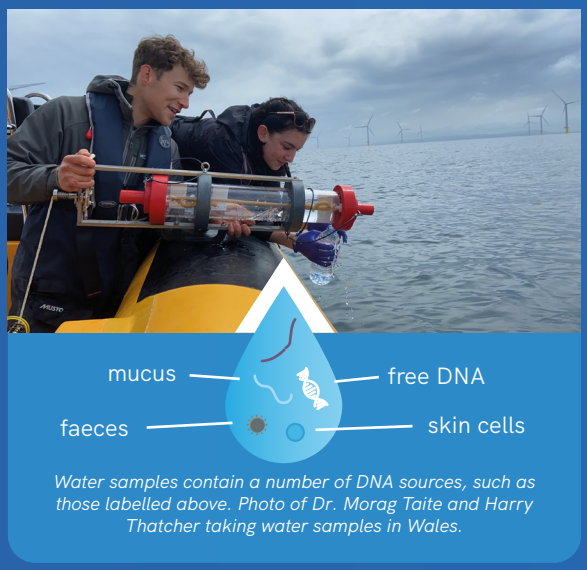
ECOSTRUCTURE

Climate Change Adaptation through Ecologically-Sensitive Coastal Infrastructure

@ecostructure_ www.ecostructureproject.eu

eDNA

Environmental DNA (eDNA) is DNA that is released from an organism into the environment. Sources of eDNA include skin cells, faeces, mucous, hair, eggs and sperm. eDNA samples can be collected from seawater, rivers, lakes, snow, soil and even air.



Water samples contain a number of DNA sources, such as those labelled above. Photo of Dr. Morag Taite and Harry Thatcher taking water samples in Wales.

How is it used in the marine environment?

Seawater samples are taken in bottles and the water is filtered through a fine filter paper. Everything that is on this filter paper is then extracted using a specialised DNA extraction kit.

Main Approaches to Analysing eDNA Samples

Metabarcoding provides DNA barcodes for everything that is in the sample

Quantitative PCR Using a quantitative PCR (qPCR) assay – a method that targets a specific species and tests whether it is present in the eDNA sample.

Using eDNA

- Detecting rare, cryptic (appears identical but is a different species) or elusive species
- Detect migration or spawning behaviour
- Determine species assemblages
- Evaluate management action – whether it is successful or not
- Monitor species abundance changes over time
- Create an archive record
- Monitoring invasion fronts for early detection to allow for rapid response.

Benefits

Non-invasive technique

Rapid detections

Cheaper and requires less human resouces than traditional surveys

Disadvantages

Different environmental conditions can affect the breakdown of DNA e.g. high UV light

Requires a reliable comparison database, which isn't always available

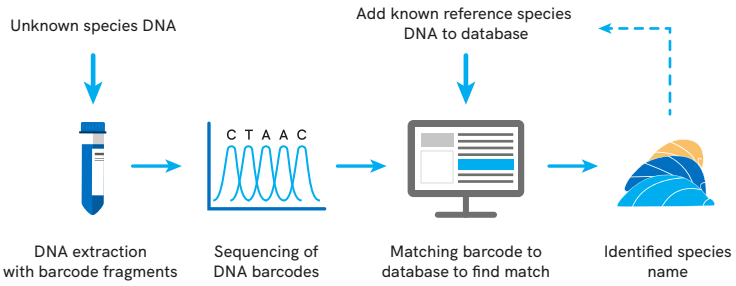
EU Funds: Ireland Wales Programme 2014-2020
Tionól Réigiúnach an Deiscirt Southern Regional Assembly
Cláir Chistí Eorpacha Struchtúrtha agus Infheistíochta na hÉireann 2014–2020
Cómhaoinithe ag Rialtas na hÉireann agus ag an Aontas Eorpach
UNDEB EWROPEAIDD EUROPEAN UNION
Llywodraeth Cymru Welsh Government
Cronfa Datblygu Rhanbarthol Ewrop European Regional Development Fund

ECOSTRUCTURE

Climate Change Adaptation through Ecologically-Sensitive Coastal Infrastructure

@ecostructure_ www.ecostructureproject.eu

DNA Barcoding



What is DNA Barcoding?

DNA barcoding is a method of identifying species using short sections of DNA or 'barcodes'.

Creating a Reference Barcode

Initially a DNA barcode from a correctly identified specimen is needed as a reference barcode. Creating this DNA barcode involves collecting a specimen and identifying it to species level by studying the form and structure of the organism. The DNA barcode is then produced by extracting DNA, amplifying a specific segment of the organism's genome by PCR, and sequencing this segment. Once the DNA barcode is produced it is then registered on an international database (such as GenBank). Once the DNA barcode is on a database, other researchers can compare their DNA barcodes to those on the database.

How is it used to identify non-native species?

DNA barcodes allow us to identify specimens to species level where the correct ID is in question or if DNA is present but no organism (for example with environmental DNA (eDNA) in samples of water or sediment). This is particularly important for non-native and invasive species as the rapid identification of non-native and invasive species could help prevent their spread.

Benefits of DNA Barcoding

- Provides identification of a species where the ID is in question.
- Particularly useful in hard to identify groups that are difficult to non-specialists to identify such as ascidians (sea squirts).
- Can be used to identify incomplete specimens where key taxonomic features are absent.
- Can be used to identify immature life stages (as some specimens are hard to identify unless they are adult) and therefore respond more rapidly to new infestations.
- Can be used to identify the DNA of non-native species from environmental samples of water, ice, sediment, soil or air.

Disadvantages

You need accurately identified DNA barcodes, which may not always be available, or they may not have been identified properly. The specimen must be preserved in such a way as to keep DNA intact (e.g. frozen, dried, preserved in ethanol).

EU Funds: Ireland Wales Programme 2014-2020
Tionól Réigiúnach an Deiscirt Southern Regional Assembly
Cláir Chistí Eorpacha Struchtúrtha agus Infheistíochta na hÉireann 2014–2020
Cómhaoinithe ag Rialtas na hÉireann agus ag an Aontas Eorpach
Undeb Ewropeaidd European Union
Llywodraeth Cymru Welsh Government
Cronfa Datblygu Rhanbarthol Ewrop European Regional Development Fund