

## APPENDIX 7 to the paper

### *A regionally scalable habitat typology for assessing benthic habitats and fish communities: application to New Caledonia reefs and lagoons*

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## Images illustrating the rules selected for each habitat

Several screenshots were sampled for each rule. Each screenshot represents a single frame at an observation station. Screenshots were selected in various sites (see Fig. 1), geomorphological units (from fringing reefs to barrier reefs) and management statuses (non protected areas (NP), MPA, WH, CSMP).





### 1. Macroalgae habitat

MA1 Very dense erect macroalgae	
Islet fringing reef Nouméa area, Signal MPA (depth 10m)	
Lagoon reef, Nouméa area, Prony reef NP (depth 5m)	
Islet fringing reef, Nouméa area, Larégnère MPA (depth 5m)(left), Goéland NP (depth 8m)(right)	




MA2 Dense erect macroalgae

<p>Islet fringing reef Nouméa area, Signal MPA (depth 5m) (left), Mba-Mbo (depth 9m)(right)</p>			
<p>Islet fringing reef, Nouméa area, Larégnère MPA (depth 3m)</p>			
<p>Islet fringing reef, Nouméa area NP, Crouy (depth 3m)(left), Goéland (depth 2m)(right)</p>			

MA3 Semi-sparse erect macroalgae






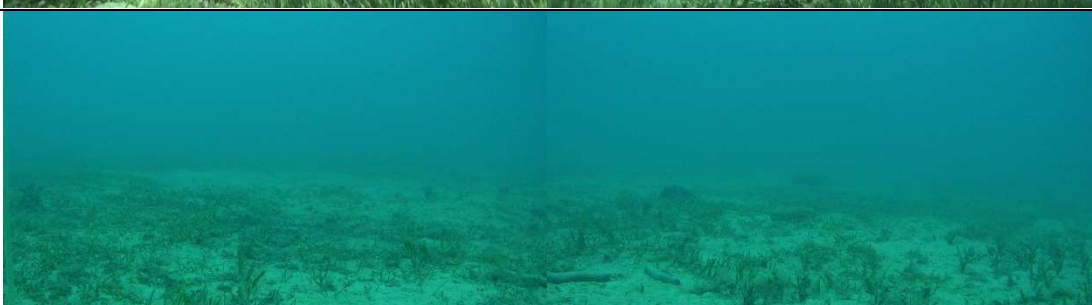
<p>Islet fringing reef, Nouméa area NP, Goéland –depth 6m)</p>			
<p>Barrier reef, internal reef flat, WH, Southern Lagoon, Merlet Integral reserve (depth 6m)</p>			

MA4 Sparse macroalgae

<p>Barrier reef, reef flat, Nouméa MPA, Aboré reef (depth 4m)</p>		
<p>Shallow lagoon, WH Southern Lagoon, Merlet Integral reserve (depth 3m)</p>		
<p>Islet fringing reef, Nouméa area, Larégnère NP (depth 6m)</p>		

## 2. Sea Grass habitat

SG1 Very dense or continuous sea grass beds	
Barrier reef, internal lagoon Nouméa MPA, Aboré reef (depth 3m)	
Deep lagoon, Nouméa area, Lange Islet NP (depth 11m)	
Deep lagoon, Nouméa area, Signal Islet MPA (depth 13m)	
Coastal fringing sea grass, WH Bourail, Poe MPA (left), Deva NP (right)(depth 1m)	
Shallow lagoon, Koné, Oundjo Customary reserve (depth 2m)	



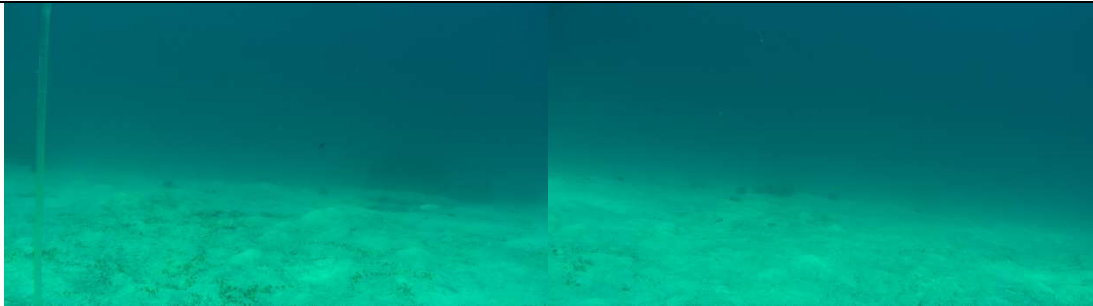

SG2 Dense possibly discontinuous sea grass beds	
Shallow lagoon, WH Bourail, Poe MPA (depth 2m)	
Deep lagoon, Nouméa area, Larégnière NP (depth 9m)	
Coastal fringing sea grass, WH Pouebo (depth 1m)	
SG3 Semi-sparse (or boundaries of) sea grass beds	
Barrier reef, internal shallow lagoon Nouméa MPA, Aboré reef (depth 3m)	
Coastal fringing reef, WH Bourail, Poe MPA (depth 1m)	
Deep lagoon, Nouméa area, Sèche-Croissant NP (depth 11m)	

SG4 Sparse deep sea grass beds, possibly mixed with sparse algae













<p>Deep lagoon, WH Ouano MPA (depth 10 m)</p>	
<p>Deep lagoon, Nouméa MPA, Larégnère (depth 12 m)</p>	
<p>Deep lagoon, Nouméa NP area, Signal (top), Larégnère (middle) (depth 14 m) and between the two islets (bottom) (depth 20 m)</p>	

*NB: SG4 not observed on internal barrier reefs*

### 3. Sandy habitat













SA1 Sandy bottoms (“white” bottoms)	
Remote barrier reef, internal lagoon, CSMP, Bellona (depth 25m)	
Barrier reef, internal shallow lagoon, WH Southern Lagoon, Garanhua reef (depth 8m)	
Barrier reef, internal deep lagoon Nouméa MPA, Aboré reef (depth 15m)	
Shallow lagoon, WH Bourail, Poe MPA (depth 2m)	

SA2 Sandy bottoms with macroalgae (including some algal turf)













<p>Barrier reef, internal shallow lagoon, WH Southern Lagoon, Nogumatiugi reef (depth 3m)</p>			
<p>Shallow lagoon, WH Southern Lagoon, Cimenia reef (depth 3m)</p>			
<p>Shallow lagoon, WH Southern Lagoon, Merlet Integral Reserve (depth 3m)</p>			
<p>Barrier reef internal deep lagoon, Nouméa MPA, Aboré (depths 11m (top) and 16m (bottom))</p>			
<p>Barrier reef internal deep lagoon, Nouméa MPA, Aboré (depths 11m (top) and 16m (bottom))</p>			
<p>Shallow lagoon, Koné NP (depth 9m)</p>			















SA3 Dominant sandy bottoms with some hard substrate, coral or debris

<p>Remote barrier reef, CSMP, Bellona, external slope Boody reef (depth 26m)(top) and internal slope (depth 3m) (bottom)</p>			
		<p>Remote barrier reef, internal shallow lagoon: CSMP, Chesterfield, South end (depth 5m)</p>	
		<p>Lagoon area, WH Southern Lagoon, close to coral patch (depth 8m)(top) and Umbei reef (depth 19m) (bottom)</p>	
			
<p>Barrier reef, internal shallow lagoon, Koné NP (depth 10m)</p>			

SA4 Dominant sandy bottoms with coral patches or debris – low to medium complexity









<p>Remote barrier reefs, CSMP, Bellona, internal slope at depths 9m (top) and 29m (bottom)</p>		
		
<p>Internal shallow lagoon: WH Southern Lagoon, Merlet Integral reserve, lagoon (depth 3m) (top) and isolated coral patch (depth 7m) (bottom)</p>		
		
<p>Barrier reef, internal slope: Borendy, Ngoe reef, NP (depth 7m)</p>		
<p>Barrier reef internal slope: WH Bourail, Poe MPA (depth 2m)</p>		

SA5 Dominant sandy bottoms with coral patches or debris – medium complexity











<p>Remote barrier reef, external slope: CSMIP, Chesterfield Bampton reef (depth 16m)</p>		
<p>Lagoon reef, WH Southern lagoon, Corne sud (depth 13m)</p>		
<p>Lagoon reef, WH Southern lagoon, Corne sud (depth 13m)</p>		
<p>Shallow lagoon, WH Southern Lagoon, Merlet Integral reserve, lagoon (depth 2m)</p>		
<p>Barrier reef, internal slope Borendy Ngoe reef, NP (depth 5m)</p>		
<p>Shallow lagoon reef, Koné, Oundjo customary reserve (depth 4m)</p>		

#### 4. Live Coral Habitat





LC1 : live coral cover > 80% : good and often excellent status of coral cover

<p>Remote barrier reef, external slope: CSMP, Entrecasteaux (top) (depths 5-6m) Chesterfield (middle and bottom) (depth 10m)</p>		
<p>Barrier reef: WH: Southern Lagoon (left) (depth 10m), Hienghene MPA (right) (depth 14m)</p>		
<p>Islet fringing reef: Nouméa MPA: Signal (top left) and Canard (top right, bottom left), Borendy MPA (bottom right) (respective depths 5, 6 and 2m)</p>		
		

LC2 : Dominant hard substrates with high live coral cover and substantial dead coral cover

<p>Remote reef: CSMP, Entrecasteaux, internal barrier (left) (depth 12m) and lagoon reef (right) (depth 3m)</p>		
<p>Barrier reef, external slope : WH, Southern Lagoon (depth 9m)</p>		
<p>Islet reef: WH, Southern Lagoon, Kouaré (depths 5 and 6m)</p>		
<p>Islet reef, Nouméa area MPA: Signal (top left)(depth 5m), Canard (top right)(depth 2m), Larégnère (bottom)(depth 4m), coastal fringing reef Kuendu (bottom right)(depth 5m)</p>		
		













LC3 : Mixed hard and sandy/debris substrate : good status of live coral cover with little dead coral, and substantial cover of either sand or debris

<p>Remote barrier reef, internal coral patch: CSMP, Astrolabe (depth 9m)</p>		
<p>Lagoon reef: WH, Southern Lagoon (depth 9m)</p>		
<p>Barrier reef, internal shallow lagoon, WH Bourail, Deva NP (depth 3m)</p>		
<p>Barrier reef internal slope: Borendy, Ngoe NP (depth 3m)</p>		

LC4 : Dominant hardcoral substrate with medium to low live coral cover

<p>Remote deep oceanic reef: CSMP, Chesterfield Dumont d'Urville (depth 17m)</p>		
<p>WH, Southern Lagoon, Merlet Integral Reserve : barrier reef, external slope (top)(depth 8m) and islet fringing reef (bottom) (depth 5m)</p>		
<p>Barrier reef, internal lagoon, Nouméa MPA, Aboré reef (depth 11m)</p>		
<p>Oceanic fringing reef, Xepenehe Bay, NP (depth 34m)</p>		
<p>Lagoon reef, Koné NP (depth 6m)</p>		

LC5 : Medium to low live coral cover with mixed hard and sandy substrates, no dominant debris





<p>Remote barrier reef: CSMP, and WH Entrecasteaux, Surprise (depth 12m)</p>		
<p>Lagoon reef: WH Southern Lagoon, Tironhua (depth 9m)</p>		
<p>Barrier reef, internal lagoon coral patch: Koné (NP) (depth 6m)</p>		
<p>Lagoon reef : Koné (customary reserve) (depth 6m)</p>		
<p>Islet fringing reef: Nouméa area, Mba NP (depth 6m)</p>		
<p>Islet fringing reef: Nouméa area, Maître MPA (depth 5m)</p>		













LC6 : Low live coral cover and substantial dead coral, possible algal turf

<p>Remote barrier reef, internal slope: CSMP, Chesterfield Bampton (depth 5m)</p>		
<p>Barrier reef, internal shallow lagoon reef: WH Southern lagoon, Garanhua (depth 5m)</p>		
<p>Barrier reef, internal lagoon reef: Nouméa MPA, Aporé reef «The forest» (depth 7m)</p>		
<p>Oceanic fringing reef: Lifou Jinek, NP (depth 14m)</p>		
<p>Shallow lagoon reef: WH Pouebo NP (depth 2m)</p>		
<p>Shallow lagoon reef: Koné, Oundjo customary reserve (depth 9m)</p>		

## 5. Debris habitat

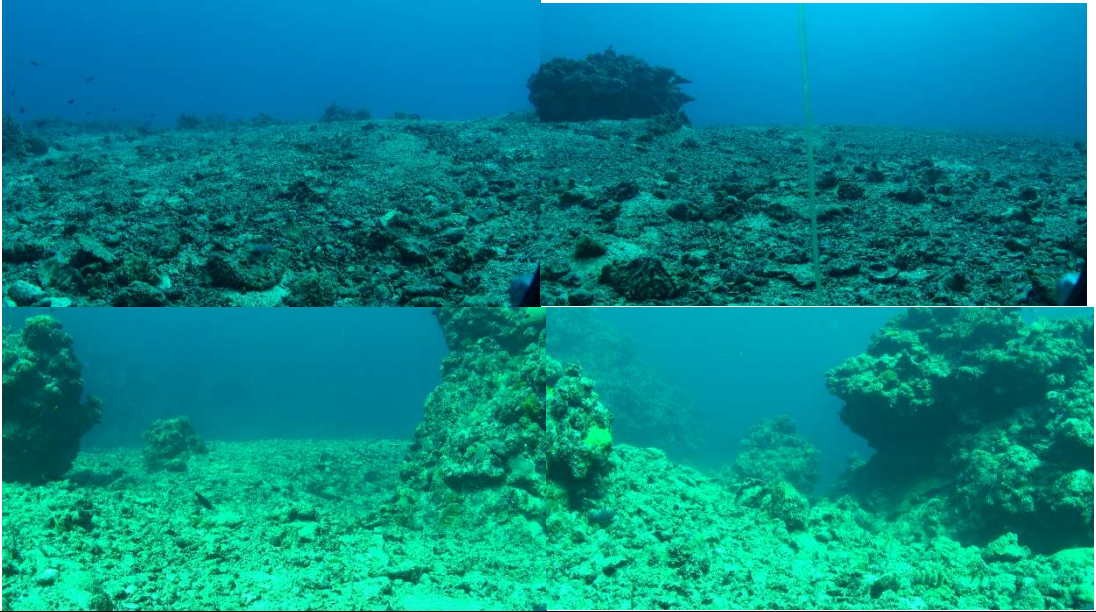
D1: Dominant small debris	
<p>Barrier reef, internal reef flat : CSMP, Astrolabe (depth 8m)</p>	
<p>Barrier reef, internal reef flat: Nouméa MPA, Aboré reef (depth 2m)</p>	
<p>Oceanic fringing reef: Lifou, Xepenehe, cruiseship mooring area (depth 40m)</p>	
<p>Islet fringing reef: Nouméa NP (mooring areas): Mbo (top left) (depth 2m), Sèche-Croissant, (top right)(depth 6m), Mbe Kouen (bottom)(depth 5m)</p>	

D2 Dominant small debris with presence of boulder (medium granularity debris)

<p>Barrier reef, internal shallow lagoon: Nouméa MPA, Aore (depth 4m)</p>		
<p>Oceanic fringing reef: Lifou, Xepenehe NP (depth 35m)</p>		
<p>Barrier reef, internal reef flat: WH, Hienghene, MPA, Doimen (depth 5m)</p>		
<p>Barrier reef, internal shallow lagoon: WH, Bourail, Deva (depth 2m)</p>		
<p>Islet fringing reef, Borendy NP (depth 4m)</p>		

D3 Dominant small debris with no boulders, possibly dead coral or slab

Remote barrier reef: CSMP and WH,  
Entrecasteaux: Grand Guilbert (top)(internal  
slope, depth 19m) and Huon  
(bottom)(external slope, depth 9m)



Oceanic fringing  
reef: Xepenehe NP  
(depth 28m)



Barrier reef, internal  
reef flat: WH,  
Bourail, Deva (depth  
2m)



D4 Dominant small debris with sand and no boulder












Remote barrier reef,  
internal shallow  
lagoon: CSMP,  
Astrolabe (depth  
9m)



Lagoon reef flat,  
WH, Southern  
Lagoon, Merlet  
Integral reserve  
(depth 3m)



D5 : Mixed debris with substantial slab, boulder or rock

<p>Remote barrier reef: CSMP, Entrecasteaux Huon external slope (top) Pelotas internal slope (bottom) (depths 13m and 9m)</p>		
		
<p>Barrier reef, internal reef flat: WH, Hienghene, Mangalia (depth 3m)</p>		
<p>Barrier reef, internal shallow lagoon: Nouméa MPA, Aboré (depth 4m)</p>		
<p>Barrier reef, internal shallow lagoon: Koné Goyeta NP (depth 3m )</p>		

D6 : Debris with few slab, boulder or rock, medium complexity (several substrate granularities)

<p>Oceanic fringing reef: Lifou NP: Easo Bay (top) and Jinek (bottom) (depths 13m and 7m)</p>		
<p>Barrier reef, internal shallow lagoon: WH Hienghene, Kaun (depth 2m)</p>		
<p>Barrier reef, internal deep lagoon: WH Pouebo, La Seine (depth 17m)</p>		
<p>Deep lagoon reef, WH Pouebo, Les Charpentiers (depth 13m)</p>		

D7 Dominant medium and large granularity substrate (boulder, rock, slab)

<p>Remote barrier reef, deep lagoon coral patch: CSMP, Astrolabe (depth 17m)</p>	
<p>Remote volcanic island, fringing reef: CSMP Matthew (depth 20m)</p>	
<p>Remote volcanic island, fringing reef: CSMP Hunter (depth 13m)</p>	
<p>Barrier reef, internal lagoon pass, Nouméa MPA, Aboré reef (depth 6m)</p>	