# S2 Table. Coral related parameters used in Guam Atlantis.

| **Parameter** | **value** | **mini-mum** | **maxi-mum** | **unit** | **source** |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| ***Growth related:*** |  |  |  |  |  |
| *Autotrophic feeding* |  |  |  |  |  |
| light threshold for feeding  | 700 |  |  | W/m2 | assuming 15% of noon sunlight |
| corals feeding during day | 20 |  |  | % |  |
| translocation of nutrients to host  | 90 |  |  | % | [[1](#_ENREF_1)] |
| *Sediment smothering effects*  |  |  |  |  |  |
| Ksmother coefftient; | 0.054 |  |  | nd | [[2](#_ENREF_2)] |
| Ksmother\_constant; | 0.4622 |  |  | nd | [[2](#_ENREF_2)] |
| *Algal-coral competition* |  |  |  |  |  |
| max growth rate massive corals | 0.0003 | 0.00011 | 0.019 | d-1 | 0.003 [[3](#_ENREF_3)]; 0.003 [[4](#_ENREF_4)]; 0.0004-0.0194 [[5](#_ENREF_5)]; 0.00011-0.0055 [[6](#_ENREF_6)] |
| max growth rate branching corals | 0.0003 | 0.00011 | 0.059 | d-1 |  |
| max growth rate turf | 0.075 | 0.027 | 0.4 | d-1 | 0.029 [[7](#_ENREF_7)]; 0.027 [[8](#_ENREF_8)]; 0.04 [[5](#_ENREF_5)]; 0.05-0.4 [[6](#_ENREF_6)] |
| max growth rate macroalgae | 0.018 | 0.014 | 0.4 | d-1 | 0.018 [[7](#_ENREF_7)]; 0.06 [[9](#_ENREF_9)] (*Kappaphycus*); 0.014 [[5](#_ENREF_5)]; 0.05-0.4 [[6](#_ENREF_6)] |
| max growth rate CCA | 0.01 | 0.01 | 0.026 | d-1 | 0.010 [[7](#_ENREF_7), [10](#_ENREF_10)]; 0.026 [[5](#_ENREF_5)] |
| max growth rate small phytoplankton | 0.41 | 0.41 | 3.2 | d-1 | 0.41 [[4](#_ENREF_4)]; 3.2 [[11](#_ENREF_11)] |
| max growth rate large phytoplankton | 4.1 | 0.41 | 6.4 | d-1 | 0.41 [[4](#_ENREF_4)]; 6.4 [[11](#_ENREF_11)] |
| turf-coral overgrow (rate of growth suppression) | 0 |  |  |  | [[12](#_ENREF_12)] |
| macroalgae-coral overgrow (rate of growth suppression) | 0.0010 | 0.00014 | 0.0011 | d-1 | [[6](#_ENREF_6), [12-14](#_ENREF_12)] |
| CCA-coral overgrow (rate of growth suppression) | 0 |  |  |  | [[15](#_ENREF_15)] |
| turf-coral facilitation (% facilitation of coral recruitment) | 5 | 5 | 15 | % | [[6](#_ENREF_6), [12](#_ENREF_12)] |
| macroalgae-coral competition (% growth inhibition) | 80 | 40 | 90 | % | [[6](#_ENREF_6), [12](#_ENREF_12)] |
| CCA-coral facilitation (% facilitation of coral recruitment) | 5 | 5 | 15 | % | [[6](#_ENREF_6), [12](#_ENREF_12)] |
| half saturation constant for growth on DIN for massive corals  | 50 | 5.6 | 28 | mgN/m3 | 0.23-0.8 µM NO3 [[16](#_ENREF_16)]; 5-22µM NO3 [[17](#_ENREF_17)] |
| half saturation constant for growth on DIN for branching corals | 50 | 5.6 | 28 | mgN/m3 | 5.6-28 (0.4-2.0 µM); NO3 0.23-0.8 µM [[16](#_ENREF_16)]; 5-22uM [[17](#_ENREF_17)] |
| half saturation constant for growth on DIN for turf algae | 6 |  |  | mgN/m3 |  |
| half saturation constant for growth on DIN for macroalgae  | 6 | 1.4 | 11.2 | mgN/m3 | 0.1-0.8 mmol/m3 [[18](#_ENREF_18)] |
| half saturation constant for growth on DIN for CCA | 6 |  |  | mgN/m3 |  |
| half saturation constant for growth on DIN for small phytoplankton | 0.35 | 0.0084 | 1.4 | mgN/m3 | 0.025 mmol/m3 [[19](#_ENREF_19)]; 0.6 nmol/m3 [[11](#_ENREF_11)]; 0.1 mmol/m3 [[18](#_ENREF_18)] |
| half saturation constant for growth on DIN for large phytoplankton | 0.35 | 0.0028 | 1.4 | mgN/m3 | 0.025 mmol/m3 [[19](#_ENREF_19)]; 0.2 nmol/m3 at [[11](#_ENREF_11)]; 0.1 mmol/m3 [[18](#_ENREF_18)] |
| light saturation branching corals | 35 | 11 | 67 | W/m2 | 50-300 µE/m2/s [[20](#_ENREF_20)] |
| light saturation massive corals  | 35 | 11 | 67 | W/m2 | 50-300 µE/m2/s [[20](#_ENREF_20)] |
| light saturation turf  | 5 |  |  | W/m2 |  |
| light saturation macroalgae | 5 |  |  | W/m2 | Skagerrak&Baltic Sea ~ 100 µmol photons/m2/s= 0.135 W/m2 |
| light saturation CCA | 5 |  |  | W/m2 |  |
| light saturation small phytoplankton | 20 |  |  | W/m2 | [[19](#_ENREF_19)] |
| light saturation large phytoplankton  | 20 |  |  | W/m2 | [[19](#_ENREF_19)] |
|  |  |  |  |  |  |
| ***Rugosity related:*** |  |  |  |  |  |
| rugosity based habitat dependency coefficient | 1.4613 |  |  | nd | Shape of relationship inferred from [[21-23](#_ENREF_21)] |
| rugosity based habitat dependency constant | 0.0475 |  |  | nd |  |
| rugosity based habitat dependency cap | 4 |  |  | nd |  |
| rugosity based habitat dependency scalar | 8 |  |  | nd |  |
|  |  |  |  |  |  |
| rugosity constant | 1.3 |  |  | nd | adapted from [[24](#_ENREF_24)] |
| massive corals colony height parameter | 0.715 |  |  | cm |  |
| branching corals colony height parameter | 0.81 |  |  | cm | average of slopes from *Porites* sp. [[24](#_ENREF_24)] |
| branching corals max. colony diameter | 60 | 0-5 | >300 | cm | mean 26 cm L. Raymundo, unpublished data, 17 cm CRED data |
| massive corals max. colony diameter | 30 | 0-5 | >300 | cm | mean 14 cm L. Raymundo, unpublished data, 15 cm CRED data |
| **Ocean change related** |  |  |  |  |  |
| *Aragonite saturation - CO3 calculation* |  |  |  |  |
| Karag\_A | 0.9485 |  |  | nd | [[25](#_ENREF_25)]; Values for coefficients from proxy fitting exercise - from data given in Bjerrum plot |
| Karag\_B | 8.20416 |  |  | nd | [[25](#_ENREF_25)]; Values for coefficients from proxy fitting exercise - from data given in Bjerrum plot |
| Karag\_C | 2.3641 |  |  | nd | [[25](#_ENREF_25)]; Values for coefficients from proxy fitting exercise - from data given in Bjerrum plot |
| Karag\_D | 8 |  |  | nd | [[25](#_ENREF_25)]; Values for coefficients from proxy fitting exercise - from data given in Bjerrum plot |
| Karag\_pH; | time series pCO2 |  |  | nd | IPCC AR5 RC8.5; for control pCO2 3580 constant |
| Kca\_const; | 0.0103 |  |  |  | [[25-28](#_ENREF_25)]  |
| K\_Ks; | 6 10-9 |  |  | nd | [[26](#_ENREF_26)] |
| *Calcification related parameters* |  |  |  |  |  |
| Reference baseline calcification rate | 15.03 | 12.03 | 17.03 | ppm | 380 ppm [[29](#_ENREF_29), [30](#_ENREF_30)] (needed to lower to get realistic rates of calcification) |
| calcification T constant  | 9.7 | 9.03 | 10.37 | nd | [[30](#_ENREF_30), [31](#_ENREF_31)] |
| calcification T coefficient | 18.83 | 12.98 | 24.68 | nd | [[30](#_ENREF_30), [31](#_ENREF_31)] |
| calcification optimum temperature | 29 |  |  | °C | close to natural summer ambient temperature [[32](#_ENREF_32)]; summer solstice temp [[30](#_ENREF_30)] |
| calcification Lambda | 0.42 | 0.33 | 0.51 | nd | [[30](#_ENREF_30), [31](#_ENREF_31)] |
| light threshold for autotrophic feeding | 700 |  |  | W/m2 | assumption 85% of noon irradiance |
| proportion feeding during light | 20 |  |  | % | assuming mostly feeding at night |
| host remineralization | 90 |  |  | % | [[1](#_ENREF_1)] |
| *Growth/fecundity relationship with pH* |  |  |  |  |
| CCA coeff. & const | -3.0, 0.5 |  |  | nd | [[33](#_ENREF_33), [34](#_ENREF_34)] |
| large phytoplankton parameters | 1.4, 1.1705, 4, 150 |  |  | nd | [[35](#_ENREF_35), [36](#_ENREF_36)] |
| small phytoplankton parameters |  3.7, 1.0, 5, 200 |  |  | nd | [[35](#_ENREF_35), [36](#_ENREF_36)] |
| macroalgae parameters | 1.6, 1.1,6, 150 |  |  | nd | [[35](#_ENREF_35), [36](#_ENREF_36)] |
| zooplankton parameters | 5.0, 1.7 |  |  | nd | [[35](#_ENREF_35), [37](#_ENREF_37), [38](#_ENREF_38)] |
| benthic grazers (urchins) coeff. & const | -3.0, 0.5 |  |  | nd | [[35](#_ENREF_35), [37](#_ENREF_37), [38](#_ENREF_38)]  |
| benthic filter feeders (bivlaves) coeff. & const |  -3.0, 0.5 |  |  | nd | [[38](#_ENREF_38)]  |
| *Bleaching parameters* |  |  |  |  |  |
| bleaching mortality massive corals | 22.5 | 3.14 | 41.87 | % | [[39-42](#_ENREF_39)] |
| bleaching mortality branching corals | 42 | 19.7 | 100 | % | [[39-42](#_ENREF_39)] |
| bleaching rate massive corals) | 25 | 9.8 | 40.2 | % | [[39-42](#_ENREF_39)] |
| bleaching rate branching corals | 24.2 | 6.9 | 41.5 | % | [[39-42](#_ENREF_39)] |
| bleaching recovery rate massive corals  | 0.0027 |  |  | d-1 | [[43](#_ENREF_43)] |
| bleaching recovery rate branching corals  | 0.0822 |  |  | d-1 | [[44](#_ENREF_44)] (0.2 degree /decade) |
| bleaching temperature massive corals/branching corals | 30.4 |  |  | °C | 1 degrees above summer max ambient, NOAA Coral Reef Watch |
| prop zooxanthellae massive corals/branching corals | 30 | 5 | 30 | % | 15% [[45](#_ENREF_45)]; <5% [[46](#_ENREF_46)]; 30% [[1](#_ENREF_1)] |
| degree heating weeks (DHW) threshold massive corals | 4 |  |  | DHW | [[41](#_ENREF_41), [42](#_ENREF_42)] |
| degree heating weeks (DHW) threshold branching corals | 3 |  |  | DHW | [[41](#_ENREF_41), [42](#_ENREF_42)] |

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