

Use of eDNA for supporting wildlife health management

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South-East Asia Wildlife Health Network Meeting

Nonthaburi, Thailand

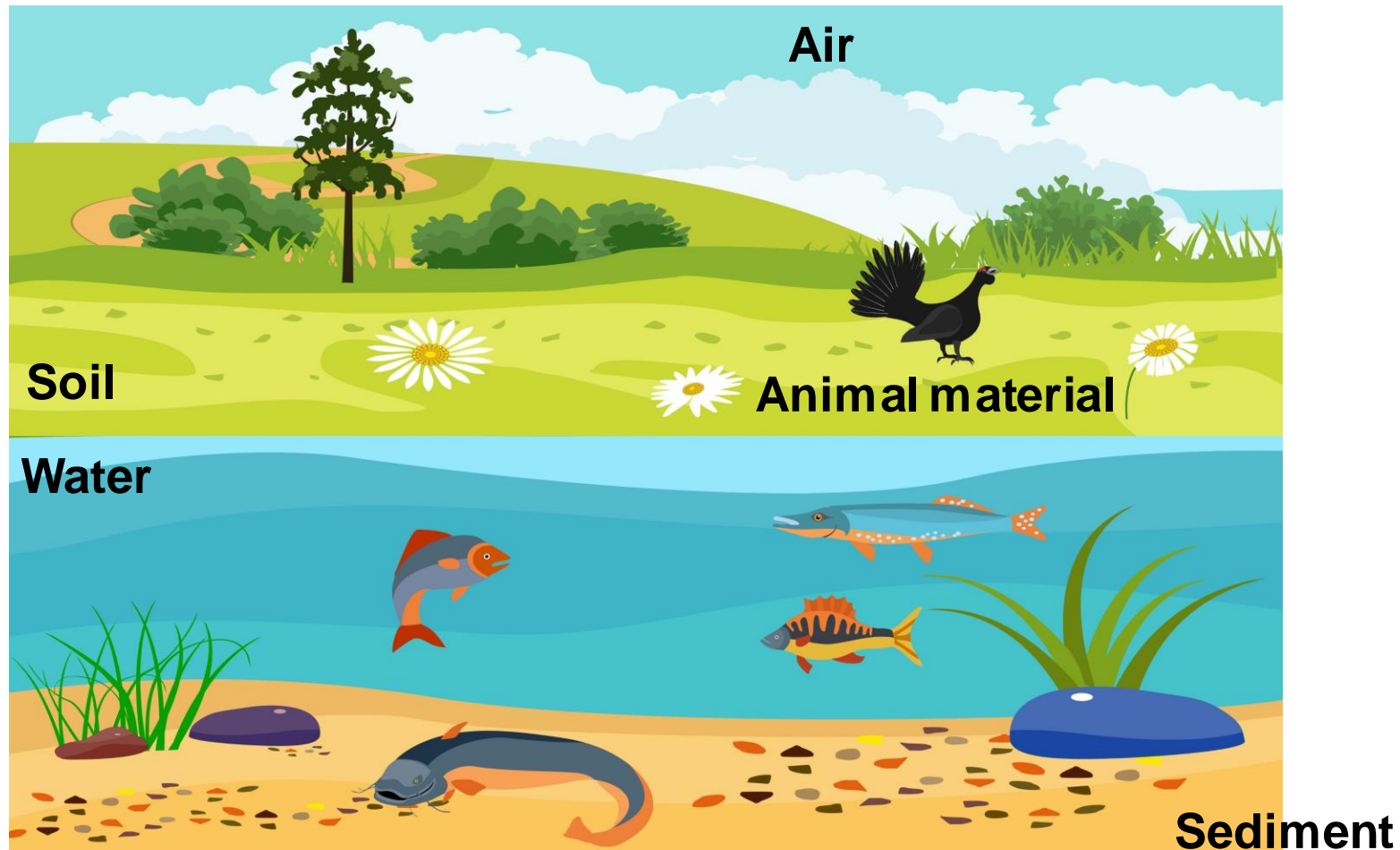
5 September 2022

Outline

- Background
- Objectives
- Sampling Methods
 1. Sediment sampling
 2. Seawater sampling
 3. Nest and Water Sampling
 4. Air sampling
- Molecular and Sequencing Technology
- Challenges
- Summary of eDNA capabilities

What is Environmental DNA (eDNA)?

- DNA collected from environmental samples



Why eDNA?

- Animals in the wild are targets and can be a reservoir for pathogens capable of infecting domestic animals and humans.
- Increasing number of emerging disease events linked to wildlife
- Constrained by challenges to survey from wildlife using conventional sampling strategies

eDNA and Wildlife Health Management

- Non-invasive sampling
- Environmental samples contain pathogen genetic material from all resident hosts rather than the subset of hosts that are captured using traditional sampling
- The same sample can be processed for the detection of multiple pathogens and hosts (Biodiversity)

Objectives

- Develop standardized sampling & diagnostic protocols to collect, sample, test, and analyze eDNA to support
 1. Biosurveillance for early detection
 2. Pathogen detection and characterisation for disease investigation
 3. Biodiversity and conservation

Sediment Sampling



High accumulation of pathogen in sediment

Increase persistence of viral and bacterial particles in sediment

Biosurveillance of migratory bird population during migratory seasons.

Collection of surface water and sediment samples for Avian Influenza Virus testing

Seawater Sampling

- Early detection of pathogen on fish farm before onset of clinical signs
- Application of eDNA methods was indicated as a high priority work for WOAHA listed aquatic pathogen as discussed in the meetings of Aquatic Animal Health Standards Commission in 2021.
- Pathogen surveillance in open sea and fish farms

Seawater Sampling



Horizontal water sampler used to collect seawater samples



Various laboratory methods for concentrating eDNA from environmental samples using pumps, syringes and spin tubes.

Nest and Water Sampling

- Marine turtles were found dead with tumours in 2020 and 2021
- Causative agent: Turtle herpes virus detected
- Potential role of turtle herpes virus infection the low survival rate from hatchlings to adulthood

Sample collection



- Environmental samples (seawater, sediment with mucus)
- Swab samples from juvenile turtles prior to release
- Unhatched eggs and/or dead hatchlings

Air Sampling

- Biological contaminants occur in the air as aerosols
- Microbiologic air sampling is the process of capturing contaminants in a known volume of air and is used as needed to determine the presence of microorganisms (viruses, bacteria and fungus)
- Infectious airborne pathogens suspended in the air can be recovered and appropriate preventive actions can be taken to minimise the threat to animal populations.

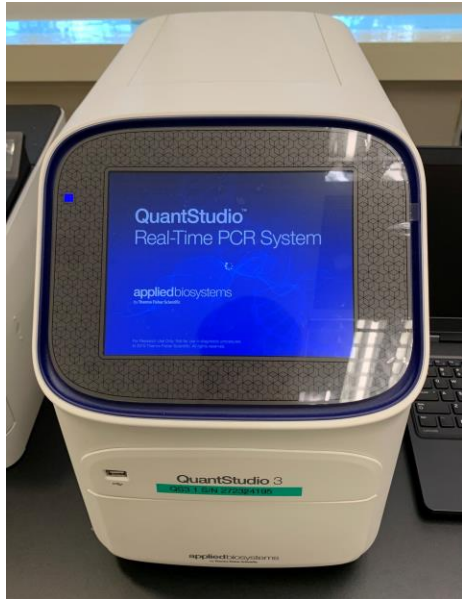
Air Sampler



Air sampler for collecting eDNA from the air

Filters can be used for bacterial culture, PCR testing, targeted sequencing and metagenomics

Molecular and Sequencing Technology



qPCR machine for specific and rapid detection of pathogen or animal signals from environmental samples



Next generation sequencing machine for high-throughput sequencing of eDNA

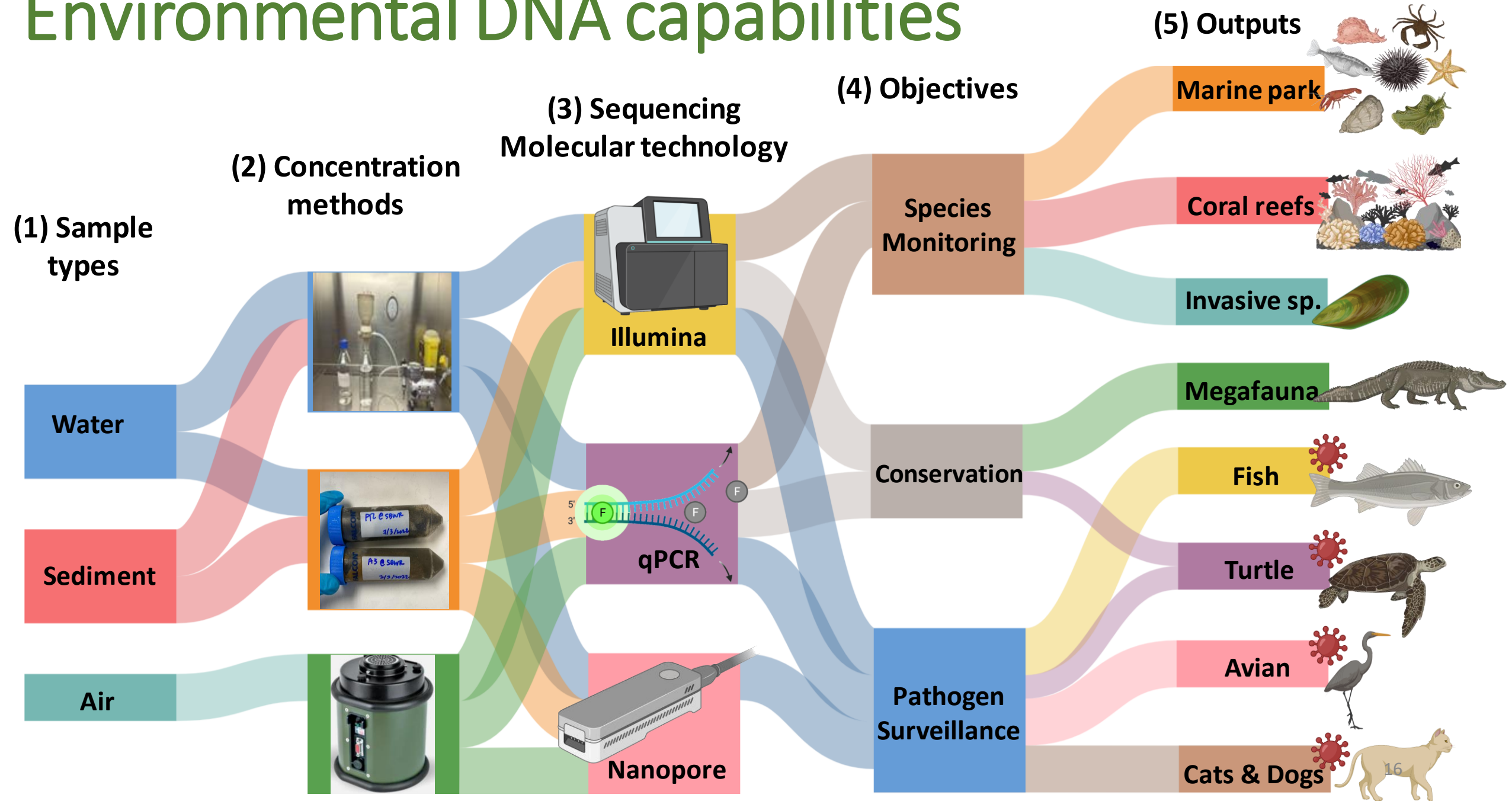


MinION nanopore sequencing unit, for rapid and real-time sequencing of eDNA

Challenges

- Sampling and testing methodology need to be optimized
- Environmental samples may not be able to determine intensity of the infection in the population
- Differentiation between live v.s. dead pathogen
- Degradation of eDNA due to environmental condition

Environmental DNA capabilities



Acknowledgment

1. Dr Charlene Judith Fernandez (Director of Centre for Animal & Veterinary Sciences)

2. Veterinary Applied Research Team

- Chen Jing
- Aden Ip
- Adrian Tan
- Lee Chee Wai
- Eileen Koh
- Ng Oi Wing
- Tan Li Ying
- Clara Lau

3. Colleagues from CAVS (Veterinary Microbiology and Veterinary Forensics & Pathology)

4. Colleagues who assisted with sample collection





Thank You!