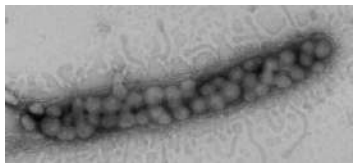
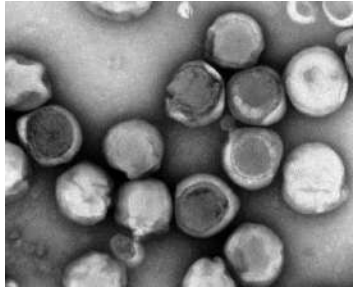




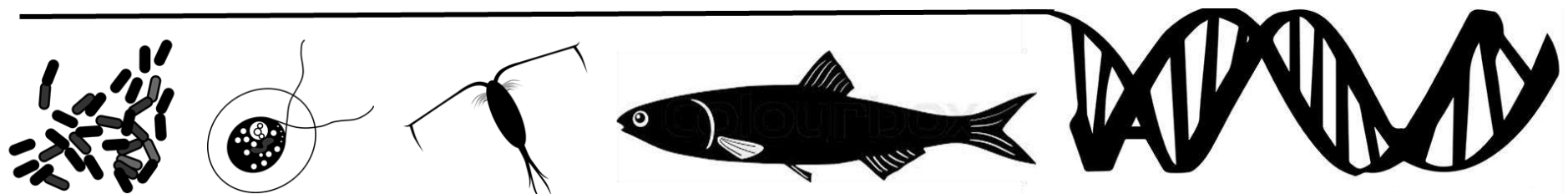
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MARINe-DNA: a forensic approach for detecting marine biodiversity

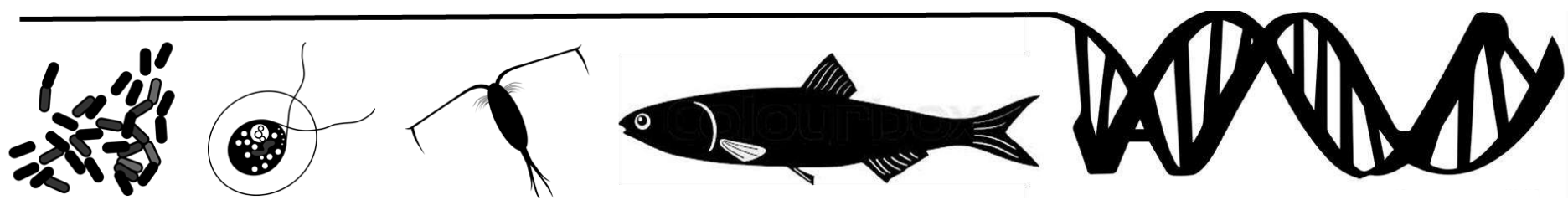
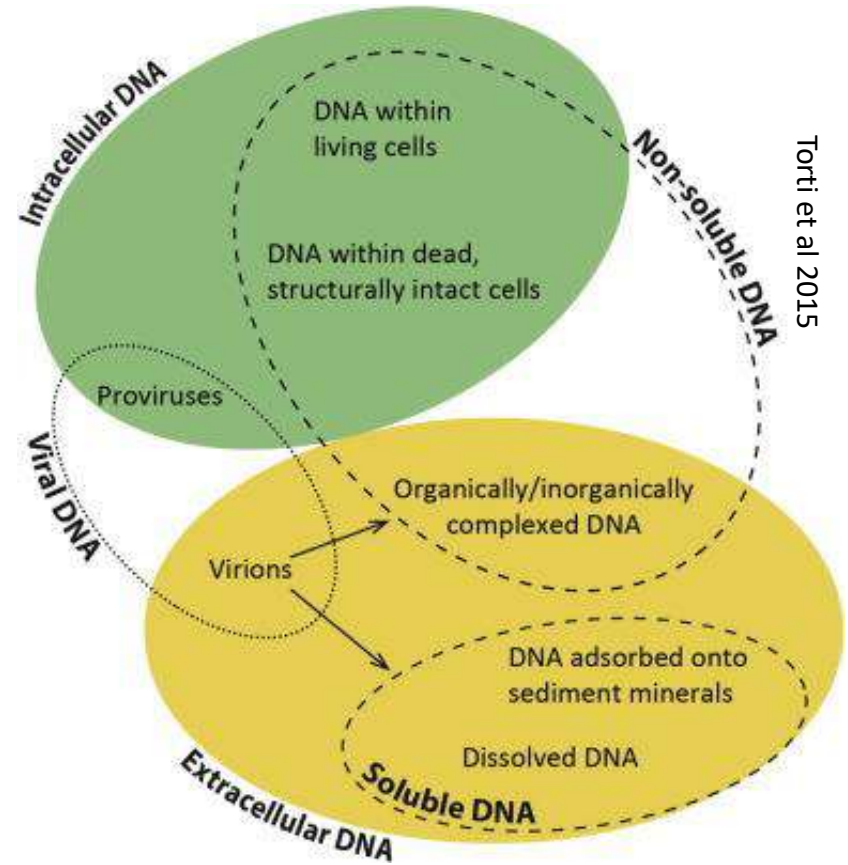
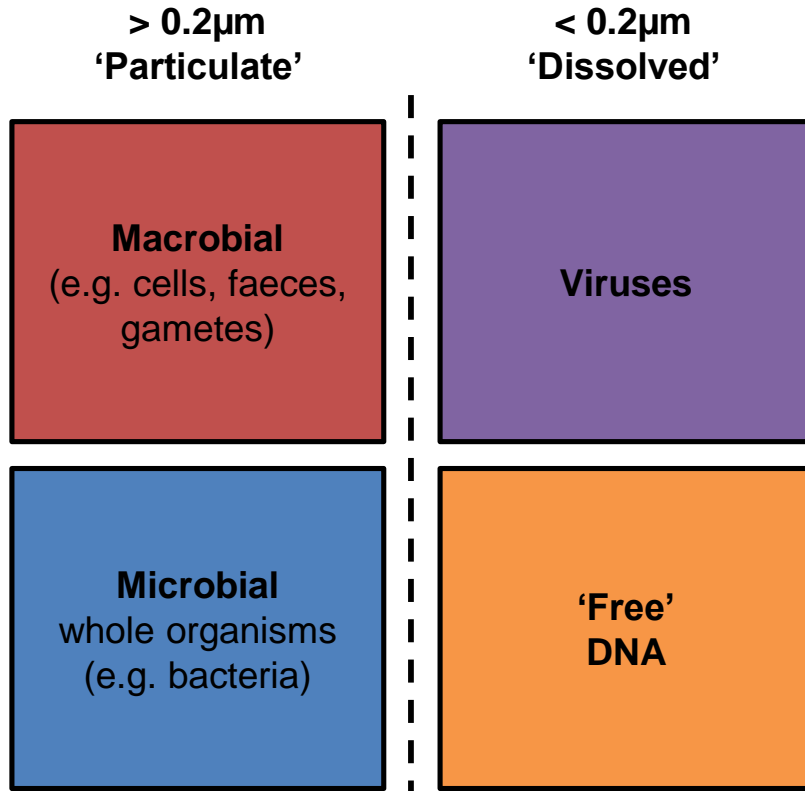


Professor Willie Wilson
Director, Marine Biological Association

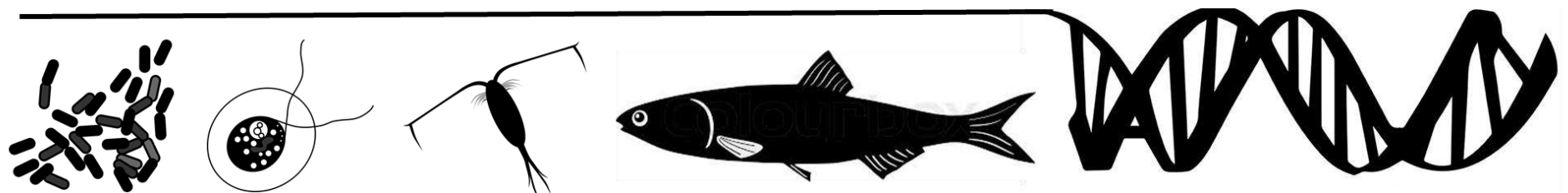
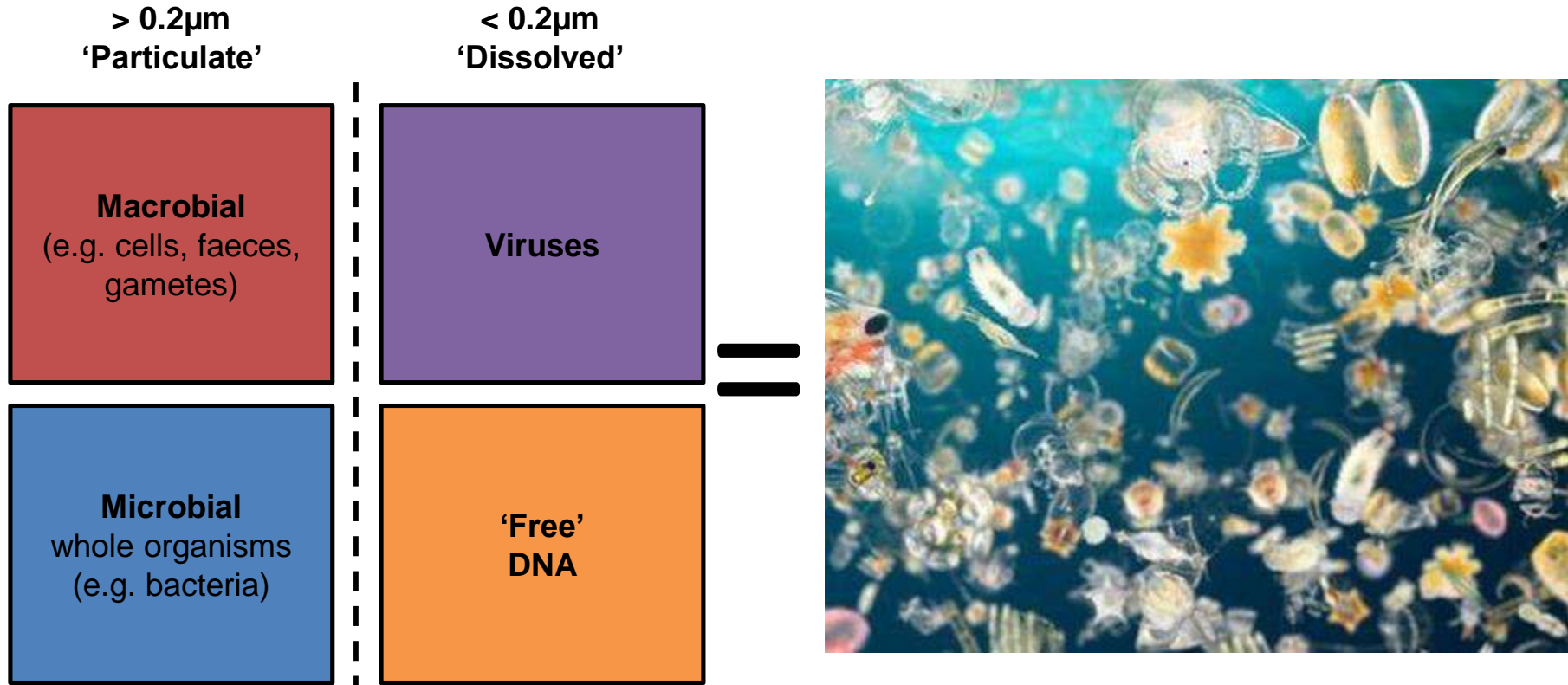
Professor of Marine Virology
University of Plymouth



MARINe-DNA: a forensic approach for detecting marine biodiversity



Does eDNA-based assessments of diversity match 'traditional' assessments of diversity?



Can eDNA-based assessments of diversity add to our understanding of the structure and function of pelagic and benthic coastal ecosystems beyond the state-of-the-art?

> 0.2µm
'Particulate'

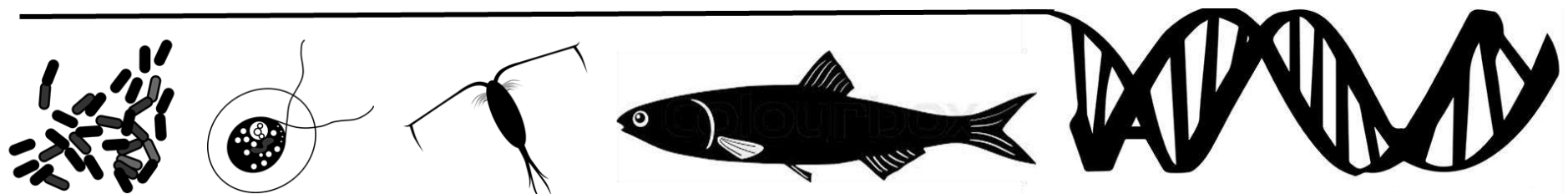
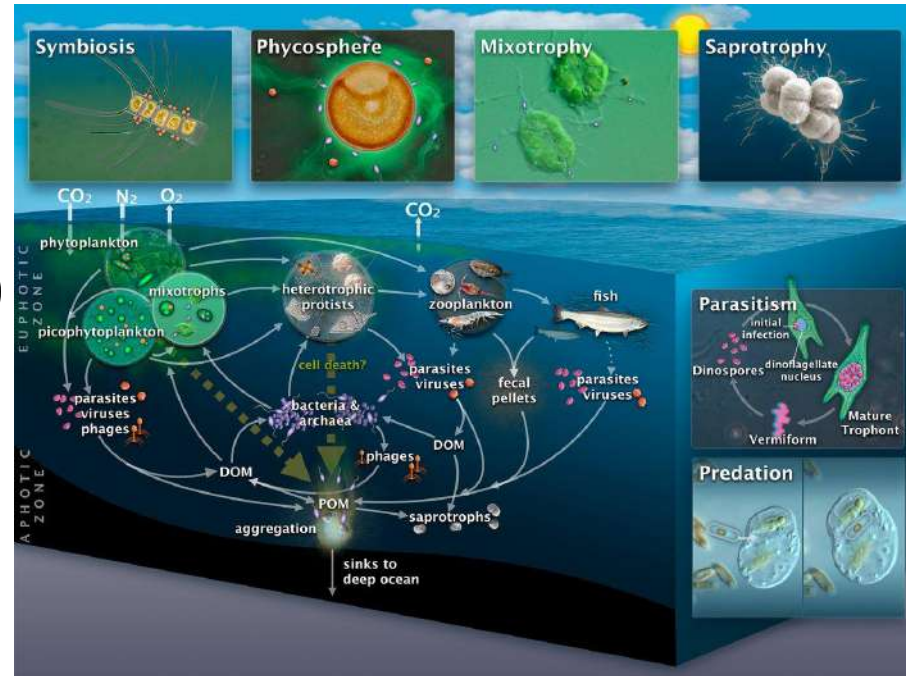
< 0.2µm
'Dissolved'

Macrobial
(e.g. cells, faeces, gametes)

Viruses

Microbial
whole organisms
(e.g. bacteria)

'Free' DNA



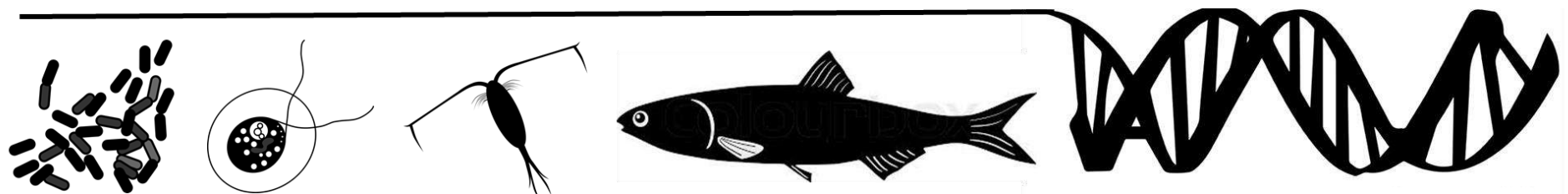
eDNA test kits are already available to detect rare or protected species



<https://commons.wikimedia.org/wiki/File:Kammolchmaennchen.jpg>



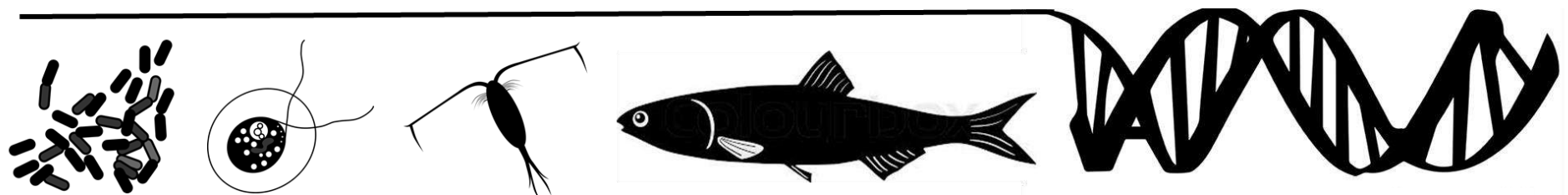
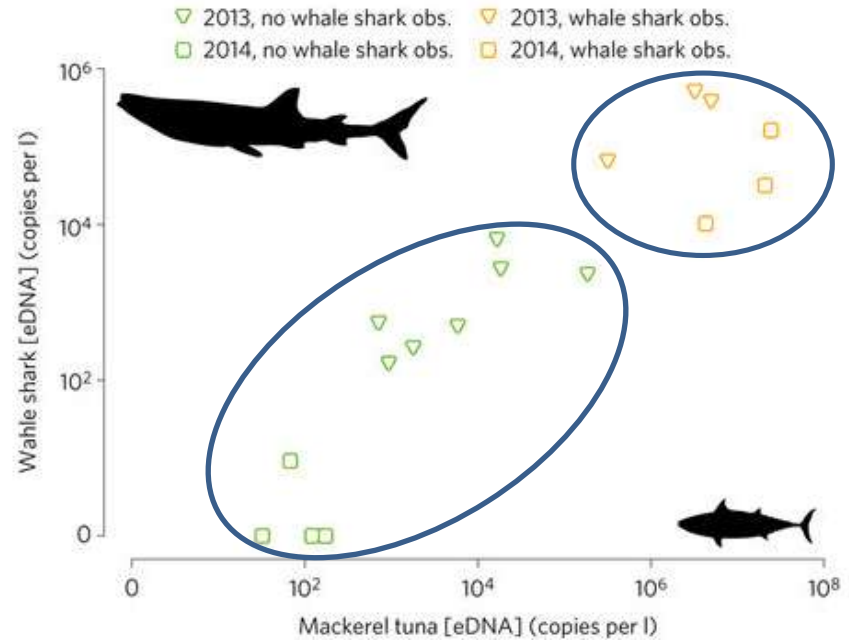
<https://greatcrestednewts.co.uk//wp-content/uploads/2015/12/eDNA-kits-2.jpg>



Population characteristics of a large whale shark aggregation inferred from seawater environmental DNA off the coast of Qatar

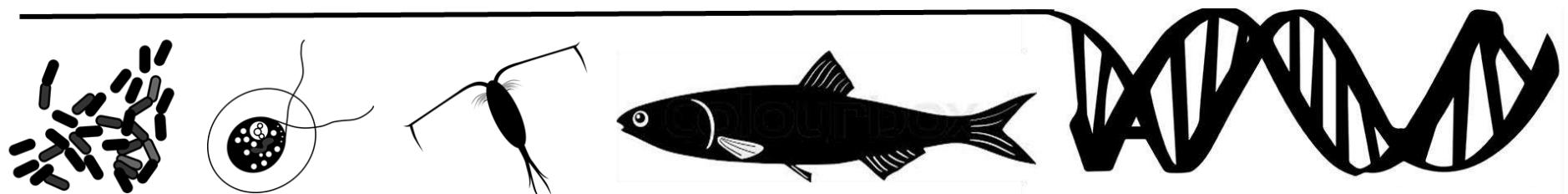


<http://www.divethebig5.co.za/wp-content/uploads/2016/11/whale7.jpg>



Validation and optimisation of eDNA tools

- Optimise methodologies to sample, concentrate and purify eDNA from the marine environment.
- Quantify the impact of environmental conditions and microbial processing on the quantity, quality and taxonomic composition of eDNA within coastal waters and sediments.
- Determine the relationship between e-metagenetic and e-metagenomic analysis of eDNA to current and legacy time-series assessments of biological communities.





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Sampling Solutions

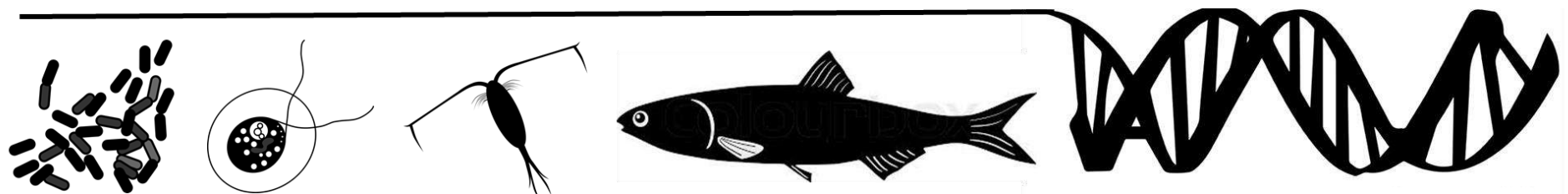


ECOLOGICAL ASSESSMENT
WITH MOLECULAR ACCURACY



- Applied Genomics, in collaboration with the MBA, Plymouth University and Benthic Solutions, have developed a large-volume eDNA sampling system for biodiversity assessment and early detection of non-native species in marine environments
- ✓ Programmable
- ✓ High-volume
- ✓ Demersal
- ✓ Representative
- ✓ Cost-effective

• Applied Genomics are seeking for partners who are interested in deploying this system for marine environmental biodiversity assessment and biosecurity surveillance.

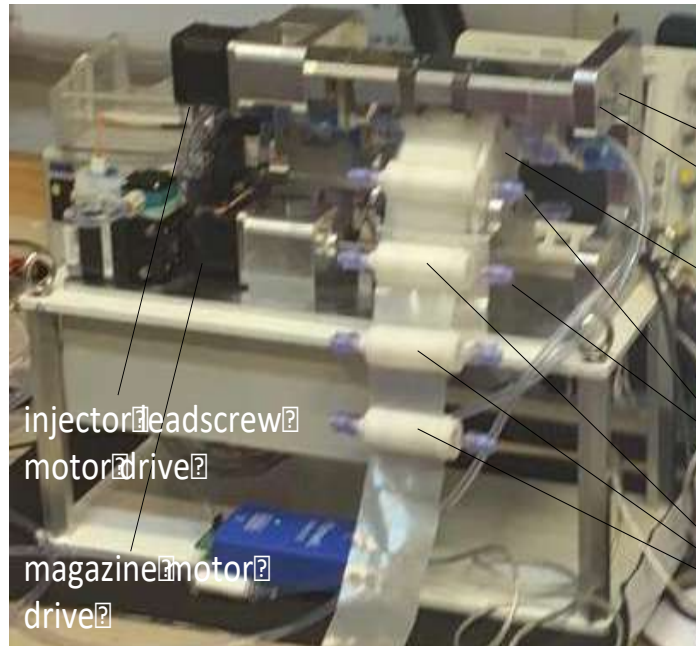


High Resolution Sampling and Preservation

Submersible sampler

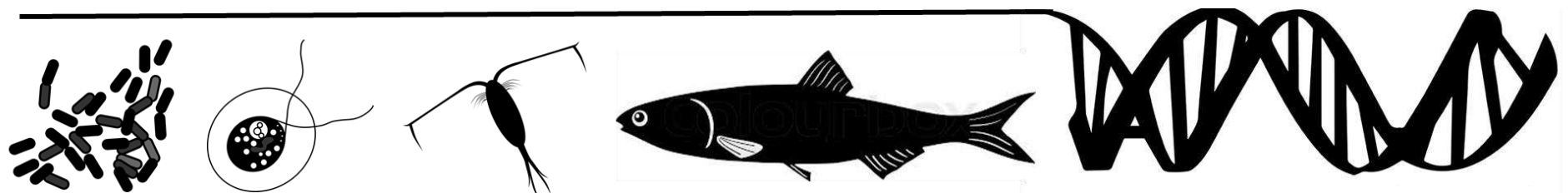


Submersible 'omics sampler

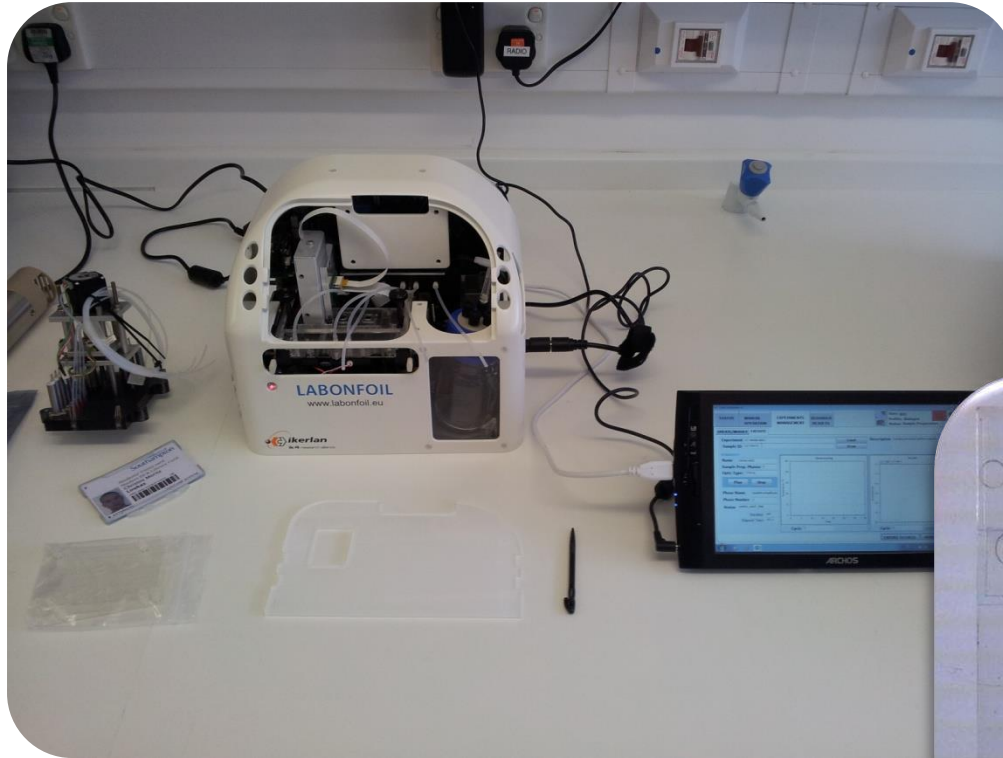


injector leadscrew motor drive
magazine motor drive

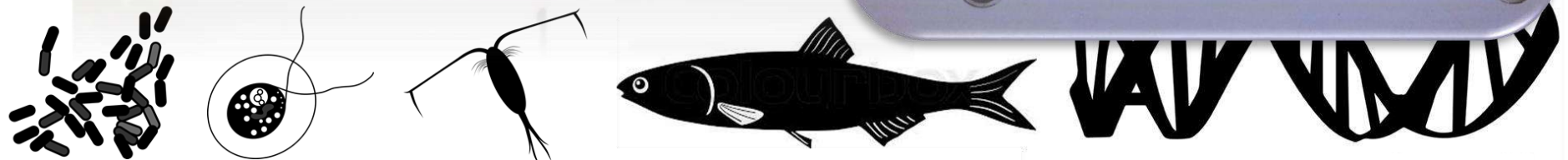
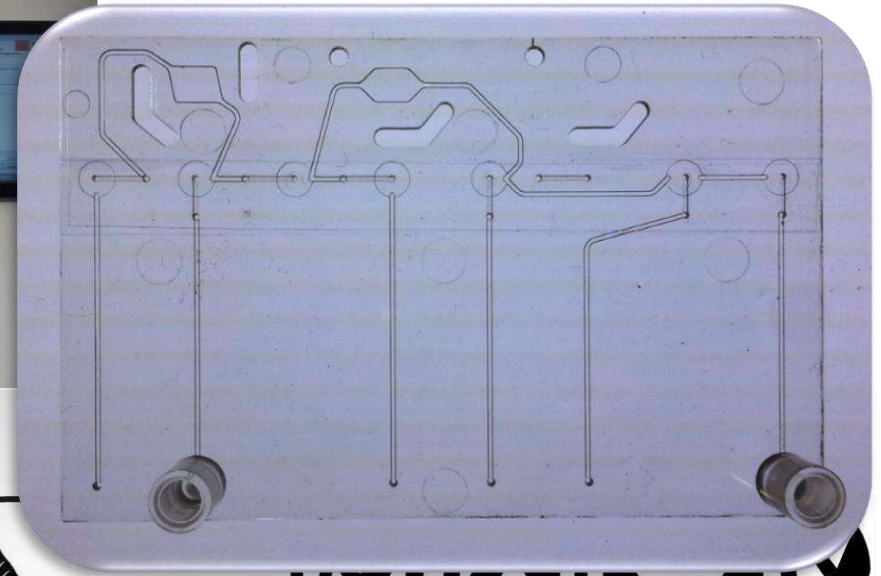
injector nozzle connected to RNA later reservoir seawater source
rotating Geneva wheel
needleless luer lock valves
Sterivex cartridges within magazine



Lab-on-a-chip technology



- Integration of one or more laboratory functions on a single chip or lab-card
- Designed to handle small fluid volumes



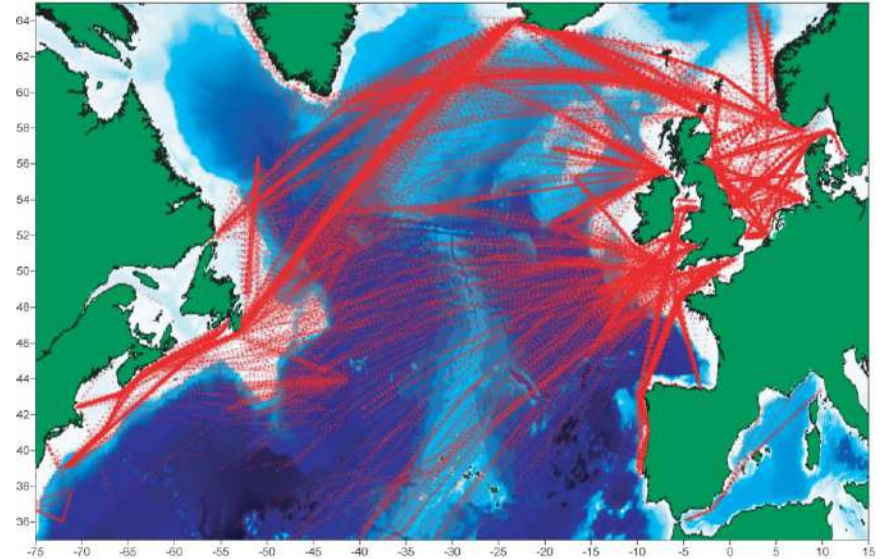


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Continuous Plankton Recorder (CPR) Survey



- Most geographically extensive and longest running marine biological survey in the world (since 1931)
- Currently tow 12,000 nautical miles/month
- Almost 7-million nautical miles towed to date with over 500,000 plankton samples
- Data freely available. Physical archive of **stored filters** back to the 1960s – **resource for molecular ecology and eDNA research.**



Tow routes in the North Atlantic and North Sea



- Impact of SAHFOS research influences policy, climate change, human health, fisheries, biodiversity, pathogens, invasive species, ocean acidification. 30-50 high impact papers/year
- CPR fleet being modernised with new autonomous instrumentation

CPR as an automated eDNA platform?

Water and microplankton Sampler (WaMS).

Aimed at smaller size-fraction plankton community e.g. harmful algal blooms, bacterial pathogens, parasites. Collects UNFILTERED seawater from the CPR for flow cytometry and molecular ecology-based tools such as PCR, barcoding, SCG/SVG, **eDNA** and sequencing.

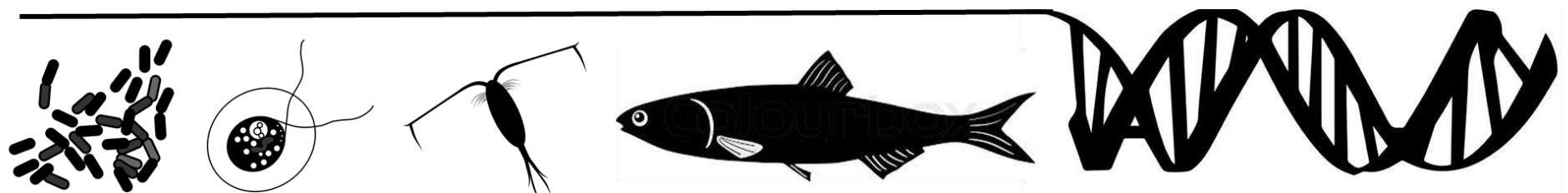
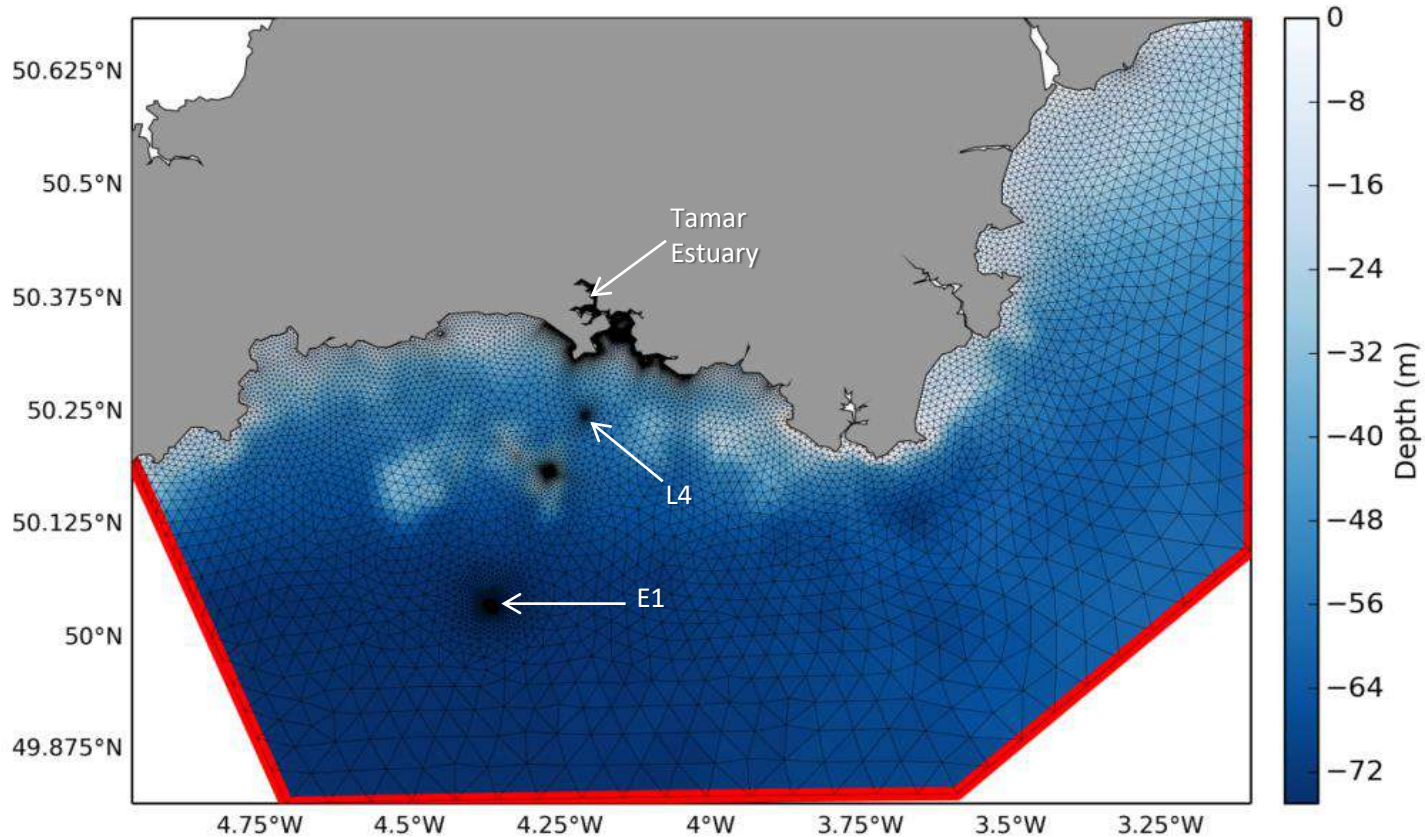




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Use of hydrodynamic modelling to define the sampling area.

PML | Plymouth Marine Laboratory



Integration of **Station L4** into a network of marine genomic observatories



Integration of **Station L4** into a network of marine genomic observatories

ASSEMBLE Plus

Association of European Marine Biological Laboratories Expanded

Initiate a distributed Marine Genomic Observatory community in European marine biological stations with time-series ecosystem monitoring programs and molecular expertise



EMBRC
EUROPEAN
MARINE
BIOLOGICAL
RESOURCE
CENTRE



MARINe-DNA



Willie Wilson
Michael Cunliffe

Steve Widdicombe
Karen Tait
Pennie Lindeque
Jorn Bruggeman

Tom Richards
Ben Temperton



Julie Robidart
Rob Young
Henry Ruhl
Matt Mowlem



Innovate UK

