INT2022-05 Determining the resilience of Fiordland corals to fisheries impacts

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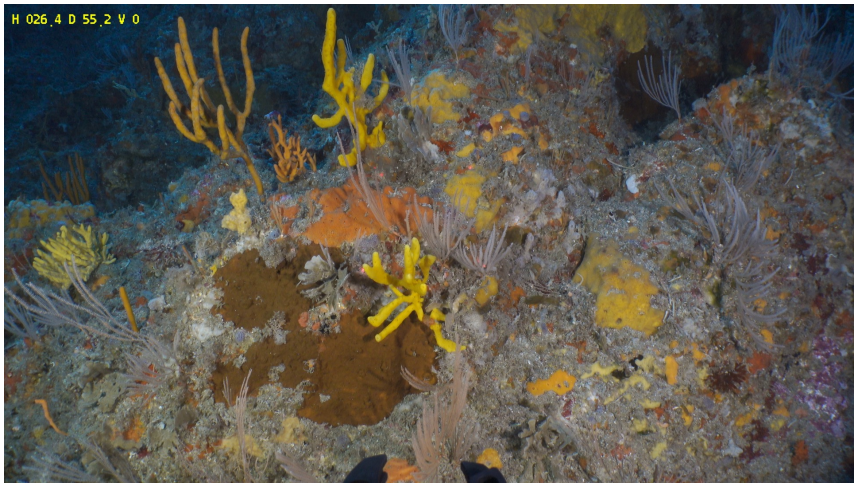

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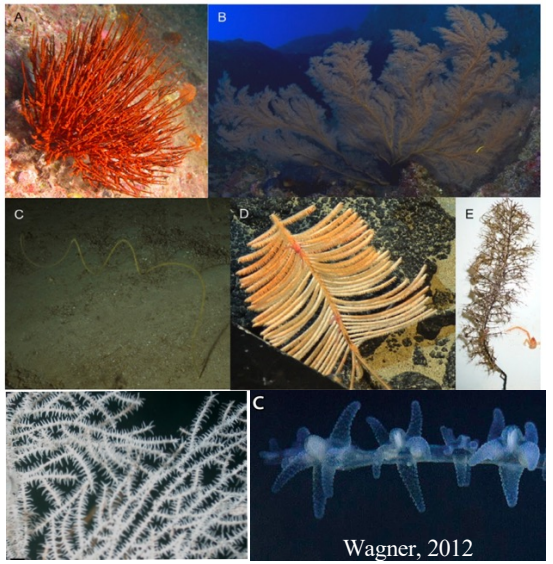
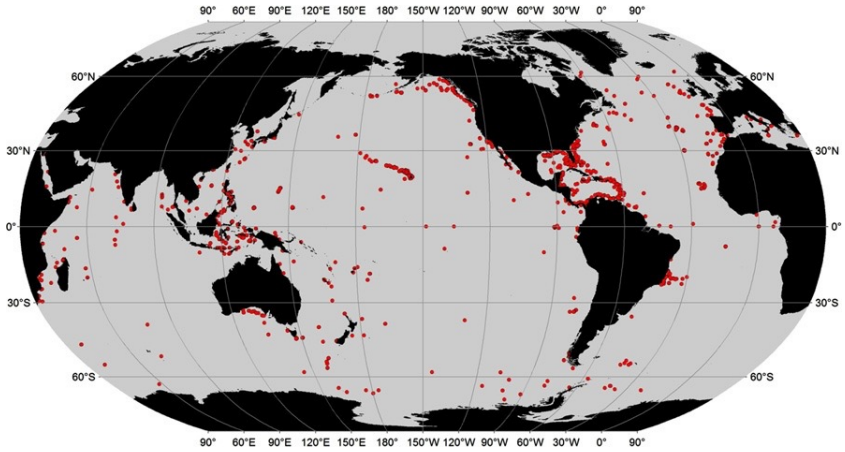
Antipatharians

Biology and Ecology

- Order: Anthozoan; Subclass: Hexacorallia
- Colonial organisms with a wide range of morphology
- Ahermatypic
- 75% below 50 m
- Found in very low light environments below the photic zone





Global Antipatharians distribution
Wagner, 2012

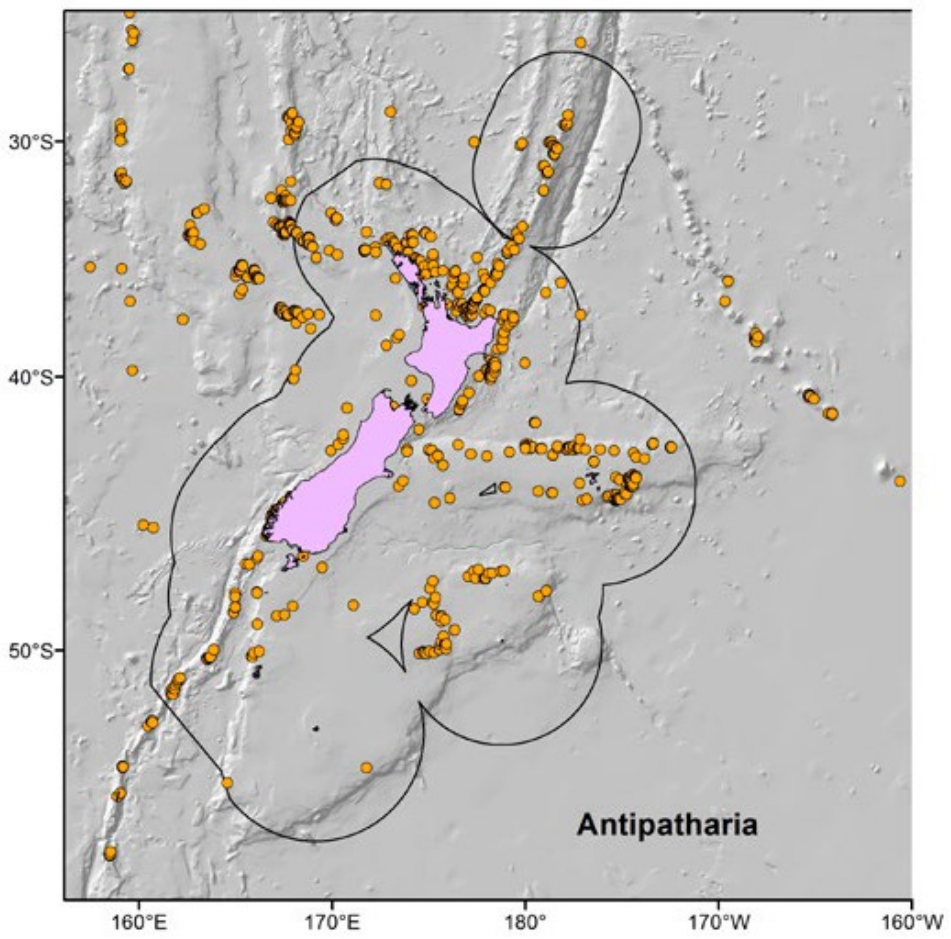
Antipatharians

Biology and Ecology

- Slow-grow rates / Longevity
- Habitat engineers
- Support sea-floor associated biodiversity and productivity
- Reproduction through both sexual and asexual processes. In general, polyps and colonies are gonochoric

Black corals in New Zealand

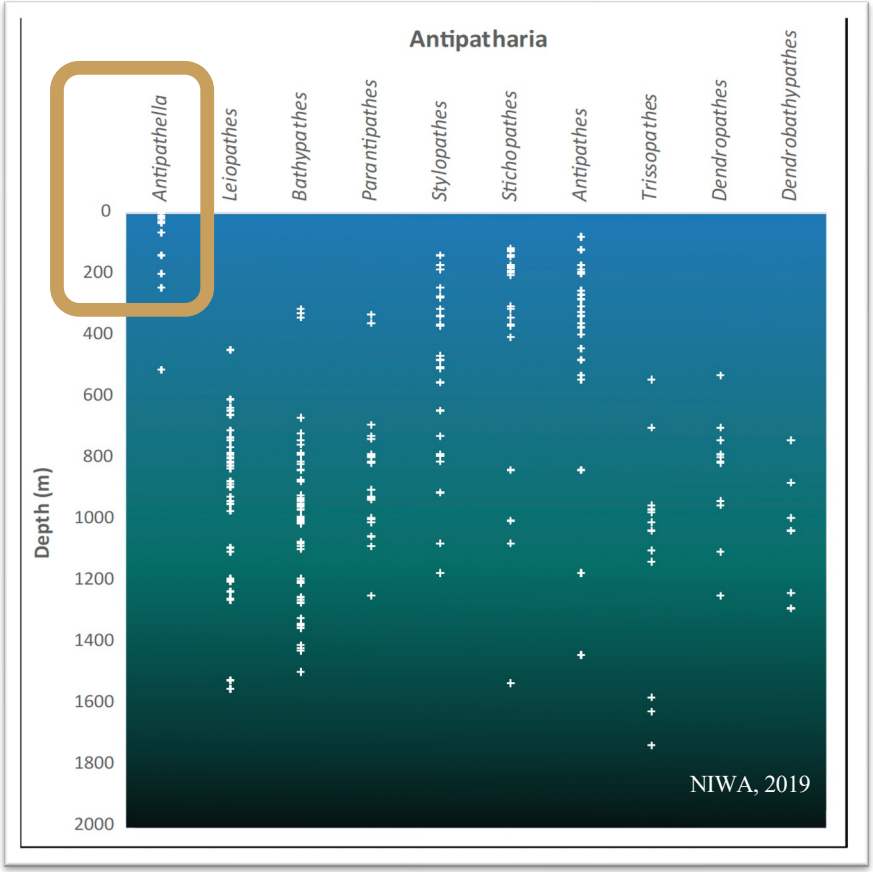
- Predominantly deep-water group
- Around 60 described species found in New Zealand and another 20+ undescribed
- 1 endemic genus to the Fiordland region, *Antipathella fiordensis*.

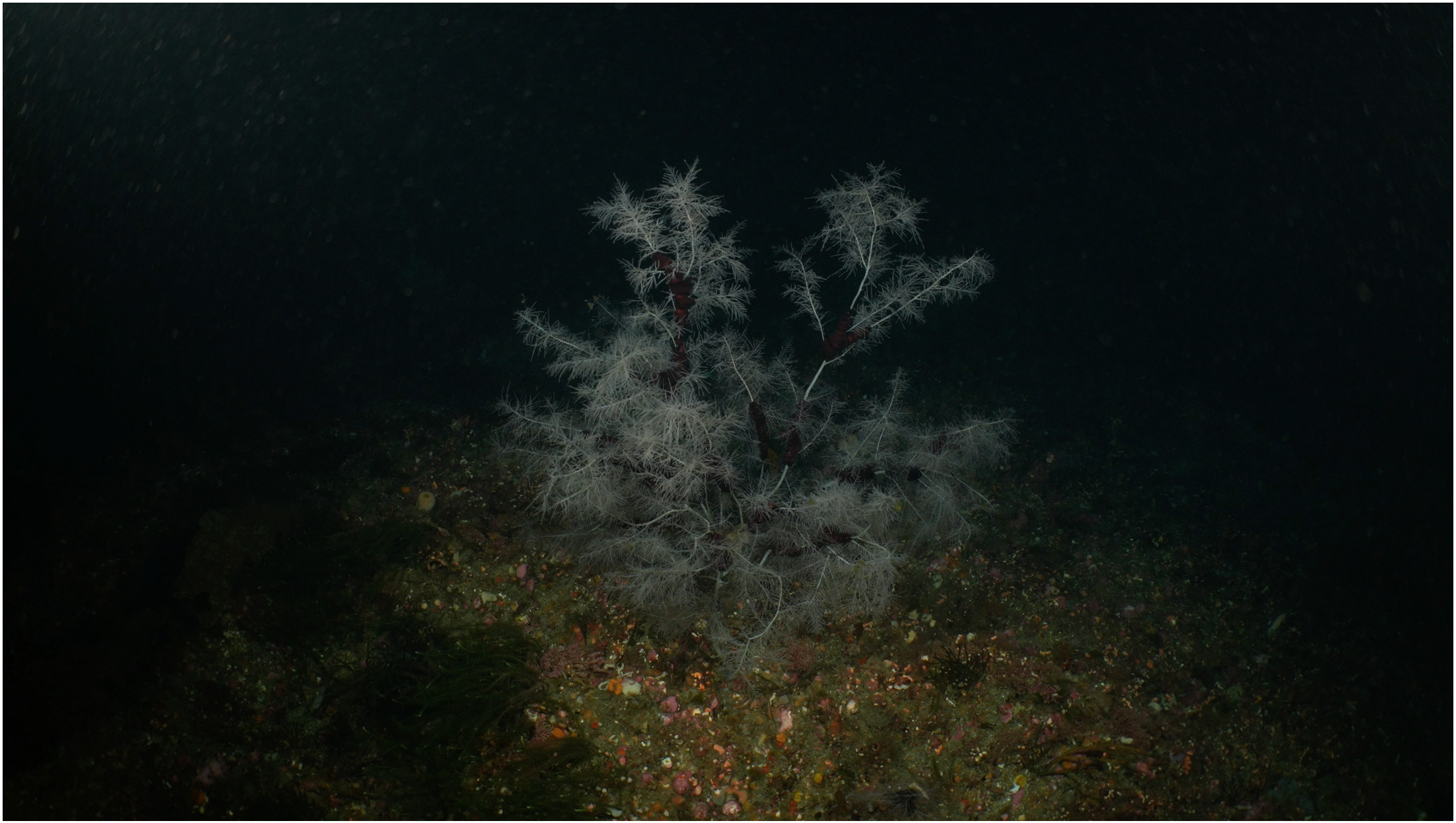


Recorded Distribution of Antipatharia around NZ

Anderson et al., 2016

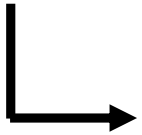
Antipathella fiordensis





Current knowledge

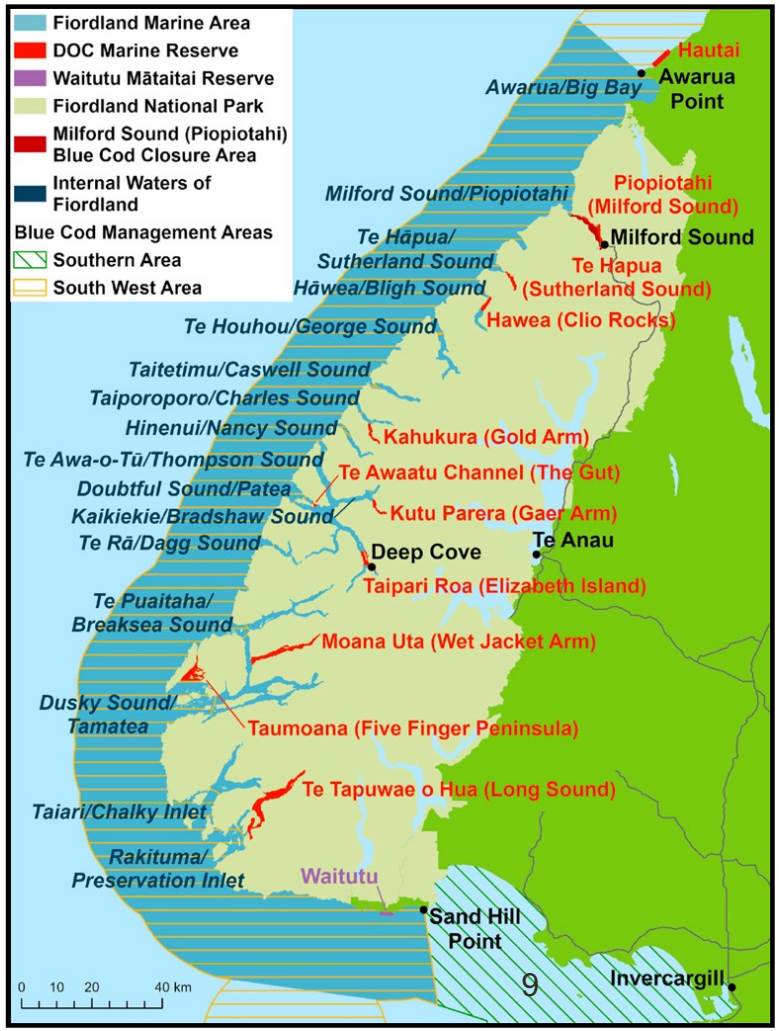
- Early reproductive and population genetic studies with allozyme showed low genetic variation among fiords (Grange, 1990; Miller, 1997)
- Growth/ultrastructure (Goldberg, 1991)
- Relationships with other mutualistic species (Parker et al., 1997)
- Distribution limits in relation to salinity (Jiang et al., 2015)
- Age (Hitt et al. 2020)



- Less information on their biology, ecology and reproductive processes, how resilient they are to different forms of disturbance and their recovery potential

Antipathella fiordensis

Fiordland Marine Management Act (FMMA 2005)



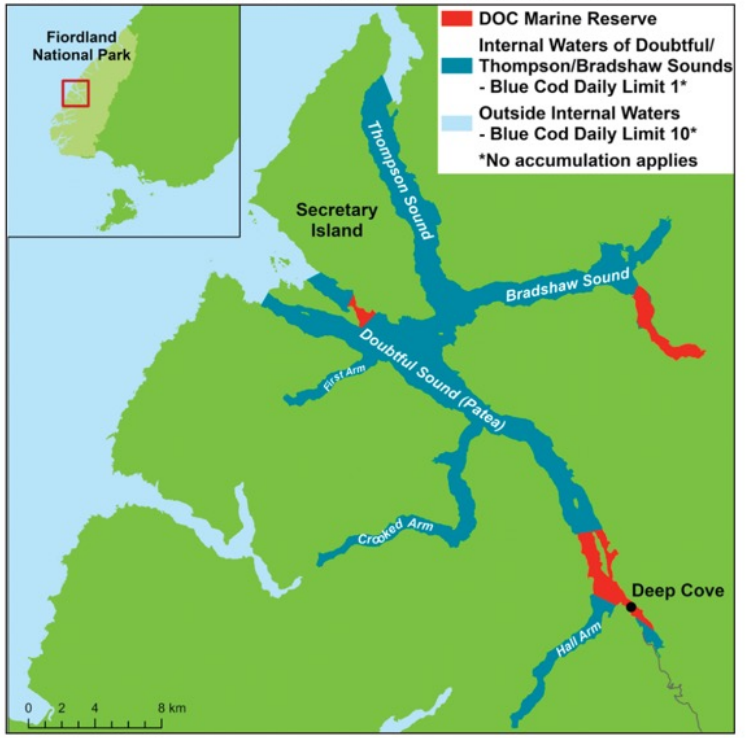
Fisheries New Zealand
Tini a Tangaroa

Recreational Fishing Rules
FIORDLAND

Effective from: November 2022 (subject to change without notice).

Doubtful Sound (Patea) fiord complex blue cod restricted area

Within the internal waters of Doubtful, Thompson and Bradshaw Sounds the daily tal and possession limit is one blue cod per person with no accumulation.



Study site

DOUBTFUL SOUND

40.4 km long, the deepest of all fiords (434 m)

Spit in 3 distinct arms - Hall Arm, Crooked Arm, First Arm and 2 outer Sounds- Bradshaw and Thompson Sounds

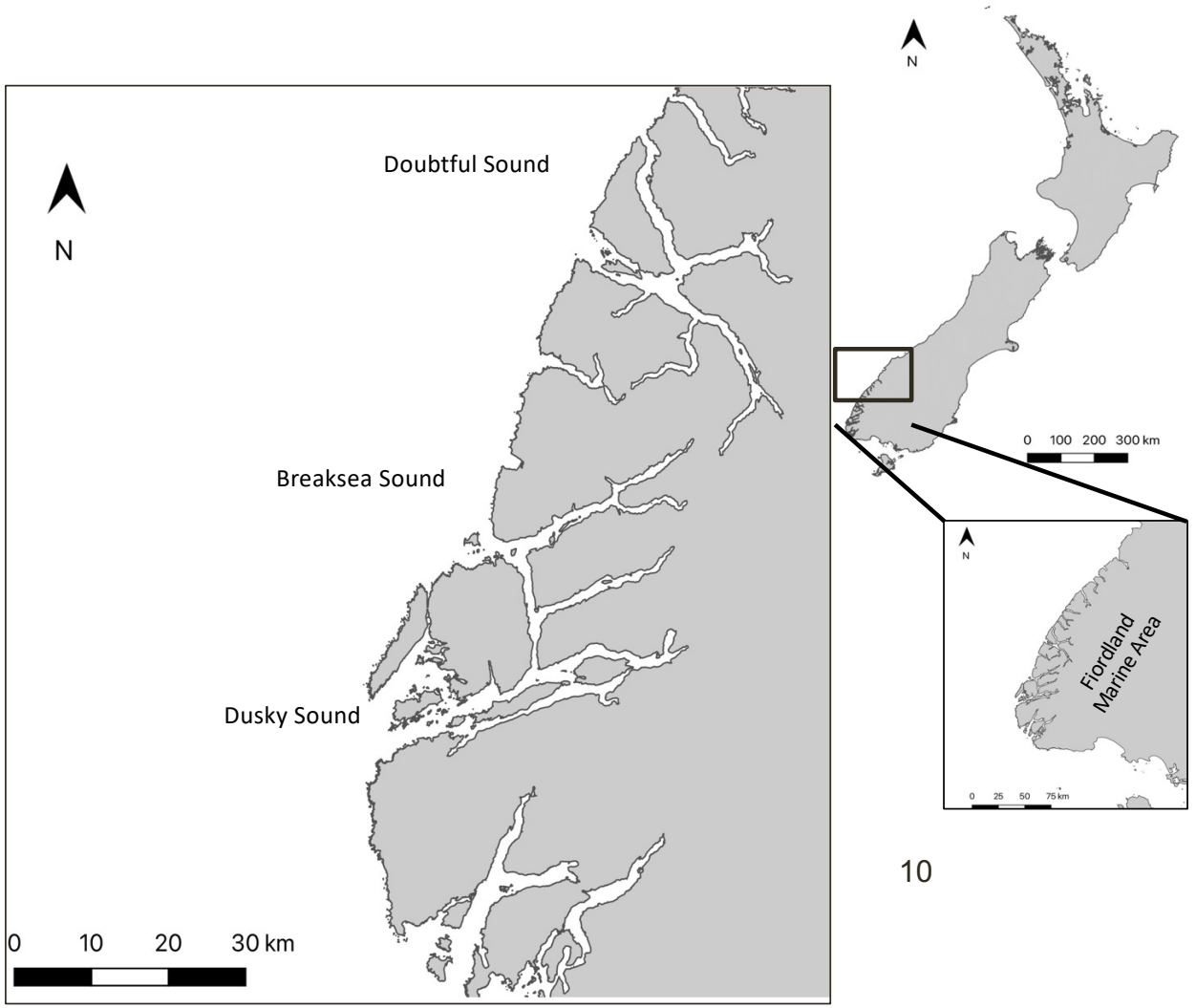
Manapouri Hydropower station

BREAKSEA-DUSKY SOUNDS SYSTEM

Biggest fiord complex with Acheron passage (15km) connecting the two Sounds

Breaksea (33km) split in 2 arms – Vancouver Arm and Broughton Arm

Dusky is the longest and most extensive fiord (43.9 km) split into 2 main channels



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Investigate the spatial distribution and population size-structure

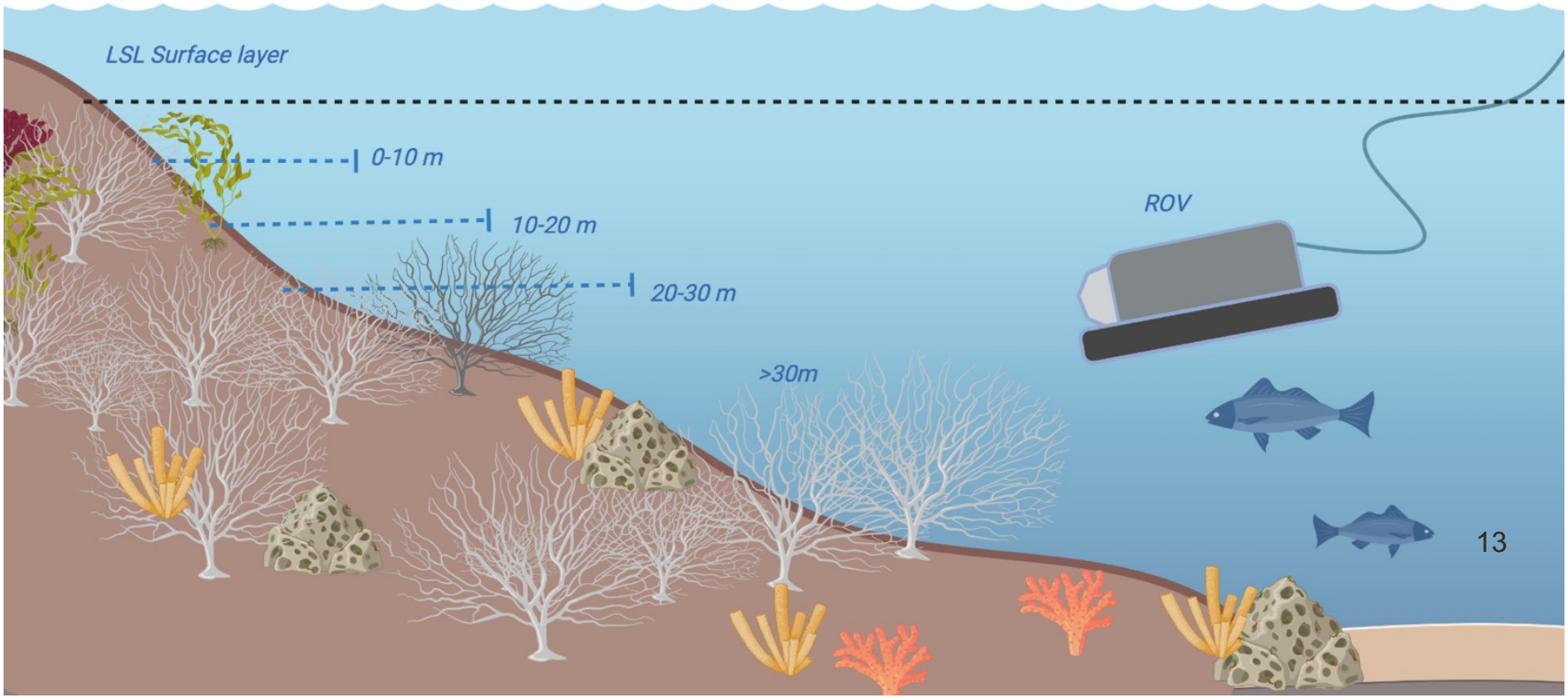
- Assessing the spatial and size frequency distribution along a vertical and horizontal gradient to quantify the abundance and size structure within and across different fiords
- Characterize distribution across fiords and with depth
- Identify environmental variables that best predict the distribution

Methods

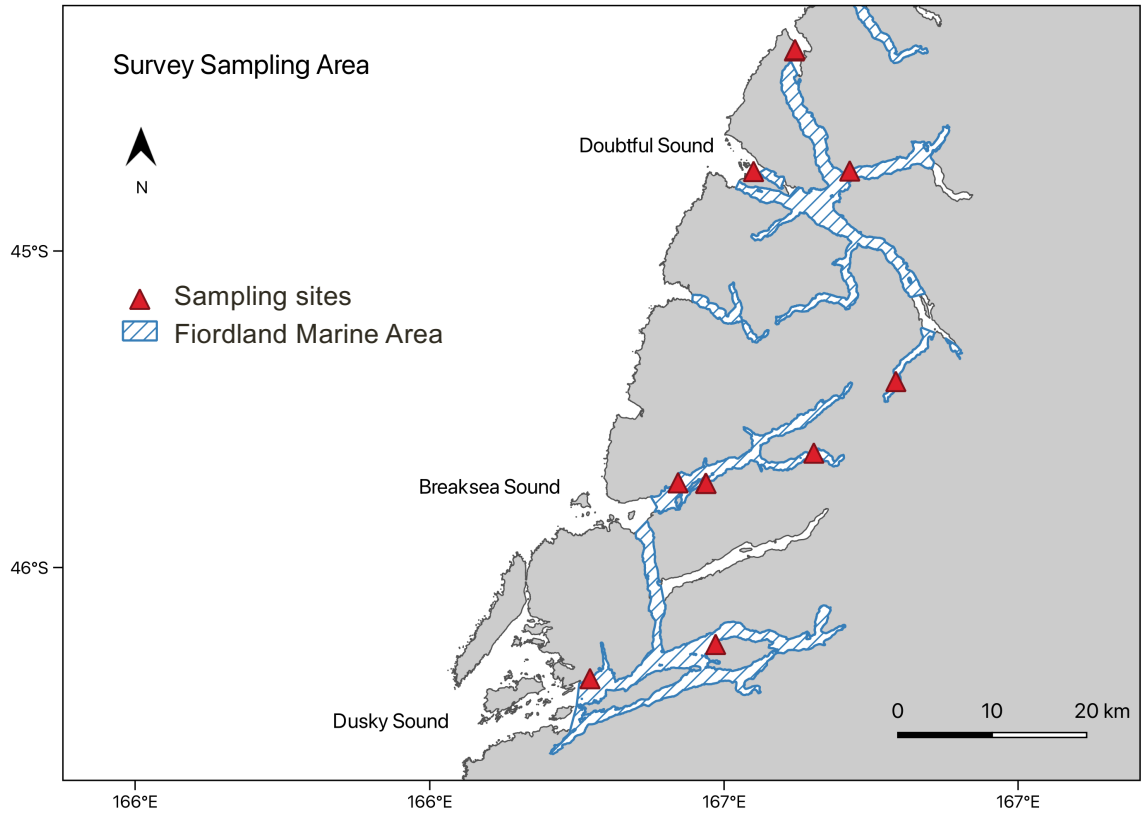
FIELD SAMPLING

Abundance and Size

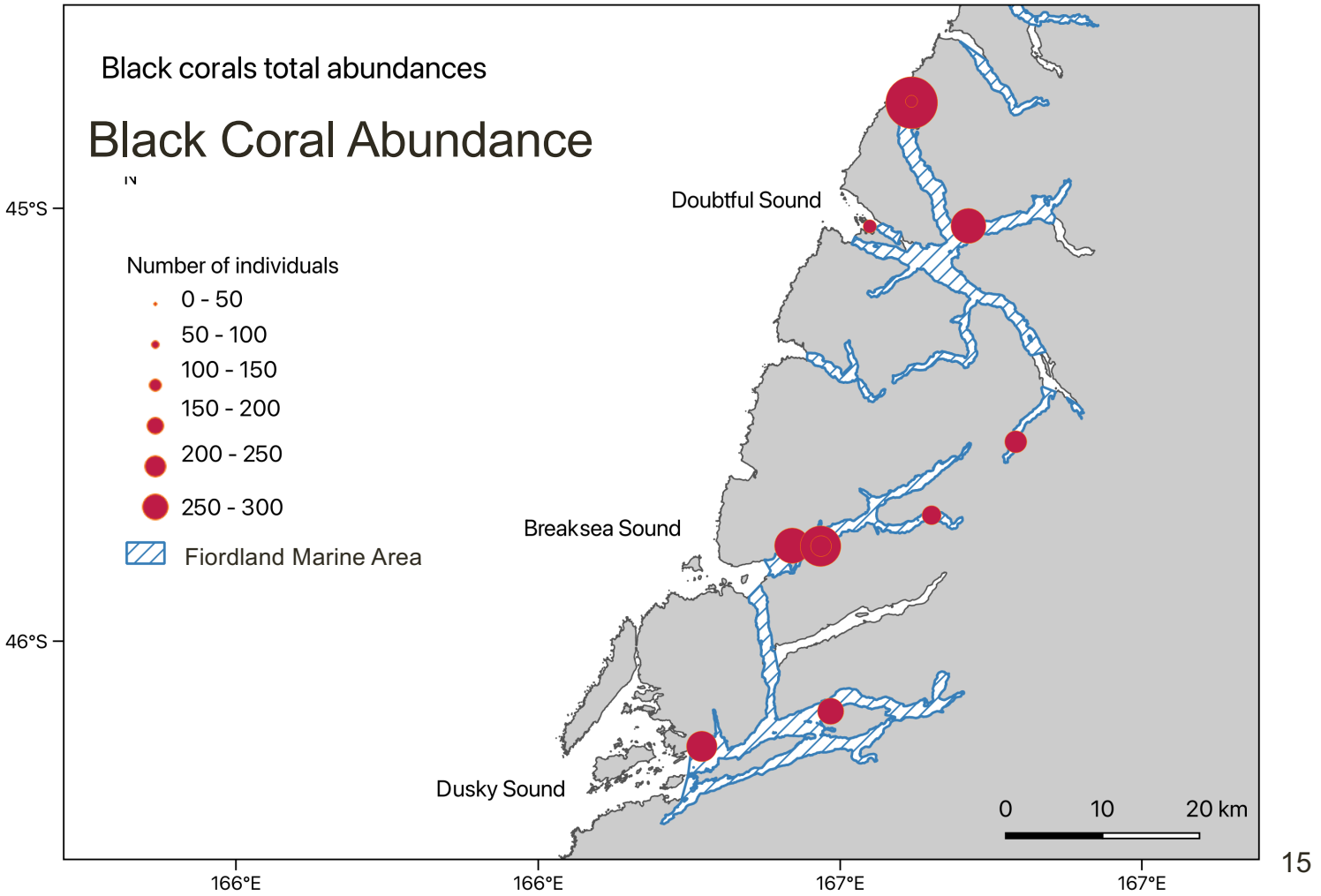
SCUBA diving	ROV
3 x 20m x 2m transects	3 x 30m x 2m transects
15-20 m	50-70 m



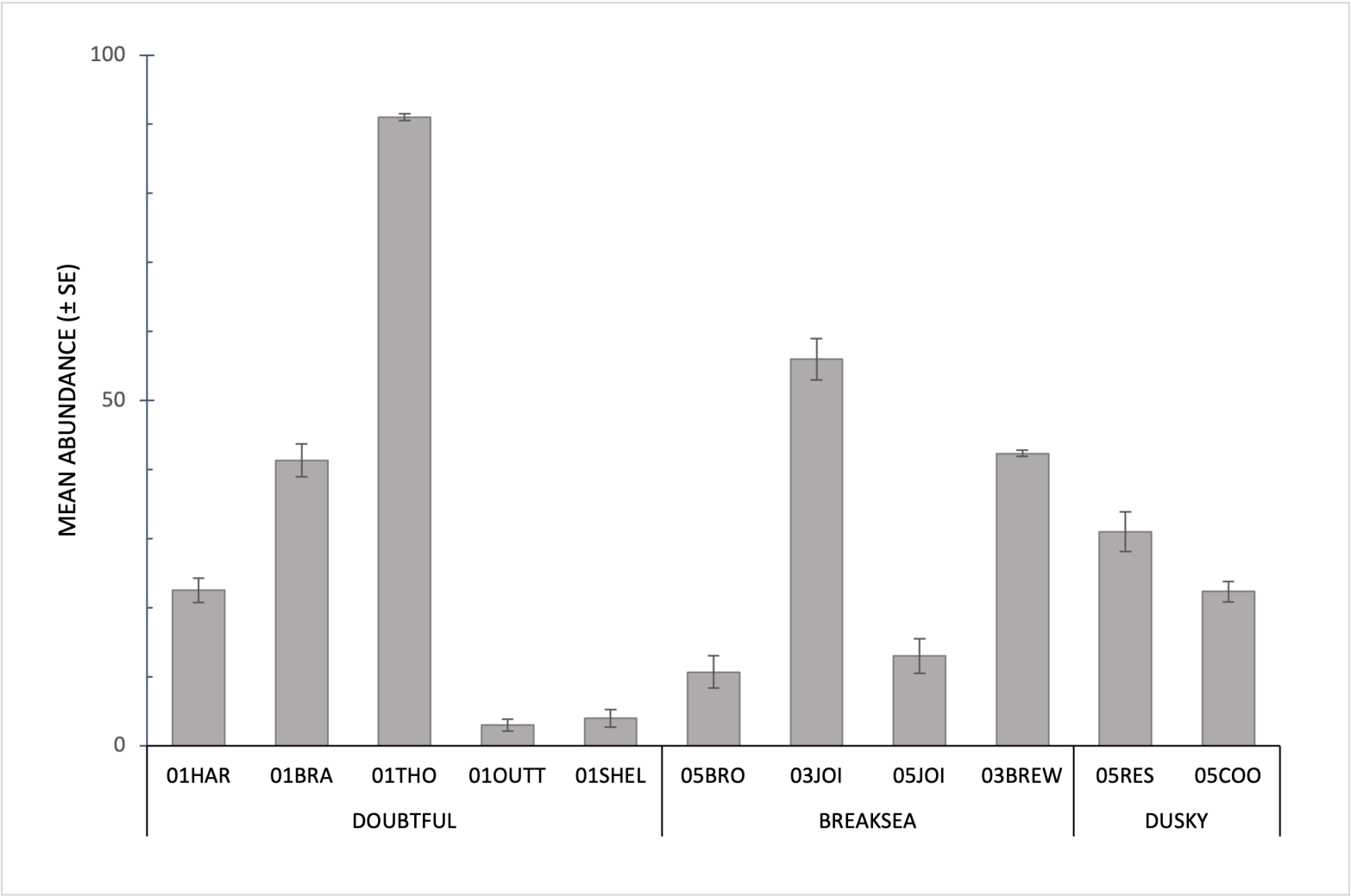
Doubtful Sound- January 23, March 2023 and May 2023



Sampling sites visited in 2023



Mean abundance of black corals across Doubtful, Breaksea and Dusky Sounds based on 3 x 20 m transects at 15 m



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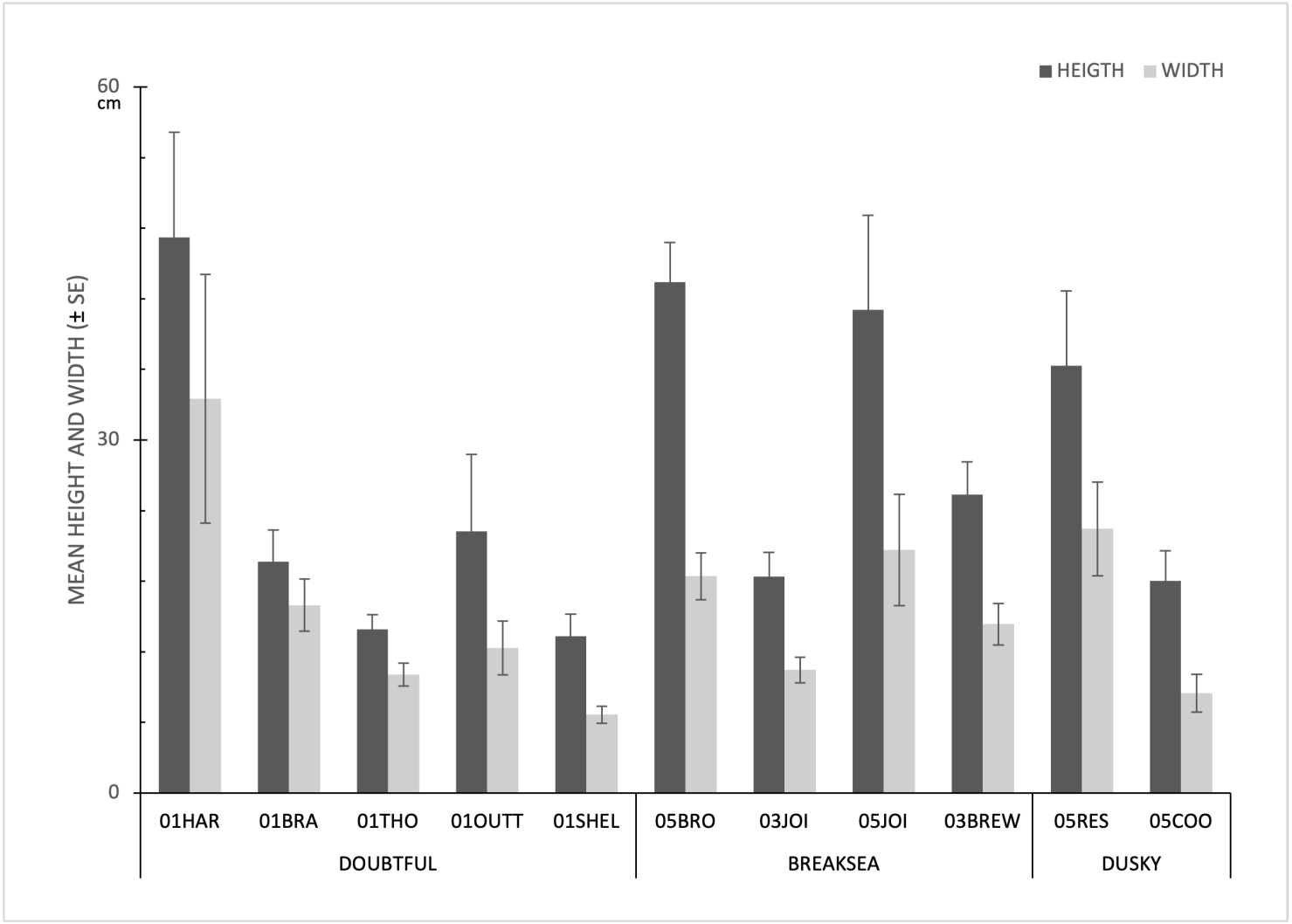

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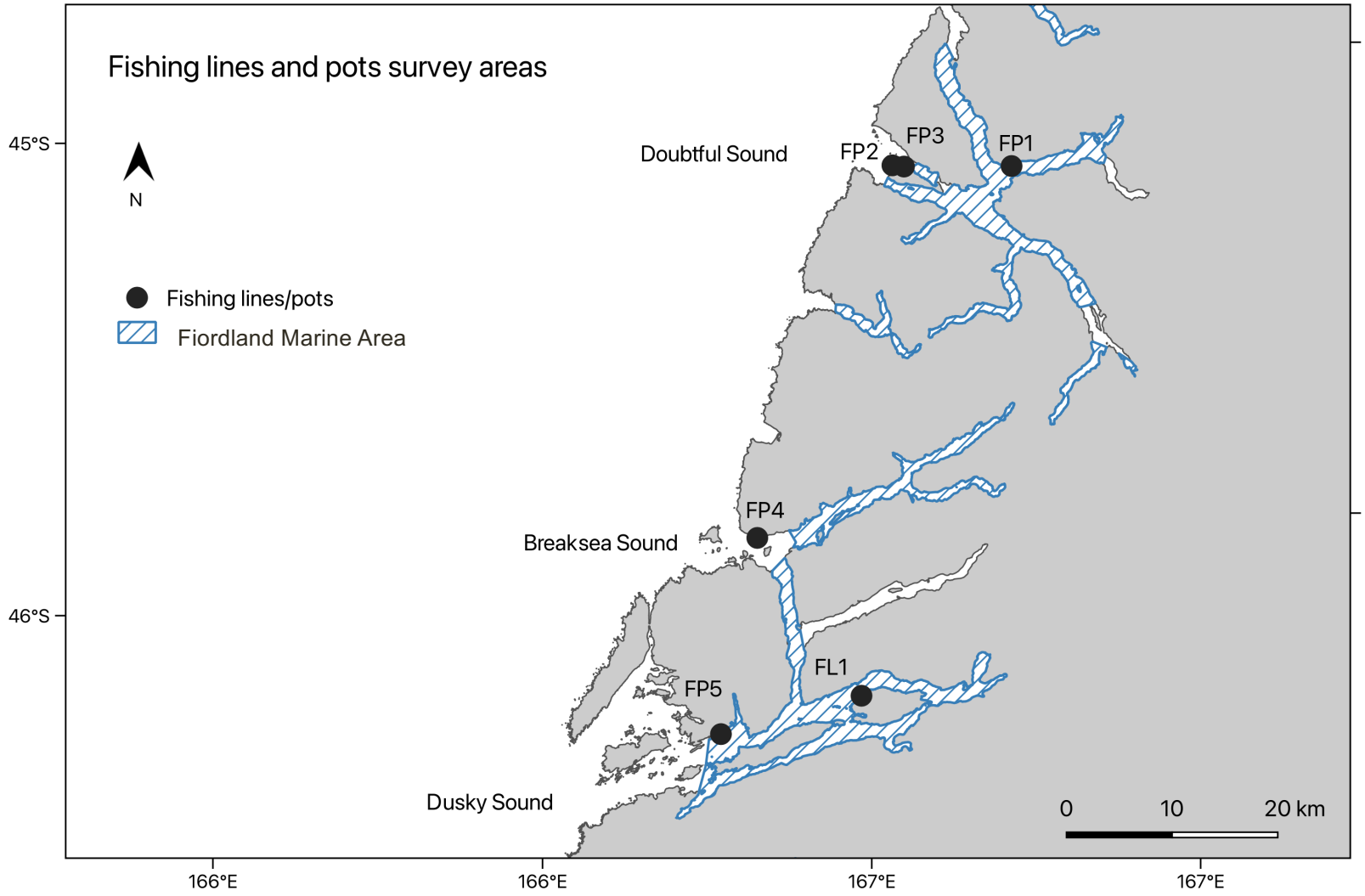
Increase understanding of the ecology and impacts of fishing on protected corals in Fiordland, including the black coral *Antipathella fiordensis*

Approaches to this include:

- Document possible impacts of potting and fishing line on the black coral populations
- Document lost pots and ropes
- Assess any damage to black coral populations
- Use previous catch databases to assess the likely impact of fishing on black corals through time



Locations where discarded fishing pots have been found

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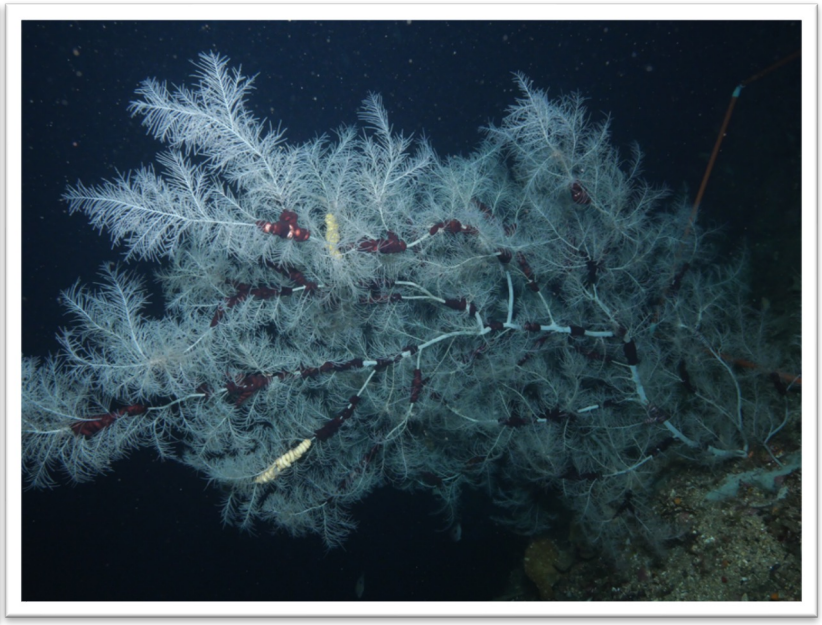
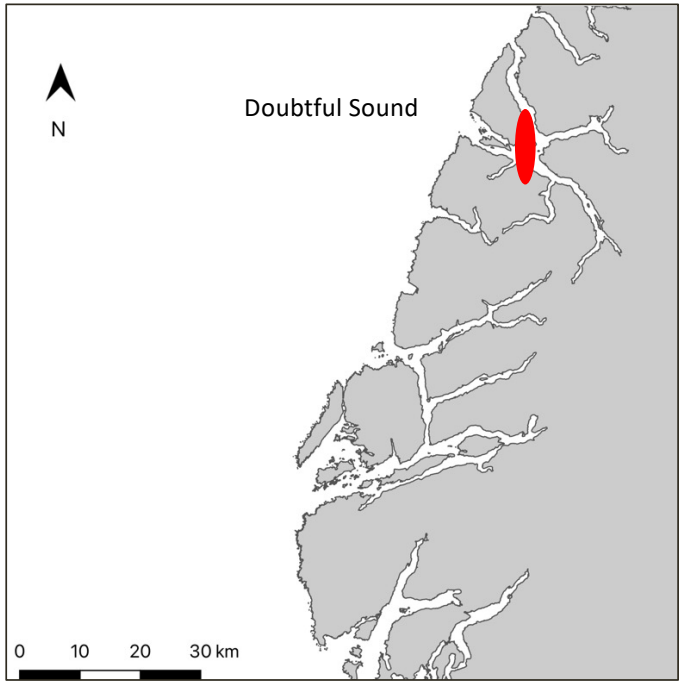
Develop a population model to investigate how population may be impacted by changing environmental conditions

- How the demographic processes affect the population dynamics and viability under different scenarios
- Predict the recovery of populations from environmental impacts



Methods

DATA SOURCING



MODELING/STATISTICAL ANALYSIS

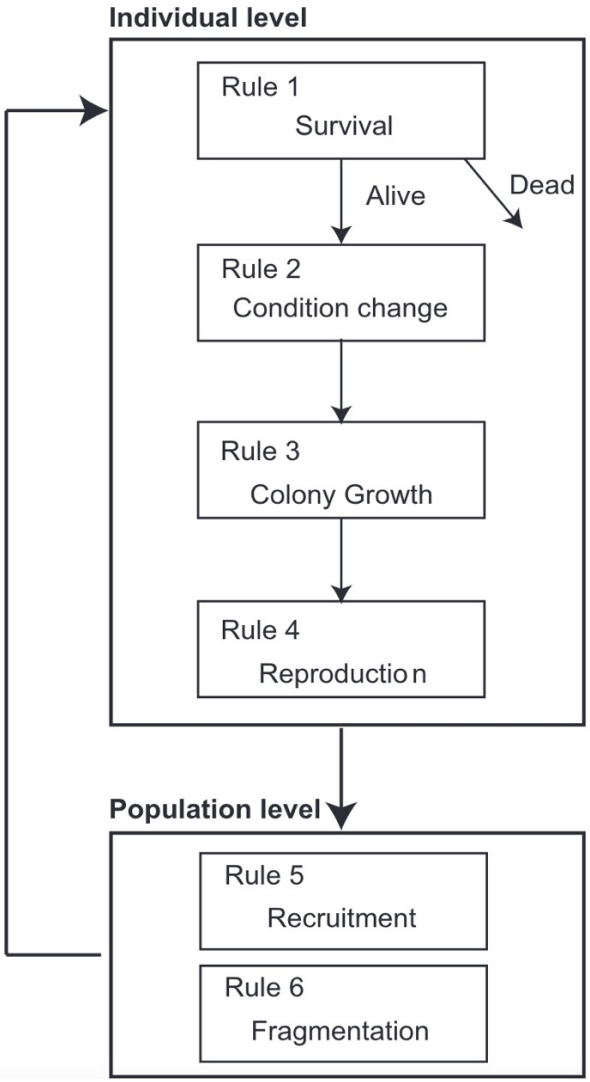
Size-age records from NIWA/Cawthron Institute dataset for Doubtful Sound

↓

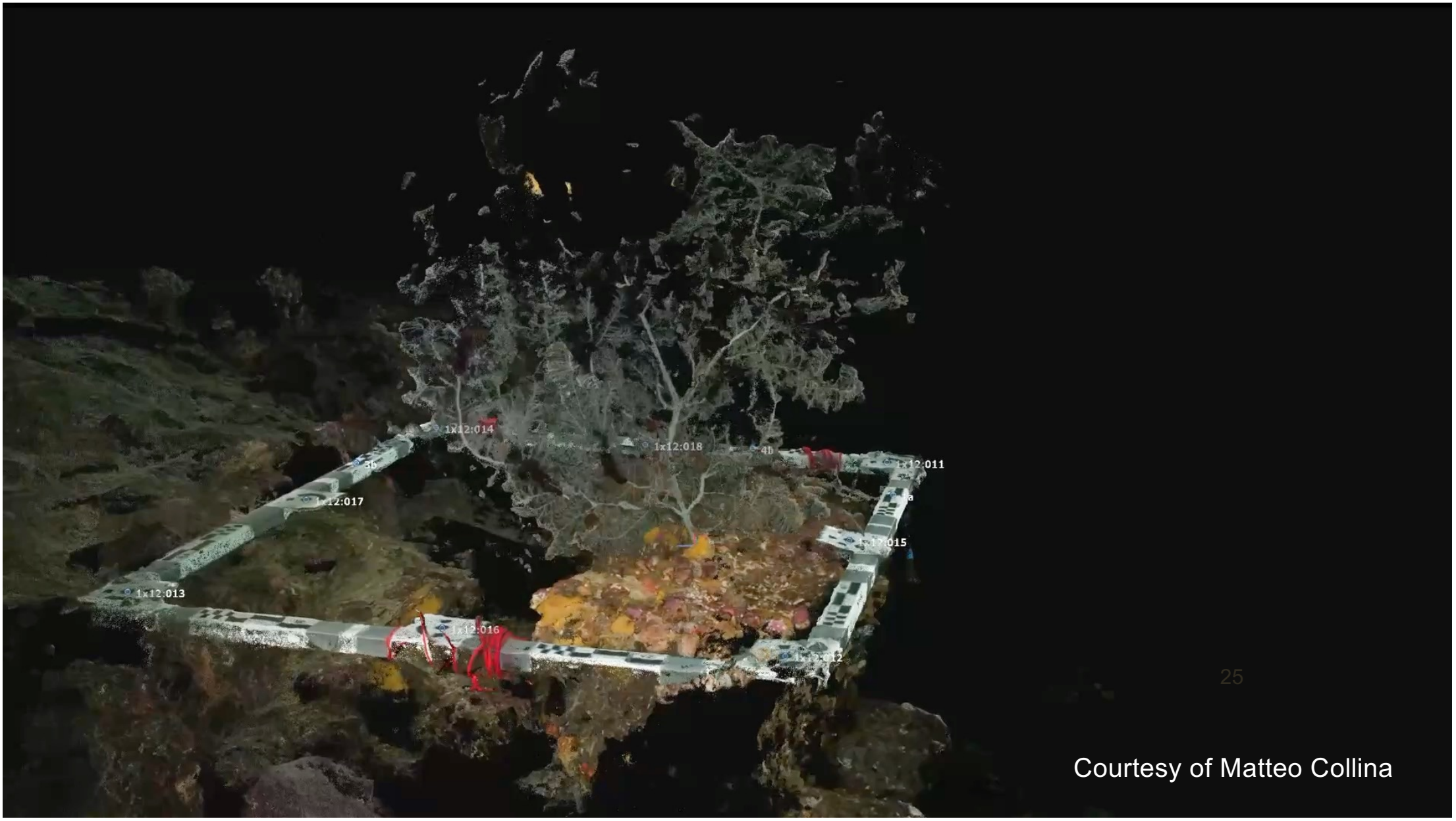
Report growth, recruitment and mortality

↓

Simulate over time different scenarios with different recruitment rates



Muko et al, 2014



Courtesy of Matteo Collina

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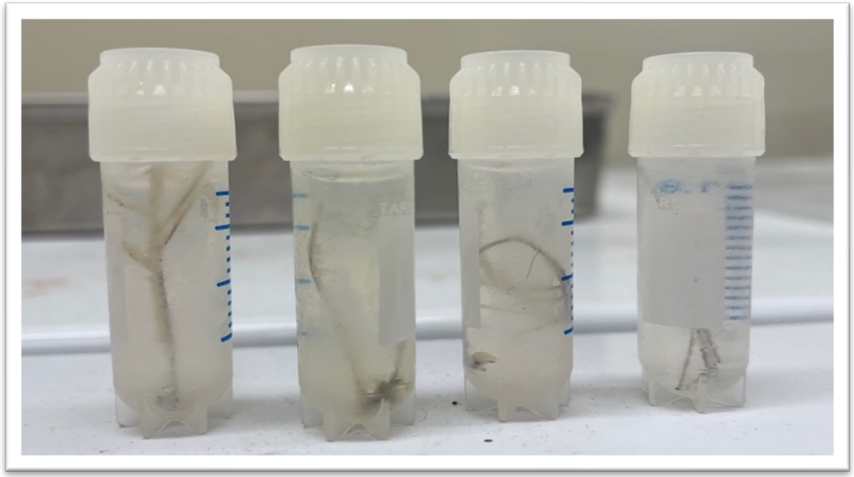
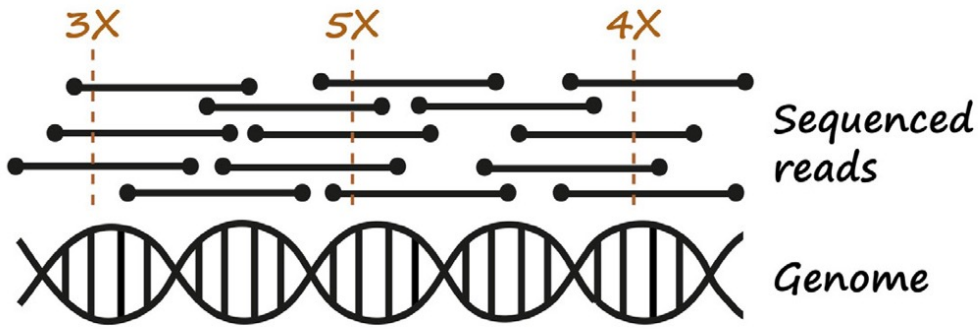
Assessing connectivity between populations using Genome-Wide SNPs

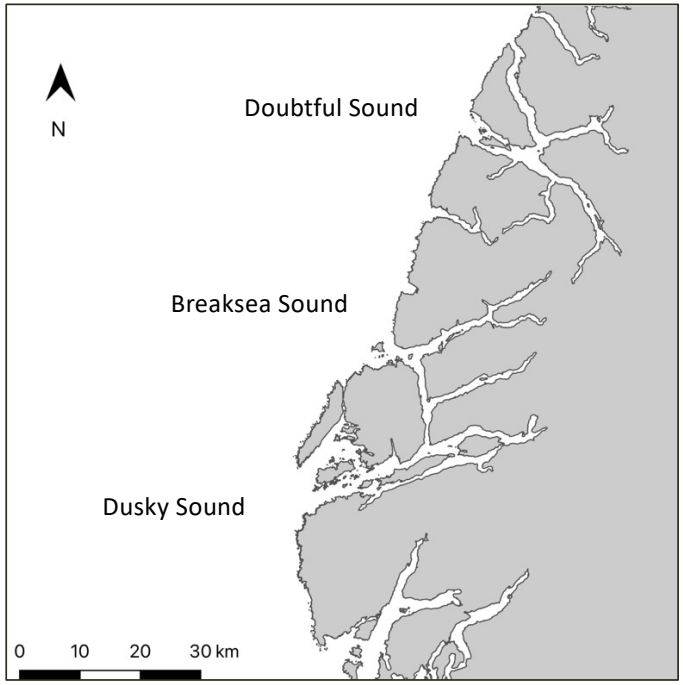
- Reconstruct a whole genome sequence to develop SNPs markers
- Assess whether populations are genetically distinct using SNPs markers
- Assess the extent of genetic connectivity across fiords and with depths





Methods

FIELD SAMPLING



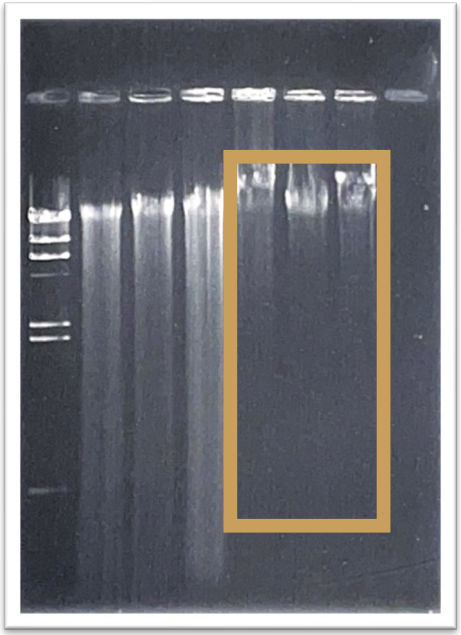
10 Sampling sites

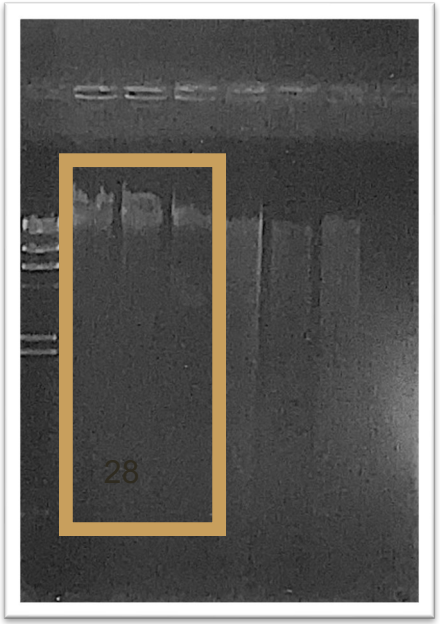
8 shallow populations
(0-20m)

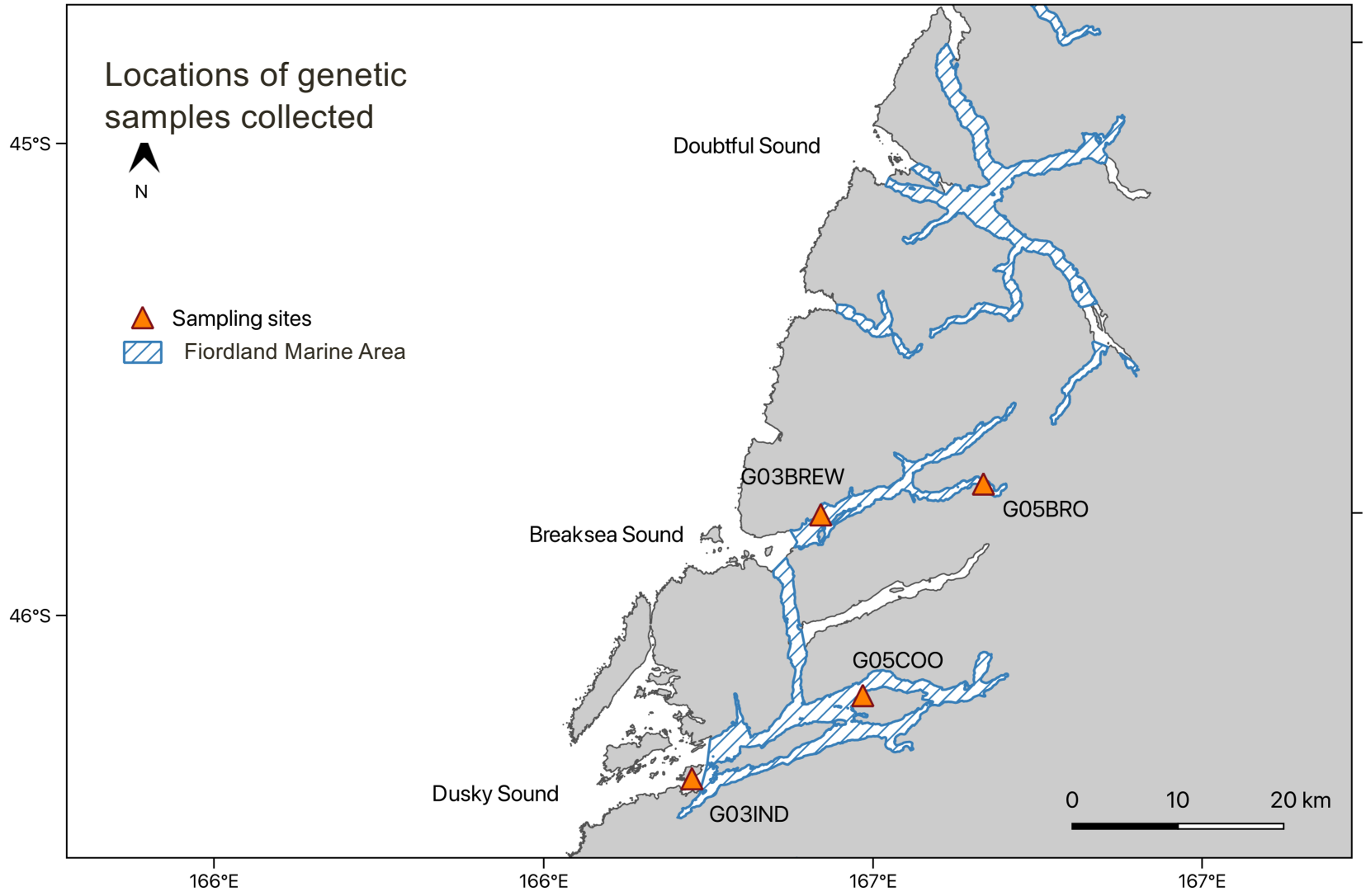
2 shallow + deep populations
(70-100m)

20-25 individuals each

- DNA extractions
- Sequencing
- Genome assembly
- Library composition






Locations of genetic samples collected
N
Sampling sites
Fiordland Marine Area
Doubtful Sound
Breaksea Sound
Dusky Sound
G03BREW
G05BRO
G05COO
G03IND
0
10
20 km
45°S
46°S
166°E
166°E
167°E
167°E

Next steps….

Acknowledgments

Associate Prof Lee Davison (VUW) and Dr Raqi Syed (VUW)
Bell research group - Francesca Strano, Valerio Micaroni, Ben Harris, Manon Broadribb, Gabi Wood
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Southern Fiordland Initiative – Kathryn and Paul Mitchell
Fiordland Marine Guardians – Rebecca McLeod

BOXFISH RESEARCH

Southern Fiordland Initiative

GEORGE MASON CHARITABLE TRUST

Department of Conservation
Te Papa Atawhai

CAPITAL THINKING. GLOBALLY MINDED.
MAI I TE IHO KI TE PAE

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