**Figure S1.** Calculation of the Bray–Curtis distance to pre-disturbance communities from the 1996-2017 time series: example of the first three reefs in the dataset. Where hard coral cover lies between its maximum, HC$_{\text{max}}$, and HC$_{\text{max}}$-5% (dotted blue lines), coral communities are considered pre-disturbance. Sections of the time-series indicated in red correspond to hard coral cover decline / community disassembly, those in green to hard coral cover recovery / community reassembly. Letters (top panel) indicate acute disturbances with C: crown-of-thorns outbreaks; M: multiple (i.e., occurrence of more than one acute disturbance between two consecutive surveys).
Figure S2. Interaction plots for the hierarchical linear models of $\Delta HC$ as a function of $SHELF$ and the Bray–Curtis distance to pre-disturbance communities corresponding to disassembly and reassembly respectively. For each level of $\Delta HC$ tested, asterisks indicate significant cross-shelf differences in disassembly or reassembly (**: $P < 0.01$; ***: $P < 0.001$).
Figure S3. Multicollinearity among water quality indices. Pearson’s correlation coefficients are indicated above the diagonal; scatter plots and non-linear regression (GAM) are shown below the diagonal, and individual variable distributions (histograms) are indicated on the diagonal. With Chl: long-term average of chlorophyll-a concentration, Kd490: long-term average of light attenuation at 490 nm, NAP: non-algal particulates.
**Figure S4.** Trace plots for posterior parameter estimates in the first model set based on three parallel chains and N = 5000 iterations (500 for burn-in, not shown).
**Figure S5.** Distribution of hard coral cover (HCC) in pre-disturbance years (i.e., when HCC differs from its maximum by less than 5%) across shelf levels (I: inner shelf; M: mid shelf, O: outer shelf). Violin plots represent data density, with plot width being proportional to the amount of data. Thick vertical lines represent the interquartile range, and the white dot the median.