ANALYSIS OF THREE COASTAL LAGOONS UNDER DIFFERENT PROTECTION REGIMES IN UPSTATE RIO DE JANEIRO

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1 INTRODUCTION

The Coastal Zone is home to a mosaic of ecosystems having high environmental importance, whose diversity is marked by the transition of land and marine environments. Interactions in these environments make them fragile. Therefore, they call for a special attention by public authorities, as shown by its inclusion in the Brazilian Constitution as Brazilian government-owned areas. (MMA, 2003)

Coastal lagoons are ecosystems occurring along the Brazilian coastline. Most of them are found in the States of Rio de Janeiro and Rio Grande do sul. The historic occupation of Brazilian coastal areas can be considered one of the major drivers of conflicts between preservation and development. This occupation brings about a rise in the consumption and in

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the depletion of the natural systems, mostly the water resources providing a variety of environmental services (Montenegro Jr., 2004).

In spite of the great ecological, social and economic importance of the coastal lagoons, they can be included among the Brazilian ecosystems undergoing the most anthropic impacts. The first signs of anthropic impacts on coastal lagoons date back to the colonial times of Brazilian history (SOFIATTI, 1998).

LEAL (2002) says these are the major forms of depletion of the natural conditions of coastal lagoons: (i) the launch of household and/or industrial waste water; (ii) land filling of margins; (iii) accelerated silting of the basin; (iv) dredging out the sand; (v) depletion of the land vegetation surrounding the lagoon or along its tributaries; (vi) introduction of exotic fish species, like the tilapia; and (vii) the building of houses on the margin of the lagoons.

Common-use resources like coastal lagoons can be run under one the four basic resource appropriation regimes: (1) the free-use one means the lack of well-marked ownership rights, in which free use means open for all; (2) the private property one refers to the situation in which an individual or a corporation has the right to prevent one from using it and to regulate its use; (3) the state-owned one, in which case the rights over the resource are a right of the government controling public access to it and regulating its use; (4) the common-use or community-owned property, in which case the resource is controlled by a community of people chosen by users. In this case, the community decides who the users will be and regulates the use itself (VIEIRA et. al., 2005).

Creating protected areas is one of the most used tools in the world to search for alternative ways to stop environmental depletion. In Brazil these areas are named conservation units (SANTOS, 2009).

This review is meant to design the scenario of three coastal lagoons under different protection regimes in upstate Rio de Janeiro.

2. METHODOLOGY

The groundwork for the development of this summary is the bibliographic research, including readings, selections, filing records and organization. Likewise, the observational and historical methods were used. The observational one helped us gain familiarity from empirical phenomena. The second, the historical method, has enabled us to analyze how facts from the past influence current society. (FACHIN, 2006).

3. DEVELOPMENT:

The three lagoons under review are under different use regimes.

The Imboassica, Jurubatiba (a.k.a. Cabiúnas lagoon) and Carapebus lagoons are located North of the State of Rio de Janeiro, in between the towns of Rio das Ostras and Carapebus. Virtually 100% of the water body of the Jurubatiba Lagoon lies inside Jurubatiba National Park. The Carapebus Lagoon is partially located within the boundaries of the National Park. The Imboassica Lagoon, sited between Macaé City and Rio das Ostras, unlike the other lagoons, is today no longer part of any Conservation Unit.

We surveyed the general features of those systems and the main conflicts to which they are subject for subsequent comparison of the consequences resulting from the different protection regimes under which they are.

3.1 The Imboassica Lagoon

The Imboassica Lagoon is located at 22° 24´S, 42° 42´W. It occupies a 3.26km² area, max width of 1.3km, max length of 5.3km and an average depth of 1.09m, resulting in a volume of 3.56 x 106 m³. (Source: Management Plan of Jurubatiba National Park, 2005).

Euthrophication conditions in the lagoon have been observed. This is directly linked to the increased discharge of household wastewater produced by the population living around it, of the companies and the use of cleaning products containing polyphosphates. (Barreto, 2009).

The major impacts undergone by the BH include: (i) land filling of the lagoon's margins and the Imboassica river; (ii) fragmented vegetation and absence of vegetation in permanently-protected areas (APP); (iii) man-made opening of the sand bar separating the lagoon from the sea; (iv) irregular discharge of sanitary and industrial wastewater; and (v) irregular settling of people in areas of the APP and the marginal protection strip (FMP) (ESTEVES, 1998; PALMA-SILVA et al. 2007; MAROTTA, 2004).

One of the oldest human interventions in the Lagoon's BH dates back to 1892. That is when the railroad section of the Companhia Leopoldina (formerly Railroad Network) connecting the cities of Macaé and Niterói was built (SILVA, 2011).

Years later, in the 20th century, Highway RJ-106, known as the Amaral Peixoto Highway, was built to connect the cities of Niterói and Campos dos Goytacazes, the major access to this area. It brought about a rise in real-estate exploitation around the lagoon and the land filling of its margins (SANTOS, 2014).

In 2004, they started the construction works to make the highway twice wider, breaking the terms of the Environmental Permit issued by the then existing State Engineering and Environment Foundation (FEEMA) and the environmental legislation, as appointed by the law-enforcement check report nº 028/2003 published by GATE (the Special Technical Support Group) of the Prosecuting Council of the State of Rio (MPRJ in Portuguese, 2006) resulting in a Conduct Adjustment Agreement (TAC) between the city and the MPRJ.

As per SANTOS (2014), that TAC was signed in 2006. It assigns the city the following duties: (i) the preparation of a Renovation Project of 31.2 ha of the lagoon's FMP and the river's riparian forest and; (ii) the project of the physical boundaries of the lagoon's and the river's FMP.

In 2014 new interventions were performed in this highway. There were resurfacing and enlargement works in the city of Macaé, authorized by the Instituto Estadual do Ambiente (INEA, the state environment institute) with the issue of Environmental Permit (AA) nº IN026729 (SANTOS, 2014).

The major recent operation in this system was performed as of 2013 with the start of operations of the Mutum Sewage Treatment Station (ETE).

It has a nominal capacity to treat 40L/s, which allowed to increase watewater treatment services in the districts in the vicinity of the lagoon's BH. This way, the ETE currently

services the following areas: São Marcos, Jardim Guanabara, Mirante da Lagoa, Granja dos Cavaleiros (only Alameda da Lagoa and Alameda do Bosque), Cavaleiros, Morada das Garças, Vale dos Cristais, Vivendas da Lagoa, Costa Dourada, Praia do Pecado (SANTOS, 2014).

The construction and the enlargement operation works of the ETE are of extreme importance for the environmental quality of the lagoon's BH, mostly because of water quality. The discharge of nutrients and pathogens into the water is being visibly reduced and has been done in compliance with the parameters outlined in current legislation. (SEMA, 2013b).

3.2 The Carapebus Lagoon

The Carapebus Lagoon is located in the city of Carapebus in Hydrographic Region IX, Lower Paraíba do Sul River (RIO DE JANEIRO, 2006), under coordinates 22° 15´S, 41° 35´W.

The Carapebus Lagoon is the major hydro ecosystem in the Jurubatiba sandbank. It is under a higher antropic pressure, mostly linked to household and industrial wastewater which is causing the artificial euthrophication of this ecosystem. The drainage basin of the Carapebus Lagoon receives affluents crossing large farming lands, sugar cane plantations and grazing lands. Another part of the drainage basin is also occupied by urban areas and a small part is taken by a relatively well-preserved sandbank area. One observes that many houses discharge their household sewage into the lagoon. (Source: Management Plan of Jurubatiba National Park, 2005).

The Carapebus Lagoon belongs in the area of the Jurubatiba NATIONAL PARK, but not the whole of it. One notes that great part of the lagoon is beyond the boundaries of the Unit, spreading out to the urban area of Carapebus.

As informed in a query sent to the employees of the Jurubatiba NATIONAL PARK (ICMBio), the option to include the whole lagoon into the decree creating the Unit was made to avoid a stronger conflict with Carapebus' local administration. With the creation of the NATIONAL PARK 22% of the town's area changed into a Conservation Unit (SANTOS, 2008).

Due to the misuse and misoccupation of the soil, particularly as observed in the vicinity of the Carapebus Lagoon and the other coastal lagoons in Jurubatiba National Park, understanding the dynamics of the coastal lagoons is key to contribute to set up conservation projects, achieve rational use of the ecosystem and allow debating the antropic intervention problems in this system.

The occupation of the Carapebus Beach may have occurred in the 17th century in a rough and provisional way. The recent occupation of the area dates back to the 60's in the 20th century, when they started selling urban land lots. (NATIONAL PARK's Managament Plan, 2005).

The creation of fully-protected units such as the Jurubatiba National Park are in the core of a variety of social, environmental conflicts. This is the case of beach goers and residents of the Carapebus Beach, who have no access to certain services, for example. This is the case of primary sanitation services because they are now within a Brazilian conservation unit or in its buffer zone. That ends up generating friction between public authorities and the community.

Another issue widely debated by NATIONAL PARK's managing body in this area relates to the fishing activities in the Carapebus Lagoon and the man-made opening of the bar. Today ICMbio controls those issues.

The technical chamber of the bar opening at the Advisory Board of Jurubatiba National Park has prepared an emergency report containing information, methodologies and studies aiming to reduce the response time to the community. They need the opening of lagoon bars during mostly the rainier season, providing local administration and society with prompt responses with technical, scientific foundation. This report highlights the following reasons for said opening of bars: the physical, chemical quality of water, which has been proved to adversely affect public health or the biodiversity; the proliferation of carriers; the high density of cyanobacteria; backflow in toilets; elargement works in houses or public streets; the killing of fish and reduced biodiversity.

The search of indicators favoring the aritificial opening of bars leads one to yearn for fishing production, for years has been seen as an intuitive management approach.

Esteves (1998) says the sharp reduction in the water volume inside the coastal lagoon and the sudden change and great scale of the salinity values are the major first-level phenomena representing a negative impact of major importance on coastal lagoons.

3.3 **The Jurubatiba Lagoon**

THE Lagoa de Jurubatiba, coordinates 22° 17´S, 41° 41´W, is virtually fully located in Jurubatiba National Park. The Jurubatiba Lagoon (a.k.a. Cabiúnas) has arm-shaped branches of the ecosystem, as shown in Figure 8. It occupies an area of 0.34 Km², has an average depth of 2.37 m and max depth of 4 m. Its perimeter is 10 Km long, max length is 0.9 Km and max width is 0.2 Km. These dimensions suggest a high ratio between the lagoon's perimeter and water volume, making the coastal area of major importance in the metabolism of the system. (Management Plan of Jurubatiba National Park, 2005).

The Cabiúnas lagoon (Jurubatiba) has been being monitored since 1992. No signs of contamination by household sewage has been found. During the 90's, analyses were performed and revealed that it is not contaminated by oils and grease. More recently, ZINK et al. (2004) have not found out any biomarkers like coprostanol (an indicator of household seeage) or PAH (poliaromatic hydrocarbons from fossil fuel) in the lagoon's sediment (Management Plan of NATIONAL PARK, 2005).

For decades, this system has undergone continuous bar openings, usually artificially, to control the effect of floods, reducing the water level and/or allowing entry of fish species of trade interest and uncontroled entertainment (Management Plan of Jurubatiba National Park, 2005).

A notice by the Brazilian Prosecuting Council (MPF in Portuguese) in the área next to Jurubatiba's lagoon between 08/25/2001 and 12/15/2003 informed continuous leakages. These leakages are linked to failures in the pipeline of the marine outfall integrated into the wastewater treatment station which discharges the 'production water' resulting of oil exploration in the Campos Basin. This fact caused major impacts to the ecosystems protected by the Fully Protection Conservantion Facility in Jurubatiba Sandbank Park. The notice also informs that early in 2004, the Brazilian Environmental Institute (IBAMA) allowed the emergency deployment of an air pipeline, removed later on in January 16, 2008, when the severe environmental damages to this facility finally stopped.

The Brazilian Prosecuting Council in Rio de Janeiro (MPF/RJ), Petrobras and Transpetro entered into a Conduct Adjustment Agreement (TAC) to design a Project and build a center for the visitors going to Jurubatiba's National Park in Macaé (RJ). This TAC prevented companies from facing civil public lawsuits filed in 2008 to have them compensate for the environmental damages linked to leakages in the marine outfall.

Another conflict that engaged many different social players in this area broke out in 2005 when Macaé's local administration faced a long-lasting lawsuit to cause part of the Lagomar district (bordering the NATIONAL PARK and close to the Jurubatiba lagoon) to be considered out of the buffer area of the Jurubatiba National Park. This allowed it to be urbanized and past claims by low-income communities living there to be met. These claims included asphalting streets, drainage and deployment of basic sanitation services.

After the Conduct Adjustment Agreement (TAC) was entered into, the local government made interventions, with the commitment to bar new buildings from being put up and to perform a controlled growth of the community.

4. FINAL REMARKS

This study confirms the relevant role played by the Conservation Units (UC) to protect and keep natural resources from the analysis of the current conditions of the coastal lagoons that are under or not protection regimes and conflicts to which those systems have been or are subject.

The managing bodies handling environmental issues must be accountable for the law-enforcement control and management to achieve the proper management of the ecosystems of the área. We found out that systems located in the area of protection regimes are less exposed to the antropic impacts when the heads of the CU set limits and rules to respect and balance the interest of all social players involved.

Guidelines allowing to set long-term measures for these environments and rules to the multiple use of the benefits and services these ecosystems provide are key to keep up the balance of coastal systems.

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