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Taihoro Nukurangi

Climate, Freshwater & Ocean Science

November 2018, Distribution of protected coral groups in New Zealand

Distribution of protected coral groups in New Zealand

Brit Finucci, Owen Anderson, Di Tracey

Prepared for Sharleen Gargiulo

Sustainable Fisheries Manager

Deepwater Group Ltd

March, 2019, NIWA

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Station data

- Time series: 1874-2017
- Records from within NZ region (positions decimalised, Lats: -24°, -57.5°; Longs: 157°, 200°)
- Databases and literature sources – mainly:
    - NIWA Specify database (*niwainvert*)
    - Ocean Biogeographic Information System (OBIS) database
    - Centralised Observer Database (*cod*)
    - Paris Museum records for the SW Pacific (MNHN)
    - MPI trawl survey database (*trawl*)
- Non-catching gear removed (e.g. CTDs, multicores)
- Depths: 0 – 3000 m, based on start position of station (finish position not always available), binned into 10 m increments and number of stations within each 10 m depth interval calculated

New Zealand coral data

- Species designated into one of four protected coral groups
  - Antipatharia (black corals)
  - Gorgonian octocorals (a subset of Alyconacea previously known as Gorgonacea)
  - Scleractinia (stony corals)
  - Stylasteridae (hydrocorals)
- Depth of capture reported from start position of station (finish position not always available), binned into 10 m increments, frequency of coral group captured within each 10 m depth interval calculated
- Coral depth distribution expressed as proportion of stations within each 10 m depth interval where coral group recorded
- Minimum and maximum depth bin (in metres) for each coral group reported; inter-quartile range calculated as an estimate of the depth range within which 50% of the group are found

Global coral data

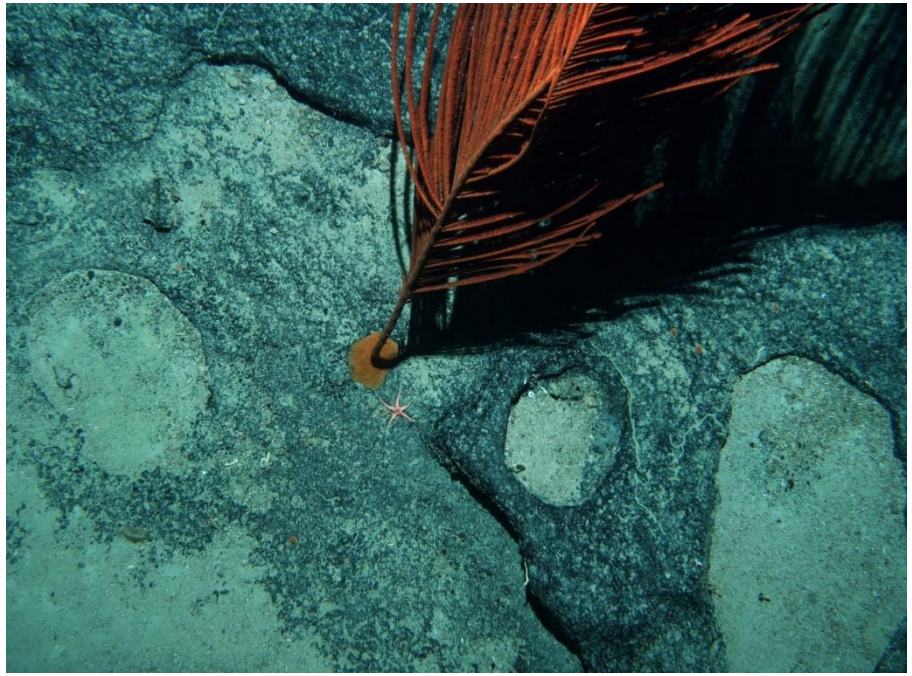
- Data were extracted from the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF) for the following coral orders. Additional information on coral selection supplied in word document
    - Antipatharia
    - Alcyonacea
    - Anthoathecata
    - Scleractinia
- Data were combined for both data sets; it is not possible to determine any duplication of records between the two databases
- Data with a minimum and maximum depth reported were selected and an average between the two values was taken; depths >5000 m were considered outliers and removed (<0.001% of records, based on depth ranges reported by Lumsden et al. 2007)
- Depths were binned into 10 m increments, frequency of coral group captured within each 10 m depth interval calculated
- Minimum and maximum depth bin (in metres) for each coral group reported; inter-quartile range calculated as an estimate of the depth range within which 50% of the group are found

Statistical analysis

- All work was completed in the statistical program *R* and plots produced with *ggplot*
- Violin plots were produced to show where the data are distributed with respect to depth (Hintze & Nelson, 1998; https://ggplot2.tidyverse.org/reference/geom_violin.html).
- The violin plot is similar to a box-and-whiskers plot, but outlines illustrate kernel probability density, i.e., the width of the shaded area represents the proportion of the captures located across the depth ranges
- Interquartile (ITQ) range for violin plots (based on density estimate) presented in black bars. ITQ range for raw data presented in tables.

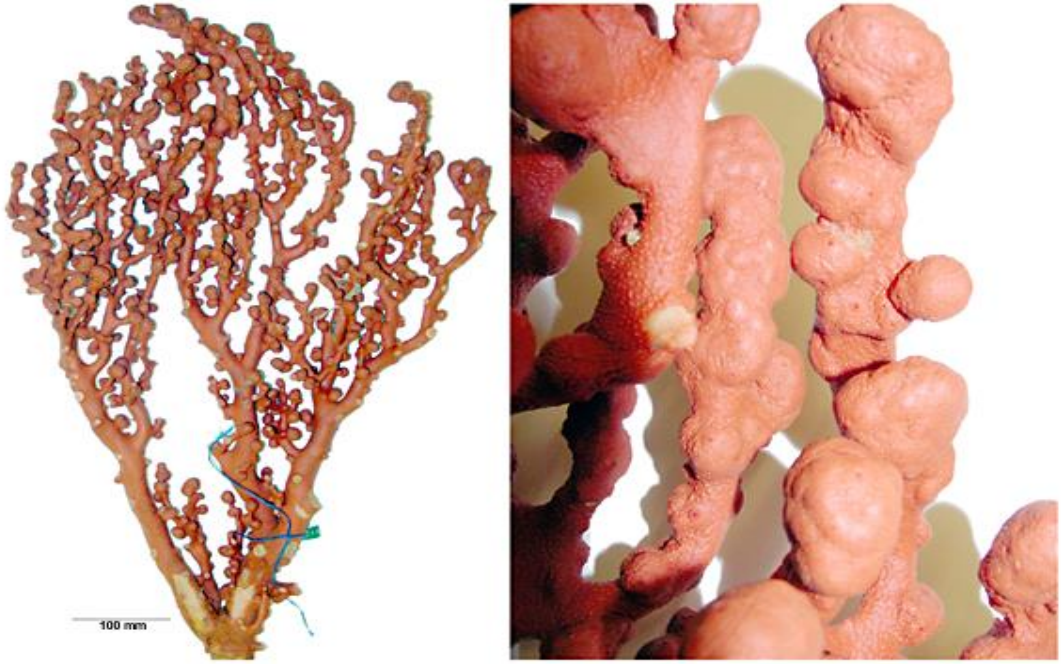
Black corals (Order Antipatharia)

Leiopathes secunda



Bathypathes spp

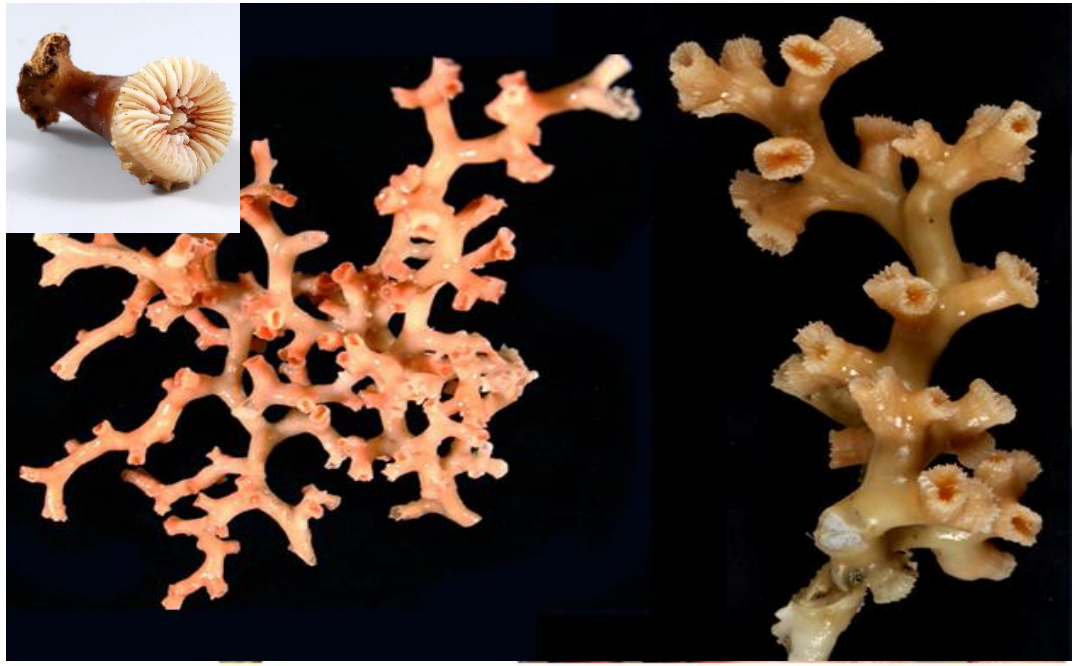
Gorgonian octocorals (Order Alcyonacea)



Paragorgia spp

White Primnoid sea fan octocorals

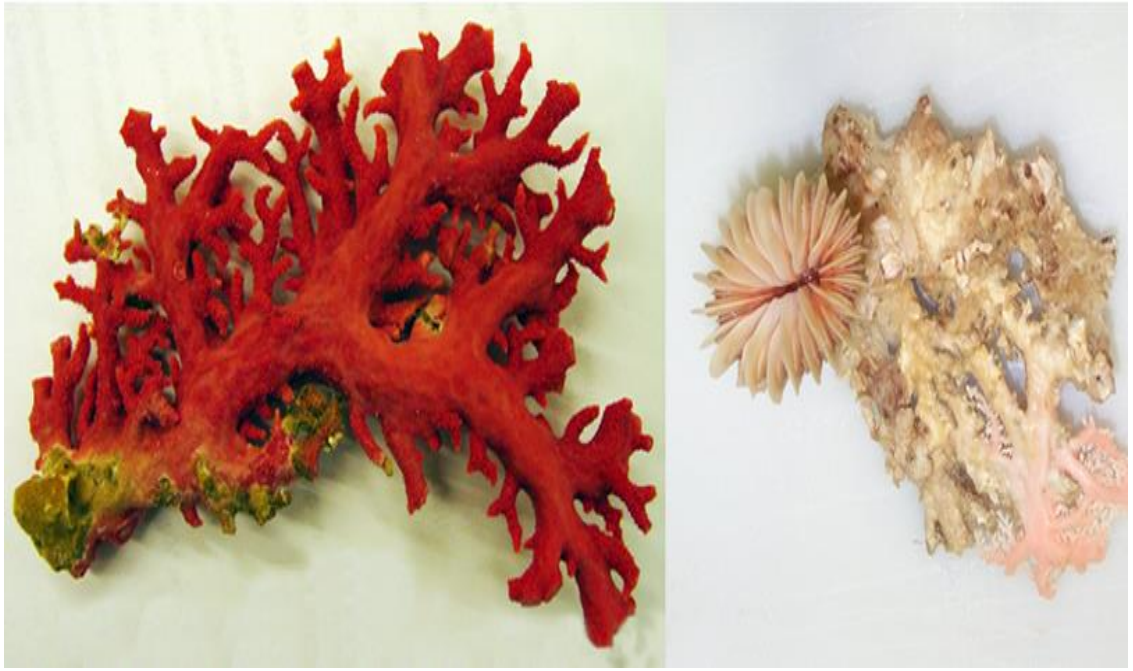
Stony corals (Order Scleractinia)



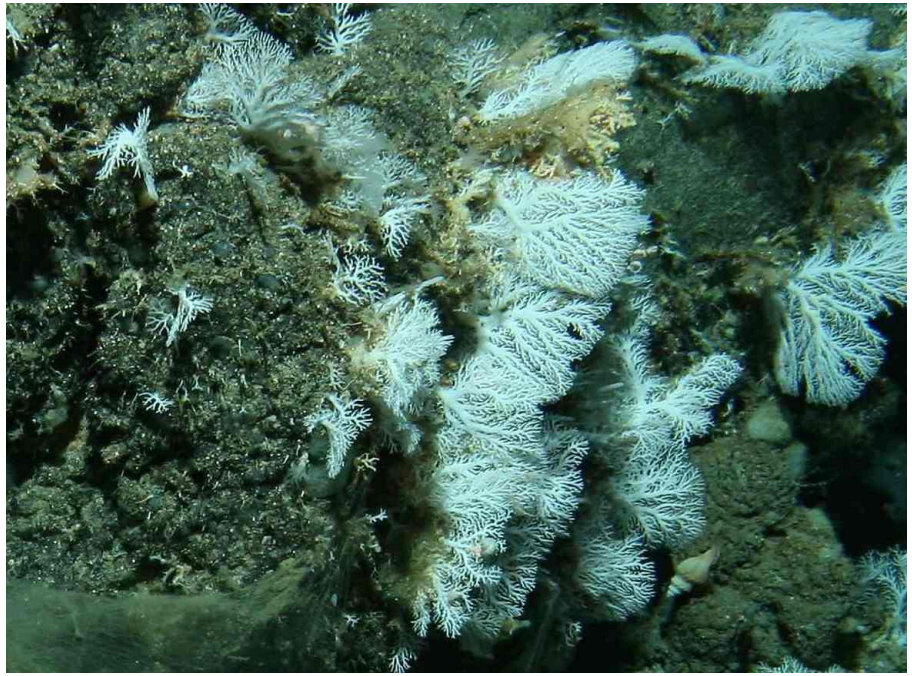
Solenosmilia variabilis & *Caryophyllia* cup coral

Solenosmilia variabilis

Hydrocorals (Order Anthoathecata)



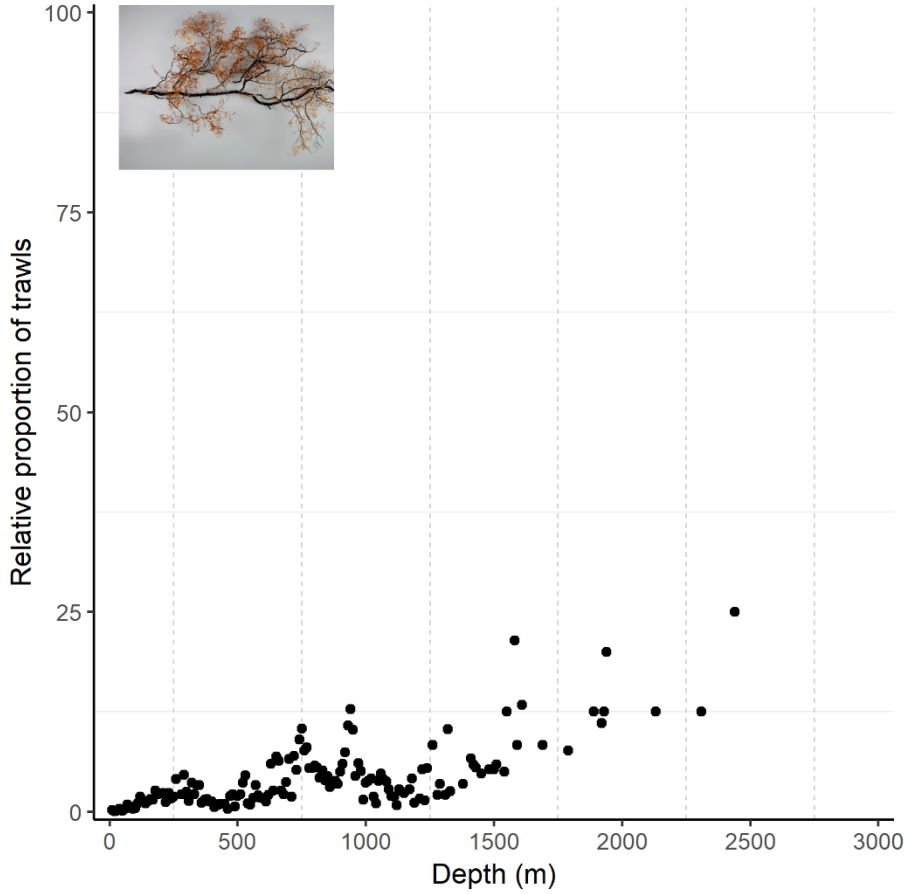
Errina novaezelandiae



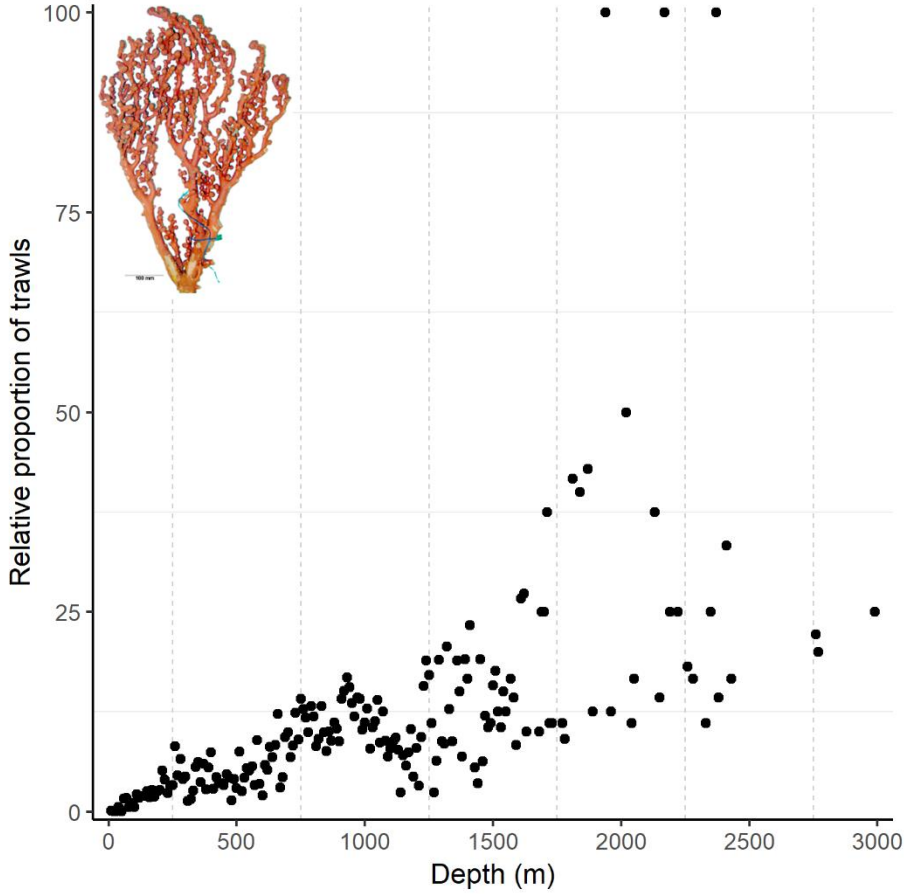
White Stylasterid hydrocorals

Depth distribution by coral group for NZ records

- Black corals



- Gorgonian octocorals



Each point represents the fraction of all sampled stations (in one 10 m depth bin) where any member of the group was recorded, i.e., when trawling at depths >3000 m, there is a 25% chance of an interaction with a gorgonian

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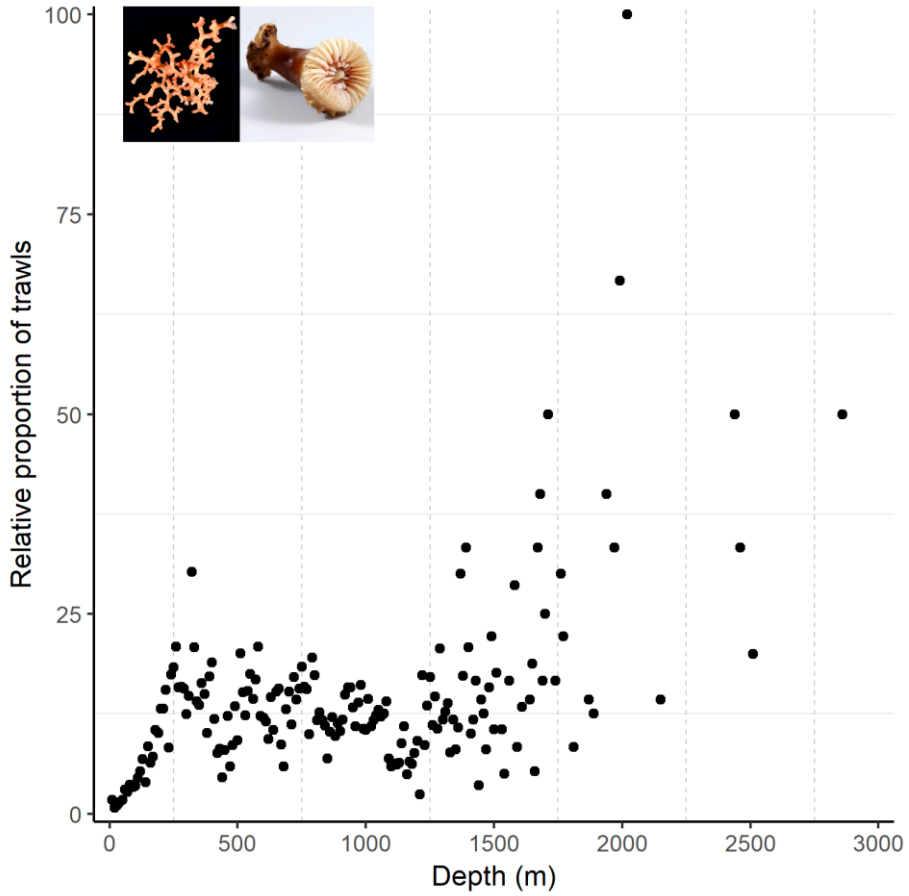
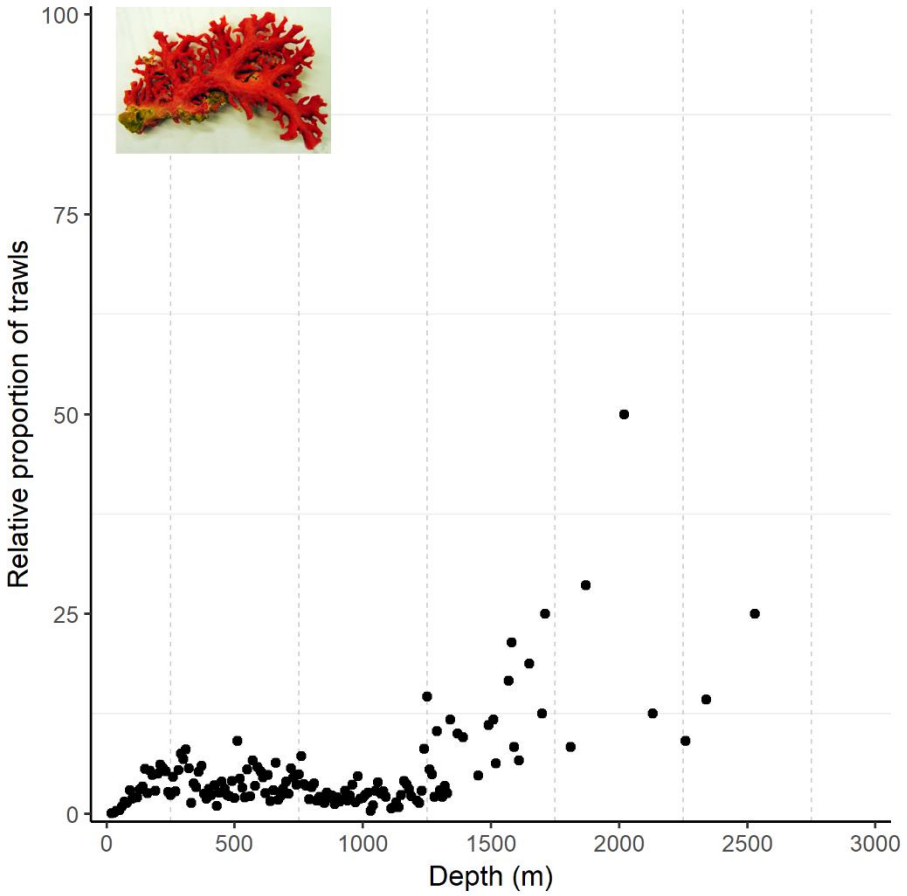
Depth distribution by coral group for NZ records

- Stony corals



- Hydrocorals



Depth distribution in NZ by coral group

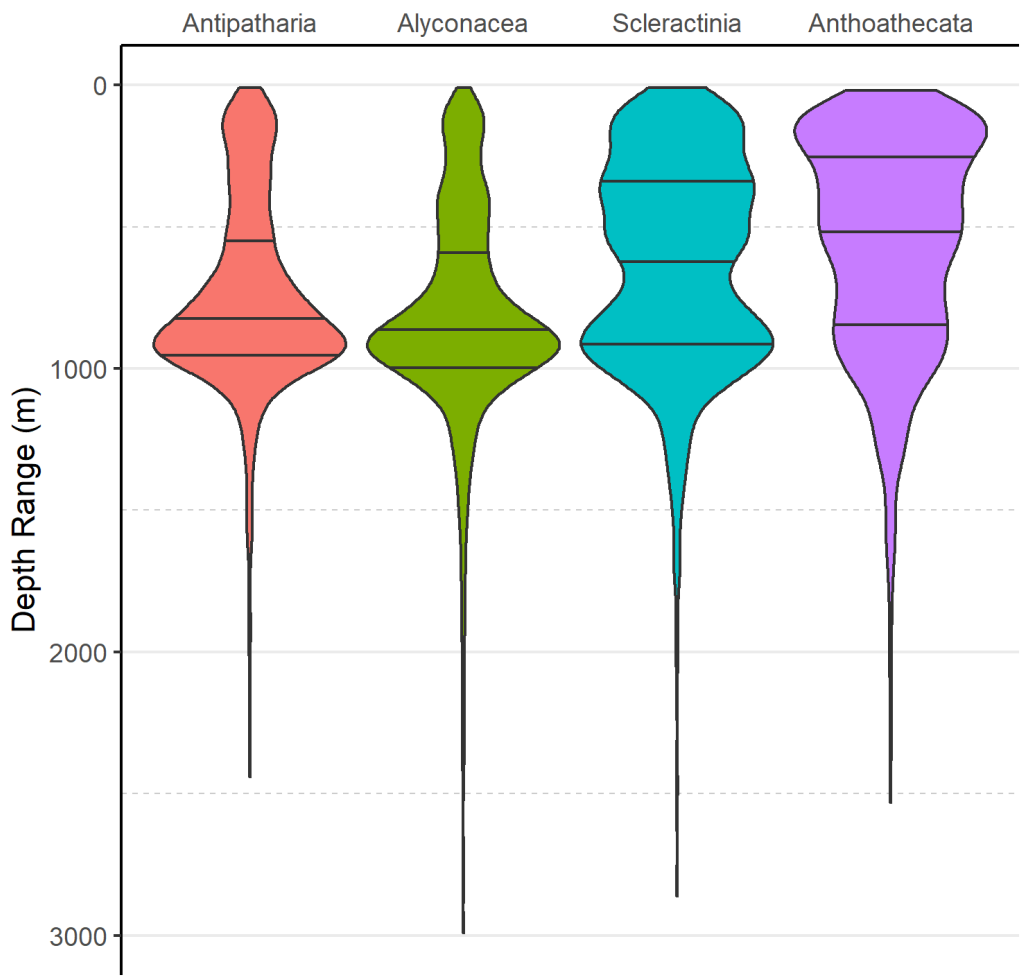
Coral group	*n*	Min depth bin (m)	Max depth bin (m)	Median (50% range, m)
Black corals	1051	10	2440	820 (520-940)
Gorgonian octocorals	2350	10	2990	800 (580-980)
Stony corals	3963	10	2860	600 (320-910)
Hydrocorals	1097	20	2530	500 (210-830)

Depth distribution globally by coral group

Coral group	*n*	Min depth bin (m)	Max depth bin (m)	Median (50% range, m)
Black corals	51 339	10	5000 (6960)	410 (190-1760)
Gorgonian octocorals	226 763	10	5000 (8000)	400 (50-1000)
Stony corals	752 668	10	5000 (7960)	30 (10-50)
Hydrocorals	53 652	10	4710	240 (40-320)

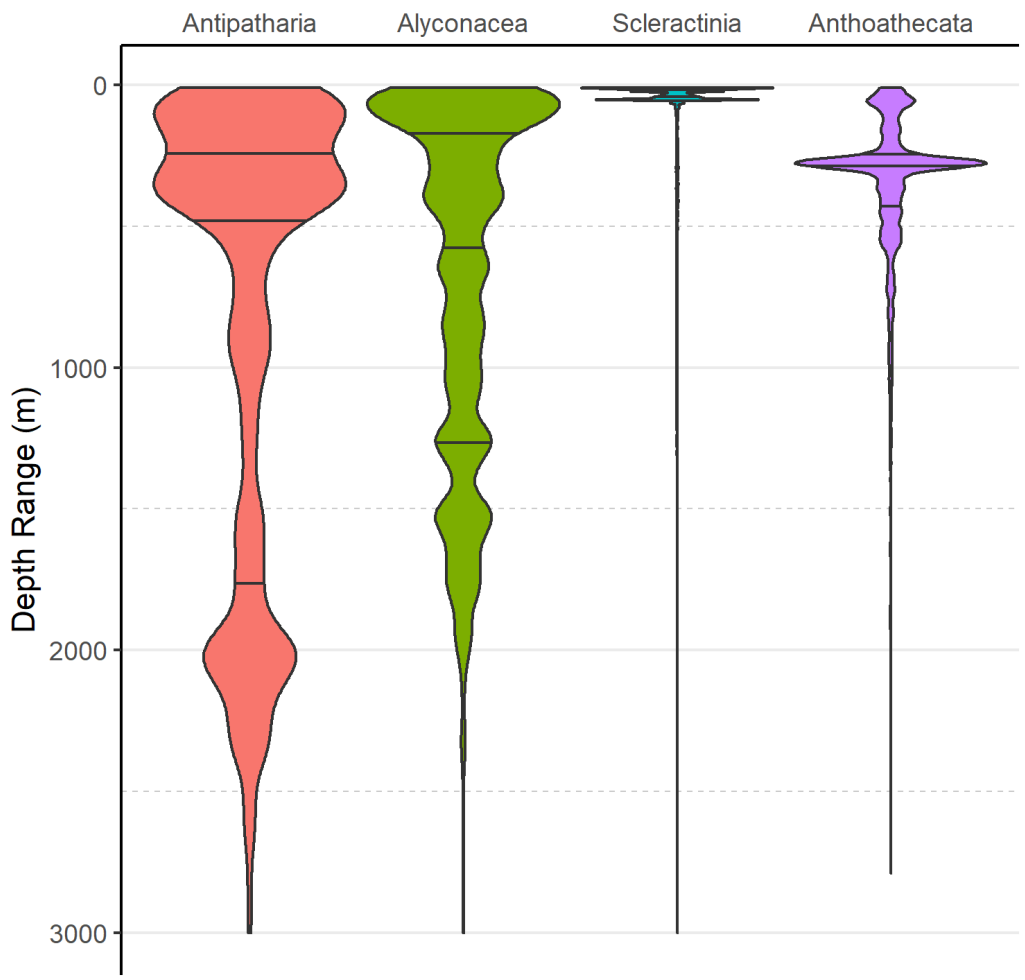
Max depth in brackets represents largest realistic depth record in database; only records <5000 m used here

Depth distribution in NZ by coral group



Data (in 10 m depth bins) where any member of a coral group was recorded, i.e., most NZ records for Antipatharia occur in the plot bulge around 8-900 m

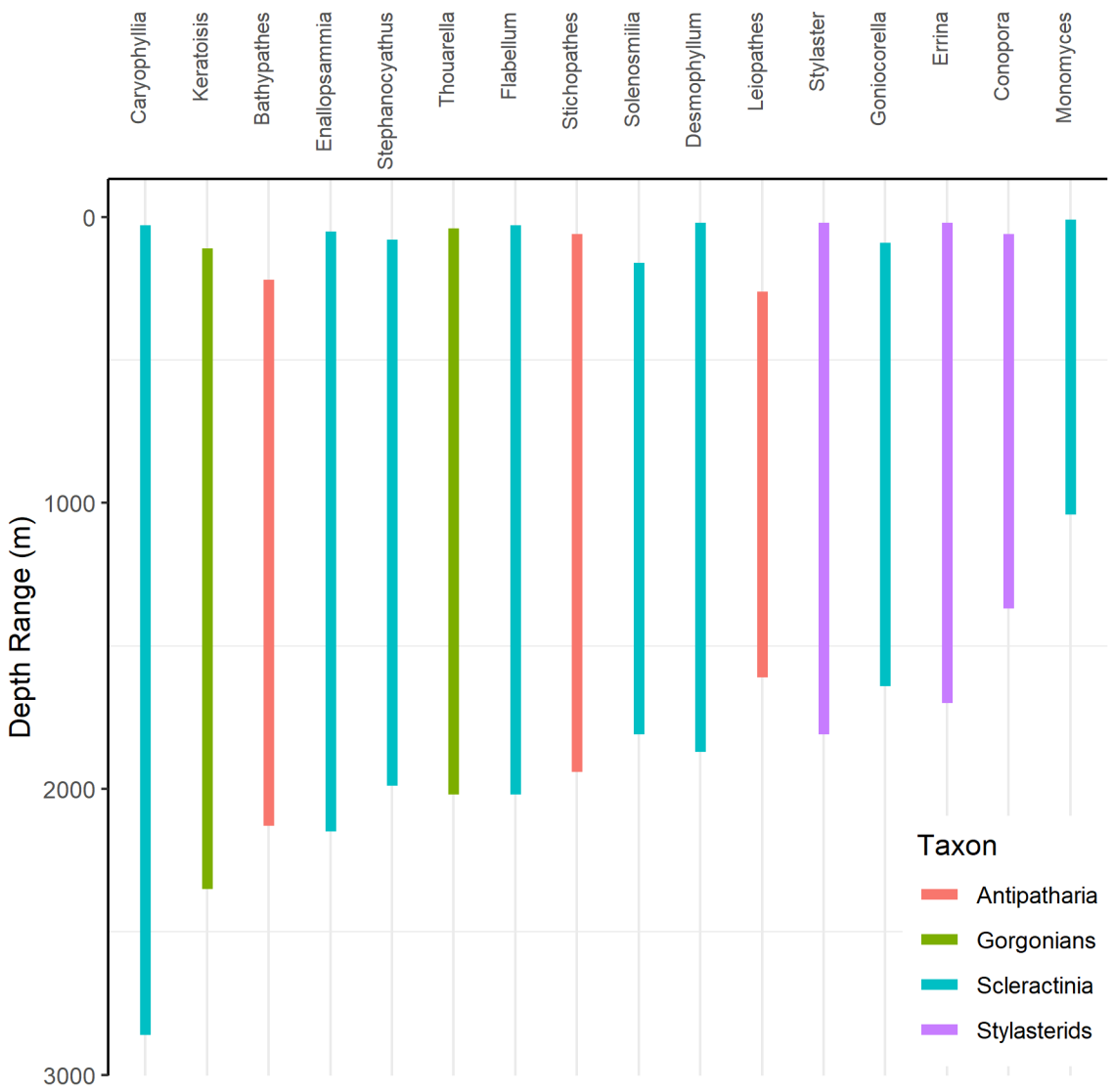
Depth distribution globally by coral group



Data (in 10 m depth bins) where any member of a coral group was recorded, i.e., most global records for Antipatharia occur in the plot bulge < 500 m

For consistency with NZ depth distribution, only records to 3000 m are shown. This represents 99.8% of global records

Depth distribution for most recorded NZ protected coral genera



- Plot for coral records (by genera) where occurrence > 100 across all coral groups
- No black coral (Antipatharia) genera >100; genera with >50 reported

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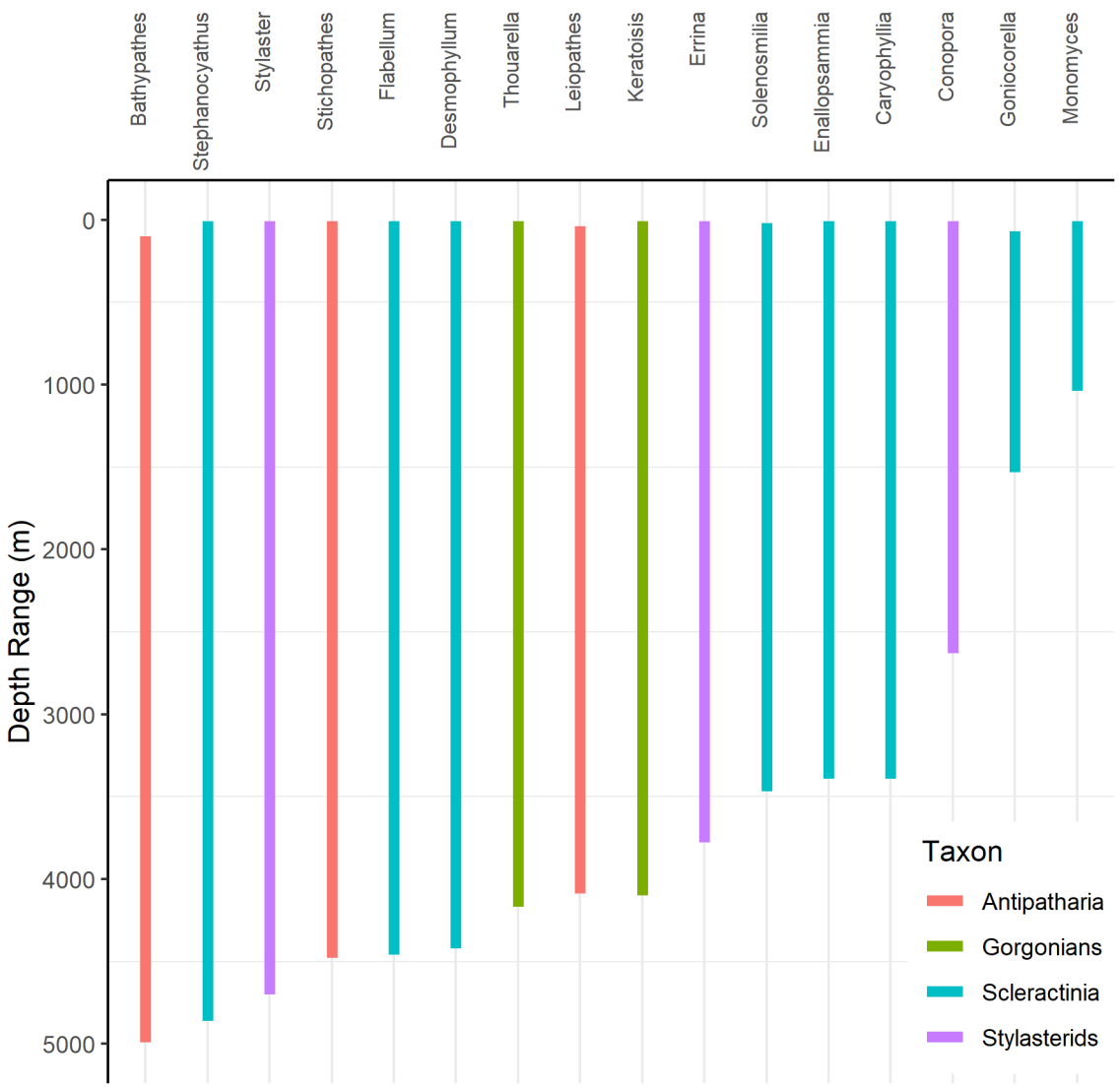
Most recorded NZ coral genera records from global databases



- Depth range of most recorded NZ coral genera (previous slide) from global databases
- Note change in scale of y-axis

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References

- Hintze, J. L., Nelson, R. D. (1998) Violin Plots: A Box Plot-Density Trace Synergism. The American Statistician 52, 181-184
- Lumsden, S.E., Hourigan, T.F., Bruckner, A.W., Dorr, G. (eds.) (2007). The State of Deep Coral Ecosystems of the United States. NOAA Technical Memorandum CRCP-3. Silver Spring MD. 365 p

Acknowledgements

- Jared Bilewitch and Kevin Mackay (NIWA) for assistance with the NZ and global database records

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