Chapter 2

New Caledonia reef and lagoon habitats

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Aboré reef extending north from Dumbéa Pass, Southwestern Lagoon. © P.-A. Pantz

Why do we need to know habitats?

Knowledge of habitat types and their spatial distribution (habitat mapping) is necessary for management at any geographical scales, from islets, to reefs, or groups of reefs. This knowledge allows for the estimation of a site's vulnerability and provides a better understanding of the effects of disturbances on a reef. Habitat characterization is also a method to identify the outstanding feature of a site. In addition, the distribution of resources is often linked to the distribution of habitats

Habitat typology

New Caledonia has a wide diversity of reef and lagoon habitats. To understand and describe this diversity, a reference habitat typology is required. Traditionally, a habitat typology requires several levels of hierarchical descriptions including geomorphology, architecture, benthic cover, and taxonomic groups.

The geomorphological description provides a preliminary indication on the reef physical environment and properties such as:

Examples of New Caledonia reefs and lagoons habitats. A-D: four coral habitats.

A: Islet reef crest dominated by large tabular Acropora (Southern Lagoon).

B: Infratidal reef flat with mixed coral assemblage (d'Entrecasteaux).

C: Reef flat of islet reef under terrigenous influence with massive micro-atoll Porites (Petit-Borendy).

D: Intertidal reef flat of barrier reef dominated by small tabular Acropora (Southern Lagoon).

E: Mixed seagrass bed associated with a Sargassopsis algal bed on a sandy terrace of fringing reef (Canala).

F: Infratidal reef flat with soft corals Sarcophyton (Thio).

G: Sandy atoll lagoon, here during a hermit crab aggregation (d'Entrecasteaux).

H: Atoll lagoon with sandy bottom and wreck (d'Entrecasteaux).

Micro-atolls made of massive corals on the modern reef flat, southeast of Maré. Wrinkles surrounding the micro-atolls result from sea-level fluctuation. © IRD/S. Andréfouët

reef genesis, influence of terrigenous inputs, distance to the shore, swell exposition, wind-waves exposition, depth, etc. For instance, a bay-exposed reef implies an enclosed area of low hydrodynamic energy that is protected, turbid, and exposed to terrigenous and freshwater inputs. A geomorphological description can have several levels. The first level can include, for example, the following classes: barrier reef, lagoon patch reef, island reef, fringing reef, oceanic patch reef, bay-exposed reef, atoll, or bank. Each of these categories is mutually exclusive; for instance, the "fringing reef" of an "atoll" is not possible.

A second level is described using the following classes: reef flat, forereef, crest, pass, terrace, lagoon, enclosed lagoon, escarpment, and channel. These categories allow for a detailed description of the first level units. For example, this is done by breaking down a "barrier reef" into all of its different sub-units from the ocean to the lagoon. The first or second level classes mentioned here are far from exhaustive. Out of the hundreds that have been described, many are rare and we listed here only those likely to be commonly observed by the public (e.g., "reef flat").

The third level of habitat description is the "biocenosis" level. This is the level that is commonly associated with the concept of "habitat". This third level is benthic and described here in a generic manner by the following classes: hard coral habitat, soft coral, dead coral, algal bed, seagrass bed, sand, detritic, and others. The label of a class thus depends on the dominant communities, organisms and substratum of the biocenosis (e.g., coral, macroalgae, or sand). The class "others" includes habitats where sponges, gorgons or other organisms are well represented. These organisms are seldom responsible for the physical structuration of a biocenosis in comparison with corals and macroalgae, at least in New Caledonia. The class "others" also includes mixed biocenoses which are assemblages of multiple elements with no particular dominance. It also includes artificial habitats, accidental or planned, such as wrecks or mine slag accumulations.

Each biocenosis has its own characteristics. Benthic cover, architecture (growth forms, rugosity, and organisms size), as well as dominant and associate organisms, are seascape structuring factors. They correspond to what scuba or free divers would see first. For example, in the case of a coral biocenosis, the visible characteristics would be: substratum, living (or dead) cover, growth forms, the size of coral colonies, and dominant genera. For a seagrass bed, characteristics that would be perceived first are: seagrass density, canopy height, species diversity (mono or multi-species assemblages), and presence of associate organisms (corals, macroalgae, sponges, or burrowing organisms). For a detritic zone, a diver would notice the origin of rubbles, their size, their degree of cementation, and the presence of associate organisms.

Finally, the taxonomic information is the lowest level of the hierarchy of habitat information and the most difficult to describe given the required expertise. In the absence of an experienced taxonomist, the information can be simplified by working at taxonomic levels higher than species, such as families, genera, or morphotypes (e.g., branching corals, massive corals, etc.).

Habitats examples

In conclusion, habitats are defined by three main key elements. In theory, each different combination of these variables describes a different habitat. A biocenosis "algal bed" of "reef flat" of "fringing reef" is not the same habitat than a biocenosis "algal bed" of "terrace" of "island reef". But it can be the same biocenosis and can be perceived as similar by a scuba or free diver. Indeed, the geomorphological context is part of the habitat concept, but is not necessarily directly perceived by the diver in his visual field.

Eight habitats are illustrated here, but these are far from an exhaustive representation of the New Caledonian diversity. A first set of 150 habitats have been described in an initial compilation (ANDRÉFOUËT, 2014) based on observation data acquired during several research campaigns conducted between 2009 and 2013. These included, notably, the Northern Lagoon (Grand Lagon Nord), the south, south-east and north-west lagoons, the east coast, Isle of Pines, Cook and d'Entrecasteaux reefs. However, considering all of the areas that have not yet been explored, we have estimated that these 150 habitats may only represent half of the possible existing configurations in the New Caledonian reefs and lagoons.

Reference

ANDRÉFOUËT S., 2014 *Fiches d'identification des habitats récifo-lagonaires de Nouvelle-Calédonie, Sciences de la Mer. Biologie Marine.* Notes techniques IRD, Nouméa : 169 p.

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