



Long term stability of coastal molluscan fisheries resources and biodiversity aided by effective spatial and temporal management intervention

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Where are we talking about?



Summary of this talk

- Background

- Western Australia's coastal and marine ecosystems are strongly influenced by local oceanography subject to global climate forcing
- Intertidal limestone platform reefs are important for biodiversity and fisheries
- Concentration and growth of coastal population in Australia puts pressure on coastal resources

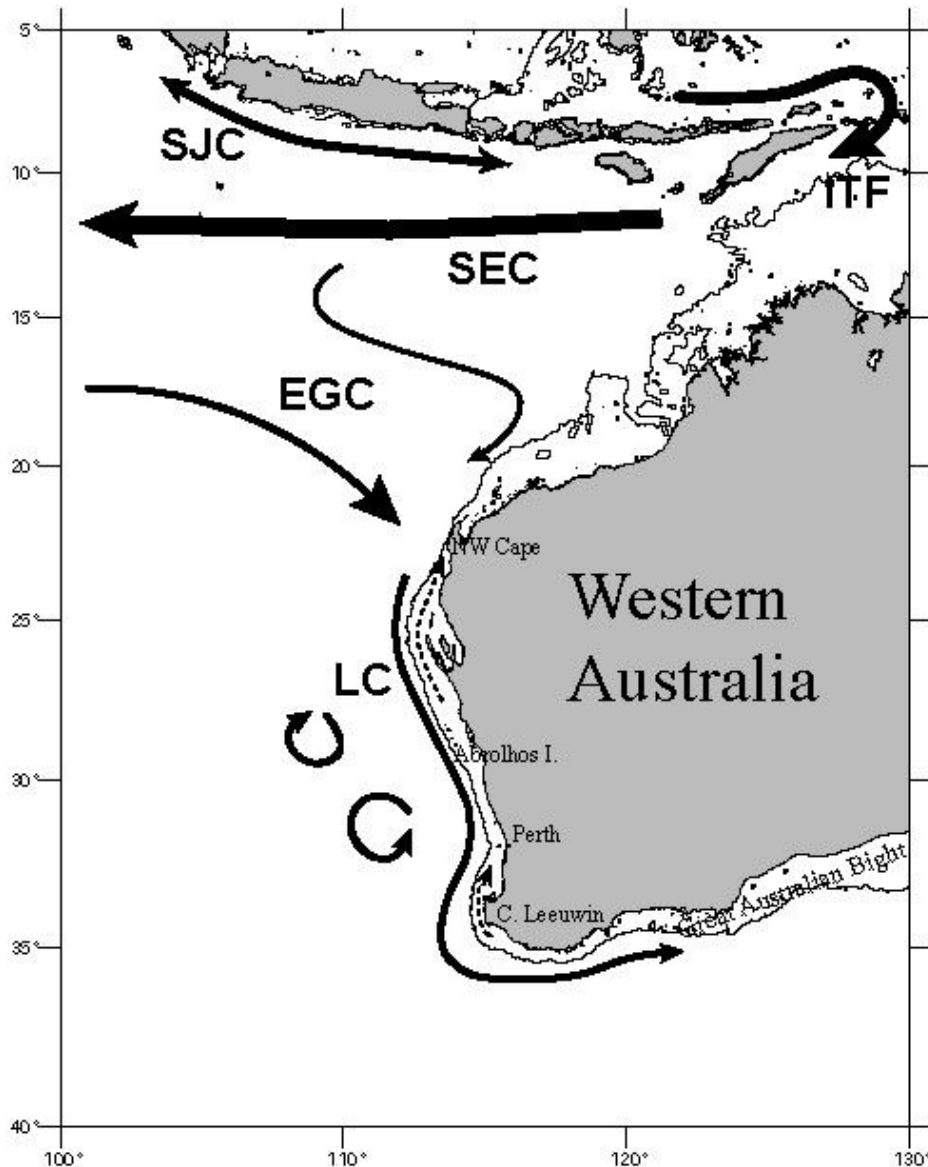
- Repeated Study after 25 years using transects/quadrats

- Patterns of mollusc biodiversity compared between reefs and reef habitats over 25 years
- Abundance and size of abalone compared between reefs

- Discussion

- Considers the success or otherwise of changes in biodiversity protection and fisheries management regulations over 25 years

Regional Currents in the southeast Indian Ocean



ITF – Indonesian Throughflow

SEC – South Equatorial Current

SJC – South Java Current

EGC – Eastern Gyral Current

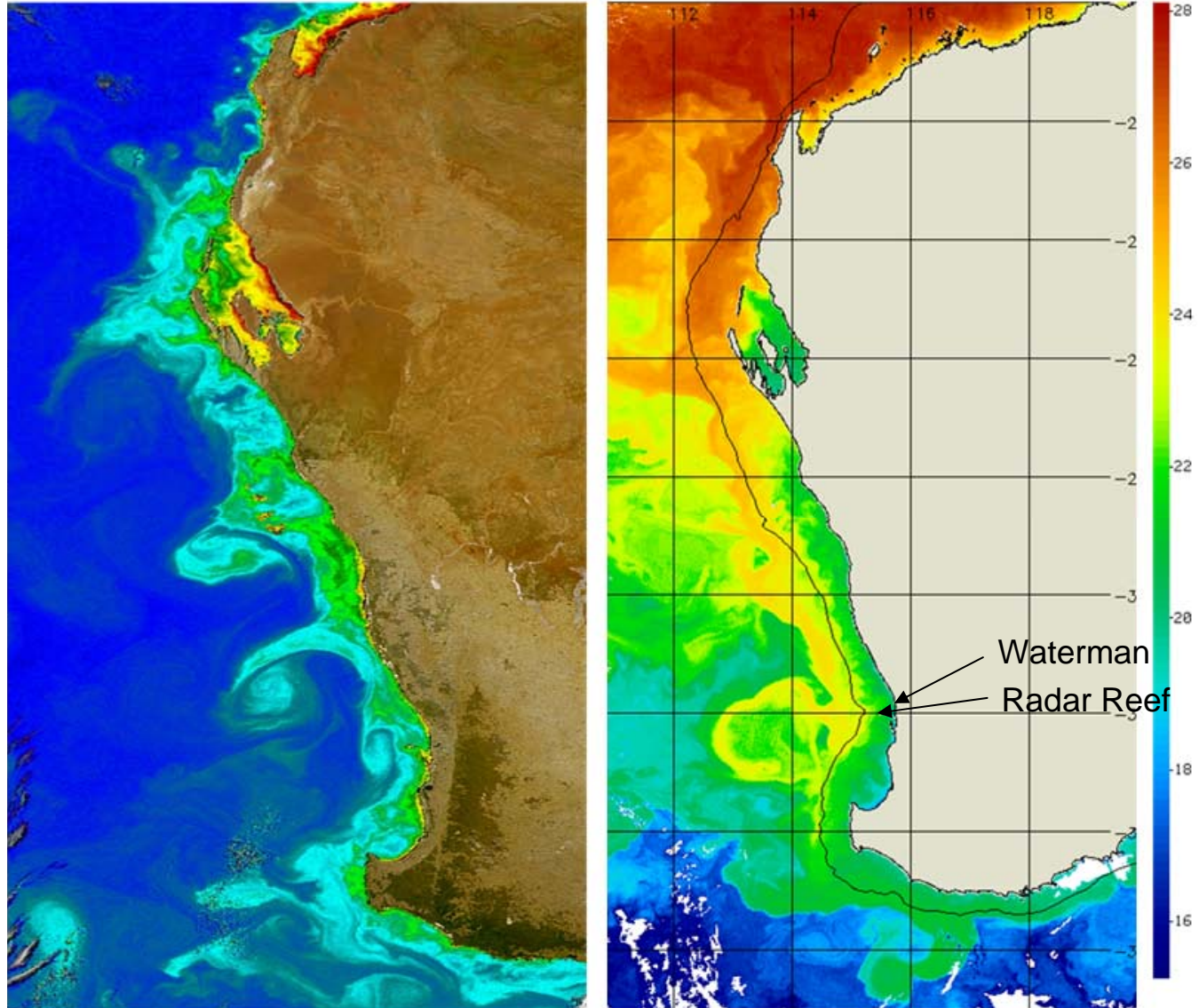
LC – Leeuwin Current

Leeuwin current dominates local oceanography in south east Indian Ocean

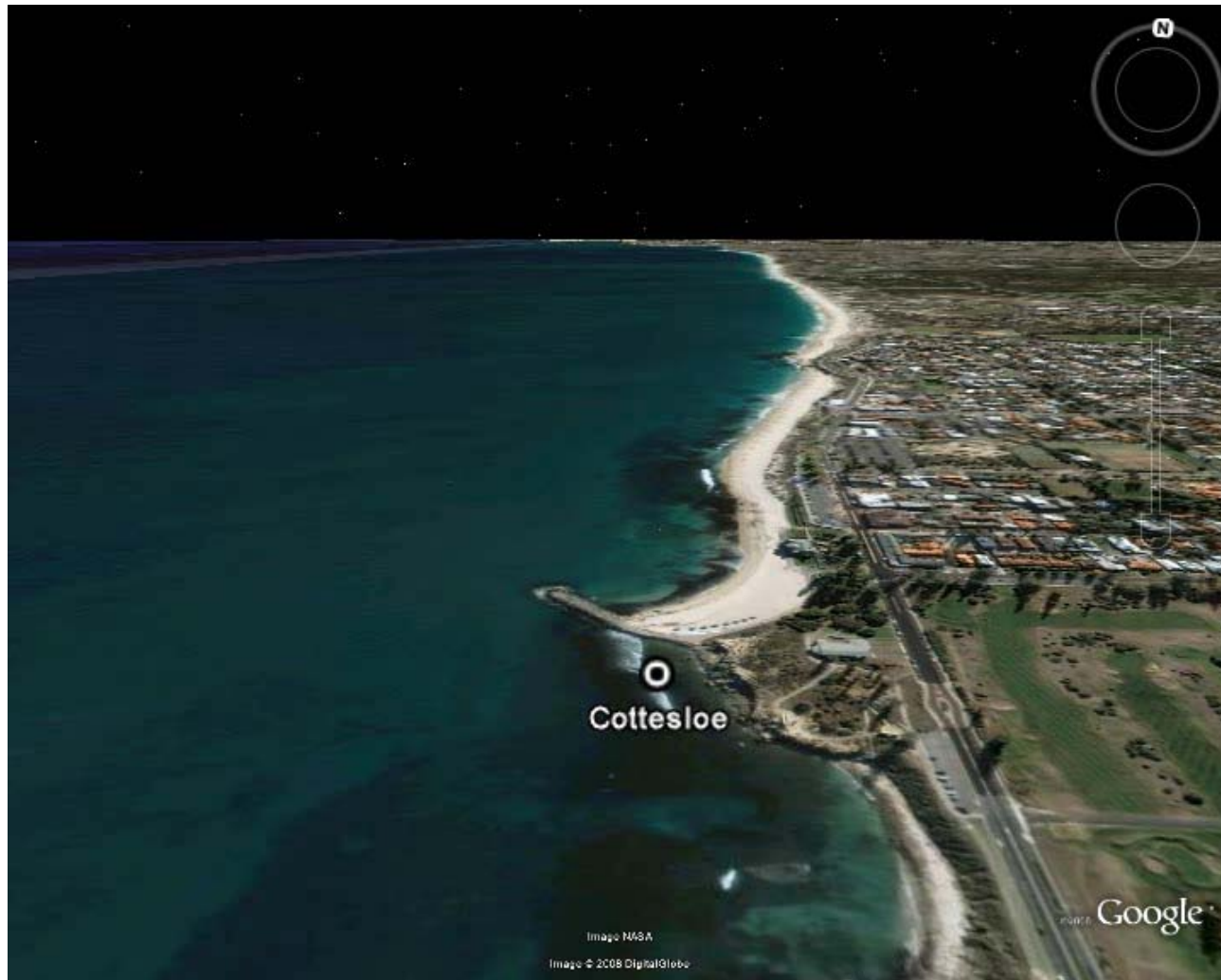
Leeuwin current brings warm tropical water along the continental shelf

Flows stronger in winter maintaining higher temperatures

Strongly influenced by ENSO (flow weaker in El Nino years)

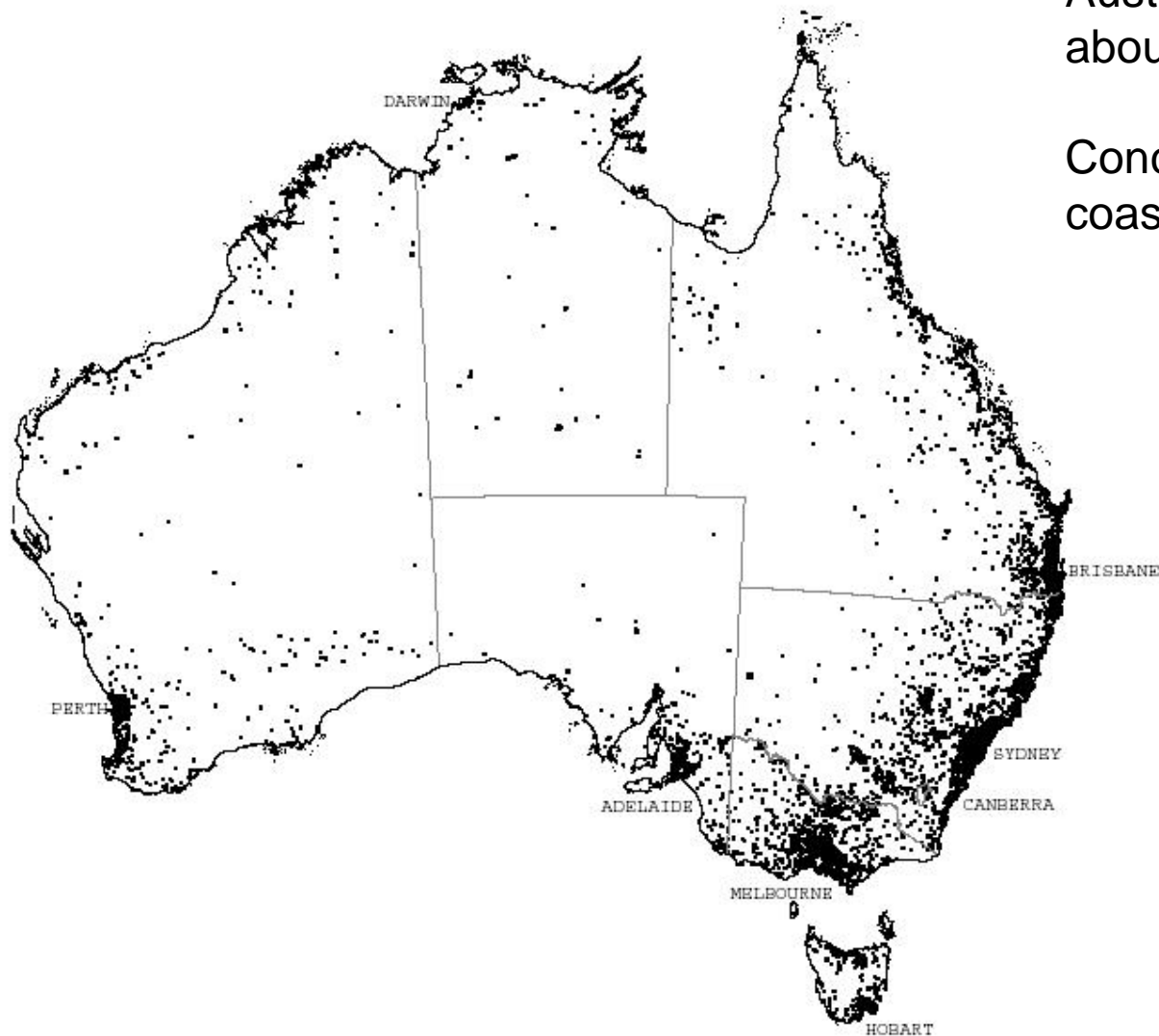


Perth's sandy beaches and limestone reefs



Australian Population

Population distribution^a, Australia, 2000

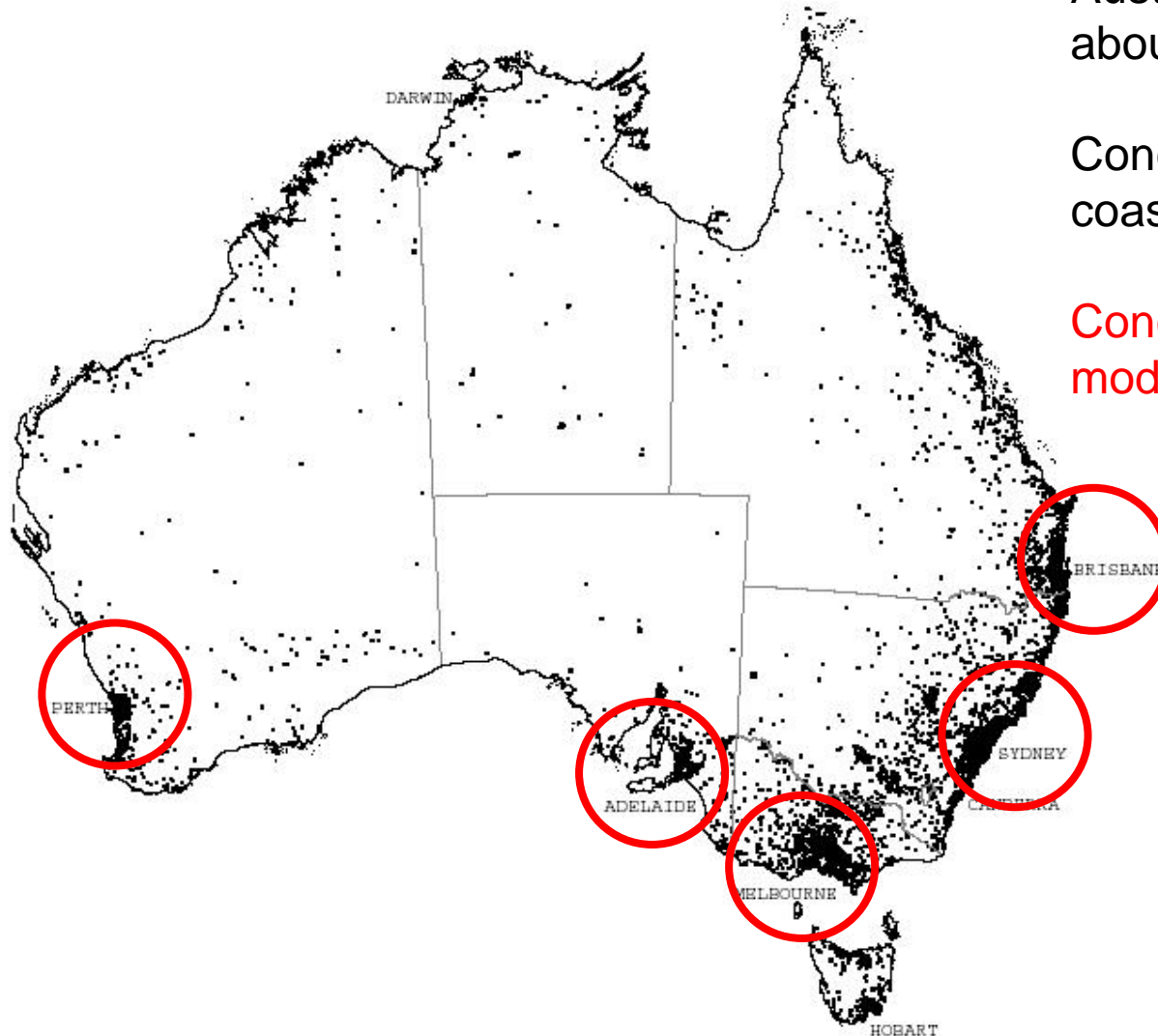


Australia's population
about 21,283,000

Concentrated on the
coast

Australian Population

Population distribution^a, Australia, 2000



Australia's population
about 21,283,000

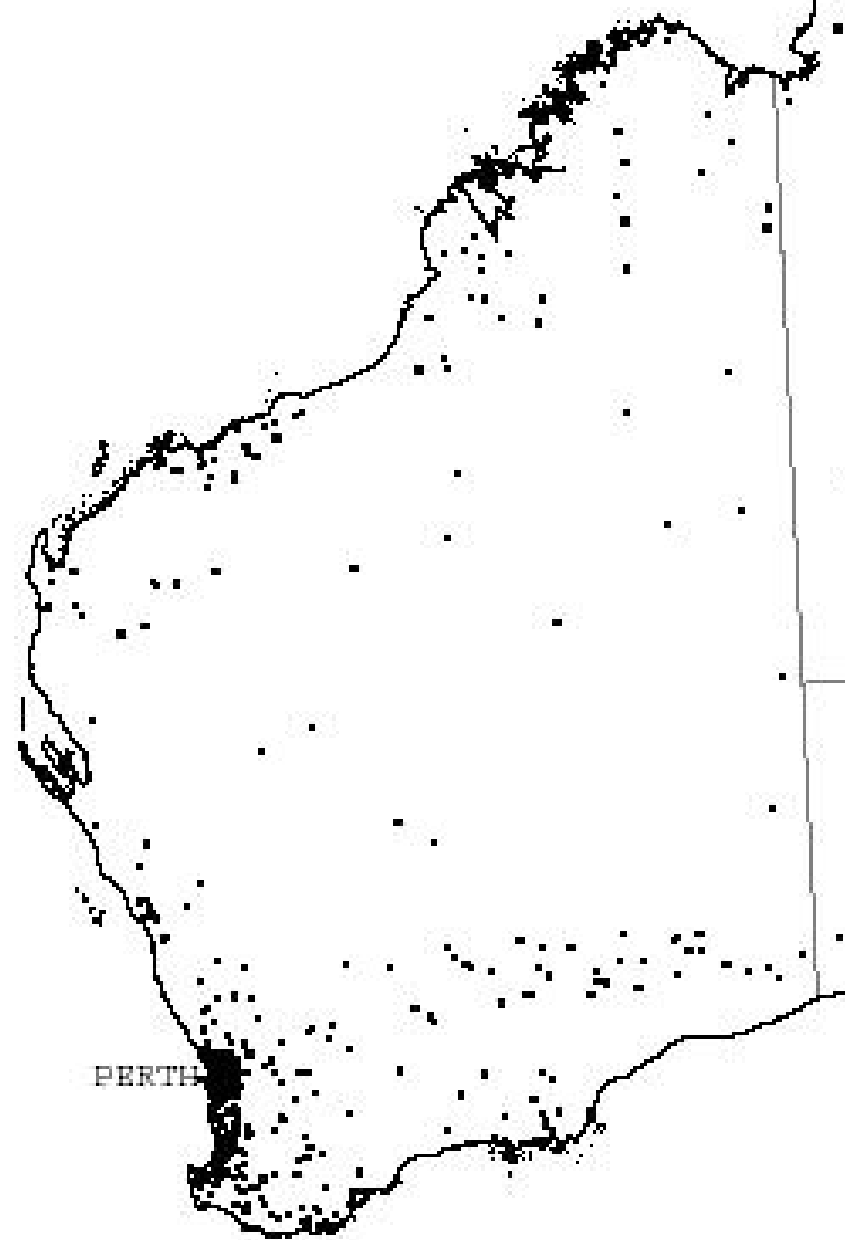
Concentrated on the
coast

Concentrated in
moderate to large cities

Population increase Western Australia

**Western Australia's population
2,149,000 in 2008**

Has increased by 60% since 1982

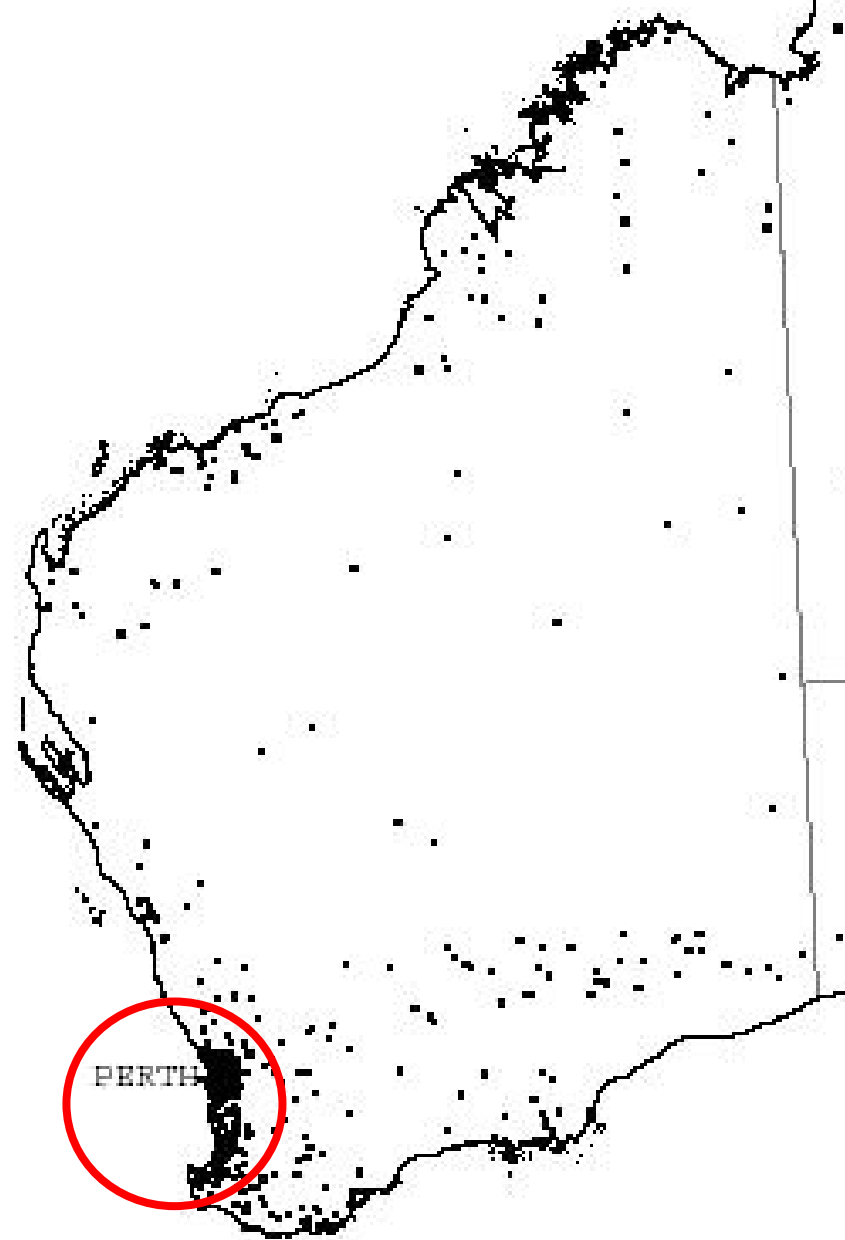


Population increase Western Australia

**Western Australia's population
2,149,000 in 2008**

Has increased by 60% since 1982

**75% Concentrated in coastal
southwest**

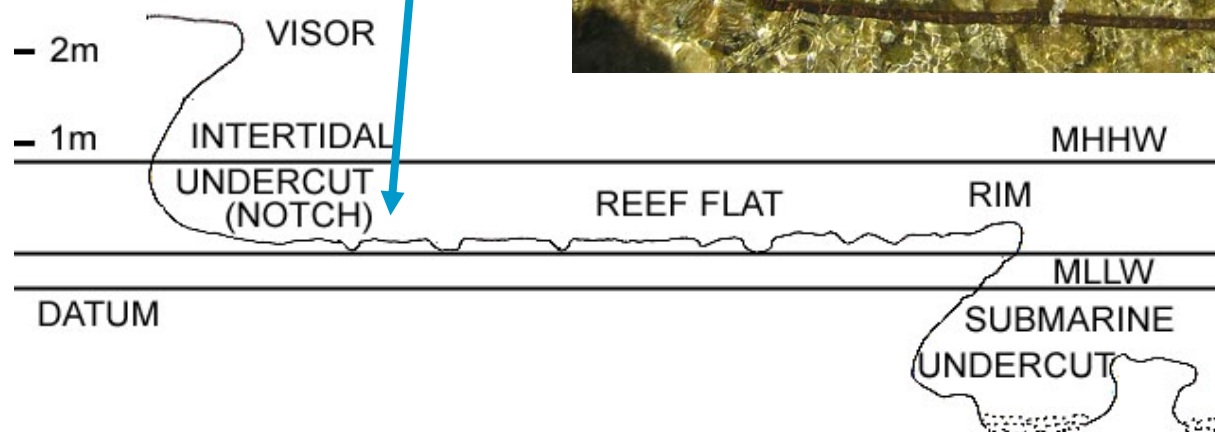


Typical intertidal platform reef structure



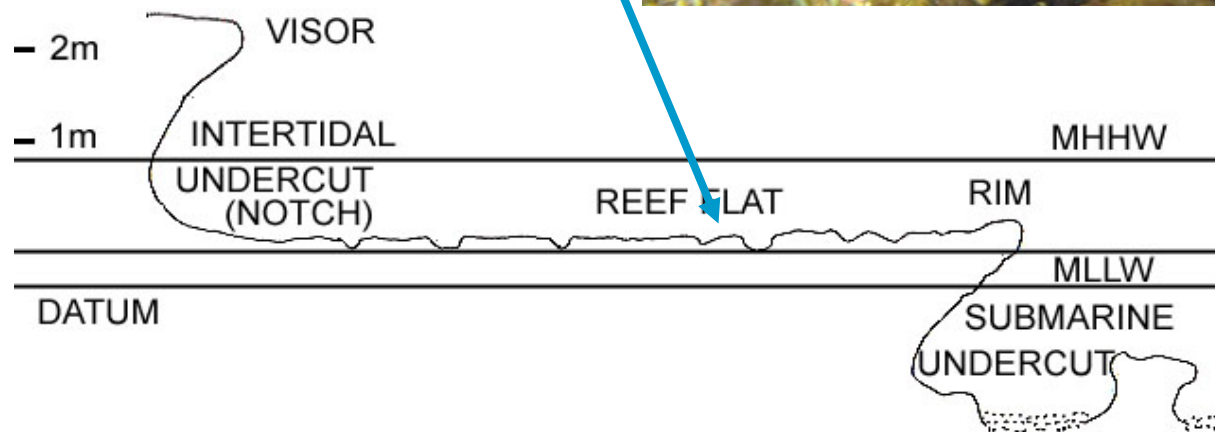
Intertidal platform reef habitat types (Mainland)

Inshore
habitat



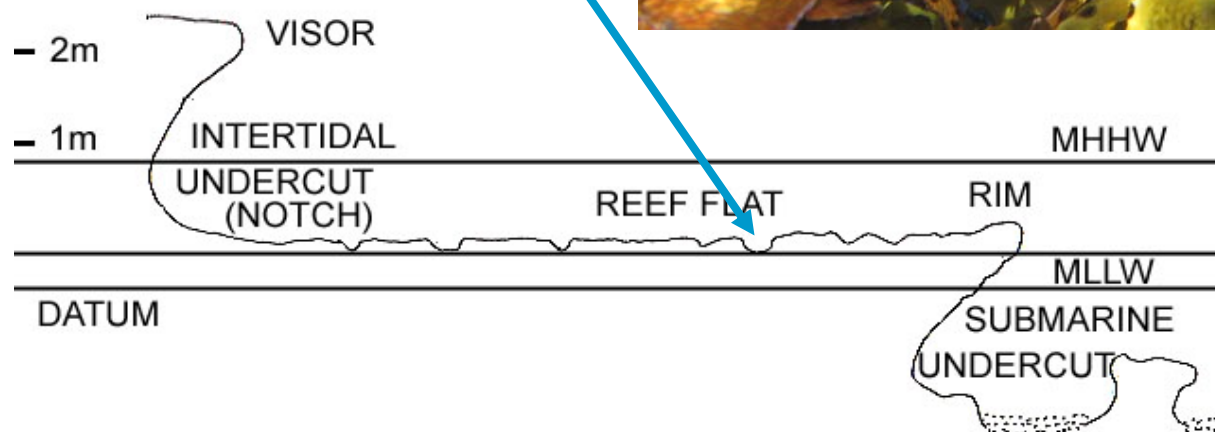
Intertidal platform reef habitat types (Mainland)

Sargassum
habitat



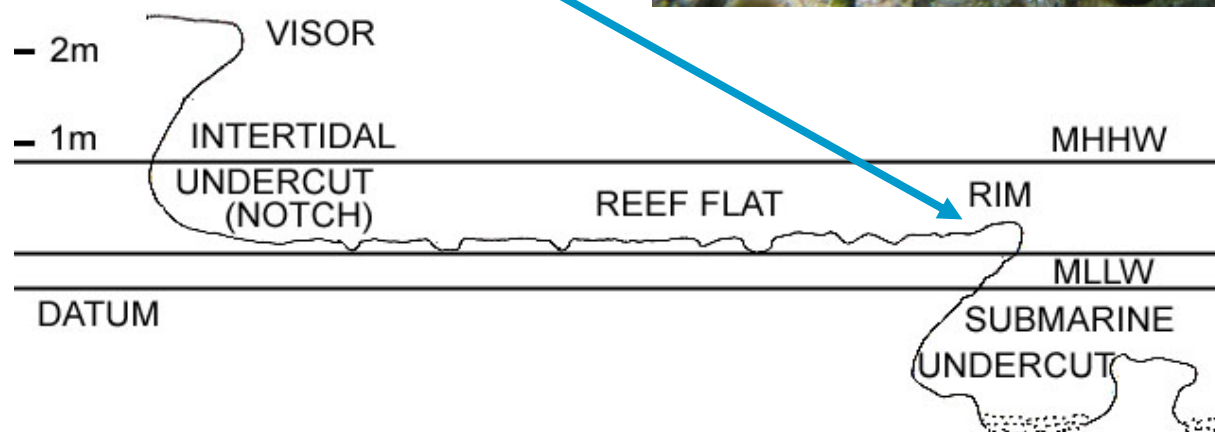
Intertidal platform reef habitat types (Mainland)

Ecklonia (kelp) habitat

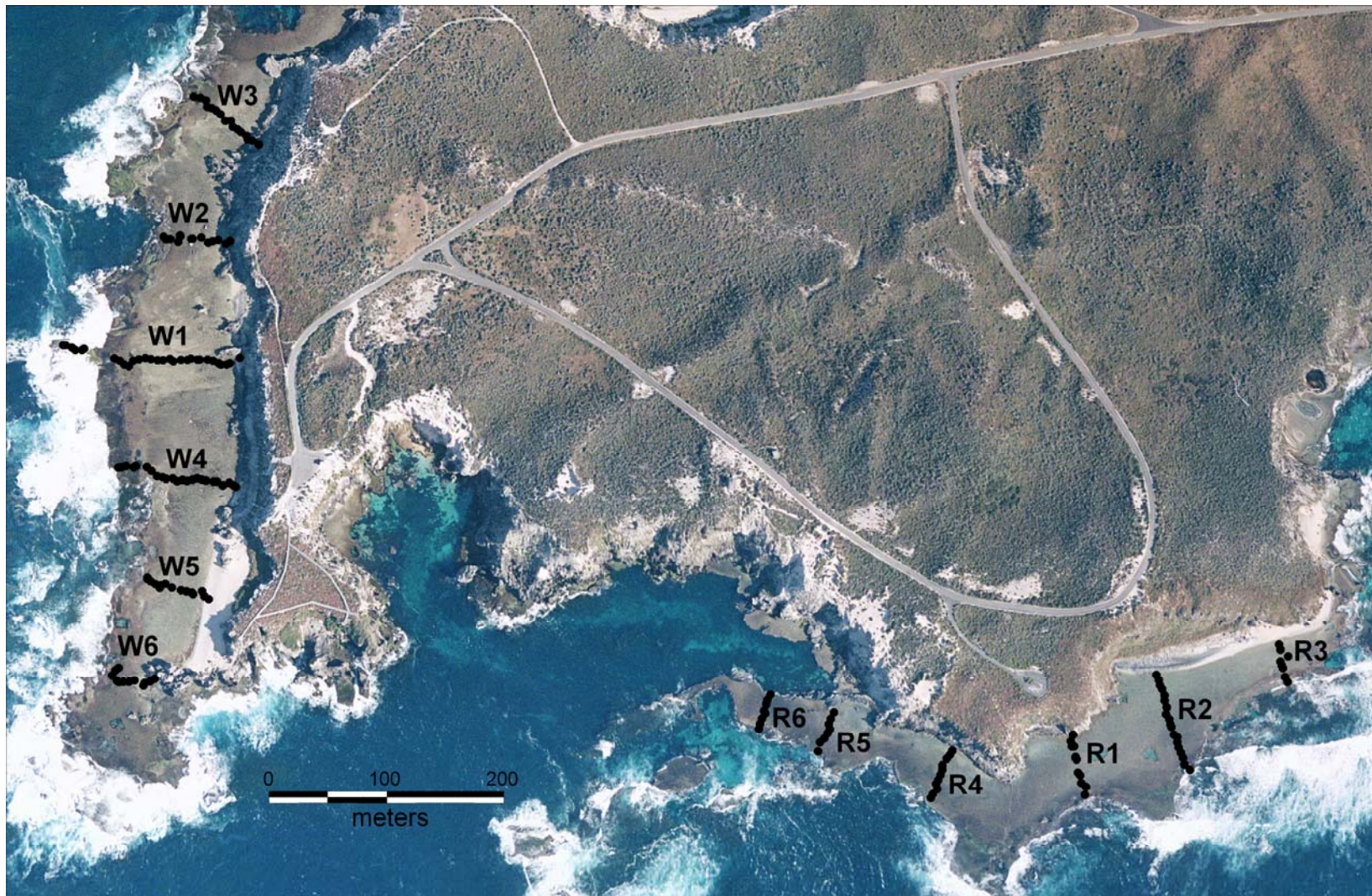


Intertidal platform reef habitat types (mainland)

**Bare Zone
habitat**



Rottnest Island Transects



Protection status of Mainland reefs

Waterman

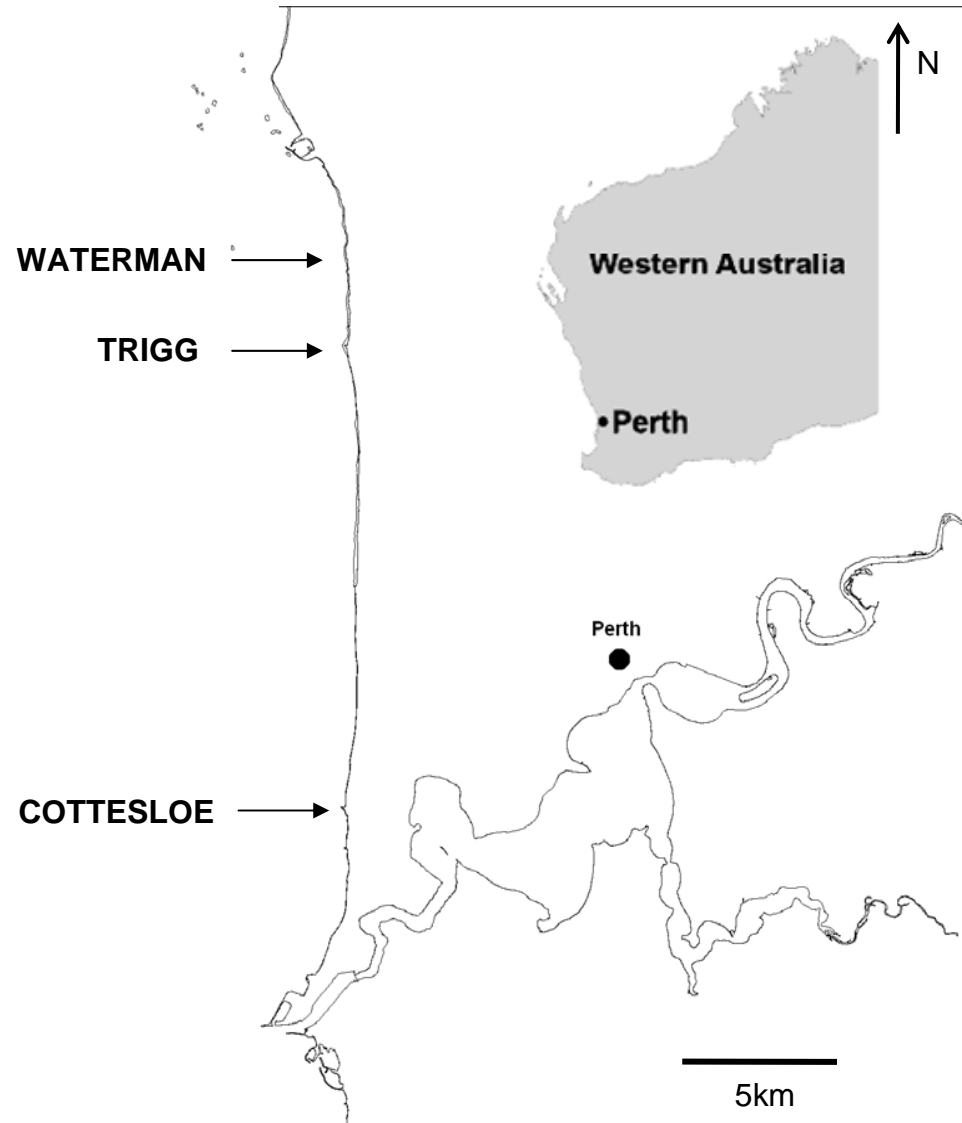
- fully protected as a marine reserve since mid 1960s

Trigg

- no restriction on collecting reef top molluscs before 1982
- From 1982 bans on collecting molluscs except size and bag limits on abalone)

Cottesloe

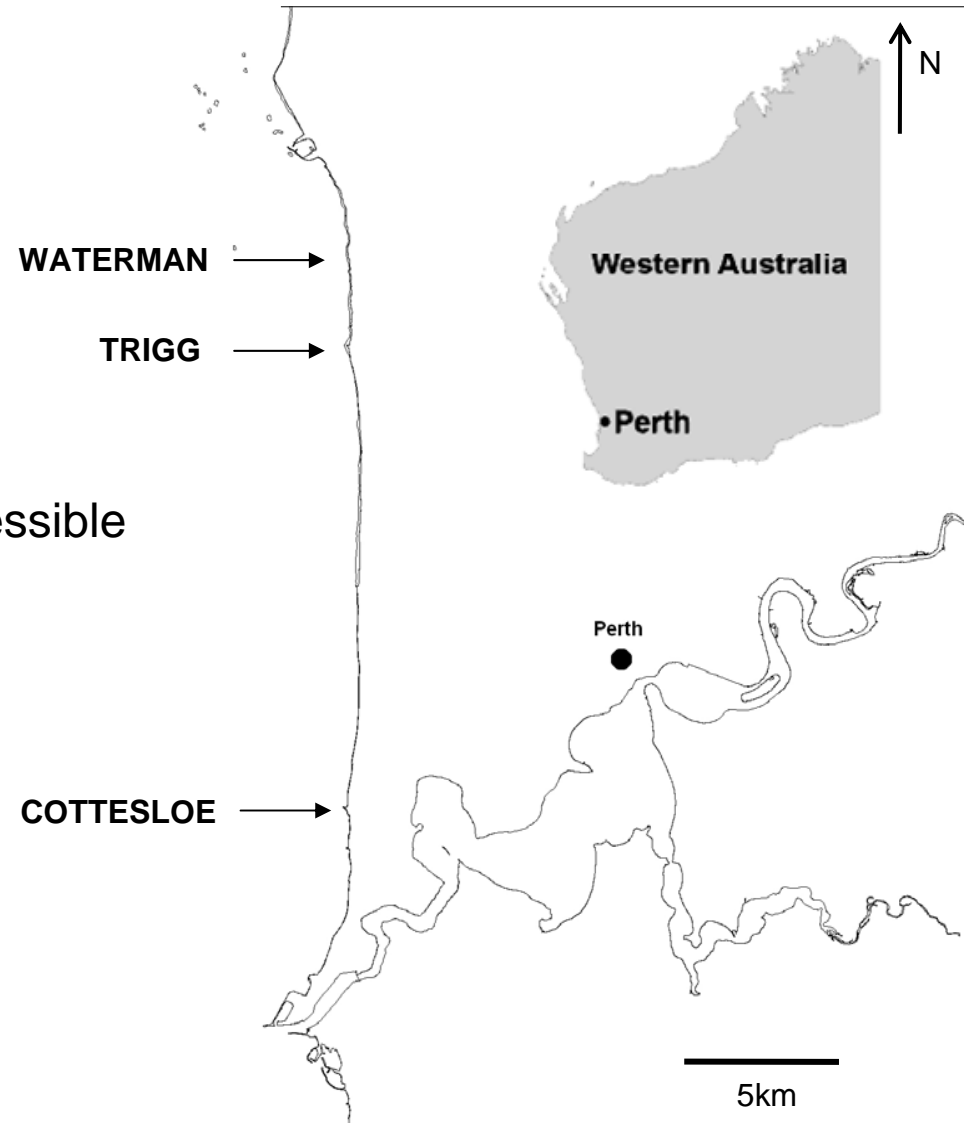
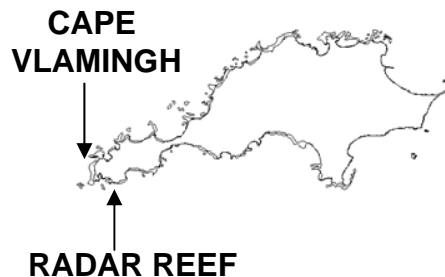
- no restriction on collecting reef top molluscs before 1982
- From 1982 bans on collecting molluscs except size and bag limits on abalone)
- fully protected as a marine reserve in 2003



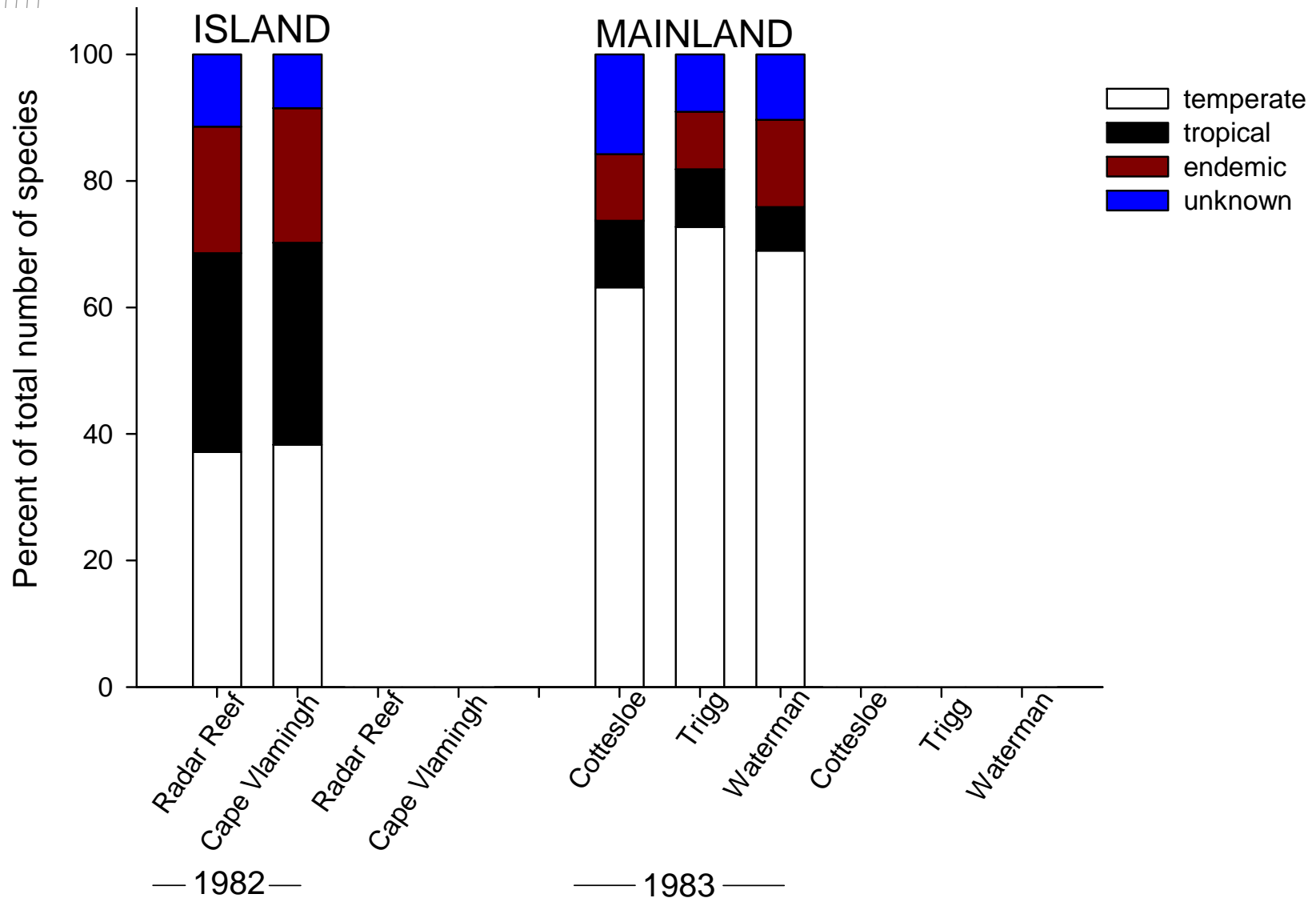
Protection status of Island reefs

Cape Vlamingh and Radar Reef

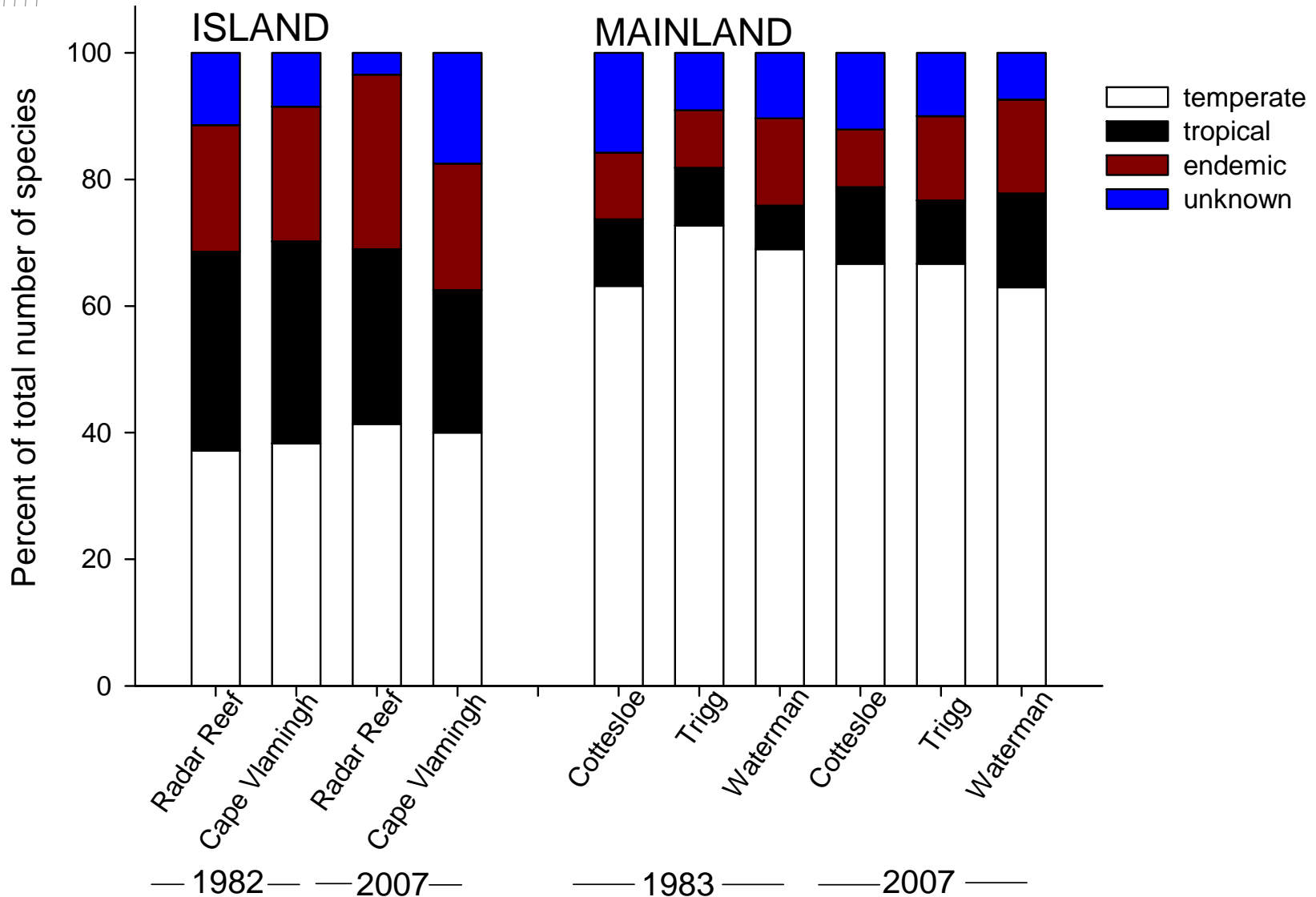
- no restriction on collecting reef top molluscs before 1982 but very inaccessible
- marine reserve established in 2007



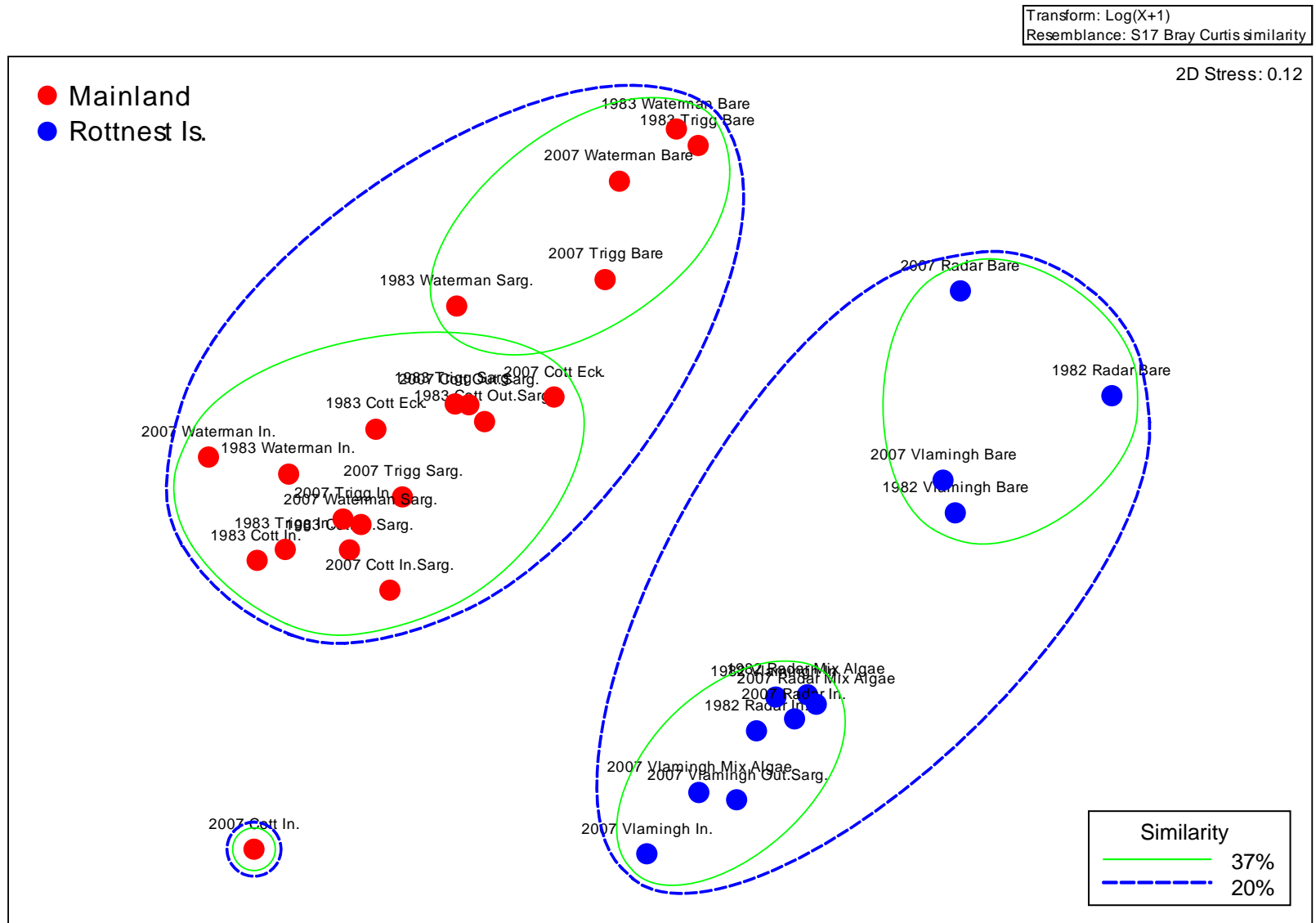
Island Reefs have more tropical species



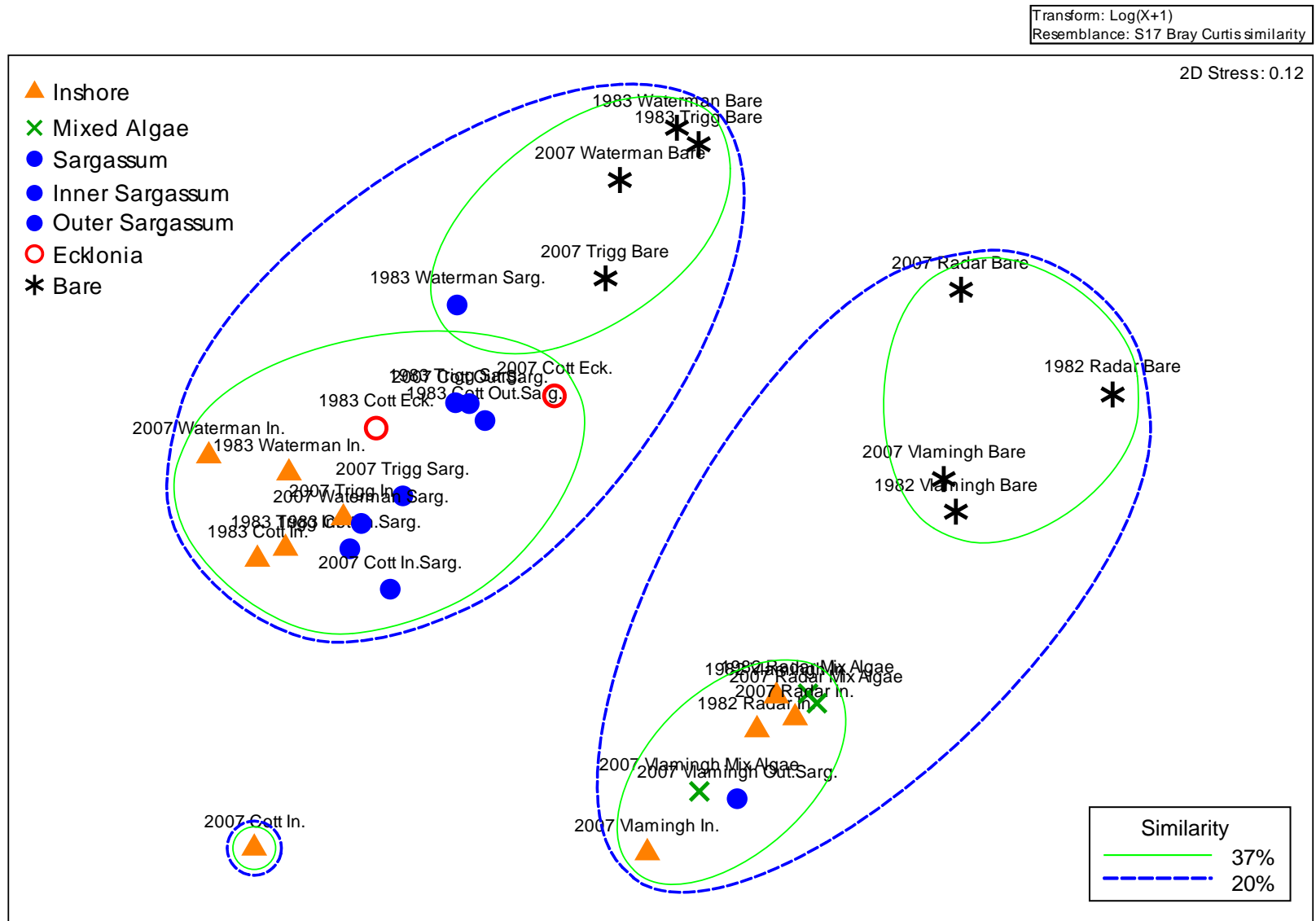
Island Reefs have more tropical species



Sampling stations separate on Location and Habitat not Year

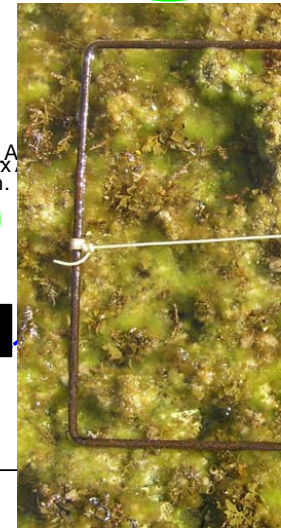
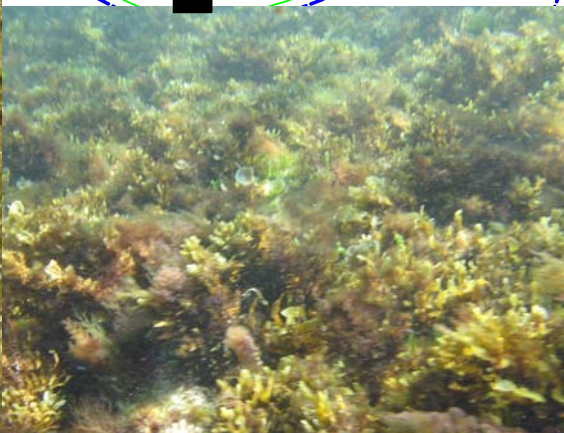
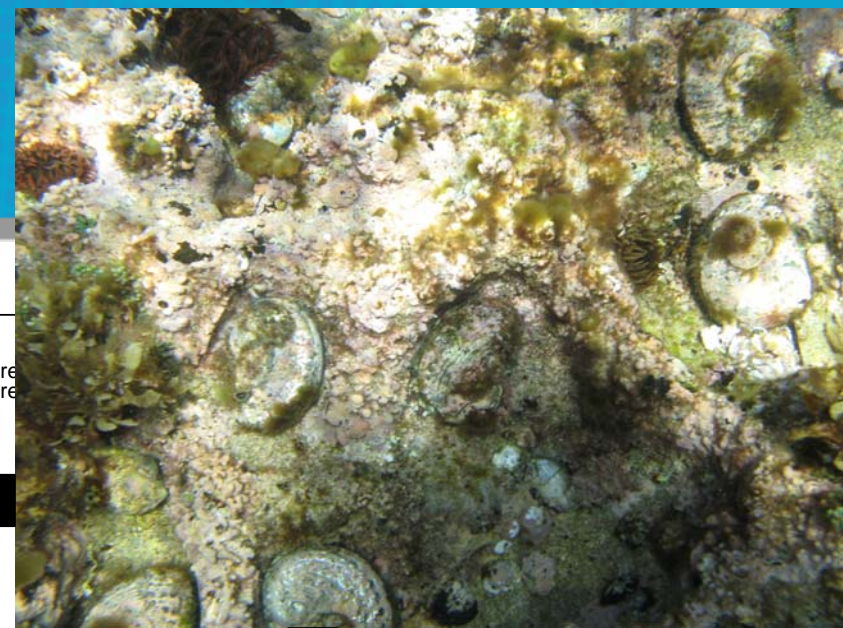
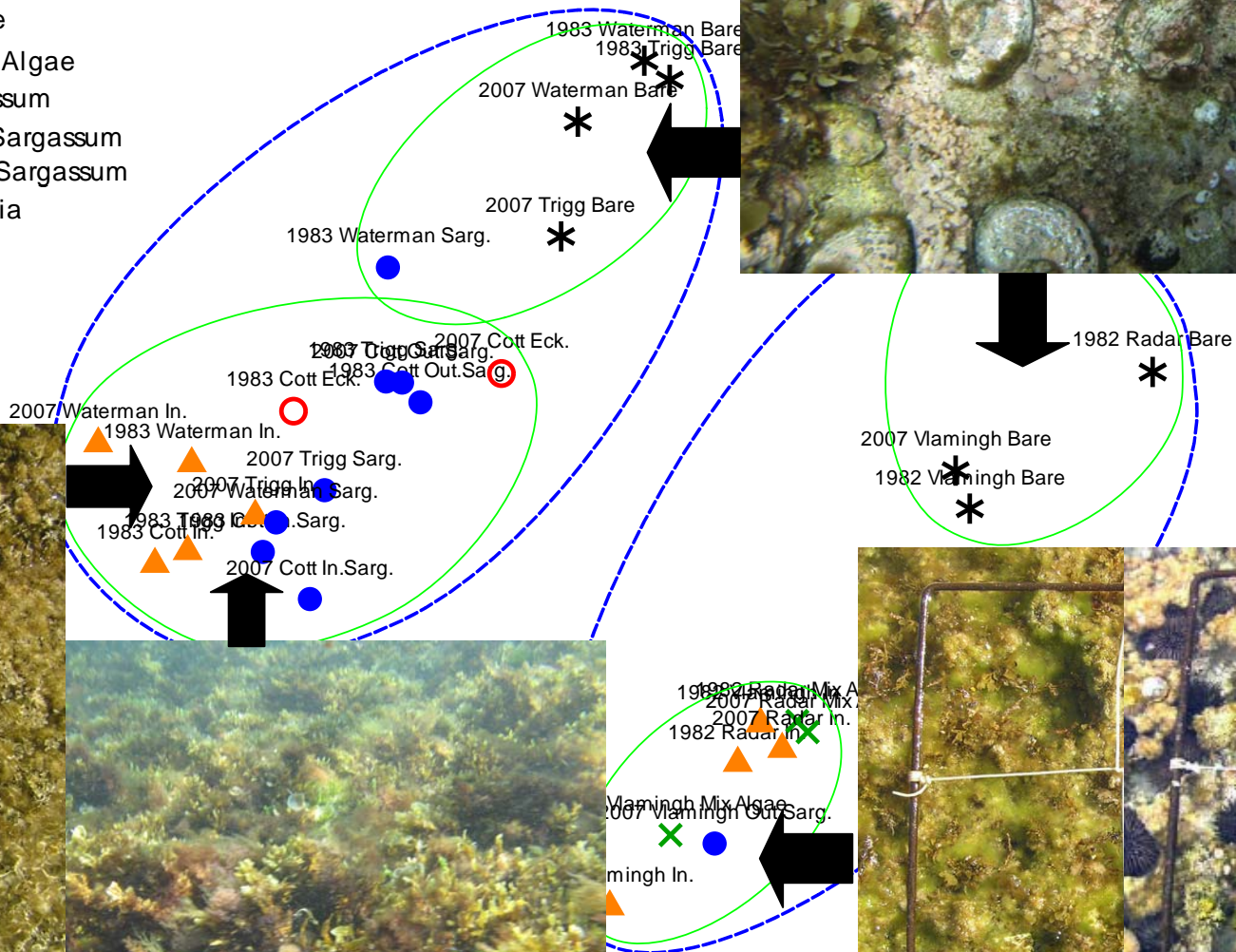


Sampling stations separate on Location and Habitat not Year



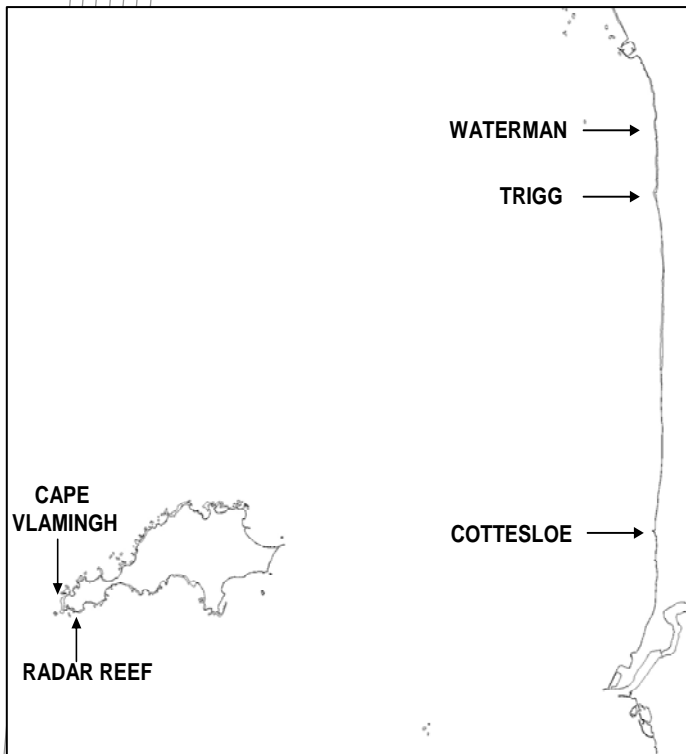
Sampling stations separate on Location and Habitat not Year

- ▲ Inshore
- ✕ Mixed Algae
- Sargassum
- Inner Sargassum
- Outer Sargassum
- Ecklonia
- * Bare



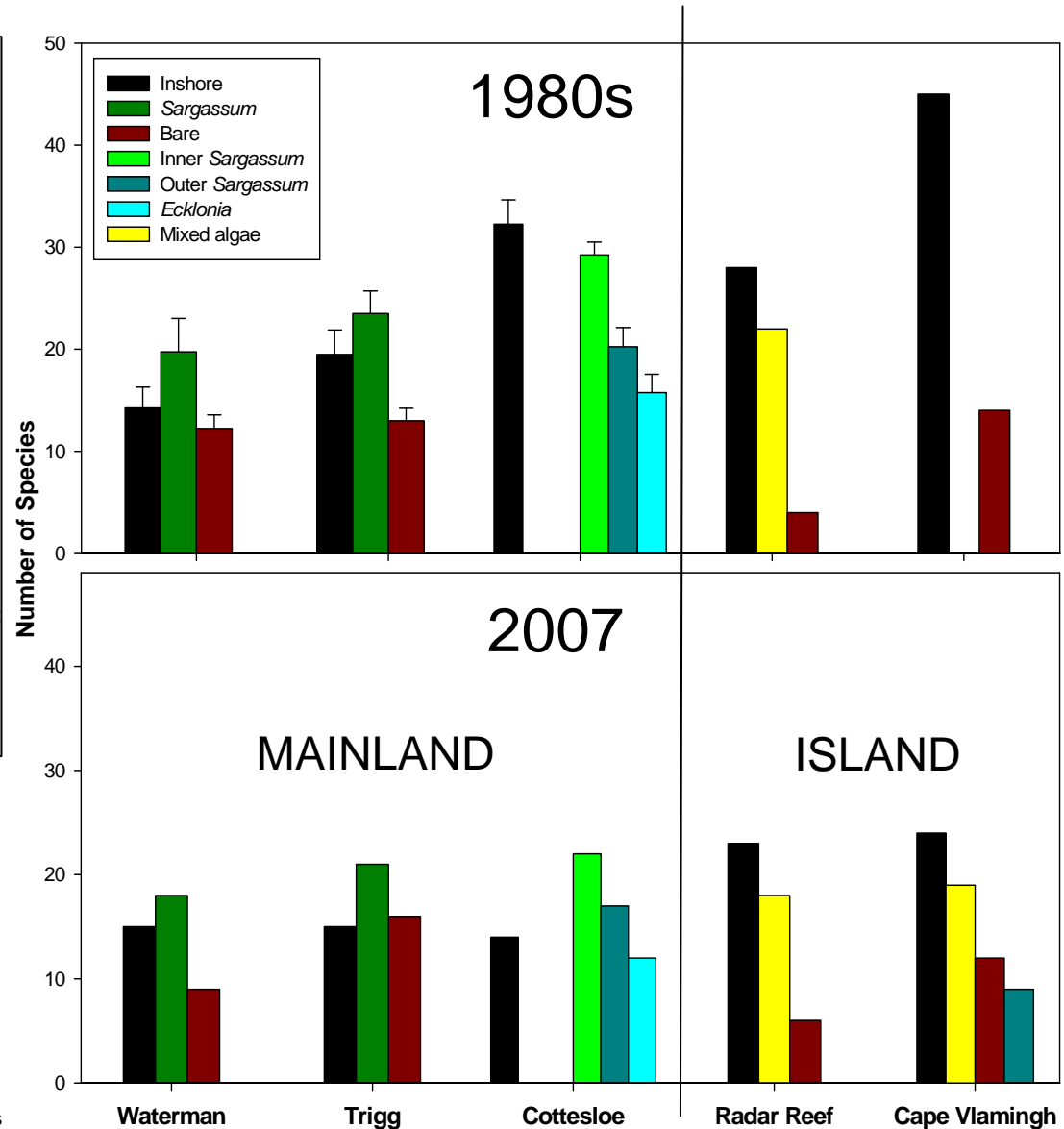


Species Richness

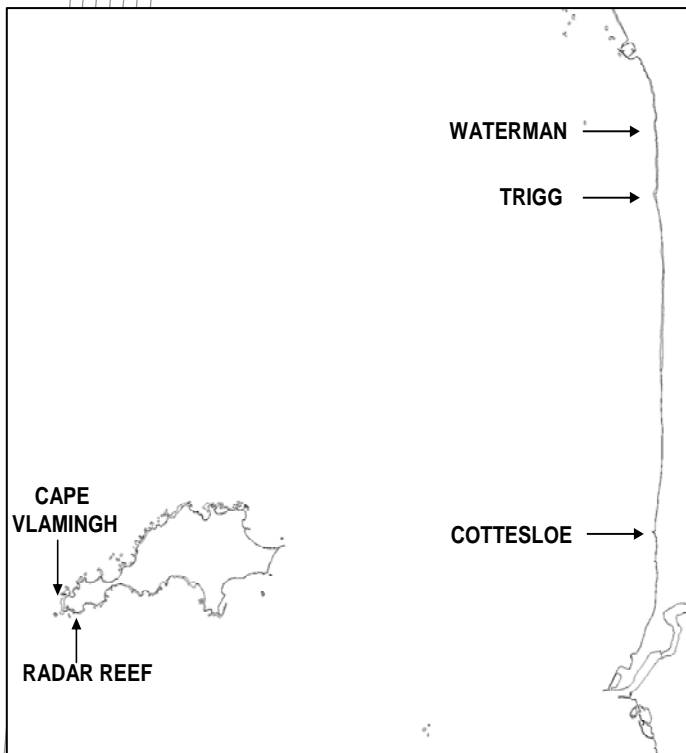


Notes:

- 1980s sampled four consecutive years on mainland reefs
- 2007 sampling effort = 25% to 33% of 1980s

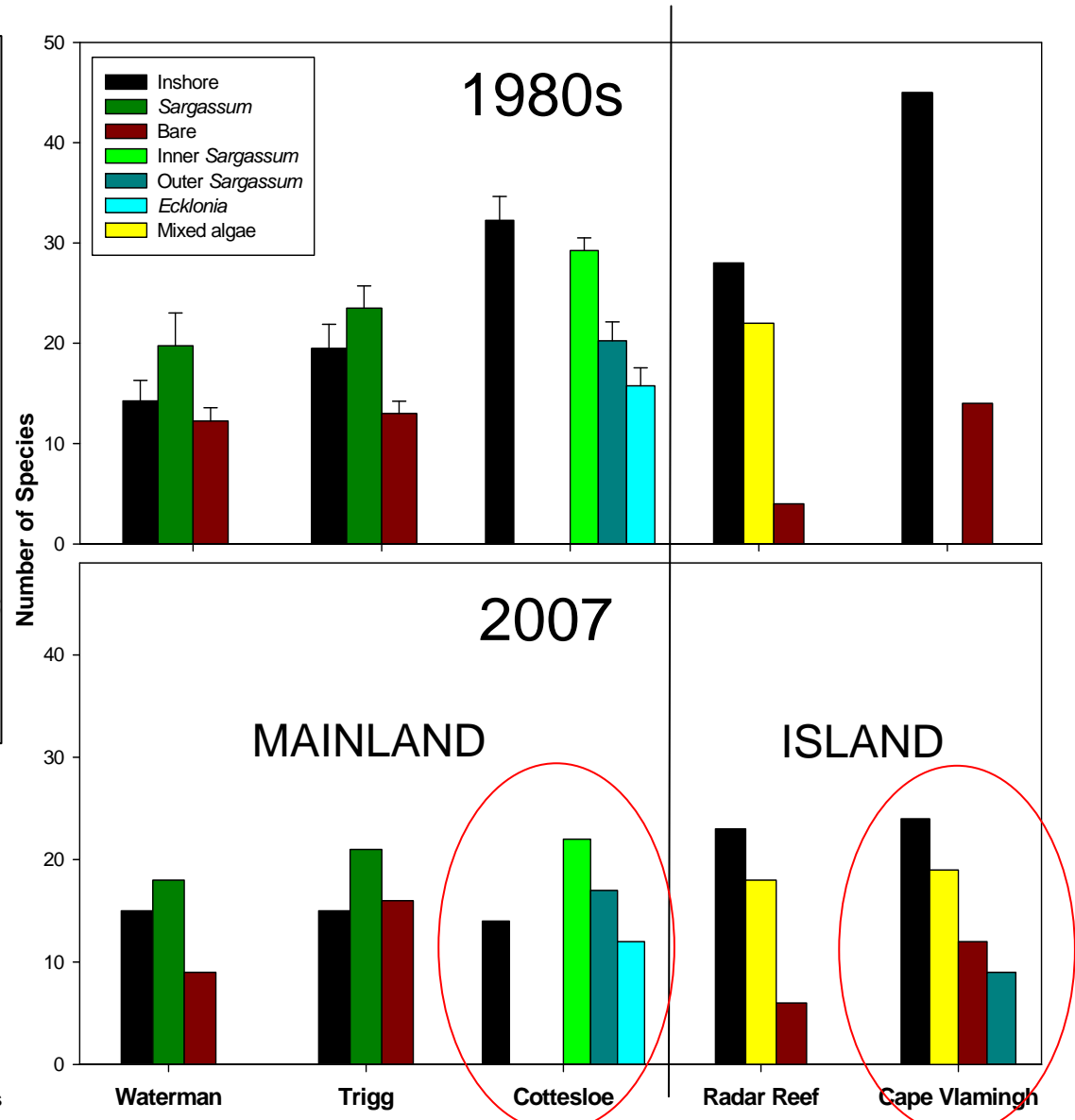


Species Richness

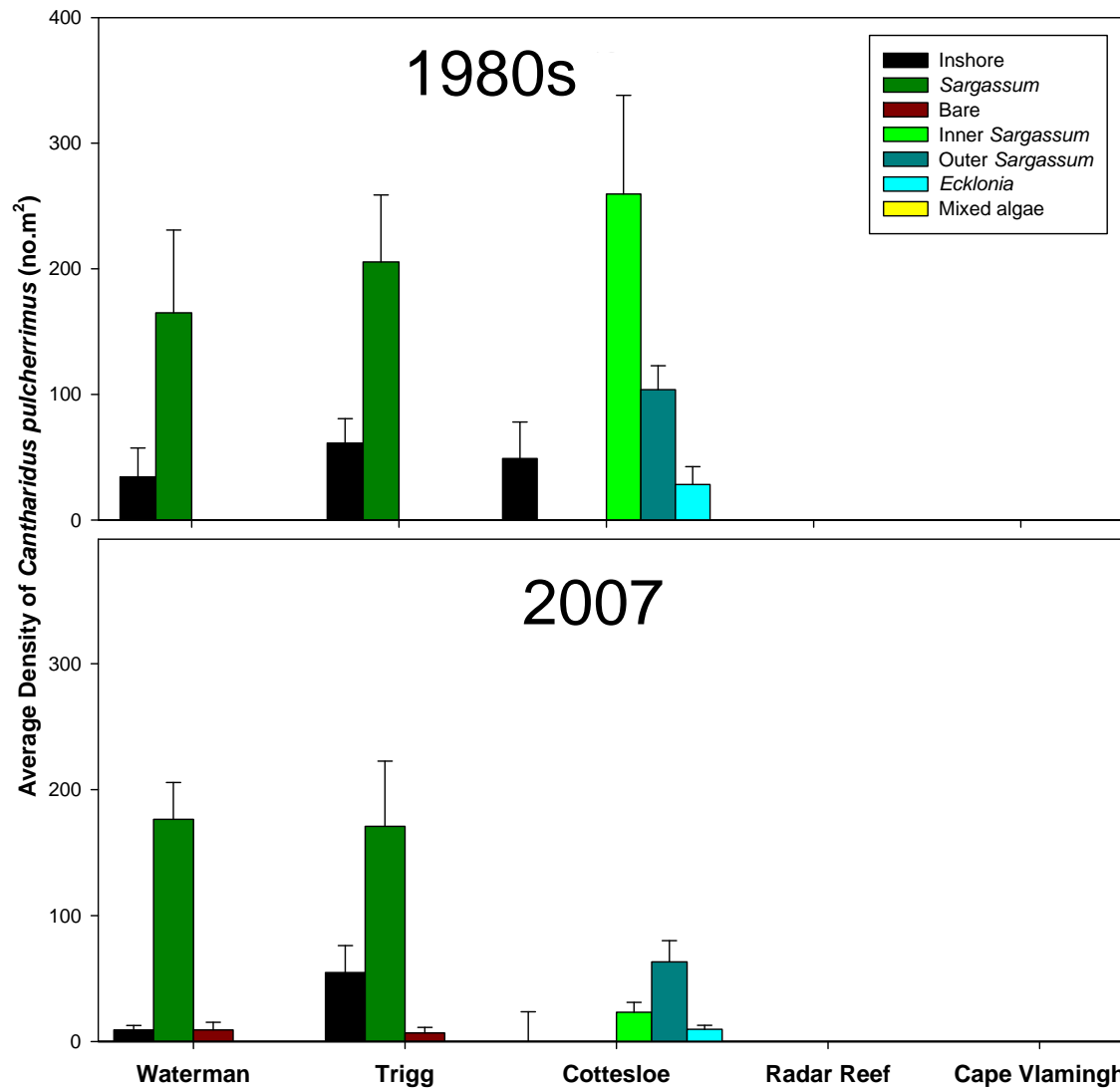


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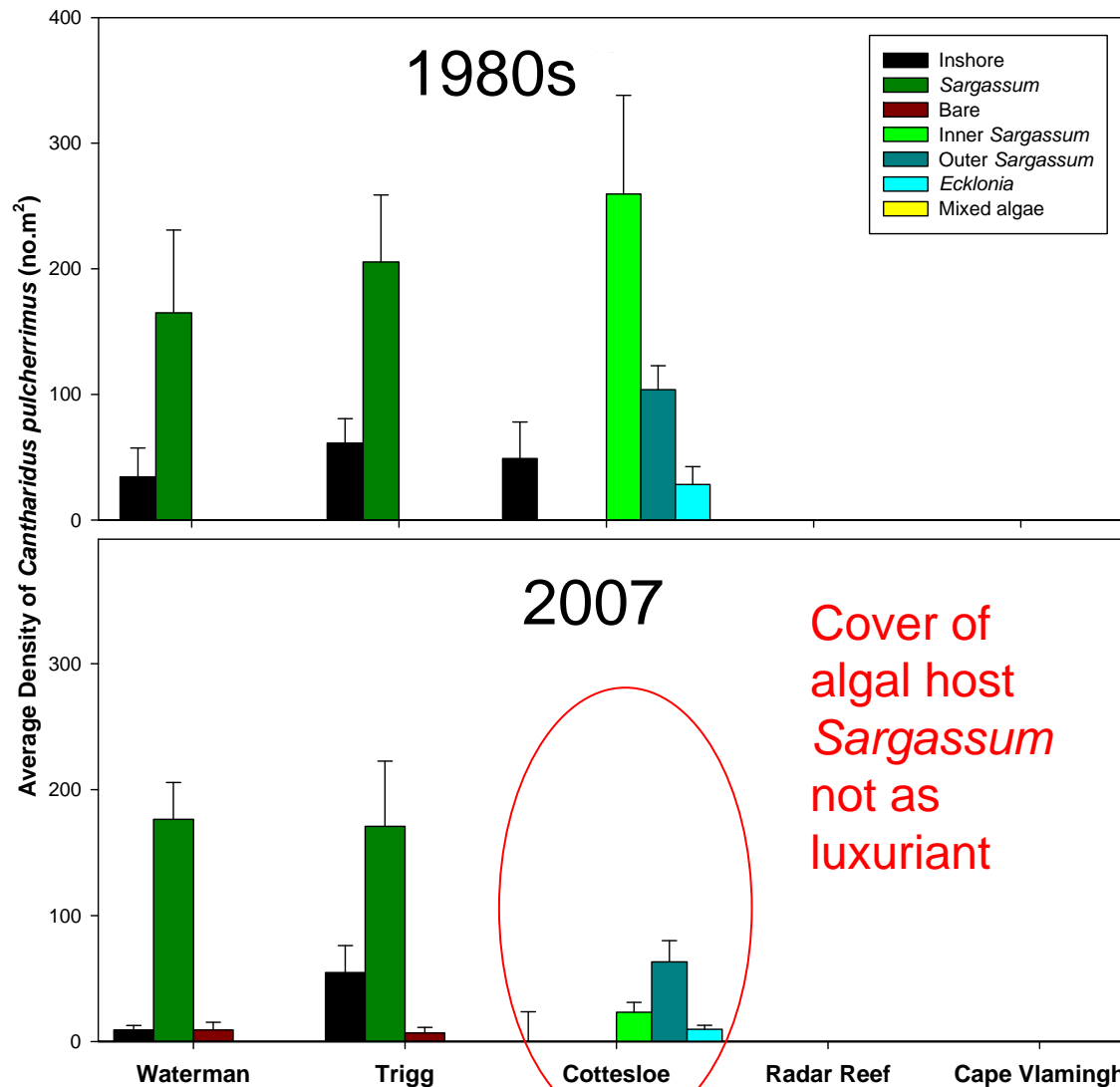
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Abundance of each species also analysed



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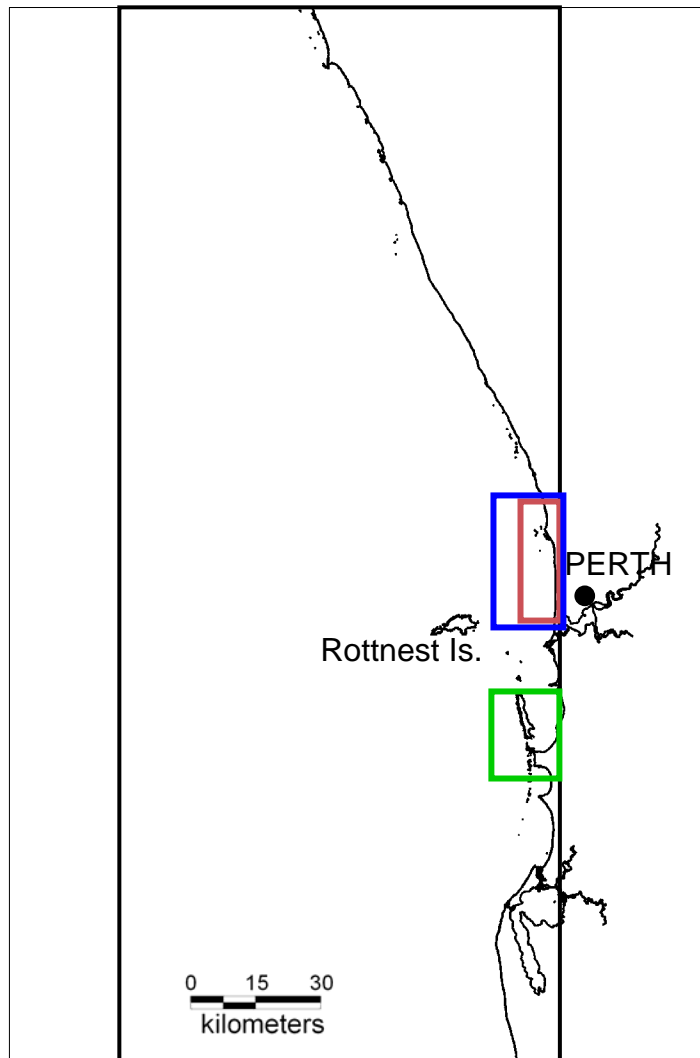
Roe's abalone *Haliotis roei*



Roe's abalone *Haliotis roei*



Estimated Abalone Catch in 2003



Total Recreational Catch = 50.5 tonnes

- over 20,000 licences issued each year

Total Commercial Catch = 36 tonnes

- 12 licences x 3 tonne quota

Recreational Catch = 43.0 t (85%)

Commercial Catch = 21.7 t (60%)

Commercial Catch = 12.6 t (35%)

Chronology of Recreational Abalone fishing regulations

- 1960s Fishery began
- 1970s – 1982 Recreational fishing increased leading to local stock depletions and conflict between commercial and recreational fishers
- 1982-1983 Fishery closed
- **1984 Seasonal closures restrict fishing to 68 hours per year**
 - (season mid Oct – mid Dec, 6am-10am weekends and public holidays)
- Late 1980s to 1990 effort increased rapidly
- 1991 Fishery closed and recreational fishing licenses introduced
- **1992 Season shortened to 34 hours per year**
 - 8 weekends (7am-9am weekends mid Oct-Mid Dec)
- 1994 Daily bag limit reduced to 20
- 1995 Use of scuba prohibited
- **1995 Season shortened to 9 hours per year**
 - 6 Sunday mornings 7-8:30am starting on 1st Sun in November
- **2006 Season shortened to 6 hours per year**
 - 6 Sunday mornings 7-8am starting on 1st Sun in November

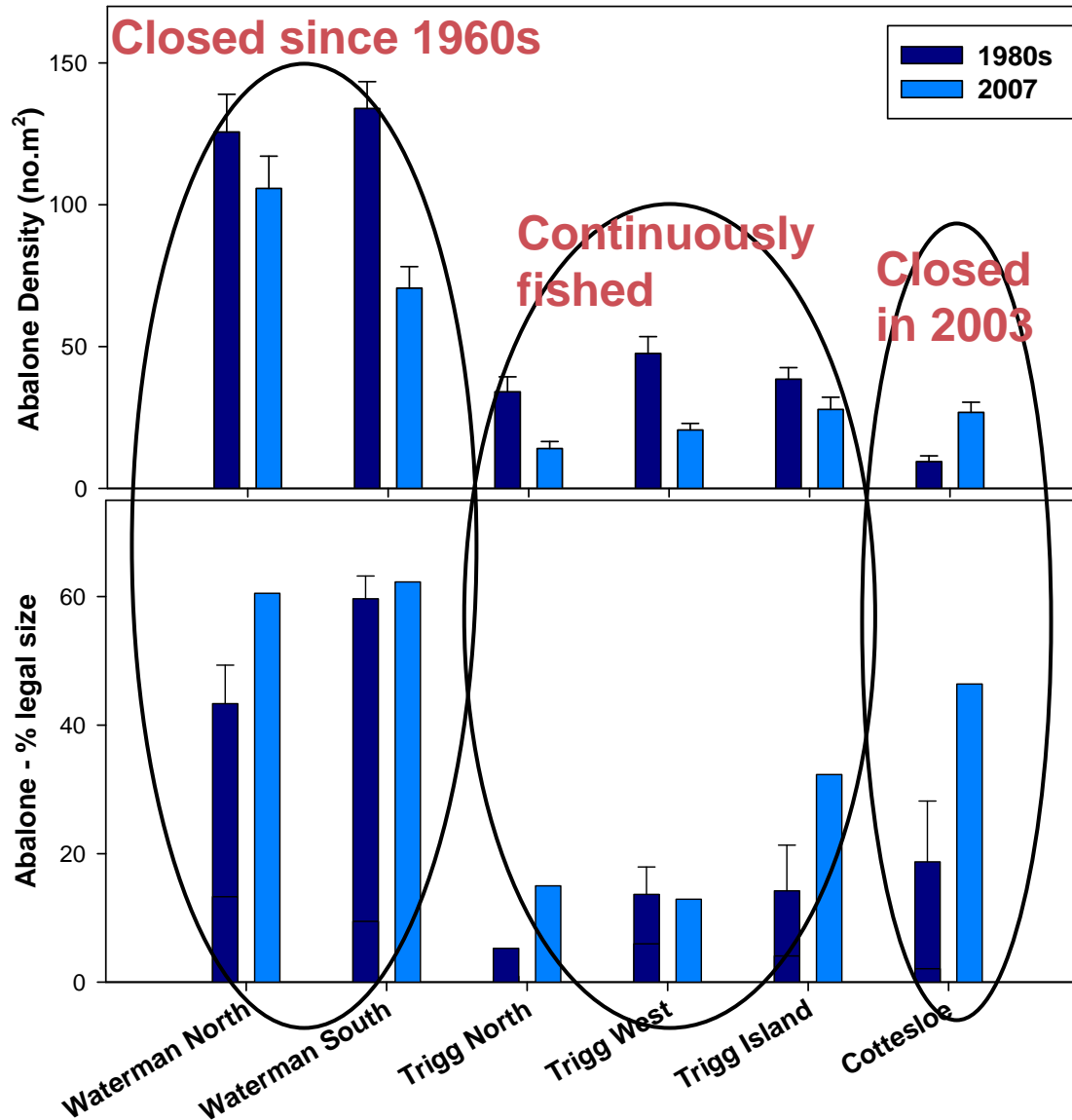
Abalone season Sunday from 7am to 8am



Abalone season Sunday 8.10 am



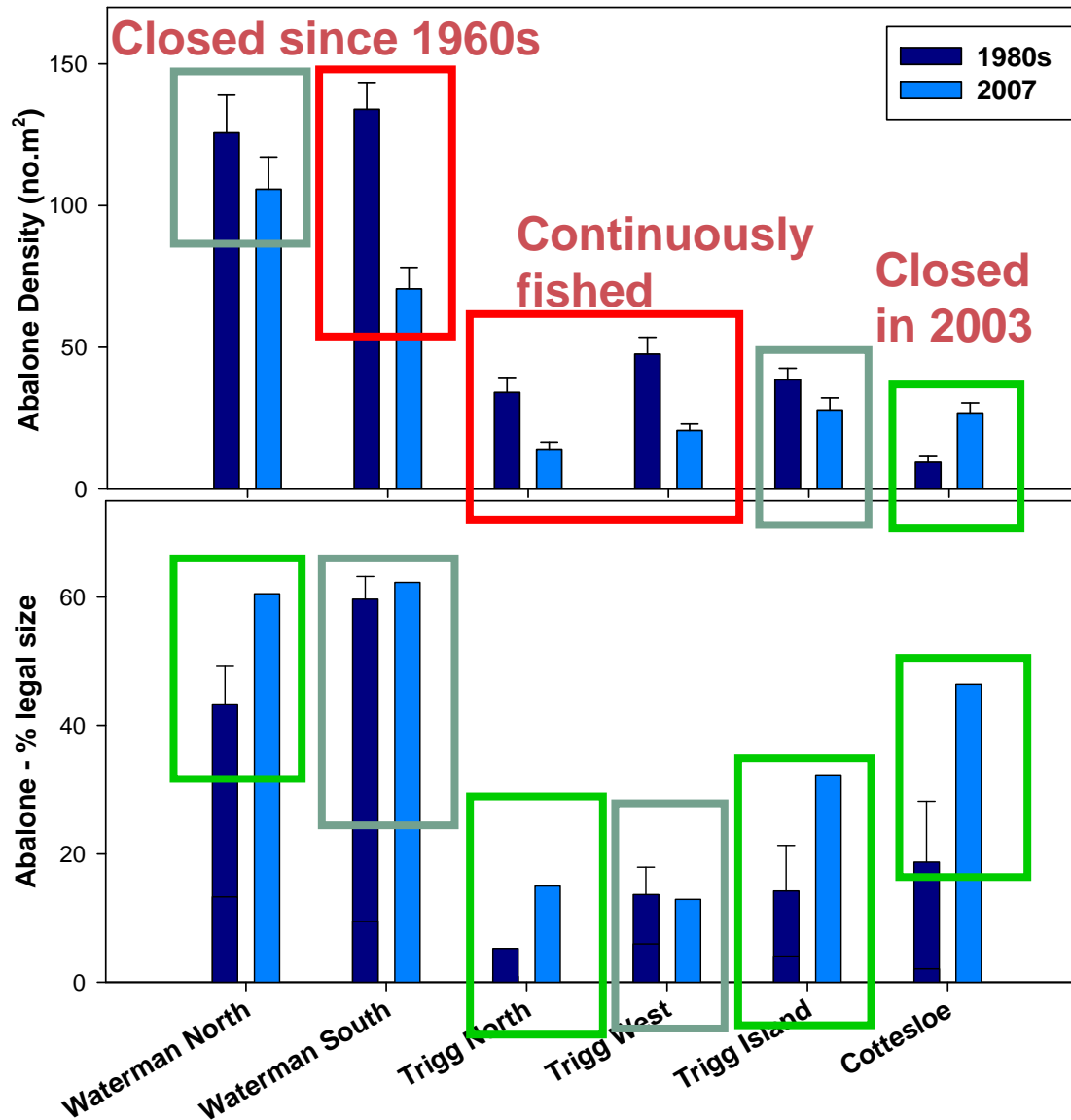
Abalone Density and % Legal Size



Density
per m²

Percent
above
legal size
(60mm)

Abalone Density and % Legal Size



Condition improved

Condition declined

Condition maintained

Density
per m²

Percent
above
legal size
(60mm)

Conclusions

- Repeated Study after 25 years
 - Patterns of biodiversity are largely unchanged over 25 years
 - Status of abalone populations varied after 25 years
 - Abalone populations have been responsive to management intervention
- Success of management measures
 - Adaptive management in the form of spatial and temporal closures has been largely successful in maintaining biodiversity, fish stocks and fishing amenity over 25 years despite a 60% increase in population and measurable climate change impacts.

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Thank you PICES and people
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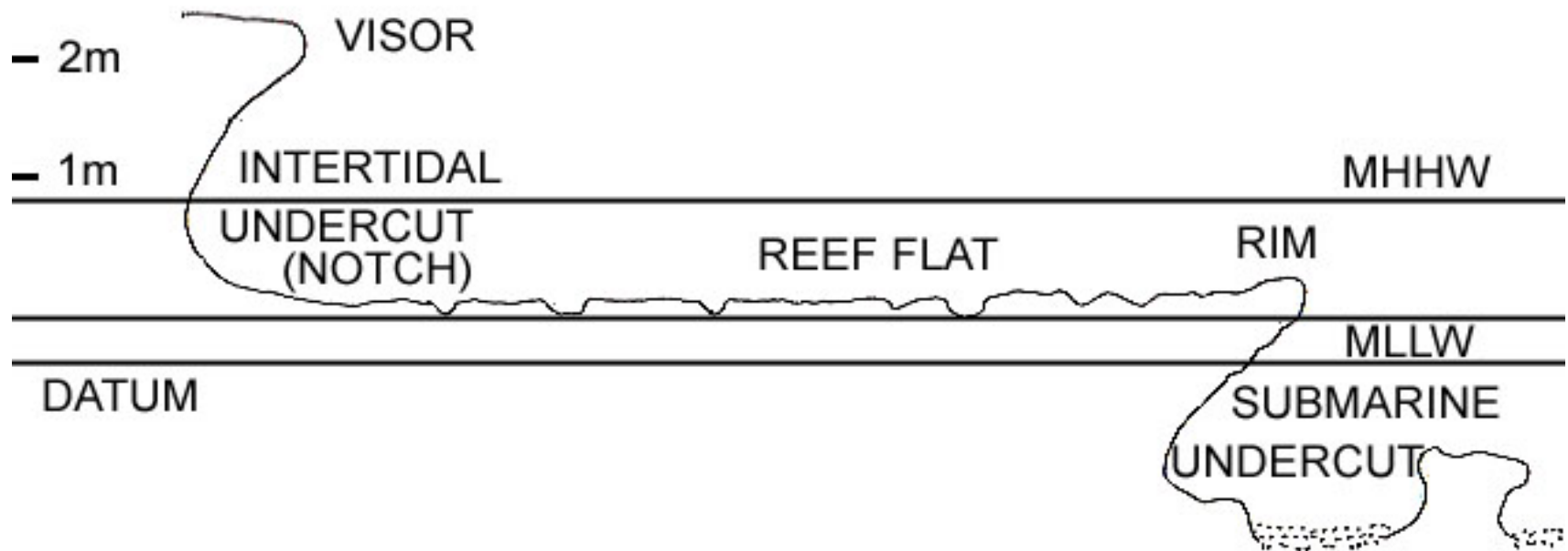
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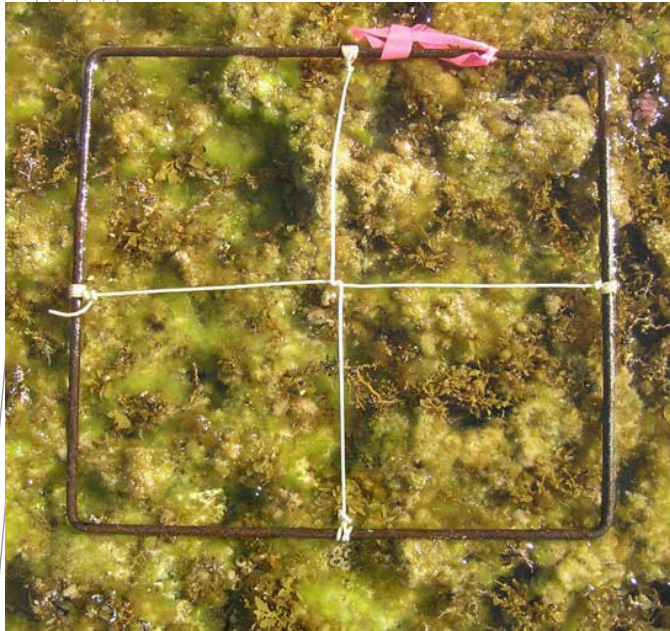
Typical intertidal platform reef structure



Mainland reefs and Rottnest Island Reefs



Intertidal platform reef habitat types (Island)



Mixed Algae
habitat

