Coral Reefs: Damage Indicators. Case in Point: The French Overseas Departments & Territories (DOM-TOMs)

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Introduction

1 Covering approximately 1.2 million km^2 or 0.25% of the world maritime domain, coral reefs represent the greatest structures formed on the earth's surface by living creatures. Although coral has existed for the past billion years, those which cover the seabed in the present day appeared in the Jurassic period (secondary era) and develop in the Atlantic, Pacific and Indian oceans (SCORE, 1998).

2 Coral reefs support a broad range of marine biodiversity (one quarter of all fish caught throughout the world live near the reefs), causing researchers to estimate that reef disappearance would jeopardise world ecological and economic functions.

3 With a view to assessing the state of coral reefs in France (DOM-TOMs), a synoptic overview of deterioration will be presented, followed by a panoramic view of future perspectives.

1. Deterioration of Coral Reefs

1.1. A few points to note

4 Studies of coral reefs are recent, since 1848 is the date of the initial surveys. It is following a trip to the Pacific Ocean that Charles Darwin built his theory on ground subsidence and showed interest in annular coral formations (atolls). These first works were followed at

the beginning of the XXth century by numerous expeditions to the Australian Great Reef (the first in 1928). American, French and British nuclear testing (Bikini, Eniwetok, Mururoa, Fangataufa, the Christmas Islands, etc.) enabled the work to be completed since, before burying their nuclear charges in the coral bedrock, scientists were required to study their geological and mechanical characteristics.

5 Being an inter-tropical coastal formation, the coral reef develops primarily in South-East Asia and more specifically in Indonesia and the Philippines; 101 countries nevertheless benefit from these particularly rich ecosystems. In France, coral mainly borders the islands of Martinique and Guadeloupe (Atlantic Ocean), Polynesia, Wallis & Futuna (Pacific Ocean) and Réunion Island and Mayotte (Indian Ocean).

1.2. A multi-faceted deterioration process

1.2.1. Coral: highly esteemed construction material

6 Present day coral reefs are particularly damaged for they are used for several economic activities; for example they supply coral sand for building houses and roadways. Coastal extensions, which were used for excavation, gradually diminished to the point of completely disappearing. The considerable demand for construction materials chewed away the fringe reefs which were later excavated to obtain a “coral soup”. It is evident that, once this material is compacted and dried, it produces very good quality hollow blocks. Although such excavation enabled the creation of road infrastructure, it induced a damaging and irreversible effect on the environment: retreat of the shoreline and advancement of silted areas for a lack of natural barriers (Saffache, 2002 [4]). In Polynesia, with a view to gaining space on the sea, the public authorities proceeded to landfill vast portions of the coast; hence, in Tahiti, the airport takes over 20 to 25% of the total surface of the fringe reefs (Saffache, 2006).

1.2.2. The various causes of coastal hyper sedimentation

7 The silting of the table reefs is none other than the result of the activity practiced on the watersheds. In New Caledonia, for example, although farming was never a dynamic sector (it represents but 1.5 to 1.9% of the GDP), vegetable crop surfaces occupy steep slopes which release large volumes of sediment during the rainy season, these are the particles which later accumulate in the lagoons.

8 Hyper sedimentation of the coastline is not only the result of farming activity. Over the past centuries, New Caledonia, the world’s third nickel producer, a little over 300 million cubic meters of waste rock has been removed and piled in the open air, without any protection or stabilisation measures being planned. Hence, during heavy rains, this lateritic waste rock feeds sediment into the rivers, to later fossilise the seabed. The table reefs which face the mining slopes have undergone substantial damage (Saffache 2002 [3]).

1.2.3 Large-scale urban and industrial pollution

9 Urban and industrial activity also participate in damaging the reefs. In Réunion Island, for example, despite considerable efforts over recent years for treating sewage water, untreated effluent is still being spilled daily into the lagoon, polluting the environment. It

is evident that the coastal fringe is highly urbanised, since 85% of the total population resides there. If, to such urban pollution we add sugar industry and rum distillery effluent – rich in organic and mineral matter – thrown into the rivers without any prior treatment, all the elements converge for creating substantial necrosis of the table reefs. As an example, it is the Gol factory which seems to be responsible for the deterioration of the *Etang Salée* coral flat, (Saffache, 2002 [1]).

10 In Guadeloupe, according to the Regional Industry & Research Agency (DRIRE), annual ' *vinasse*' (cane residue), would be equivalent (in terms of organic pollution) to the untreated household wastewater of 180,000 inhabitants. One can hence understand the considerable coral mortality rate and the appearance of necrosis on those which survive. (Saffache, 2002 [2]).

11 In Martinique, urban pollution is due to the lack of a system of waste water collection. As an example, the five towns surrounding the Bay of Fort-de-France total over 170,000 inhabitants, while the ten water purification stations presently in service were designed for a little over 130,000 inhabitants. Some neighbourhoods are hence not hooked up to a waste water collection system and several individual houses do not have septic tanks; and waste effluent is hence spilled into the rivers via the Fort-de-France Bay. Such polluted waters foster the proliferation of filamentous algae which progressively stifle the coral. This is worsened by the impact of the Trompeuse (Fort-de-France) municipal landfill, located along the coast, whose toxic residues regularly runs into the bay.

12 In Polynesia, apart from the Bora-Bora atoll, no other island is hooked to a sewage system, hence the considerable amounts of waste discharged directly into the lagoon. The decalcification of some table reefs along with the proliferation of the algae are direct consequences of this situation.

1.2.4. Fishing: an activity synonymous with various forms of deterioration

13 Always with a view to drawing the most profit from the milieu, numerous casual fishermen walk over the reefs during low tide to gather the fish trapped there. Such stamping on the reefs is in itself damaging, but nothing compared with the damage the area is subjected to when the fishermen poison the fish to gather them all the more easily. Hence, in the uneven plane which acts as their shelter, the fishermen pour a mixture of cyanide which puts the animal to sleep momentarily without killing it. Although this technique is quite handy and efficient, it is particularly damaging for the future consumers due to its bio-accumulation of toxic products in the flesh of the captured animals. The reefs which suffer such practices gradually blanch and finally retract. (Saffache, 2002 [4]).

14 In Wallis, the damage is even greater since fishing with dynamite – although prohibited – is heavily practised as it enables capturing dozens of fish and crustaceans in a record time . The repeated deflagration and their shock waves destroy the seagrass, stagger and fragment the table reefs which, over time are transformed into unproductive and moribund surfaces. (Saffache, 2005).

1.2.5. Tourist & recreational activity

15 Although pleasure boating is a highly enjoyed activity among Europeans living in Polynesia, this activity sustainably damages the seabed. When the boats moor on the

table reefs, their anchors and chains shear the coral and tear away the sponge. Knowing the rate of growth of a table reef (1 to 8 mm per year), the least sheared fragment represents a loss of several decades of bio-construction.

16 Diving also adds to the deterioration process. During each dive – despite the monitors' recommendations – the trainees take small fragments of coral or sponge away; this all contributes to the deterioration process and the depletion of the seabed.

17 Finally, collectors also participate in the destruction of the marine environment since, to find seashells, they walk on and turn over the madrepores, thus facilitating their degradation. Furthermore, they accentuate demand on a few species which are becoming very rare or disappear completely.

18 This alarming situation may be broadened to the scale of the entire globe since it is estimated that 10% of the world's coral reefs (70,000 km^2) are irremediably damaged; the remaining 90% is 60% in danger and the rest, slightly threatened (SCORE, 1998).

19 Faced with such a process of deterioration, one mustn't overlook the importance of the table reefs. They protect the coastal areas from erosion and enable the development of coastal economic activity. They bear one of the richest biodiversities, and provide local populations with food and hence prevent the massive exodus to urban centres; they also serve as a support to some States (the Maldives, for example, are an archipelago formed exclusively of atolls and in French Polynesia, 84 of the 118 islands of the archipelago are of coral origin), and finally, they open unlimited perspectives in the area of medical research.

2. Pessimistic perspectives

20 To overcome the damaging process affecting coral reefs and to avoid jeopardising world economic and ecological order, the American Department of State launched an ICRI (*International Coral Reefs Initiative*) in 1995. This programme was jointly initiated with France, Great Britain, Australia, Sweden, the Philippines, Jamaica and Japan. This intergovernmental initiative was supported by the United Nations and in particular by the UNEP (United Nations Environment Programme) and the UNDP (United Nations Development Programme). The objectives sought were simple: setting down more efficient protection and management policies and facilitating research on coral reefs.

21 After having run the secretariat of the ICRI in 1999 and in 2000, France adapted this programme to the scale of its territory, the "*Initiative Française en faveur des récifs Coralliens* " ('*IFRECOR*') (French Initiative in Favour of Coral Reefs) was hence created. It is a programme placed under the double auspices of the Ministry of the Environment and of the Overseas Ministry and managed by forty members (scientists, elected representatives, associations and Ministry representatives). This initiative has proven to be all the more useful since the dangers, which threaten the coral reefs, are so numerous. In fact, over the next twenty years, a massive extension of westernising customs and lifestyles is to be expected. The result is a decrease or total disappearance of traditional practices which have until presently protected the environment and the resources. To take but one example, in Polynesia, certain tribes have set-up a system of fallow land which limits the pressure exerted on the coral reefs. Today, how can one explain to a Polynesian, who is part of the dynamics of a market economy, that he must wait several months or years before being able to fish on a given reef? This question, in a brutal manner, raises the

problem of setting down a realistic policy of sustainable development, and even more, of communicating awareness of such new methods of development.

22 It is also important to keep in mind that the ultimate danger for coral reefs is global climate change. Although prospective models of a rise in sea level were down-graded (ten years ago, it was estimated the sea level would rise sixty centimetres by the mid XXIst century, whereas, it will most likely rise but twenty centimetres), the average rise in temperature (+ 1°C as of the beginning of the XXth century), the rise in sea level and the increased frequency and force of hurricanes are all elements which will exert stress on the coral and bring on blanching and thus eventually make them disappear. The future of the coral on a world scale, as well as on a national scale, will be played out in the years to come.

Conclusion

23 The coral reefs of the DOM-TOMs are greatly endangered since they are subject to several forms of damage: pollution, hyper sedimentation, picking, global warming, etc., and are thus veritable indicators of contemporary ecosystemic deterioration.

24 In an attempt to halt such dynamics, the *Initiative Française en faveur des récifs Coralliens* (IFRECOR) was created; despite its title, this programme is not yet satisfactory for it does not totally include the coral world in a movement towards sustainable development. Scientific monitoring and above all, protection efforts are sporadic and at times not in line with the substantial nature of the deterioration. This initiative being quite a recent one, it is evident it can be improved upon. However, in the perspective of global warming, time is running out and decision-makers no longer have the right to commit any errors, especially when it is a known fact that coral reefs serve as a support to the tourist industry which the DOM-TOM's economy depends upon.

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