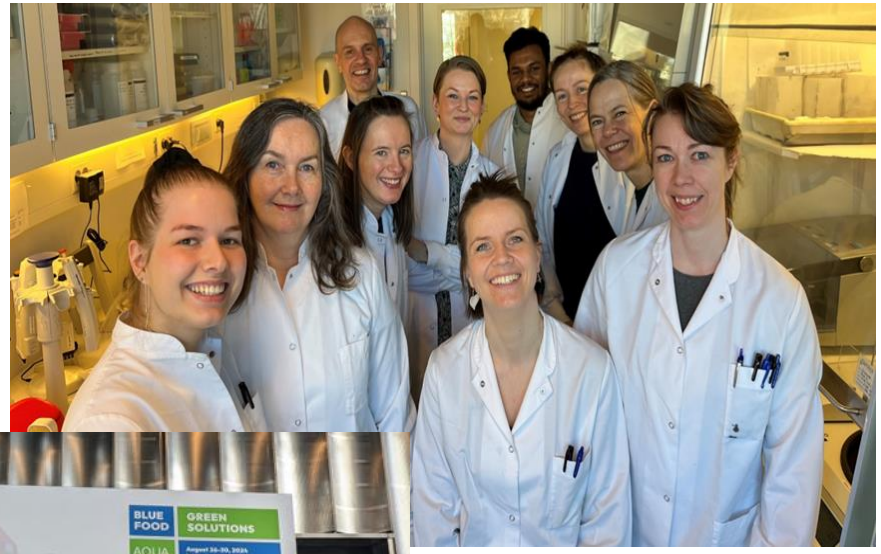
EU Horizon 2020



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