**Supplementary Table 2.** Some dimensions illustrating opportunities for partitioning among biological mechanisms and physico-chemical parameters of the reef coral multi-dimensional niche.

|  |
| --- |
| Biological  |
| Reproductive modes | Sexual – gonochoric or hermaphroditic with multiple variations; brooding – broadcast spawning; asexual – fragmentation, budding |
| Transmission of zooxanthellae, other members of coral microbiome |  ‘Vertical’ or ‘horizontal’, shuffling – flexibility in symbiosis re physiological acclimation by mutualists, commensals, parasites in holobiont |
| Larval survivorship | Length of competency, resistance to disturbance (e.g. heat waves, radiation flux) |
| Sensitivity to different larval settlement cues | Substrate type, chemical cues, orientation, and illumination  |
| Trophic modes and flexibility 1 | Autotrophy – levels of illumination, colony morphology, types of zooxanthellae, capacity for shuffling; Heterotrophy – prey capture, detrital feeding |
| Growth and space creation 2 | Colony form, growth rate, and capacity for injury repair, all differ in different environmental settings in response to illumination – shading, wave energy, current flow, substrate type, orientation of slope, current flow and exposure |
| Space maintenance | Interactions via sweeper tentacles, mesenterial filaments, toxins, overtopping, and sediment removal via physical or physiological shedding, with photosynthetic and respiratory responses |
| Resistance to diseases | Intra- and interspecific physiological variation  |
| Environmental  |
| Substrate type | Consolidated reef pavement, large – small blocks, rubble, sand |
| Physical exposure | Intertidal, subtidal |
| Illumination | Water clarity – turbidity, with diurnal, seasonal changes |
| Sedimentation | Rates, particle sizes and composition, and variability |
| Wave energy and current flow | Diurnal, seasonal and inter-annual variability |
| Water temperature | Diurnal, seasonal and inter-annual variability |
| Slope angle and rugosity | Vertical to horizontal |

1. Relations among colony morphology and polyp diameter, proxies for autotrophy and heterotrophy respectively, provide evidence of resource partitioning, considered a key factor in the structure of well-developed coral communities of the Caribbean Sea (Porter, 1976). That no two species occupied the same place on a graph of autotrophic and heterotrophic abilities was taken as evidence of niche separation for these energy resources. Despite seminal early work (e.g. Yonge, 1930), we are unaware of similar studies on IWP reefs (but see Anthony and Connolly, 2004). It is known, however, that a suite of some 50 IWP species are specialized detritus feeders, rather than predators of plankton, adding additional dimensions to the auto- / heterotroph continuum, as do differential capacities for rejection of sediment (Stafford-Smith and Ormond, 1992). Autotrophy also has complex intra- and interspecific variability, governed by degree of flexibility in the coral-algal symbiosis, aided by as yet poorly-understood, complex relations and degree of host specificity between corals and their endosymbionts (Sampayo et al., 2007; Cooper et al., 2011; Lajeunesse et al., 2018). Crucially, this includes variable capacities for acquisition, shuffling or, unproven, switching of zooxanthellae, and the roles of other members of the coral microbiome (Baker, 2003; Little et al., 2004; Mieog et al., 2009; Sweet and Bulling, 2017; Grottoli et al., 2018).
2. As one example of coral growth creating space for other corals, upward growth of large massive corals, major framework builders, can shade their own colony bases. The reduced illumination contributes to differential mortality on affected colony surfaces, causing development of isolated ramets that ultimately become dislodged, forming cloned daughter colonies around the colony base or further afield, contributing to reef-building (Potts et al., 1985; DeVantier and Endean, 1989; Done and Potts, 1992) and aggregated community structure (Idjadi and Karlson, 2007). The loss of living tissue around parent colony bases also provides space for recruitment by more shade-tolerant coral taxa. Large *Porites* colonies can support numerous additional species on such surfaces, including species of *Leptoseris* more commonly found in the mesophotic zone, significantly increasing SL (L.M. DeVantier, unpubl.).

**References**

Anthony, K.R., and Connolly, S.R. (2004). Environmental limits to growth: physiological niche boundaries of corals along turbidity–light gradients. *Oecologia* 141, 373–384. doi:10.1007/s00442-004-1647-7

Baker, A.C. (2003). Flexibility and specificity in coral-algal symbiosis: Diversity, ecology, and biogeography of *Symbiodinium*. *Annu. Rev. Ecol. Evol. Syst.* 34, 661–689. [doi:10.1146/annurev.ecolsys.34.011802.132417](https://doi.org/10.1146/annurev.ecolsys.34.011802.132417)

Cooper, T.F., Ulstrup, K.E., Dandan, S.S., Heyward, A.J., Ku¨hl, M., Muirhead, A., O’Leary, R.A., Ziersen, B.E.F., and Van Oppen, M.J.H. (2011). Niche specialization of reef-building corals in the mesophotic zone: metabolic trade-offs between divergent *Symbiodinium* types. *Proc. R. Soc. B* 278, 1840–1850. doi:10.1098/rspb.2010.2321

DeVantier, L.M., and Endean, R. (1989). Observations of colony fission following ledge formation in massive reef corals of the genus *Porites*. *Mar. Ecol. Prog. Ser.* 58, 191–195.

Done, T.J., and Potts, D.C. (1992). Influences of habitat and natural disturbances on contributions of massive *Porites* corals to reef communities. *Mar. Biol.* 114, 479–493. doi:10.1007/BF00350040

Grottoli, A.G., Dalcin Martins, P., Wilkins, M.J., Johnston, M.D., Warner, M.E., Cai, W-J., Melman, T.F., Hoadley, K.D., Pettay, D.T., Levas, S., and Schoepf, V. (2018). Coral physiology and microbiome dynamics under combined warming and ocean acidification. *PLoS One* 13, e0191156. doi:10.1371/journal.pone.0191156

Idjadi, J.A., and Karlson, R.H. (2007). Spatial arrangement of competitors influences coexistence of reef-building corals. *Ecology* 88, 2449–2454. www.jstor.org/stable/27651389

Lajeunesse, T.C., Parkinson, J.E., Gabrielson, P.W., Jeong, H.J., Reimer, J.D., Voolstra, C.R. and Santos, S.R. (2018). Systematic revision of Symbiodiniaceae highlights the antiquity and diversity of coral endosymbionts. *Curr. Biol.* 28, 2570–2580. doi:10.1016/j.cub.2018.07.008

Little, A.F., Oppen, M.J., and Willis, B.L. (2004). Flexibility in algal symbioses shapes growth in reef corals. *Science* 304, 1492–1494. doi:[10.1126/science.1095733](https://doi.org/10.1126/science.1095733)

Mieog, J.C., Olsen, J.L., Berkelmans, R., Bleuler-Martinez, S.A., Willis, B.L., van Oppen, M.J.H. (2009). The roles and interactions of symbiont, host and environment in defining coral fitness. *PloS One* 4, e6364. [doi:10.1371/journal.pone.0006364](https://doi.org/10.1371/journal.pone.0006364)

Porter, J.W. (1976). Autotrophy, heterotrophy, and resource partitioning in Caribbean reef-building corals. *Am. Nat.* 110, 731–742. doi:[10.1086/283100](https://doi.org/10.1086/283100)

Potts, D.C., Done, T.J., Isdale, OP., and Fisk, D. (1985). Dominance of a coral community by the genus Porites (Scleractinia). *Mar. Ecol. Prog. Ser.* 23, 79–84. doi:10.3354/meps023079

Sampayo, E.M., Franceschinis, L., Hoegh-Guldberg, O., and Dove, S. (2007). Niche partitioning of closely related symbiotic dinoflagellates. *Mol. Ecol.*16, 3721–3733doi: 10.1111/j.1365-294X.2007.03403.x

Stafford-Smith, M., and Ormond, R.F.G. (1992). Sediment-rejection mechanisms of 42 species of Australian scleractinian corals. *Aust. J. Mar. Freshw. Res.* 43, 683–705. doi: 10.1071/MF9920683

Sweet, M.J., and Bulling, M.T. (2017). On the importance of the microbiome and pathobiome in coral health and disease. *Front. Mar. Sci*. 4, 9. [doi:10.3389/fmars.2017.00009](https://doi.org/10.3389/fmars.2017.00009)

Yonge, C.M. (1930). Studies on the physiology of corals. I. Feeding mechanisms and food. *Scientific Report of the Great Barrier Reef Expedition, 1928-29.* British Museum (Natural History) 1, 13–57.