National SCIENCE Challenges

SUSTAINABLE SEAS

Ko ngā moana whakauka

Ecosystem Connectivity

Tracking biochemical fluxes to inform Ecosystem Based Management

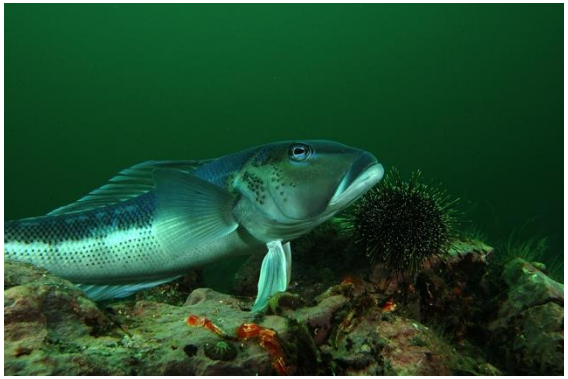
Project Leader Steve Wing

CAWTHRON INSTITUTE | GNS SCIENCE TE PŪ AO | NIWA Taihoro Nukurangi | THE UNIVERSITY OF AUCKLAND NEW ZEALAND | UC UNIVERSITY OF CANTERBURY Te Whare Wānanga o Waitaha CHRISTCHURCH NEW ZEALAND | THE UNIVERSITY OF WAIKATO Te Whare Wānanga o Waikato | UNIVERSITY of OTAGO Te Whare Wānanga o Otāgo NEW ZEALAND | VICTORIA

The Mission, and how 4.1.1 fits into it

"To enhance utilisation of our marine resources within environmental and biological constraints"

We seek to help inform sustainable development by resolving key aspects of connectivity within the marine ecosystem



Our Team: Multidisciplinary Expertise

- Prof. Steve Wing - Population and Food Web Structure, Fisheries Ecology
- Prof. Russell Frew - Chemical Oceanography, Forensic Chemistry, Stable Isotope Analysis
- Prof. Jeff Shima - Fish Ecology, Population Structure, Connectivity
- Prof. David Schiel - Kelp Forest Ecology, Land based inputs
- Assoc. Prof Kim Hageman – Persistent Organic Pollutants, Contaminants in Marine Systems

Our Team: Building expertise in environmental chemistry and Ecosystem Connectivity

- Sorrel O'Connell-Milne (Research Fellow) - Trophic ecology and material dynamics in bivalve communities
- Rebecca McMullin (PhD Student) - Biochemical fluxes in aquaculture systems
- Leonardo Durante (PhD Student) -Trophic dynamics of fish communities
- Jacquetta Udy (MSc Student) – Trophic structure of coastal reef fishes
- Stina Kolodzey (PhD Student) – Demographics and reproduction in fish population networks

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Structure, core and aligned projects

1) Material dynamics in Aquaculture systems (McMullin, PhD)
2) Biochemical fluxes in bivalve communities (O'Connell-Milne, Research Fellow)
3) Trophic dynamics of fish communities (Durante, PhD and Udy, MSc)
4) Demographics and reproduction in fish population networks (Kolodzey, PhD)
5) Trophic structure of prehistoric and historic fisheries (Connolly MSc)

1) Effects of environmental change on pelagic food webs (Meyers, PhD)

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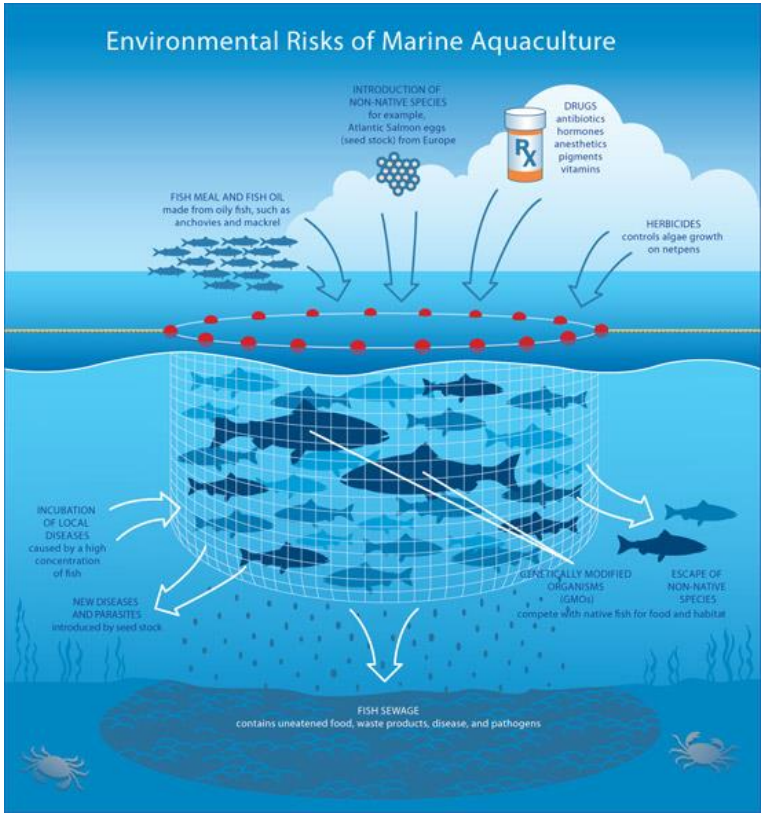
Project 1: Biochemical fluxes in aquaculture systems

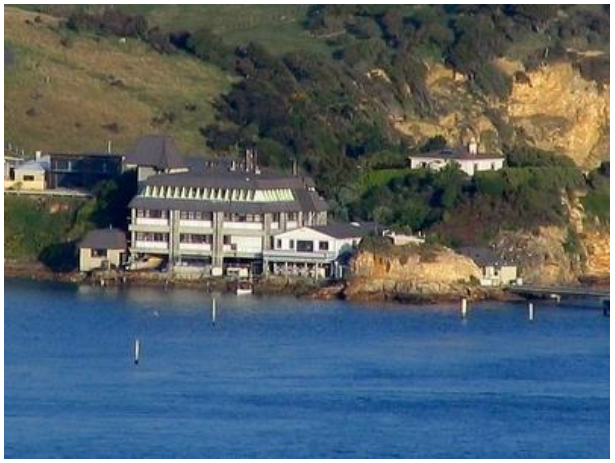
- How are the by-products of aquaculture processed by the recipient food web?
- Who are the most important members of the detrital community in this regard?
- What is the magnitude of inputs?



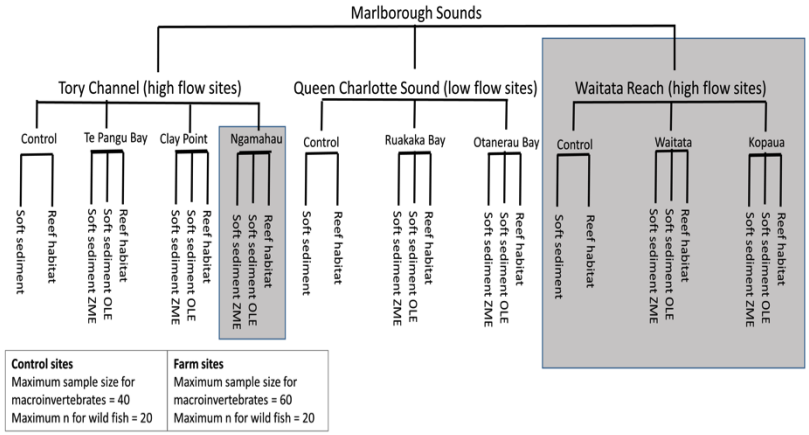
Aquaculture: Work programme

- Sampling in the Marlborough Sounds
- Experimental programme at PML

McMullin PhD



Mesocosm experiments PML 2017-2019



Sampling during Jan-Feb 2017 Polaris II voyage

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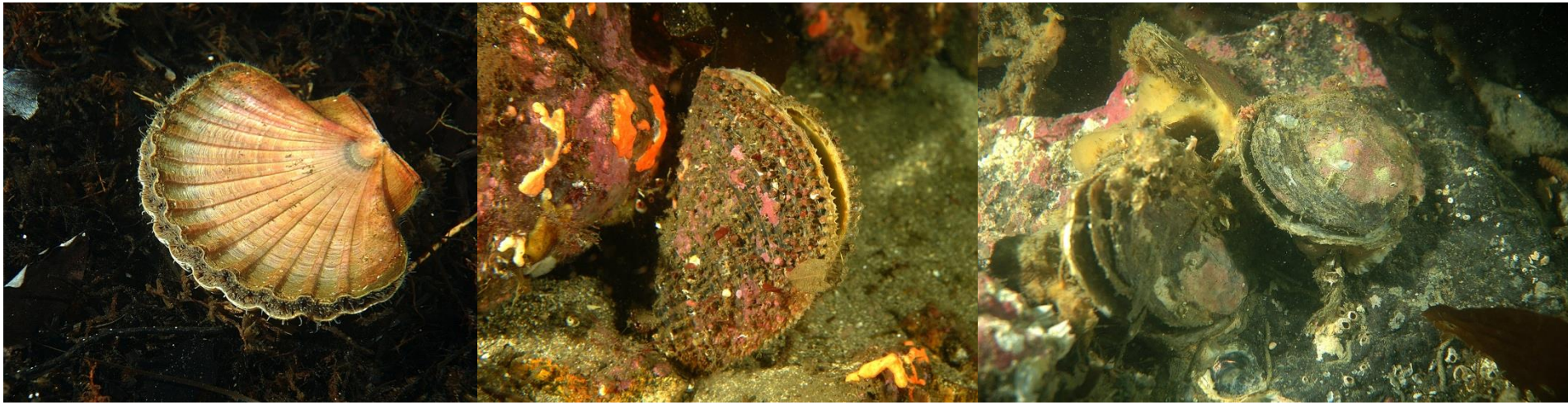
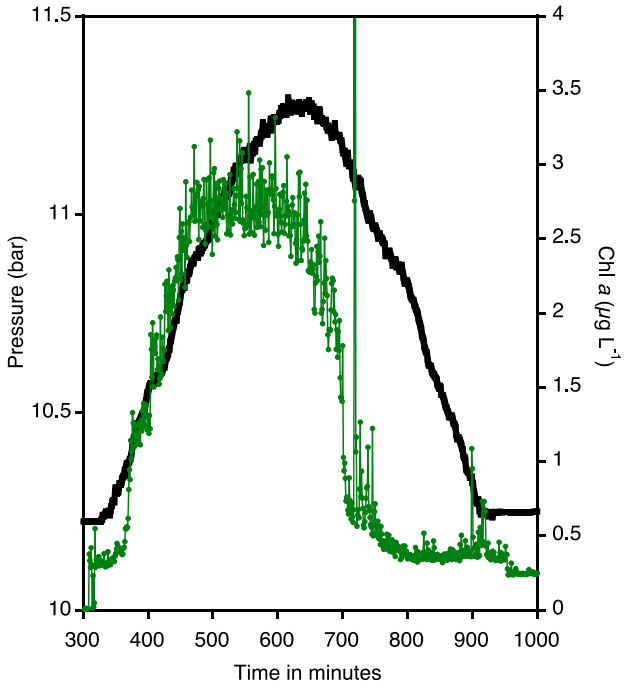
Project 2: Material dynamics in bivalve communities

- How do different species of bivalves process suspended particulate organic matter (SPOM), trace metals and pollutants?
- How do bivalves influence composition and functional diversity of bacterial communities?



Bivalve communities: work programme

- Sampling multiple species of bivalves in case study area for biochemical analysis (stable isotopes, trace metals, organic contaminants)
- Experimental work on influence of bivalve filter feeding on bacterial and phytoplankton communities



O'Connell-Milne (Research Fellow)

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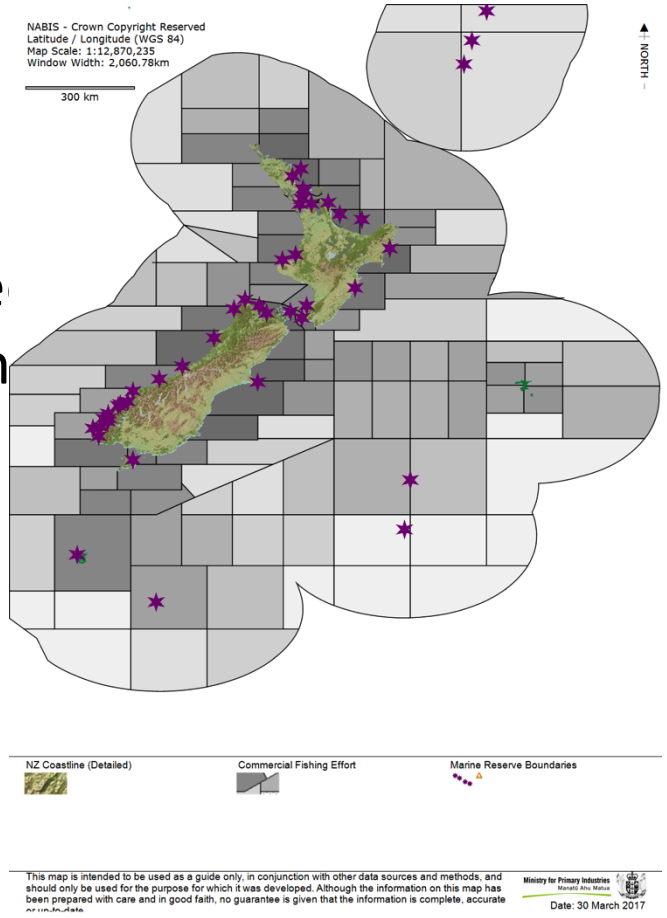
Project 3: Fish Communities: Trophic dynamics

- How has the composition of trophic levels and inputs from basal organic matter sources (macroalgae and phytoplankton) changed within fish communities managed under QMS?
- How are critical habitats (estuaries, kelp be biogenic reefs) connected through ontogen of key species?



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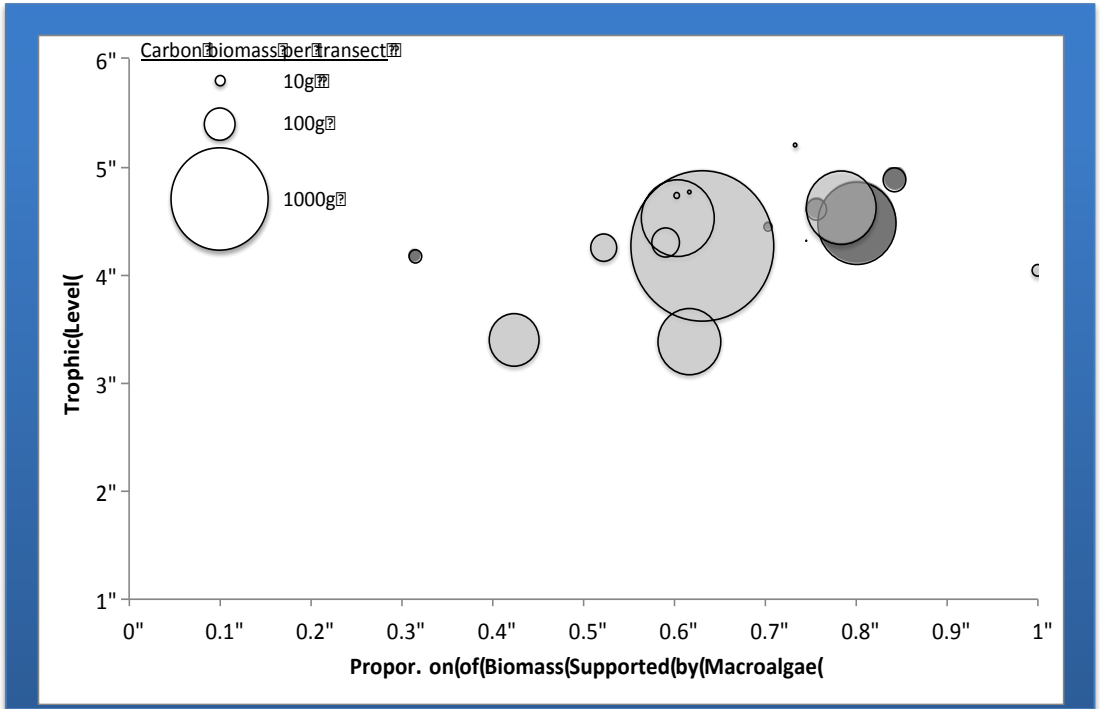
Fish communities: work programme

- Isotopic analysis to estimate trophic level and proportion of alternative organic matter sources (kelp vs phytoplankton) supporting QMS species.
- Models of food web architecture and energetics.

Durante PhD

Udy Msc



Udy et al. (in prep) *Reef fish in a dynamic sea: Does trophic downgrading modify food web efficiency?* Marine Ecology Progress Series

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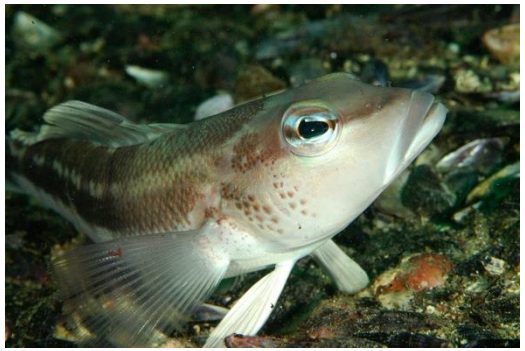
Fish demographics, reproduction and links to critical habitat

- How do maternal age, size and condition influence larval quality?
- How does habitat quality influence reproductive output for key species?
- How does variability in reproductive output of local populations support the wider population network for key species?



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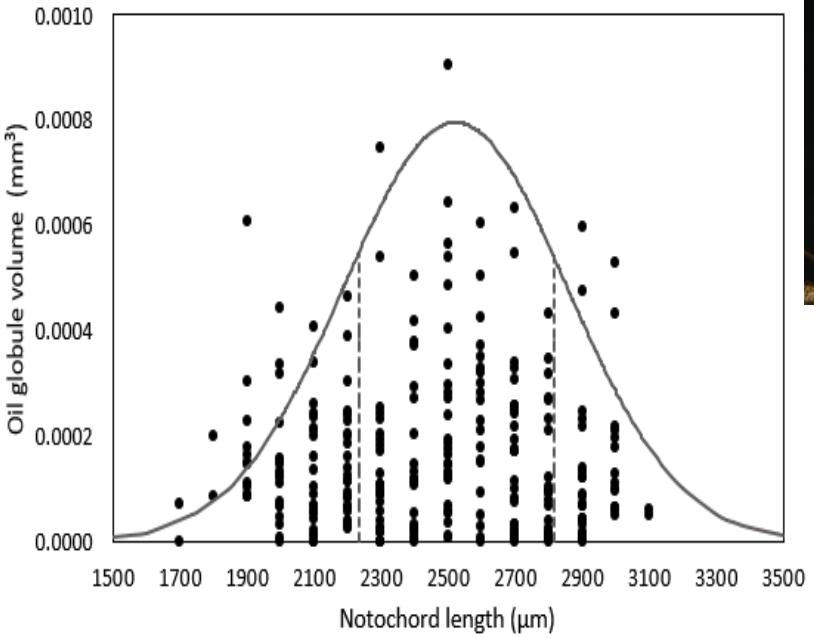
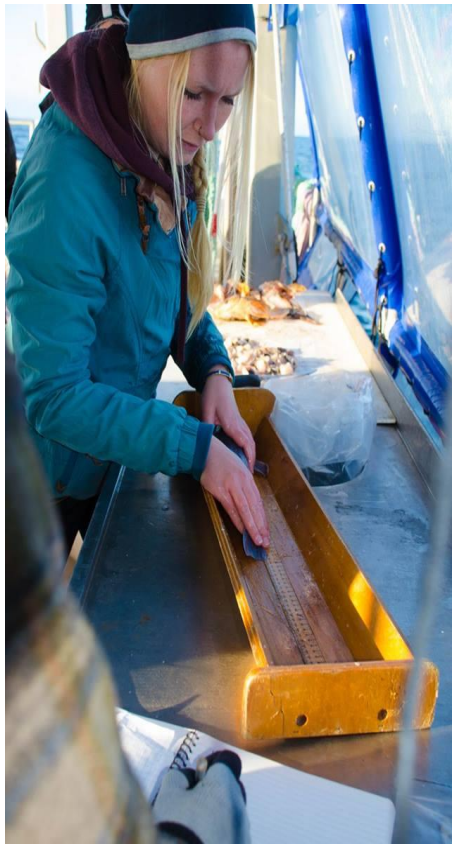
Fish demographics: work programme

- Laboratory experiments on larval survival
- Sampling populations for demographic differences, defining source-sink structure
- Estimating spatial variability in reproductive output





Kolodzey PhD

Kolodzey S and SR Wing (in review) Maternal investment in the viviparous temperate reef fish *Helicolenus percoides* relative to age, size and condition. *Marine Ecology Progress Series*

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The year ahead

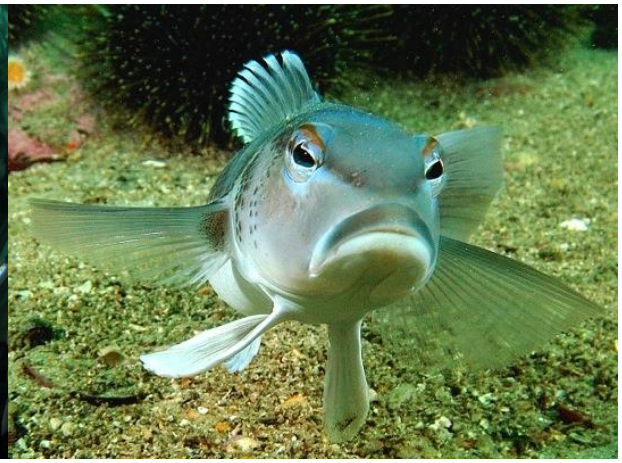
- Second research cruise to “Top of the South”
- Mesocosm experiments at PML, development of biomarkers
- Trophic position of QMS species
- Bivalve community experiments at PML
- Development of aligned projects

4.1.1- Ecosystem Connectivity

How can resolving biochemical fluxes help inform sustainable development New Zealand's marine ecosystem?

Biochemical fluxes in bivalve communities

Material Dynamics in Aquaculture Systems



Trophic dynamics of fish communities

Jan-Feb 2017 voyage to case study area, primary sampling and data collections for 3 PhD projects

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