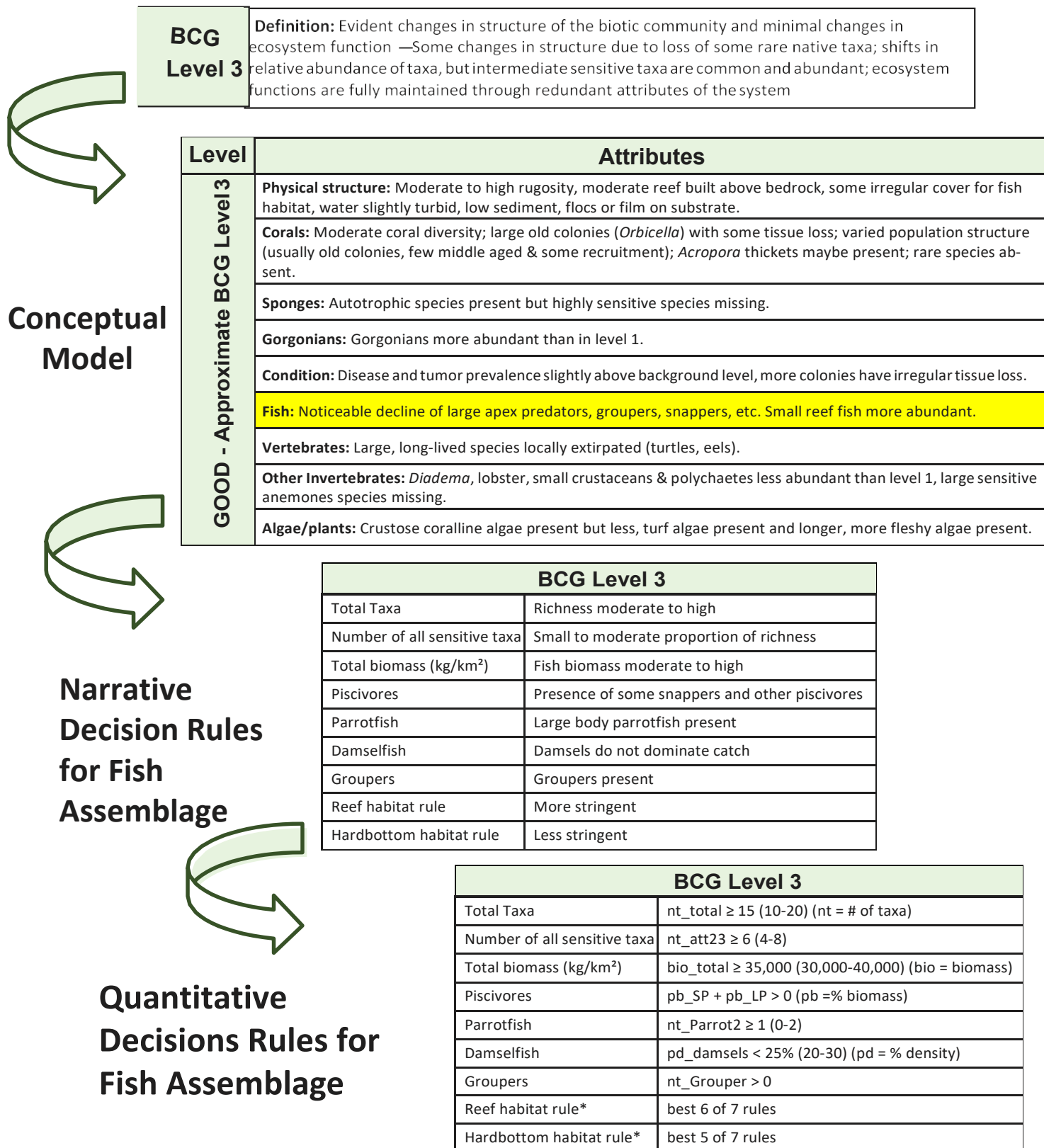# Hand Out #3   What constitutes the final BCG model?

The final model is a set of quantitative decision rules for assigning sites to BCG levels. The rules are supported by expert knowledge and narrative descriptions for each level and includes a method for entering site data (e.g. R code, database, or spreadsheet) to routinely assign sites to the appropriate BCG level. See example below.

BCG Level 3	Definition: Evident changes in structure of the biotic community and minimal changes in ecosystem function —Some changes in structure due to loss of some rare native taxa; shifts in relative abundance of taxa, but intermediate sensitive taxa are common and abundant; ecosystem functions are fully maintained through redundant attributes of the system

Conceptual Model

Level	Attributes
GOOD - Approximate BCG Level 3	**Physical structure:** Moderate to high rugosity, moderate reef built above bedrock, some irregular cover for fish habitat, water slightly turbid, low sediment, flocs or film on substrate.
	Corals: Moderate coral diversity; large old colonies (*Orbicella*) with some tissue loss; varied population structure (usually old colonies, few middle aged & some recruitment); *Acropora* thickets maybe present; rare species absent.
	Sponges: Autotrophic species present but highly sensitive species missing.
	Gorgonians: Gorgonians more abundant than in level 1.
	Condition: Disease and tumor prevalence slightly above background level, more colonies have irregular tissue loss.
	Fish: Noticeable decline of large apex predators, groupers, snappers, etc. Small reef fish more abundant.
	Vertebrates: Large, long-lived species locally extirpated (turtles, eels).
	Other Invertebrates: *Diadema*, lobster, small crustaceans & polychaetes less abundant than level 1, large sensitive anemones species missing.
	Algae/plants: Crustose coralline algae present but less, turf algae present and longer, more fleshy algae present.

Narrative Decision Rules for Fish Assemblage

BCG Level 3	
Total Taxa	Richness moderate to high
Number of all sensitive taxa	Small to moderate proportion of richness
Total biomass (kg/km²)	Fish biomass moderate to high
Piscivores	Presence of some snappers and other piscivores
Parrotfish	Large body parrotfish present
Damselfish	Damsels do not dominate catch
Groupers	Groupers present
Reef habitat rule	More stringent
Hardbottom habitat rule	Less stringent

Quantitative Decisions Rules for Fish Assemblage

BCG Level 3	
Total Taxa	nt_total ≥ 15 (10-20) (nt = # of taxa)
Number of all sensitive taxa	nt_att23 ≥ 6 (4-8)
Total biomass (kg/km²)	bio_total ≥ 35,000 (30,000-40,000) (bio = biomass)
Piscivores	pb_SP + pb_LP > 0 (pb =% biomass)
Parrotfish	nt_Parrot2 ≥ 1 (0-2)
Damselfish	pd_damsels < 25% (20-30) (pd = % density)
Groupers	nt_Grouper > 0
Reef habitat rule*	best 6 of 7 rules
Hardbottom habitat rule*	best 5 of 7 rules

The BCG process is intended to explicitly link expert knowledge with statistical analysis in development of a quantitative BCG model. This example shows the sequential linkage between the conceptual level description, narrative and then numeric rules for assigning a coral reef fish community to BCG level 3. The rules are adjusted for substrate.