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Understanding the benthic community for reef surveys

Advanced taxonomy and
labelsets in ReefCloud

AIMS: Australia's tropical marine research agency.




ReefCloud

Advanced taxonomy for coral reef monitoring



What is an advanced labelset or Tier 3 labelset in ReefCloud?

- Taxonomic labels given to common coral genus and some other common reef taxa
- These labels help us understand:
 - ✓ the status of the reef systems at a snapshot;
 - ✓ changes across reefs at a highly specific scale



What questions can the Tier 3 labelsets answer?

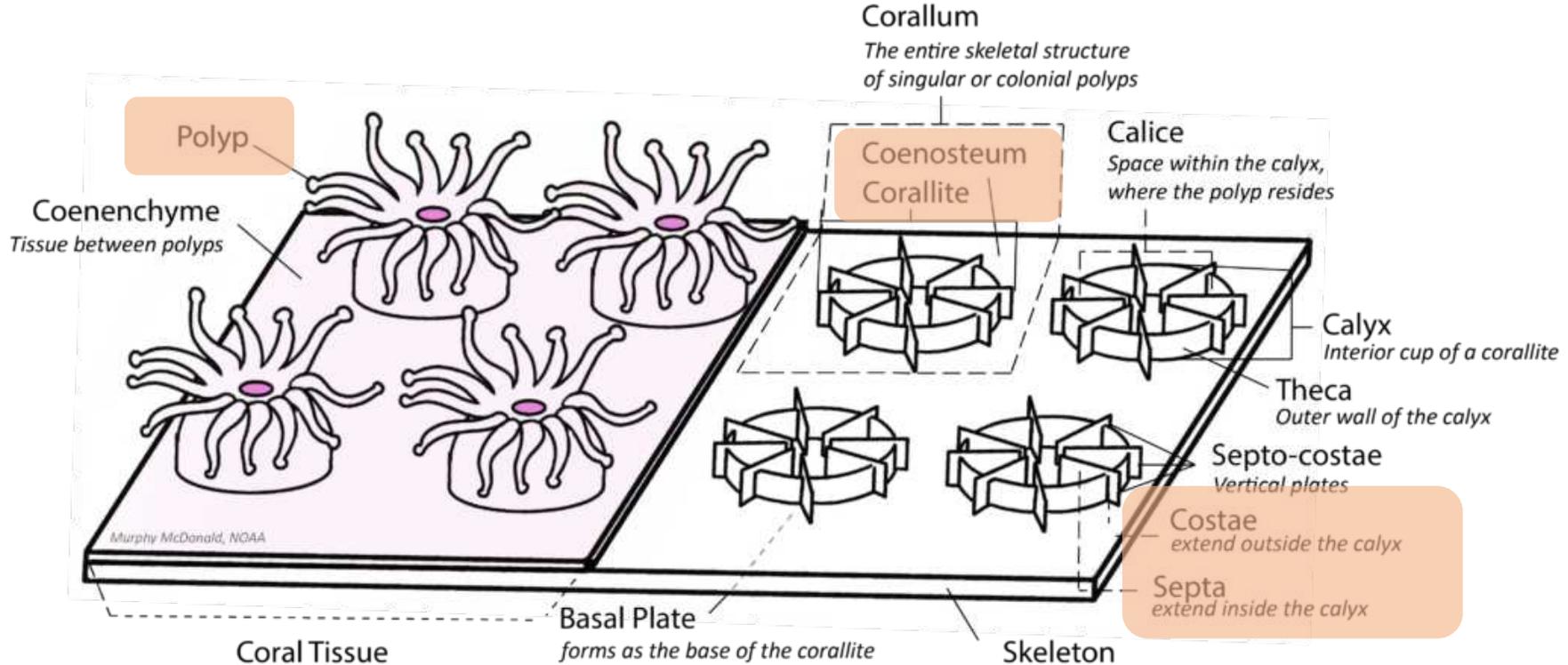


- How has the reef changed over time?
- What benthic taxa has increased in abundance and how much?
- What is the composition of the reef?



What is a Hard Coral (HC)?

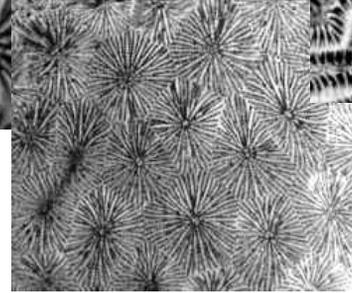
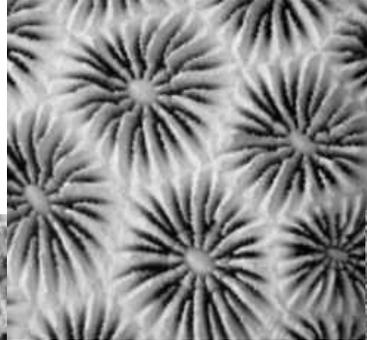
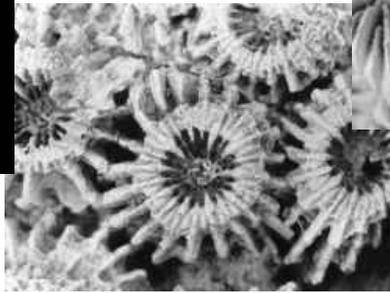
Coral morphology



What is a Hard Coral (HC)?

Coral morphology

Phaceloid – Plocoid – Subplocoid – Ceroid – Meandroid



Corallites separate to increasingly joined

Family Acroporidae (ACR)



- Common genera in most shallow, clear water reefs
- Genera: **Acropora**, **Astreopora**, **Isopora**, **Montipora**
- Less common but distinct: **Alveopora**
- Much less common: Anacropora, Enigmopora



Acropora (ACR_ACR)

- **Axial (tip) corallites** different from radial corallites
- Fast growing, often with white tips
- Variety of branching patterns



Montipora (ACR_MON)

- Most commonly encrusting or foliose, sometimes massive
- Presence of different bumps, nodes, and ridges on surface
- Similar to Isopora, but **corallites between bumps**



Isopora (ACR_ISO)

- Corallites like Acropora without axial corallites
- Encrusting or submassive forms
- Similar to Montipora, but **corallites not between bumps**



Family Poritidae (POR)

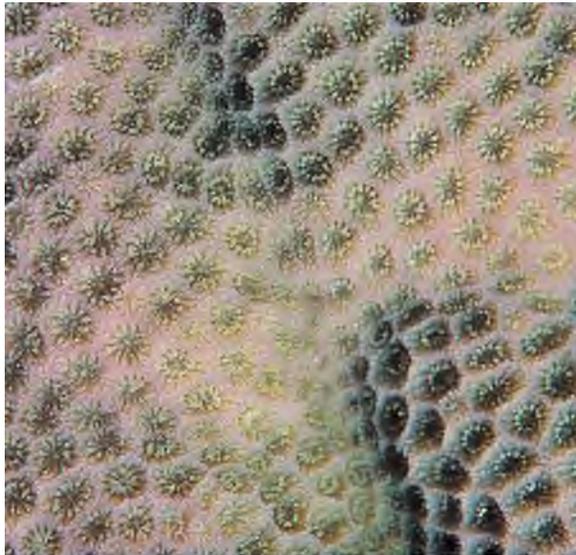


- **Pore corals – generally small corallites**
- Common genera: **Porites, Goniopora**
- Less common monotypic genera: **Bernardpora, Stylaraea**



Porites (POR_POR)

- Colonies encrusting to **massive**, sometimes branches
- Corallites **small, “pore-like” in honeycomb arrangements**
- Surface generally smooth and featureless



Goniopora (POR_GON)

- **Long tentacles out in the day, arrangements of 24**
- Small corallites underneath tentacles in skeleton
- Colony generally massive or submassive



Bernardpora (POR_BER)

- Very small corallites underneath tentacles in skeleton
- **Small version of Goniopora**, smaller corallites and tentacles but same shapes
- One species only



Family Pocilloporidae (POC)



- **Generally branching corals**, sometimes submassive
- Common genera: **Pocillopora**, **Seriatopora**, **Stylophora**
- Other genera: Madracis



Pocillopora (POC_POC)

- Colonies thinly-branching to submassive
- **Black ring around corallite**, can look brown at distance
- Small bumps “verrucae” with polyps all over and between



Family Agariciidae (AGA)

- Generally foliose/laminar/plating corals
- Common genera (Indo-Pacific): **Pavona**
- Less common genera: Gardineroseris, Leptoseris
- Non-IP: Agaricia, Helioseris

Family Leptastreidae (LER)



- Mainly encrusting and small
- New family, only one genus: Leptastrea



Family Merulinidae (MER)

- Large group of massive, submassive and encrusting forms, can be difficult to identify
- Some of which used to be under Faviidae/Montastreaidae
- **Distinct: Hydnohpora**
- **Small exsert corallites: Cyphastrea**
- **Plates/Foliose: Merulina, Pectinia, Echinopora, Mycedium, Physophyllia**

Family Merulinidae (MER)

- Large group of massive, submassive and encrusting forms, can be difficult to identify
- Some of which used to be under Faviidae/Montastreaidae
- **Corallites w/ shared walls: Favites, Goniastrea, Platygyra, Coelastrea, Oulophyllia, Paragoniastrea**
- **Corallites w/o shared walls: Dipsastraea, Caulastrea**
- **Meandering corallites: Platygyra, Leptoria, Trachyphyllia, Paragoniastrea, Oulophyllia**

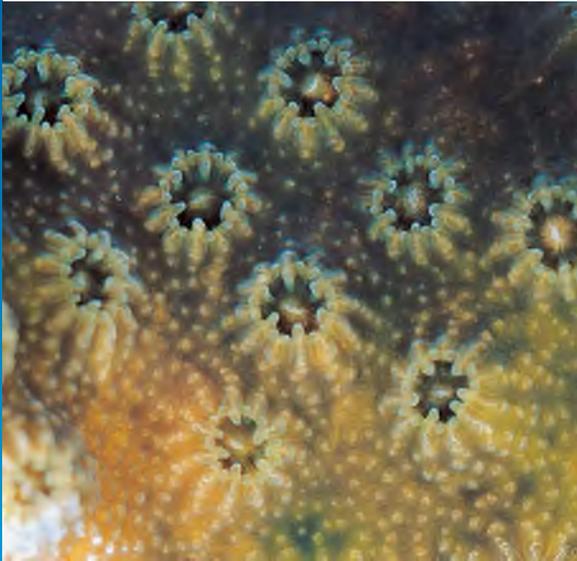
Hydnophora (MER_HYD)

- “Hydnophores” or **bumps rising from coral skeleton, like a lemon-squeezer**
- Colonies of many different shapes or forms



Cyphastrea (MER_CYP)

- Conical corallites small with **septa running out of corallites**, in arrangements of 10-12
- Colonies encrusting to massive
- See also Astreopora, but AST has no septa lines



Echinopora (MER_ECH)

- **Corallites small and rounded, coenosteum beady**
- Colony thin plates to branches
- Much neater and usually more regular in appearance than Echinophyllia



Merulina (MER_MER)

- **Corallites small within “train-track” valleys** leading out from center of colony
- Colonies plating or laminar with some species with small branches



Pectinia (MER_PEC)

- Colonies foliose to larger and thicker plates
- Generally **large valleys or large fronds** where large corallites sit



Physophyllia (MER_PHY)

- Colonies very foliose
- Generally **large valleys or large fronds** where corallites sit
- One Pectinia moved to this genus, which has one species



Mycedium (MER_MYC)

- **“Nose-like” raised corallites always point outwards**
- Colonies plating to foliose
- Can be similar to Echinopora, Echinophyllia



Mycedium (MER_MYC)

- **“Nose-like” raised corallites always point outwards**
- Colonies plating to foliose
- Can be similar to Echinopora, Echinophyllia



Platygyra (MER_PLA)

- Colonies massive, **corallites form valleys**
- Walls **generally thin** and **straight to the corallite**
- Ridges on walls have break at the top
- See also Leptoria



Platygyra (MER_PLA)

- Colonies massive, **corallites form valleys**
- Walls **generally thin** and **straight to the corallite**
- Ridges on walls have break at the top
- See also Leptoria



Leptoria (MER_LEP)

- Colonies massive
- Similar to *Platygyra* but **neat rounded walls**
- Usually brown to pink



Favites (MER_FVS)

- Corallites generally more angular, no palliform lobes
- **Corallites generally small**
- Colonies encrusting to massive
- *Some species have moved genera



Goniastrea (MER_GOS)

- Corallites small, angular, and shallow with **distinct palliform lobes**
- Colonies encrusting to massive
- Some species moved to Coelastrea – larger corallites



Coelastrea (MER_COA)

- **Corallites larger than Goniastrea and angular, with distinct palliform lobes**
- Colonies encrusting to massive
- Few species that have moved from Goniastrea and Favites



Dipsastraea (MER_DIS)

- Corallites **small and rounded**, coenosteum neat generally
- Corallite walls are distinctly separated
- Colonies encrusting to massive
- *Previously Favia



Family Diploastraeidae (DIP)



- Monotypic – one species in one genus only



Diploastrea (DIP_DIP)

- Colonies massive, can form large colonies
- **Moon shape corallites**, very distinct in shape
- Single species



Family Oulastreidae (OUR)



- Monotypic – one species in one genus only



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Family Euphylliidae (EUP)



- Generally corals with tentacles out in the day
- Common genera: **Galaxea**, **Euphyllia**, **Fimbriaphyllia** (Split from Euphyllia)
- Other genera: Coeloseris (Monotypic), Montigyra (Potentially extinct), Simplastrea (Monotypic)
- Non-IP: Ctenella (Monotypic), Gyrosmilia (Monotypic)



Galaxea (EUP_GAL)

- Tentacles out in daytime, **tips are white because of visible skeleton** and look like stars – “galaxy”
- Colonies encrusting to massive
- Can form large stands



Euphyllia (EUP_EUP)

- **Tentacles out in daytime, ball tips**
- Colonies submassive
- Check skeleton to determine if Euphyllia or Heliofungia



Fimbriphyllia (EUP_FIM)

- **Tentacles out in daytime, tips are anchor or club**
- Colonies submassive
- Non-ball tip Euphyllia were moved to this family



Family Plerogyridae (PLE)



- Bubble coral and others
- Generally quite rare
- Common genera: **Plerogyra**, **Physogyra**
- Other genera: Blastomussa



Family **Lobophylliidae (LOB)**



- Generally fleshy and large corallites
- Common genera: **Echinophyllia, Lobophyllia**
- Less common genera: **Acanthastrea, Oxypora, Homophyllia, Micromussa**



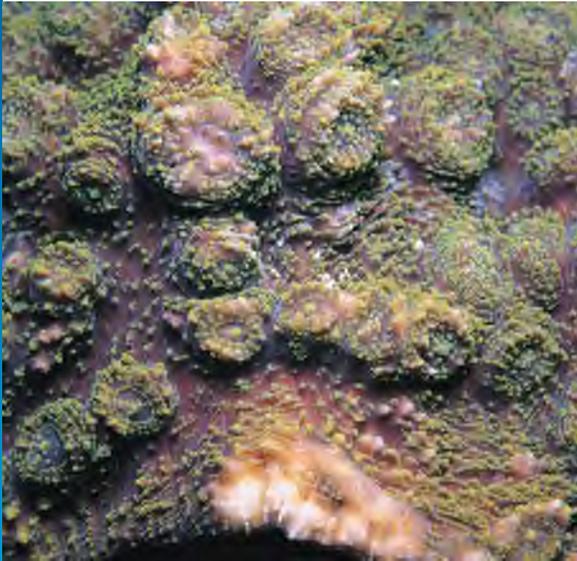
Lobophyllia (LOB_LOB)

- **Fleshy corallites that are large**, can be joined or separated
- Merged from Lobophyllia and Symphyllia
- Can be similar to Acanthastrea, Trachyphyllia



Echinophyllia (LOB_ECL)

- **Larger corallites exert generally rougher looking**, in a variety of colours
- Colonies encrusting to submassive to laminar
- See also Echinopora, Oxypora



Oxypora (LOB_OXY)

- **Larger corallites exert generally rougher looking**, in a variety of colours
- Colonies skeleton protruding to form spiky, rough texture, especially at edges
- Echinophyllia echinata moved to Oxypora



Acanthastrea (LOB_ACA)

- **Large fleshy corallites,** circular patterns distinct
- Larger corallites than Echinophyllia, smaller than Lobophyllia



Family Pachyseridae (PAC)



- New family with only one genus and species



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Pachyseris (PAC_PAC)

- Plating or laminar colonies
- **Ridges that form circles, parallel to the edge**
- Can get irregular in contorted colonies



Family Dendrophylliidae (DEN)



- Conical corallites with distinct shape
- Mostly azooxanthellate corals but some zooxanthellate
- Zoox: **Turbinaria, Duncanopsammia**
- Azoox: **Tubastraea, Balanophyllia, Dendrophyllia, Heteropsammia, Rhizopsammia**



Turbinaria (DEN_TUR)

- **Unifacial laminae** with distinct corallites
- **Coenosteum usually smooth**
- *T. peltata* moved to *Duncanopsammia* for now*



Tubastraea (DEN_TUB)

- Cave corals, generally found under structures, in dark areas
- **Azooxanthellate** so they do not need sunlight
- Can be a variety of colours – yellow-orange, green, black

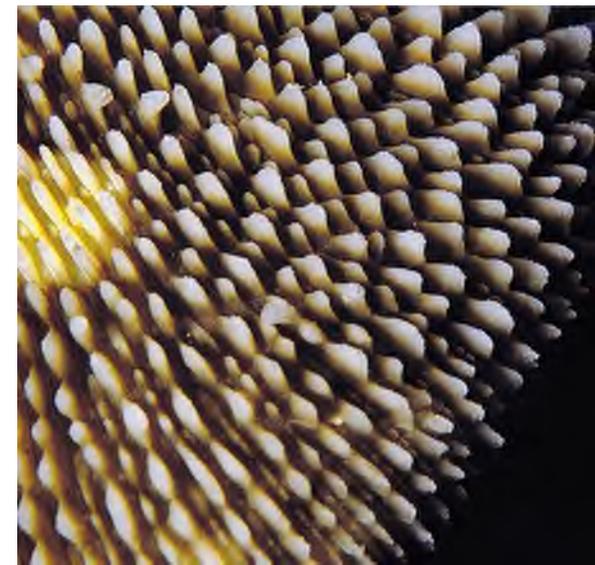


Family Fungiidae (FUN)

- Mostly free-living mushroom & some plating colonies
- Free-living all grouped in **Other Fungiidae**
- Typical mushroom shape: Cycloseris, Fungia, Danafungia, Lobactis, Pleuractis
- Elongated: Herpolitha, **Ctenactis**, Halomitra, Zooplius
- Tentacles out: Polyphyllia (Monotypic), Heliofungia (Monotypic)
- Plating: Lithophyllon, Podabacia

Ctenactis (FUN_CTE)

- Large mushroom coral, usually oval
- Jagged teeth on coral



Other Fungiidae (FUN_FUN)

- Typical mushroom coral, round to oval
- Septa teeth can be distinct, mouths coloured
- Many species but can be difficult to distinguish



Lithophyllon (FUN_LIT)

- Plating mushroom coral with **distinct white mouths**
- Coenosteum patterns clear and colonies plating to laminar
- Similar to Podabacia which has no white mouths



Podabacia (FUN_POD)

- Plating mushroom coral with distinct patterns
- Coenosteum patterns clear and colonies plating to laminar
- **Mouths are distinct but not white** like in Lithophyllon



Soft Corals

- Three main groups of soft corals commonly found
- Leathery Sarcophytidae: Sarcophyton, Lobophytum, Sclerophytum (Ex: Sinularia)
- Tree-like Nephtheidae: Litophyton (Ex: Nephthea), Dendronephthea
- Stalked Xeniidae: Xenia

Heliopora (HEL_HEL)

- "Blue Coral" is a soft coral with skeleton
- Forms hard skeleton that is blue, surface can be brown
- Pores on the surface look distinct, with polyps sometimes out in day causing fuzzy appearance



Hydrozoan



- Not hard coral or soft coral
- But contains stinging cells too
- Specific hydrozoan - Millepora



Millepora (MIL_MIL)

- "Fire Coral" is a hydroid with skeleton
- Yellow-brown with very tiny pores where polyps are
- Surfaces can look smooth, with fine hairs
- Colonies branching, plates or encrusting



Macroalgae Brown (MA_BR)



- Brown in colour, sometimes a bit green
- Some common groups – Sargassum, Lobophora, Padina
- Other groups – Dictyota, Turbinaria (Algae)



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Sargassum

- Brown algae
- **Bubble-like vesicles that help algae float**
- Fronds can be a variety of shapes, edged



Padina

- Brown algae (Mermaid's fan)
- **Half-circle fronds with distinct white edges**
- Hard to the touch



Lobophora

- Brown algae
- **Sheets that form layers with half-circle shapes**



Turbinaria

- Brown serrated algae
- **Serrated fronds with different angular shapes**



Dictyota

- Brown ribbon algae
- **Fronds form Y-shapes with rounded/squarish tips**



Macroalgae Green (MA_GR)



- Usually bright or deep green in colour
- Some common groups – Halimeda
- Other groups – Bryopsis, Ulva



Halimeda

- Green calcareous algae
- **Rounded discs that form chains**
- Hard structures



Bryopsis

- Green filamentous algae
- **Hairy, filamentous algae**



Ulva

- Green lettuce algae
- **Thin sheets that look see-through**
- Variety of different shapes



Macroalgae Red (MA_RE)



- Red in colour, usually distinct from brown
- Some common groups – Peysonnelia
- Includes CCA, ECA, but those are categorised separately



Resources



Corals of the World ([Corals of the World](#)): Resources for species pages (Taxonomy not fully updated)

World Register of Marine Species ([WoRMS - World Register of Marine Species](#)): Resources for checking updated taxonomy and nomenclature

Taxonomy Morphological Characteristics ([Glossary Menu of Coral Morphology \(miami.edu\)](#)): Glossary for taxonomy terms

ReefCloud Labelsets and Guidelines (<https://docs.reefcloud.ai/>): Image library and Taxonomy used in different labelsets

CoralFinder and ReefFinder ([BYOGUIDES - Be Your Own Guide!](#)): For purchasing of Reef and CoralFinders





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