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

Dr Tim O’Hara
Senior curator of marine invertebrates
Museum Victoria
Australia

Brittle star on black coral. J Mallefet
Outline

• Ophiuroids
• Seamount ophiuroid faunas in the SW Pacific
  — Community analyses
  — Latitude, longitude, depth
• Seamount endemicity
• Seamount species richness
• Impact of mining/dredging
• Future
Ophiuroids (Brittle-stars)

*Clarkcoma canaliculata* (Sth Aust)

*Amphiophiura confecta* (Tasman Sea)

*Ophiarachna incrassata* (coral reefs)

*Conoclus australis* (Sth Aust)

*Ophiopsammus assimilis* (Sth Aust)
Echinoderms

- Hemichordates
- Carpoids
  - Crinoids
  - Asteroids
  - Ophiuroids
  - Echinoids
  - Holothurians
Ophiuroids

• 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

Astroporpa australensis
(NE NZ, NIWA)
Ophiuroid dataset

Combined collection data from:
Australia (AM, MV, QM, NTM, SAM, WAM, TM)
NZ (NIWA, NMNZ)
Europe (MNHN, BM, ZMA, ZMUC)
Historical publications

All habitats (not just seamounts)
Ophiuroid dataset - Reliability

- 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

Norfolk

Lord Howe

Tasmanid

Tasmanian
Results – multivariate analysis

Seamount regions

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

??
N. temperate
Tropical
S. temperate
Southern Ocean
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

Stress: 0.07
Results – depth range

• Seamount species bathymetric range increases with depth
Summary: E Indo-W Pacific

- 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 is higher in *Solenosmila* beds on seamounts.
Summary

• Communities change with latitude, longitude & depth

• Seamount fauna in SW Pacific includes
  • Many continental species
  • Some endemics
    At all depths

• Seamounts often species rich
Dredging/mining impact

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

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

- 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