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GENERAL STATUS OF CUBAN CORAL REEFS

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ABSTRACT

In spite of their fairly good general condition, Cuban coral reefs are suffering deterioration in varying degrees near urban and industrial settlements. Great extensions of wide shallow shelfs, with surrounding chains of bordering keys, act as a buffer that limits the terrigenous influence on coral reefs (e.g. pollution, sedimentation, direct human influence, etc.). However, in some places algae are proliferating and dominating at the expense of corals, maybe because of the black urchin die-off and local, fairly high concentrations of phosphates. Over-fishing affects some coral reef populations. Management of coral reefs is not specifically directed, nor does it have a system and comprehensive approach. It is fragmentary and measures are poorly enforced. Some degree of protection is achieved by fishing regulations; the existing legislation on pollution, collection of marine life, and environmental impact assessment; and the commitments with some international treaties. Our Environmental Agency is presently formulating plans and a new legislation for protecting marine ecosystems.

ECOLOGICAL STATUS

Cuban coral reefs stretch along virtually the entire border of the Cuban shelf (shelf contour measures roughly 3200 km). About 54 % of that border is separated from the mainland by broad shallow water bodies and by groups of keys that prevent the anthropogenic influences from reaching the reefs. Great stretches of the mainland coasts are only slightly urbanized or industrialized. However, watersheds were extensively and historically deforested enhancing the runoff of sediments to the sea. For these reasons, pollution affects coral reefs only at a few localized stretches, and some degree of sedimentation (including that of natural origin) seems to be one of the most generalized problems (Alcolado et al. 1994).

At present, a great proliferation of fleshy algae, mainly represented by *Cladophora catenata, Microdictyon marinum, Lobophora variegata, Dictyota spp., Sargassum spp.* and *Halimeda spp.*, is being observed in some reefs that are very far from sources of organic pollution (central north, northeast and southwest of Cuba).

Our estimates of wet biomass of algae in the reefs of the Sabana-Camaguey Archipelago (Fig. 1) in April to March of 1994 ranged from 0.27 to 3.05 kg/m^2 (at 37 stations distributed along 10 reef profiles from the rear zones to 20 m deep). Highest values of biomass were more frequent at 5 m deep, where about 80% of the stations displayed values that were equal or higher than 1 kg/m^2 (biomass is referred to coral free space). This percentage is 60% at 10 m, and 20% at 20 m deep. Unfortunately we have no previous values for comparison.

This phenomenon is very probably due to the synergistic action of the observed relatively high nutrient concentrations (P and N) and the massive mortality of the black sea urchin *Diadema antillarum* (whose populations do not display any sign of recovery).

Organic and chemical pollution have been observed to affect the coral reefs of the Havana City coast due to the highly polluted waters of Havana Bay, and the rivers Almendares and Quibú, as well as the submarine sewage outfall located east of the Havana Bay entrance (Chivo Beach). Nutrient enrichment has been observed to produce dense algal growth at the reefs located near the above mentioned bay and near the entrance of Mariel Bay (the last located north of Pinar del Río Province).

On Havana City reefs, diversity of scleractinians, sponges and gorgonians dropped to very low values and their communities were dominated by the scleractinian *Siderastrea radians*, the sponges *Clathria venosa* and *Iotrochota birotulata f. musciformis*, and the gorgonians *Plexaura homomalla, P. flexuosa or Pseudoplexaura spp.* The dominance of these species, only when it is accompanied with low species diversity, is considered as an indicator of organic pollution (Alcolado et al. 1994). Population density of stony corals and gorgonians is very low, and is variable for sponges (Alcolado et al. 1994).

As a consequence of the degradation of these reefs, shelter capacity and available food considerably decreased, thus inducing a drastic decrease in diversity and abundance of fish.

Thermal pollution caused by the cooling system of a power plant located east of Mariel Bay has killed a shallow reef area, producing extensive coral bleaching.

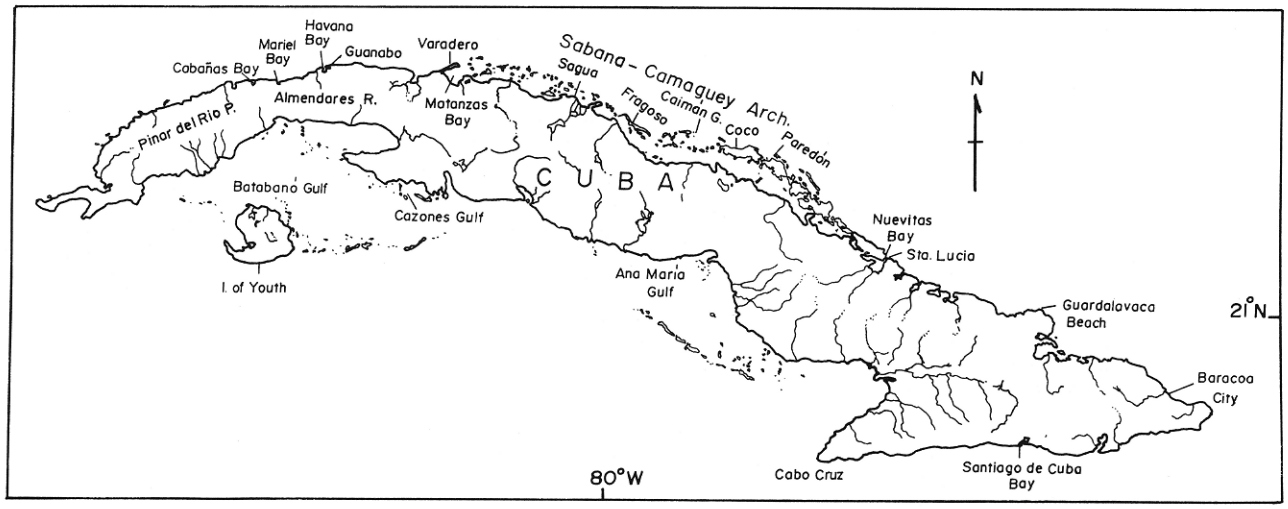

Fig. 1: Cuban Archipelago

Mechanical pollution by fiber wastes from a henequen fiber factory was observed at a shallow reef near Mosquito River (east of Mariel Bay), causing abrasion of stony corals, sponges and gorgonians.

Some degree of pollution may be affecting the reefs near the mouths of the bays of Cienfuegos (south of Cuba), Santiago de Cuba (southeast), Nuevitas and Nipe (northeast), Matanzas Bay (northwest), near Baracoa City (northeast), and some other sites, but this has not been assessed yet. We roughly estimate that less than 3% of the shelf contour (where almost all reefs are found) is affected by a significant degree of organic pollution.

Coral reefs have been locally deteriorated by military practices in some places of the country.

Up to the present, regulations directed at tourists and tour-guides for protection of coral reefs are not fully implemented. For that reason, mechanical damage and extraction of stony corals and other organisms are degrading the quality of reefs in sites where tourists engage in diving and boating activities. Two examples of this situation are the once beautiful scenic reefs of Rincón de Guanabo and Puerto Escondido (northeast of Havana Province). Anchoring on coral outcrops is a current practice in fishery and nautical activities. Ministries of Tourism and of Science, Technology and Environment are aware of this situation and there are plans to enhance efforts for improving education and awareness about coral reef value and vulnerability. The GEF/UNDP Project CUB/92/G31 on biodiversity protection and sustainable development of the Sabana-Camaguey Archipelago, the National Aquarium and CARICOMP Cuban participants are working in that direction.

Natural stress produced by sedimentation (local sediment resuspension and outflow of suspended sediments from inshore waters) has been detected along long stretches of the east side of the Gulfs of Batabanó (southwest) and Ana María (southeast), due to the outflowing currents that are often heavily loaded with fine sediments. The same was observed once at the reef of Cayo Cantiles (south of the Gulf of Batabanó).

Because of the high frequency of cyclones and hurricanes, the reef communities of the southwestern part of Cuba are comparatively more structured by those events. There is a remarkable dominance of species resistant to sedimentation and water movement, mainly in the unsheltered west and south borders of Gulf of Batabanó (Alcolado, in prep.).

CORAL DISEASES

Until 1994 coral bleaching was documented as a sporadic and very localized event in Cuba, and did not seem to be a critical problem for our reefs. However, systematic national monitoring of coral diseases (which is badly lacking) would give us a more objective and conclusive idea and might have shown a worse situation than was suspected. In late summer of 1995, a very widespread and intense coral bleaching situation was reported from many points in the north of Cuba, from Cayo Jutía (Pinar del Río Province) to Santa Lucia Beach (East of Camaguey Province).

Before 1995, the same ntense coral bleaching was recorded only at:

-North of Cayo Paredón Grande (northern central part of Cuba) on October 12th, 1989. Affected corals were *Acropora palmata* at a reef crest and *Meandrina meandrites* at 10-15 m depth.

-3 miles west of the mouth of Cabañas Bay (northwest of Cuba) in a reef crest (1.2 m depth) in September 29th, 1990. *Millepora alcicornis f. complanata* was affected about 90%.

-Near Guardalavaca Beach, Banes (northeast of Cuba) on a fore-reef about 15 m depth, in August 20th of 1993). Stands of *Agaricia sp.* were bleached.

Diving cruises in April-May of 1994 along the north-central part of Cuba (Sabana-Camaguey Archipelago), and in the first half of June of 1995 along the southern coast of Isle of Youth (southwest) did not reveal the occurrence of massive coral bleaching events.

During the first cruise (May, 1994) some partially bleached colonies of *Montastrea annularis* and *M. cavernosa* were observed on a reef of Cayo Coco (12-20 m deep), as well as some colonies of *Acropora palmata* on a rear zone of a reef crest at Cayo Guillermo (west of Cayo Coco). On the reef of Cayo Cayman Grande (more to the west), at 18-20 m deep, some colonies of *Stephanochoenia intersepta* and *Dichocoenia stokesi* were fully bleached, while a few *M. annularis* appeared to be partially bleached. On the reef of Cayo Fragoso (even more westward) some partially bleached colonies of the last species were also detected but at a depth of 5 m.

On the second cruise some *Siderastrea* displayed black spots at a depth of 30 m (D. Ibarzábal, pers. com.), and some isolated *Montastrea* were completely bleached at about 20 m deep (J. P. García, pers. com.).

The above mentioned 1995 summer coral bleaching extended from very shallow reefs (1 m) to those 30 m deep. Affected corals were *Montastrea annularis, Diploria strigosa, Agaricia agaricites, Porites astreoides, Acropora palmata, Millepora alcicornis* and *Palythoa caribbaea*. Surprisingly, observed *Siderastrea siderea* were not bleached. A great recuperation of colonies was reported in January from Santa Lucia Beach. Signs of recuperation were seen also in October in a shallow reef at Cayo Guillermo.

Periodic monitoring of the Cuban CARICOMP reef sites (twice a year since September 1993) at Cayo Coco (north) has not revealed massive coral bleaching. In November 1995 coral bleaching was lately recorded at the site in many coral colonies. A virtual full recovery was reported at Santa Lucia reef.

CORAL REEF FISHERIES

In islands surrounded by broad shelves, like Cuba, finfish fishery takes place in seagrass beds, coral reefs and mangrove ecosystems, which constitutean ecological ensemble.

After a period of great increases in fish catches from 1960 to 1975, some commercial species were over-fished: the snapper (*Lutjanus synagris*) in the Gulf of Batabanó; the Nassau grouper (*Epinephelus striatus*) in virtually the whole Cuban shelf (Claro et al. 1994); shrimps (*Penaeus spp.*) of the southern shelf; and Queen Conch (*Strombus gigas*).

In following years, the partial substitution for these species resulted in an increase in the catches of other species like rays (*Dasyatis sp.*), gray snappers (*L. griseus*), jacks (Carangidae), and grunts (Haemulidae) among others. That was followed by a drop of bathoid yields. Shark yields also decreased in recent years due to a long period of sustained low-grade overfishing (Claro *et al.* 1994).

Cuban coral reef ichthyofauna, as revealed by higher biomass, species richness and average size, displays a better situation than those from other Caribbean Islands as Martinique, Guadeloupe and Jamaica (Claro and García-Arteaga 1994).

Most of the damage to the finfish fishery was caused by the use of massive and poorly selective fishing gear (e. g., stationary nets), and by heavy fishing during reproductive periods.

In this regard, the most significant issue was overfishing of the lane snapper in the Gulf of Batabanó. This activity induced great changes in the structure of reef fish communities. Their populations were substituted by grunts (Haemulidae), that are species of lower quality and commercial value. The proliferation of grunts prevented recuperation of the lane snapper stocks, in spite of the imposition of several and drastic administrative and protective measures.

The Queen Conch has been submitted by the Ministry of Fishery Industry for permanent closed seasons (in the entire Cuban shelf from 1978 to 1982, and currently in the north and southwest of Cuba since 1990), reproductive closed seasons (April-September), prohibition of catching juveniles, and to restrictions of quotas as a response to the spectacular reduction of its stocks. This reduction was produced by an over-fishing based mainly upon illegal extraction of the meat as bait (with a rough estimate of more than 1500 T per year), or for selling the shells as curios. The first population collapse occurred in 1978 after an official capture of 2578 T in 1977. After this the above mentioned measures were implemented.

Two stock assessments carried out in 1984 (all around Cuba) and 1987 (central north) and a qualitative survey in 1991 (central north) revealed that these measures do not seem to have stopped the decline in conch populations, at least on the north coast. Two stock assessments suggested a slight recovery in the south of Cuba one in Cabo Cruz (southeast of Cuba) in 1990, and another in the south of the Gulf of Batabanó (southwest) in 1991. Very rarely, the percentage of juveniles in the assessed populations exceeded 20%. We suspect a possible drop of recruitment of larvae coming from abroad (Ferrer and Alcolado 1994). The need of an up-to-date assessment of national conch stocks is wanting.

Spiny lobster *Panulirus argus* is a resource closely linked to coral reefs. Its fisheries are considered the best regulated and sustainable in Cuba. Since 1978 catches varied between 11000 and 13000 metric tons per year and were mainly based upon lobsters inhabiting the seagrass beds of the Cuban shelf, and not just upon those dwelling in the reefs, where an important reproductive potential remains. Private lobster fishing is not allowed, but some poaching for the black market takes place.

Stable catches of turtles in the order of 250 metric tons were obtained from 1968 to 1992. Those catches were based upon quotas established by enterprises of the Ministry of Fishery Industry and territorial ordering of fisheries among other regulations.

Since 1970, a National Program for Conservation of Turtles has been implemented. It prohibits the private catching of turtles and the collection of eggs, and also their transportation and consumption. Among other measures, it establishes the protection of beaches where turtles nest. The official harvesting of turtles was interrupted in 1992 in accordance with the International Agreement for Trade of Endangered Species of Flora and Fauna, which declared turtles as an endangered species. There is some illegal catching of turtles for private consumption and for the black market.

Research for testing the hypothesis that Cuba has a resident turtle population is being undertaken. If it appears to be true, a sustainable collection could be re-opened. For the establishment of turtle farms, research on the artificial rearing of the hawksbill turtle *Eretmochelys imbricata* is being carried out.

Some extraction of the gorgonian *Plexaura homomalla* has taken place along two reefs at the southeast of Island of Youth (southwest of Cuba) to obtain prostaglandines. This collection was done in a sustainable way by pruning 50% of the "mature" (>30 cm high) colonies and "resting" harvested areas.

Recently, several species of gorgonians are being illegally collected, without any control, by craftsmen and some local governmental minienterprises for the manufacture of jewelry and handicrafts, and also to mimic black coral (by some private sellers). This has led to the devastation of gorgonian gardens in the shallow reef zones of Havana City and Varadero Beach (as far as we know).

The discovery of commercial stocks of black coral (*Anthipates sp.*) took place in 1960. Since that year, these corals began to be collected in an unregulated manner. The extraction of this resource was officially regulated in 1986 but currently it takes place in an ineffectively coordinated and poorly controlled way by a few government enterprises. Illegal extraction has occurred since the 70's in spite of the fact that this activity is forbidden. As a consequence, adult black coral stocks have been depleted in some places (at the shallower depth ranges of black coral) along the north of Pinar del Río Province, in Matanzas Bay (northeast of Cuba), Puerto de Sagua (central north) and Cazones Gulf (east of the Gulf of Batabanó), among others. Up to the present, there is an official estimate that 1339 kg of black coral has been extracted at depths of 20-55 m by four enterprises.

Regulated minimum size for black coral collected in Cuba is 1.20 m high and 2.5 cm in diameter.

Due to the lack of enough knowledge about the abundance, biology, ecology and distribution of black coral, this resource is being studied and assessed in Cuba by an UNDP project.

MANAGEMENT PROSPECTIVE

The management of Cuban coral reefs is not specifically directed, nor does it have a system nor comprehensive approach. Rather, management in fragmentary and regulatory measures are poorly enforced. Some degree of protection and sustainability is achieved by:

-Fishery regulations;

- Existing legislation on protection of natural resources, flora and fauna (Law 33), on prevention of pollution, on marine life collecting and on environmental impact assessment;

- Commitments with international treaties MARPOL, SPAW and CITES.

Cuba has good human resources and the institutional framework for the necessary research and management of its coral reefs. However, the present economic difficulties seriously limit the financial resource available to implement and enforce the appropriate conservation measures.

The Environmental Agency of the Ministry of Science, Technology and Environment is aware and conscious of the urgent need for action in terms of conservation and sustainable use of coral reefs. Our Environmental Agency is presently formulating plans an a new legislation for the achievement of these goals.

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REFERENCES

Alcolado PM, Herrera-Moreno A, Martínez-Estalella N (1994) Sessile communities as environmental biomonitors in Cuban coral reefs, 1993. In: Ginsburg RN (ed) Proceeding of the colloquium on global aspects of coral reefs: Health, hazards, and history, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, pp 27-33

Claro R, García-Arteaga JP (1994) Estructura de las comunidades de peces en los arrecifes del grupo insular Sabana-Camagüey, Cuba. Revista de Oceanología y Ecología Tropical, Avicennia 2: 83-107.

Claro R, Baisre JA, García-Arteaga JP (1994) VIII. Evolución y manejo de los recursos pesqueros. In: Claro R (ed) Ecología de los peces marinos de Cuba, CIQRO, México, pp 435-492

Ferrer L, Alcolado PM (1994) Panorámica actual de *Strombus gigas* en Cuba. In: Appeldorn RS, Rodríguez B (ed) Biología, pesquería y cultivo del caracol *Strombus gigas*. I Congreso Latinoamericano de Malacología, Editorial Ex Libris, Caracas, pp 73-78