

# Seamount Ophiuroids: diversity, extent, reliability and patterns of distribution and endemism



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Brittle star on black coral. J Mallefet



# Outline



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- Ophiuroids
- Seamount ophiuroid faunas in the SW Pacific
  - Community analyses
  - Latitude, longitude, depth
- Seamount endemism
- Seamount species richness
- Impact of mining/dredging
- Future

# Ophiuroids (Brittle-stars)



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*Clarkcoma canaliculata*  
(Sth Aust)



*Amphiophiura confecta*  
(Tasman Sea)



*Ophiarachna incrassata* (coral reefs)

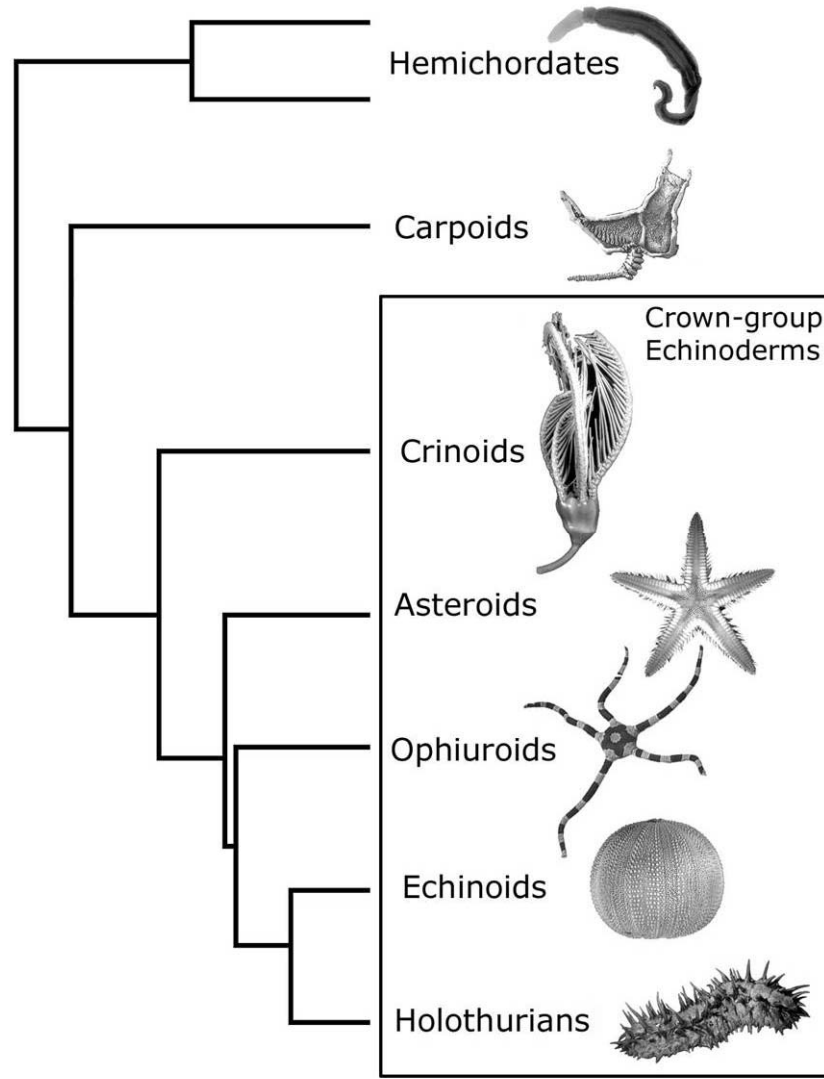


*Conocladus australis* (Sth Aust)



*Ophiopsammus assimilis* (Sth Aust)

# Echinoderms



# Ophiuroids

*Astroporpa australensis*  
(NE NZ, NIWA)



- Reasonable taxonomy
- Diversity/abundance
  - Rich enough for statistical approaches
  - Not too rich to be impossible to process
- Occur in all benthic habitats
- Various life histories:
  - viviparous, lecithotrophic, planktotrophic
  - fissiparous

# Ophiuroid dataset

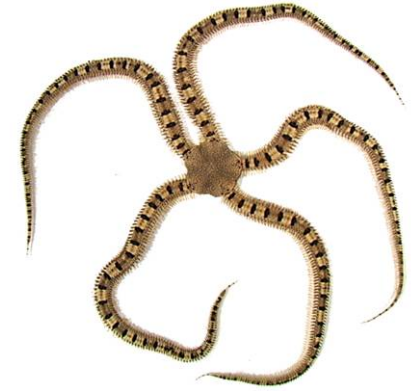
Combined collection data from:

Australia (AM, MV, QM, NTM, SAM, WAM, TM)

NZ (NIWA, NMNZ)

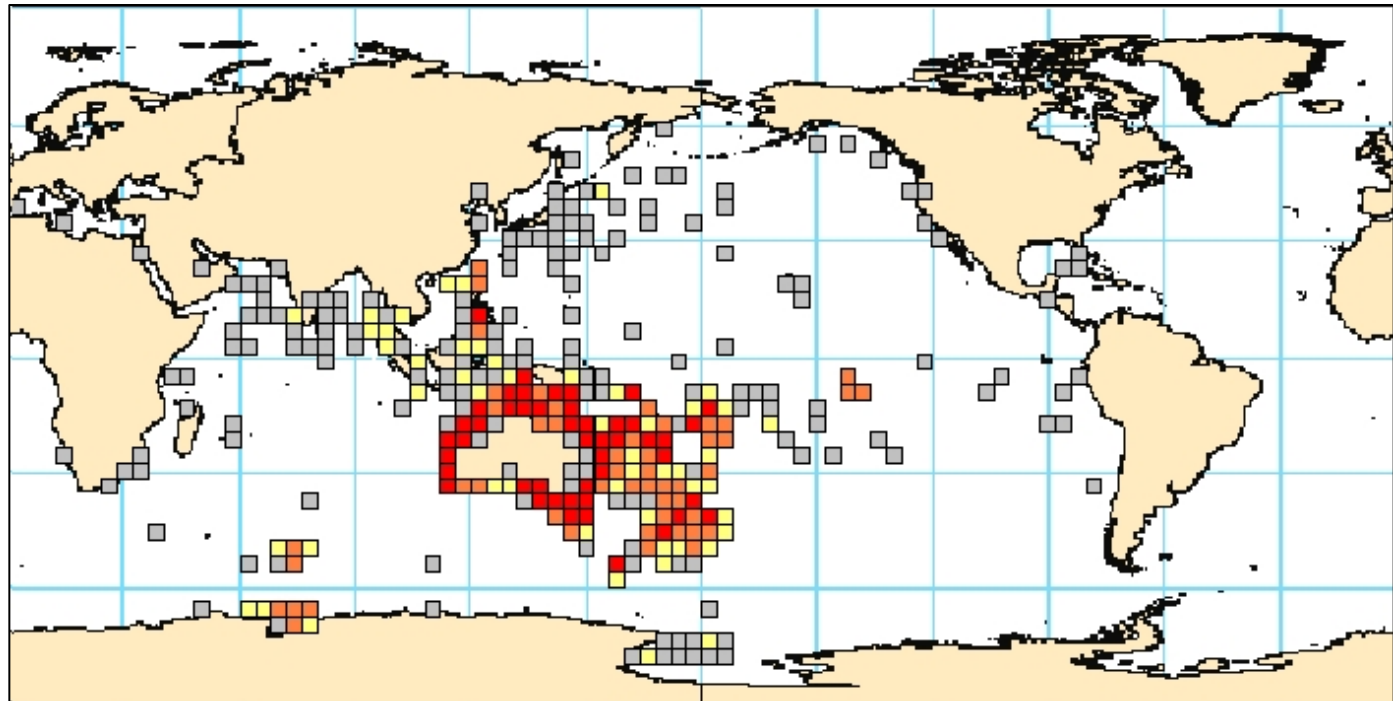
Europe (MNHN, BM, ZMA, ZMUC)

Historical publications



*Ophioneis schayeri*  
(Sth Aust) J Mallefet

All habitats (not just seamounts)



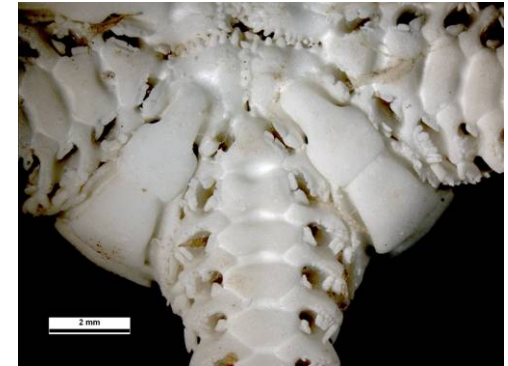
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# Ophiuroid dataset - Reliability



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- Most material identified by a single taxonomist
- Historical identifications checked or reliably illustrated



# Projects



- Ophiuroid bioregionalisation of Australian deep-sea waters (National Oceans Office)

- Macro-ecology of ophiuroids in SW Pacific
- Latitudinal patterns from Arctic – Antarctic
- SW Pacific seamounts



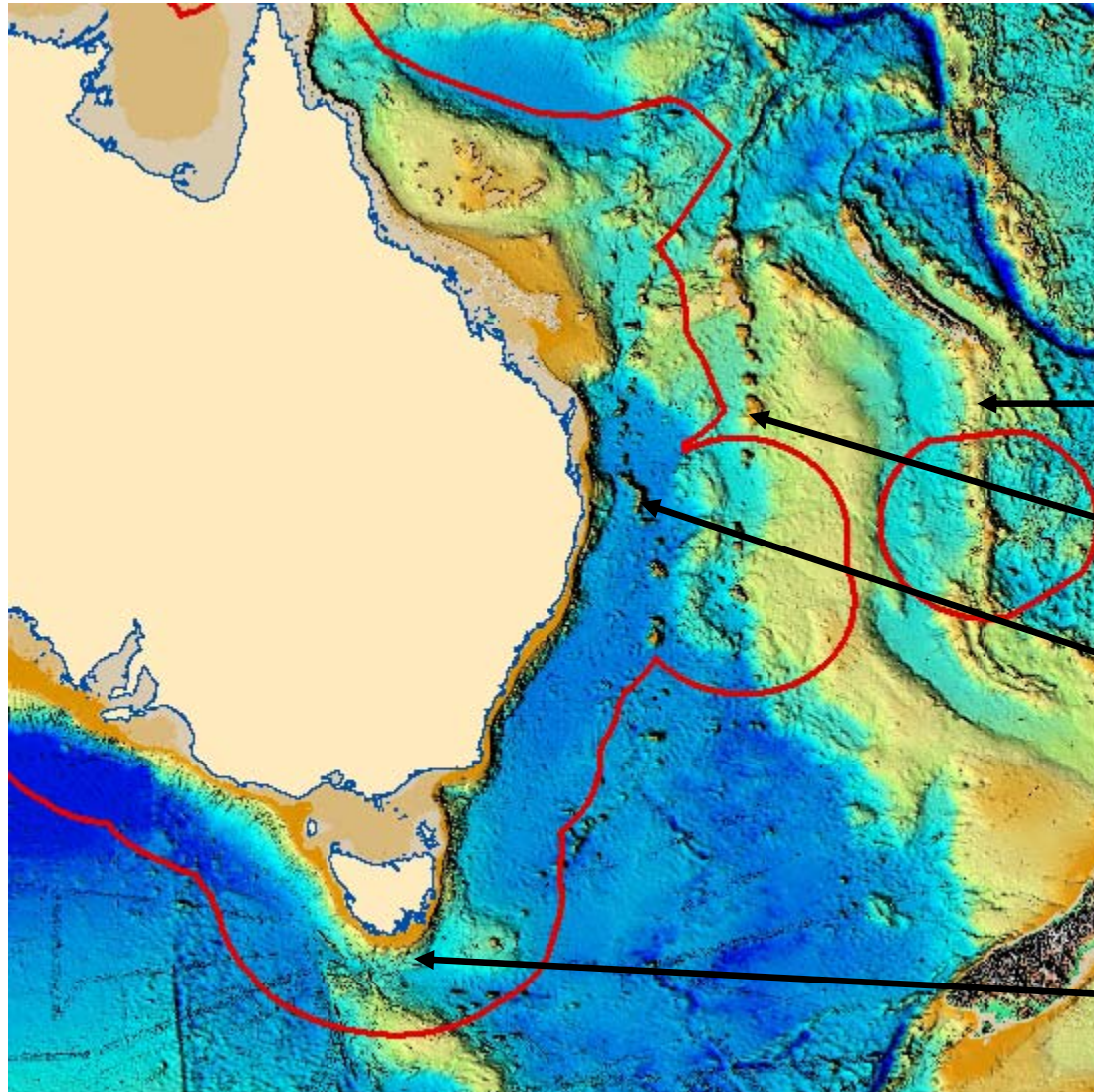
*Ophiomyxa* sp nov  
(NZ seamounts - NIWA)



# SW Pacific Seamounts



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**Norfolk**

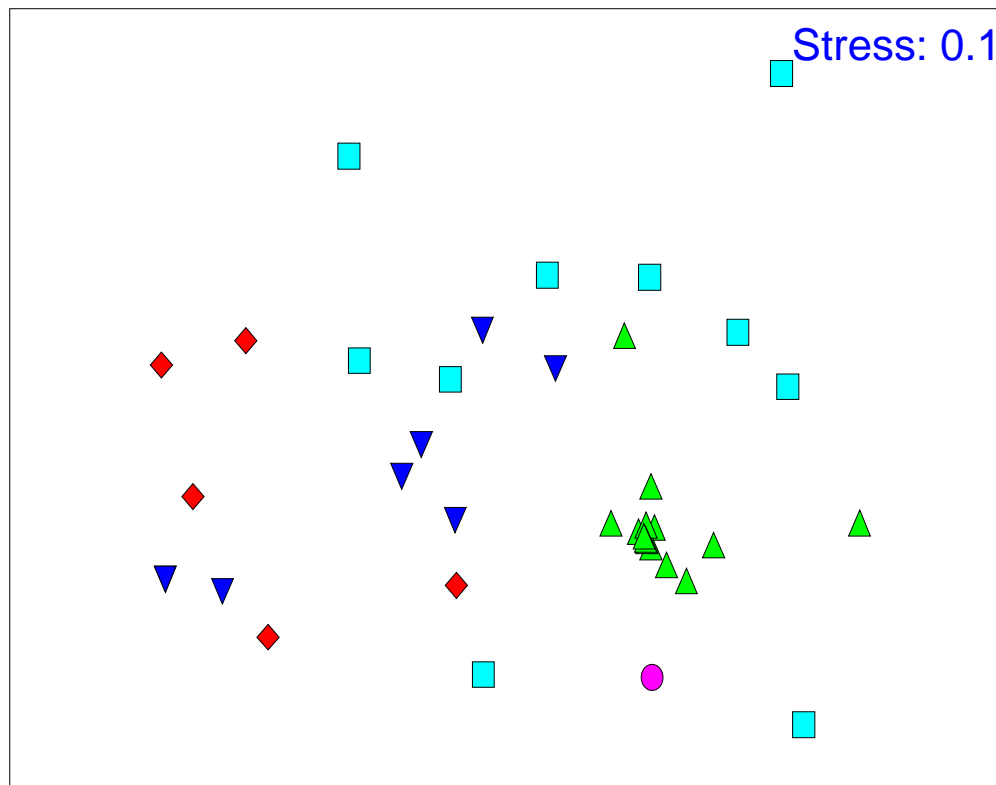
**Lord Howe**

**Tasmanid**

**Tasmanian**

# Results – multivariate analysis

## *Seamount regions*



- ▲ Tas seamounts
- ▼ Lord Howe Rise
- Norfolk Ridge
- ◆ Tasmantid sear
- SW WA

ANOSIM Global statistic:  $R = 0.579$

# Results

## – Environmental matching



- BIO-ENV analysis

Longitude:  $\rho = 0.419$

Latitude:  $\rho = 0.398$

Depth:  $\rho = 0.366$

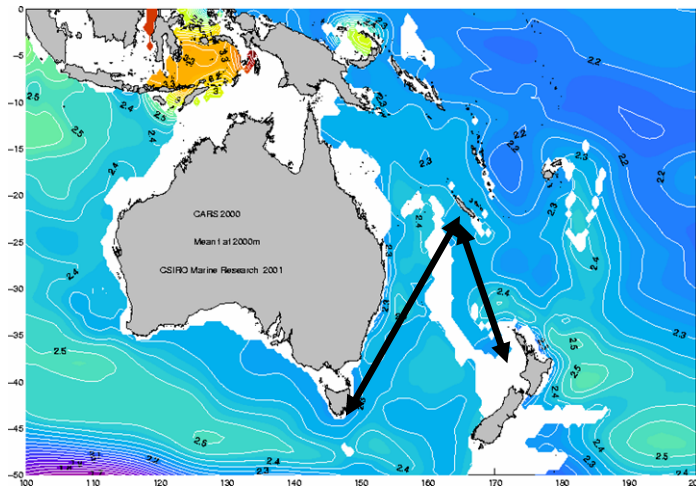
- Location and depth - important



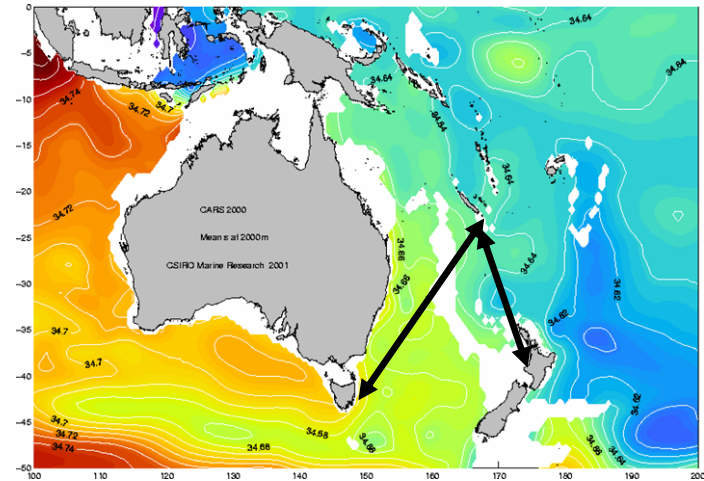
*Ophiothrix proteus* – Lizard Is, G. Rouse

# Results - latitude

Only 10-15% of fauna is common to  
New Caledonia and Tasmania/NZ  
at depths of 200-2000 m



**Temperature - 2000m**  
2.3-2.4°C

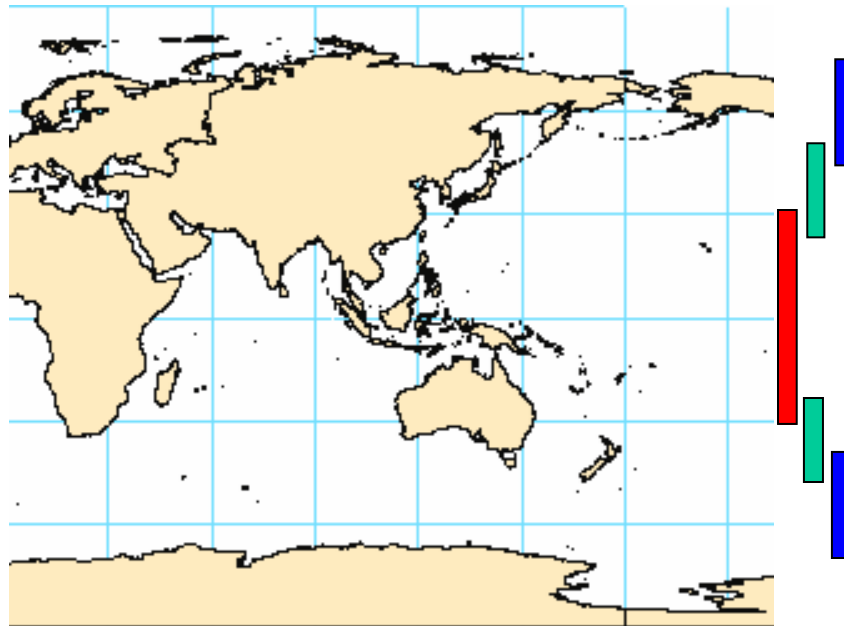


**Salinity - 2000m**  
34.64-34.68

# Results – latitudinal study 200-1500 m



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??

N. temperate

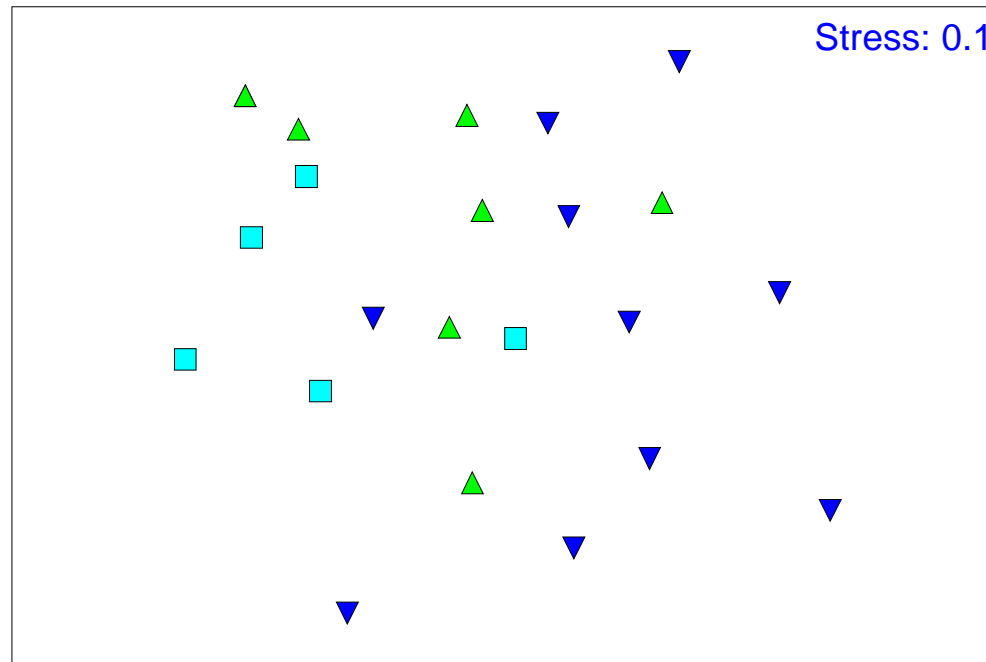
Tropical

S. temperate

Southern Ocean

# Results - longitude

*Seamount longitude*



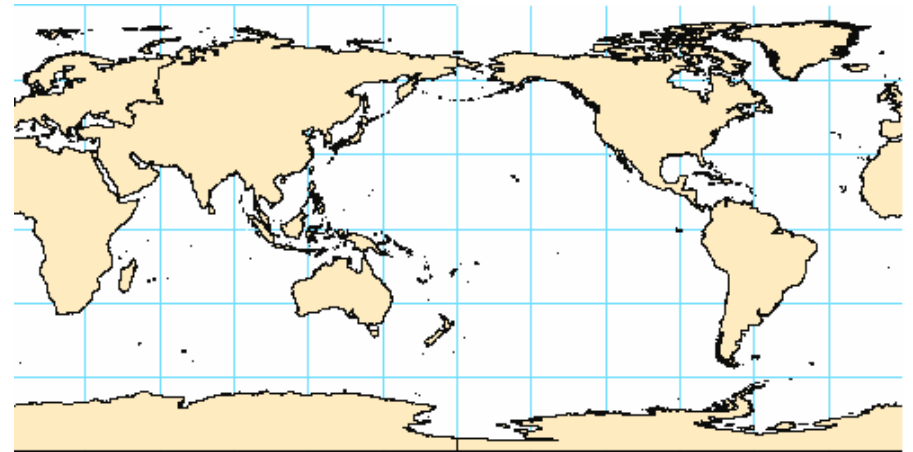
- ▲ Lord Howe Rise
- ▼ Norfolk Ridge
- Tasmantid seamou

Richer de Forges et al. (2000). Nature 405

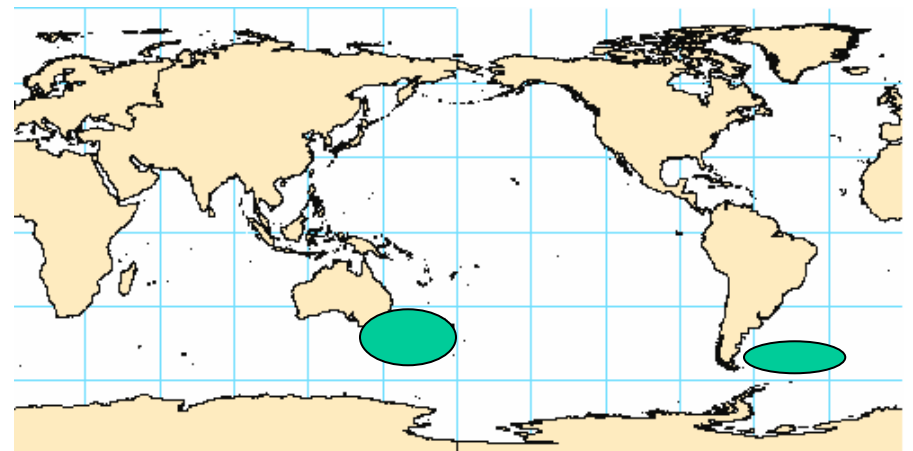
also found significant differences between these regions

# Longitudinal variation

- Sampling artefact?
- Patchiness at biogeographic scales?
- Cryptic species?



*Ophiacantha fuscina*



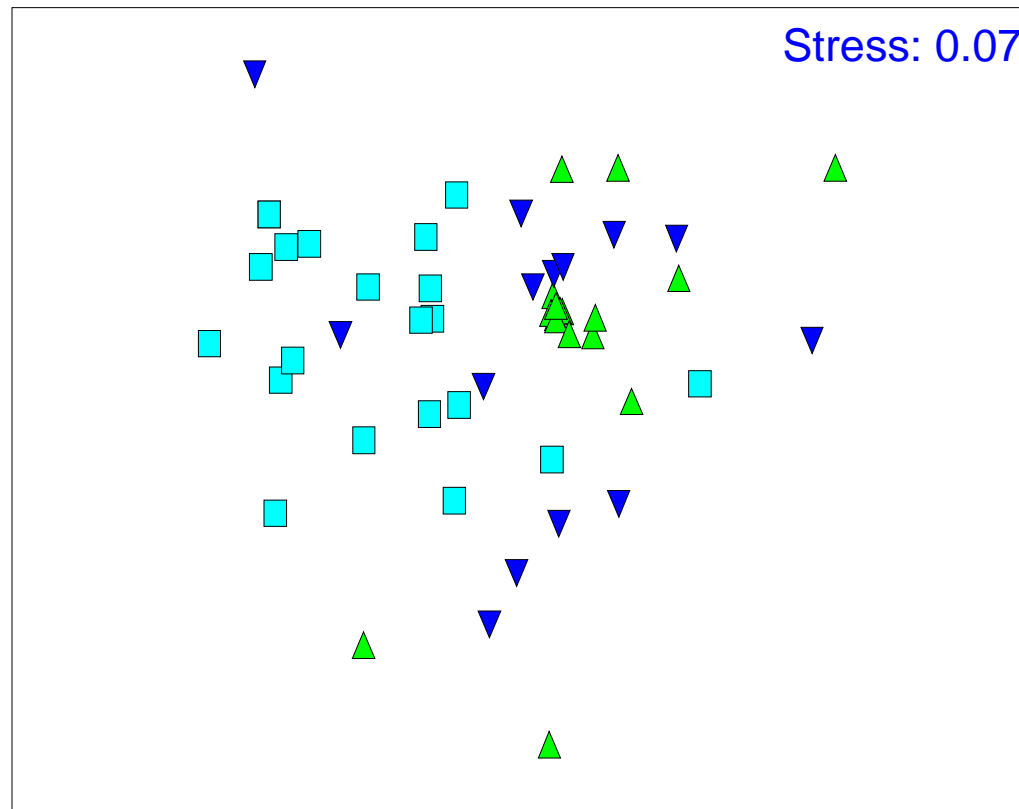
*Amphiura magellanica*

# Results - depth

*Seamount depth*



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▲ 2000

▼ 1000

■ 500

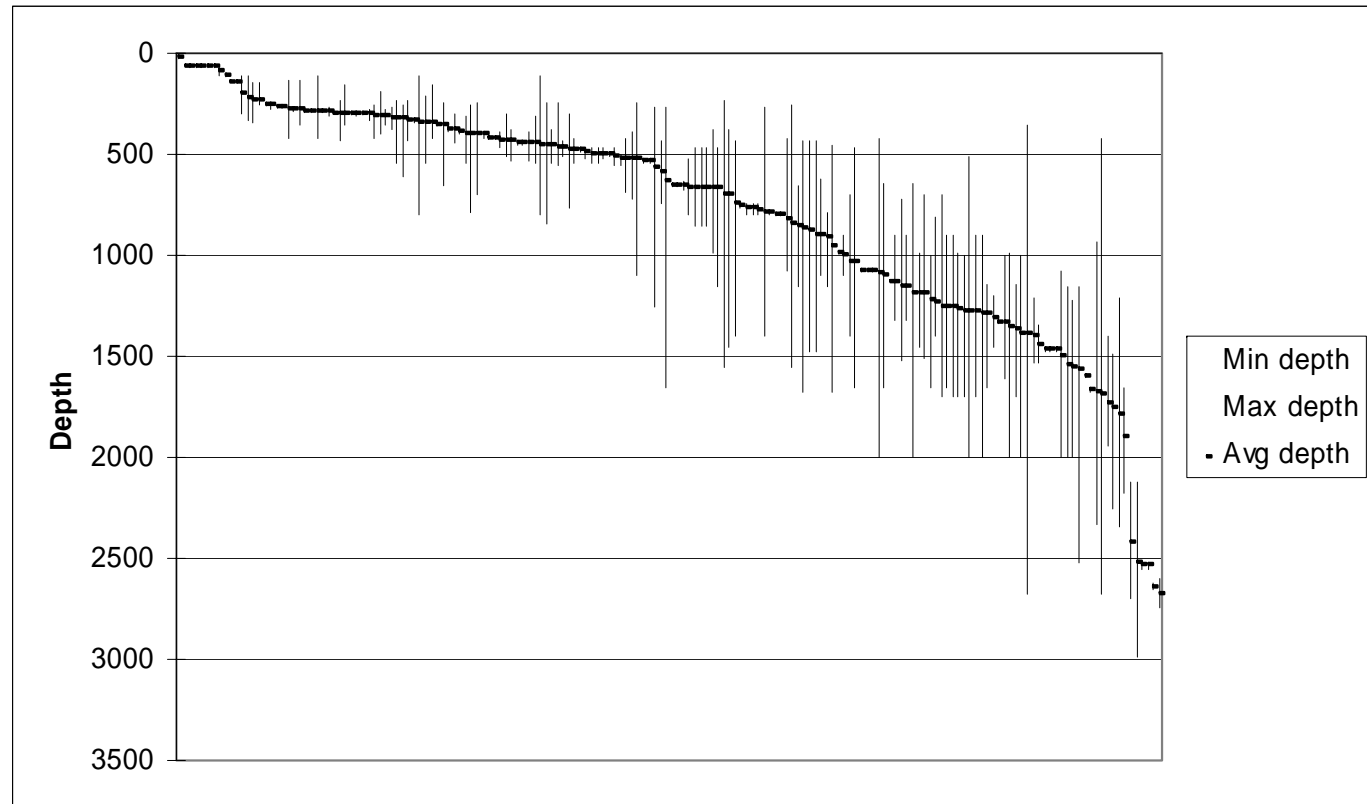


# Results – depth range

- Seamount species bathymetric range increases with depth



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# Summary: E Indo-W Pacific

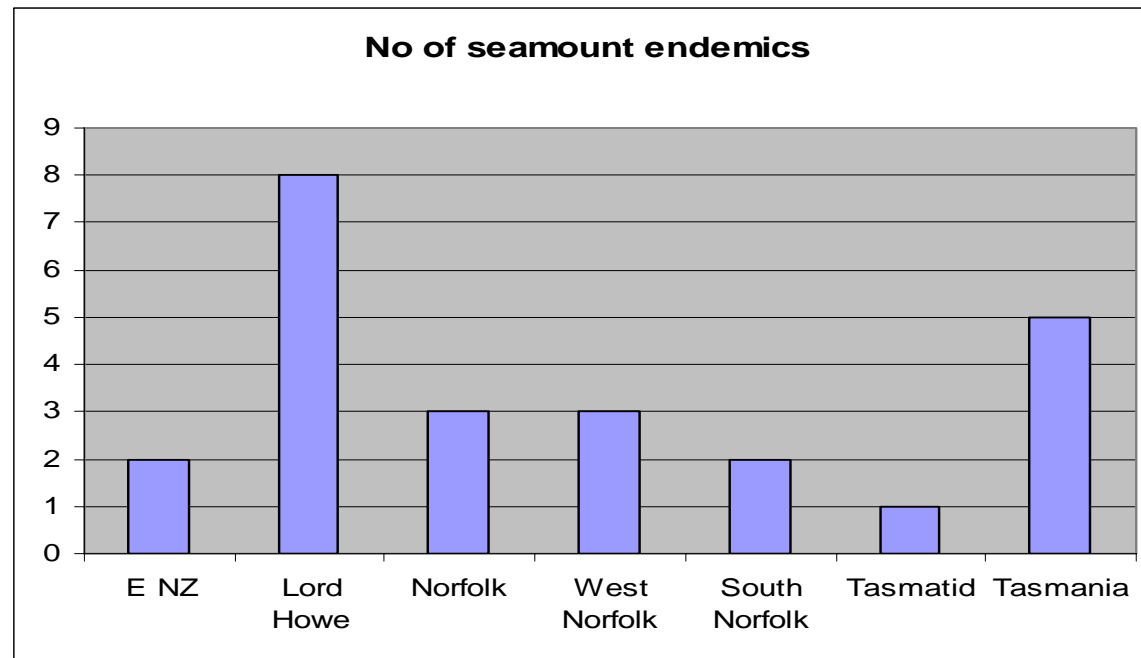


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- Latitude - biogeographic boundaries
- Longitude - patchiness at regional to local scales
  - Ecology (especially depth)
  - History

# Seamount endemics

- 191 seamount ophiuroids in SW Pacific
- 23 only recorded from seamounts (12%)
- Only 3 described, 12 from a single sample
- All but one restricted to one region



# Seamount endemics

- Many seamount species also found on along continental margins



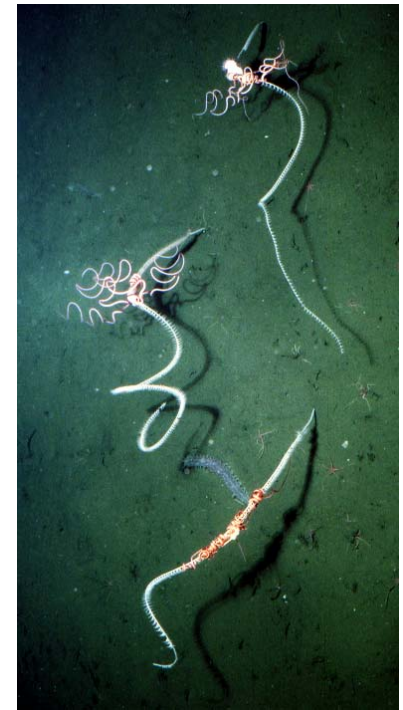
- Seamount habitats include
  - Hard & soft substrates
  - Epifauna & cryptofauna



*Solenosmilia*

# What is a species?

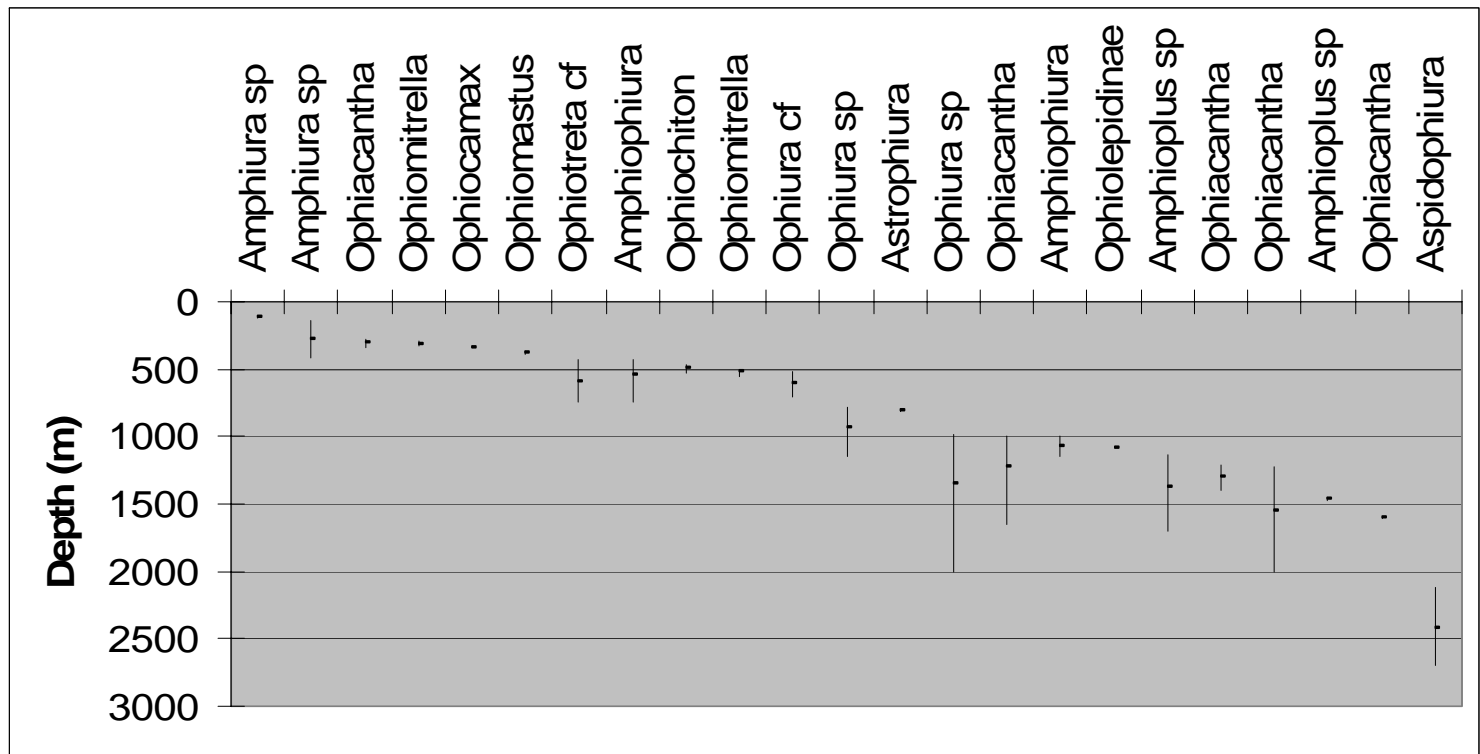
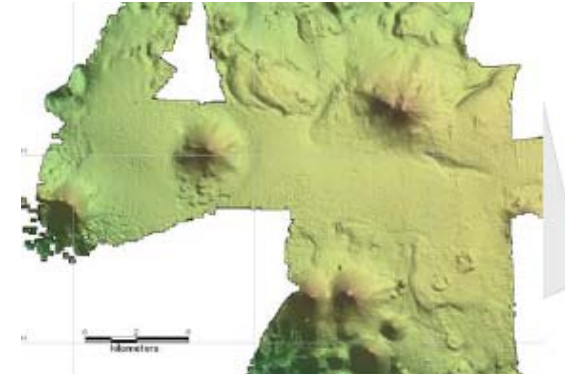
- Current analyses based on morpho-species
- Genetic studies of shallow water species
  - numerous cryptic species
  - sympatric, various ages
- Fragmented habitat
  - seamounts – millions years
  - epifauna
- Limited dispersal capacity
  - Viviparity/lecithotrophy
  - Fissiparity



*Asteronyx loveni* – Japan

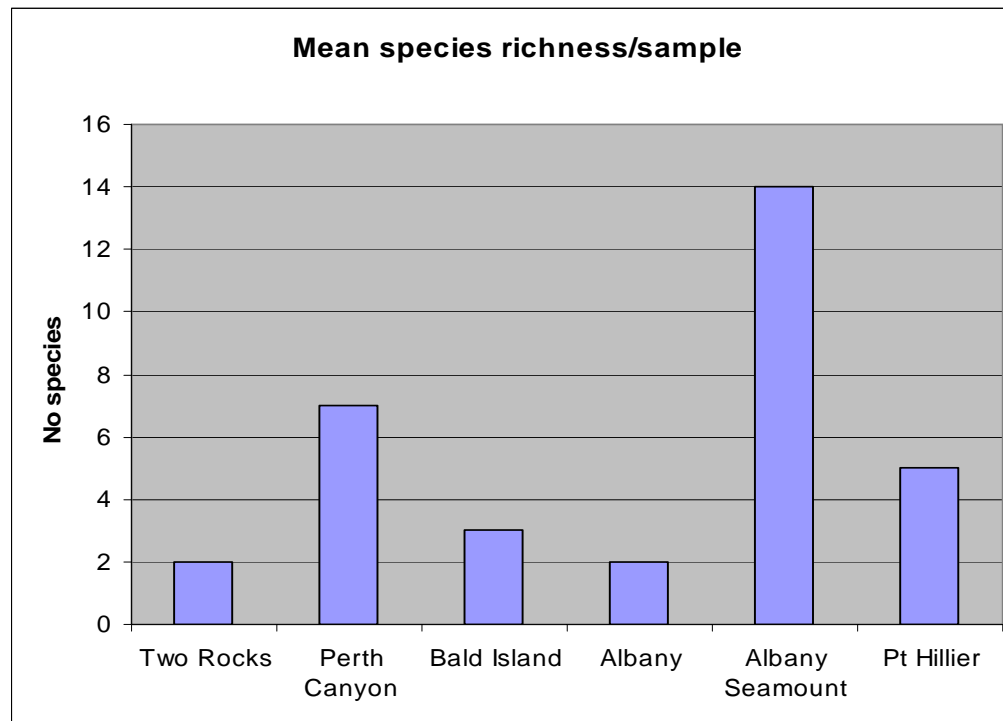
# Seamount endemics

- Expect endemism to decrease with depth
- Not restricted to shallow water



# Species richness

Species richness is higher in *Solenosmilia* beds on seamounts.



# Summary



- Communities change with latitude, longitude & depth
- Seamount fauna in SW Pacific includes
  - Many continental species
  - Some endemics
- At all depths
- Further surveys ↓ Genetics ↑
- Seamounts often species rich





# Dredging/mining impact

- Destruction of slow-growing sessile animals
- Removal of habitat
- Damage to deeper habitat – rock falls, tailings



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# Restoration

- Limited dispersal capacity
  - infrequent dispersal events
- Longevity – species and communities
- Re-colonisation from local refuge habitats
  - habitat corridors on every seamount (>30%)

# Future studies - baseline data



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- Genetic studies
  - what are morpho-species?
  - choose taxa with care?
  - bar code of life
- Taxonomic specialists required
  - para-taxonomists unable to deal with unknown fauna from 'voyage of discoveries'
  - need to compare animals, examine types etc
  - prepare image catalogs