

# INT2023-05

## High-resolution estimation of species diversity for a protected coral family commonly occurring as coral bycatch



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Climate, Freshwater & Ocean Science



**NIWA**

Taihoro Nukurangi

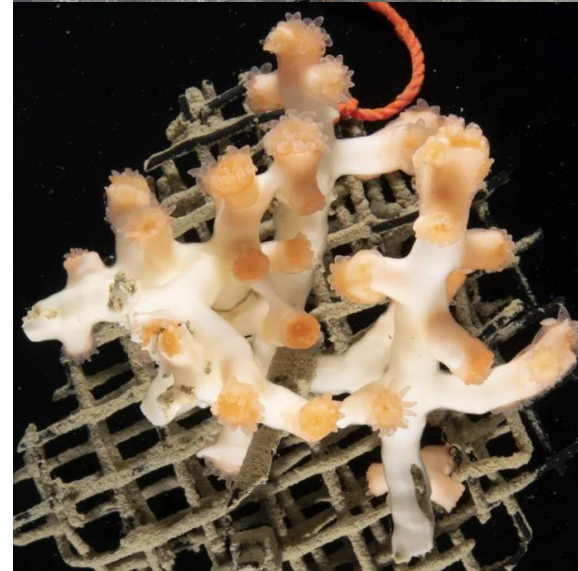


Wildlife Act 1953

# Protected Corals in Aotearoa New Zealand

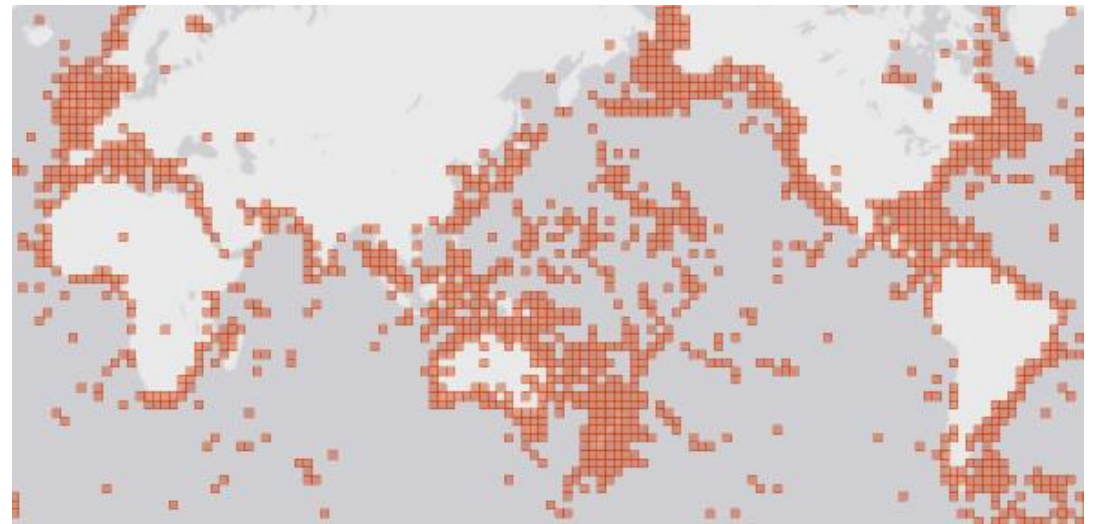
## Schedule 7A:

- O. Antipatharia (black corals)
- O. Scleractinia (stony corals)
- F. Stylasteridae (hydrocorals)
- O. Gorgonacea (gorgonian octocorals)



## Octocorallia (octocorals)

- Ancient – over 500my old
- Over 3000 species worldwide
- Found in all oceans, nearly all depths
- ‘Gorgonians’ → VME Indicator Taxa



OBIS: records of Alcyonacea

# Octocorallia: Order 'Gorgonacea' (GOC)

- vs. O. Alcyonacea – soft corals (SOC)
- vs. O. Pennatulacea – sea pens (PTU)
- Orders (& suborders) shown to be invalid - 2001

Marine Biology (2001) 138: 235-246

E. A. Bertson · F. M. Bayer · A. G. McArthur  
S. C. France

**Phylogenetic relationships within the Octocorallia  
(Cnidaria: Anthozoa) based on nuclear 18S rRNA sequences**

- Families became unit of reference

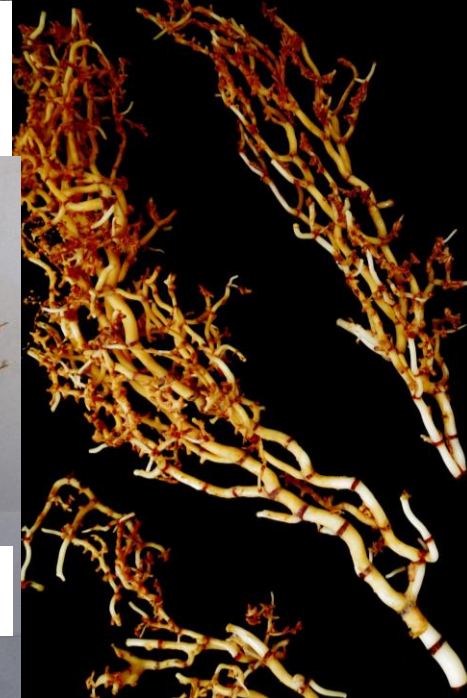
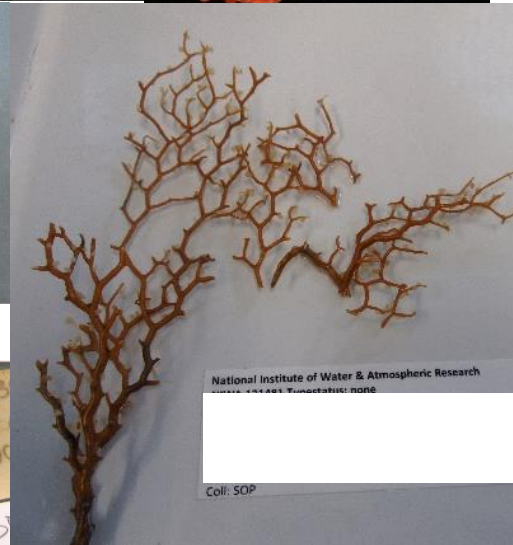
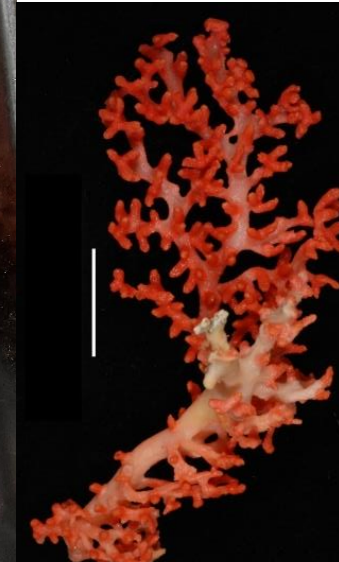




# Protected gorgonian families previously within Gorgonacea

Wildlife Act 1953

- Paragorgiidae (bubblegum corals)
- Coralliidae (precious corals)
- Plexauridae & Acanthogorgiidae (sea fans)
- Isididae (bamboo corals)
- Chrysogorgiidae (golden corals)
- Primnoidae
- Anthothelidae



**Revisionary systematics  
of Octocorallia (Cnidaria:  
Anthozoa) guided by  
phylogenomics**

Catherine S. McFadden<sup>1</sup>, Leen P. van  
Ofwegen<sup>2,‡</sup>, and Andrea M. Quattrini<sup>1,3</sup>

2022: *Bulletin of the Society of Systematic  
Biologists* 1(3)

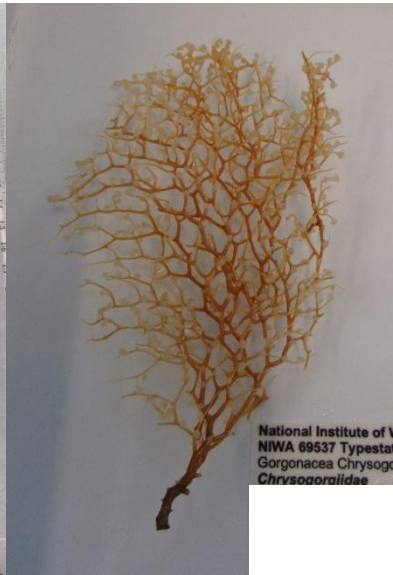
## Protected gorgonian families (GOC)

- Paragorgiidae (bubblegum corals) → Coralliidae (bubblegum & precious corals)
- Coralliidae (precious corals) → Coralliidae (bubblegum & precious corals)
- Plexauridae & Acanthogorgiidae (sea fans) → Paramuriceidae (+Astrogorgiidae, Euplexauridae, Gorgoniidae)
- Isididae (bamboo corals) → Keratoisididae (big bamboo corals)
- Isididae (bamboo corals) → Mopseidae (little bamboo corals)
- Chrysogorgiidae (golden corals) → Chrysogorgiidae (golden corals)
- Primnoidae → Primnoidae
- Anthothelidae → Alcyoniidae (soft corals + *Anthothela*)
- Anthothelidae → Victorgorgiidae (*Victorgorgia*)
- Anthothelidae → Melithaeidae (*Iciligorgia*)

# Fishing Impacts on Coral *Species*

- How many gorgonian species affected?
- Cryptic and poorly described, fragile, long-lived
- Common amongst coral bycatch
- ORH, OEO, HOK, SCI (bottom trawl) – inshore?
- Observer ID ~20% accuracy (for gorgonians)

(INT19304 report)



**INT2019-05**

# **Coral biodiversity in deep-water fisheries bycatch**

- Use genetic analysis of collected gorgonians to examine how much diversity exists among trawl bycatch

Jaret P. Bilewitch

Di M. Tracey

Climate, Freshwater & Ocean Science

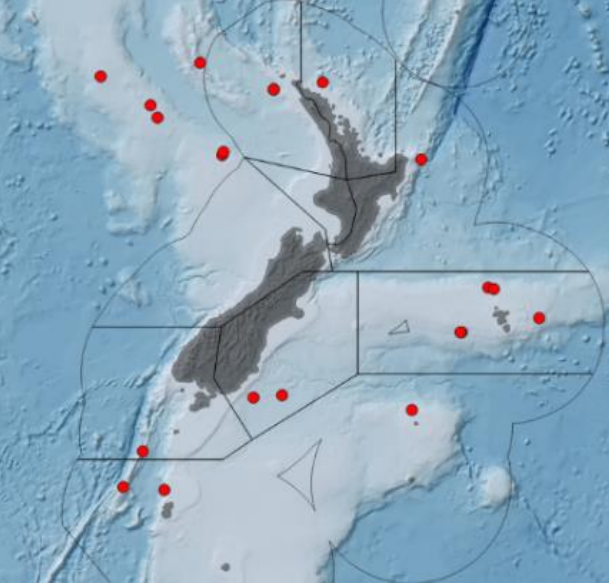


**NIWA**

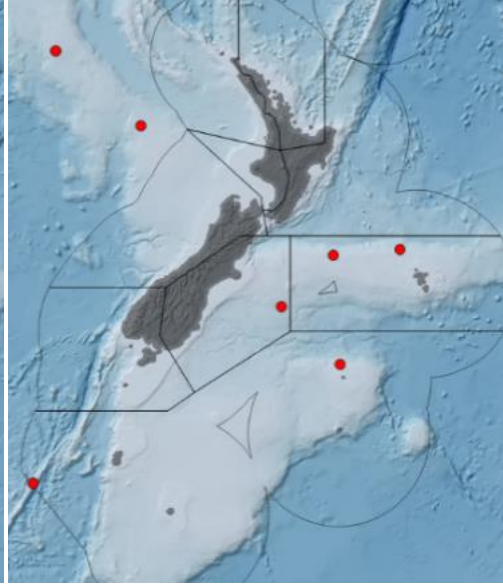
Taihoro Nukurangi



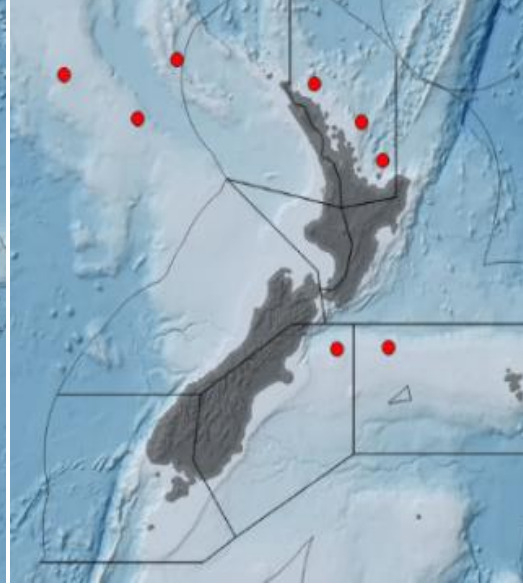




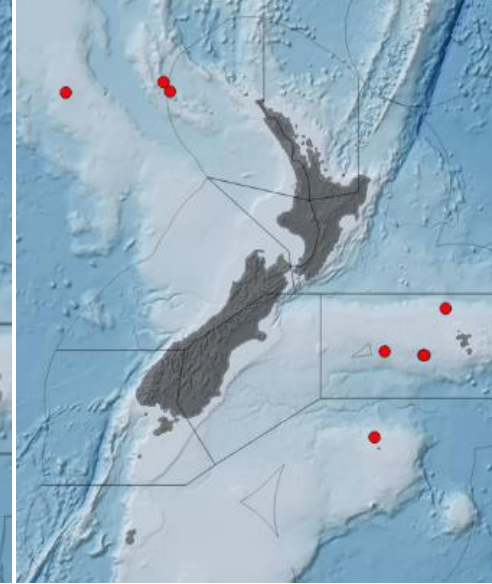
Isididae



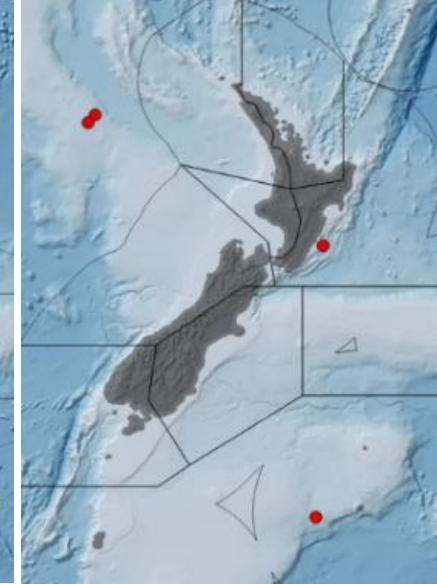
Primnoidae



Chrysogorgiidae



Paragorgiidae



Plexauridae +  
Acanthogorgiidae



Few samples of many different families, from diverse localities

# BCBC2020-26

## Octocoral bycatch diversity on the Chatham Rise

Genetic characterization to improve understanding of:

1. Extent and distribution of gorgonian diversity
2. Proportion of total diversity impacted by fishing

- Inclusion of bycatch and non-bycatch material
- Focus on a single family of octocorals
- Focus on a restricted region of EEZ



## Single family:

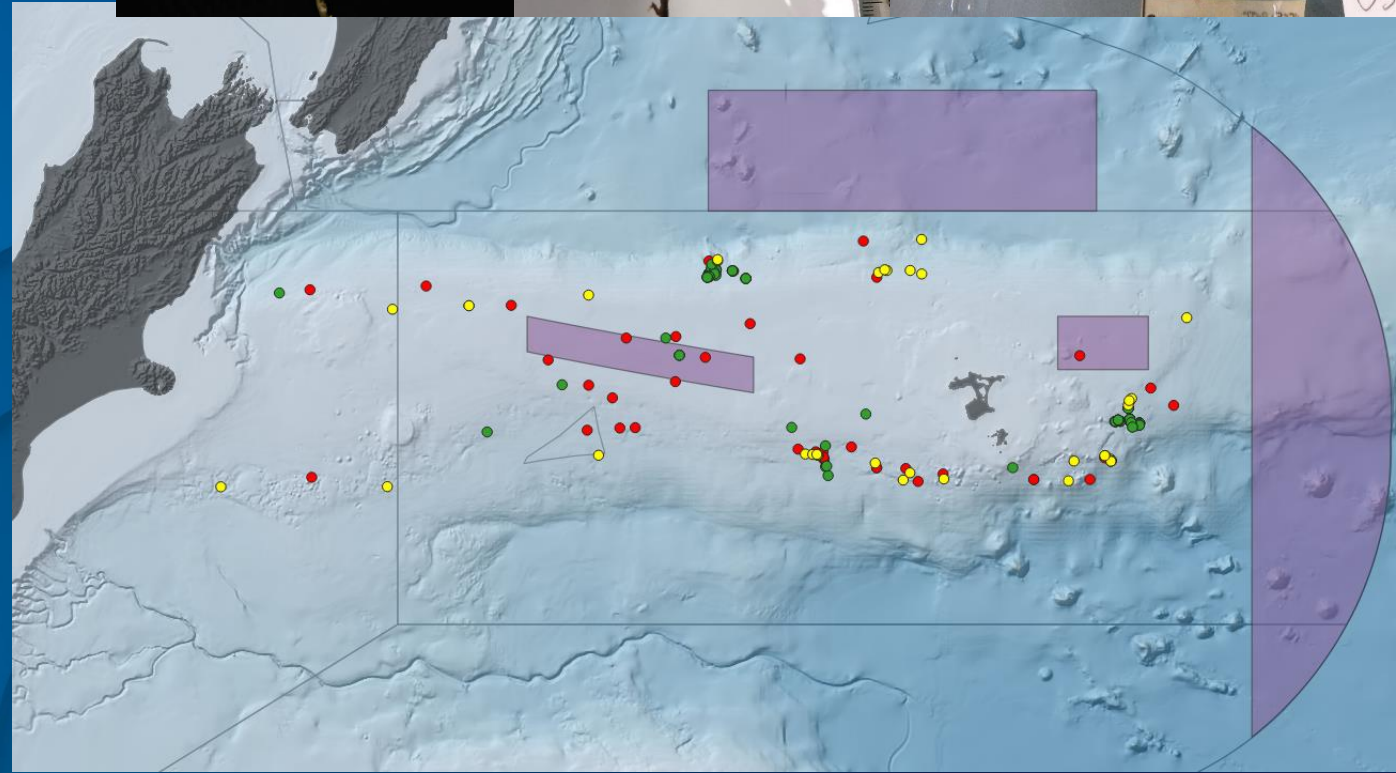
### Primnoidae ('bottlebrush corals'):

- Common trawl-bycatch component (THO, PRI)
- Taxonomically well-studied (3 monographs)
- Globally significant (VMEs, fisheries, diversity)
- Baseline data from INT2019-05



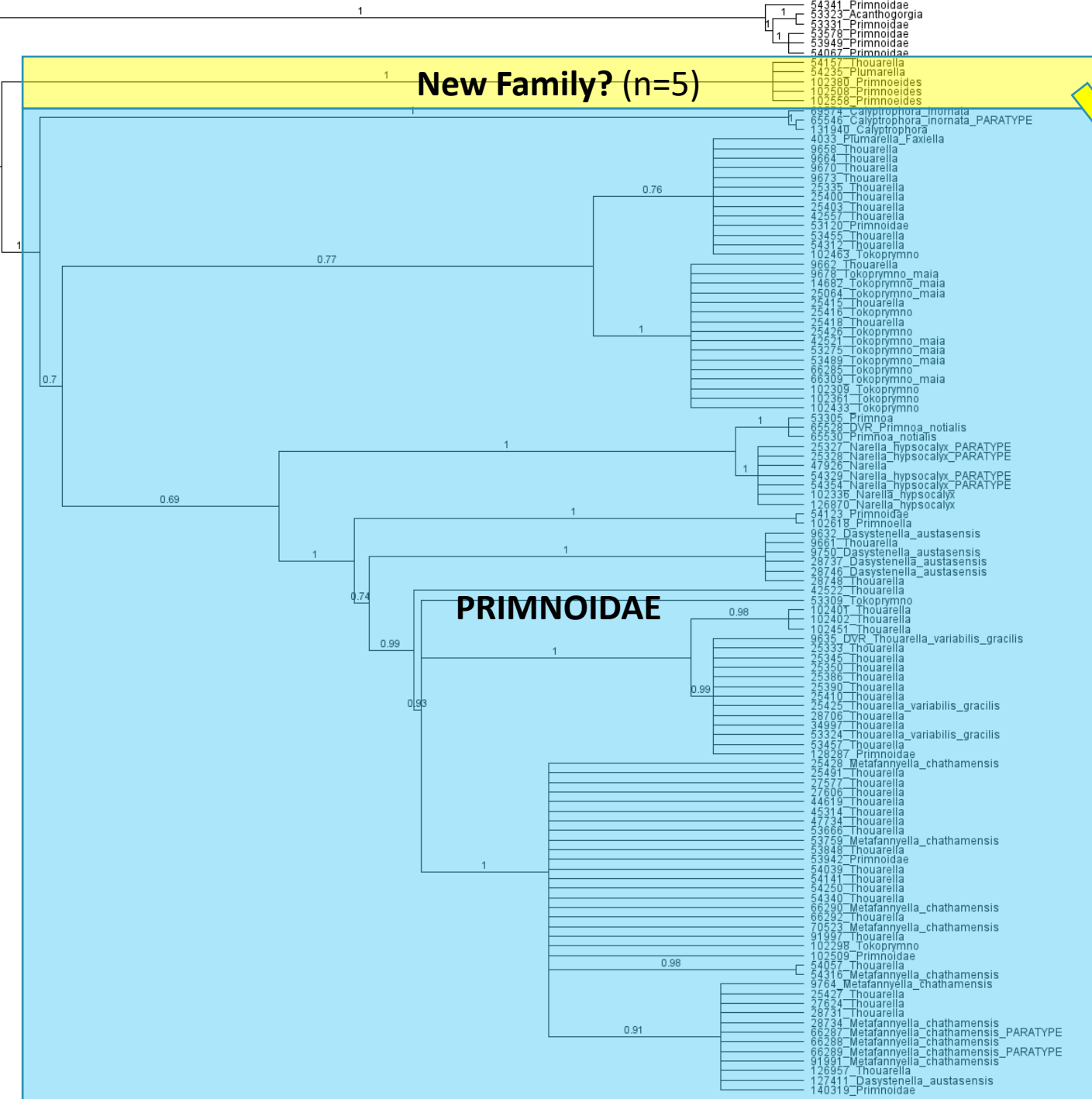
## Chatham Rise:

- Highest concentration of available samples (n=122)
- Relevant to trawl fisheries & seamount biodiversity



**New Family? (n=5)**

- new family discovered (see INT2022-03 Bycatch ID)



Molecular Systematic Identification	Comm. Bycatch	Res. Bycatch	Res. Sled
<b>Calyptrophora inornata</b>	3	-	-
<b>Dasystenella austasensis</b>	-	2	5
<b>Metafannyella sp.</b>	4	8	15
<b>Metafannyella chathamensis</b>	3	2	3
<b>Narella hypsocalyx</b>	1	1	5
<b>Plumarella (Faxiella) sp.</b>	1	-	13
<b>Primnoa notialis</b>	2	-	1
<b>Primnoella sp.</b>	-	-	2
<b>Primnoella insularis</b>	-	-	1
<b>Thouarella sp.</b>	-	-	4
<b>Thouarella cf. laxa</b>	1	-	1
<b>Thouarella variabilis var. gracilis</b>	1	4	11
<b>Tokoprymno maia</b>	3	-	12
<b>TOTALS</b>	<b>19</b>	<b>17</b>	<b>73</b>

- 13 species detected – 10 as bycatch
- commercial bycatch = 17% of sample size but 69% of diversity
- w/previous studies, 17 primnoid species on Chatham Rise; 12 as bycatch

# INT2023-05 High-resolution estimation of species diversity for a protected coral family commonly occurring as coral bycatch

Genetic characterization to improve understanding of:

1. Extent and distribution of octocoral diversity
2. How fisheries interactions might impact this diversity

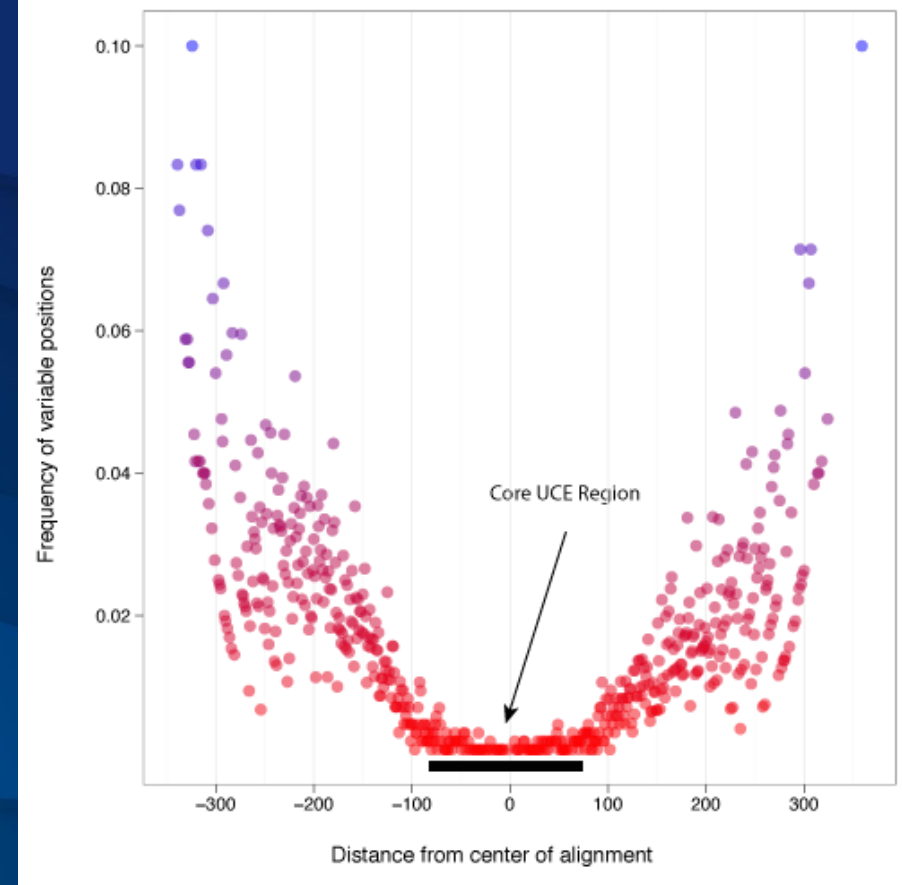
- Inclusion of bycatch and non-bycatch material
- Focus on a single family of octocorals
- Focus on two restricted regions of EEZ
- Use genomic approaches to diversity discovery



## Genomic approaches to diversity discovery

Ultra-conserved elements:

- Only target conserved stretches of DNA throughout genome, that have variable regions next to them
- NGS sequencing using target bait enrichment, to generate SNP dataset for genetic relatedness
- 28,500bp/\$ vs. 100bp/\$ for traditional barcoding

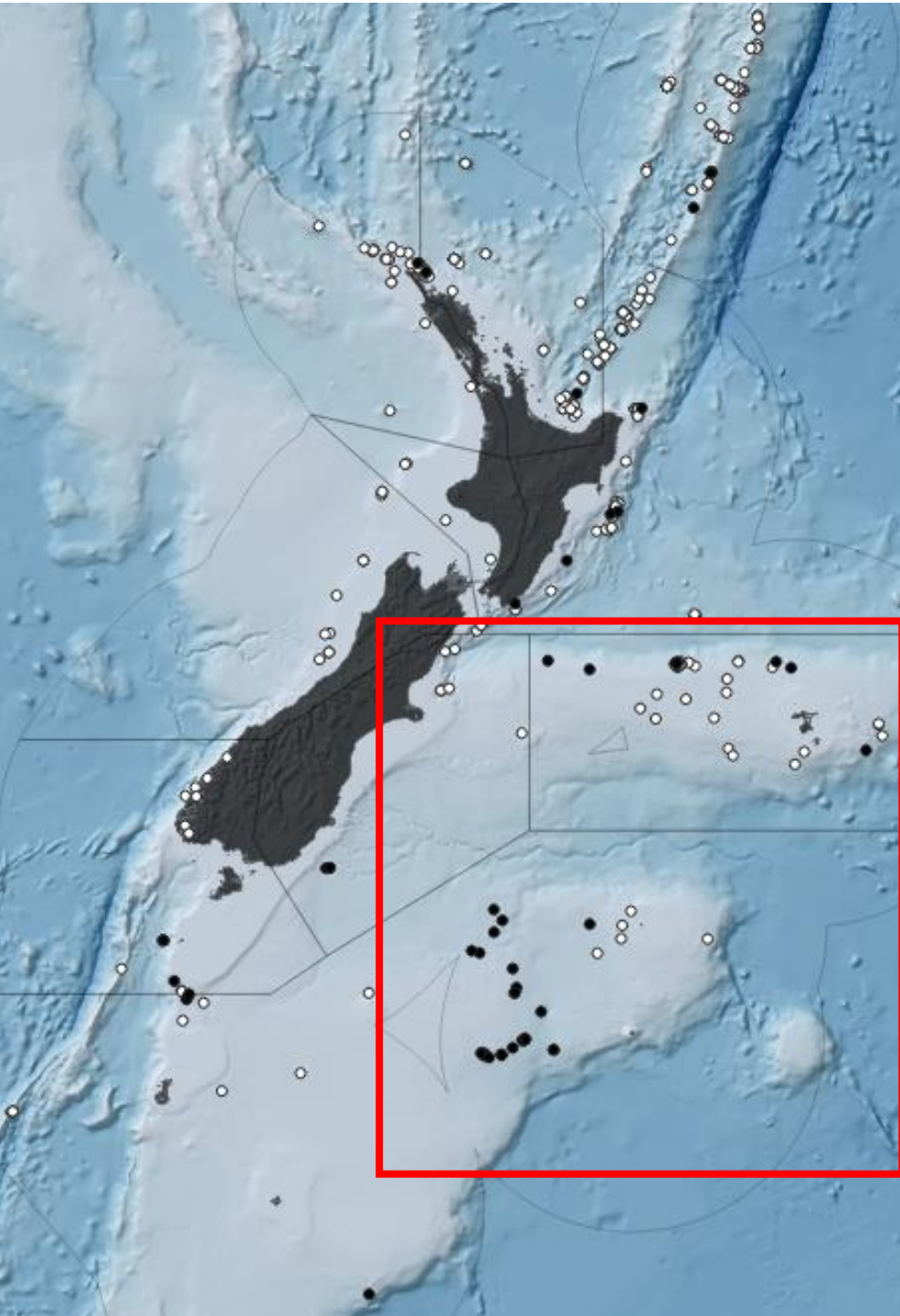




## Paramuriceidae (sea fans)

- previously Plexauridae + Acanthogorgiidae
- 12 genera in NZ
- records of 2 named species
- Globally - seamounts/slopes





## NIC sample availability

- Focus on FMA4 & eastern FMA6
- Relevant to trawl fisheries
- Campbell/Bounty Plateaus poorly characterised

## Sampling

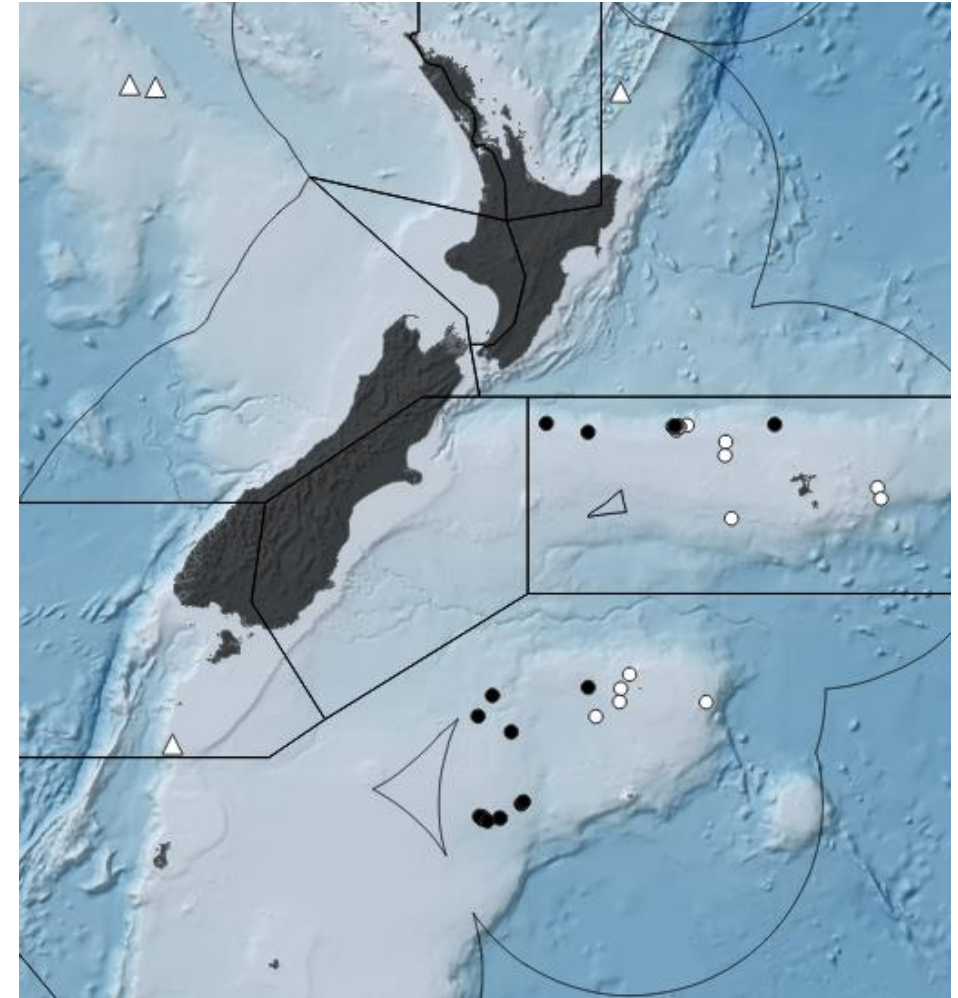
- 92 NIC specimens
- 30 mis-ID'd, no tissue, lost
- 42 FMA4 (4 bycatch)
- 20 FMA6 (15 bycatch)

## Sequencing

- 4 too weak, -12 low priority
- 46 samples submitted + 8 refs + 8 outgroups

## Analysis

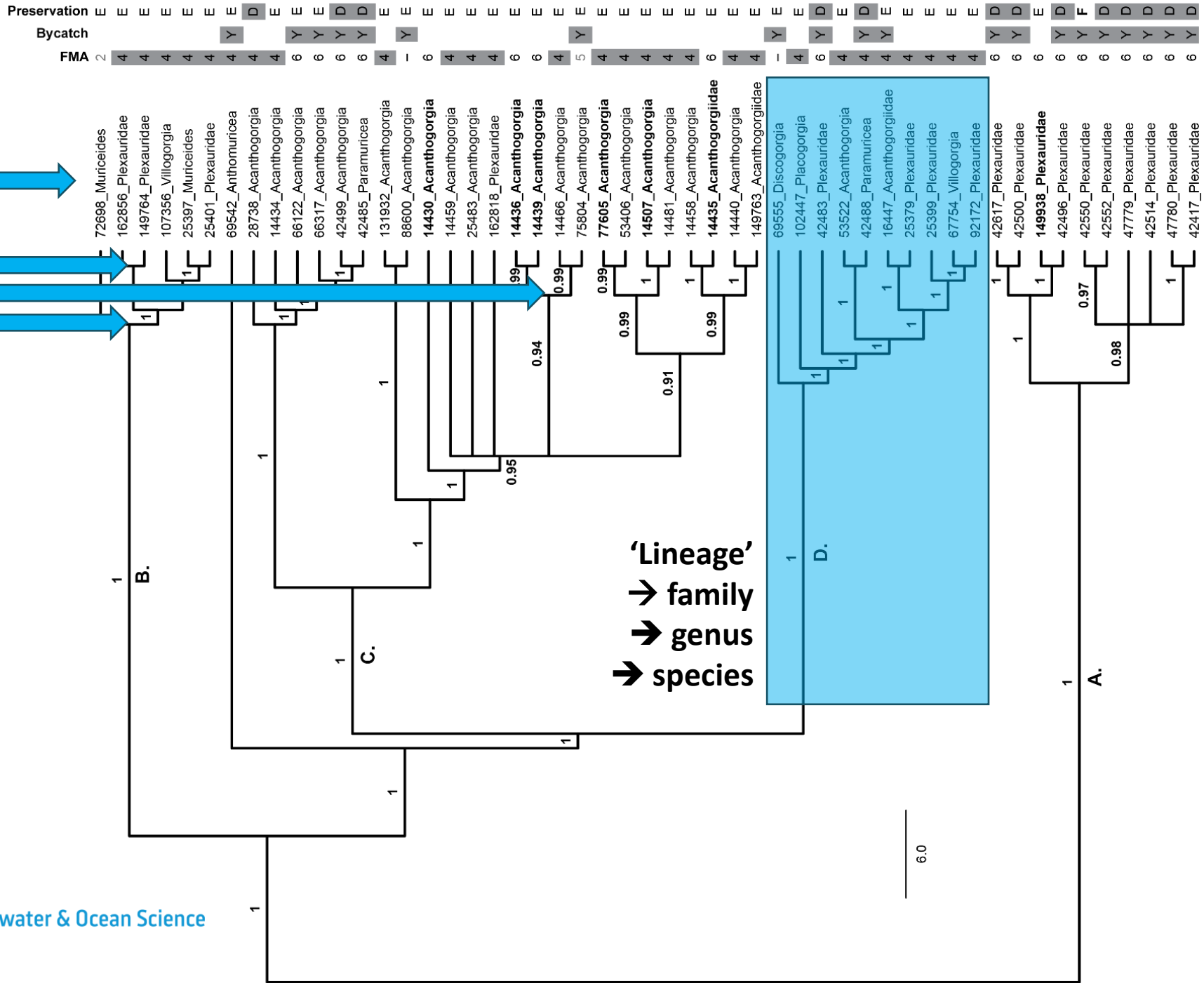
- 59 sequenced → 57 successful (51 + 6)
- $\bar{x}$  = 11M reads/sample, >1B bp DNA/sample



Specimens

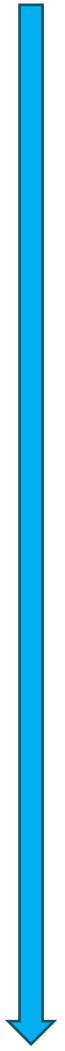


Shared  
Ancestors



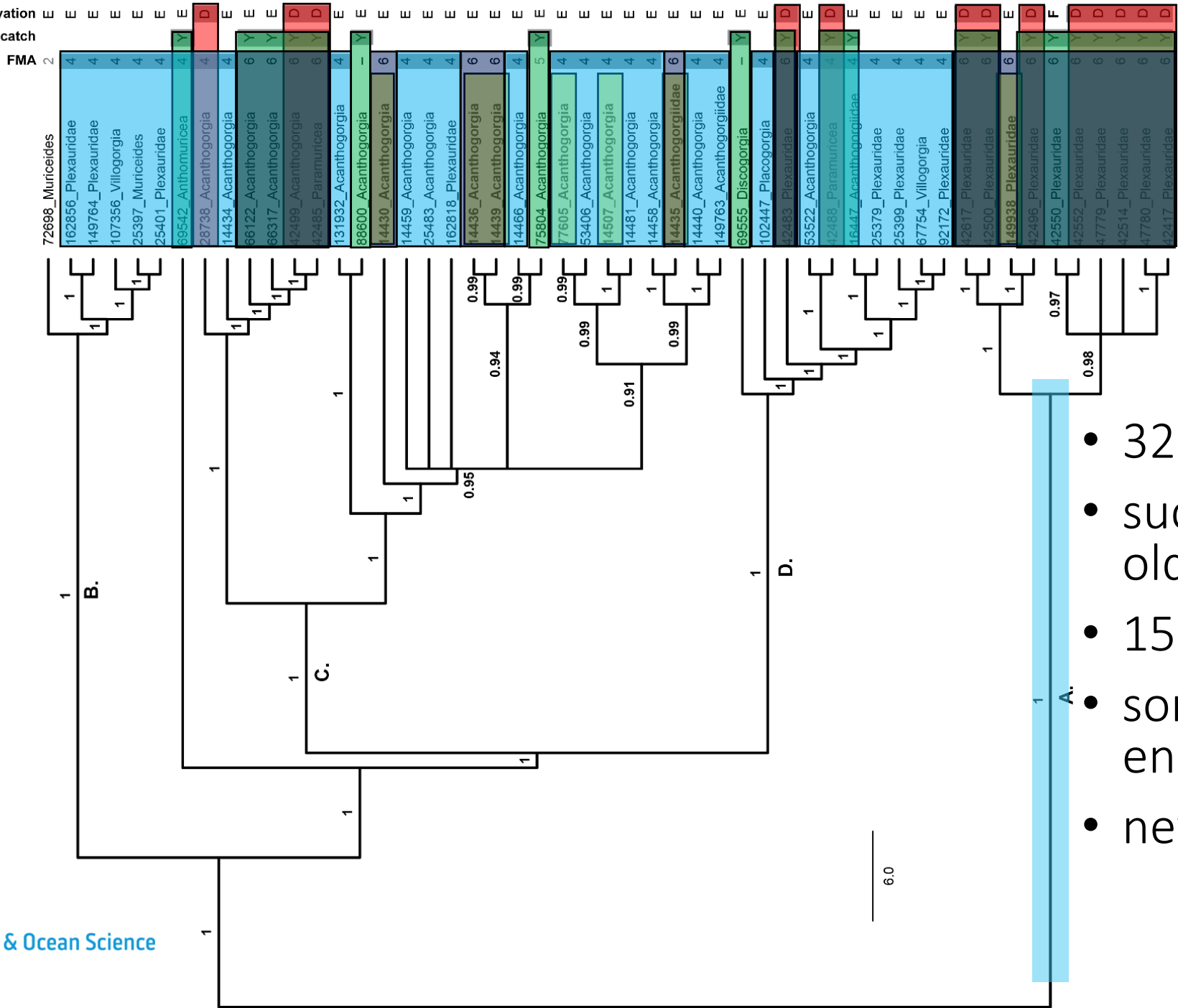
'Lineage'  
 → family  
 → genus  
 → species

Relative Time  
(past)





**DRY**
  
**OLD**
  
**BYCATCH**
  
**FMA**



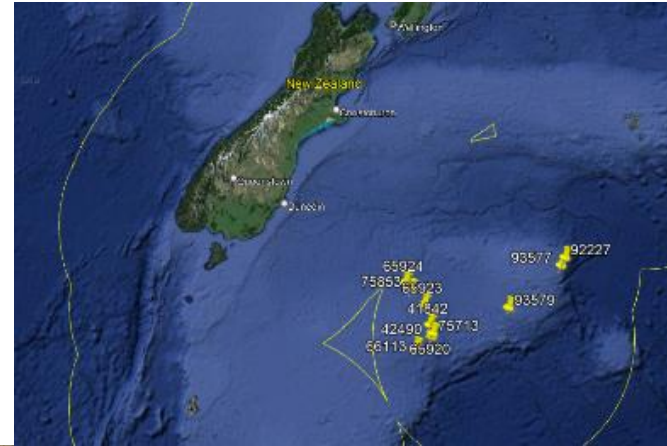
- 32 taxa/51 samples
- success for dried & old material
- 15 taxa – bycatch
- some regional endemism
- new family?

# (another) new family?

INT2023-07: Expert identification

Dr. Kirrily Moore (Tasmania Museum)

Subergorgiidae: *Rosgorgia* ???



## Summary

- UCE → High taxonomic resolution
- Works on old & dried material
- Globally, 1<sup>st</sup> look at Paramuriceidae
- 7 genera -> 32 'taxa' -> 15 as bycatch
- More diversity than expected
- Some regional endemism FMA4/6
- New family record for NZ?





# Acknowledgements

- Fisheries Observers
- DOC Conservation Services Programme: Lyndsey Holland, Katie Clemens-Seeley, Hollie McGovern
- NIWA Invertebrate Collections team: Sadie Mills, Diana Macpherson, Amelia Connell, Dean Stotter
- NIWA Molecular Biology team: Amber Brooks, Lisa Smith, Felix Vaux, Henry Lane
- MPI RDM team and COD database managers at NIWA
- Daicel-Arbor Biosciences & Andrea Quattrini (USNM)