Quantifying marine biodiversity using environmental DNA

Michael Knapp[1], Gert-Jan Jeunen[1], Chris Hepburn[1], Mike Bunce[2] and Neil Gemmell[1]

1: University of Otago, Dunedin, New Zealand
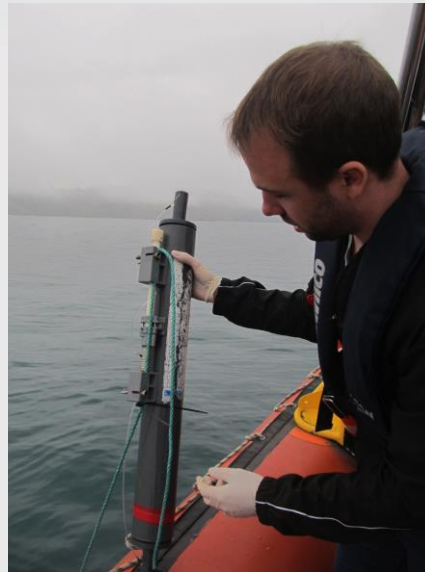
2: Curtin University, Perth, Australia

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By Peter Southwood - https://commons.wikimedia.org/w/index.php?curid=25270269

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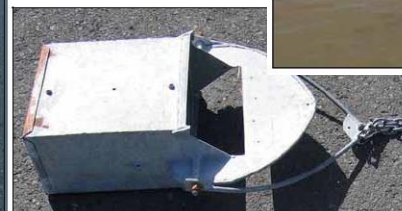
Background: Marine Biodiversity monitoring today

- Wide variety of different approaches, for example (from MAF Milford Sound survey 2008; Inglis et al.)

- Quadrant scraping

- Core samples

- Surface dredging

- Beach seine netting

- Crab and shrimp traps

- Beach wrack survey…..

Pictures from Inglis et al. 2008

Background: Marine Biodiversity monitoring today

- Problems: Gold standard of biodiversity screening BUT:

- Very time intensive

- Requires lots of expert time to identify species and analyse data

- Only suitable for narrowly defined areas. NZ wide application cost prohibitive
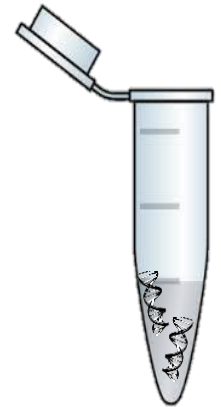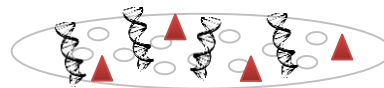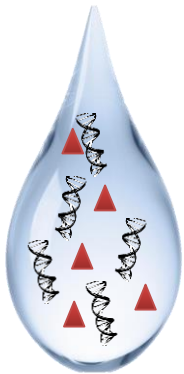
Our challenge

- Develop a quick and cost efficient strategy for marine biodiversity monitoring suitable to inform community based management of marine resources across NZ.
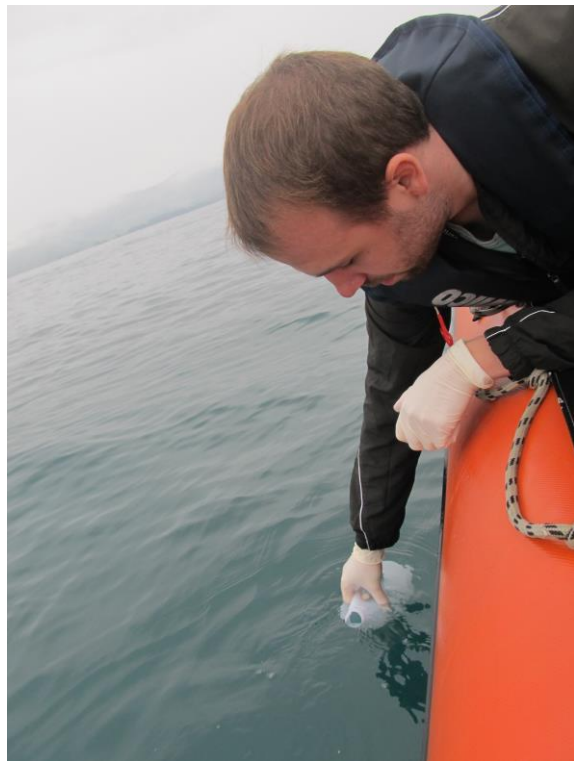
Aquatic environmental DNA (eDNA)

- Definition: DNA left behind by organisms in the environment through the shedding of skin cells, mucus, gametes, decomposition,…

Environmental DNA: Quantifying marine biodiversity from DNA present in sea water samples
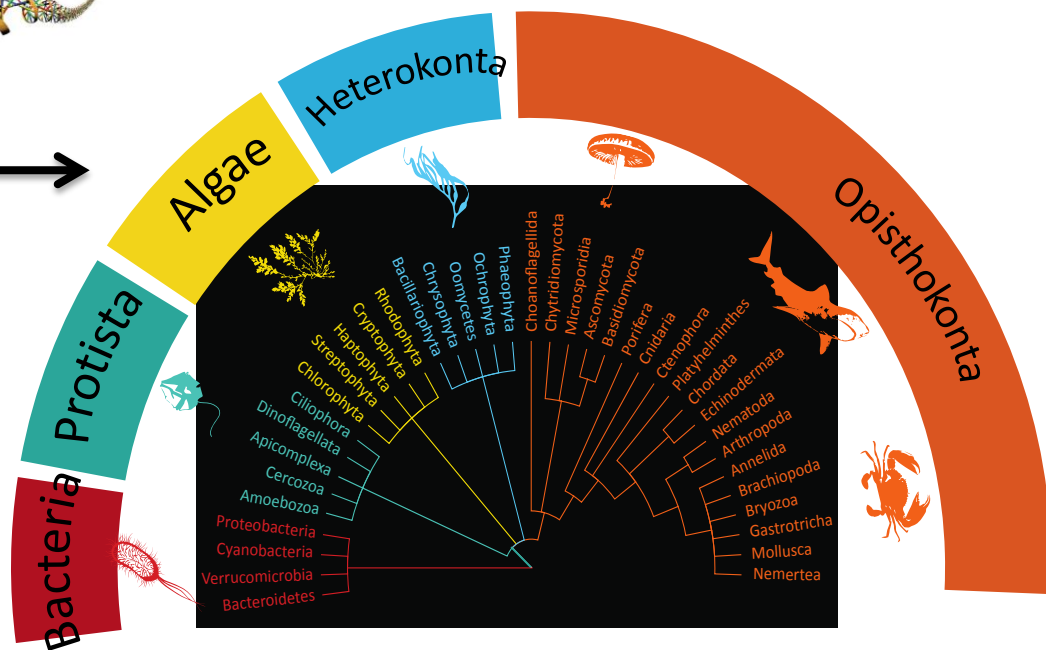

Sample collection:
two liters of sea water

Environmental DNA analyses

Biodiversity identified from DNA in two liters of sea water

Status of project

Otago harbour: Method development (completed)

Milford Sound:
Transfer approach to radically different environment.
Field test against conventional sampling (November 2017)

East Otago Taiāpure:
Refinement of analyses pipeline in actual field experiment (two of three sample trips completed, analyses pending)
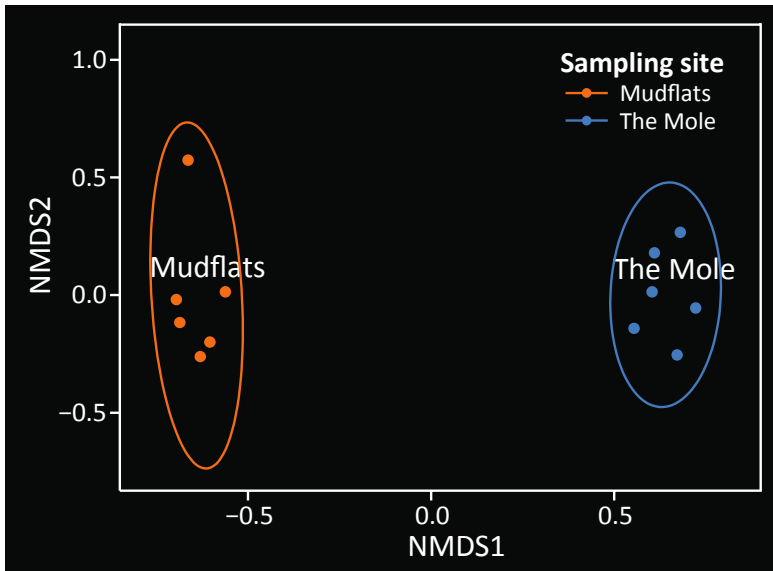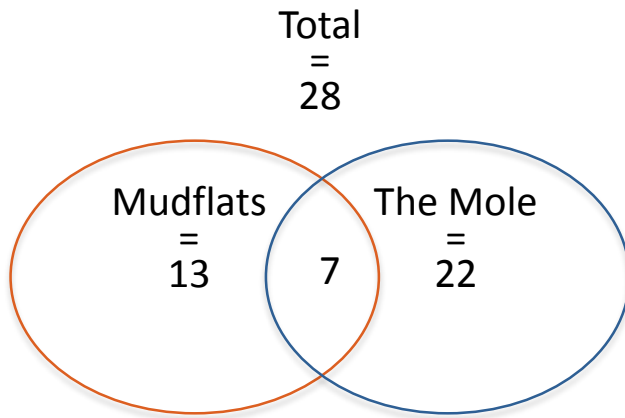

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eDNA detects habitat specific communities

Species we detect with eDNA

Total
=
28

Mudflats
=
13

7

The Mole
=
22

The Mole

Mudflats

Rocky shore associated species

The Mole

Maori chief
- Juveniles in rock pools
- Adults found deep rocky reefs

www.flickriver.com

Mudflats

Heyward Point

Aramoana Rd

Aramoana

Royal Albatross Centre

Harington Point

Otakou

Thornfish
- Endemic to New Zealand
- Found in rock pools

www.flickriver.com

Rocky shore associated species

The Mole

New Zealand half crab

- Native to New Zealand
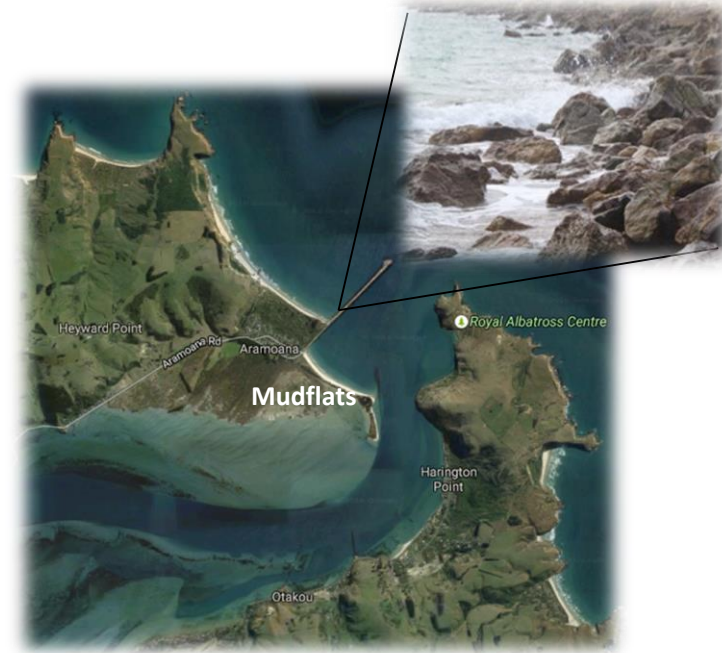- Most abundant crab species under boulders

www.padil.gov.au

Mudflats

Common rock crab

- Endemic to New Zealand
- Found under stones left dry by the tide

www.naturewatch.org.nz

Muddy beach associated species

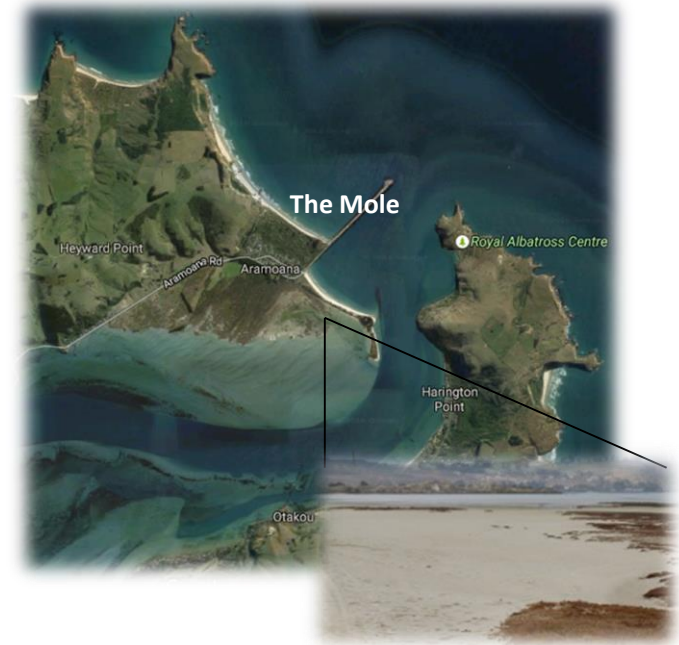**Tunneling mud crab**
- Most commonly found within harbours at mudflats

www.naturewatch.org.nz

Stalk-eyed mud crab
- Endemic to New Zealand
- Found within harbours at mudflats

www.naturewatch.org.nz

The Mole

Mudflats

Species with a DNA signal at both sites

New Zealand paddle crab
- Swimming-crab
- Digs itself into sand

www.ispotnature.org

The Mole

Mudflats

Cryptosula
- Encrusting bryozoan
- Grows on hard surface (rocks, seaweed,...)

www.exoticsguide.org

Nyctiphanes
- Coastal euphausiid

www.blog.tepapa.govt.nz

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Perspectives

- Develop eDNA laboratory and computational pipeline to a standard suitable for commercial service providers such as ESR → affordable marine biodiversity monitoring for communities.

- Establish database of community eDNA monitoring projects around the country → knowledge transfer between communities; coordination of management efforts.

- New Zealand marine biodiversity atlas

- Use newly developed pipeline to contribute to other Sustainable Seas projects, such as for example project 4.1.1 "ecosystem connectivity".

Acknowledgements

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