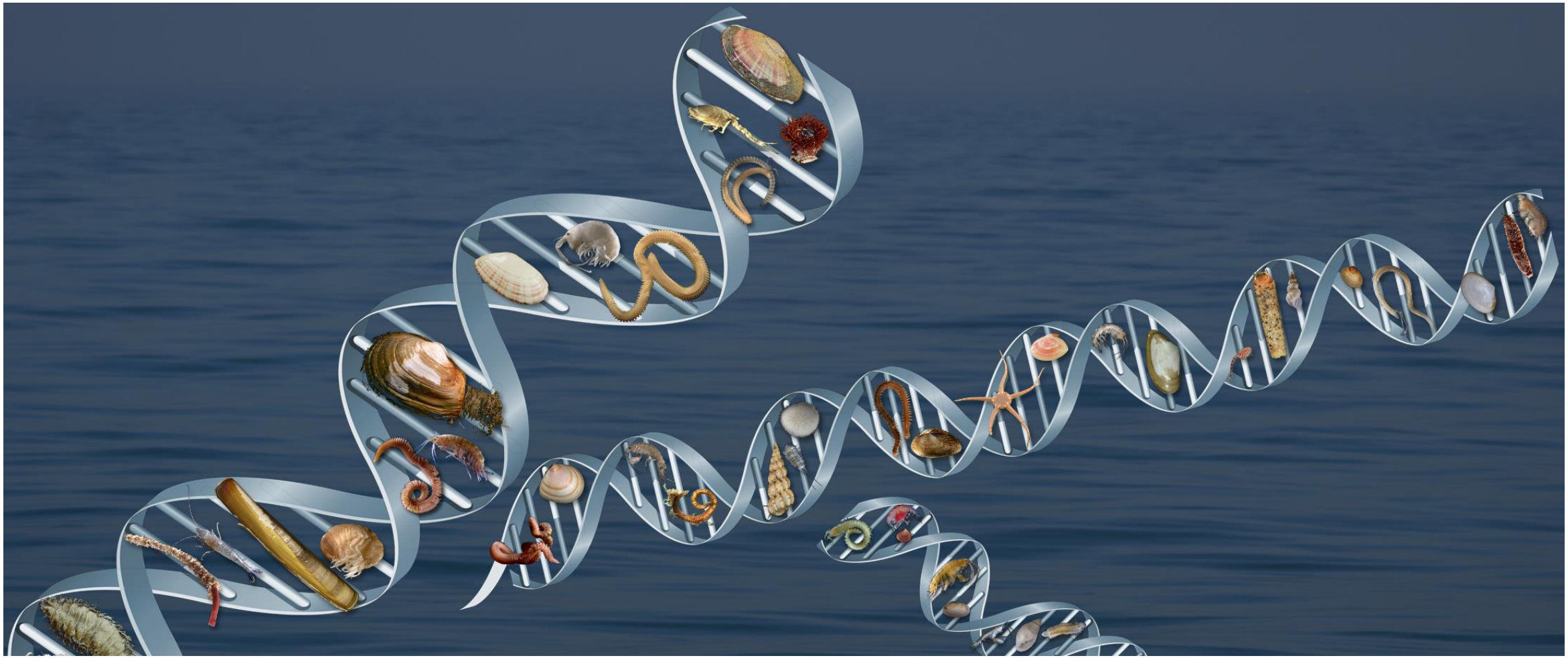
Towards zero-impact North Sea reef monitoring using environmental DNA



GEANS stakeholder event – 26 October 2022

Interreg North Sea Region GEANS
European Regional Development Fund
EUROPEAN UNION

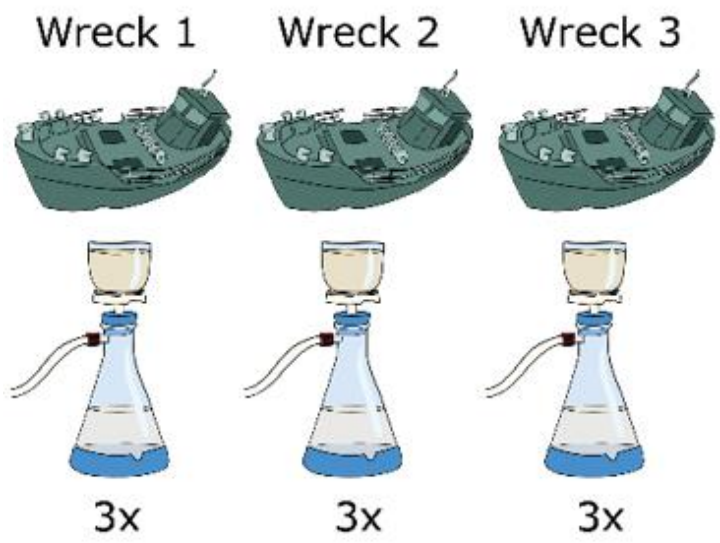
“Classical” biodiversity monitoring in North Sea

eDNA metabarcoding by Nanopore sequencing

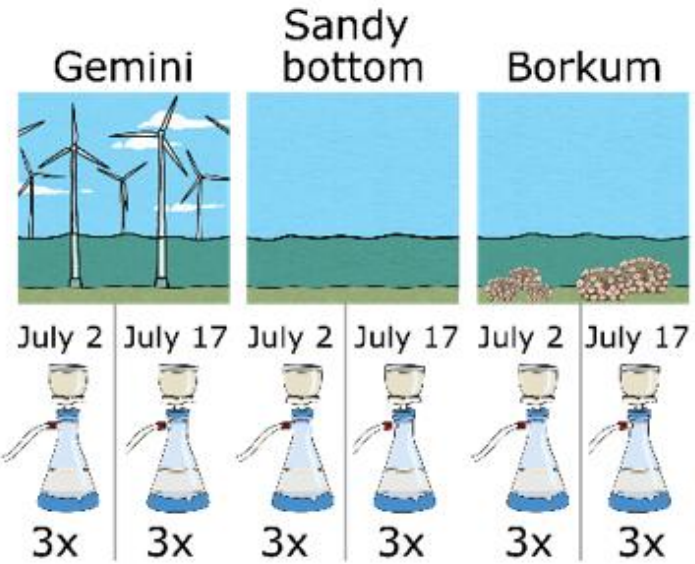
- Fast
- Relatively affordable
- Real-time data access
- Sequencing on location

Promising combination for biodiversity assessment

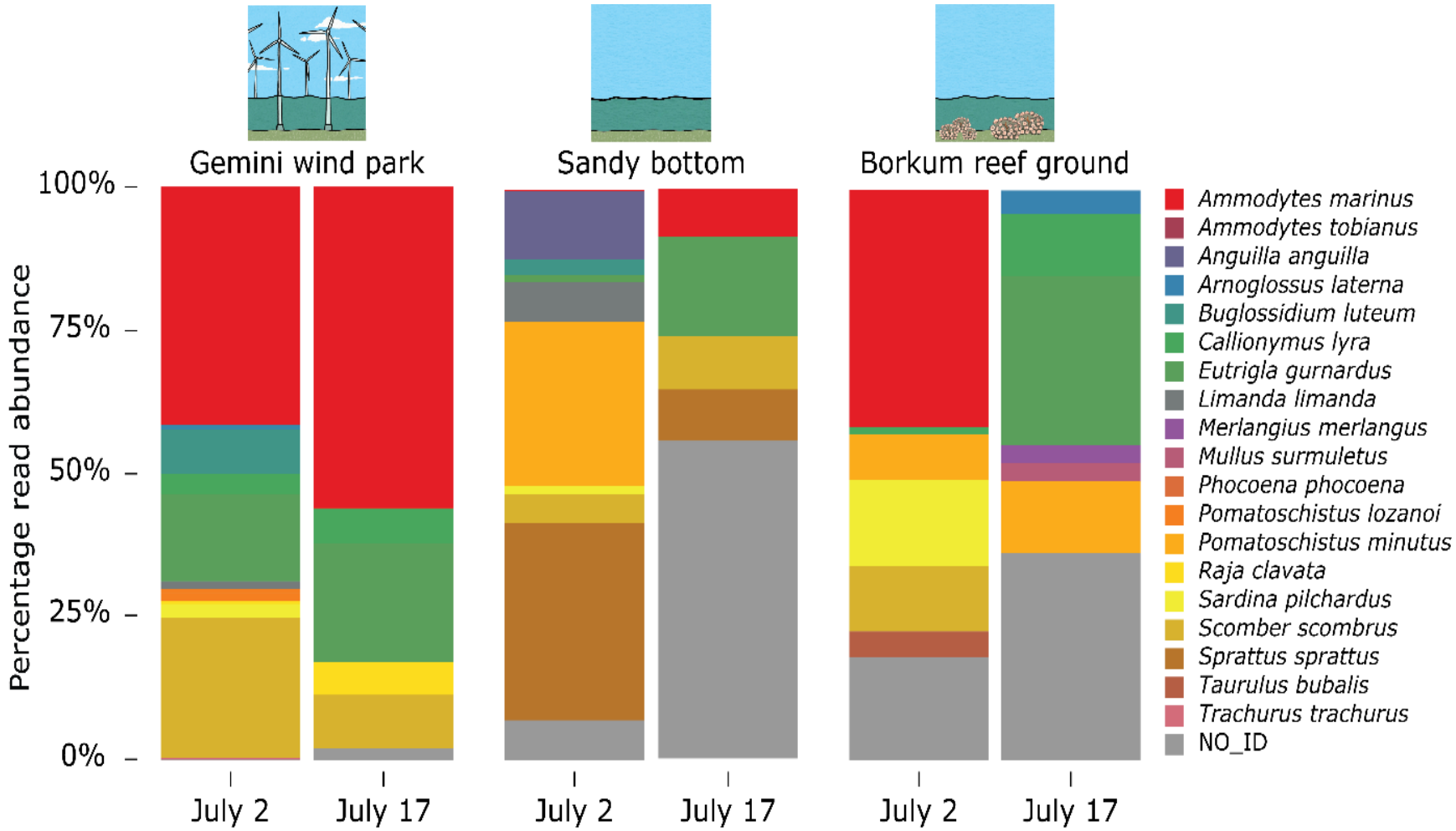
b Ship wrecks



c Gemini/Borkum

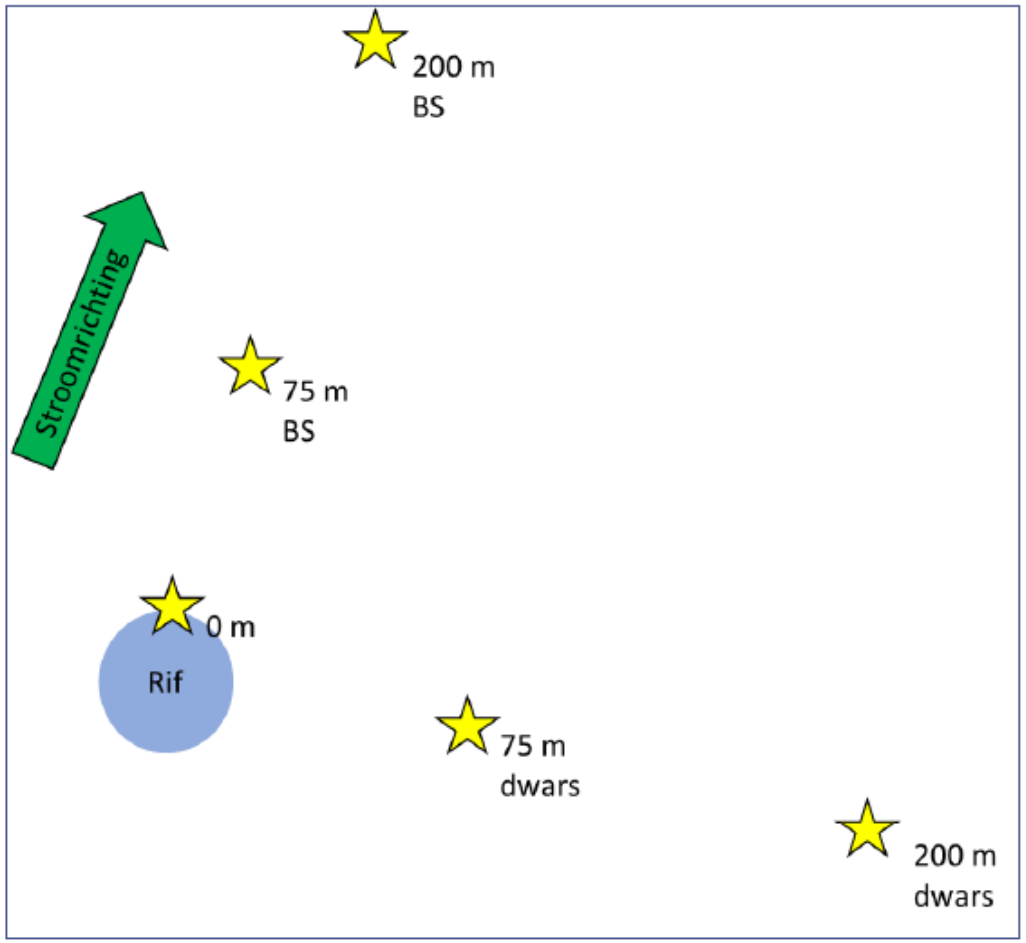


eDNA metabarcoding with fish specific primers



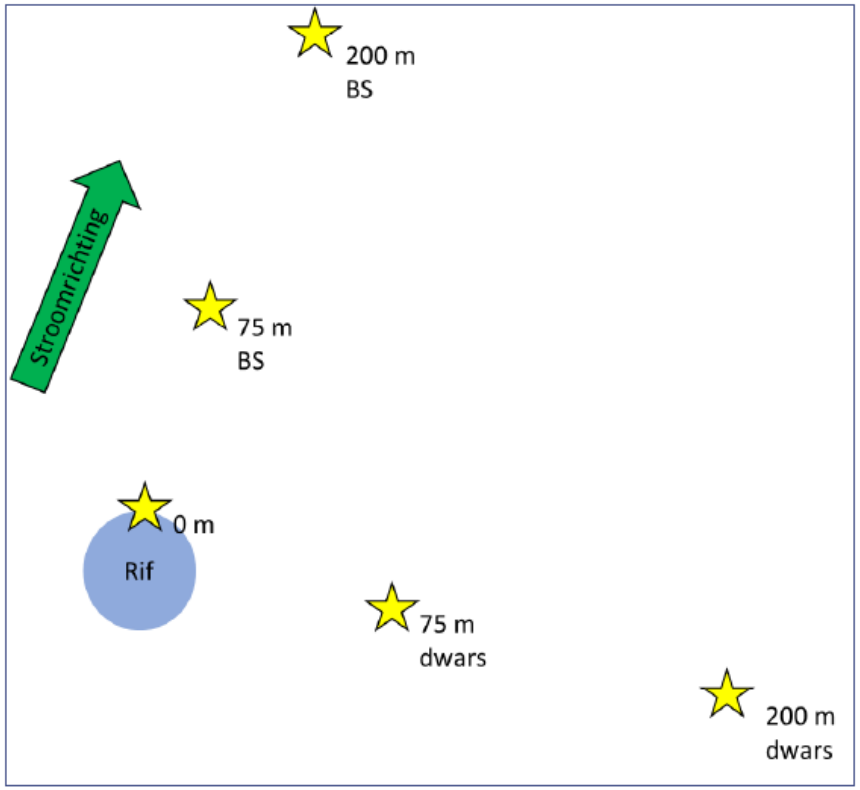
Reef proximity detection

Reef proximity detection



How do eDNA signals change depending on distance + current?

- Sampling eDNA on or just downstream (~50m) of the reef detects reef bound species such as rock gunnel (*Pholis gunnellus*), four-bearded rockling (*Enchelyopus cimbrius*) and pouting (*Trisopterus luscus*).
- 200 m away from the reef, perpendicular to the current these species are not detected
- Larger species associated, but not bound to reefs are detected in most samples, such as cod, whiting, harbour porpoise.
- Smaller pelagics (herring, pilchard) or sandy bottom species (sandeels, flatfish) form a background signal.

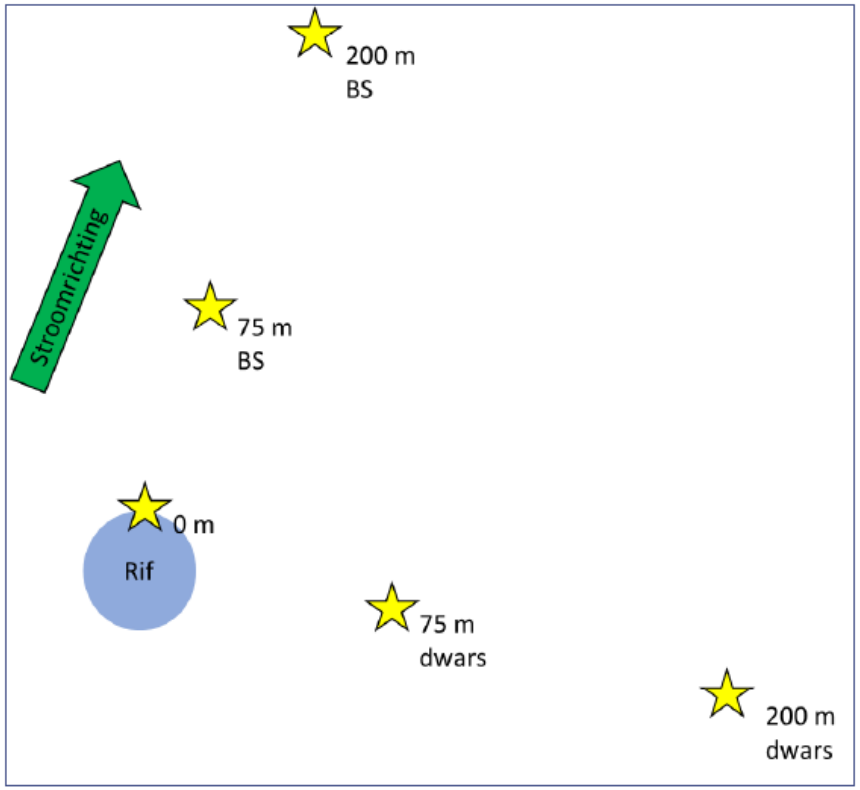


How do eDNA signals change depending on distance + current?

<u>Conclusions</u>

Monitoring in the North Sea using eDNA can provide a relatively local picture (~200m resolution) of reef-bound fish species

There always is a background signal present of species that live in the vicinity of the reef, and pelagic species.



What can be the added benefits of eDNA for fish monitoring

- Next to fish we also detected most other vertebrates, such as seabirds (gulls, razorbills, guillemots, cormorants)

- Using another set of PCR primers, possible to identify to species level benthic species that are hard to ID on camera images (Ensis sp., other burrowing shellfish)

- We encountered many traces of marine mammals, such as harbour porpoise, seals (both common and grey) and white beaked dolphins.
  > > Most are common species, and local detection does not proof they are attracted to the reef.

Benefits and drawbacks of eDNA based monitoring

- Easy sample collection +
- High throughput +
- Ecological patterns +
- Less catchability issues +
- More species detected +

- Primer/PCR bias -
- No barcoding gap -
- No life stage information -
- No quantitative information -
- Dedicated lab space -
- No eDNA indicator -

High resolution biodiversity monitoring

Autonomous sample collection

Future applications for eDNA biomonitoring

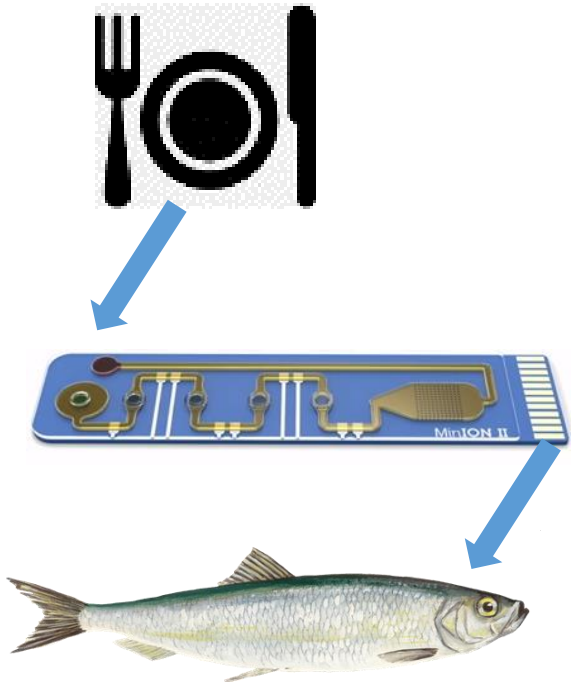
- Autonomous sampling of eDNA: Sample at set timepoints at artificial reefs, sluices, power cables, etc.

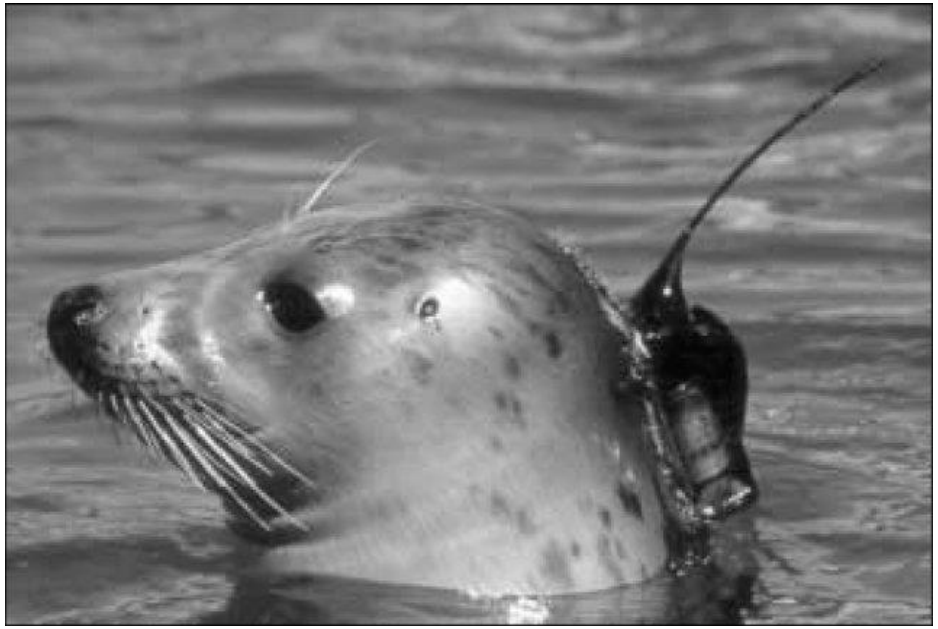
- Automated DNA sampling and sequencing: Couple DNA sampling to DNA isolation, library prep and sequencing. Send data to lab through satellite

Marine DNA biomonitoring outlook

5-10 years from now:
On line, real time biodiversity monitoring

Or: diet analysis by in situ sequencing of eDNA





Vincent et al., Aquatic Mammals 2002, 28.2, 121–130

QUESTIONS?
REMARKS?
SUGGESTIONS?

CONTACT US

reindert.nijland@wur.nl

Interreg North Sea Region GEANS
European Regional Development Fund

EUROPEAN UNION

https://www.geans.eu/

@GEANS_Interreg

ILVO Cefas AARHUS UNIVERSITY SEANALYTICS AB Naturalis Biodiversity Center
NORD University SENCKENBERG world of biodiversity VLIZ WAGENINGEN UNIVERSITY & RESEARCH